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Faculty of Economics and Social Sciences

Department of Economics

Doctoral Thesis

The Effects of Commodity Prices and Governance
on
Emerging Economies

Comparative Correlation Research on Brazil and China

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Dedication

In loving memory of my mother.

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'The firm, the enduring, the simple, and the modest are near to virtue.'

孔丘 Confucius (551 BC – 479 BC)

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Overview

List of Tables 8
List of Figures 12
List of Appendixes 13
List of Abbreviations 17
List of Price Denominations 21
List of Symbols 22

1 Introduction **23**
1.1 Overview 23
1.2 Regional Analysis 24
1.3 Empirical Data and Data Methodology 25
1.4 Empirical and Econometric Analysis 27
1.5 Comparative Econometric Result Analysis of Selected Variables 32
1.6 Conclusion 34

2 Regional Analysis — Brazil and China **35**
2.1 Introduction 35
2.2 Sociopolitical Framework 37
2.3 Macroeconomic Framework 42
2.4 Commodities and the External Sector 58
2.5 Brazil and China: Dualism — Cooperation — Partnership? 75
2.6 Conclusion 84

3 Empirical Data and Data Methodology **86**
3.1 Introduction 86
3.2 Dependent Variables: Selected Macroeconomic Measures 88
3.3 Independent Variables Set 1: Commodity Price Indexes 98
3.4 Independent Variables Set 2: Governance Indexes 112
3.5 Conclusion 165

4 Empirical and Econometric Analysis ... 167
4.1 Introduction ... 167
4.2 Statistical Diagnostic Tests ... 176
4.3 Multiple Regression Analysis ... 250
4.4 Conclusion ... 269

5 Comparative Econometric Result Analysis of Selected Variables ... 280
5.1 Introduction ... 280
5.2 Selected Macroeconomic Variables ... 284
5.3 Conclusion ... 331

6. Conclusion ... 336

APPENDIXES ... 351

ATTACHMENTS ... 440

REFERENCES ... 444

Table of Contents

List of Tables **8**
List of Figures **12**
List of Appendixes **13**
List of Abbreviations **17**
List of Price Denominations **21**
List of Symbols **22**

1 Introduction **23**
- 1.1 Overview 23
- 1.2 Regional Analysis 24
- 1.3 Empirical Data and Data Methodology 25
- 1.4 Empirical and Econometric Analysis 27
- 1.5 Comparative Econometric Result Analysis of Selected Variables 32
- 1.6 Conclusion 34

2 Regional Analysis — Brazil and China **35**
- 2.1 Introduction 35
- 2.2 Sociopolitical Framework 37
- 2.3 Macroeconomic Framework 42
  - 2.3.1 Domestic Economic Development 42
  - 2.3.2 Key Sectors 48
  - 2.3.3 GDP Composition 52
    - 2.3.3.1 Gross Capital Formation, Industry Value Added, and Agriculture Value Added 52
    - 2.3.3.2 Household Consumption, Government Final Consumption, and Gross Domestic Savings 54
    - 2.3.3.3 Trade to GDP, Exports & Imports of Goods and Services 55
- 2.4 Commodities and the External Sector 58
  - 2.4.1 Global Commodity Production and Consumption 58
  - 2.4.2 Commodity Sectors 59
  - 2.4.3 External Sector Composition 66
    - 2.4.3.1 Exports and Export Structure 66

2.4.3.2 Imports and Import Structure 71
2.4.3.3 Major Trade Partners 72
2.5 Brazil and China: Dualism — Cooperation — Partnership? 75
2.5.1 Dualism 75
2.5.2 Cooperation 78
2.5.3 Partnership? 81
2.6 Conclusion 84

3 Empirical Data and Data Methodology 86
3.1 Introduction 86
3.2 Dependent Variables: Selected Macroeconomic Measures 88
3.2.1 Data Source 88
3.2.2 Data Methodology 89
3.2.3 Data Series 90
3.3 Independent Variables Set 1: Commodity Price Indexes 98
3.3.1 Data Source 98
3.3.2 Methodology 98
3.3.3 Commodity Price Indexes 99
3.3.3.1 Data Series 99
3.3.3.2 Commodity Price Indexes: Correlation and Granger Causality .. 101
3.3.3.3 Commodity Price Indexes and World GDP per Capita 104
3.3.3.4 Commodity Price Indexes and China’s GDP 109
3.4 Independent Variables Set 2: Governance Indexes 112
3.4.1 Worldwide Governance Index 112
3.4.1.1 Data Source 112
3.4.1.2 Data Methodology 113
3.4.1.3 Data Series 115
3.4.1.3.1 Summary View: Brazil and China 115
3.4.1.3.2 Voice and Accountability 116
3.4.1.3.3 Political Stability 119
3.4.1.3.4 Government Effectiveness 121
3.4.1.3.5 Regulatory Quality 124
3.4.1.3.6 Rule of Law 125
3.4.1.3.7 Control of Corruption 128

3.4.2 The Economic Freedom Index 130
3.4.2.1 Data Source 130
3.4.2.2 Data Methodology 131
3.4.2.3 Data Series 134
3.4.2.3.1 Summary View: Brazil and China 134
3.4.2.3.2 Business Freedom 135
3.4.2.3.3 Trade Freedom 140
3.4.2.3.4 Fiscal Freedom 142
3.4.2.3.5 Government Size 146
3.4.2.3.6 Monetary Freedom 148
3.4.2.3.7 Investment Freedom 153
3.4.2.3.8 Financial Freedom 155
3.4.2.3.9 Property Rights 161
3.4.2.3.10 Freedom from Corruption 163
3.5 Conclusion 165

4 Empirical and Econometric Analysis 167
4.1 Introduction 167
4.2 Statistical Diagnostic Tests 176
4.2.1 Unit Root Analysis 176
4.2.1.1 Methodology and Hypothesis 176
4.2.1.2 Unit Root Tests Results 177
4.2.2 Correlation Analysis 177
4.2.2.1 Correlation Methodology 177
4.2.2.2 Correlation Analysis Brazil 178
4.2.2.3 Correlation Analysis China 190
4.2.3 Causality Analysis 201
4.2.3.1 Causality Methodology and Hypothesis 201
4.2.3.2 Causality Analysis Brazil 204
4.2.3.3 Causality Analysis China 218
4.2.4 Principal Component Analysis 231
4.2.4.1 Methodology 231
4.2.4.2 Principal Component Analysis of Commodity Prices 236

        4.2.4.2.1 Principal Component Analysis of Commodity Price Indexes 236
        4.2.4.2.2 Principal Component Analysis of Changes in Commodity Price Indexes 239
      4.2.4.3 Principal Component Analysis of Worldwide Governance 240
        4.2.4.3.1 Principal Component Analysis of Worldwide Governance Indexes 240
        4.2.4.3.2 Principal Component Analysis of Changes in Worldwide Governance Indexes 243
      4.2.4.4 Principal Component Analysis of Economic Freedom 244
        4.2.4.4.1 Principal Component Analysis of Economic Freedom Indexes 244
        4.2.4.4.2 Principal Component Analysis of Changes in Economic Freedom Indexes 248
4.3 Multiple Regression Analysis 250
  4.3.1 Methodology 250
  4.3.2 Multiple Regression Analysis Brazil 251
    4.3.2.1 Multiple Regression MatrixBrazil 251
    4.3.2.2 Multiple Regression Results Brazil 258
  4.3.3 Multiple Regression Analysis China 261
    4.3.3.1 Multiple Regression Matrix China 261
    4.3.3.2 Multiple Regression Results China 266
4.4 Conclusion 269
  4.4.1 Conclusion Correlation Analysis 269
  4.4.2 Conclusion Causality Analysis 271
  4.4.3 Conclusion Principal Component Analysis 275
  4.4.4 Conclusion Multiple Regression Analysis 277

5 Comparative Econometric Result Analysis of Selected Variables 280
5.1 Introduction 280
5.2 Selected Macroeconomic Variables 284
  5.2.1 GDP Growth Rate 284
  5.2.2 GDP Per Capita Growth Rate 285
  5.2.3 Industry Value Added to GDP 286

5.2.4 Manufacturing Value Added to GDP 287
5.2.5 Gross Fixed Capital Formation to GDP..288
5.2.6 Trade Variables...292
5.2.7 Manufacturing Trade Variables...298
5.2.8 Trade Indexes..302
5.2.9 Trade Tariffs 307
5.2.10 Foreign Direct Investment 308
5.2.11 Stocks Traded Total Value to GDP 311
5.2.12 Consumer Price Index and M2 to GDP 316
5.2.13 Energy Efficiency 321
5.2.14 Rural Migration..324
5.2.15 Communication Coverage: Internet and Mobile Coverage 328
5.3 Conclusion 331

6 Conclusion 336

APPENDIXES...351

ATTACHMENTS...440

REFERENCES..444

List of Tables

Table 2.1 Brazil GDP Relative to World GDP 1970-2009 43
Table 2.2 China GDP Relative to World GDP 1970-2009 47
Table 2.3 Commodity Production & Consumption 2008–2009 58
Table 2.4 Top 10 Export / Import Commodities Brazil 2009 59
Table 2.5 Top 10 Export / Import Commodities China 2009 63
Table 2.6 Export Structure Brazil 1995-2009 67
Table 2.7 Export Structure China 1995-2009 70
Table 2.8 Import Structure Brazil 1995-2009 71
Table 2.9 Import Structure China 1995-2009 72
Table 2.10 Top 10 Export Trading Partners Brazil 1990-2009 73
Table 2.11 Top 10 Export Trading Partners China 1990-2009 74
Table 2.12 Foreign Direct Investment Brazil and China 1991–2009 77
Table 2.13 Trade Balance Brazil and China 2000–2008 78
Table 3.1 Macroeconomic Topics and Subsets 90
Table 3.2a Dependent Variables Brazil 1996-2009 (Variables 1-26) 92
Table 3.2b Dependent Variables Brazil 1996-2009 (Variables 27-52) 93
Table 3.2c Dependent Variables Brazil 1996-2009 (Variables 53-79) 94
Table 3.3a Dependent Variables China 1996-2009 (Variables 1-26) 95
Table 3.3b Dependent Variables China 1996-2009 (Variables 27-52) 96
Table 3.3c Dependent Variables China 1996-2009 (Variables 53-79) 97
Table 3.4 Commodity Price Indexes 1996–2009 99
Table 3.5 Pearson Correlation Commodity Price Matrix 1971–2009 101
Table 3.6 Pearson Correlation Commodity Price Matrix 1996–2008 102
Table 3.7 Granger Causality — Crude Index and Minerals and Metals Index 1996–2008 104
Table 3.8 Correlation — Change in Commodity Price Indexes and Change in World GDP per Capita 1971-2009 107
Table 3.9 Correlation — Change in Commodity Price Indexes and Change in World GDP per Capita 1996-2009 107
Table 3.10 Granger Causality — Change in Commodity Price Indexes and Change in World GDP per Capita 1971–2009 108

Table 3.11 Correlation of Changes in Commodity Price Indexes and China GDP Growth Rate 1971-2009 110
Table 4.1 GDP Per Capita Growth Correlations Brazil 178
Table 4.2a Correlation Matrix Brazil (Variables 1-26) 182
Table 4.2b Correlation Matrix Brazil (Variables 27-54) 183
Table 4.2c Correlation Matrix Brazil (Variables 55-79) 184
Table 4.3 Significant Correlation Counts Brazil 185
Table 4.4 Consumer Price Index Correlation China 190
Table 4.5a Correlation Matrix China (Variables 1-27) 193
Table 4.5b Correlation Matrix China (Variables 28-54) 194
Table 4.5c Correlation Matrix China (Variables 55-79) 195
Table 4.6 Significant Correlation Counts China 196
Table 4.7 Granger Causality GDP_gr Brazil 206
Table 4.8a Granger Causality Matrix Brazil (Variables 1-29) 207
Table 4.8b Granger Causality Matrix Brazil (Variables 30-54) 208
Table 4.8c Granger Causality Matrix Brazil (Variables 55-79) 209
Table 4.9 Significant Granger Causality Counts Brazil 210
Table 4.10 Granger Causality Trade_GDP China 219
Table 4.11a Granger Causality Matrix China (Variables 1-29) 222
Table 4.11b Granger Causality Matrix China (Variables 30-54) 223
Table 4.11c Granger Causality Matrix China (Variables 55-79) 224
Table 4.12 Significant Granger Causality Counts China 225
Table 4.13 Pearson Correlation of Commodity Price Indexes 1996 – 2008 236
Table 4.14 PCA of Commodity Price Indexes — Newly Created Independent Variables 237
Table 4.15 Pearson Correlation of Changes in Commodity Price Indexes 1996 - 2008 239
Table 4.16 PCA of Changes in Commodity Price Indexes: Newly Created Independent Variable 240
Table 4.17 Pearson Correlation of Worldwide Governance Indexes Brazil 1996 - 2008 240
Table 4.18 Pearson Correlation of Worldwide Governance Indexes China 1996 - 2008 242
Table 4.19 PCA of WGI China — Newly Created Independent Variable 242

Table 4.20 Pearson Correlation of Changes in Worldwide Governance Indexes Brazil 1996-2008 243
Table 4.21 Pearson Correlation of Changes of Worldwide Governance Indexes China 1996-2008 244
Table 4.22 Pearson Correlation of Economic Freedom Indexes Brazil 1996-2008 .. 245
Table 4.23 PCA of EFI Brazil — Newly Created Independent Variable 245
Table 4.24 Pearson Correlation of Economic Freedom Indexes China 1996-2008 .. 246
Table 4.25 PCA of EFI China — Newly Created Independent Variable 247
Table 4.26 Pearson Correlation of Changes in Economic Freedom Indexes Brazil 1996-2008 248
Table 4.27 Pearson Correlation of Changes in Economic Freedom Indexes China 1996-2008 249
Table 4.28a I. Correlation-Granger Causality Matrix and II. Multi Regression Matrix Brazil 254
Table 4.28b I. Correlation-Granger Causality Matrix and II. Multi Regression Matrix Brazil 255
Table 4.29 Parameter Estimates for GDP_gr Brazil 257
Table 4.30 Significant Multiple Regression Dependent Variables for Brazil 257
Table 4.31 Multiple Regression Results Brazil 260
Table 4.32a I. Correlation-Granger Causality Matrix and II. Multi Regression Matrix China 262
Table 4.32b I. Correlation-Granger Causality Matrix and II. Multi Regression Matrix China 263
Table 4.33 Parameter Estimates for GrossNatExp_GDP China 264
Table 4.34 Significant Multiple Regression Dependent Variables for China 265
Table 4.35 Multiple Regression Results China 268
Table 5.1 GDP Growth Rate 284
Table 5.2 GDP Per Capita Growth Rate 285
Table 5.3 Industry Value Added to GDP 286
Table 5.4 Manufacturing Value Added to GDP 287
Table 5.5 Gross Fixed Capital Formation to GDP 288
Table 5.6.1 Trade to GDP 292
Table 5.6.2 Exports of Goods and Services to GDP 292
Table 5.6.3 Imports of Goods and Services to GDP 292

Table 5.7.1 Manufacturing Exports to Merchandise Exports....................................298
Table 5.7.2 Manufacturing Imports to Merchandise Imports....................................301
Table 5.8.1 Export Value Index Brazil / Import Value Index China..........................302
Table 5.8.2 Export Volume Index Brazil / Import Volume Index China...................304
Table 5.8.3 Unit Value Index Exports Brazil / Unit Value Index Imports China 305
Table 5.8.4 Export Value Index China / Export Volume Index China.......................306
Table 5.9 Weighted Tariffs Brazil / China 307
Table 5.10 Foreign Direct Investment...308
Table 5.11 Stocks Traded Total Value to GDP 311
Table 5.12.1 US CPIx and US M2 to GDP and Commodity Price Indexes.................316
Table 5.12.2 CPIx Brazil and China..318
Table 5.12.3 M2 to GDP Brazil and China...320
Table 5.13 Energy Efficiency (GDP_UEnUPPPOilE)...321
Table 5.14 Rural Migration 324
Table 5.15.1 Internet Coverage...328
Table 5.15.2 Mobile Coverage 329

List of Figures

Figure 2.1 PMI Index Brazil–China April 2007 – May 2011 80
Figure 3.1 Commodity Price Indexes 1971–2009.. 100
Figure 3.2 Commodity Price Indexes and Change in World GDP per Capita 1971–2009 105
Figure 3.3 Change in Commodity Price Indexes and Change in World GDP per Capita 1971–2009... 106
Figure 3.4 Changes in Commodity Price Indexes and China GDP Growth Rate 1971–2009 110
Figure 3.5 Worldwide Governance Indexes Summary — Brazil versus China....... 115
Figure 3.6 WGI Voice and Accountability 116
Figure 3.7 WGI Political Stability.. 119
Figure 3.8 WGI Government Effectiveness 121
Figure 3.9 WGI Regulatory Quality.. 124
Figure 3.10 WGI Rule of Law.. 125
Figure 3.11 WGI Control of Corruption 128
Figure 3.12 Economic Freedom Indexes — Brazil versus China 134
Figure 3.13 EFI Business Freedom 135
Figure 3.14 EFI Trade Freedom 140
Figure 3.15 EFI Fiscal Freedom... 142
Figure 3.16 Credit Default Swaps of Brazil and China 2004–2010........................... 144
Figure 3.17 EFI Government Size... 146
Figure 3.18 EFI Monetary Freedom and Inflation 148
Figure 3.19 FX Rates and Inflation 150
Figure 3.20 EFI Investment Freedom.. 153
Figure 3.21 EFI Financial Freedom 155
Figure 3.22 EFI Property Rights 161
Figure 3.23 EFI Freedom from Corruption 163
Figure 4.1 SAS Syntax Granger Causality Example — GDP_gr and changes in MinMetalsIx 203

List of Appendixes

Appendix 2.1 Macroeconomic Figures 1996–2008 352
Appendix 2.1a Macroeconomic Figures 1996–2008 — GDP, FDI, China Trade 353
Appendix 2.1b Macroeconomic Figures 1996-2008 — GDP Composition 354
Appendix 2.1c Macroeconomic Figures 1996-2008 — GDP Composition 355
Appendix 2.1d Macroeconomic Figures 1996-2008 — Trade, Exports 356
Appendix 2.1e Macroeconomic Figures 1996-2008 — Imports, Stocks, M2 357
Appendix 2.1f Macroeconomic Figures 1996-2008 — FDI, Reserves, Energy 358
Appendix 2.1g Macroeconomic Figures 1996-2008 — Mobile Subscribers 359
Appendix 3.1 Definition Macroeconomic (Dependent) Variables 360
Appendix 3.1a Definition Macroeconomic (Dependent) Variables (1/26) 361
Appendix 3.1b Definition Macroeconomic (Dependent) Variables (2/26) 362
Appendix 3.1c Definition Macroeconomic (Dependent) Variables (3/26) 363
Appendix 3.1d Definition Macroeconomic (Dependent) Variables (4/26) 364
Appendix 3.1e Definition Macroeconomic (Dependent) Variables (5/26) 365
Appendix 3.1f Definition Macroeconomic (Dependent) Variables (6/26) 366
Appendix 3.1g Definition Macroeconomic (Dependent) Variables (7/26) 367
Appendix 3.1h Definition Macroeconomic (Dependent) Variables (8/26) 368
Appendix 3.1i Definition Macroeconomic (Dependent) Variables (9/26) 369
Appendix 3.1j Definition Macroeconomic (Dependent) Variables (10/26) 370
Appendix 3.1k Definition Macroeconomic (Dependent) Variables (11/26) 371
Appendix 3.1l Definition Macroeconomic (Dependent) Variables (12/26) 372
Appendix 3.1m Definition Macroeconomic (Dependent) Variables (13/26) 373
Appendix 3.1n Definition Macroeconomic (Dependent) Variables (14/26) 374
Appendix 3.1o Definition Macroeconomic (Dependent) Variables (15/26) 375
Appendix 3.1p Definition Macroeconomic (Dependent) Variables (16/26) 376
Appendix 3.1q Definition Macroeconomic (Dependent) Variables (17/26) 377
Appendix 3.1r Definition Macroeconomic (Dependent) Variables (18/26) 378
Appendix 3.1s Definition Macroeconomic (Dependent) Variables (19/26) 379
Appendix 3.1t Definition Macroeconomic (Dependent) Variables (20/26) 380
Appendix 3.1u Definition Macroeconomic (Dependent) Variables (21/26) 381
Appendix 3.1v Definition Macroeconomic (Dependent) Variables (22/26) 382
Appendix 3.1w Definition Macroeconomic (Dependent) Variables (23/26) 383

Appendix 3.1x Definition Macroeconomic (Dependent) Variables (24/26)..............384
Appendix 3.1y Definition Macroeconomic (Dependent) Variables (25/26)..............385
Appendix 3.1z Definition Macroeconomic (Dependent) Variables (26/26)..............386
Appendix 3.2 Macroeconomic Topics 387
Appendix 3.3 Commodity Price Index..388
Appendix 3.3a Commodity Price Index — Food, Tropical Beverages, Vegetables..389
Appendix 3.3b Commodity Price Index — Agri, Oil, Minerals and Metals 390
Appendix 3.4 Commodity Price Index Constituents...391
Appendix 3.4a Commodity Price Index Constituents — Food.................................392
Appendix 3.4b Commodity Price Index Constituents — Tropical Beverages...........393
Appendix 3.4c Commodity Price Index Constituents — Vegetables 394
Appendix 3.4d Commodity Price Index Constituents — Agricultural Raw Materials 395
Appendix 3.4e Commodity Price Index Constituents — Ores, Minerals, Metals 397
Appendix 3.4f Commodity Price Index Constituents — Crude Index......................399
Appendix 3.5 Commodity Price Indexes Weights...400
Appendix 3.6 Commodity Price Index and Constituents 1971-2009 — Figures.....401
Appendix 3.6a Crude & Minerals and Metals Index Constituents............................402
Appendix 3.6b Agricultural Raw Materials and Vegetables Oils Seeds Index Constituents...403
Appendix 3.6c Tropical Beverages and Food Index and Constituents 404
Appendix 3.7 Pearson Correlations of Commodity Price Index Constituents 1996-2008 / 1971-2009...405
Appendix 3.7a Pearson Correlations of Commodity Price Index Constituents 1996-2008 — Ores, Minerals and Metals...406
Appendix 3.7b Pearson Correlations of Commodity Price Index Constituents 1996-2008 — Agricultural Raw Materials..407
Appendix 3.7c Pearson Correlations of Commodity Price Index Constituents 1996-2008 — Vegetables Oils Seeds 408
Appendix 3.7d Pearson Correlations of Commodity Price Index Constituents 1996-2008 — Food...409
Appendix 3.7e Pearson Correlations of Commodity Price Index Constituents 1996-2008 — Tropical Beverages...410

Appendix 3.7f Pearson Correlations of Commodity Price Index Constituents 1971-2009 — Ores, Minerals and Metals 411
Appendix 3.7g Pearson Correlations of Commodity Price Index Constituents 1971-2009 — Agricultural Raw Materials 412
Appendix 3.7h Pearson Correlations of Commodity Price Index Constituents 1971-2009 — Vegetables Oils Seeds 413
Appendix 3.7i Pearson Correlations of Commodity Price Index Constituents 1971-2009 — Food 414
Appendix 3.7j Pearson Correlations of Commodity Price Index Constituents 1971-2009 — Tropical Beverages 415
Appendix 3.8 Pearson Correlations — Commodity Price Index vs. Constituents 416
Appendix 3.9 Worldwide Governance Index Definition 417
Appendix 3.9a Worldwide Governance Index — Voice and Accountability, Political Stability, Government Effectiveness 418
Appendix 3.9b Worldwide Governance Index — Regulatory Quality, Rule of Law, Corruption 419
Appendix 3.10 Worldwide Governance Indexes — Individual Data Sources 420
Appendix 3.11 Economic Freedom Index Definition 421
Appendix 3.11a Economic Freedom Index — Business, Trade 422
Appendix 3.11b Economic Freedom Index — Fiscal, Government Size 423
Appendix 3.11c Economic Freedom Index — Monetary 424
Appendix 3.11d Economic Freedom Index — Investment, Financial 425
Appendix 3.11e Economic Freedom Index — Property Rights, Corruption 426
Appendix 3.12 Data Series Brazil 427
Appendix 3.12a Data Series Brazil (Governance Data) 428
Appendix 3.12b Data Series Brazil (Variables 1-34) 429
Appendix 3.12c Data Series Brazil (Variables 35-71) 430
Appendix 3.12d Data Series Brazil (Variables 72-79, Others) 431
Appendix 3.13 Data Series China 432
Appendix 3.13a Data Series China (Governance Data) 433
Appendix 3.13b Data Series China (Variables 1-35) 434
Appendix 3.13c Data Series China (Variables 36-71) 435
Appendix 3.13d Data Series China (Variables 72-79, Others) 436

Appendix 3.14 Commodity Price Indexes and World GDP / World GDP per Capita / World Trade to World GDP ratios 437
Appendix 3.15 Data Series Standard Deviations 1996–2008 438
Appendix 5.1 CPIx, M2 to GDP — US, Brazil, China.. 439

List of Abbreviations

ABC	Agricultural Bank of China
ARG	Argentine
AUD	Australian Dollar Currency
AUS	Australia
Avg.	Average
Big Cap	Company with market capitalization of USD10bio and greater
Bio	Billion
BL	Belgium
Bloomberg	Bloomberg L.P., New York, US.
BOC	Bank of China
Bovespa	Bolsa De Valores De São Paulo, Brazilian Stock Exchange
Bpd	Barrel Per Day
BRL	Brazilian Real Currency
BTI	Bertelsmann Transformation Index
CAD	Canadian Dollar Currency
Cap	Capitalization
Capex	Capital Expenditures
CCB	China Construction Bank
CCP	Chinese Communist Party
CD-ROM	Compact Disk Read Only Memory
CDS	Credit Default Swaps
CHI	Chile
CHN	China
CNOOC	China National Offshore Oil Corporation
CNPC	China National Petroleum Corporation
COSCO	China Ocean Shipping Company
CPI	Corruption Perception Index
CSCL	China Shipping Container Lines
DF, DFT	Dickey-Fuller, Dickey Fuller Test
EFI	Economic Freedom Index/Indexes

EFIBiz	Economic Freedom Index Business
EFICorrup	Economic Freedom Index Corruption
EFIFisc	Economic Freedom Index Fiscal
EFIFin	Economic Freedom Index Financial
EFIGovtS	Economic Freedom Index Government Size
EFIInvest	Economic Freedom Index Investment
EFIMon	Economic Freedom Index Monetary
EFIPropRi	Economic Freedom Index Property Rights
EFITrade	Economic Freedom Index Trade
EIU	The Economist Intelligence Unit
FDI	Foreign Direct Investments
ff	And following pages
FTC	Foreign Trade Company
FR	France
FX	Foreign Exchange
GBP	British Pound Currency
GDP	Gross Domestic Product
GER	Germany
GNI	Gross National Income
GOE	Government Owned Entities/Enterprises
HK	Hong Kong
HKD	Hong Kong Dollar Currency
HSI	Hang Seng Index, Hong Kong, Equity Index
ICBC	Industrial Commercial Bank Of China
ICT	Information Communication And Technology
IFC	International Finance Corporation
IN	India
IT	Italy
Iv	Inverse
JP	Japan
K	Thousand Units
Kg	Kilogram
Kt	Kilo tons

Kwh	Kilo Watt Hours
Lula	President Luiz Inácio da Silva, 35th Brazilian President from January 1, 2003, to January 1, 2011.
Market Cap	Market Capitalization
MD$	Malaysia Dollar Currency
MEX	Mexico
Micro Cap	Firm with market cap between USD50 mio and USD300 mio
Mid Cap	Firm with market cap between USD2 bio and USD10 bio
Mio	Million
MPT	Ministry of Phone and Telecommunications (China)
Mt, mt	Metric Tons
Multi	Multiple and multi are used synonymously
MYR	Malaysian Ringgit
NL	Netherlands
NPC	National People’s Congress, China
NPL	Non Performing Loans
ns.	Not significant
NTB	None-Tariff Barrier
NZD	New Zealand Dollar Currency
p.	page
pp.	pages
PAC	Plano de Aceleracão do Crescimento 2007-2010
PASW	PASW Statistics 18, or PASW Statistics
PCA	Principal Component Analysis
PCR	People’s Republic Of China
P/E	Price Earnings Ratio
PMI	Purchase Manager Index
PPP	Purchasing Power Parity
PT	Partido Trabalhador (Workers Party), Brazil
R*	Adjusted R^2
R^2	R-square
R&D	Research and Development
REG	Regression
RMB	Renminbi, Chinese Currency (officially used)

RU	Russia
SAS	SAS 9.1.3 Service Pack 4 Software, or SAS Software
SELIC	Special Settlement and Custody System Overnight Rate (Brazil)
SEZ	Special Economic Zones
SG	Singapore
SGD	Singaporean Dollar Currency
sig	Significant
SK	South Korea
SOE	State Owned Entities/Enterprises
SP	Spain
S&P	Standard and Poor’s
SSE	Shanghai Stock Exchange
Sqkm	Square Kilometers
TH	Thailand
Trio	Trillion
TWh	Terra Watt Hours
TVE	Township and Village Enterprises
UK	United Kingdom
UR	Unit Root
US	United States
USD or U$	United States Dollar Currency
VZ	Venezuela
WGI	Worldwide Governance Index/Indexes
WGICC	Worldwide Governance Index Control Of Corruption
WGIGE	Worldwide Governance Index Government Effectiveness
WGIPS	Worldwide Governance Index Political Stability
WGIRL	Worldwide Governance Index Rule Of Law
WGIRQ	Worldwide Governance Index Regulatory Quality
WGIWA	Worldwide Governance Index Voice And Accountability
WTO	The World Trade Organization
Yuan	Chinese Currency

List of Price Denominations

Mal$/kg	Malaysian dollars per kg
Mal/Sing¢/kg	Malaysian/Singapore cents per kg
n.pence/kg	New pence per kg
SDR/t	SDR's (Swap Data Repository) per tonne
Sing¢/kg	Singapore cents per kg
£/t	Sterling pound per tonne
US¢/Fe unit	US cents per Fe (ferrum) unit
US¢/troy ounce	US cents per troy ounce
US¢/kg	US cents per kg
US¢/lb.	US cents per lb
US¢/sheet	US cents per sheet
US$/100kg	US dollars per 100 kg
US$/barrel	US dollars per barrel
US$/m3	US dollars per cubic meter
US$/troy ounce	US dollars per troy ounce
US$/mtu Mn	US dollars per metric tonne unit of metallurgical manganese.
US$/mtu Wo3 Bottom of Form	US dollars per metric tonne unit of Wo3 (tungsten trioxide) Bottom of Form.

List of Symbols

%	Percentage
Δ	Delta
$\sum$	Sum
$\surd$	Square Root
$\leq$	Smaller than
$\geq$	Larger than
=	Equals to
α	(i) Alpha; (ii) Polynomial lag operator.
β	(i) Beta, Beta coefficient; (ii) Linear predictor variable; (iii) Multiple regression coefficient; (iv) Polynomial matrix.
ε	Error term
H_0	Null Hypothesis
H_1	Alternative Hypothesis
k	One Thousand
κ	Coefficient
p_c	Price in period c
q_c	Quantity in period c
r_{xy}	Pearson correlation coefficient
$	United States Dollar Currency
$\hat{W}$	(i) Coefficient, (ii) Polynomial matrix
$\bar{y}$	Sample mean of y
y_t	Value of variable y in period t
$\bar{x}$	Sample mean of x
x_t	Value of variable x in period t
*	Significance level of 0.05
**	Significance level of 0.01

1 Introduction

1.1 Overview

A large number of empirical studies analyze the effects of commodity prices on macroeconomic variables. Others measure interdependencies and causalities between macroeconomic variables of developed and emerging economies. A third group of studies examines the effects of governance on economies. Most such studies are carried out by analyzing only a rather small number of variables. Few studies exist that analyze the effects of both governance and commodity prices on macroeconomic measures in emerging economies. This study aims to fill this void. It merges the examination of the effects of both commodities and governance to one single field of study. More specifically, it analyses the effects of commodity prices and governance indexes on macroeconomic variables in Brazil and China. Also, instead of focusing on only a few variables, I take into account a large number of them —seventy-nine— to ensure a holistic view of the matter.

The importance of governance architecture has gained significant recognition and appreciation over the past decade, on both regional and global levels. Especially in developing countries, political and corporate leadership is very much aware and cognizant of the positive effects a functioning governance framework and architecture can have (Sangmeister and Schönstedt, 2010, p. 179). By including the analysis of governance effects in the macroeconomic discussion and by aligning it comparatively with commodity price effects on emerging economies this study attempts to contribute to the ongoing discussion on regional and global governance architecture. In this context, the study attempts to draw a comparison between two sets of independent factors affecting emerging economies: Governance and commodity prices.

This thesis consists of six parts (Chapters 1-6). Chapter 1 serves as its introduction. Chapter 2 establishes the regional focus. Chapter 3 elaborates on the data and data methodology used in this study. Chapter 4 presents the methodological framework of the econometric analysis. Chapter 5 concludes the study by performing a comparative econometric analysis on selected macroeconomic variables for Brazil and China. The conclusion in Chapter 6 is split into three parts: Overall Conclusion, Sectional Summaries, and Final Remarks. The overall conclusion summarizes the scope, objective, and findings of the study and provides a top level summary. The

Sectional Summaries offer an in depth summary of the thesis' individual chapters and their sections. The final remarks round up the conclusion and thesis as a whole.

1.2 Regional Analysis

The dissertation’s geographical scope is defined by today’s two major emerged forces in their respective regions. In Latin America, Brazil is dominant in its size, geopolitical role and economic weight. The pace of its democratic transformation and economic development since the mid nineties is impressive. In stark contrast to Brazil stands China, one of the world's oldest continuous civilizations, as archaeological evidence dating back more than five thousand years proves. In the mid-1800s, China’s GDP represented approximately 25% of world GDP. Its economy was then extremely bottom heavy with a very large number of family businesses and farms. China missed the industrial revolution at the beginning of the 1900s, triggering the country’s industrial base to stall. However, after China opened to the outside world in the 1980s, its macroeconomic development was again remarkable. At the turn of the 21st century, China, similar to Brazil, faced overwhelming internal challenges magnified by the information, communication and technology revolution.

Chapter 2 provides a brief comparative overview of the sociopolitical developments of Brazil and China during the past fifty years. It illustrates the two countries' macroeconomic frameworks and economic structures according to their demographics, labor markets, domestic sectors, GDPs and their composition, natural resources, and external sectors. The latter two factors play pivotal roles. Brazil is a net exporter of energy commodities, minerals and metals, as well as soft commodities such as soybeans and sugar, whereas China is a net importer of all these commodities. Chapter 2 furthermore details the external sectors of Brazil and China, including the important role of commodities for their trade structures, and explores their main commodity sectors, including each country’s energy mix. It also provides an overview of Brazil’s and China’s main trading partners, revealing the changing dynamics of their bilateral trade relations in the past two decades. The chapter concludes with the assessment of the two countries' direct relations, retracing the transformation of the countries’ relationship from dualism in the 1990s to co-operation starting from the early 2000s to their difficult and complex partnership at the end of the last decade.

1.3 Empirical Data and Data Methodology

Chapter 3 introduces the data sets and methodology used in the empirical and econometric analysis in Chapter 4. The econometric analysis comprises the following metric data sets: UNCTAD commodity composite price indexes; World Bank governance indexes (WGI); economic freedom governance indexes (EFI); and seventy-nine selected variables from various economic topics, provided —if not otherwise stated— by the World Bank during Q3 2009 and Q4 2010.

The governance dimensions of the WGI and EFI indexes complement each other. WGI indexes examine governance dimensions from a holistic socio-political perspective, whereas the scope of the EFI indexes is rather specific and to a large extent geared towards business and economic freedom dimensions.

The macroeconomic variables serve as dependent variables (endogenous) which are affected by commodity prices and governance indexes. Governance indexes and commodity price indexes serve as independent variables (exogenous) in the regression analysis. The assumption and hypothesis for the latter is as follows (please see also Section 1.5): Governance framework and governance architecture are established, formulated, controlled, and managed at the top of central and local authority levels, and are thus exogenous. Commodity prices are also exogenous due to market size and the number of market participants.[1]

Data Sets

Commodity Price Indexes (exogenous): The six UNCTAD commodity indexes cover the annual end-of-year prices of food, vegetable oils and seeds, tropical beverages, agricultural raw materials, minerals as well as base and precious metals, and oil.

World Bank Governance Indexes (exogenous): The six composite World Bank governance indexes cover the following dimensions: voice and accountability (degree of democracy), political stability, government effectiveness, regulatory quality, rule of law, and control of corruption.

Economic Freedom Indexes (exogenous): The nine governance dimensions of the economic freedom index are based on equally weighted averages covering business

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[1] As of 2009/2010 the value of physical trades in global commodity markets was over USD4 trillion, and the value of commodity related financial trades was over USD40 trillion (The Reserve Bank of Australia, June 2011, p. 54).

freedom/market-based competition, trade freedom/liberalization of foreign trade, fiscal freedom/economic performance, government size, monetary freedom/currency and price stability, investment freedom/macro stability, financial freedom, property rights/private property, and freedom from corruption.

Macroeconomic Variables (endogenous): The seventy-nine macroeconomic variables serve as dependent variables and cover a wide range of economic activities and topics such as the private and trade sector, financial sector, national accounts, balance of payments and external debt. The World Bank data used has been accessed during the 3rd quarter of 2009 and 4th quarter of 2010.

Data Points

The data series analysed in Chapters 4 and 5 consist of thirteen annual data points per variable from 1996 to 2008. This is due to the fact that World Bank governance indexes —measured only annually— are not available prior to 1996. Also, the study's analysis in Chapters 4 and 5 does not include post crisis data points from 2009 in order to avoid the effects of structural breaks in the data series as a result of the macroeconomic effects of the global financial crisis with potential subsequent distorting effects on correlation, causality and regression analysis. Then, due to regular updates of The World Bank's Data Catalog, it is possible that data series found online after the 4th quarter of 2010 may deviate from data series used in this study. Macroeconomic data for the econometric analysis covers data points from 1996 to 2008. Any data series analysed and elaborated on before 1996 —for example in Chapters 2 and 3—, specifically between 1960 and 1995, and after 2008 are for information purposes only and mainly based on World Bank (2009, 2010) data if not otherwise stated.

In Chapter 3 (Empirical Data and Data Methodology) I also elaborate on the price development of each commodity composite group between 1971 and 2009 and their correlations for the periods of 1971 to 2009 and 1996 to 2008 in order to illustrate co-integration and spurious correlation between commodity price indexes. In addition, I carry out a number of initial correlation and Granger causality tests between price indexes of crude, minerals and metals (e.g., base and precious metals), and soft commodities in order to establish commodity groupings which are essential for the co-integration check and econometric analysis in Chapter 4. Furthermore, I include output measures such as world GDP and world GDP per capita in the initial correlation and Granger Analysis in Chapter 3 in order to establish key assumptions on causality.

The underlying data sets in this thesis have not gone through standardization or normalization of variables due to the nonparametric nature of the data series. The statistical methods preceding the multiple regression analysis in Chapter 4 do not depend on population fitting or any particular parameterized distributions. Also, the variables I use are either indexed, percentage shares or change rates in percentages. None of the variables used for analysis are denominated in absolute numbers or currency units. Thus, I have chosen not to standardize and not to log normalize data series.

For computation and analysis purposes I use data with three digits after the decimal point. For illustration (e.g., charts, tables) and discussion purposes I mainly use and display rounded data with one or two digits after the decimal point. Data ranges are mostly discussed with no decimal point.

1.4 Empirical and Econometric Analysis

The econometric analysis is the core element of this study. The objective of the econometric analysis is as follows: First, to test the effects of governance and commodity prices on macroeconomic variables of Brazil and China and reveal significant statistical associations such as correlation, Granger causality, and regression, which are then —in Chapter 5— empirically validated. Secondly, to provide a comparative view on macroeconomic effects of governance and commodity prices for Brazil and China by drawing comparative conclusions.

Framework

The majority of my empirical and econometric analyses are based on the standard approach used in prevalent academic literature including unit root tests, correlation tests, Granger causality tests, principal component analyses, and regression analyses. My results are significant to the choice of methodology to calculate correlation, Granger causality, and regression analysis.

The econometric analysis consists of four statistical diagnostic tests designed to select statistically significant pairs of independent and dependent variables before considering them for multiple regression analysis. The statistical diagnostic tests introduced below are based on the theory of hypothesis testing. In the majority of statistical research papers the level of statistical significance required to reject the null hypothesis, that is to obtain a statistically significant result, is conventionally set at 0.05, or 5%, representing a confidence level of 95%. In this study I follow the prevalent threshold convention and also chose a p-value level of 0.05. The significance level (p-value) measures the probability that the null hypothesis H_0 will be rejected incorrectly, provided the assumption that the null hypothesis H_0 is true. Generally, the lower the percentage required for statistical significance, the more problematic is it to reject the null hypothesis H_0. The lower the observed p-value is, the lower is the probability to wrongly reject H_0. In some rare cases, which can be considered borderline cases, I will work with a p-value slightly higher than 0.05.

Unit Root Test

The statistical diagnostic tests in the econometric analysis in Chapter 4 begin with the Dickey-Fuller unit root test in which I test data series of independent and dependent variables on unit root in order to obtain valid correlation, causality, and regression results. The H_0 states that the data series have a unit root, that is, the data series are non-stationary. Unit root analysis is carried out using SAS program software.

Correlation Analysis

After successfully passing the unit root analysis, which will reveal that all data series are stationary, I perform correlation analysis on the dependent and independent variables. I seek to identify and understand the associations of certain variables pairs which may be worth further investigation in the Granger causality analysis. For the purposes of this thesis, I posit that correlation coefficients above 0.50 but lower than 0.70 represent moderate correlation. Correlation coefficients above 0.70 and below 0.90 represent high correlation, and correlation coefficients above 0.90 represent very high correlation. In principle, I accept all correlation pairs with correlation significance at the minimum of a p-value of 0.05. That is, correlation pairs with a confidence level equal to or larger than 95% are deemed to be statistically significant and will thus be selected to proceed to the next stage of statistical diagnostic tests, the Granger causality evaluation. Correlation pairs at the 0.01 significance level will be denoted as such. Also, it is important to note that the thesis focuses primarily on positive correlation pairs, except for ten specified macroeconomic variables for each country, for which I also perform correlation analysis. All correlation results for Brazil and China are summarized and displayed in the correlation matrix in Section 4.2.2, which is one of the key elements in this thesis.

Causality Analysis

The causality analysis is based on the concept of Granger causality (Granger causality and causality are used synonymously in this thesis). The causality analysis in Chapter 4 is also referred to as Granger tests or Granger causality tests.[2] It examines the direction of interdependence —if any— between a dependent and an independent variable. Granger tests represent the third statistical diagnostic test in the thesis. Granger causality tests are an integral part of macroeconomic research —especially in time-series analysis— to reveal the possibility of one independent variable controlling/affecting one dependent variable (efficient cause). I have chosen Granger causality testing over a vector error correction model due to the fact that Granger tests examine short- to medium term causality, whereas vector correction models test long-term causality.

The null hypothesis H_0 (null, or H_0) of Granger causality tests states that there exists non-causality. That is, significance values below 0.05 allow rejecting the null hypothesis in favor of the alternative hypothesis which posits that Granger causality exists. The results of the Granger causality analysis for Brazil and China are summarized and displayed in the causality matrix (Section 4.2.3), which also incorporates the correlation results of the previous sections. The Granger causality matrix for Brazil and China, another key element of this thesis, provides the basis for the regression matrix for Brazil and China in Section 4.3 (Multiple Regression Analysis).

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[2] The Granger causality tests in SAS are carried out through Granger-Wald causality tests.

Principal Component Analysis

As the next step after Granger causality testing follows the principal component analysis. Multicollinearity is a statistical occurrence within a multiple regression model in which more than one independent variable is highly correlated with at least one other independent variable. A high degree of multicollinearity may distort the results of the effect of a single independent variable in a regression model. That is, a regression model with highly correlated or co-integrated independent variables may result in regression models with large standard errors (or noise). Statistically significant multiple regression models are those in which independent variables correlate highly with specific dependent variables, but correlate minimally with other non-specific variables. Multiple regression models with these features are characterized as low noise and statistically robust. Multicollinearity does not actually distort results, but it generates large standard errors in the related independent variables. The principal component analysis solves this problem and is carried out based on a set of criteria which are described in more detail in Chapter 4.

Multiple Regression Analysis

Following the principal component analysis, I will carry out multiple regression[3] analysis for those independent and dependent variable pairs which have been validated and passed the statistical diagnostic tests applied in the previous sections. In the regression analysis I seek to establish significant relationships between one or more than one of the seventy-nine dependent variables with one or several independent variables consisting of commodity price indexes and governance indexes. In this context I use adjusted R-square (or adjusted R^2) as a key measure to identify how well the regression equation fits the data. In this thesis, an adjusted R-square above 0.80 will be considered to represent a strong goodness of fit to the model. Also, the t-test associated with regression analysis determines whether the independent variable is a significant predictor of the dependent variable by measuring the proportion of variance in the dependent variable explained by the independent variable. A t-value of above 2.0 will be considered to be meaningful, suggesting strong explanatory power of the independent variable.

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[3] Multi regression and multiple regression are used synonymously in this thesis.

The correlation matrixes in Section 4.2.2, and the Granger causality matrixes in Section 4.2.3 represent an integral part for the creation of the multi-regression matrixes for Brazil and China displayed in Section 4.3. The multiple regression matrixes in Section 4.3 incorporate significant correlation results, significant Granger causality results, as well as regression results for each dependent variable. Each matrix represents a different analysis level of the thesis. The correlation matrix analysis results are a pivotal input factor for the Granger causality matrix, which in turn represents a key element for the multiple regression matrix in Section 4.3.

Econometric Software and Statistical Application Packages

The statistical diagnostic tests —including unit root analysis, Granger causality analysis, principal component analysis—, as well as regression analysis have been carried out with the SAS 9.1.3. Service Pack 4 XP_HOME Platform. The correlation tests have been performed with the PASW Statistics 18 statistical application package (PASW). A comprehensive overview of SAS programming syntax, and SAS output syntax for Chapters 3, 4, and 5 on Brazil and China can be found in the attached compact disk (CD-ROM). The CD-ROM contains folders for Brazil and China with respective sub-folders for each respective statistical diagnostic test and regression analysis. The CD–ROM folder structure mirrors the content structure of each respective diagnostic test of Brazil and China. The diagnostic test and multiple regression files are segregated by variables measured in percentage shares and by variables measured in change rates, mirroring the content structure of the respective diagnostic tests. The SAS output syntax for each test-run offers a vast range of statistical measures. Not all of these SAS measures are relevant for my econometric analysis. Such SAS output syntax which is neither relevant for the statistical diagnostic tests nor for the results in the econometric analysis is initially marked in gray letters in the attachments for purposes of reader friendliness.

The correlation data in the respective matrixes in Chapters 3, 4, and 5 has been exported to Excel from PASW. The CD-ROM attachment contains pdf files with SAS program syntax, output syntax and log syntax for the unit root analysis, the causality analysis, the principal component analysis and the regression analysis of Chapters 2, 3, 4, and 5, and their respective appendixes.

1.5 Comparative Econometric Result Analysis of Selected Variables

Comparative Analysis

Chapter 5 discusses the regression results and offers comparative economic interpretations for selected dependent variables. The objective is to uncover significant empirical relationships supported by findings of statistical significance. In Chapter 5 I do not discriminate between dependent variables which reveal significant regression results and those which do not. The criteria for selecting dependent variables are based on empirical and correlational significance, and/or causality significance, and/or regression significance, and also to some extent on my own subjective rationale. A dependent variable must reveal at least significant correlation results and yield sufficient empirical evidence to perform analysis on. The objective is to isolate meaningful macroeconomic variables and to draw comparisons on surfacing explanatory variables at the example of Brazil and China. Also, the fact that certain regression significant variables of Chapter 4 are not discussed in Chapter 5 does not imply that these variables are empirically insignificant.

The structure of Chapter 5 is as follows: First, I display the regression metrics of Brazil and China in an introductory table of a selected dependent variable, indicating significance levels, correlation levels, regression results including adjusted R-square, and —case by case— t- and p-values. Then, in a second step, I examine and illustrate empirical associations by supporting these with statistical significance found through the correlation, causality, and regression analysis.

Inverse Causality

In a number of cases discussed in this thesis I observe inverse causality. Inverse causality happens when a dependent macroeconomic variable leads, or Granger causes, the independent variable. I observed inverse causality to a large extent with Chinese macro variables affecting commodity price indexes. Inverse causalities play a key role in revealing and pointing out inverse effects of Brazilian or Chinese macroeconomic variables on independent variables such as commodity price indexes and/or governance indexes. In Chapter 5 I provide a comparative analysis of Brazil and China by displaying correlation, Granger causality and regression results. There I will also discuss inverse Granger causality (dependent variables affecting independent variables) on basis of selected individual macroeconomic variables.

I do not perform an inverse Granger causal multiple regression analysis in which commodity price indexes and governance indexes are treated as dependent variables (endogenous), and in which macroeconomic variables are treated as independent (exogenous) variables. As illustrated at the beginning of Section 1.3, the reasons are as follows:

(1) Governance dimensions are too complex, too heterogeneous, and politically too multifaceted as that they can be affected by one or more than one specific macroeconomic variable over the long-term. It is problematic to envision that governance architecture and its dimensions is caused or significantly influenced by one or more than one (or a set of) macroeconomic variable(s). Governance architecture is established, formulated, and influenced at top central and/or local authority levels, supporting the political and economic framework of an economy. Thus, governance architecture and its dimensions are treated as exogenous factors in this thesis.

(2) As I illustrate in Chapter 3, Commodity price indexes trend with the general state of the global economy and not solely with the trend of a single economy such as China's. Also, the volume of commodities traded and the number of market participants is very high. Undoubtedly, China's economic expansion in tandem with global growth specifically affected global commodity prices, as I will illustrate in Chapters 2, 3, 4, and 5. Nonetheless, a hypothetical Chinese domestic expansion and simultaneous economic deterioration in Europe and/or the US would hardly positively affect global commodity prices.[4]

Therefore I maintain the original hypothesis that commodity prices and governance are exogenous factors and choose not to perform inverse regression analysis. Instead, I built an inverse Granger debate within the comparative econometric discussion in Chapter 5 on a selective and individual variable basis. That is, I limit the inverse Granger causality debate to the context of significant correlation results. Inverse Granger discussion alone does offer insightful findings. Inverse Granger causal associations in the Granger causal and regression matrixes in Chapter 4.2 and 4.3 are marked in yellow, whereas regular or positive (non inverse) Granger causal associations are marked in green.

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[4] As of 2010: China GDP to world GDP = 8.56%, US GDP to world GDP = approximately 23%, Europe GDP to world GDP = approximately 25% (please see Chapter 2 for details) (Data Source: World Bank, 2009, 2010).

In general, I find evidence supporting the view of many researchers that exports drive the GDP of emerging economies. With the example of Brazil I also find statistical evidence that degrees of democracy are positively affected by the degree of trade openness. Furthermore there is empirical evidence that China’s economic expansion does affect specific commodity prices (inverse Granger causality).

1.6 Conclusion

The conclusion following Chapter 5 is split into three parts: Overall Conclusion, Sectional Summaries, and Final Remarks.

The overall conclusion summarizes the scope, objective, and findings of the thesis and provides a top level summary. The Sectional Summaries offer an in depth summary of the thesis' individual chapters and their sections. The final remarks round up the conclusion and thesis as a whole.

2 Regional Analysis — Brazil and China

2.1 Introduction

This chapter instantiates the regional focus of this thesis by summarizing the sociopolitical and macroeconomic framework of both, Brazil and China. This chapter provides the qualitative foundation for the subsequent multiple regression analysis of 79 identical macroeconomic variables for both countries. This chapter is hence organized according to the comparative analysis of Brazil and China, highlighting structural differences in their sociopolitical and macroeconomic frameworks; the data is mainly based on the World Bank (2009, 2010) data catalog if not otherwise stated.

One of the key premises underlying Brazil's and China's pursuit of regional and global economic and political leadership has been each country's protracted economic growth. China's economic expansion and its appetite for soft and energy commodities, minerals and metals has increased commodity prices and amplified Chinese demand for key Brazilian exports, including soybeans, oil products, pulp, and iron ores. In contrast, Brazil has engaged in greater imports of Chinese manufactured goods in the past decade. The rise of China's economy appears threatening to South American countries such as Brazil due to the greater degree of export complementary compared with Chinese exports. The intensified relationship with China has also led primary commodities and their share among total Brazilian exports to rise (together with imports of manufactured products), threatening to undermine or neutralize three decades of continuous efforts to build and expand Brazil's manufacturing and high-tech export sector. Thus Brazil's relationship with China comprises three phases: (1) dualism and competition for FDI, (2) cooperation through trade relations, and (3) partnerships in the form of, e.g., cross-country loan agreements, acquisitions, and joint ventures.

Section 2.2 provides a comparative overview of the sociopolitical development of Brazil and China during the past 50 years. Then, Section 2.3 illustrates their macroeconomic frameworks and economic structures according to each country's demographics, labor markets, domestic sector, GDPs and their composition, natural resources, and external sectors. Natural resources and the external sector play pivotal roles; Brazil is a net exporter of energy commodities, minerals and metals, as well as soft commodities such as soybeans and sugar, whereas China is a net importer of these commodities. In this sense, Brazil's and China's export structures have developed in diametrically opposed directions. Yet, they also remain linked by the trade in primary commodities in the context of the emergence of the ‘commodity super cycle’ (Blanch, F. et al, 2010. Lyons, G. 2010), as discussed in more detail in Chapter 3, which introduces commodity and governance indexes as well as the independent and dependent variables for the multiple regression analysis in Chapter 4. Therefore, Chapter 2 does not focus in depth on the countries’ monetary systems or capital markets, as these topics appear in the discussion of the governance index within the world governance index and economic freedom index framework in Chapter 3. Instead, Section 2.4 details the external sectors of Brazil and China, including the important role of commodities for their trade structures, with an elaboration on their main commodity sectors including each country’s energy mix. This section also provides an overview of Brazil’s and China’s main trading partners, revealing the changing dynamics of their bilateral trade relations in the past decade.

Finally, Section 2.5 describes Brazil’s and China’s changing relationship from dualism to cooperation to partnership. Bilateral relations between them have changed considerably in the past two decades, such that the 1990s represent the competitive-dualistic era when Brazil and China competed for global FDI. China was relatively more successful in attracting FDI for manufacturing and production platforms for low-tech consumer goods sectors, mainly due to what was commonly believed to be an unmatched competitive advantage in terms of low labor costs. Starting in the early 2000s, several gravitational forces changed their relations from a state of competition to a nascent state of cooperation, largely because of their intensified trade relations. For example, from 2004 to 2010, Brazil and China sought to leverage their unique competitive advantages by establishing joint ventures, or executing bilateral loan agreements in commodity-related sectors such as energy, minerals and metals to face global technology and supply challenges. Especially from the Brazilian perspective, these undertakings initiated a developing partnership stage.

The figures in Appendixes 2.1a – 2.1g provide illustrative comparisons of key macroeconomic variables for Brazil and China illustrated and discussed in Chapter 2.

2.2 Sociopolitical Framework

BRAZIL

Brazil is the fifth largest country worldwide by size and population, and it dominates South America in terms of political and economic power. Its boundaries span more than 8.51 million km^2, including 8.45 million km^2 of land and 55,460 km^2 of water. Its population has grown, on average, by 1.63% since 1980, reaching 193.7 million in 2009 (World Bank, 2009, 2010) and is estimated to surpass 203.4 million in 2012 (CIA, 2011a).

Unlike China, Brazil is a federal republic with a relatively solid democratic foundation. Its 1988 constitution grants extensive powers to the federal government, which consists of executive, legislative, and judicial branches. The directly elected president assumes office for four years and can be re-elected for an additional four-year term (U.S. Department of State, 2011a). The president appoints his or her own cabinet. The Brazilian senate consists of 81 senators (3 for each state) and 513 deputies, who serve eight- and four-year terms, respectively. Federal elections are based on a system of proportional representation by states, weighted in favor of geographically large but sparsely populated states. Brazil’s political system currently harbors 19 separate parties.[5]

Brazil gained its independence in 1822, after more than three centuries under Portuguese rule. Until the abolition of slavery in 1888 and the following proclamation of a republic by the military in 1889, Brazil continued to maintain a monarchical system of government. The economic importance of coffee allowed coffee exporters to dominate Brazil politically, at least until populist leader Getúlio Vargas gained power in 1930 (Baer, 2008, pp. 41-48). Between the late 1920s and the late 1930s, industrial output increased by nearly 50%, and by 1940 it was more than double that of agriculture. Brazil was still a neo-colonial debtor nation, therefore industrial self-sufficiency and protection of the country’s natural resources were seen as essential in order to guarantee sovereignty, economic independence and the realization of world-

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[5] Including: The Workers' Party (PT, center-left), Democrats (DEM, center-right), Brazilian Democratic Movement Party (PMDB, center), Brazilian Social Democratic Party (PSDB, center-left), Green Party (PV, center-left), Socialism and Freedom Party (Psol, left), Brazilian Labor Party (PTB, center-right), Brazilian Socialist Party (PSB, center-left), Democratic Labor Party (PDT, center-left), Communist Party of Brazil (PCdoB, left), Progressive Party (PP, center-right), Party of the Republic (PR, center-right), Brazilian Republican Party (PRB, center), and Christian Social Party (PSC, center) (Source: U.S. Department of State, 2011a).

power status (Baer, 2008, p. 41ff). Brazil remained under the control of populist and military governments until 1985, when the military regime peacefully ceded power to civilian governments (Baer, 2008, p. 41-48). However, Brazil’s cautious democratic transformation had actually already begun in 1974, ten years after the military coup in 1964, so that it spanned more than 11 years. In March 1974, first steps of political liberalization began when General Geisel assumed power. Under President Figueiredo, from 1979 to 1985, liberalization efforts continued.

In early 1984, Brazil undertook the largest political mobilization in its history with the ‘diretas ja’ campaign to institute direct democratic presidential elections (‘diretas ja’, direct elections; Lopes, 2007, pp. 2ff). However, the Brazilian military leadership insisted on indirect elections of the first civil government. Tancredo Neves became the first elected Brazilian president, designated by an electoral assembly in January 1985, but he died shortly before he could take office (BTI, 2008b, p. 4). The presidential office thus was assumed by the elected vice president, José Sarney, who served from 1985 until 1990. The final step of democratization took place during the Constitutional Convention (1987–1988), which did not include any far-reaching limitations on the military’s institutional autonomy (Baer, 2008, p. 41ff).

The new Brazilian constitution took effect in October 1988; the transition to democracy was consolidated in March 1990 by the direct, democratic election of President Fernando Collor de Mello. By September 1992, public and political pressure in response to corruption charges pushed congress to remove President Collor from office, and Vice President Itamar Franco completed his term. In October 1994, internationally renowned sociologist, Fernando Henrique Cardoso, won the presidency, then established democracy as the foundation for the state and government. An amendment to the Brazilian constitution allowed his re-election, and Cardoso, who introduced significant and far reaching orthodox economic reforms, became the first Brazilian president to be elected for a second term from 1999 until 2002.[6]

The election of President Luiz Inácio (Lula) da Silva, a former union leader and the co-founder and chairman of the PT (Partido Trabalhador, or workers’ party) in October 2002 marked the second largest sociopolitical change in Brazil's history after the ‘diretas ja’ movement in 1994. President Lula had previously run for office three

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[6] For more details on the economic reforms under the Cardoso presidency please see also Section 3.4.2.3.6 Monetary Freedom, Brazil.

times (in 1990, 1994, and in 1998), without success. Now, for the first time in Brazil's history, the country's leader was a member of the working class, which had so far been largely excluded from meaningful political or economic participation. During his first term of office (2003–2006) President Lula solidified Brazil’s macroeconomic stability and strengthened its social and economic framework by reducing unemployment, poverty, and income inequality, as well as by providing an increasingly efficient social safety net (BTI, 2008b, p. 5). Lula was re-elected for a second term in office despite various corruption and bribery scandals involving the PT between 2005 and 2006 (BTI, 2008b, p. 5). President Lula then was succeeded by Dilma Vana Rousseff, another PT member, who has benefited from her predecessor’s strong popularity and the country’s solid economic recovery track record. Rousseff, elected president in October 2010, is likely to carry on President Lula’s pragmatic form of social capitalism.

Despite its recent economic success, Brazil continues to face major challenges in terms of infrastructure, education, taxation, and the pension system. The government’s aptitude for implementing structural reforms has been limited, especially in the last years of Lula’s presidency, due to the lack of consensus building with view of reforms that required a 60% majority vote. Despite a strong mandate for the PT, coalition reforms remain difficult, considering the vast variety of interests, both within the PT and among other party members of any such coalition.

CHINA

China is the fourth largest country in terms of geographic size, after only Russia, Canada, and the United States. It is the largest country in terms of population. Its boundaries encompass 9.59 million km^2, 99.7% of which is land. China’s population includes 91.5% Han Chinese and 8.5% other nationalities (e.g., Tibetan, Uyghur, Mongol, and Korean). Overall, its population has grown an average of 1.1% since 1980. From 1.331 billion people as of 2009 (World Bank, 2009, 2010), the population is predicted to surpass 1.337 billion in June 2011 (CIA, 2011b).

For centuries, China has been the world’s leading civilization, outpacing everyone else in the arts and sciences. In the 19th and early 20th century China became overwhelmed by internal political unrest and wars, major food crises, military defeats, and foreign occupations. In the post-World War II era, the communists, led by Mao Zedong, established an autocratic, socialist, Leninist system. After 1978, Mao’s successor Deng Xiaoping focused on market-oriented reforms and economic development. By 2000 the country's output had quadrupled. The economic reforms that began in 1978 proceeded in a highly decentralized manner and allowed only for gradual changes, which helped China avoid significant transformation shocks that for example the Russian economy endured in the 1990s.

In comparison to Brazil's relatively democratic political system, China's is characterized by the Leninist principle of concentration of state powers, with the National People's Congress (NPC) as the highest locus of power, followed by the head of state, currently President Hu Jintao, Vice President Xi Jinping, and the State Council. Members of the State Council include the head of the government, Premier Wen Jiabao, as well as four vice premiers, five state councilors (equivalent to vice premiers but with narrower portfolios), 25 ministers, the central bank governor, and the auditor-general (U.S. Department of State, 2011b). The NPC traditionally meets at least once every five years, but annual gatherings often last for approximately two weeks as the Congress attempts to validate and approve new policy directions, laws, the budget, and major personnel changes. Although the NPC generally approves State Council policy and personnel recommendations, various NPC committees hold active debate in closed sessions, and changes may be made to accommodate alternate views (U.S. Department of State, 2011b).

However, the Chinese Communist Party (CCP), authoritarian in structure and ideology, remains superior to the constitution and dominates the government, such that the NPC and local People's Congresses are subject to CCP directives and control. No system of checks and balances or subordination of the party and state powers to the law exists. The primary organs of power in the CCP include the Politburo Standing Committee, which currently consists of 9 members; the Politburo, with 25 full members, including members of the Politburo Standing Committee; the Secretariat, which is the principal administrative mechanism of the CCP, headed by the Politburo Standing Committee member and executive secretary Xi Jinping; the Central Military Commission; and the Discipline Inspection Commission, which is charged with rooting out corruption and malfeasance among party cadres (U.S. Department of State, 2011b).

Although China's state is characterized by Leninist principles, communism effectively stopped being the country's state ideology sometime between the Tiananmen Square protests of 1989 and the collapse of communism in East Europe and the Soviet

Union soon thereafter. As a myriad of political decisions to promote market openness and economic development shows, the CCP effectively has modified its rigid Leninist political system to embrace a more economically sensitive system that aims to adapt to the challenges of global trade and take advantage of China's primary competitive edge, which is its low labor cost (Tsang, 2010, pp. 3-7). The CCP has imposed a social contract on China's citizens by delivering stability, order, rapid growth, and generally improved living conditions, in return for its continued dominance of government and politics. Tsang (2010, pp. 3-4) thus describes a *'general improvement in living conditions which include not only economic prosperity but a larger scope for individual freedom and improved government responsiveness to public demands'*, which he considers to be an effect of *'Consultative Leninism'*, a system that combines Leninist control mechanisms with innovative economic developments to benefit China's citizens.

The rapid, CCP-controlled economic development of China and the rise in individual wealth (mainly in coastal areas and the South East) suggests that communist ideology no longer exclusively dominates the CCP's policies. Key CCP policies manifested in its twelfth five-year plan (2011–2015) revolve around maintaining stable GDP growth, and a slightly higher GDP per capita growth than GDP growth, balancing state-controlled capitalism and maintaining social stability by enabling less privileged segments of the society to benefit from China's economic prosperity.[7] Core macroeconomic and structural reforms to ensure sustainable growth and social stability are hence likely to define China's policy in the next five years. However, many significant structural economic challenges remain, including the reform of the banking system to apply resources more efficiently for private-sector development, the introduction of social security systems to boost domestic consumption, the reduction of state-sector involvement, the liberalization of China's capital accounts, the improvement of anti-corruption governance, and the reduction of environmental damages and destruction in light of China's economic expansion.

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[7] China's current five-year plan emphasizes growth quality. The government has set an annual growth target of 7% p.a. for the next five years on the basis of improving growth quality in order to reflect in higher living standards of Chinese citizens. The five-year plan focuses mainly on balanced growth with domestic demand as a new source of growth, science & technology as a driving force for industrial upgrading, and energy saving & environment protection as an important yardstick for solidified, less volatile GDP growth. Annual per capita household income growth is set above the 7% GDP growth rate target in order to increase the share of household income to GDP to spur domestic demand (Ding et al, 2011, pp. 1-3).

2.3 Macroeconomic Framework

2.3.1 Domestic Economic Development

BRAZIL

Gross Domestic Product Development

Brazil's conversion to a market economy began in the 1930s, with a mainly isolated and protected local market. Its main economic policies were shaped by theories of industrialization through import substitution. Although import substitution fueled the Brazilian economy for decades, until the early 1980s it did not translate into competitive pressures to maximize domestic economic efficiency, for example by establishing a fully functional banking system and self-sustaining industrial bases, which would have helped reduce the risk of a balance-of-payments crisis. In the early 1980s Brazil eventually moved away from its long-running import substitution model to adopt a more outward- and trade-oriented development model. Despite soaring exports in the 1980s and 1990s, the new model still failed to translate into domestic economic growth. Existing social, economic and regional inequalities and discrepancies increased further. In particular, the 1980s were characterized by increasing unemployment, hyperinflation (1980: 101% p.a., 1990: 2,900% p.a.), highly volatile GDP growth rates measured in constant USD (1980: 6.6%, 1981: –6.6%, 1982: –1.7%, 1983: –5.9%, 1984–1987: average of 6.2%, 1988: –.1%, 1989: 3.3%, 1990: –4.3%), intensifying problems due to large ratios of external debt stocks to GNI (1980: 31%, 1984: 53%), and rising deficits (World Bank, 2009, 2010). The government's attempts to stabilize the economy with various heterodox economic strategies were unsuccessful — until 1994, with the introduction of the Real Plan and its orthodox elements.

Inflation and Plano Real

Perennial problem in Brazil's past was the lack and absence of essential and urgently needed fiscal adjustments in order to contain the risk of inflationary pressures. Brazil's macroeconomic experience of the last ten years reveals the complexity of merging orthodox policies with socio economic measures to even out the significant income concentration and imbalance in wealth distribution. An orderly process of firstly establishing orthodox policies and then subsequently engaging in social economic activities proved to be highly problematic in the case of Brazil.

The Real Plan, or Plano Real, involved the introduction of the new Brazilian currency, the Real, in 1994. Under President Henrique Cardoso the plan featured the simultaneous application of fiscal adjustment, a nominal exchange rate anchor that started at USD parity, a defensive monetary strategy, and a debt restructuring agreement with commercial lenders. The results were very positive. Inflation, which had been at 2,076% in 1994, dropped to 66% in 1995, 15.8% in 1996, 6.9% in 1997, and a record low of 3.2% in 1998. Since 1998, inflation has followed an inverted parabola, slightly increasing year by year to peak at 14.7% in 2003, one year after Lula's election. Since 2004, inflation has dropped gradually to 4.9% in 2009, in response to the conservative monetary policy adopted by Brazil's Central Bank.

Similarly, the volatility of GDP growth rates declined such that they developed positively and with relative stability to 4.4% in 1995, then fluctuated between a minimum of 0.04% in 1998 and a maximum of 6.1% in 2007. In 2009, during the global financial crisis, GDP growth rates dropped to –0.2%. The ratio of external debt stocks to GNI also developed favorably, declining from 34% in 1993 to 21.9% in 1996 and 16.2% in 2008. Nonetheless, negative trade balances, measured as the ratio of the external balance of goods and services to GDP, persisted, developing negatively from 1995 until 2001 and ranging between –1.3% and –2.2%. To manage its external balance, the Brazilian Central Bank opted to modify its currency regime to a managed depreciation regime against the USD, which led the Real to peak at BRL/USD 3.08 at the end of 2003 and drop to BRL/USD 2.0 in 2009. Thus it failed to cover the wider margin of relative inflation differentials with major trading partners, and Brazil lost some of its competitiveness (World Bank, 2009, 2010, Data Catalog).

As of 2009, Brazil's economy featured a GDP valued at USD856 billion, measured in 2000 constant USD, or USD1.59 trillion measured in current USD. In contrast, these values were USD596 billion and USD840 billion, respectively, in 1996. Furthermore, GDP per capita in constant (2000) and current USD terms grew from USD3,631 and USD5,115 in 1996 to USD4,399 and USD8,230 in 2009, respectively.

Table 2.1: Brazil GDP Relative to World GDP 1970-2009

Year	**1970**	**1975**	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2009**
Brazil GDP (U$bio)*	42.3	123.7	235.0	222.9	462.0	769.0	644.7	882.2	1,594.5
% of World GDP	1.47%	2.13%	2.14%	1.79%	2.11%	2.59%	2.00%	1.93%	2.74%

Data Source: World Bank (2009, 2010), Table created and arranged by the author. *) current USD.

As Table 2.1 shows, Brazil's share of global GDP, measured in current USD, fluctuated between 1.47% (1970) and 2.88% (1997), for an average of 1.96% between 1970 and 2009. In contrast, China's share of global GDP averaged 2.93% during the same period and reached 8.6% in 2009.[8]

Despite the successes of President Cardoso's macroeconomic measures, including the Real Plan, his successor and the PT initially contested the reforms, claiming they led to social imbalances. Yet, even with this anti-Real Plan and socialist rhetoric, President Inácio da Silva (or Lula) maintained the fundamental characteristics of the Real Plan and exhibited significantly more business-friendly acumen than generally had been expected by the industrial and business sector. Starting in 2002, President da Silva operated as an economic pragmatist and retained the Cardoso reforms successfully —as evidenced by the solid GDP and inflation growth rates, as well as the foreign exchange rates. He also added micro- and social economic reforms to Brazil's macroeconomic framework. Since 2000, Brazil's government has taken significant steps forward by pursuing stability-oriented policies, including a focus on a floating exchange rate, an inflation-targeting regime, and the generation of primary fiscal surpluses. As a result, the global economic downturn hit Brazil less severe, and recovery started earlier in Brazil than in many other Latin American countries. Key factors to this recovery have been strong private consumption, counter-cyclical fiscal measures, counter-cyclical reductions of the SELIC rate (Brazilian Central Bank overnight rate), and a stable banking system. Brazil's net foreign debt was 17% of current account receipts in 2009, and its large USD currency reserves of USD238 billion covered about 13 months of interest payments on its foreign debt and imports of goods and services, which provided additional stabilizing factors to help weather the crisis of 2008/2009.

Challenges

Nonetheless, economic reforms in the fiscal, social security and labor sectors continue to be pivotal requirements to enhance Brazil's growth potential. For example, research and development was at 1.0% of GDP in 2008 —one of the lowest levels among emerging economies— and it was mainly being carried out by government and public universities (in contrast, China continues to increase R&D expenditures as a

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[8] For comparison purposes, United States GDP to World GDP measured in current USD was 36% in 1970, 25% in 1980, 31% in 2000, and 24% in 2009 (Data Source: World Bank (2009, 2010)).

percentage of GDP, from 3.4% in 2002 to 4.0% by 2011[9]). Although during the past 16 years Brazil has experienced consolidated macroeconomic stability and recognized the significance of sound macroeconomic fundamentals as a prerequisite for private-sector development, it has not fully capitalized on its performance potential in terms of GDP growth rates. Rather, Brazil’s average annual GDP growth rate of 3.4% for the 1993–2008 period seemed weak compared with other BRIC countries, such as China, which grew at an average of 10.8% in the same period. Its relatively low savings and investment rates also undermine Brazil’s potential output growth, which may help explain Brazil’s poorly developed infrastructure. In comparison with other emerging markets, Brazil is a relatively closed economy in terms of exports of goods and services, which are well diversified by destination, accounting for only about 13% of GDP as of 2009.

CHINA

Shift in Economic Dogma

Before 1978, China was centrally planned: The allocation of resources was solely determined by central and sometimes local governments. Agriculture played a dominant role in China’s economy with agriculture to GDP ratios ranging from 30% to 40%. In addition, heavy industries such as the steel industry strongly influenced China’s economy until the late 1970s. Farming was based on a collective framework, and the industrial output of state-owned enterprises (SOEs) was determined centrally rather than based on organic demand. China’s GDP growth rates were highly volatile, ranging from -27% in 1962 to 19% in 1970. Nominal GDP in 1961 was at USD50 billion, and almost doubled to USD91.5 billion by 1970. By 1978 it had surged to USD148.2 billion.

After 1978 though, China’s economy began to change gradually from a centrally planned economy to a market-oriented economy in which market dynamics determine resource allocations. The market reform process, which began under Deng Xiaoping, became the catalyst for the vigorous expansion of China’s emerging market economy. Deng’s market reform strategy followed a carefully managed progression, liberalizing China’s economic framework gradually and experimentally, at first only on a trial-and-error basis at a local level to examine their impact. Generally, macroeconomic reforms

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[9] In 2006, China spent more than USD136 billion on R&D, becoming the world’s second-largest investor after the United States (Naughton, 2007, p. 355).

progressed through a decentralized approach that allowed for gradual changes, limited any implementation errors, and avoided transformation shocks. Only those reform initiatives that had proven successful on lower administrative levels proceeded to national-level adoption. One standout example was to make individual households responsible for agriculture, which dismantled the collectivization of farming, thus permitting commercialization, and the generation of private agricultural surpluses (BTI, 2008c, pp. 1-24). With this gradual approach, China's economy has taken on a unique blend of market capitalism in emerging private sectors coexisting with a planned economy on local and federal levels. Throughout the economic reformation process the private sector's economic importance and political appreciation rose. In turn, the centrally managed plan economy has gradually been abandoned in favor of market practices that forced SOEs to accept a more competitive macroeconomic framework. These market reform policies have more than doubled China's nominal GDP, from USD148.2 billion in 1978 to USD306.7 billion in 1985. When Deng died in 1997, China's transformation from a centrally planned economy to a market-based economy had progressed significantly, now enjoying the necessary infrastructure and a modernized industrial complex to provide room for an increasingly dynamic service sector. Nominal GDP thus reached USD952.7 billion in 1997, an increase of more than 300% compared with 1985.

Export Orientation and Gross Domestic Product Growth

The gradual and careful adoption of an open-door policy in the mid-1990s led to the establishment of special economic zones for enterprises (SEZs) along China's Eastern coastal regions, introduced to encourage FDI and integrate China into global trade routes. As a consequence FDI rose from USD4.5 billion in 1991 to USD44.24 billion in 2001 —the year China's integration efforts were rewarded with its acceptance into the WTO. Since then, FDI has continued to increase and make use of China's vast and inexpensive labor, reaching USD94 billion in 2008 (though it peaked at USD138.4 billion in 2007). China's exports grew modestly from USD2.6 billion in 1960 to USD9.9 billion in 1978, but they exploded to USD62 billion in 1990 and then USD266.1 billion in 2001. By 2009, exports had surpassed the USD1 trillion mark. Furthermore, nominal GDP in 2009 was USD4.98 trillion, though it was coupled with a relatively low nominal GDP per capita of USD3,744 (current USD). China’s economic weight thus clearly has increased significantly on a global stage.

Table 2.2: China GDP Relative to World GDP 1970-2009

Year	**1970**	**1975**	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2009**
China GDP (U$bio)*	91.5	161.2	189.4	306.7	356.9	728.0	1,198.5	2,256.9	4,985.5
% of World GDP	3.18%	2.78%	1.72%	2.47%	1.63%	2.45%	3.72%	4.95%	8.56%

Data Source: World Bank (2009, 2010), Table created and arranged by the author. *) current USD.

As Table 2.2 shows, China’s GDP share of global GDP averaged 2.93% from 1970 to 2009, ranging between 1.6% (1987 and 1990) and 8.6% (2009), which suggests impressive growth in its share (in comparison, recall that Brazil’s nominal GDP and GDP per capita in 2009 were USD1.59 trillion and USD8,230 (current USD), respectively, and its global GDP share averaged 1.96% between 1970 and 2009).

China’s external reserves continue to grow due to its continuing positive trade balance of USD2.5 trillion in 2009 and USD3 trillion in 2010. Its foreign exchange rate depreciated gradually after 1990, from RMB/USD 4.47 to RMB/USD 8.28 in 1998, which supported its exports. It remained at this level until 2004, then appreciated by 17.6% to RMB/USD 6.83 in 2009. Inflation went from 3.4% in 1990 to double-digit rates until 1995 (16.9%), and then declined gradually to 0.7% in 2001. Although it picked up to 5.9% in 2008, it closed at –0.7% in 2009 according to official World Bank data.

After achieving double-digit average GDP growth rates from the early 1990s to 2006, China’s leadership shifted its focus from politically tainted debates about whether to establish a socialist or market-oriented economy toward the question how to ensure sustainable GDP growth. The 2004 revision to the Chinese constitution acknowledged the importance of protecting private property, which fueled significant expansion in the real estate sector and its peripheral industries. Economic growth and living standards have continued to improve significantly, reducing the absolute number of poor from 250 million in 1978 to 55 million in 2009.

Challenges

Nonetheless, the CCP and the Chinese government face a myriad of severe socioeconomic challenges, including reducing rampant corruption, as well as ecological challenges.

In the 2009 Corruption Perception Index (CPI) report, China ranked 79 out of 178, with 3.6 points, then moved up to rank 78 with 3.5 points in 2010 (In comparison, Brazil ranked 69th and scored 3.7 points.). Other socioeconomic challenges include strengthening China's pension and health system and building a functioning social security system. High domestic savings rates of 42.5% of GDP in 1996 and 54.2% in 2009 continue to limit domestic consumption to GDP, which declined from 43.5% in 1996 to 34% in 2009. Another major project must address the challenges of sustaining adequate job growth for millions of migrant workers, new hires in the work force, and workers laid off from SOEs. Furthermore, China is facing serious ecological and environmental concerns as a result of its rapid growth and economic transformation, which have led to deterioration in air and water quality, soil erosion, and loss of arable land.[10] Finally, the one-child policy has made China one of the most rapidly aging countries in the world and produced significant economic disparities in cross-generational wealth distribution. These elements all have encouraged the continuing erosion of the legitimacy of the Chinese Communist Party, along with a significant deterioration of social stability and increasing unrest among Chinese citizens (BTI, 2008c, pp. 1-24), who, lacking access to institutionalized channels for criticism, resort to violent clashes and riots with state authorities to express their despair and anger.

2.3.2 Key Sectors

BRAZIL

Brazil's relatively sophisticated industrial base, coupled with its relatively low labor costs, make it the largest FDI recipient in key economic sectors in Latin America. It has in particular benefited from key competitive advantages in industrial segments, agriculture, and livestock, which are key sources of export revenues and pivotal factors for its future supplementary industrial and export diversification. The ratio of net FDI to GDP grew gradually from 0.2% in 1990 to 0.6% in 1995. The positive effects of the Real Plan helped to increase net FDI from 1.3% in 1996 to a record level of 5.1% in 2000, though it gradually reversed to 2.8% of GDP in 2008. In 2009, the ratio of net

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[10] The environmental damages of China's rivers are enormous. For example, Naughton (2007, pp. 487-504) states that approximately 40% of China's river flow is classified at IV or between IV and V on a scale ranging from I (acceptable for human contact) to V (highly toxic).

FDI to GDP dropped to 1.7% due to the financial crisis (World Bank (2009, 2010), Data Catalog). The following are Brazil's key sectors:

Automotive

Brazil’s industry sector, which represents 27.2% of GDP as of 2009, ranges from heavy engineering to consumer goods and is among the most complex and diversified in Latin America. Within the industrial sector, the automotive industry is by far the biggest segment, not only in Brazil but in South America overall. Vehicle production capacity increased rapidly during the mid- to late 1990s as auto producers invested heavily in Brazil to meet local demand and avoid protectionist trade tariffs, which averaged 32% in 1989 and dropped only slowly to 11% in 1995 before increasing to 16% in 1998 (World Bank, 2009, 2010, Data Catalog). In 2010 Brazil produced approximately 3.6 million vehicles (ANFAVEA, 2011).

Oil

The state-owned Petrobras’ monopoly over the Brazilian oil sector, South America’s largest energy sector, ended with a constitutional change in 1997. The Brazilian government expected that opening the oil sector to private investors would increase domestic exploration and production, improving oil sufficiency and export potential. Fuel exports as a proportion of total merchandise exports increased from 0.9% in 1996 to 9.5% in 2008, underscoring the importance of the energy sector.

Agribusiness

Agribusiness accounted for 6.6% of GDP in 2009, up from 5.5% in 1996. This sector, including both agricultural raw materials and food, is very dynamic in the Brazilian economy, and it accounted for almost 40% of total merchandise exports in 2009. Brazil is among the world's leading producers of coffee, sugar cane, cocoa, oranges, beef, corn, and soy products. Agricultural land as a percentage of total land area was 26.5% in 1980, 30.6% in 1996, and 31.3% in 2008. Arable land —fertile land that is not already under cultivation— was 5.3% in 1980, 6.8% in 1996, and 7.2% in 2008. Brazil has potential for expansion, especially of its soy production, which may create new pressure for investments in infrastructure, such as ports and roads.

Telecommunications

The telecommunications sector in Brazil is among the largest and most attractive in the emerging markets, trailing only China's and India's telecom markets. The privatization process initiated by the government in 1996 prompted strong private investments. Particular interest was triggered by the 1998 sale of Telebras, the former state-run telecommunications operator. Foreign investor interest has been particularly strong in Brazil's industrial heartland, which include the states of São Paulo and Rio de Janeiro and their well-known capitals. The main investment target has been the wireless segment, which has grown significantly larger than the landline segment. In 1996, there were 9 landline connections and 1 wireless connection per 100 inhabitants. In 2008 there were only 21 landline connections per 100 inhabitants, while wireless (mobile) connections grew to 78 per 100 inhabitants.

CHINA

China's economic activities encompass all WTO-defined fields, particularly telecom, insurance, financial services, and agriculture.

Manufacturing and Industry

China continues to benefit from its labor cost advantage in both light and heavy manufacturing, though the latter is still dominated by SOEs. In the manufacturing sector, industry dominates the GDP composition (46.3% in 2009; cf. Brazil's ratio of 27.2% in 2009). The manufacturing sector has benefited from significant reductions in regulatory measures, such as ownership caps, geographic restrictions, or limitations on foreign investors, particularly in the auto sector.[11] China's Pearl River Delta in the southern province of Guangdong continues to maintain its leadership position as the country's biggest manufacturing hub, despite competition from Shanghai. Together with China's industry sector, its manufacturing sector continues to dominate the country's GDP composition. The relocation of assembly and finishing processes by many multinational enterprises to China has created a constant trade flow of imported assembly pieces, which are processed into finished goods for re-export to developed

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[11] The WGIRQ index of China provided by the World Bank measures regulatory quality, which improved from -0.385 in 2001 to -0.15 in 2008.

consumer markets in the United States and Europe. The ratio of manufacturing value added to GDP was 33.9% in 2009 (cf. Brazil's ratio of 15.5% in the same period).

High Technology

Despite the dominance of heavy industry and manufacturing, high technology (or high tech) plays an important role in China, including online gaming, software production, solar energy, and wireless telecommunication. In 1996, 1 of every 100 Chinese consumers was a wireless subscriber; in 2008, the subscriber base rose to 48 out of 100. Less than 1% of the population had internet access in 1996, but this level surged to 23% in 2008. As a result of high demand for online services, internet activities and wireless capabilities, China is gradually gaining recognition for its high tech industries. The focus of China's tech affinity in the last decade has largely been the assembly of hardware rather than software (BTI, 2008c, pp. 2-5, pp. 10-16). Nonetheless, this pattern is changing towards higher value added production in the technology chain. The main center for high tech activities is Beijing, closely followed by Shanghai.

Chemicals and Refining

Refiners in China are thriving due to the massive local demand for petrochemical products and chemical based commodities such as polyethylene. Most of the chemical, petrochemical, and petrol industry is located along the Chinese Eastern coast to facilitate logistics from refiners to ports and vice versa. The low labor costs, skilled workforce, and large domestic markets represent the main incentives for refiners to choose this location.

Energy

China's demand for energy is high. The country is a net importer of oil and gas, which means the world's largest energy firms are present in China and have shareholdings in Chinese energy firms. Details on the Chinese energy sector are discussed in Section 2.4.

Tourism

Due to China’s enormous ecological variety, the World Tourism Organization estimates that it can establish itself as the top global tourist destination by 2020, with over 8% of global market share. As of 2010, China's annual air passenger volume reached 140 million passengers.

2.3.3 GDP Composition

2.3.3.1 Gross Capital Formation, Industry Value Added, and Agriculture Value Added

BRAZIL

In comparison with China, Brazil’s domestic economy is very different in terms of its GDP composition. From 1960 to 1970 industry value added to GDP fluctuated between 34% and 38%. From the 1970s until 1994, Brazil’s ratio of industry value added to GDP oscillated around 40%, peaking at 45.9% in 1989. With the fiscal reforms in 1995 and their positive effects on GDP, the ratio fell to 27.5% in 1995. Since then industry value added to GDP gradually rose to 30.1% in 2004, thereafter gradually declining to 27.2% in 2009.

Agriculture, one of the largest sectors historically, displayed a value added to GDP ratio of 20% in 1960. The ratio then declined with high volatility to 5.7% in 1995, rebounding to 6.6% in 2009 due to strong demand for commodities (with a peak at 7.4% in 2003).

In 1960, the ratio of gross capital formation to GDP was 19.7%, and since then it has ranged from 15.7% in 1984 to 27.0% in 1989. After 1989 though, the gross capital formation to GDP ratio gradually declined to 17.0% in 1996, oscillating around this level until 2009. This shift reflected the fiscal reforms in 1995, which brought stability to the capital intensive sectors in Brazil.

Overall, since 1960, industry, manufacturing, together with agriculture value added as combined ratio of GDP have declined from 87% to 52% in 1995 and then to 49% in 2009. These trends indicate the emergence of the Brazilian service sector, which accounted for almost 50% of GDP in 2009.

CHINA

From the 1960s until 1995, China’s ratio of industry value added to GDP displayed an average of 42% (about 3% higher than Brazil’s ratio in the same period). By 1995, it grew to 47.2%. This level persisted in a relative stable range until 2009, which underscores the importance and focus of industry and investments in China. Gross capital formation to GDP was 18% in 1961, gradually improving to 41.9% in 1995, reaching 44.8% in 2009, again providing evidence of the importance of structural investments in China’s industry and manufacturing sectors, the key sectors to China’s competitive edge.

Agriculture, historically one of the largest sectors in China, displayed a value added to GDP ratio of 40% in the early 1960s, which gradually decreased to 20% by 1995, reflecting the shift from agriculture to manufacturing. After 1996, this ratio decreased steadily further to approximately 10.4% in 2009. China now faces a shortage in terms of producing soft commodities in order to match domestic demand (i.e., wheat, grain). Despite the fact that China's agriculturally used land sustains 200 million small sized farms, making it the world's largest agricultural producer, it must now import soft agricultural commodities in large amounts.

China’s agricultural sector faces new challenges as incomes rise and demand for improved diet reshapes markets for food and beverage products. Traditionally relying on grain, this implies that China’s agriculture sector will need to both diversify and grow, which may have positive impacts on agricultural research. Thanks to imported green technology, biotech and other efficiency measures, China was able to increase its agricultural production output significantly on an absolute basis. Despite a relative constant agricultural land to total land ratio of 57% from 1985 to 2005, per capita yields of specific products grew as follows: grain developed relatively flat from 350kg to 370kg, meat rose from 17kg to 37kg and oil seeds rose from 14kg to 24kg (Naughton, 2007, pp. 253-258). In relative terms, China also fared well in comparison to world efficiency in regards to rice, wheat and corn production. For example, as of 1997 China produced 6.2 tons of rice per hectare, 3.7 tons of wheat, 4.6 tons of corn, and 1.7 tons of soybean; world average is 3.9 tons of rice per hectare, 2.7 tons of wheat, 4.3 tons of corn, and 2.2 tons of soybean (Naughton, 2007, p. 265). However, the improved productivity came at a price: Fertilizer consumption per hectare was 271kg compared to a world average of 94kg in the same time period. Also, China’s crop production is much more labor and less machinery intensive, with 310 workers per 100 hectares and 6 tractors per 1,000 hectares compared to world average of 82 workers and 18 tractors, respectively (Naughton, 2007, p. 265).

Yet, despite a large population share emerging gradually to middle class, China is a major rice exporter to the Asia Pacific region. Nonetheless, imports of land intensive products such as soy products (mainly from Brazil as shown further down), corn and cotton reflect the need on part of China to internally diversify its agricultural production. It remains to be seen if China extends food supply into global markets, which would open new productivity cycles for food producers.

2.3.3.2 Household Consumption, Government Final Consumption, and Gross Domestic Savings

BRAZIL

Brazil's ratio of gross domestic savings to GDP peaked at 30.4% in 1989 and gradually declined to 15.2% in 1996. Fiscal reforms implemented under the Plano Real in 1995 and the subsequent macroeconomic stability had positive effects on consumer consumption, which in turn reduced the ratio of gross domestic savings to GDP to 14.79% in 1999. From 1996 until 2009, the gross domestic savings to GDP ratio fluctuated between 15% and 21% (in 2004), reaching 16.2% at the end of 2009. In contrast, household final consumption as a ratio to GDP ranged between 64% and 71% between 1960 and 1983, hitting a low point at 54.0% in 1989 and improving gradually to 59.6% in 1994. The fiscal reforms through the Plano Real eventually also led to an increase of final household consumption to GDP to 64.3% in 2009. Finally, the ratio of government final consumption expenditures to GDP was 14% in 1960, gradually declining to 8.3% in 1984, then surging continuously to 21.0% in 1995, oscillating between 19% and 21% in the period from 1996 to 2009 and closing at 19.5% at the end of 2009.

CHINA

China’s gross domestic savings to GDP ratio has been rising since the mid-1970s for a number of factors, such as the absence of functional social security and pension systems as well as the existence of specific cultural norms regarding money and spending habits. Low income levels in the centrally planned economy before 1970 did not leave sufficient room for discretionary savings. Generally, SOEs would provide for retirement funding. Due to the very minor but gradual departure from the socialist plan economy framework in the 1970s and due to the start of the demise of the SOEs, savings quotas started to rise. Gross domestic savings to GDP increased gradually from 28.9% in 1970 to 37.3% in 1978. By 1995 gross domestic savings to GDP stood at 44.1%, rising even more to 54.2% in 2009, which implies that significant domestic buying power remains captured and frozen. Accordingly, Chinese household final consumption declined from 63% in 1970 to 42% in 1995, then to 34.0% in 2009 — almost half the level of Brazil's ratio in 2009.

Whereas government final consumption expenditure as a ratio of GDP remained at 7% from 1960 until the late 1970s, it doubled to 15% in 1980 in response to an active government that implemented the major structural economic reforms initiated by Deng Xiaoping in 1978. This ratio averaged 14.6% p.a. from 1980 until 2009, with a declining trend from 2000 until 2009, leading to a ratio of 11.5% in 2009.

2.3.3.3 Trade to GDP, Exports & Imports of Goods and Services

BRAZIL

The most visible effect of the fiscal reforms in 1994 on Brazil's GDP composition appeared in Brazil's external sector, which benefited from a gradual but significant increase in economic and trade openness. Between 1960 and 1982 the ratio of trade to GDP developed from 14.2% to 15.9%, and exports and imports accounted for a relatively even share that fluctuated up to 5% on an annual basis. With a few exceptions in the early 1990s exports generally accounted for more than 50% of the trade to GDP ratio.[12] In 1984, trade to GDP reached its second highest record level at 21.5% (1974: 21.9%), declining to 14.93% in 1995. Then, since 1996, trade to GDP has improved significantly, reaching all-time highs (since 1960) at 28.97% in 2004, reverting to 26.1% in 2009. Exports accounted for 44% of the trade to GDP ratio in 1996, compared to 49.1% in 2009, peaking at 56.8% in 2005. Exports of goods and services to GDP were therefore only 12.8% in 2009, nonetheless up from 7% in the

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[12] Source: World Bank (2009, 2010). Recall, all data between 1960 and 1995, and 1996 and 2009 are based on the World Bank Data Catalog. Definition: The ratio of trade to GDP is the sum of merchandise exports and imports, divided by the value of GDP, in current U.S. dollars.

early 1960s. However, compared with China, Brazil remains a relatively closed economy measured by its trade to GDP ratio of 26.1% in 2009.

CHINA

China’s emergence as export nation has been based on a myriad of factors, including its size and economic growth, customer base, relatively low labor costs, vast and skilled workforce, and tax-light special economic zones, which have attracted multinational firms to set up their assembly and production lines in China.

Perhaps the most obvious metric that underscores China’s successful transformation from a closed agricultural economy with focus on domestic heavy industry to a global export nation are trade ratios as well as exports and imports in nominal values, both of which have soared impressively. The ratio of trade to GDP was 5.3% in 1970, and exports and imports of goods and services accounted each for 50% of it. By 1980, the trade to GDP ratio reached 21.7%, and by 1996 it had surged to 38.1%. The buoyant late 1990s, supported by low interest rates in the United States and Europe as well as vast monetary and credit supplies, fueled external demand, and thus the ratio hit a record level of 70.5% in 2006. By then, Chinese exports accounted for 55% of the trade to GDP ratio, suggesting improved added value margins compared with 1970. However, 2007 and 2008 represented a cooling off period in external demand; trade to GDP fell to 67.8% and 62.1% in these years. The global demand meltdown as a result of the financial crisis also adjusted trade to GDP down to 47.1% in 2009, of which 55.6% was attributable to exports. As a result of China’s strong export position, its foreign reserve position also has grown very robust, equal to USD2.4 trillion in 2009 and almost USD3 trillion at the end of 2010. These values stem from the positive external balance of goods and services to GDP for almost two decades: from 1.7% in 1992 to 5.3% in 2009, peaking at 8.8% in 2007.

Government policies supporting private consumption and the growing sophistication of the Chinese economy imply that imports of consumer goods and services may achieve higher growth rates than exports, which may well lead to a gradually shrinking external balance of goods and services to GDP, as well as to declining reserve positions.

In comparison to Brazil, China’s trade to GDP ratio underscores the country’s export focus: 62.1% in 2008, slightly down from 65.4% in 2004, and 47.1% in 2009 due to the global financial crisis. Exports of goods and services as a ratio of GDP were 34.9% in 2008, down from their record level of 39.1% in 2006. In 2009 exports to GDP collapsed to 26.2% as a result of contracted demand due to the global financial crisis. In comparison to Brazil, China’s collapse in trade to GDP ratios was much more pronounced and drastic, which reveals China’s dependence on exports and global demand.

2.4 Commodities and the External Sector

2.4.1 Global Commodity Production and Consumption

Table 2.3 gives an overview of the state of global production (Prod.) and consumption (Cons.) of primary commodities in 2008-2009, as well as Brazil's and China's production and consumption of commodities relative to global volumes.

Table 2.3: Commodity Production & Consumption 2008–2009

Commodities	**World**		**China**		**China**		**Brazil**		**Brazil**	
(in Units[13])	Prod.	Cons.*	Prod.	%	Cons.*	%	Prod.	%	Cons.*	%
Aluminum	39,425	37,796	13,177	33%	12,413	33%	1,661	4%	932	2%
Copper	18,475	18,032	3,779	20%	5,134	28%	Na	Na	252	1%
Gold	2,161	2,850	222	10%	342	12%	49	2%	Na	Na
Nickel	1,368	1,295	171	13%	305	24%	31	2%	25	2%
Tea	3,804	3,170	1,200	32%	903	28%	Na	Na	Na	Na
Coffee	128,073	130,004	Na	Na	Na	Na	45,992	36%	17,526	13%
Cocoa	3,515	3,508	Na	Na	Na	Na	157	4%	216	6%
Maize	791,627	646,188	165,900	21%	112,731	17%	51,000	6%	29,403	5%
Rice	443,650	353,852	135,100	30%	90,955	26%	8,500	2%	Na	Na
Sugar	143,781	116,211	13,317	9%	9,853	8%	31,850	22%	10,300	9%
Wheat	682,034	518,281	112,646	17%	63,961	12%	Na	Na	6,000	1%
Soybeans	210,870	168,463	15,500	7%	41,035	24%	57,000	27%	15,348	9%
Palm oil	44,262	44,700	Na	Na	5,917	13%	Na	Na	Na	Na
Cotton	22,165	11,488	6,750	30%	3,683	32%	1,170	5%	566	5%
Natural rubber	10,026	9,550	560	6%	2,934	31%	Na	Na	Na	Na
Synth. rubber	12,789	12,568	2,325	18%	3,479	28%	Na	Na	533	4%
Petroleum	84,878	83,117	3,821	5%	8,576	10%	2,499	3%	2,436	3%

Data Source: World Bank (2010), Global Commodity Markets, (pp. 6-29), Table created and arranged by the author. Na: not available in the World Bank database. *) excluding stock.

As Table 2.3 impressively shows, Brazil's potential as an exporter of agricultural products, including food, beverages, oils and seeds, minerals and metals, is outstanding; it also is relatively independent of oil. China on the other hand consumes more than it produces in almost all of these commodity groups, except aluminum, maize, rice, wheat, sugar, and cotton (World Bank, 2010).

Yet, Table 2.3 also reveals that China has a dominant share in producing and consuming commodities compared with global levels. China is believed to have been driving global commodity prices in the 2000s, mainly because its demand for oil, metals and soft commodities represented by a significant share of global imports. The relationship between commodity prices and China's economic expansion will be analyzed in Chapter 3 and, especially, in Chapter 5 in which I illustrate inverse causality

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[13] Measured in mt (year): Aluminum (2008), Cocoa (2009), Copper (2008), Cotton (2009), Gold (2008), Maize (2009), Nickel (2008), Palm Oil (2009), Rice (2009), Rubber (2008), Tea (2008), Soybeans (2009), Sugar (2009), Wheat (2009). Measured in 1000 bags: Coffee (2009). Measured in 1,000 bpd: Petroleum (2009).

effects of China’s expanding economy (e.g., fixed capital formation to GDP) on commodity price indexes.

The following sections of this chapter comparatively elaborate on the dynamics of Brazil’s and China’s energy, agricultural, food, and minerals and metals sector, contrasting their relative weight in terms of exports and imports of commodities.

2.4.2 Commodity Sectors

BRAZIL

Brazil’s emergence as a global economic power is significantly linked to its export revenues, based on its vast mineral, energy, agricultural, and food commodity resources —the latter referred to as soft commodities. These exports have experienced significant price appreciation in the past 16 years.

The table below summarizes Brazil’s top ranking export and import commodities in 2009 (UN COMTRADE, 2011).

Table 2.4: Top 10 Export / Import Commodities Brazil 2009

In USD billion (2009)	Exports	Imports
All Commodities	**152.994**	**127.647**
Iron Ores and Concentrates	13.246	Na
Petroleum Oils, Crude	9.351	9.206
Soybeans	11.424	Na
Sugar Cane	8.377	Na
Meat	4.945	Na
Aircraft	3.870	Na
Motor Cars and other vehicles	3.244	5.466
Parts and accessories vehicles	Na	3.652
Petroleum oils, other than Crude	3.085	4.538
Petroleum gases	Na	2.358
Oil-Cake and other solid residues	4.592	Na
Other commodities	2.799	9.717[14]

Data Source: UN COMTRADE (2011), Table created and arranged by the author.

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[14] Coal products account for USD2.07 billion, electronic integrated circuits account for USD2.9 billion, fertilizers for USD2.1 billion, and medicaments account for USD2.63 billion.

Energy Commodities and Energy Mix

Oil

Brazil’s oil production in 2009 was 2.44 million barrels per day (bpd); its consumption was 2.49 million bpd. In comparison, world production of 84.87 million matched up with consumption of 83.12 million bpd in the same period.[15]

In the mid-1980s, the Brazilian government commenced an ambitious program to reduce Brazil oil dependency, which accounted for more than 75% of the country’s oil and oil derivatives needs. Today Brazil is net exporter of oil. Prior to the discovery of the Tupi and Carioca oil fields off the coast of Rio de Janeiro in early 2008, Brazil’s oil reserves were estimated at 16 billion barrels. Including the oil reserves in these fields, which conservative estimates put at 30 to 80 billion barrels, total oil reserves range somewhere from 46 billion to 100 billion barrels. Furthermore, the latest estimates nearly double the original assumptions about the deposits in the Tupi and Carioca oil fields, such that they may hold at least 123 billion barrels of reserves (Bloomberg, 2011a). Brazil’s fuel export to total merchandise export ratio in 1960 stood at less than 1%, then gradually increased to 7.2% in 1982 until —in a parabolic move— declining to 0.89% in 1996 and again rising to a record of 9.5% in 2008, though it dropped to 9.0% in 2009 due to the global financial crisis.

Electricity and Energy Mix

Brazil consumed TWh 428.8 of electricity in 2008, which corresponds to a per capita usage of KWh 2,232, and it produced TWh 463.4. In comparison, consumed electricity in 1971 was TWh 44.8, or per capita consumption of KWh 456, with production levels of TWh 51.6. Moreover, in 2008 (1970), Brazil’s electricity

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[15] Brazil’s majority government-owned oil firm, Petróleo Brasileiro (Petrobras), is among the ten largest fully vertically integrated global oil firms. As of June 27, 2011, market capitalization was at USD197 billion (P/E ratio of 6.48x, Beta 1.01x, with a low gross yield of 0.55% expressing strong investor interest in Petrobras). PetroChina, China’s largest fully integrated oil firm, had a market capitalization of USD300 billion on the same date (P/E ratio of 11.73x, Beta 1.16, gross yield 3.62%). Historically, P/E ratios in mainland China are significantly higher than for example in Hong Kong (offshore) and also Brazil. This phenomenon will be explained more in detail in Chapter 3 and Chapter 5 in stock market related topics. China’s major oil refiner Sinopec and CNOOC (China’s second-largest oil exploration firm) achieved market capitalizations of USD7.6 billion (P/E ratio of 22.78x, Beta .90, gross yield 1.14%) and USD101 billion (P/E ratio of 12.02x, Beta 1.14, gross yield 2.61%) as of June 27, 2011, respectively (Bloomberg, 2011c).

production mix consisted of 80% (84%) hydro power, 4% (12%) oil, 6.3% (0%) natural gas, 3% (4%) coal, 3% (0%) nuclear power, and 3.7% (0%) others.

Brazil’s energy consumption mix has also shifted since 1971, from combustible renewables towards a larger share of nuclear and fossil energy use. As of 2008, its energy consumption mix consisted of 13% hydro power, 2% nuclear energy, 32% combustible renewables (e.g., sugar cane) and waste, and 53%[16] fossil energy; 8% of its total energy consumption was imported. Energy use in kg of oil equivalent per capita increased from 709 in 1971 to 1,295 in 2008, and total energy use/consumption of oil equivalent surged from Kt 69,768 to Kt 248,528 in the same period. In comparison, total energy production in Kt oil equivalent increased from Kt 49,124 to Kt 228,127, which led to the 8% energy import level mentioned above. In 2008, carbon dioxide emissions per capita were 1.9 tons, with 0.43 kg carbon dioxide emissions per one unit GDP (International Energy Agency, 2011a; World Bank, 2009, 2010, Data Catalog). Thus, despite its vast demand for energy, Brazil has managed to establish relative self-sufficiency in terms of electricity and energy consumption, positioning itself as a net exporter of oil.

Agricultural and Food Commodities

Agriculture used to be Brazil’s strongest economic sector. In 1960 agriculture value added to GDP accounted for 20.6% of GDP. Its share declined continuously to 5.5% in 1996 as a result of the emerging services, industrial, and manufacturing sectors. Since 1996 though, agriculture, which still accounts for approximately 20% of formal jobs, has risen from 5.5% to 6.6% of GDP in 2009.

Brazil's agricultural potential is progressing in small steps, covering crops such as sugarcane, coffee, tropical fruits, frozen concentrated orange juice, soybeans, cotton, cocoa, tobacco, forest products, and commercial cattle herds (which at 170 million head is 50% larger than the U.S.' capacity (U.S. Department of State, 2011a)). The remaining agricultural production covers livestock such as poultry, pork, milk, and seafood. The share of agriculture in the export sector is significant, too. The ratio of agricultural raw materials and food exports to total merchandise exports was 87.5% in 1962 and fell to 28.7% in 1992, but since then its share has risen continuously to almost 38% in 2009 —

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[16] Including 9% gas, 39% oil, and 5% coal (International Energy Agency, 2011a).

the highest level since 1986. Moreover, food imports as a percentage of merchandise imports fell from 15.9% in 1962 to 10.8% in 1996 and then to 5.26% in 2009, underscoring Brazil's role as food producer and exporter. The food, crops, and livestock production index rose continuously between 1960 and 1995. Between 1996 and 2008, food, crops and livestock production indexes rose from 84.0, 82.0, and 87.0 to 131.7, 149.6 and 120.0, respectively. As Table 2.3 (Commodity Production & Consumption 2008–2009) shows, Brazil's production of agricultural products, food, and beverages as well as soy, maize, oils and seeds significantly exceeded its domestic consumption in 2008, underscoring the country's role as exporter of these commodities and as major world trade participant since the mid-1990s.

Minerals and Metals Commodities

Brazil has ample mineral resources and is one of the world's leading producers of tin, iron ore, gold, bauxite, manganese, nickel, copper, lead, and uranium. Similarly to Brazil's supply base of carbon-based fossil fuels, Brazil's proven resources in minerals and metals are vast. Iron and manganese reserves, mainly held by Brazil's former state-owned and now private Companhia Vale Do Rio Doce, are significant sources for industrial raw materials and export revenues. Their importance for the export sector is reflected by the relatively high percentage of ore and metals exports to total merchandise exports, which has oscillated between 8.6% in 1962 and 12.1% in 2008.

CHINA

With a population exceeding 1.3 billion people and an average GDP per capita growth rate of 9.7% p.a. since 1996, China's demand for soft commodities and energy commodities has increased dramatically to support the country's rapidly expanding industrial and commercial base as well as private households that enjoy rising living standards. In 2010 China was the world's second-largest energy consumer, using Kt 2,116,427 of oil equivalent annually, trailing only the United States, which consumed Kt 2,172,107 p.a. oil equivalent.

While Brazil is close to establishing its energy self-sufficiency, China will remain a net importer of all primary commodities for the foreseeable future especially of energy commodities (except coal) as a result of its large and growing population.

China’s top ten export items are dominated by computers, data equipment, electronic products and other manufactured commodity products. China’s top ten imports also are heavily concentrated on energy and soft commodities, as Table 2.5 summarizes (UN COMTRADE, 2011).

Table 2.5: Top 10 Export / Import Commodities China 2009

In USD billion (2009)	Exports	Imports
All Commodities	**1,201.6**	**1,005.6**
Automatic data processing machines	101.6	21.8
Electrical apparatus for line telephony	86.5	19.1
Reception apparatus for television	26.7	Na
Machine parts and accessories	26.2	13.7
Electronic integrated circuits	23.6	120.8
Ships (cargo, cruise, boats, ferries)	23.9	Na
Liquid crystal devices	20.3	38.3
Printing machinery	17.1	Na
Textiles	14.9	Na
Electronic transformers	14.7	Na
Petroleum, crude	Na	89.3
Petroleum products other than crude	Na	17.0
Iron ores	Na	50.1
Soybeans/products	Na	18.8
Transistors and semiconductors	Na	15.6

Data Source: UN COMTRADE (2011), Table created and arranged by the author.

Energy Commodities and Energy Mix

Oil

In 2009 China’s oil production reached 3.82 million bpd, consumption was 8.57 million bpd. Recall, that world production was 84.87 million bpd and world consumption 83.12 million bpd in the same period (World Bank, 2009, 2010). China’s known oil reserves are approximately 20.3 billion barrels (CIA, 2011b) and will be fully depleted in about 6.5 years, assuming a constant consumption rate of 8.57 million bpd. China’s rapid economic development has accelerated oil consumption, especially considering the large-scale transition away from mass transit toward private automobiles. As a result, China shifted from a net exporter to a net importer of oil in the early 1990s. Its oil imports as a percentage of total imports also continued to climb steadily, from 3.9% in 1995 to 9.7% in 2005 and 12.3% in 2009. Oil imports as a percentage of total merchandise imports grew from 4.97% in 1996 to 13.4% in 2009.

Coal

China also possesses large energy resources of coal in the North, which constitutes its key domestic energy resource. For the foreseeable future China will rely heavily on domestic coal production and oil imports as its primary energy sources. However, the environmentally adverse effects of coal consumption, especially in the context of rising environmental awareness and high environmental costs, may encourage a steady increase in hydro power production and alternative energy supply sources. In contrast to its relatively restricted oil reserves, China's hydro power potential is vast. Its main rivers extend to a cumulative total length of more than 130,000km (Naughton, 2007, p. 492) and exert annual flow rates greater than 500 billion cubic meters, representing tremendous hydroelectric potential. The ambitious construction of the Three Gorges Dam on the Yangtze River, which has received widespread criticism from environmentalists and engineers for alleged capital mis-allocation and inefficiency, exemplifies a grand scale attempt to capitalize on the abundance of hydroelectric potential.

Electricity and Energy Mix

China consumed TWh 3,252 electricity in 2008 (approximately eight times more than Brazil in the same year), or KWh 2,455 per capita. Electricity production was TWh 3,456 in the same year. In comparison, in 1971 consumed electricity was TWh 127.2, per capita consumption was KWh 151, and electricity production was TWh 138. In 2008 (1971), China's electricity production mix was heavily geared towards coal, consisting of 79% (71%) coal, 17% (22%) hydro power, 1% (0%) natural gas, 2% (0%) nuclear power, and 1% (7%) oil. In comparison to China's energy mix, the rest of the world's energy mix is much more aligned to oil and gas. Globally, in 2004 energy production was based on 21% coal sources, 6% hydropower, 27% natural gas, 7% nuclear power, and 39% oil (Naughton, 2007, p. 336).

In order to match its energy consumption China is expected to increase the number of nuclear facilities from ten as of 2008 to 38 in the next ten years. In addition, China plans to relax its dependency on coal by increasing the share of natural gas in its energy mix.[17]

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[17] E.g., the establishment of two state of the art liquid natural gas (LNG) terminals in Guangdong and Fujian in order to accommodate LNG trade between the Near and Middle East and mainland China.

The absence of large, long-lasting oil fields is the reason why China’s energy mix is skewed towards the domestic coal fields in the Mongolian part of the country and hydro power. Since 1971, China’s energy consumption mix also has shifted slightly toward nuclear and fossil (coal) energy use. As of 2008, China’s energy consumption mix consisted of 86.9% fossil fuel,[18] 9.6% renewables and waste,[19] and 3.5% nuclear energy. 8.2% of energy use came from imports, mainly oil. The energy use in kg of oil equivalent per capita increased from 466 in 1971 to 1,597 in 2008. China’s overall energy use of oil equivalent surged from Kt 391,708 to Kt 2,116,427 in the same period. In comparison, total energy production in oil equivalent increased from Kt 394,149 to only Kt 1,993,106, thus requiring the 8.2% of energy imports (mainly oil).

In 2008, carbon dioxide emissions per capita were 4.91 tons, with 2.5 kg carbon dioxide emissions per one unit GDP (International Energy Agency, 2011b). As demand has outpaced production, energy efficiency and the effective use of energy resources has been a consistent element in China’s recent five-year plans. As a result, energy efficiency measured in GDP per unit of energy use in kg of oil equivalent[20] improved by 860% from 0.4 GDP units in 1980 to 3.44 GDP units in 2008. Despite these significant improvements, China continues to trail the energy efficiency of other BRIC countries, including Brazil, whose GDP per unit of energy use in kg of oil equivalent increased from 3.8 GDP units in 1980 to 7.6 GDP units in 2008.

Agricultural and Food Commodities

Similarly to Brazil, agriculture used to be China’s strongest economic sector in terms of GDP composition. In the 1960s it accounted for 42% of GDP, but since then the agriculture to GDP ratio has steadily declined to 10.4% in 2009 due to the emergence of a strong industry sector and a manufacturing sector as well as an

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Through its state owned Korea Gas Corporation (Kogas), South Korea is the largest LNG importer globally sourcing approximately 85% of its LNG from the Middle East, but increasingly also from the Asia Pacific region, especially Indonesia. China’s emergence as LNG trader and LNG energy sourcer represents a significant threat for South Korea’s national LNG importer, Kogas (Korea Gas Corporation), which has mainly been the dominant LNG importer in Asia Pacific (Source: Managed transactions by the author as portfolio manager at investment firms in Hong Kong and New York between 2006-2008 and 2008-2011).

[18] Including 66.5% coal, 17.2% oil, and 3.2% gas (International Energy Agency, 2011b).

[19] Mainly hydro power.

[20] GDP per unit of energy use is the purchase price parity of GDP per kilogram of oil equivalent of energy use (Variable 74: GDP_UEnUPPPOilE).

emerging services sector since the early 2000s. As of 2009 China is a net importer of food products (including soy seeds and oils from Brazil) and accounts for 4.6% of global food imports, up from 2.9% in 2005 and 2.3% in 1995 (Table 2.9: Import Structure China 1995-2009). While the ratio of food imports to total merchandise imports in 2009 remained at approximately 5.0%, compared with 5.9% in 1996, the food exports to total merchandise exports ratio declined from 8.2% in 1996 to 2.9% in 2009 due to an overall large increase of manufactured products for export (faster rising denominator). In comparison to world food exports, China's share retrenched slightly from 3.7% in 2005 to 3.5% in 2009 (Table 2.7: Export Structure China 1995-2009). As Table 2.3 (Commodity Production & Consumption 2008–2009) shows, China's production of agricultural products, food, and oils and seeds has significantly lagged its domestic consumption in 2008, establishing the country as major importer of these commodities since the mid-1990s (please see also Table 2.9: Import Structure China 1995-2009 for China's rising share in global food imports).

Minerals and Metals Commodities

China's reserves in mineral resources are vast. China holds large reserves of tungsten and zinc, iron, lead, aluminum, and copper. In addition, its abundant reserves feature mercury, tin, manganese, molybdenum, vanadium, and magnetite. Nonetheless, its economic expansion in the past two decades has forced China to remain a net importer of ores and metals, as underlined by the increase of the ratio of imports of ores and metals to total merchandise imports from 4.4% in 1996 to 13.1% in 2008; its exports of ores and metals to total merchandise exports in comparison declined from 1.8% to 1.7% in the same period, suggesting a dire need for iron ores and minerals and metals to support infrastructure expansion, and housing.

2.4.3 External Sector Composition

2.4.3.1 Exports and Export Structure

BRAZIL

Trade plays a pivotal role in Brazil's GDP composition. The ratio of trade to GDP (Variable 25: Trade_GDP), which includes both imports and exports to GDP, was 14.2% in 1960 and 21.9% in 1974, after which point it grew increasingly volatile, fluctuating between 21.5% in 1984 and 14.9% in 1996. Since 1996, trade to GDP has risen gradually to reach 26.1% in 2009. Furthermore, in 1960 Brazil's exports measured USD1.27 billion, but since then its exports have evolved impressively with several years of continuous growth, peaking at USD197.9 billion in 2008. However, in 2009 the value of exports declined by 22.7% to USD152.9 billion as a result of the global financial crisis. Imports showed a similar pattern with a 26.3% decline in 2009 to USD127.6 billion.

Brazil's external balance of goods and services to GDP (Variable 29: ExtBalGS_GDP) ratio was at –0.06% in 1960 and remained mostly negative, fluctuating between –5.8% in 1974 and –0.67% in 1982, due to its import substitution strategies. However, once it turned positive in 1983 (+2.4%), the external balance of goods and services to GDP ratio peaked at 5.2% in 1988 before it gradually dropped to 0.35% in 1994 and then reverted to negative values from 1995 (–1.58%) to 2001 (–1.32%). Increasing commodity prices led again to a positive ratio of external balance of goods and services to GDP, 1.5% in 2002, peaking at 3.9% in 2004, and gradually declining to 0.16% in 2008 and -0.45% in 2009 —again— due to the global financial crisis.

Brazil's export is characterized by significantly increasing shares of food, fuel, and ore and metal exports at the expense of agricultural raw materials and manufactured goods between 1995 to 2009 (UNCTAD, 2010) as the table below shows.[21]

Table 2.6: Export Structure Brazil 1995-2009

Brazil	**1995**	**2005**	**2009**
Total Exports (USD bio)	**46.505**	**118.529**	**152.995**
Total Exports (%)	**100.0%**	**100.0%**	**100.0%**
Food	28.5%	25.7%	33.9%
Agricultural Raw Materials	5.2%	3.9%	3.8%
Fuels	0.9%	6.0%	8.9%
Ores and Metals	11.3%	10.5%	13.4%
Others	1.3%	1.8%	1.8%
Manufactured Goods	52.8%	52.1%	38.2%
Chemical products	*6.6%*	*6.1%*	*6.9%*
Machinery	*19.0%*	*25.8%*	*17.2%*
Diversified	*27.2%*	*20.2%*	*14.1%*
Total Exports: Brazil vs. World	**0.90%**	**1.13%**	**1.23%**
Total Exports: US vs. World	***11.3%***	***8.6%***	***8.5%***

Data Source: UNCTAD (2010), Table created and arranged by the author.

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[21] The data of Table 2.6 has been assembled from various trade and country sections in the 2010 UNCTAD report. The US vs. World share data in Table 2.6 and the following tables is provided for comparison purposes.

The increasing export shares in food, fuels, and ores and metals underline the pivotal role of these commodities for Brazil's trade related revenues. As the table above shows, Brazil's global export share rose from 0.90% in 1995 to 1.13% in 2005 and then 1.23% in 2009, an increase of 37%. Yet, Table 2.8 (Import Structure Brazil 1995-2009) reveals that Brazil's import structure development on the other hand underscores the notion of self-sufficiency in food, oil, and fuels. Food imports fell by almost half in percentage terms from 1995 to 2009. In contrast, chemical products increased their share, reflecting an advanced stage of economic demand in Brazil. Imported fuels, such as oil-related lubricants and petrochemical products rather than crude, have remained relatively stable since 1995 while export shares in fuels increased.

Brazil has significantly capitalized on its trade ties with China, starting in the mid-1990s. In recent years, Brazil has been able to maintain a trade surplus as a result of increasing price levels in minerals and metals, and soft commodities. Nonetheless, as will be subsequently discussed, Brazil is also experiencing a concentration bias toward the export of primary products. Unlike most of Latin America, Brazil has manufactured industrial and high-tech products, such as aircraft and transport equipment. Nevertheless, export shares in manufactured products, as shown in Table 2.6 above, declined as a result of China's demand for commodities from Brazil; export shares of commodities rose at the expense of export shares of manufactured products.

CHINA

China's external trade is dominated by manufacturing and production related trade by foreign companies, which were set up naturally along China's coastal regions to take advantage of the functioning infrastructure and the proximity to ports. In the context of China's open door policy, special economic zones for enterprises (SEZs) were established along the Eastern coastal regions to integrate China into global trade flows and encourage foreign direct investment. The main incentives include favorable tax frameworks that aim to attract foreign investors into the SEZs as well as China's relatively stable foreign exchange rate, low labor costs, and a relatively skilled labor force. Thus, multinational companies have relocated their assembly processes to China's coastal regions, triggering the development of an intraregional market among China's SEZs. Multinationals began exporting components and parts to China for assembly, such that the parts get successively processed into finished goods for re-export to mature consumer markets in Europe and the United States. The inflow of mainly process and manufacturing related FDI saw the net FDI to GDP ratio grow significantly from 0.2% in 1982 to 6% in 1995, though it declined gradually to 3.3% in 2008 as a result of investment saturation and to 1.6% in 2009 due to the global financial crisis. Such developments, which have favored bilateral trade balances with Europe and the United States at the expense of the trade balances with the rest of Asia, were specifically supported by China's accession to the WTO in late 2001. Today, more than 90% of China's manufacturing and trade processing firms are located in the Eastern coastal areas, approximately 60% of which are under foreign ownership.

Similarly to Brazil, trade plays a crucial role in China's GDP composition. The trade to GDP ratio rose from approximately 5% in 1960 relatively steadily to 62.1% in 2008, though its peak was at 70.5% in 2006. In 2009 the ratio crumbled to 47.1% as a result of trade contraction due to the global financial crisis.

In 1960 China's export and import values in current USD were 2.57 billion and 2.65 billion, respectively, approximately double the amounts of Brazil in the same year. Until the end of the 1960s export and imports developed relatively flatly. The big push in trade volumes began only in the 1970s. By 1980 exports had surged to USD18.1 billion and imports to USD19.9 billion. Just a decade later exports of USD62.1 billion had surpassed imports (USD53.3 billion) for the first time. China had begun its rise as a major exporter. By 2000, exports surpassed USD249.2 billion, and by 2007 (two years before the financial crisis) exports hit the trillion-dollar threshold (USD1.22 trillion). Imports were USD243.6 billion and USD956.1 billion at those points in time. The year 2008 marked a record year for China's trade: USD1.431 trillion in exports and USD1.132 trillion in imports. Yet, the financial crisis led to export declines of 16% to USD1.2 trillion, whereas imports showed a less pronounced decline, falling by 11% to USD1.0 trillion in 2009. Nonetheless, China's exports and imports constituted roughly eight times the value of Brazil's exports and imports.

In 1970, China's external balance of goods and services to GDP was –0.1%, similar to Brazil's slightly negative value of –0.4%.[22] Until 1990 this ratio showed great volatility in China, reaching 2.1% in 1982 and –4.1% only three years later. Since 1990 the external balance of goods and services to GDP has remained consistently positive

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[22] Data about the external balance of goods and services to GDP are not available prior to 1970 in the World Bank Data Catalog.

(c.f. 1993, –2.1% for Brazil) and grown in cycles, from 1.8% in 1994 to a record of 8.8% in 2007. In 2008, this value dropped by 1%, then fell an additional 2.5% to the ratio of 5.3% in 2009. However, the external balance of goods and services to GDP remained positive, despite the financial crisis, unlike Brazil's (c.f. –0.5% in 2009).

The table below clearly exhibits China's surging machinery and diversified manufacturing export sector, which accounted for almost 94% of its total exports in 2009, compared with only 10% less than 15 years earlier (UNCTAD, 2010). China's global share of exports in manufactured goods was 5.5% in 1995, 13.2% in 2005, and 17.0% in 2009. In 2009 Chinese exports of machinery goods accounted for almost 50% of its total exports.

Table 2.7: Export Structure China 1995-2009

China	**1995**	**2005**	**2009**
Total Exports (USD bio)	**148.8**	**761.9**	**1,201.6**
Total Exports (%)	**100.0%**	**100.0%**	**100.0%**
Food and Seeds and Oils	**8.3%**	**3.2%**	**2.9%**
China's Global Share of Food, Seeds, Oils Exports	2.7%	3.7%	3.5%
(US Global Share of Food, Seeds, Oils Exports)	*14.0%*	*10.0%*	*10.1%*
Agricultural Raw Materials	**1.8%**	**0.5%**	**0.5%**
China's Global Share of AgriRaw Exports	2.3%	3.2%	3.6%
(US Global Share of AgriRaw Exports)	*16.7%*	*12.5%*	*12.4%*
Fuels	**3.6%**	**2.3%**	**1.7%**
China's Global Share of Fuels Exports	1.5%	1.2%	0.8%
(US Global Share of Fuels Exports)	*3.2%*	*2.3%*	*3.0%*
Ores and Metals	**2.4%**	**2.0%**	**1.3%**
China's Global Share of Ores and Metals Exports	1.9%	3.4%	2.9%
(US Global Share of Ores and Metals Exports)	*8.5%*	*5.7%*	*5.5%*
Manufactured Goods	**83.9%**	**92.0%**	**93.6%**
Chemical products	*6.2%*	*4.8%*	*5.2%*
Machinery	*21.2%*	*46.3%*	*49.2%*
Diversified	*56.5%*	*40.9%*	*39.2%*
China's Global Share of Manufactured Goods Exports	5.5%	13.2%	17.0%
(US Global Share of Manufactured Goods Exports)	*13.3%*	*10.1%*	*9.3%*
Total Exports: China vs. World	**2.9%**	**7.3%**	**9.7%**
Total Exports: US vs. World	***11.3%***	***8.6%***	***8.5%***

Data Source: UNCTAD (2010), Table created and arranged by the author.

Manufactured goods grew to almost 94% of China's total exports at the expense of declining export shares in commodities overall, which fell from 16.1% in 1995 to 6.4% in 2009. On a national export share basis, exports of fuels declined from 3.6% to 1.7% during 1995 and 2009, underscoring the domestic demand for oil. Its main non-fuel export markets were the United States, Hong Kong, and Japan.

2.4.3.2 Imports and Import Structure

BRAZIL

Brazil’s global import share remained relatively stable at 1% between 1995 and 2009 indicating that Brazil maintained parity with global import volume, whereas China’s imports grew stronger than the global import volume, mainly due to its aggressive economic expansion.

Table 2.8: Import Structure Brazil 1995-2009

Brazil	**1995**	**2005**	**2009**
Total Imports (USD bio)	**53.734**	**73.600**	**127.647**
Total Imports (%)	**100.0%**	**100.0%**	**100.0%**
Food and Seeds and Oils	10.7%	4.4%	5.2%
Agricultural Raw Materials	2.7%	1.5%	1.2%
Fuels	12.1%	18.3%	14.8%
Ores and Metals	3.4%	3.9%	2.8%
Manufactured Goods	71.1%	71.9%	76.0%
Chemical products	*15.2%*	*19.9%*	*19.8%*
Machinery	*39.2%*	*37.9%*	*39.9%*
Diversified	*16.7%*	*14.1%*	*16.3%*
Total Imports: Brazil vs. World	**1.03%**	**0.72%**	**1.1%**
Total Imports: US vs. World	***14.7%***	***16.1%***	***12.8%***

Data Source: UNCTAD (2010), Table created and arranged by the author.

Brazil’s import structure inversely mirrors the trend of its export structure. Imports of manufactured goods represented about 76.0% of all imported goods in 2009, up from 71.1% in 1995, whereas exports of manufactured products to total exports fell in that period from 52.8% in 1995 to 38.2% in 2009 (Table 2.6: Export Structure Brazil 1995-2009). Imported machinery and transport equipment, which remained relatively stable between 39% and 40% between 1995 and 2009, continues to dominate Brazil’s import structure. Similarly, imports of fuels and food fell between 2005 and 2009, and between 1995 and 2009 respectively, while exports of the identical commodity groups grew in the same time period.

CHINA

From 1995 to 2009, imports of manufactured goods were declining. In 2009, China’s imports consisted of 67.2% manufactured goods —down from 79.2% in 1995—, of which of 40.6% were machinery and transport equipment to be assembled in China. Almost 33% of China’s imports in 2009 consisted of soft commodities, such as animal and vegetable oils, fats, and mineral fuels. Between 2005 and 2009, China’s main imports were electronic integrated circuits, petroleum oils, oils obtained from bituminous minerals, crude and iron ores (UNCTAD, 2010; Global Insight, 2009).

Table 2.9: Import Structure China 1995-2009

China	**1995**	**2005**	**2009**
Total Imports (USD bio)	**132.1**	**659.9**	**1,005.6**
Total Imports (%)	**100.0%**	**100.0%**	**100.0%**
Food and Seeds and Oils	**7.0%**	**3.3%**	**4.5%**
China's Global Share of Food, Seeds, Oils Imports	2.3%	2.9%	4.6%
(US Global Share of Food, Seeds, Oils Imports)	*7.6%*	*10.0%*	*8.1%*
Agricultural Raw Materials	**5.2%**	**3.6%**	**3.1%**
China's Global Share of AgriRaw Imports	5.5%	13.7%	18.2%
(US Global Share of AgriRaw Imports)	*11.7%*	*13.1%*	*7.4%*
Fuels	**3.9%**	**9.7%**	**12.3%**
China's Global Share of Fuels Imports	1.6%	4.5%	6.7%
(US Global Share of Fuels Imports)	*17.6%*	*20.4%*	*15.1%*
Ores and Metals	**4.7%**	**8.8%**	**12.9%**
China's Global Share of Ores and Metals Imports	2.5%	9.8%	16.0%
(US Global Share of Ores and Metals Imports)	*11.6%*	*11.6%*	*7.7%*
Manufactured Goods	**79.2%**	**74.6%**	**67.2%**
Chemical products	13.0%	11.8%	11.1%
Machinery	40.0%	44.0%	40.6%
Diversified	25.5%	18.6%	15.1%
China's Global Share of Manufactured Goods Imports	3.1%	5.9%	7.2%
(US Global Share of Manufactured Goods Imports)	*15.9%*	*15.9%*	*12.6%*
Total Imports: China vs. World	**2.5%**	**6.1%**	**7.9%**
Total Imports: US vs. World	***14.7%***	***16.1%***	***12.8%***

Data Source: UNCTAD (2010), Table created and arranged by the author.

2.4.3.3 Major Trade Partners

BRAZIL

Brazil's trading partner structure changed considerably from 1990 to 2009. Considering this thesis' focus on Brazil's export relationship with China, this section addresses the country's export partners only.

Brazil's exports to its non–top ten trading partners increased from 37.1% in 1990 to 46.9% in 2009; that is, Brazil's export revenues show strong diversification tendencies. For decades, the United States was Brazil's main export market, but between 2005 and 2009 China had assumed this position.

Table 2.10: Top 10 Export Trading Partners Brazil 1990-2009

Ranking	**1990**	**100%**	**2005**	**100%**	**2009**	**100%**
1	US	24.6%	US	19.2%	CHN	13.2%
2	NL	7.9%	ARG	8.4%	US	10.3%
3	JP	7.5%	CHN	5.7%	ARG	8.4%
4	GER	5.9%	NL	4.5%	NL	5.3%
5	IT	5.1%	GER	4.2%	GER	4.0%
6	UK	3.0%	MEX	3.5%	JP	2.8%
7	FR	2.9%	CHI	3.0%	UK	2.4%
8	SP	2.2%	JP	3.0%	VZ	2.4%
9	ARG	2.1%	IT	2.7%	IN	2.2%
10	SK	1.7%	RU	2.4%	BL	2.1%
Top 10	*62.9%*		*56.6%*		*53.1%*	
	Others	37.1%	Others	43.4%	Others	46.9%
All		**100.0%**		**100.0%**		**100.0%**

Data Source: UNCTAD (2010), Global Insight (2009, pp. 18-20), Table created and arranged by the author.

Specifically, exports to China accounted for 13.2% (USD20.19 billion) of Brazil’s total exports in 2009, followed by 10.3% (USD157.4 billion) to the United States and 4% (USD6.2 billion) to Germany, which maintained its fifth position, comparable with prior years. Most exports to China involved agricultural raw materials and vegetable oils and seeds, such as inedible crude materials except fuels, animal and vegetable oils (i.e., soy), and fats and waxes, which accounted for 76%, or USD15.34 billion of total exports to China. Manufactured goods exported to China accounted for 8.8% (USD1.8 billion); mineral fuels, lubricants, and related materials accounted for 6.6% (USD1.33 billion), followed by machinery and transport equipment at 3.1% (USD630 million), food, live animals, beverages, and tobacco at 2.8% (USD565 million), and chemicals and other commodities at 2.7% (USD545 million).

In essence, 88% of Brazil’s exports to China in 2009 are related to energy and soft commodities, whereas 12% stem from manufactured goods and machinery. In comparison, Brazil’s overall 2009 exports consisted to 68.7% of energy and soft commodities and to 31.3% of machinery and manufactured goods.

CHINA

China’s trading partner structure changed considerably upon the country’s entry into the WTO. In the 1990s, its main export markets were Hong Kong —which served as a shipping hub— and Japan, China’s traditional export market.

In the early 2000s, China’s trading partner profile changed its focus to the United States, which has since remained China’s largest export customer (UNCTAD,

2010. Global Insight, 2009, pp. 18–20). Similar to Brazil, China's top ten export partners decreased their share of China's total exports, from 79.4% in 1995 to 61.5% in 2009; China's export revenues thus continue to diversify globally. Before China's open door policy, Hong Kong had been its main export trading partner, but by the turn of the 20th century the United States took the lead, outpacing Hong Kong and Japan. Germany maintained its position among the top five export markets.

Table 2.11: Top 10 Export Trading Partners China 1990-2009

Ranking	**1990**	**100%**	**2005**	**100%**	**2009**	**100%**
1	HK	43.3%	US	21.4%	US	18.4%
2	JP	14.7%	HK	16.3%	HK	13.8%
3	US	8.5%	JP	11.0%	JP	8.1%
4	GER	3.3%	SK	4.6%	SK	4.5%
5	SG	3.2%	GER	4.3%	GER	4.2%
6	NL	1.5%	NL	3.4%	NL	3.1%
7	TH	1.4%	UK	2.5%	UK	2.6%
8	IT	1.4%	SG	2.2%	SG	2.5%
9	UK	1.1%	RU	1.7%	IN	2.5%
10	FR	1.0%	AUS	1.5%	FR	1.8%
Top 10	*79.4%*		*68.9%*		*61.5%*	
	Others	20.6%	Others	31.1%	Others	38.5%
All		**100.0%**		**100.0%**		**100.0%**

Data Source: UNCTAD (2010), Global Insight (2009, pp. 18-20), Table created and arranged by the author.

2.5 Brazil and China: Dualism — Cooperation — Partnership?

2.5.1 Dualism

Foreign direct investment has been a persistent topic in recent literature to characterize the dynamics between Brazil and China since the 1990s. Most research indicates that China’s superior FDI attractiveness is due to its low labor costs. This section offers an assessment of FDI in Brazil and China and elaborates on FDI features through a comparison that reveals that low labor costs are not the only competitive advantage that can draw in FDI.

Trade and FDI are closely linked in China, which undeniably has an FDI-specific competitive advantage over Brazil. China’s 2009 labor participation rate is 74% of the total population of 1.33 billion people, down from 79% in 1990. Brazil’s labor participation rate has increased from 65% in 1990 to 71% of the total population of 194 million in 2009. That is, in relative terms Brazil’s workforce is increasing, whereas China’s is decreasing. Yet, China maintains its significant advantage in absolute labor abundance and low labor costs as indicated by its vast population base, large labor pool, and lower GDP per capita, which is a proxy for low wages. China’s comparative advantage in this respect will likely persist in the mid to long-term future. China’s population density, which rose from 122 people per square kilometer in 1990 to 143 people in 2009, is more than six times larger than Brazil’s. Brazil’s population density has grown also, but at remarkably lower levels, from 18 people to 23 people per square kilometer during the same period.

Also, China’s skilled workforce is far more regionally concentrated than Brazil’s, which creates another form of competitive advantage for FDI in China. Such concentration is fueled by population-dense areas, such as the Pearl River Delta, Guangzhou, Shanghai, or Shenzhen, that offer industry clusters and production hubs. Despite the higher corruption levels and more insecure property laws in China, Western firms prefer it for their FDI because they can rely on sounder infrastructure levels among others. Such offerings provide significant FDI-related advantages. As Hunya and Stöllinger (2009, p. 25) find, (1) market size and growth prospects are the primary FDI decision factors, followed by (2) proximity to customers and markets, (3) low labor costs, (4) a skilled workforce, (5) industry clusters, and (6) an acceptable and sound infrastructure.

Brazil has begun to address its infrastructural weakness. In January 2007 it established the Plano De Aceleração Do Crescimento (PAC) 2007–2010 (enhanced by PAC 2 in March, 2010), which mandated capital expenditures of approximately USD236 billion to support infrastructure enhancement programs for 20 ports, 42,000 km of roads, 10,000 km of railroads, more than 10 airports, and approximately 13,000 km of high-voltage electricity transmission lines (Governo Federal, 2007, pp. 7-17. PAC 2, 2011).

These factors may explain the significant difference in the size of FDI flows when I compare China with Brazil. In 1993 FDI into China reached USD27.5 billion, compared with USD1.3 billion into Brazil. By 2008, FDI into China was USD147.8 billion, compared with Brazil's USD45 billion. FDI in China did not suffer much from the post-2000 global FDI decline as a result of subdued global macroeconomics. Whereas Brazil's FDI declined by 31%, 26%, and 39% p.a. from 2001 to 2003, China's FDI actually increased by 15% and 11% p.a. in 2001 and 2002 and only declined in 2003 by 5% (Table: 2.12 FDI Brazil and China 1991-2009).

Nonetheless, the GDP composition and the domestic economic situation of each country as well as global macroeconomic trends may alter some of the FDI decisions of multinational firms. Brazil's and China's FDI structures differ on key points. For example, in 2007 over 50% of FDI to China involved the manufacturing sector, whereas approximately 70% of FDI to Brazil entailed the service sector (Hunya and Stöllinger, 2009, p. 11).[23] Since 2000, Brazil's FDI has maintained this bias toward the service

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[23] It is worth to mention that China's FDI is mainly driven by export oriented manufacturing investments undertaken by foreign-invested companies. There exists vast academic research on foreign direct investment and its effects on terms of trade of developing countries (e.g., by Bhagwati, referred to by Li, Huizhong, (n.d.)), which suggests that terms of trade may deteriorate due to FDI inflows depending of a host country's trading mode, its degree of development, and trade openness. Under the export promotion strategy that China runs, foreign direct investments have indeed led to a biased growth in exports. The weight of processing trade in exports to imports was 86.3% to 54.9% in 1996, 81.4% to 58.5% in 2000, 78.7% to 59.9% in 2004, and 72.5% to 51.6% in the first 11months of 2008 (Li, Huizhong, (n.d.)), worsening the country's terms of trade, which declined from 105.9 in 1996 to 73.9 in 2008 (Variable 42: Terms of Trade (ToT), China 1996-2008). Chinese terms of trade negatively correlate predominantly above 70% (significance of 0.01 and 0.05) with all commodity price indexes (except tropical beverages and vegetables, oils and seeds price indexes) between 1996 and 2008 (Table 4.5b).

Also, on a side note, findings by Alfaro et al (2006, pp. 29-34) provide support to the discussion that FDI increases productivity of a host country through spillover effects under certain preconditions. Alfaro's models are based on mechanics that stress the function and role of domestic financial markets in enabling FDI to promote growth through the creation of backward linkages (Alfaro, 2006, pp. 34-35). One of the preconditions: domestic financial markets need to be developed and evolved sufficiently in order to generate benefits for the host country through backward linkages between the foreign and the local companies with positive spillovers to the economy, which would lead to higher growth; in contrast, host sector, whereas FDI to China stays focused on manufacturing. Furthermore, when comparing the FDI coverage of China and Brazil in 1993, I note that China's FDI was 21.3 times greater than Brazil's. Undeniably, China has an array of competitive advantages in terms of FDI attractiveness. However, the positive effects of the Plano Real allowed FDI into Brazil to increase in 1995 and 1997, such that the comparison of China-to-Brazil FDI coverage fell to 2.3 times in 1997 and to 1.4 times in 1999. In 2007, FDI was particularly strong in China —and in Brazil—, leading to China-to-Brazil FDI coverage comparisons of 4.0 times, and just 3.0 times after the 2009 crisis. The FDI coverage ratios, as shown in Table 2.12, cannot conclusively demonstrate that FDI inflows intrinsically favor China over Brazil, solely due to market size, growth perspectives, proximity to markets, or low labor costs. Rather, global macroeconomic conditions and Brazil's improved macroeconomic status also play significant roles.

Table 2.12: Foreign Direct Investment Brazil and China 1991–2009

Year	**1991**	**1993**	**1995**	**1997**	**1999**	**2001**	**2003**	**2005**	**2007**	**2009**
Brazil (USD bio)	**1.10**	**1.29**	**4.86**	**19.65**	**28.58**	**22.46**	**10.14**	**15.07**	**34.58**	**25.95**
Change rate	*12%*	*-37%*	*58%*	*75%*	*-10%*	*-31%*	*-39%*	*-17%*	*84%*	*-42%*
China (USD bio)	**4.47**	**27.51**	**35.85**	**44.24**	**38.75**	**44.24**	**47.08**	**79.13**	**138.41**	**78.19**
Change rate	*25%*	*147%*	*6%*	*10%*	*-11%*	*15%*	*-5%*	*44%*	*77%*	*-47%*
Coverage (x)	**4.0x**	**21.3x**	**7.4x**	**2.3x**	**1.4x**	**2.0x**	**4.6x**	**5.3x**	**4.0x**	**3.0x**
FDI change rate Correlation	**15%**, Sig. 0.271 (1991-2009)									
						57%, Sig. 0.043 (2000-2009)				

Data Source: FDI data from the World Bank (2009, 2010). Coverage ratios and correlation calculated by the author with PASW Statistics 18. Table created and arranged by the author.

In addition, the FDI change rate correlation between Brazil and China from 1991 to 2009 was 15% (Sig. 0.271 (not significant)), whereas the FDI change rate correlation between Brazil and China from 2000 to 2009 was 57% (significant below the 0.05 p-value threshold). That is, change rates of FDI flows into Brazil and China between 2000 and 2009 appear to be driven largely by a buoyant global macroeconomic environment. For Brazil I note that the stabilizing fiscal and monetary framework as a result of the Plano Real may have additionally contributed to the healthy FDI inflows. In contrast, Brazil's low FDI in the early 1990s may be associated with its generally difficult macroeconomic environment prior to the Plano Real, especially compared with the more stable economic framework of China in the same period. This is reflected by a lower FDI change rate correlation between Brazil and China in the period from 1991 to 2009.

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countries with less developed financial markets would not benefit from the spillover effect (Alfaro, 2006, pp. 34ff).

Brazil’s economic growth between 2003 and 2007 was of historic dimensions, yet still below the rate of the very high growth periods in the 1970s. Although Brazil’s growth figures never reached Chinese levels, Brazil enjoyed solid growth coupled with large foreign currency reserves, which emphasized its relative stability and encouraged increased FDI. Many factors contributed to this boom, including a relatively stable economy as a result of the Plano Real and generally strong global demand for Brazil’s key export commodities (Bull, Kasahara, 2011, p. 2-7), specifically from China, one of the main single factors that can explain Brazil’s expansion — and thus the increase in commodity prices as I will illustrate in Chapter 4 and 5.

2.5.2 Cooperation

In the early 2000s the gravitational forces between Brazil and China changed significantly, from a dualistic to a more cooperative notion. Today Brazil and China seek to leverage their competitive advantages by forging joint ventures in commodity-related sectors, such as in the oil or iron ore sector, so that both countries can confront global and technology challenges. China’s double digit annual GDP growth rates from 2003 to 2008 were a major impulse for the growth in Brazil’s exports to China, which initiated increasingly cooperative trade ties.

Table 2.13: Trade Balance Brazil and China 2000–2008

China (USD billion)	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Imports from Brazil	1.6	2.3	3.0	5.8	8.7	10.0	12.9	18.3	29.6
Exports to Brazil	1.2	1.3	1.5	2.1	3.7	4.8	7.4	11.4	18.8
Trade Balance	**-0.4**	**-1.0**	**-1.5**	**-3.7**	**-5.0**	**-5.2**	**-5.5**	**-6.9**	**-10.8**
Trade Deficit Ratio *	-14%	-28%	-33%	-47%	-40%	-35%	-27%	-23%	-22%

Data Source: World Trade Organization (2009a, 2009b). Table created by the author. *) Trade Balance / (Imports plus Exports).

As Section 2.4 detailed, China is a leading importer of minerals and metals, food commodities, and oil commodities, as well as Brazil’s top export partner. Thus, there is a direct association between Chinese commodity imports and Brazilian commodity exports. Since 2000, the Brazilian–Chinese trade balance has been moving increasingly in Brazil’s favor on an absolute basis, such that it recorded a trade surplus of USD10.8 billion in 2008. In relative terms however, China gradually improved its trade balance with Brazil; the trade deficit ratio improved from -47% in 2003 to -22% in 2008.

Brazil’s terms of trade index also experienced rather volatile developments, increasing from 66.4 index points in 1990 to 108.3 in 1996, then declining to 96.98 in

2003, and then gradually improving to 110.4 index points in 2008 as a result of global commodity demand. It dropped to 107.8 index points in 2009 in the wake of the global financial crisis. China’s terms of trade index on the other hand demonstrates the country’s status as a major export manufacturer but also as a major importer of commodities. It improved from 102 index points in 1990 to 110.6 in 1998, then it dropped to 73.9 index points in 2008 as a result of its immense demand for commodities as previously mentioned.

China’s emergence as Brazil’s main trading partner has been a tension-filled process. Brazil’s appreciating currency, lack of labor market reforms, and poor improvements in infrastructure conditions have reduced Brazil’s competitiveness in the industrial private sector, at least from a Chinese import perspective. Conventional wisdom among economic observers indicates that Brazil’s main risk is the so-called ‘*Dutch Disease*’[24]; that is, the de-industrialization of the country’s economy as a result of structural export–import imbalances with China. For Brazil, growing trade relations with China bear the risk of being a step backward. As a commodity importer China controls quantity and prices, which means less control for the exporter (Brazil); ultimately a less transparent market. In comparison, in the manufacturing sector prices are more visible due to longer term contract features. Furthermore, the commodity sector creates lower-grade jobs in comparison to the manufacturing sector, which also creates larger multiplier effects through longer production chains.

Brazil’s overall export structure is thus heavily geared toward the export of commodities, as Table 2.6 (Export Structure Brazil 1995-2009) shows. The export of food, fuels, agricultural raw materials, and ores and metals accounted for roughly 62% of Brazil’s global exports in 2009, benefiting companies such as Vale Do Rio Doce[25], whereas the export of manufactured products such as aircraft and machinery accounted for only 38.2%.[26] The Brazilian export structure to China is even more unbalanced with

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[24] This expression refers to the presumed negative effects of the exploitation of a country’s natural resource base at the expense of its industrial sector. ‘*Dutch Disease*’ was formulated in 1977 by The Economist (2010) to refer to a newly discovered gas field and then a declining manufacturing sector in the Netherlands in the late 1950s. Another prominent example of Dutch Disease is Venezuela in the 1970s and in the last decade (until today), where oil revenues undermined the development of non-oil sectors because oil revenues increased national income in ways unmatched by increased national productivity; agricultural and industrial imports were cheaper than their production in Venezuela.

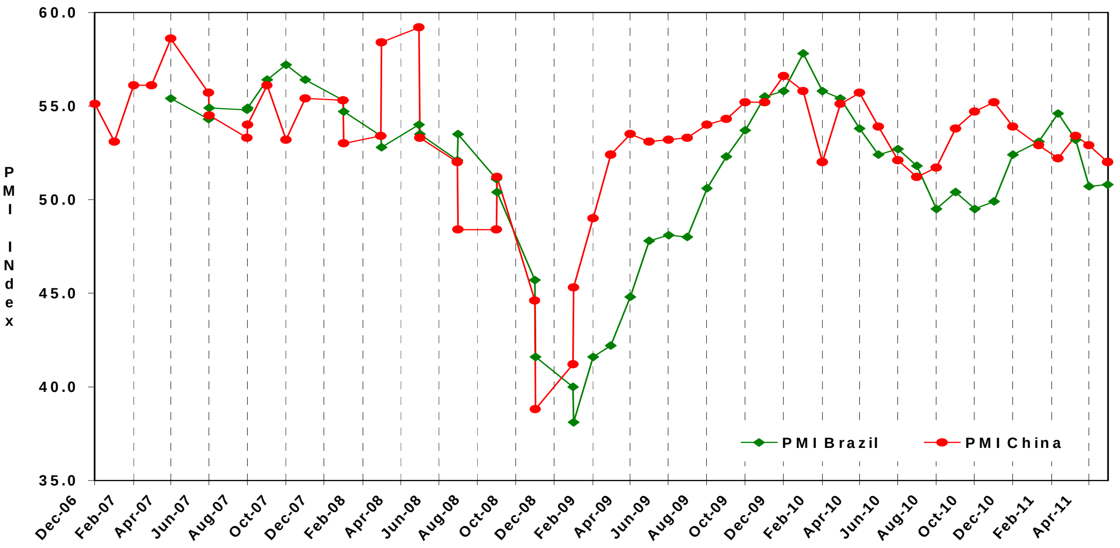
[25] Customers from China, which constitute a major customer base of Companhia Vale do Rio Doce, accounted for 17.7% of revenues for Companhia Vale Do Rio Doce in 2007 (2007, p. 5).

[26] Geromel (2011).

commodities exports of 89% and manufactured products of 11% of total export volume to China (World Trade Organization, 2009a). That is, Brazil's export structure with China is more commodity-centric than Brazil's overall export structure. In contrast, Brazil's overall import structure is heavily geared toward manufactured goods, which accounted for 76% in 2009, as Table 2.8 shows. At the same time, Brazil's imports from China are 94% manufactured products. That is, Brazil's import structure with China is more focused on manufactured products than Brazil's overall import structure.

The Brazil–Chinese trade interdependence also has some effects on the manufacturing sector as evidenced by the purchase manager index (PMI) for Brazil and China (Bloomberg, 2011b). As the figure below shows, Brazil's PMI has lagged China's by one to three months since April 2007, with a correlation of 70.3% at a confidence level of above 99% (sig. < 0.00).

Figure 2.1: PMI Index Brazil–China April 2007 – May 2011



Data Source: Bloomberg (2011b). Correlation analysis computed and Figure arranged by the author.

Considering China's share of only approximately 15% of total Brazilian exports over the last years and considering Brazil's greater than 60% commodities exports in 2009 compared with its overall export volume, it appears that Brazil's Dutch Disease dilemma is not rooted so much in its increased trade relations with China and its sustained demand for commodities, but rather in the deep-seated shortcomings in Brazil's economic structure. Brazil exports more primary and resource-based manufactured products; China specializes increasingly its exports to provide higher-technology products. Brazil's structural problems are long-term and politically complex to solve. Nonetheless, imports from China and the push of Chinese firms into Brazil to gain ownership of commodity producing assets in Brazil, as well as to rebalance foreign currency holding compositions away from the USD, constitutes a viable threat to Brazil's private sector independence. Prevalent warning signs suggest Brazil is locking itself into a position as a commodity exporter, reversing the positive trend of its past 30 years of increasing industrial production and exports.[27]

2.5.3 Partnership?

China's increasing importance as a primary trading partner of Brazil is a positive development from the perspective of commodity-related revenue streams. Yet, despite this connection, relations between Brazil and China are not without tensions or conflicts of interest. Brazilian exporters face increased competition from Chinese competitors, both within onshore and offshore markets, for various segments of manufactured products. According to a survey by the Brazilian National Confederation of Industry, between 2006 and 2010 45% of Brazilian firms that competed against Chinese firms lost domestic market shares, and 67% of Brazilian exporters competing against Chinese counterparts lost shares in offshore markets (Bull and Kasahara, 2011, p. 6). Thus, Brazilian exporters have been forced to realign their cost structure and productivity to maintain their competitiveness. In particular, Brazil's textile industry has been significantly threatened by low-cost Chinese textile producers (Barbosa and Mendes, 2006, pp. 8-9).

Even more pressure on the competitiveness of Brazil's private sector stems from China's economic expansion. China's substantial demand for commodities and the associated increases in commodity prices have created incentives for China to expand through asset acquisitions in the commodity sector, investments, or bilateral loan agreements with governments in commodity-rich regions —like South America,[28] and specifically Brazil, but also Africa— to secure a supply chain of vital commodities.

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[27] Industry value added and manufacturing value added to GDP declined from 30.1% and 19.2% in 2004 to 27.2 and 15.6% in 2009.

[28] For example Argentina: In 2009 the Chinese oil firm CNOOC sealed a joint venture with Bridas Energy Holdings Ltd., a family-owned Argentine firm, which CNOOC used as vehicle to buy out British Petrol's shares in Pan American Energy, which generates 18% of Argentina's oil and natural gas production. In 2011 the joint venture acquired Exxon Mobil's shares in Argentina, Paraguay, and Uruguay, including a refinery and more than 700 service stations. CNOOC also owns 50% of Argentina's largest oil field, Cerro Dragon, which provides the license for all associated oil and gas reserves in the Santa Cruz province in southern Argentina for the next 40 years. For this transaction, the China

Sino-Brazilian economic and political relations date back to 1993 when China and Brazil forged their first strategic partnership (Sangmeister and Zhang, 2008, p. 12). Under the rule of President Lula, Brazil extended this strategic partnership by signing and executing many bilateral agreements that incorporated agricultural trade accords, oil and iron ore supply agreements, and bilateral loan programs. In 2004, President Lula and his business delegation took their second visit to China and signed 14 separate agreements, including those between:

1. Companhia Vale do Rio Doce and the Shanghai Baosteel Group Corporation (Soliani, 2009), closing a USD3.6 billion joint venture.[29]
2. Companhia Vale do Rio Doce and the Aluminum Corporation of China for bauxite exploration and export to China.
3. Petrobras and Sinopec for the exploration and export of oil.
4. China National Machinery and Equipment Import and Export Corporation and Central Termelétrica Do Sul for the construction of a coal thermoelectric plant in Rio Grande do Sul.
5. Banco Nacional de Desenvolvimento Econômico and the Chinese Citic Group to develop export focused finance and joint venture projects (Barbosa and Mendes, 2006, pp. 8-9).

Development Bank provided a USD2.6 billion 10-year term loan to restore a freight train system that connects Buenos Aires to Argentina's central region. In the Rio Negro province, the Metallurgical Corporation of China paid USD80 million to revive an iron ore mine. China's Beidahuang Group pledged a USD14 billion irrigation infrastructure investment for a 20-year license to grow agricultural products such as corn, wheat, soy, and dairy to supply Chinese domestic demand. In the southern Tierra del Fuego, Chinese firms are investing USD1 billion to produce fertilizer and build an energy plant, in exchange for natural gas supplied by Argentina over a 25-year period ((James, 2011), (CNOOC, 2010)).

Chile: In 2005, the Chilean and Chinese governments executed a USD2 billion sales-and-lease-back investment joint venture that secures 836,250 metric tons of copper over a 15-year period. The collateral for China includes 49% in Chile's state-owned Codelco, plus an option for China to acquire 100% of one of Chile’s largest copper mines (James, 2011).

Venezuela: In 2009, the China Development Bank extended a USD32 billion term loan to the Venezuelan government in exchange for a 10-year oil supply contract at market rates (James, 2011).

Ecuador: Also in 2009, Petro China agreed to arrange an USD1 billion loan to the state-owned PetroEcuador in exchange for oil supplies. As a flanking measure, in the first quarter of 2011, the China Development Bank pledged an additional USD1 billion to Ecuador's government in exchange for oil supplies (James, 2011). Also in 2011, it offered another USD1 billion for oil, increasing total Chinese loan amounts to Ecuador to USD3 billion (El Comercio, 2011).

[29] Companhia Vale Do Rio Doce (2007, p. 25) also holds majority and minority shares in a number of additional joint ventures based in Brazil and China (e.g., Zhuyhai Yueyufeng Iron and Steel Co. Ltd, Zhuhai, Guangdong/China).

Furthermore, China is deploying its state-owned China Development Bank as a strategic financing and economic vehicle to shape foreign economic policy. In the past 10 years, it has become the primary vehicle for Chinese foreign economic activities and policy, providing large term loans with maturities up to 25 years to governments and state-owned enterprises in South America and Africa in return for exploration licenses and shipments of energy and agricultural commodities. A recent prominent example is China Development Bank's May 2009 loan agreement, providing USD10 billion to Brazil's state-owned Petrobras in exchange for guaranteed oil supply to Sinopec, China's largest refiner (Xiaokun and Zhang, 2009).[30]

Because iron ore has become one of the most important Brazilian exports, many Chinese investments are focused on expanding mines and exploring new reserve fields. China's persistent demand for iron ore continues to encourage Sino–Brazilian cooperation, such that Companhia Vale do Rio Doce invested USD10 billion to expand its mining activities and double output by 2015, according to a June 2010 announcement by the firm. In addition to the huge landmark agreements, a significant number of bilateral investment and trade agreements between small to medium sized Brazilian and Chinese companies in various sectors further strengthen Sino–Brazilian economic ties (Sangmeister and Zhang, 2008, pp. 12-13).

The Brazilian government's reaction to the Chinese threat to its domestic market has been twofold: On the one hand, Brazil's government under President Lula continued strengthening its diplomatic ties with China to increase Brazil's prominence on the international political level. It established bilateral commissions, such as the Brazil–China High-Level Coordination and Cooperation Commission (COSBAN). On the other hand, the Brazilian government initiated defensive trading measures, such as anti-dumping procedures and law suits with the WTO to avoid the possibility that Chinese products would flood the Brazilian market at the expense of domestic products (Bull and Kasahara, 2011, pp. 6-8). According to Bull and Kasahara (2011, pp. 6-7), approximately 26% of the anti-dumping procedures established between 1988 and 2009 targeted Chinese imports. In light of current trends, including intensifying pressure from Chinese imports on Brazil's trade balance, anti-Chinese import measures appear likely to increase under President Dilma Roussef's administration.

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[30] The agreement includes 150,000 barrels a day of crude oil provided to Sinopec in 2009 and 200,000 barrels per day for nine years from 2010 onwards.

2.6 Conclusion

Both Brazil and China have undergone significant economic changes and integration development in the past two decades as a result of their respective competitive advantages in context of increasing degrees of economic openness.

From the mid-1990s to the early 2000s, Brazil and China offered general trade complementarities in their export structures. Brazil has largely benefited from its vast natural resources, which have dominated the country's export structure. This structure in turn has been partially shaped by China's immense demand for agricultural and energy commodities. On the other hand, China could benefit from its vast and skilled labor base, coupled with low wages in high density areas, which attracted FDI to its SEZs and enabled the country to serve as an assembly bench for export markets in Europe and the United States.

Then, starting in the early 2000s, a new trading pattern emerged. The Chinese trade deficit ratio with Brazil narrowed from 47% in 2003 to 22% in 2008 (Table 2.13). Meanwhile, Brazil's export balance of goods and services to GDP declined from 3.88% in 2004 to 0.16% in 2008, even though it retained a relatively strong position as a global provider of natural resources. The increasingly tight trade relations between Brazil and China have resulted from their complementarities: Brazil's abundance of commodities, China's dynamic industrialization strategy.

However, Brazil's continued structural weaknesses coupled with increasing Chinese exports of manufactured products to Brazil suggest a major threat to Brazil's industrial base, one that haunts public discussions about Brazilian job losses and a potential return to a commodity-based economy. Furthermore, Chinese acquisitions and investments in Brazilian commodity sectors appear likely to increase significantly in the future, considering China's need to import commodities to maintain its domestic growth. Brazil's concentration on exporting commodities and the threat of Chinese manufactured imports have together prompted concerns among Brazilian economists, industry lobbies, and the public. If Brazil becomes locked into a role as a commodity exporter it will undermine its positive trends of a widening industrial base and increased exports.

Together with increasing dependence on exported primary products, the Brazilian–Chinese relationship has fundamental effects and consequences for the

Brazilian development paradigm and for domestic support of the idea of stronger relations with China. The main question in this context involves the direction and quality of the developing relationship between the two countries. Will Brazil and China develop as partners, continue to enter mutually beneficial FDI projects and joint ventures —even though Brazil’s FDI is quite small compared with China’s— and achieve balanced trade relations? Or will the two countries emerge as competitors on both regional and global levels?

3 Empirical Data and Data Methodology

3.1 Introduction

Chapter 3 consists of four sections: Section 3.1 provides the introduction of the data and the data methodology. In Section 3.2 I outline the scale and scope of the 79 macroeconomic variables employed in this thesis, as well as their measures and sources. As rationalized in Section 1.3 and 1.5, these macroeconomic variables serve as the dependent variables of the analysis in Chapter 4. Commodity prices and governance indexes serve as independent variables, as introduced in Sections 3.3 and 3.4.

I also elaborate on the price development of each commodity composite index from 1971 to 2009 and their inter-correlations for the periods of 1971 to 2009 and 1996 to 2008. Commodity price indexes represent the first set of independent variables. In Section 3.3.3, I test the crude price index and the minerals and metals index on Granger causality. Oil price and metals price indexes are major indicators of global activity in capital markets. In the same section I illustrate the correlation and Granger causality levels between the individual composite commodity price indexes and world GDP per capita. In doing so I will give statistically support to the intuitive notion that global demand represented by GDP per capita affects/causes commodity price indexes. The methodology on correlation and Granger causality is introduced and discussed in Section 4.2 (Statistical Diagnostic Tests).

In Section 3.4, I elaborate on the second set of independent variables, those representing governance dimensions. These include the World Bank governance index (WGI index) and the economic freedom index (EFI index). These governance indexes are complementary: The former examines governance dimensions from a holistic perspective; for example the WGIRQ index by the World Bank, which covers the regulatory framework governance as a whole. EFI indexes in comparison are rather specific and cover governance dimensions largely in economic terms. The World Bank indexes, which were first introduced in 1996, are composite indexes, whereas the economic freedom indexes are —with few exceptions— non-composite, genuine indexes.

The governance indexes are based on a questionnaire about perceptions, as well as evidence related to each governance dimension. Indexes of a socially responsible market economy measure not only free markets and property rights but also principles of social justice, equal opportunities, and sustainability. Both WGI and EFI indexes rely on the analysis of multiple economic freedom and competition components, some of which are composites of additional quantifiable measures.

The econometric analysis of change rates of the independent and dependent variables consists of annual data points measured from 1996 to 2008, including absolute governance index data, absolute commodity price index data, and dependent variables expressed as percentage shares. The analysis and computation period in this thesis covers annual data points from 1996 to 2008 due to data restrictions of Worldwide Governance indexes. Worldwide Governance indexes are provided only for 1996 going forward. I included 2009 data for information purposes only.

3.2 Dependent Variables: Selected Macroeconomic Measures

3.2.1 Data Source

The primary source for these macroeconomic variables is the World Bank's publicly available Data Catalog section (World Bank, 2009, 2010 (Data Catalog)). The World Bank has significantly increased the scope of its monitoring of global world development indicators. Today, it provides data of more than 1,150 individual variables of more than 200 economies, covering a time span from 1960 to 2009. It updates its world development indicators tri-annually, in April, September, and December. The World Bank data I used stems from the 3rd quarter in 2009 and the 4th quarter in 2010. Therefore, slight deviations might exist between the macroeconomic data used in this thesis and data posted online as of today due to regular World Bank update batches.

The macroeconomic variables cover a wide range of topics, including, but not limited to, balance of payments, external debt, national accounts, the financial sector, and infrastructure. A full overview of all macroeconomic variables definitions and their topics can be found in Appendix 3.1 and Appendix 3.2.

The World Bank is the main source for macroeconomic variables statistically analyzed in this study for several reasons. First, whereas data from national providers such as Banco Central in Brazil or the National Statistic Buero in China are published mainly in local currency, World Bank data are denominated in US dollars (USD), eliminating any currency translation problem. Second, national data providers often lack the scale and scope of the macroeconomic variables compared to the World Bank. The data time frame of national data providers is also restrictive, whereas the World Bank offers publicly accessible data dating back to 1960. Third, in terms of data compatibility and integrity, the World Bank generates share percentages, such as the trade to GDP ratio, derived from macroeconomic data comparisons that have relied on the same data generation methodology for all economies and years. Thus, this data ensures integrity for country comparisons. Fourth, World Bank data is among the most current and accurate global development data available and is widely used in academic research.

In general, data examined in this thesis is based on World Bank Group data, if not otherwise stated.

3.2.2 Data Methodology

The World Bank’s aggregated macroeconomic variables used in this thesis are in form of (1) percentages of macroeconomic variables measured, e.g., trade to GDP; (2) change rates, such as aggregated GDP change rates; (3) trade indexes, including e.g., export value index; or (4) price indexes, such as the consumer price index (CPI). The majority of the macroeconomic variables in this study are percentage measures or change rate measures as opposed to index variables. Macroeconomic variables as a share percentage are measured annually on a weighted average basis, whereas macroeconomic variables, such as agriculture value added growth rate, are based on constant USD. Trade indexes rely on an average calculation; the base period is usually the year 2000. Finally, aggregated price indexes such as CPIx (Variable 58: consumer price index) are based on the Laspeyres ($_L$) price index, expressed as $P_L= [\sum (pc_i,t_n \cdot qc_i,t_0) / \sum (pc_i,t_0 \cdot qc_i,t_0)]$, where p denotes the price of good c_i (i=1,…,k), t indicates the time period, q is the quantity, and n and 0 are the current and previous periods, respectively. In the Laspeyres price index, the reference quantities are those associated with the price reference period 0, which means it uses the basket of the earlier of two periods.

3.2.3 Data Series

This section introduces the macroeconomic variables data series selected for the econometric analysis performed in Chapter 4. As noted previously, this thesis examines 79 macroeconomic variables over the period from 1996 to 2008 on an annual basis. The econometric analysis measures the effects of the independent variables, namely commodity price and governance indexes, on the dependent variables.

Table 3.1: Macroeconomic Topics and Subsets

Private Sector & Trade	**Economic Policy & Debt**
Exports	Shares of GDP
Imports	Other Share measures
Trade Indexes	Growth Rates
Total Merchandise Trade	Debt Ratios and Other Items
Tariffs	Capital & Financial Account
	Reserves and Other Items
International Merchandise Indexes	National Accounts & Balance of Payments
Terms of Trade Indexes	
Purchasing Power Indexes of Exports	**Financial Sector**
	Capital Markets
Environment	Monetary Holdings
Agricultural Production	Interest Rates
Energy Production & Use	Exchange Rates & Prices
Density & Urbanization	
	Infrastructure
Labor & Social Protection	Communications
Unemployment	Technology

Source: World Bank (2009, 2010). Table created and arranged by the author.

The macroeconomic variables analyzed for both, Brazil (Tables 3.2a-c) and China (Tables 3.3a-c), cover seven topics as categorized by the World Bank: (1) economic policy & debt: national accounts, (2) private sector & trade, (3) financial sector, (4) environment, (5) infrastructure, (6) international merchandise indexes, and (7) labor and social protection. Each category contains several subsets, as summarized in Table 3.1.

The Tables 3.2a-c and 3.3a-c below give an overview of the entire set of macroeconomic variables of Brazil and China, respectively, covering the entire analysis period from 1996 to 2008. The variables in these tables are stated in abbreviated form. The definition of each dependent variable, its extended as well as its abbreviated form, is provided in Appendix 3.1.

Most of the variables (38 of 79) come from the topic of economic policy & debt, 13 variables are from the private sector & trade topic, followed by ten from the financial sector topic and seven from the environment topic. The infrastructure topic supplies six variables, and the international merchandise topic contains four variables. Labor & social protection supplies only one variable (unemployment). Within the economic policy & debt topic, the selected variables cover a broad selection of key economic performance and output measures, their change rates (e.g., GDP growth rates) as well as shares of GDP, e.g., the ratio of household final consumption to GDP. In addition, this category contains debt ratios and important national account variables, as well as capital and financial account variables.

The financial sector topic offers key variables from a wide range of subsets, such as capital markets, monetary, and interest and foreign exchange (FX) rate subsets. Thus, it can measure the impact of governance and commodity prices on financial and monetary sectors.

Private sector & trade and international merchandise indexes are neighboring topics and include a range of trade-related indexes, which are essential for measuring the effects of price changes of commodities and trade-related governance of Brazil and China. The comparative analysis thus highlights the different effects the independent variables have in the dissimilar contexts of Brazil and China, i.e., on a major global commodity exporter in the case of Brazil versus a major global commodity importer in the case of China.

The selected variables from the environment, infrastructure, and labor & social protection topics complement the analysis of significant effects of commodity prices and governance for the macroeconomic framework in Brazil and China.

Typographically, during the course of this study —for information purposes and reader friendliness— the variables are initially either put in abbreviated form first with their order number and extended form in brackets, e.g., GDP_gr (Variable 2: GDP growth rate). Or —depending on the context— they are put in extended form first with their order number and abbreviated form in brackets, e.g., GDP growth rate (Variable 2: GDP_gr).

Table 3.2a: Dependent Variables Brazil 1996-2009 (Variables 1-26)

Dependent Variables (%)	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
GDPDefl	77.38	83.29	86.82	94.18	100.00	108.97	120.47	137.00	148.02	158.69	168.45	178.33	191.52	200.69
GDP_gr	2.15	3.37	0.04	0.25	4.31	1.31	2.66	1.15	5.71	3.16	3.96	6.09	5.14	-0.19
GDPpCap_gr	0.62	1.83	-1.45	-1.22	2.81	-0.11	1.25	-0.20	4.37	1.93	2.81	5.00	4.12	-1.09
Agri_GDP	5.51	5.40	5.52	5.47	5.60	5.97	6.62	7.39	6.91	5.71	5.47	5.82	6.40	6.61
Agri_gr	2.96	0.81	3.41	6.53	2.72	6.06	6.58	5.81	2.32	0.30	4.52	5.86	5.78	3.65
IndustValAd_GDP	25.98	26.13	25.66	25.95	27.73	26.92	27.05	27.85	30.11	29.27	28.78	27.27	26.70	27.19
IndustValAd_gr	1.13	4.16	-2.50	-1.94	4.93	-0.61	2.13	1.31	7.85	2.08	2.28	4.76	4.30	-36.91
ManuValAdd_GDP	16.80	16.67	15.72	16.12	17.22	17.13	16.85	18.02	19.22	18.10	17.40	16.93	15.28	15.54
ManFactValAdd_gr	0.08	2.49	-4.84	-1.86	5.69	0.70	2.44	1.85	8.47	1.25	1.14	4.69	3.18	1.96
GrossSav_GDP	14.08	13.58	13.03	12.06	13.94	13.81	15.16	17.99	20.36	18.79	18.68	17.66	16.86	14.78
GrossSav_GNI	14.29	13.84	13.32	12.46	14.34	14.27	15.63	18.21	20.59	19.06	18.94	17.92	17.16	15.02
GrossDomSav_GDP	15.24	15.23	15.03	14.97	16.49	16.71	17.71	18.68	20.99	19.81	19.67	18.81	18.37	16.15
GrossNatExp_GDP	101.80	102.20	102.00	101.40	101.76	101.32	98.49	97.09	96.12	96.39	97.10	98.50	99.84	100.45
GovFinConExp_GDP	20.10	19.90	20.64	20.30	19.17	19.82	20.57	19.39	19.23	19.91	20.04	19.44	19.45	19.52
GovFinConExp_gr	-1.83	1.25	3.22	1.69	-0.15	2.74	4.75	1.15	4.09	2.30	2.58	4.73	5.64	1.09
FinConExp_GDP	84.76	84.77	84.97	85.03	83.51	83.29	82.29	81.32	79.01	80.19	80.33	81.19	81.63	83.85
FinConExp_gr	2.02	2.62	0.18	0.68	3.04	3.74	1.61	1.75	0.36	3.45	4.02	7.87	6.62	2.25
HHFinConExp_gr	3.24	3.03	-0.72	0.38	4.03	4.03	0.68	1.93	-0.78	3.82	4.47	8.83	6.92	2.59
HHFinConExp_GDP	64.66	64.88	64.33	64.73	64.35	63.47	61.72	61.93	59.78	60.27	60.29	61.75	62.18	64.33
HHFinConExpPCap_gr	1.69	1.49	-2.20	-1.09	2.54	2.57	-0.70	0.57	-2.03	2.58	3.31	7.41	6.74	2.50
GroCapF_GDP	17.04	17.43	17.03	16.38	18.25	18.03	16.20	15.77	17.12	16.21	16.77	17.31	18.21	16.60
GroCapF_gr	1.50	8.73	-0.34	-8.20	14.10	-7.55	-5.23	-4.59	9.12	3.63	9.77	13.50	13.77	-10.18
GrossFixCapForm_GDP	16.87	17.37	16.97	15.66	16.80	17.03	16.39	15.28	16.10	15.94	16.43	17.10	18.26	16.22
GrossFixCapForm_gr	1.50	8.73	-0.34	-8.20	5.03	0.44	-5.23	-4.59	9.12	3.63	9.77	13.50	13.77	-10.18
Trade_GDP	14.93	15.84	15.87	20.23	21.72	25.68	26.68	27.06	28.97	26.65	25.83	25.20	27.41	26.12
MrchTrade_GDP	12.45	13.35	13.31	17.03	17.70	21.11	21.83	22.43	24.57	22.24	21.46	21.03	23.21	18.23

Data Source: World Bank (2009, 2010). All variables are in % except for index variables. Table created and arranged by the author.

Table 3.2b: Dependent Variables Brazil 1996-2009 (Variables 27-52)

Dependent Variables (%)	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
ExpGS_GDP	6.57	6.82	6.93	9.41	9.98	12.18	14.10	14.99	16.43	15.13	14.37	13.35	13.79	12.83
ExpGS_gr	-0.42	11.02	4.91	5.71	12.86	10.05	7.42	10.40	15.29	9.33	5.04	6.72	-0.60	11.37
ExtBalGS_GDP	-1.80	-2.20	-2.00	-1.40	-1.76	-1.32	1.51	2.91	3.88	3.61	2.90	1.50	0.16	-0.45
CurrACC_GDP	-2.77	-3.50	-4.01	-4.33	-3.76	-4.19	-1.51	0.76	1.77	1.59	1.25	0.11	-1.72	-1.55
ImpGS_GDP	8.37	9.02	8.93	10.82	11.74	13.50	12.58	12.08	12.55	11.52	11.47	11.85	13.63	13.29
ImpGS_gr	5.60	14.59	-0.06	-15.09	10.80	1.52	-11.82	-1.62	13.30	8.48	18.45	20.79	18.49	8.12
AgRawImp_MrchImp	3.00	2.57	2.10	2.02	1.97	1.35	1.50	1.75	1.75	1.54	1.52	1.42	1.22	1.16
ManfImp_MrchImp	69.95	73.85	76.30	75.72	73.29	75.96	74.05	72.35	71.16	71.81	70.09	63.82	70.22	75.88
FuelImp_MerchImp	13.17	11.68	9.30	11.37	14.93	13.97	14.87	15.55	18.31	18.37	18.83	18.55	19.82	14.80
ExpValX	86.62	96.15	92.78	87.11	100.00	105.75	109.65	132.81	175.40	215.04	250.02	291.46	359.12	277.57
ImpValIx	97.17	109.55	103.42	88.27	100.00	99.55	84.79	86.76	113.28	132.37	163.42	215.82	310.97	227.74
ExpVolX	74.08	80.84	82.89	88.94	100.00	109.63	119.08	137.86	164.03	178.76	184.72	194.86	190.05	169.62
ImpVolIx	89.93	106.60	105.56	92.93	100.00	102.85	90.59	87.34	103.67	109.14	126.07	153.82	181.67	150.00
UnitValIxExp	117.00	119.00	112.00	98.00	100.00	96.45	92.08	96.34	106.93	120.30	135.35	149.58	188.96	163.64
UnitValIxImp	108.00	104.00	98.00	95.00	100.00	96.80	93.60	99.34	109.27	121.29	129.63	140.31	171.17	151.83
ToT	108.33	114.42	114.29	103.16	100.00	99.64	98.38	96.98	97.86	99.18	104.42	106.61	110.39	107.78
PPIxExp	80.26	92.50	94.73	91.75	100.00	109.24	117.15	133.69	160.52	177.29	192.88	207.73	209.80	182.82
TariffAllweight	13.80	14.00	15.94	12.31	12.65	10.42	9.98	9.40	7.55	7.09	6.71	6.83	6.74	NA
HiTekExp_ManuExp	6.09	7.32	9.17	12.97	18.56	19.11	16.92	11.96	11.59	12.84	12.09	11.95	11.97	NA
ICTExp_TTExp	2.22	2.22	2.33	3.08	4.56	4.53	4.00	3.19	2.37	3.41	3.19	1.97	1.82	NA
ICTImp_TTImp	13.05	13.05	12.63	14.02	16.35	15.65	12.74	12.77	13.71	14.45	14.51	6.96	10.91	NA
AgrRwExp_MerchExp	3.70	3.56	3.72	4.51	4.76	4.10	3.92	4.49	3.98	3.83	3.70	3.78	3.53	3.77
FoodExp_MrchExp	30.27	31.26	29.84	28.94	23.39	27.63	27.92	28.66	28.00	25.77	25.04	26.35	27.58	34.20
ManufExp_MrchExp	53.76	53.66	54.67	54.07	58.43	54.30	52.62	51.82	53.35	52.96	50.83	47.85	44.85	39.47
FDInet_GDP	1.33	2.26	3.78	4.87	5.08	4.06	3.29	1.84	2.74	1.71	1.72	2.53	2.75	1.65
StoxVal_GDP	13.35	23.24	17.38	14.87	15.71	11.76	9.56	10.94	14.10	17.48	23.37	42.82	44.42	41.30

Data Source: The World Bank (2009, 2010). All variables are in % except for index variables. Table created and arranged by the author.

Table 3.2c: Dependent Variables Brazil 1996-2009 (Variables 53-79)

Dependent Variables (%)	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
FuelExp_MerchExp	0.89	0.61	0.72	0.84	1.64	3.58	4.88	5.19	4.57	5.98	7.71	8.29	9.46	9.00
MrktCapList_GDP	25.84	29.32	19.07	38.84	35.08	33.64	24.55	42.46	49.77	53.80	65.30	100.32	35.97	74.26
FoodPrdIx	84.00	88.00	89.00	96.00	98.00	104.00	111.00	121.00	125.00	129.00	125.00	131.00	131.67	133.98
CropProdIX	82.00	88.00	89.00	96.00	98.00	105.00	111.00	122.00	127.00	125.00	131.00	143.00	149.56	NA
LivStockProdIX	87.00	87.00	88.00	95.00	100.00	103.00	110.00	115.00	124.00	132.00	118.00	119.00	120.01	NA
CPIx	53.32	57.01	58.84	61.70	66.04	70.56	76.52	87.78	93.57	100.00	104.18	107.97	114.09	119.66
Infltn	15.76	6.93	3.20	4.86	7.04	6.84	8.45	14.72	6.60	6.87	4.18	3.64	5.66	4.89
M2_GDP	31.36	34.72	38.10	40.37	43.37	45.27	44.02	44.40	46.38	49.62	53.58	56.63	59.12	NA
M2_gr	31.03	17.24	12.02	18.12	19.70	11.52	9.32	22.13	16.98	19.48	18.86	18.59	17.28	NA
IRSSpread	53.84	53.84	58.36	54.42	39.63	39.76	43.73	45.11	39.51	37.75	36.88	33.14	35.59	NA
RealIR	65.54	65.54	78.79	66.34	47.71	44.64	47.33	46.92	43.40	44.93	42.07	35.75	37.11	NA
ExtDebtST_ExpGSInc	303.55	301.40	373.54	404.65	348.48	318.07	308.22	264.17	191.34	133.85	116.16	119.39	104.84	NA
ExtDebtST_GNI	21.91	23.21	29.25	42.97	38.54	42.74	47.22	43.70	33.92	21.78	18.15	18.14	16.21	NA
STD_ExpGSInc	60.16	52.93	46.24	48.45	44.68	39.27	31.23	27.67	22.03	17.13	12.20	19.73	15.03	NA
STD_TTExtDbt	19.82	17.56	12.38	11.97	12.82	12.35	10.13	10.47	11.51	12.80	10.50	16.53	14.34	NA
STD_TTResv	60.19	67.41	68.09	80.43	93.81	78.83	61.84	49.89	47.73	44.60	23.68	21.76	18.91	NA
TTRes_TTExtDbt	32.92	26.05	18.18	14.89	13.67	15.66	16.38	20.99	24.12	28.70	44.36	75.94	75.81	NA
M2_TTReserv	5.00	6.31	7.74	7.06	9.23	7.38	6.15	5.47	6.27	8.86	7.38	4.66	5.40	NA
MultiDebt_TTExtD	5.19	5.07	6.76	7.60	7.55	8.46	9.08	8.74	8.85	10.27	11.23	9.70	7.27	NA
EnrgyImp_Euse	30.05	29.13	26.85	24.24	21.57	19.95	14.39	10.29	12.81	9.44	7.22	8.48	8.18	NA
GDP_UEnUKPPPOilE	7.56	7.41	7.24	7.07	7.29	7.34	7.33	7.30	7.31	7.34	7.38	7.41	7.43	NA
GDP_UEnUPPPOilE	6.17	6.15	6.08	6.02	6.35	6.54	6.64	6.76	7.07	7.34	7.62	7.87	8.06	NA
RuPp_ToTPp	21.52	20.84	20.16	19.48	18.80	18.20	17.60	17.00	16.40	15.80	15.34	14.88	14.42	13.96
Internet_100	0.45	0.79	1.48	2.04	2.87	4.53	9.15	13.21	19.07	21.02	28.18	30.88	37.52	NA
Phonelines_100	9.20	10.22	11.82	14.55	17.76	21.19	21.67	21.60	21.53	21.42	20.62	20.72	21.43	NA
Unempl_Lforce	6.80	7.70	8.90	9.60	9.45	9.30	9.10	9.70	8.90	9.30	8.40	9.30	7.90	NA
MobileSubs_100	1.52	2.73	4.36	8.76	13.31	16.27	19.47	25.54	35.68	46.33	53.10	63.63	78.47	NA

Data Source: World Bank (2009, 2010). All variables are in % except for index variables. Table created and arranged by the author.

Table 3.3a: Dependent Variables China 1996-2009 (Variables 1-26)

Dependent Variables (%)	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
GDPDefl	98.59	100.08	99.22	97.98	100.00	102.05	102.65	105.33	112.61	117.04	121.47	130.70	140.89	140.02
GDP_gr	10.00	9.30	7.80	7.60	8.40	8.30	9.10	10.00	10.10	11.30	12.70	14.20	9.60	9.10
GDPpCap_gr	8.85	8.19	6.77	6.67	7.55	7.52	8.37	9.32	9.45	10.65	12.07	13.61	9.04	8.54
Agri_GDP	19.69	18.29	17.56	16.47	15.06	14.39	13.74	12.80	13.39	12.12	11.11	10.77	10.73	10.35
Agri_gr	5.10	3.50	3.50	2.80	2.40	2.80	2.90	2.50	6.30	5.20	5.00	3.70	5.40	4.20
IndustValAd_GDP	47.54	47.54	46.21	45.76	45.92	45.15	44.79	45.97	46.23	47.37	47.95	47.34	47.45	46.30
IndustValAd_gr	12.10	10.50	8.90	8.10	9.40	8.40	9.80	12.70	11.10	12.10	13.40	15.10	9.90	9.90
ManuValAdd_GDP	33.51	33.18	31.84	31.59	32.12	31.64	31.42	32.85	32.37	32.51	32.92	32.90	32.92	33.92
ManFactValAdd_gr	11.33	9.85	8.06	8.67	10.77	8.62	10.07	14.90	8.97	9.47	13.10	16.62	20.06	NA
GrossSav_GDP	41.29	41.83	40.19	38.37	36.83	37.58	40.30	44.00	46.82	50.73	52.96	52.34	51.95	NA
GrossSav_GNI	41.90	42.32	40.86	39.02	37.29	38.13	40.72	44.21	46.90	50.49	52.67	51.96	51.59	NA
GrossDomSav_GDP	42.49	42.44	41.40	39.57	37.53	38.39	40.44	43.40	45.81	49.14	51.33	50.50	50.24	54.17
GrossNatExp_GDP	97.95	95.50	95.70	97.17	97.59	97.88	97.43	97.80	97.45	94.47	92.31	91.23	92.30	90.66
GovFinConExp_GDP	14.00	14.21	14.64	15.30	15.79	16.11	15.89	15.18	14.51	14.39	13.92	13.24	12.97	11.50
GovFinConExp_gr	10.15	8.19	10.19	11.97	10.51	10.55	7.77	5.48	7.06	9.53	8.57	10.48	8.13	11.50
FinConExp_GDP	57.51	57.56	58.60	60.43	62.47	61.61	59.56	56.60	54.19	50.86	48.67	49.50	49.76	45.83
FinConExp_gr	11.67	9.86	8.74	11.48	8.99	7.07	5.44	4.00	3.40	5.97	8.52	14.41	12.47	8.75
HHFinConExp_gr	12.19	10.41	8.27	11.32	8.49	5.89	4.61	3.46	2.04	4.58	8.50	16.02	14.16	7.60
HHFinConExp_GDP	43.51	43.35	43.96	45.13	46.69	45.50	43.67	41.42	39.67	36.48	34.75	36.26	36.79	34.03
HHFinConExpPCap_gr	9.62	3.52	4.99	6.86	5.08	4.50	5.42	5.36	6.13	5.93	7.77	9.41	7.66	7.31
GroCapF_GDP	40.44	37.95	37.10	36.74	35.12	36.27	37.87	41.20	43.26	43.61	43.64	41.73	42.55	44.84
GroCapF_gr	8.47	3.86	4.66	4.17	3.69	11.96	12.13	16.90	13.59	9.01	11.13	11.45	9.51	15.80
GrossFixCapForm_GDP	33.79	32.88	33.85	34.04	34.11	34.43	36.26	39.38	40.73	41.80	41.68	39.67	40.19	42.43
GrossFixCapForm_gr	10.45	7.72	10.22	5.77	8.70	9.38	13.20	16.64	11.88	11.00	10.72	10.93	8.82	16.00
Trade_GDP	38.06	39.01	36.39	37.97	44.24	43.08	47.70	56.91	65.35	68.63	70.47	67.81	62.09	47.10
MrchTrade_GDP	33.86	34.13	31.78	33.29	39.57	38.47	42.70	51.86	59.77	63.00	64.80	62.08	56.55	44.96

Data Source: The World Bank (2009, 2010). All variables are in % except for index variables. Table created and arranged by the author.

Table 3.3b: Dependent Variables China 1996-2009 (Variables 27-52)

Dependent Variables (%)	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
ExpGS_GDP	20.05	21.75	20.35	20.40	23.33	22.60	25.13	29.56	33.95	37.08	39.08	38.29	34.89	26.18
ExpGS_gr	-0.71	22.93	7.16	15.16	30.57	10.04	28.88	26.78	28.41	21.18	16.98	8.69	-9.49	-12.09
ExtBalGS_GDP	2.05	4.50	4.30	2.83	2.41	2.12	2.57	2.20	2.55	5.53	7.69	8.77	7.70	5.25
CurrACC_GDP	0.85	3.88	3.09	1.95	1.71	1.31	2.44	2.80	3.55	7.13	9.32	10.61	9.40	NA
ImpGS_GDP	18.00	17.26	16.05	17.57	20.92	20.48	22.56	27.36	31.40	31.55	31.39	29.52	27.20	20.93
ImpGS_gr	1.14	11.12	3.11	22.59	24.50	12.71	25.30	24.76	22.49	11.17	9.57	3.34	-13.35	-5.73
AgRawImp_MrchImp	5.12	5.23	4.25	4.30	4.81	4.57	4.25	3.99	4.03	3.88	3.98	3.76	3.56	3.37
ManfImp_MrchImp	79.10	77.14	81.26	80.29	75.12	77.56	79.62	78.89	75.26	73.07	71.18	68.47	61.93	64.38
FuelImp_MerchImp	4.97	7.25	4.87	5.40	9.47	7.45	6.89	7.50	9.12	10.56	12.36	11.99	16.25	13.44
ExpValX	60.61	73.35	73.72	78.22	100.00	106.78	130.65	175.85	238.09	305.76	388.99	488.67	573.29	482.25
ImpValIx	61.68	63.25	62.30	73.61	100.00	108.20	131.13	183.37	249.33	293.19	351.68	424.82	502.73	446.11
ExpVolX	56.65	67.92	70.88	77.45	100.00	108.78	134.80	179.80	236.78	300.54	376.93	459.18	507.27	438.06
ImpVolIx	61.07	64.54	66.28	75.89	100.00	112.64	138.31	183.77	229.10	248.38	281.47	321.19	328.62	323.19
UnitValIxExp	107.00	108.00	104.00	101.00	100.00	98.16	96.92	97.80	100.55	101.73	103.20	106.42	113.01	110.09
UnitValIxImp	101.00	98.00	94.00	97.00	100.00	96.05	94.81	99.78	108.83	118.04	124.94	132.27	152.98	138.03
ToT	105.94	110.20	110.64	104.12	100.00	102.19	102.23	98.02	92.39	86.19	82.60	80.46	73.87	79.75
PPIxExp	60.01	74.85	78.43	80.64	100.00	111.17	137.81	176.24	218.77	259.03	311.33	369.46	374.74	349.37
TariffAllweight	19.76	15.82	15.58	14.46	14.62	14.10	10.30	6.49	6.00	4.83	4.29	4.30	3.92	NA
HiTekExp_ManuExp	12.00	12.68	15.08	16.76	18.58	20.57	23.31	27.10	29.81	30.60	30.30	29.68	28.66	NA
ICTExp_TTExp	12.30	12.69	14.92	16.76	18.86	20.78	24.38	28.14	30.41	30.86	30.86	29.20	27.46	NA
ICTImp_TTImp	12.14	13.76	18.19	20.98	22.48	23.51	25.90	26.78	26.49	27.73	28.62	26.70	23.19	NA
AgrRwExp_MerchExp	1.56	1.38	1.09	1.21	1.09	0.86	0.78	0.64	0.54	0.52	0.48	0.46	0.43	0.45
FoodExp_MrchExp	8.21	7.13	6.62	6.01	5.44	5.34	4.96	4.39	3.50	3.23	2.87	2.71	2.51	2.94
ManufExp_MrchExp	84.36	85.36	87.29	88.28	88.22	88.60	89.84	90.57	91.38	91.88	92.38	93.08	92.99	93.57
FDInet_GDP	4.69	4.64	4.29	3.58	3.20	3.34	3.39	2.87	2.84	3.51	2.87	3.95	3.26	1.57
StoxVal_GDP	29.90	38.79	27.93	34.81	60.20	33.89	22.93	29.06	38.74	25.98	60.18	222.27	120.69	179.67

Data Source: World Bank (2009, 2010). All variables are in % except for index variables. Table created and arranged by the author.

Table 3.3c: Dependent Variables China 1996-2009 (Variables 53-79)

Dependent Variables (%)	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
FuelExp_MerchExp	3.91	3.81	2.80	2.38	3.14	3.16	2.59	2.54	2.43	2.30	1.81	1.69	2.21	1.70
MrktCapList_GDP	13.29	21.66	22.69	30.53	48.48	39.55	31.85	41.51	33.12	34.59	89.31	177.61	61.63	100.46
FoodPrdIx	84.00	89.00	93.00	97.00	100.00	102.00	107.00	109.00	116.00	120.00	123.00	125.00	126.71	NA
CropProdIX	89.00	91.00	93.00	96.00	100.00	102.00	108.00	107.00	115.00	118.00	120.00	123.00	124.71	NA
LivStockProdIX	79.00	87.00	94.00	97.00	100.00	102.00	105.00	109.00	113.00	119.00	122.00	122.00	123.02	NA
CPIx	92.80	95.40	94.60	93.27	93.50	94.18	93.46	94.54	98.21	100.00	101.46	106.28	112.52	111.72
Infltn	8.32	2.81	-0.84	-1.41	0.26	0.72	-0.77	1.16	3.88	1.82	1.46	4.75	5.86	-0.70
M2_GDP	90.65	101.80	112.82	121.44	124.06	127.54	135.70	142.83	141.81	142.06	145.30	140.90	139.89	159.38
M2_gr	26.53	23.09	14.66	14.11	12.07	15.01	18.28	19.24	14.89	16.74	22.12	16.74	17.78	28.42
IRSSpread	2.61	2.97	2.61	3.60	3.60	3.60	3.33	3.33	3.33	3.33	3.60	3.33	3.06	NA
RealIR	3.42	7.02	7.31	7.20	3.71	3.72	4.70	2.63	-1.25	1.59	2.25	-0.12	-2.31	4.19
ExtDebtST_ExpGSInc	71.30	67.49	67.52	66.21	49.79	59.67	49.58	41.32	36.37	32.22	28.96	26.03	22.42	NA
ExtDebtST_GNI	15.27	15.58	14.36	14.23	12.31	14.15	12.93	12.76	12.85	12.64	12.17	10.97	8.65	NA
STD_ExpGSInc	14.06	14.47	8.13	6.61	4.47	18.18	17.50	17.46	17.00	16.82	15.44	14.19	11.10	NA
STD_TTExtDbt	19.72	21.45	12.04	9.98	8.98	30.46	35.29	42.26	46.74	52.21	53.30	54.50	49.49	NA
STD_TTResv	22.74	21.48	11.34	9.40	7.62	25.58	22.06	21.17	18.58	17.83	16.04	13.17	9.52	NA
TTRes_TTExtDbt	86.73	99.83	106.15	106.15	117.88	119.08	159.98	199.68	251.51	292.76	332.27	413.72	519.78	NA
M2_TTReserv	7.76	7.31	8.04	8.69	9.15	8.21	7.18	6.13	4.70	4.15	4.01	3.43	3.48	3.64
MultiDebt_TTExtD	13.74	12.93	15.48	15.69	17.71	14.53	14.73	12.59	10.71	9.30	8.53	7.83	8.10	NA
EnrgyImp_Euse	-1.03	-0.74	0.03	2.23	2.85	-0.20	0.88	2.10	4.60	4.39	6.88	7.25	8.57	NA
GDP_UEnUKPPPOilE	2.26	2.47	2.66	2.87	3.08	3.35	3.38	3.27	3.09	3.17	3.28	3.53	3.66	NA
GDP_UEnUPPPOilE	1.85	2.05	2.24	2.44	2.68	2.99	3.07	3.03	2.99	3.17	3.38	3.75	3.96	NA
RuPp_ToTPp	67.72	66.84	65.96	65.08	64.20	63.28	62.36	61.44	60.52	59.60	58.70	57.80	56.90	56.00
Internet_100	0.01	0.03	0.17	0.71	1.78	2.65	4.62	6.17	7.25	8.58	10.60	16.13	22.50	NA
Phonelines_100	4.51	5.72	7.04	8.68	11.47	14.18	16.73	20.39	24.05	26.88	28.05	27.74	25.73	NA
Unempl_Lforce	3.00	3.10	3.10	3.10	3.10	3.60	4.00	4.30	4.20	4.20	4.10	4.00	4.20	NA
MobileSubs_100	0.56	1.08	1.92	3.46	6.75	11.39	16.09	20.95	25.83	30.18	35.17	41.53	48.41	NA

Data Source: The World Bank (2009, 2010). All variables are in % except for index variables. Table created and arranged by the author.

3.3 Independent Variables Set 1: Commodity Price Indexes

3.3.1 Data Source

The primary source of data for commodities is the United Nations Conference on Trade and Development (UNCTAD, 2009). Its data series for commodity price indexes are publicly available, wide in scope and scale, and date back to 1961. The scope of my econometric analysis is from 1996 to 2008 only, but several charts and tables include 2009 data for information and reference purposes. The analysis contains six individual groups of composite commodity price indexes, following the commodity group framework established by UNCTAD as introduced below. Each composite commodity price index consists of several individual price indexes.

3.3.2 Methodology

Commodities are key input factors in various sectors. Their prices have profound effects on various macroeconomic measures. UNCTAD categorizes commodities into six composite commodity indexes, each of which consist of multiple commodity sub-indexes priced in USD, British Pound (GPB), Singaporean dollar (SGD), and Malaysian Ringgit (MYR):

(1) Minerals, ores, and metals index (MinMetalsIx), with 21 sub-indexes ranging from prices for phosphate rock to silver.

(2) Agricultural raw materials index (AgriRawIx), consisting of 26 sub-indexes including but not limited to the prices of different types of cotton, rubber, and plywood.

(3) Vegetable oil seeds and oils index (VegOilSeedsIx), with nine sub-indexes ranging from soybeans to cottonseed oil prices.

(4) Tropical beverages index (TropBevIx), consisting of prices for eleven sub-indexes, such as different types of coffee, cocoa, and tea.

(5) Food index (FoodIx), consisting of eleven sub-indexes such as prices for wheat, rice, and fish meal.

(6) Crude index (CrudeIx), an equally weighted blend of Dubai/Brent/Texas crude measured in USD per barrel.

Appendix 3.4 contains an overview of the individual commodity constituents for each composite commodity price index in UNCTAD's categorization. These commodity price indexes are based on the Laspeyres price index, as previously detailed. Appendix 3.3 provides an overview of the definition of each commodity price index. And Appendix 3.5 provides the constituent weightings of each composite commodity price index (UNCTAD, 2009, 2010).

3.3.3 Commodity Price Indexes

3.3.3.1 Data Series

Although I examine the effects of commodity prices on macroeconomic variables between 1996 and 2008, Table 3.4 also includes the most recent data points for 2009 as well.

Table 3.4: Commodity Price Indexes 1996–2009

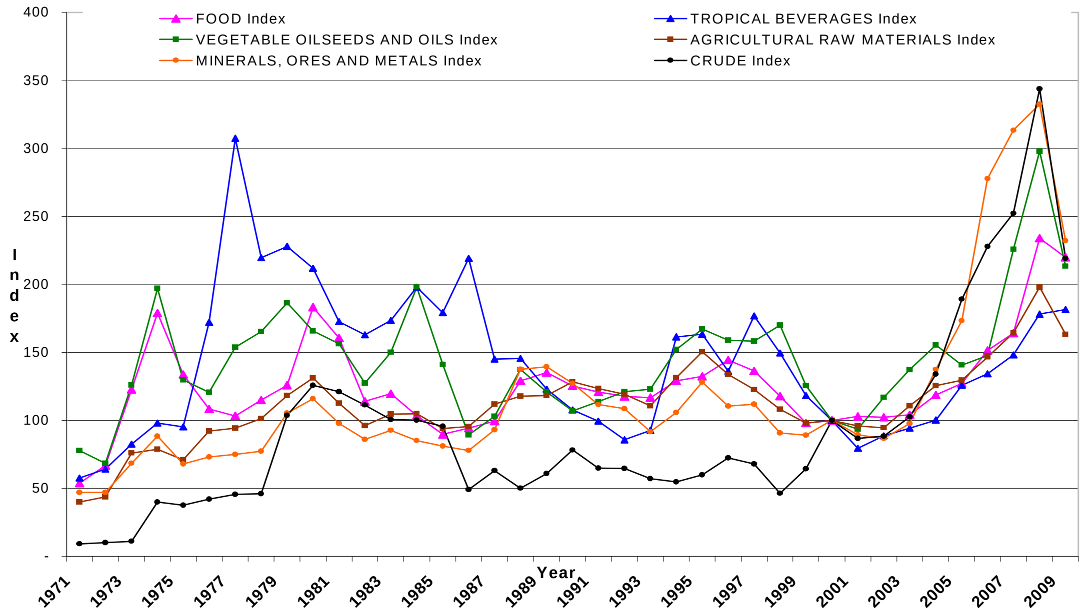
	1996	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
FoodIx	144	136	118	98	100	103	102	104	119	127	151	164	234	220
Change %	*9.0*	*-5.4*	*-13.6*	*-16.8*	*2.1*	*2.8*	*-0.5*	*1.9*	*13.9*	*7.2*	*19.0*	*8.5*	*42.5*	*-6.0*
TropBevIx	136	177	150	118	100	79	89	94	100	126	134	148	178	182
Change %	*-16.6*	*29.8*	*-15.4*	*-21.0*	*-15.4*	*-20.6*	*11.7*	*6.2*	*6.4*	*25.5*	*6.7*	*10.4*	*20.2*	*1.9*
VegOilSeedsIx	159	158	170	125	100	94	117	137	155	141	148	226	298	213
Change %	*-4.9*	*-0.5*	*7.5*	*-26.2*	*-20.3*	*-6.4*	*24.9*	*17.4*	*13.2*	*-9.5*	*5.0*	*52.9*	*31.9*	*-28.4*
AgriRawIx	134	123	108	98	100	96	95	111	125	129	147	164	198	163
Change %	*-11.2*	*-8.2*	*-12.0*	*-9.3*	*2.1*	*-4.2*	*-1.4*	*17.0*	*13.4*	*3.2*	*13.3*	*12.0*	*20.5*	*-17.5*
MinMetalsIx	110	112	91	89	100	89	87	98	137	173	278	313	333	232
Change %	*-13.8*	*1.4*	*-19.0*	*-1.8*	*12.4*	*-10.8*	*-2.7*	*12.4*	*40.7*	*26.2*	*60.3*	*12.8*	*6.2*	*-30.2*
CrudeIx	72	68	46	64	100	87	88	102	134	189	228	252	344	219
Change %	*20.7*	*-6.0*	*-31.8*	*38.7*	*55.6*	*-13.3*	*2.0*	*15.8*	*30.7*	*41.3*	*20.4*	*10.7*	*36.4*	*-36.3*

Data Source: UNCTAD (2009), Table created and arranged by the author. Index data is rounded.

Commodities emerged as a broad new tradable asset class in the early 2000s in the context of new product development in capital markets due to asset diversification and investor demand. Commodity prices move in cycles depending on global demand, which is represented by world GDP per capita in this section. Figure 3.1 displays the price development of the six individual UNCTAD composite commodity groups from 1971 to 2009 (2000 is the base year).

From 1995 to 2000, commodity prices were declining, then rising in 2000, displaying a sustainable positive trajectory of unmatched levels until the dawn of the financial crisis in the second half of 2008. The financial crisis triggered a sharp reversal of commodity prices. Although remarkable, it is helpful to place the recent boom in commodity prices —in the literature often referred to as the 'commodity super cycle'— in an historical context. Oil prices quadrupled between 1973 and 1974 due to the oil crisis and again doubled in 1979. After the strong upward trend of non-fuel and energy commodities during 1973 and 1979, the steep rise of US interest rates in the early 1980s were the catalyst for the decline in price indexes for all non-fuel commodities between 1980 and 2002.

Figure 3.1: Commodity Price Indexes 1971–2009



Data Source: UNCTAD (2009, 2010), Figure created and arranged by the author.

The amplitude of the rise in commodity prices from 2002 to 2008 was unprecedented. By mid-2008, virtually all UNCTAD commodity price indexes except the tropical beverage index reached their highest levels. From 2002 to 2008 the crude index rose by approximately 289%; the minerals, ores and metals index jumped by 283%; the food, vegetable oil seeds and oils, and the agricultural raw material indexes rose by 129%, 155%, and 109%, respectively. The tropical beverages index rose by 101% over the same period. Among all commodity groups the crude price index increase is the most striking: Oil rose sharply from a 2002 average monthly level of USD25 to USD108 per barrel in the first half of 2008. The historically extreme price of oil in July 2008, when oil traded at USD147 per barrel, was due to momentum by oil speculators though, rather than elevated consumer demand (Masters, 2008, pp. 3-7).

Structural shifts in commodity prices are already observable, caused mainly by the emerging middle classes in developing countries, which swing the demand pull of commodities towards emerging markets in Asia, Asia Pacific, and Latin America, particularly China, India, and Brazil.

Appendix 3.6 provides a figurative overview of the development of each composite commodity price index including its constituents. Appendix 3.14 displays in detail the commodity price index data series including its yearly changes between 1971 and 2009, as well as world GDP, world trade to GDP, and world GDP per Capita.[31]

3.3.3.2 Commodity Price Indexes: Correlation and Granger Causality

Correlation

As shown in Table 3.5, commodity price indexes inter-correlate significantly. The Pearson correlation coefficient between the crude index (CrudeIx) and the minerals, ores, and metals index (MinMetalsIx) is very high compared with all other commodity group correlation coefficients. Between 1971 and 2009 this correlation coefficient reached 90.7%.

Table 3.5: Pearson Correlation Commodity Price Matrix 1971–2009

1971-2009	FoodIx	TropBevIx	VegOilSeedsIx	AgriRawIx	MinMetalsIx	CrudeIx
FoodIx	1	0.244	.794**	.746**	.719**	.681**
TropBevIx	0.244	1	.451**	0.306	0.108	0.186
VegOilSeedsIx	.794**	.451**	1	.696**	.668**	.686**
AgriRawIx	.746**	0.306	.696**	1	.836**	.778**
MinMetalsIx	.719**	0.108	.668**	.836**	1	.907**
CrudeIx	.681**	0.186	.686**	.778**	.907**	1

* Significant at .05. ** Significant at 0.01. Source: Calculated and arranged by the author.

I have found that correlation coefficients increase across the board for the time period between 1996 and 2008 compared to that from 1971 to 2009. Table 3.6 shows the correlation coefficients among the six individual UNCTAD commodity price indexes for the 1996 to 2008 period. The high correlation coefficient between the crude index (CrudeIx) and the minerals, ores and metals index (MinMetalsIx) increased even further, from 90.7% between 1971 and 2009 to 95.8% between 1996 and 2008. In general, correlation coefficients increased across all commodity groups between 1996 and 2008 compared with the period of 1971 to 2009. The reason for this development is based on the increasing interconnectedness of global trade sectors since the mid-1990s

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[31] World GDP output data is available only since 1970 in the World Bank database.

and the emergence of tradable commodity indexes, commodity baskets, and benchmark funds since the early 2000s. World trade as a ratio of world GDP increased gradually from 27.1% in 1971 to 59.0% in 2008, though it dropped to 46.7% in 2009 due to the global financial crisis (Appendix 3.14). In addition, the gradual advancement of automated trading platforms since the mid-1990s facilitated rapid trade executions which reveal the commodity trading patterns by market participants such as banks, asset managers, and institutional investors in context of macroeconomic outlook.

Table 3.6: Pearson Correlation Commodity Price Matrix 1996–2008

1996-2008	FoodIx	TropBevIx	VegOilSeedsIx	AgriRawIx	MinMetalsIx	CrudeIx
FoodIx	1	.753**	.929**	.969**	.859**	.838**
TropBevIx	.753**	1	.762**	.699**	0.55	0.42
VegOilSeedsIx	.929**	.762**	1	.917**	.787**	.755**
AgriRawIx	.969**	.699**	.917**	1	.923**	.895**
MinMetalsIx	.859**	0.55	.787**	.923**	1	.958**
CrudeIx	.838**	0.42	.755**	.895**	.958**	1

*Significant at .05. **Significant at 0.01. Source: Calculated and arranged by the author.

The correlation analysis of commodity price indexes reveals that the correlation between the constituents of a specific composite index and the specific index itself is fairly high, particularly when considering the period between 1996 and 2008 (Appendixes 3.7 and 3.8: Pearson Correlations of Constituents and Composite Indexes). For example, the correlation analysis of minerals and metals (MinMetalsIx) constituent prices between 1971 and 2009 reveals that the correlations of gold prices with any other constituent of the composite MinMetalsIx range between 45.7% for tungsten and 88.7% for iron ore (AUS), all highly significant at a p-value of 0.01. These correlations increased for the period of 1996 to 2008 to 87.5% for tungsten and 96.6% for iron ore (AUS). And the MinMetalsIx composite index itself correlates at 55.4% and 89.6% with tungsten and iron ore (AUS) between 1971 and 2009 (Appendix 3.8); these correlations rose to 96.0% and 90.6% for the period of 1996 to 2008, respectively. Therefore, MinMetalsIx —which includes base metals such as aluminum, copper, lead, nickel, tin, and zinc, as well as highly liquid tradable metals— offers a fair proxy for observing the moves of its constituents. Similarly, UNCTAD composite indexes for agricultural raw materials, vegetables, oils and seeds, and food represent fair proxies of their constituents, according to the high constituent correlations. Appendix 3.7 shows the correlations among all constituents within their respective commodity price index during the periods of 1971 to 2008 and 1996 to 2008. Appendix 3.8 compares the correlations of commodity price index constituents with its respective composite price index (e.g., MinMetalsIx with tin) between 1971 and 2009, and between 1996 and 2008.

Before proceeding to the causal analysis of world GDP per capita and commodity prices, I point out —for the sake of completeness— association peculiarities within the commodity price index set, namely the price pattern between oil (CrudeIx) and minerals and metals (MinMetalsIx).

Granger Causality between Crude Oil- and Minerals and Metals Price Index

The correlation between the crude index and the minerals and metals index plays a significant role in capital markets and the commodity trading space because of the trade link between crude futures and metal futures. Crude futures are a leading indicator of global economic activity, and crude oil is one of the most actively traded commodities globally. Crude markets are highly liquid. The largest, most liquid and most popular crude oil trade location is the New York Mercantile Exchange’s (NYMEX) Light Sweet Crude Oil (light sweet) Futures division. Light sweet is the most popular grade of crude oil traded.

Gold, silver, and platinum are the three main precious metals within MinMetalsIx which are also actively traded on exchanges. Prevalent academic literature empirically analyzes the movement of gold prices, together with respect to changes in other economic variables such as inflation and interest rates. Gold prices in particular, but also silver and platinum, often trend in directional patterns with inflation. With its price inelasticity (due to industrial demand), gold tends to retain more price stability than silver and platinum in volatile market conditions. In the context of economic outlook, oil prices tend to serve as a leading indicator.

It is widely accepted in the marketplace that metal futures follow oil futures, such that the change in metal prices is caused by the change in oil prices. A validation of this theory can be undertaken by Granger causality testing carried out on the crude index (CrudeIx) and the minerals and metals index (MinMetalsIx) for the period of 1996 to 2008. Table 3.7 presents the result of such a Granger causality test, which reveals that the crude price index Granger causes changes in the minerals and metals price index at a 0.01 significance level. That is, changes in the crude price index induce changes in the minerals and metals price index, and not vice versa.

Table 3.7: Granger Causality: Crude Index and Minerals and Metals Index 1996–2008

Test	Group 1 Variables	Group 2 Variables	Chi-Square	Pr>ChiSq
1	CrudeIx	MinMetalsIx	0.00	0.9913
2	MinMetalsIx	CrudeIx	11.98	0.0005

Source: Calculated and arranged by the author.

The null hypothesis of the first Granger test (Granger 1, or Test 1) is defined as follows: The change of the crude price index is only affected by itself and not by the change in the minerals and metals price index (Null Hypothesis test for non-causality). This null hypothesis H_0 cannot be rejected because the p-value of 0.9913 is very high, suggesting a 99.13% probability of wrongly rejecting the null hypothesis.[32] By contract, the null hypothesis for the second Granger causality test (Granger 2, or Test 2) states that the minerals and metals price index is only affected by itself and not by the crude price index. This null hypothesis can be rejected at a significance level of less than 1%. The minerals and metals index is affected by the crude index, not vice versa.

The findings for these two indexes are relevant for the principal component analysis carried out in Section 4.2.4. The significant correlation levels between crude prices and minerals and metals prices suggest that there exists multicollinearity between the crude price index and the minerals and metals price index.

3.3.3.3 Commodity Price Indexes and World GDP per Capita

In this section I compare the intuitively plausible presumption that changes in commodity prices are due to changes in world GDP per capita. I reflect on the strong correlation and Granger causality associations.

Significant changes in commodity prices have been observed in times during abnormal inflationary pressure, such as the high inflationary period of the early 1990s, or the period at the end of the 1990s to mid-2008.

The correlation analysis results between changes in commodity price indexes and changes in GDP per capita are statistically favorable in comparison to the correlation analysis between commodity price indexes and changes in world GDP per

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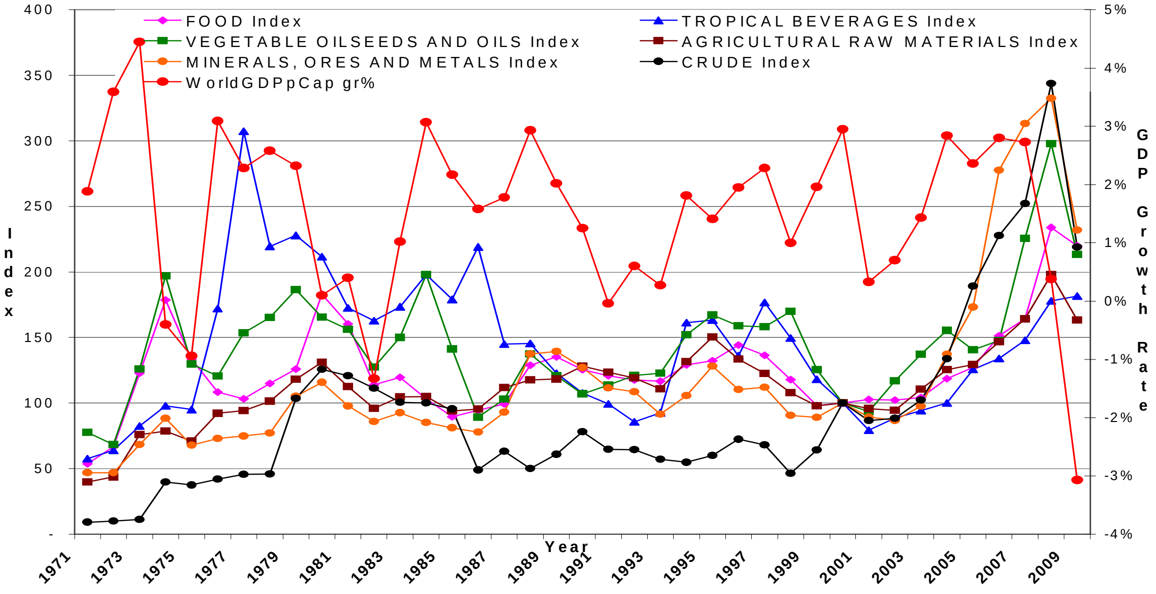
[32] The p-value stands for the significance level of a test for which the null hypothesis can be rejected. It represents the actual significance level of the test. If a p-value is small, then the result is significant. By contract, significance threshold is a p-value of 0.05. The smaller the p-value, the more convincing is a rejection of the null hypothesis. The significance level of a statistical hypothesis test is the probability of wrongly rejecting the null hypothesis that is actually in fact true. Type I error means, the null hypothesis is wrongly rejected; Type II error means, the null hypothesis is not rejected even though it actually is false.

capita. This is due to the fact that the former compares two change values whereas the latter compares an index value with a change value. The latter analysis may therefore lead to statistically distorted results due to data integrity issues. However, for demonstration and completeness purposes I also present a figurative comparison between commodity price indexes and changes in world GDP per capita.

Commodity Price Indexes and Change in World GDP per Capita

Figure 3.2 illustrates the highly cyclical moving patterns of commodity price indexes in the context to changes in global aggregate demand measured by the world GDP per capita change rate.[33] Between 1971 and 2009 world GDP per capita in constant USD grew at an annual compound rate of 1.44%.[34] In comparison, the crude price index rose by 8.5%, the food index 3.7%, tropical beverages 3.0%, vegetable oil seeds and oils 2.6%, agricultural raw materials 3.7% and minerals and metals grew by 4.2% on an annual compound basis. As history has shown, periods of high or low price fluctuations are typical in commodity markets, irrespective of their length.

Figure 3.2: Commodity Price Indexes and Change in World GDP per Capita 1971–2009



Data Source: UNCTAD (2009, 2010), Figure created and arranged by the author.

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[33] World GDP and world GDP per capita correlated at 98.4% between 1971 and 2009.

[34] Annual growth compound rate = ((Reference year $_t$ / Base year$_n$)$^{(1/(t-n))}$-1); Base year is 2000.

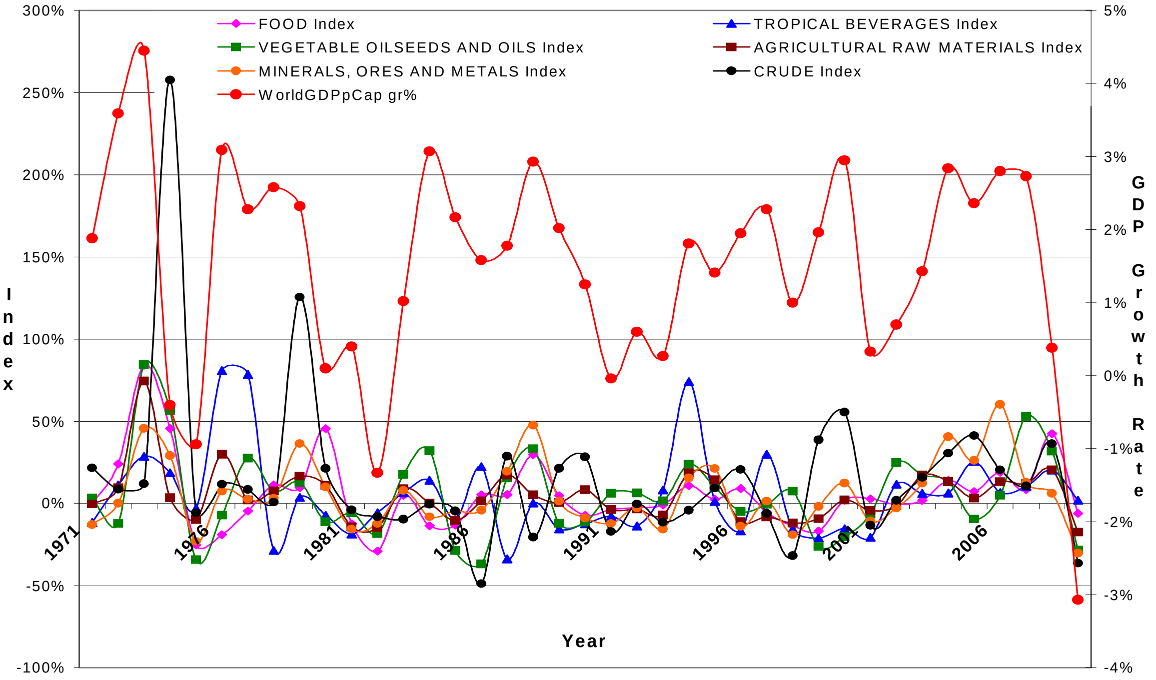
The recent commodity super cycle, from 2001 to 2008, was driven by buoyant global economic growth in developed economies, and supported by the strong economic and industrial growth in developing countries.

Change in Commodity Price Indexes and Change in World GDP per Capita

Correlation

Figure 3.3 illustrates the change rates of the UNCTAD commodity price indexes in comparison with the change rate of world GDP per capita. The correlation between the change rates of commodity price indexes and the change rate of world GDP per capita from 1971 to 2009 is high, with a high degree of significance, except for the tropical beverages price index as Table 3.8 illustrates.

Figure 3.3: Change in Commodity Price Indexes and Change in World GDP per Capita 1971–2009



Data Source: UNCTAD (2009, 2010), Figure created and arranged by the author.

Correlation 1971 - 2009

Table 3.8: Correlation –– Change in Commodity Price Indexes and Change in World GDP per Capita 1971–2009

1971-2009	**FoodIx**	**TropBevIx**	**VegOilSeedsIx**	**AgriRawIx**	**MinMetalsIx**	**CrudeIx**
W. GDPpCap	.684**	0.158	.589**	.703**	.773**	.727**

**Significant at 0.01. Source: Calculated and arranged by the author.

The rising degree of global trade integration increased the correlation not only among commodity price index composites but also between commodity prices indexes (except VegOilSeedsIx) and world GDP per capita. Table 3.9 reflects on these increased correlation coefficients.

Correlation 1996 - 2009

Table 3.9: Correlation –– Change in Commodity Price Indexes and Change in World GDP per Capita 1996–2009

1996-2009	**FoodIx**	**TropBevIx**	**VegOilSeedsIx**	**AgriRawIx**	**MinMetalsIx**	**CrudeIx**
W. GDPpCap	.752*	0.112	0.417	.710*	.744*	.874**

*Significant at .05. **Significant at .01. Source: Calculated and arranged by the author.

The correlation coefficient between the change in crude, which is widely accepted as leading indicator for global economic activity, and world GDP per capita was 72.7% between 1971 and 2009. Between 1996 and 2008 the correlation coefficient of crude and world GDP per capita rose to 87.4%.

Granger Causality

Table 3.10 illustrates the Granger causal relationship of changes in global GDP per capita and changes in commodity price indexes. The null hypothesis H_0 states that GDP per capita is not affected by changes in the crude index. The first Granger test of world GDP per capita and the change in crude price index suggests that world GDP per capita is not affected by the change of the crude price index. P-value is 0.0622, which leads to non-rejection of the null. The null hypothesis of the second Granger test states that the crude price index is not affected by changes in GDP per capita. A p-value of 0.0038 (<0.05, 0.05 = p-value threshold) allows the rejection of the null (H_0); that is, it is statistically safe to say that changes in world GDP per capita Granger cause the change in crude price index, and not vice versa.

Table 3.10 also illustrates the results of the Granger causality tests for changes in world GDP per capita and commodity price indexes. Granger causality applies to changes in food prices, changes in crude prices and changes in minerals and metals prices (borderline case with Granger 2 test, p-value at 0.0621). The results of Granger tests on changes of the vegetables, oils, and seed price index, the tropical beverages price index, and the agricultural raw materials price index are somewhat ambiguous. However, the moderately high, high, and very high correlations of commodity price indexes (except TropBevIx) at significance levels of 0.01 with the crude price index as shown in Tables 3.5 and 3.6 (Pearson Correlation Commodity Price Matrix 1971–2009, 1996-2008) support the suggestion that world GDP per capita Granger causes changes of each of these commodity indexes, except for the tropical beverage price index. In borderline cases in which the p-value is slightly above the 0.05 threshold (such as 0.0621 for MinMetalsIx, or 0.0752 for VegOilSeedsIx) the null hypothesis for Granger 2 may be rejected. The tropical beverage price index is the only UNCTAD commodity price index without Granger causality in either direction and with a low correlation to oil prices (CrudeIx).

Table 3.10: Granger Causality — Change in Commodity Price Indexes and Change in World GDP per Capita 1971–2009

Test	Group 1 Variables	Group 2 Variables	DF	Chi-Square	Pr>ChiSq
1	World GDP per capita	FoodIx	1	9.83	0.0017
2	FoodIx	World GDP per capita	1	11.43	0.0007
Test	**Group 1 Variables**	**Group 2 Variables**	**DF**	**Chi-Square**	**Pr>ChiSq**
1	World GDP per capita	TropBevIx	1	0.14	0.7089
2	TropBevIx	World GDP per capita	1	0.31	0.5777
Test	**Group 1 Variables**	**Group 2 Variables**	**DF**	**Chi-Square**	**Pr>ChiSq**
1	World GDP per capita	VegOilSeedIx	1	7.43	0.00640
2	VegOilSeedIx	World GDP per capita	1	3.17	0.0752
Test	**Group 1 Variables**	**Group 2 Variables**	**DF**	**Chi-Square**	**Pr>ChiSq**
1	World GDP per capita	MinMetalsIx	1	1.90	0.1678
2	MinMetalsIx	World GDP per capita	1	3.48	0.0621
Test	**Group 1 Variables**	**Group 2 Variables**	**DF**	**Chi-Square**	**Pr>ChiSq**
1	World GDP per capita	AgriRawIx	1	5.56	0.0184
2	AgriRawIx	World GDP per capita	1	1.87	0.1718
Test	**Group 1 Variables**	**Group 2 Variables**	**DF**	**Chi-Square**	**Pr>ChiSq**
1	World GDP per capita	CrudeIx	1	3.48	0.0622
2	CrudeIx	World GDP per capita	1	8.37	0.0038

Source: Calculated and arranged by the author.

Changes in commodity prices fluctuate with changes in global GDP per capita. As shown above, there exist significant Granger causalities between the changes in world GDP per capita and the changes in commodity price indexes between 1971 and 2009. That is, world GDP per capita drives variations in the crude index, food price index, minerals and metals index, and vegetables, oils, and seeds index.

In Chapter 4, I examine such causality from a regional view for Brazil and China. Specifically, I examine the Granger causality effects of commodity price changes on macroeconomic variables in the emerging economies of Brazil and China.[35] In Chapter 4, I also examine inverse Granger causalities for Brazil and China to assess the effects when macroeconomic variables (inversely) Granger cause global commodity prices due to economic expansion.

3.3.3.4 Commodity Price Indexes and China's GDP

As established in the previous sections, commodity prices tend to move in cycles correlating with changes in global aggregate demand. As shown before, changes in world GDP per capita cause changes in the majority of commodity price indexes between 1971 and 2009 with a fairly high correlation. Also, as seen in Table 3.9, correlations between GDP per capita and commodity price indexes rose significantly when considering the period between 1996 and 2008.

It is commonly presumed that China's expansion is one of the main drivers of commodity price changes since the early 2000s, affecting prices of oil, metals, and soft commodities — hence the catchphrase '*China moves markets*' (Wittner, 2010; Girault, 2010). As seen in Chapter 2, China's imports of soft commodities, energy commodities, and minerals and metals represent a significant share of global imports of these commodities. Also, as shown in Chapter 2, China's GDP relative to global GDP grew dramatically between 1990 and 2009. In comparison, Brazil's GDP was fairly volatile in the low single percentages during the same period (Tables 2.1, 2.2: Brazil, China GDP Relative to World GDP). In this section I therefore briefly reflect only on China's GDP causing changes in commodity price indexes.

In order to establish a link to the previous sections in the context of the findings of Chapter 4 (e.g., on '*China moves markets'*), I first reveal the correlation effects between Chinese GDP change rates and change rates of commodity price indexes between 1971 and 2009. At this stage, I only analyze correlation effects between change rates of commodity prices and changes of China's GDP per capita. I do not yet perform

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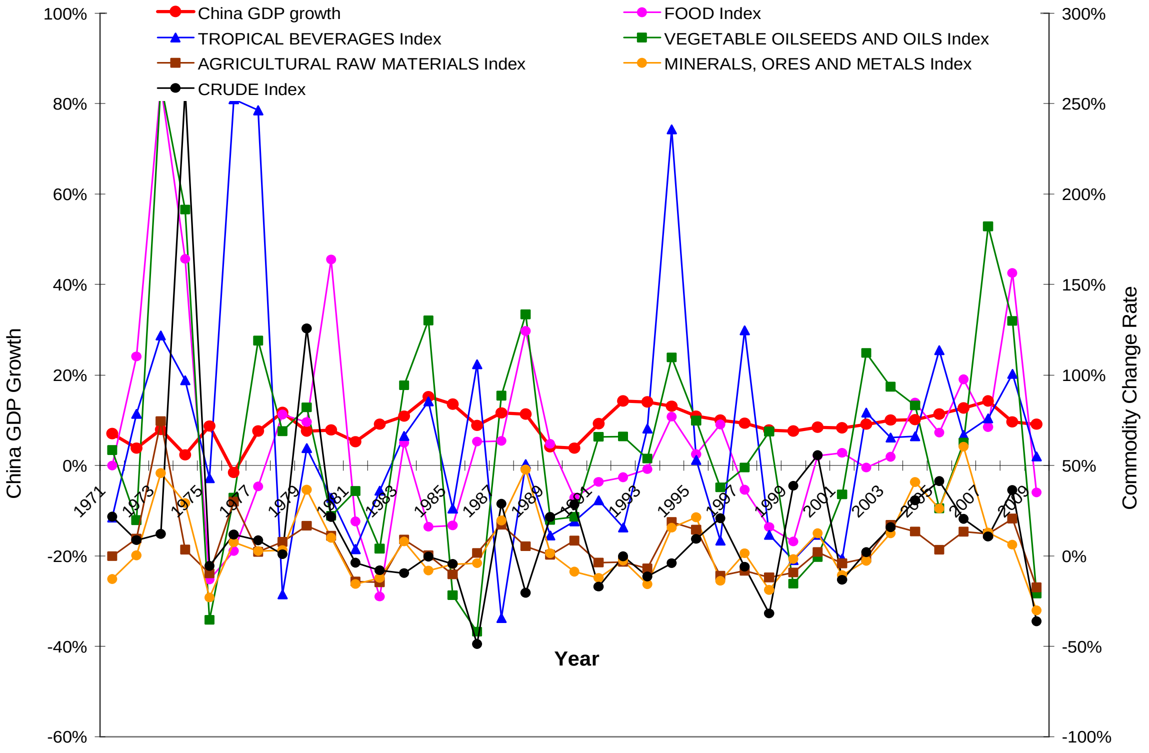
[35] I specifically differentiate between the analysis of change rates of dependent variables (such as GDP growth rate) for which I create change rates of the respective independent variables, and the analysis of percentage shares of dependent variables (such as gross domestic savings to GDP) which I compare with the respective independent indexes.

Granger causality computations. Granger causality computations and the analysis of specific macroeconomic variables (e.g., GDP per capita) with commodity prices will be discussed in the context of the multiple regression analysis in Chapter 4 and the econometric analysis in Chapter 5.

Figure 3.4: Changes in Commodity Price Indexes and China GDP Growth Rate 1971–2009



Data Source: UNCTAD (2009, 2010), World Bank (2009, 2010), Figure created and arranged by the author.

China's GDP change rate, i.e., growth rate (in red), does not reveal any significant signs of positive correlation with any of the six aggregated UNCTAD commodity price indexes between 1971 and 2009, as shown by Figure 3.4.

Table 3.11 below provides the correlation coefficients for Figure 3.4 above. Based on the data I can say that between 1971 and 2009 there exists no significant correlation between China's GDP growth rate and changes in commodity prices.

Table 3.11: Correlation of Changes in Commodity Price Indexes and China GDP Growth Rate 1971– 2009

1971-2009	FoodIx	TropBevIx	VegOilSeedsIx	AgriRawIx	MinMetalsIx	CrudeIx
China GDP_ gr	-0.041	-0.165	0.149	-0.115	0.093	-0.344*

*Significant at .05. Source: Calculated and arranged by the author.

The correlation analysis in Table 3.11 supports the notion that there is no conclusive correlation associated with the rather cyclical rise of China's GDP and commodity prices between 1971 and 2009. However, the picture changes dramatically when analyzing the period between 1996 and 2008. The effects of China’s rising global GDP share on commodities are specifically observable during that shortened time span. Recall from Chapter 2 that China’s GDP share of global GDP grew substantially from 3.2% in 1970 to 8.6% in 2009. In Chapter 4 and Chapter 5 I provide significant findings related to China’s expansion and its effects on commodity prices.

3.4 Independent Variables Set 2: Governance Indexes

3.4.1 Worldwide Governance Index

3.4.1.1 Data Source

Overview

Governance architecture covers a myriad of complex socioeconomic dimensions, such as political stability, government effectiveness, business freedom, and the degree of democracy (The Economist Intelligence Unit, 2008, 2010 p. 16). Many aspects of the relationship between good governance and national prosperity are still poorly understood and may vary across countries. In addition, governance indexes remain a relatively new empirical research area. For example, The Economist Intelligence Unit's research indicates that levels of democracy and prosperity are interdependent, with inconclusive causality effects however.

Rigobon and Rodrik (2005, p. 5) go a step further and argue that democracy and rule of law have a positive effect on economic performance. Moreover, in their interrelationship study they found that trade openness measured by trade to GDP is adversely affecting democracy levels. However, with the example of Brazil in Chapters 4 and 5 I show that trade openness actually positively affects levels of democracy (WGIVA); trade openness is not only highly correlating with the World Bank's voice and accountability index (WGIVA, i.e., democracy index) but also Granger causing it.

In Chapters 4 and 5 I perform empirical and econometric analyses of correlation and causality associations between the various governance indicators and the 79 macroeconomic variables of Brazil and China.

Data Source

The worldwide governance indexes (WGI) are published by the World Bank, its worldwide governance project is a relatively new area of research. The annual governance data encompasses six composite WGI indexes dating back to 1996 that are publicly and freely available on the World Bank's Worldwide Governance indicator website (2009).

The worldwide governance project includes approximately 440 governance variables from more than 30 different organizations and sources, including (1) commercial business information providers such as Business Environment Risk Intelligence and The Economist Intelligence Unit (2008, 2010), (2) surveys of firms and households such as the Gallup World Poll and the World Competitiveness Yearbook, (3) nongovernmental organizations such as the Bertelsmann Transformation Index and Reporters Without Borders, and (4) public-sector data providers such as the Asian Development Bank and the OECD Development Center (The World Bank, 2010a, 2010b). Appendix 3.9 provides an overview of the definitions of each WGI governance dimension. And Appendix 3.10 provides an overview of the data sources used by the worldwide governance project.

3.4.1.2 Data Methodology

The composite WGI indexes form an aggregate of individual governance indicators for 212 countries, with scores ranging between –2.5 index points and +2.5 index points (or points), where –2.5 represents the worst level of governance and +2.5 the best. In addition, the data note the percentile rank of different countries on governance, indicating the percentage of countries worldwide that rate below any focal country. The higher the value the better the governance level of that dimension. The overall rankings of Brazil and China are hence not only affected by their own governance levels, but also by the shifting governance levels of other countries. Because my goal is to compare Brazil to China, I do not analyze the percentile rank of both countries. Instead, I focus on the range score between -2.5 and +2.5.

The following brief description summarizes the six WGI governance dimensions based on the definition and formulation by the World Bank (2010a, 2010c):

(1) Voice and Accountability (WGIVA): According to the WGI methodology, the governance indicator for voice and accountability considers the level of democracy in a country including freedom of expression, freedom of association, free media, as well as the ability of citizens to participate in selecting their country’s government.

(2) Political Stability and Absence of Violence (WGIPS): The probability or likelihood that a government may be destabilized, undermined, or thrown off through unconstitutional and/or violent actions and activities, including political and nonpolitical violence or terrorism.

(3) Government Effectiveness (WGIGE): The government’s policy formulation quality, provision of public services, the capacity of its civil service offerings and the civil service’s independence from political pressures. Also, WGIGE examines the implementation and credibility of the government's commitment to its policies.

(4) Regulatory Quality (WGIRQ): A government’s competence and ability to provide, implement, and operate sound policies and regulations to promote and support private-sector development and improvement.

(5) Rule of Law (WGIRL): The extent to which citizens, organizations, parties, and other agents abide by and are confident in the rule of law of a country or nation, including the quality of contract enforcement and property rights, the executive force (police), and the judicial and legislative systems. The rule of law measure refers specifically to the likelihood of crime and violence.

(6) Control of Corruption (WGICC): The perception of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as manipulating or corrupting/seizing the state by elites and private interest groups.

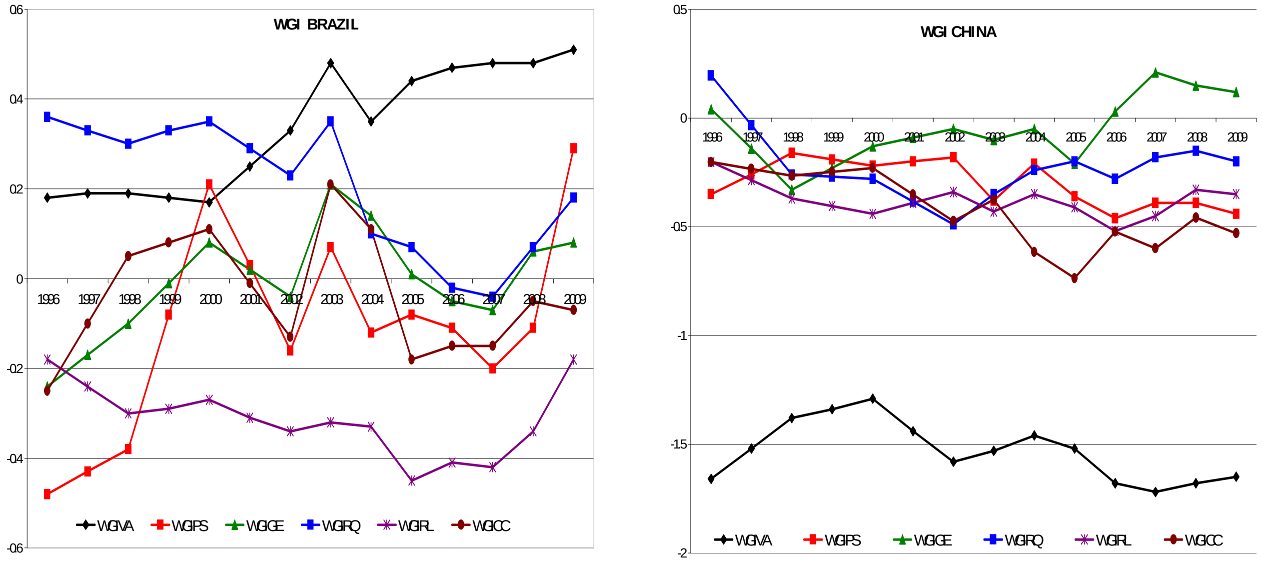
The WGI indexes are aggregated, weighted averages of primary data material used by the worldwide governance project (World Bank, 2010a, 2010c). The weights represent the accuracy of each individual data source; the method that underlies this weighted average aggregation is the unobserved component model. This model predicts that any monitored correlation between two measures of a specific governance dimension results from their common, unobserved signal of the specific governance dimension. Therefore, data sources that are more correlated grant more information reliability to a specific governance dimension, which translates into a greater weight for the data source. A fuller description of this model has been published by the World Bank (Worldwide Governance Indicators, 2009), which also provides the data from all underlying sources to calculate an individual indicator. To compare indicators over time and across countries it is necessary to rescale the individual ratings from 0 (low) to 1 (high). Confidence levels can be selected interactively at 50%, 75%, 90%, and 95%. For this study, I selected a confidence level of 95% (probability of 95% that governance index levels are within the indicated range). The worldwide governance project does not offer data points for 1997, 1999, or 2001. To close this data gap, I created a new data point by averaging the preceding and the following yearly data points.

3.4.1.3 Data Series

3.4.1.3.1 Summary View: Brazil and China

The multiple regression analysis in Chapter 4 includes data from 1996 to 2008. Due to metric distortions the quantitative analysis excludes data points for the year 2009, which was negatively impacted by the global financial crisis unfolding at the end of 2008. Nevertheless, Figure 3.5 includes 2009 data for information purposes only to provide a comparative overview of Brazil's and China's governance levels between 1996 and 2009.[36]

Figure 3.5: Worldwide Governance Indexes Summary — Brazil versus China



Brazil's individual governance indexes, unlike China's, displayed wide swings since 1996. Regulatory quality for example deteriorated notably after 1996, despite the hike in 2007, and rule of law improved from –0.45 in 2005 to –0.2 in 2009, recovering somewhat after having dropped from –0.18 in 1996. Overall, Brazil's general governance climate improved significantly after 2007.

China's governance framework developed in a less volatile way. China's governance dimensions are mostly in negative territory and oscillate between –0.5 and 0.0, except for WGIVA, which consistently remains near the –1.5 mark.

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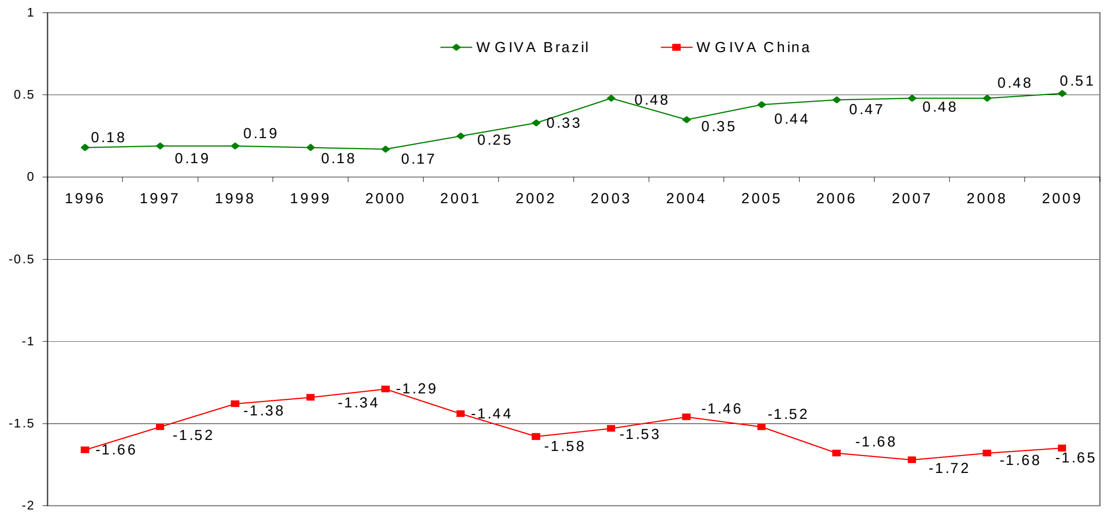
[36] The following WGI figures are based on World Bank (2010c) governance indicators. All figures have been created and arranged by the author. World Bank governance data is being updated on a regular basis. Therefore, data displayed in this thesis and data online may slightly differ.

The following sections compare each individual governance index of Brazil and China between 1996 and 2009. The regression analysis in Chapter 4 incorporates data series from 1996 and 2008 only.

3.4.1.3.2 Voice and Accountability

Figure 3.6: WGI Voice and Accountability



Data Source: World Bank (2010c). Figure created and arranged by the author.

BRAZIL

Brazil’s transition from military rule to democracy effectively began in the mid-1980s. Since then Brazil's democratic transformation has been impressive. Today it is a democratic republic with a presidential system. The president is directly elected by the people and serves as both head of state and head of government. Members of the executive and legislative branches are directly elected. The voice and accountability governance index thus has been improving from 0.18 points in 1996 to 0.51 points in 2009 — an impressive improvement of 183%. The positive trend is mainly attributable to growing political awareness and an improved culture of political debate among Brazil’s citizenry and political parties.

The Brazilian constitution guarantees unrestricted freedom of opinion, assembly, and association rights — rights generally respected by the government. Freedom of press and media, which often catalyze political investigations and uncover political scandals, is non-restrictive and generally respected. Yet, despite the media’s vigorous reporting style, media ownership is highly concentrated and information is often biased by powerful special interest groups (BTI, 2008b, p. 7).

The political participation of citizens grew especially under the Lula administration, which institutionalized direct consultations with a vast number of civil society organizations that represented various interest groups, e.g., such as labor, women's rights, environmentalists, ethnic minorities, and so on. The establishment of councils on municipal, regional, and state levels is an important democratic factor for establishing effective public policies.

However, the degree of democracy decreases from the South of Brazil to its North, where powerful landlords tend to control and own local judiciaries and police, who in recent history responded violently to agrarian reform movements, for example.

CHINA

In the case of China, the voice and accountability index has generally been at a very low level, oscillating around the –1.5 mark, with some improvements in the late 1990s but then again deteriorating since 2000. Thus, in stark contrast to Brazil's improved level of democracy, China's very low degree of democracy is illustrated by a governance index as low as –1.72 in 2007. China's democratic landscape has not effectively changed in the past 14 years: It remains an autocratic system with limited opportunities for citizens to engage in political activities that have not been previously approved by the ruling Communist Party (CCP). Freedom of expression is severely limited. The media are controlled by state organs or state-owned companies. Journalists who cover sensitive and controversial issues such as human rights or criticize the CCP suffer harassment or much worse. To further restrict press freedoms, new legislation in 2006 allowed government to punish and fine media units that ran independent reports on public issues. In September 2006, the Chinese government also released new restrictions that granted the government-owned Xinhua News Agency control over network and information distribution within China. Foreign agencies are censored by Xinhua when the topics relate to national unity or social stability. Internet restrictions are also severe. Critical websites and chat rooms have been shut down, access to foreign websites is controlled, and the e-mail correspondence of political activists is monitored. According to Reporters Without Borders (2009), China has jailed more journalists than any other state, and it ranks 168 out of 175 countries on its press freedom index (Brazil is ranked 71). In 2010, China dropped to rank 171 out of 178, while Brazil improved to rank 58 (Reporters without Borders, 2010).

Freedom of religion is somewhat recognized; the CCP officially recognizes but also strictly controls the main five religions, namely Protestantism, Catholicism, Buddhism, Daoism, and Islam. Questions about the legitimacy of the CCP and eroding traditional family values that have arisen during China’s rapid economic and social development have led to a spiritual vacuum, as a response to which many Chinese citizens searching for spiritual guidance have created a revival of Buddhism and Confucianism. The CCP is allowing such forms of spiritual guidance, which so far have not had political implications (BTI, 2008c, pp. 8-12, 10-16).

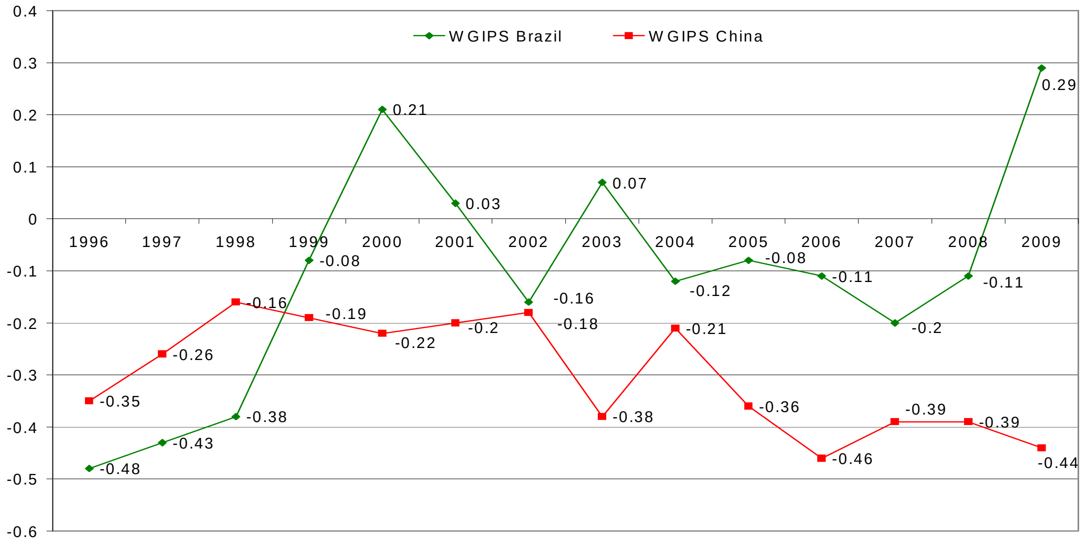
At the central level of state, there are no democratic institutions. The judiciary is not independent. It is institutionally differentiated, but there is a significant lack of judicial independence because judges’ decisions must be vetted and approved by the courts’ CCP committees (U.S. Department of State, 2011c). The outlook for democratization remains bleak; CCP leadership appears completely unprepared to share power with other political actors and consistently rejects Western models of pluralist democracy.

However, China’s large population, geographic size, and social diversity make effective autocratic rule from Beijing difficult. Central leaders increasingly work to build consensus for new policies among party members, local and regional leaders, influential non-party members, and the population at large (US Department of State, 2011b). Although consultative Leninism is meant to preempt democratization (Tsang, 2010, pp. 3-7), the implementation and acceptance of this model involves specific changes that are common to democratization processes, such as expanding good governance practices, granting a wider scope for civil liberties, and permitting political participation.

The most important general elections in China are not those for the National People’s Congress but for the Communist Party’s national congress (Tsang, 2010, pp. 3-7). In periods of greater economic openness Chinese entrepreneurs and citizens outside the formal structure of the CCP gained increased influence, especially in rapidly developing coastal regions. Yet, the CCP still aims to maintain its influence in all key government, economic, and cultural institutions, which might explain why the intensity of the CCP's control is very high in coastal areas and relatively softer in rural areas, where the majority of Chinese people live (Tsang, 2010, pp. 10-14).

3.4.1.3.3 Political Stability

Figure 3.7: WGI Political Stability



Data Source: World Bank (2010c). Figure created and arranged by the author.

The political stability and absence of violence index (WGIPS) observes the likelihood that governments may be destabilized, undermined or thrown off through coup d'etats, non-constitutional actions and/or military activities, including political and non-political related motivated violence or terrorism.

BRAZIL

From 1964 to 1985, Brazil was governed by military regimes. They left behind fewer victims than the dictatorships in neighboring countries such as Argentina and Chile, where some 300 and 10,000 people, respectively, were murdered.

Recall that Brazil's military government introduced its gradual democratic transformation in the mid-1980s. Worldwide governance data are available only since 1996, so no direct comparison is possible between the decades before with those after 1996. However, due to the military's influence and the nature of Brazil's governments prior to the 1990s, it is sensible to assume that political stability has improved significantly in the past two decades.

Yet, Brazil's political stability index between 1996 and 2009 is still characterized by high volatility, with notable recent improvements. For example, the period from 2007 to 2009 was marked by significant democratic political debate and participation prior to the federal elections in October 2010. These elections were required by law because President da Silva's (Lula) second four-year term had ended. Constitutional restrictions prevented da Silva from running for a third presidential term. A run-off election led to the appointment of Brazil's first female president, Dilma Rousseff, who effectively controls both the military and police forces. Brazil thus has underscored its strengthening political democratic culture and stability among its peers in Latin America. In conclusion, Brazil's political landscape and people's participation developed to the better compared to its entire history.

CHINA

In contrast, China's political stability index displays lower volatility but also a consistently negative trend, deteriorating from –0.35 points in 1996 to –0.44 points in 2009. Its dictatorial government maintained the grip on political power by further limiting freedom of speech, free press, and citizen engagement in political anti-government activities. The CCP's power is still absolute. These restrictions seemingly fuel the threat of a violent collective upraising of citizens. In recent years a growing number of public uprisings have been recorded, threatening the political stability measured by WGIPS.[37] Accordingly, the very recent history of violent events such as concerted attacks on police stations or government buildings is partly reflected in the deteriorating WGIPS for China.

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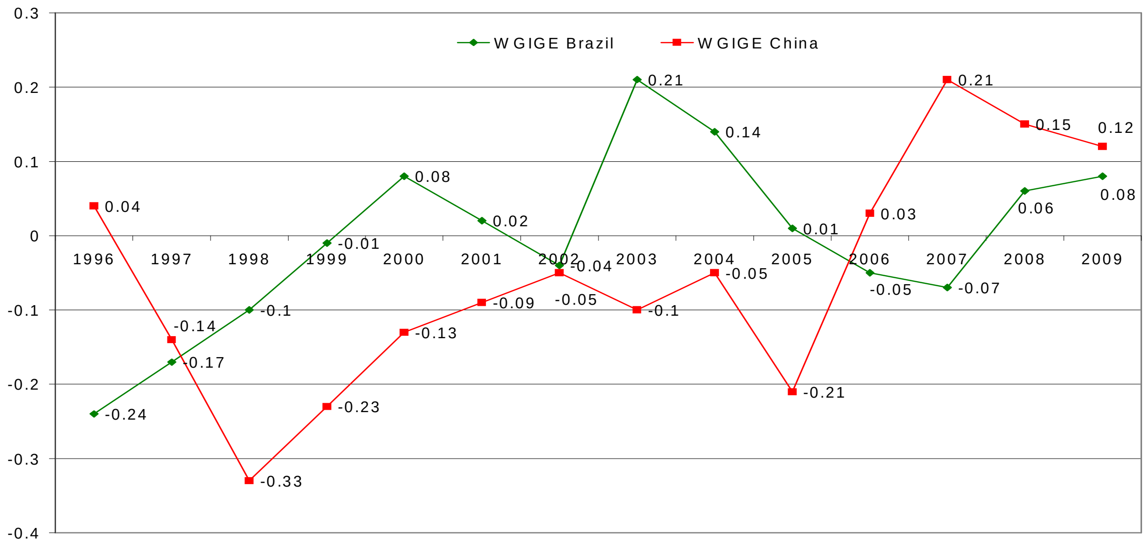
[37] Examples include violent protests in the provinces of Urumqui, sporadic uprisings in Tibet, and economic protests —some of which grew very violent— in industrial centers, demanding judicial justice, the elimination of police brutality, and laws to address political bribery.

3.4.1.3.4 Government Effectiveness

Figure 3.8: WGI Government Effectiveness



Data Source: World Bank (2010c). Figure created and arranged by the author.

The WGI of government effectiveness (WGIGE) includes both policy formulation and public service provision quality. It thus captures the capabilities of the government's civil service offerings and the civil service's independence from political pressures. However, this latter measure plays no role for China's WGIGE because there is no independence of federal and state service providers from the government. In comparison with China, Brazil's WGIGE improved significantly from –0.24 in 1996 to 0.08 in 2009. China's index gained slightly from 0.04 to 0.12 in the same period, after absorbing a drastic deterioration of its WGIGE from 1996 to 1998. Both countries' indexes improved despite high volatility.

BRAZIL

The federal government's organizational capabilities in Brazil are limited by virtue of constitutional provisions regarding federalism, where it is curtailed by the significant autonomy of the individual states and municipalities (BTI, 2008b, p. 20). The government's success in implementing large-scale reform policies or fiscal growth plans, such as the Plano De Aceleração Do Crescimento (PAC), have been mediocre at best due largely to the conflicting interests and differing policy goals of the ruling parties, as well as due to a fragmented political system with a very large number of parties (BTI, 2008b, p. 20). In addition, the governmental decision making process is susceptible to political tensions as exemplified by the corruption scandals in 2005 and 2006 that dominated the political scene and public debates until 2007. This development is reflected by the relative decline of WGIGE between 2003 and 2009.

CHINA

All of China's policies are formulated and steered centrally. Despite political barriers on the federal, state, or municipal levels, the effectiveness of economic policies improved somewhat starting in 2006 when the CCP introduced its 11th Five-Year Plan, aimed at strengthening China's domestic consumption. The latter stood at 34.8% of GDP in 2006, increasing to 36.8% in 2008, which was still lower than the 2000 high of 46.7%. Thus, the plan aimed to establish a more sustainable domestic growth framework to lift the heavy reliance on export-led growth, which is reflected by the high trade to GDP ratio of 70.5% in 2006 (Bank of East Asia, 2010). Since then environmental regulations have been introduced, energy prices have been liberalized, and export rebates have been trimmed further. In addition, China's government produced a 15% appreciation of its national currency, the Renminbi (RMB), from RMB/USD 7.97 in 2006 to RMB/USD 6.83 in 2009 in an effort to curb exports. Yet, the ratio of household final consumption expenditures to GDP also increased from 34.8% in 2006 to 36.8% in 2008. The financial crisis caused this ratio to drop to 34.0% in 2009. The trade to GDP ratio started dropping from 70.5% in 2006 to 62.1% in 2008 and then to an astounding 47.1% in 2009.

Despite rising production costs and wages, China's global share of exports as a percentage of world exports increased from 7.25% (2.8%) in 2005 (1995) to 9.68% in 2009 (Table 2.7: Export Structure China 1995-2009), compared with Brazil's percentages (Table 2.6: Export Structure Brazil 1995-2009) of 1.13% (0.90%) in 2005 (1996), up to 1.23% in 2009 (UNCTAD, 2010). China's ratio of exports to world exports grew despite its currency appreciation, higher wages, and the competition of low cost producers from Vietnam, Cambodia, and Bangladesh. It thus appears that China's exporters have gradually adjusted to rising costs. According to China's 12th Five-Year Plan (2011–2015), a key target is the continuous increase in China's share in the ratio of final consumption to GDP, from 45.8% in 2009 to 55% in 2015 (Bank of East Asia, 2010). A stronger RMB would support this goal by lowering the price of imports and increasing final household consumption, in addition to inducing strong wage growth.

These measurable effects of the CCP's policy implementation proved the government's ability to execute some policies effectively using various instruments, such as (1) increasing the minimum wage in July 2009, (2) intervening/managing the RMB/USD FX rate as seen in the past, and (3) granting access for foreign investors to mainland stock exchanges to fuel stock market driven wealth in conjunction with currency appreciation and thereby strengthening the growth of domestic consumption.[38] Nonetheless, in many areas resources are still not used efficiently.

However, overall efficiency levels of public services and the judiciary are still heavily restricted by corruption and embezzlement. A lack of public oversight means nepotism and arbitrary behavior on virtually all levels of federal, state, and municipal government, undermining effective and efficient management and control. Another serious issue is the conflict of interests between state and municipal levels due to their conflicting policy objectives and interests. The national government's recent efforts to control GDP growth counteracts the incentive structures of local officials, who participate directly in ensuring high economic growth rates in their municipalities. Local officials even tend to thwart national policies by fueling excess development in their localities, undermining the centrally planned, controlled, and sustained growth path. Freedom of speech and free media remain the missing catalysts to uncover corruption and its detrimental effects on government effectiveness.

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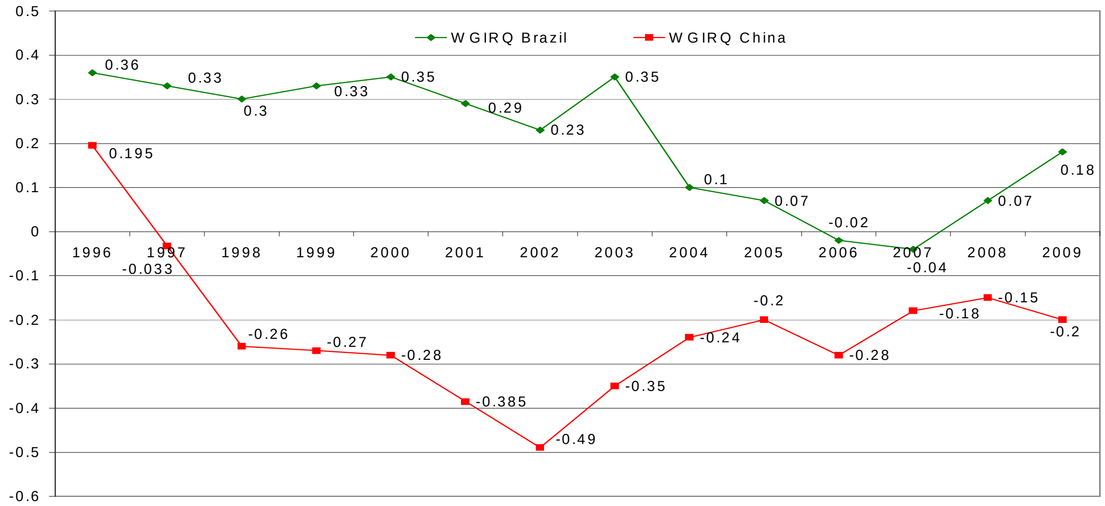
[38] On January 18, 2011, the Chinese government announced that it would open mainland stock markets (Shanghai and Shenzhen) and grant access for international investors, potentially leading to the appreciation of the RMB.

3.4.1.3.5 Regulatory Quality

Figure 3.9: WGI Regulatory Quality



Data Source: World Bank (2010c). Figure created and arranged by the author.

Regulatory quality (WGIRQ) pertains to the government’s competence and ability to provide, implement, and operate sound policies and regulations to promote and support private-sector development and improvements. Both Brazil and China recorded overall declines in WGIRQ, from 0.36 to 0.18 index points and from 0.195 to –0.2 index points, respectively. Both countries also experienced deterioration with the exceptions of two brief hikes, when the index reversed trends in 2002 and 2007 for China and Brazil, respectively.

BRAZIL

Brazil’s WGIRQ decline has taken longer than China’s, and reversed only in 2007. Reform projects in the judicial, educational, and agrarian arenas showed limited progress in President Lula’s first term. Reforms to electoral and party legislation, a precondition for efficient governing in Brazil, were pushed back. The trend reversal in 2007 is largely the result of Lula’s achievements in improving the regulatory framework in his second four-year term, which started on January 2007. Lula pledged faster economic growth and a stronger focus on developing Brazil’s educational system by improving Brazil’s regulatory environment.

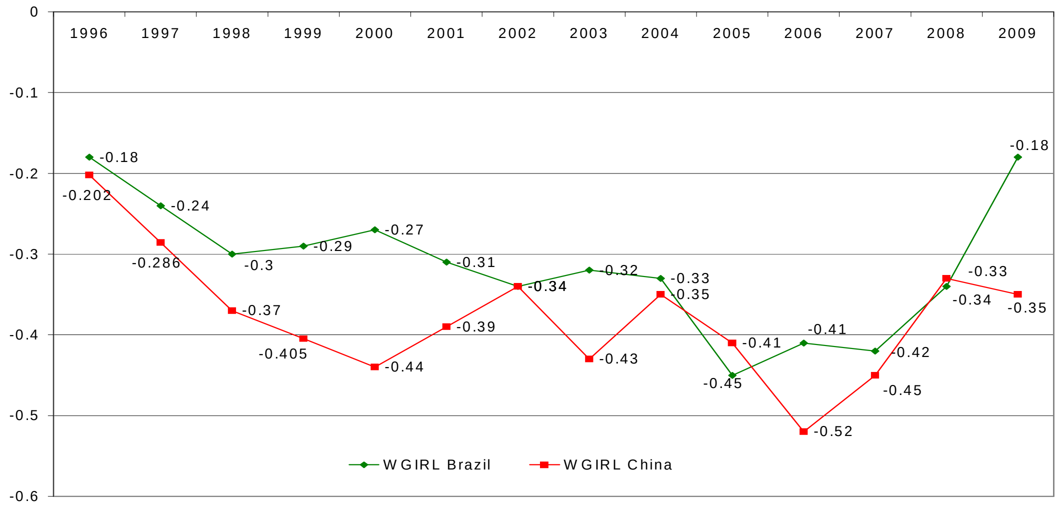
CHINA

In comparison to Brazil, the CCP's regulatory focus is mainly on macroeconomic stability and economic development. Macroeconomic stability demands monetary and administrative actions to prevent the economy from overheating. Monetary measures, such as setting reserve requirements or interest rates, are implemented stringently. The success of administrative measures such as investment guidelines and policies for municipalities depend to a large extent on the support of local governments. Local governments at times oppose the implementation of the CCP's policies, whether to support their personal gains or because of their corruption, which disables the development of an effective regulatory framework.

Furthermore, despite strengthening its legal framework since joining the World Trade Organization (WTO), China's intellectual property and related laws (e.g., trademark, copyright, patent) are difficult to enforce. Despite stronger statutory protections, China continues to harbor one of the highest rates of product, brand and copy right piracy in the world.

3.4.1.3.6 Rule of Law

Figure 3.10: WGI Rule of Law



Data Source: World Bank (2010c). Figure created and arranged by the author.

The rule of law (WGIRL) measures the extent to which citizens, organizations, groups, and firms are confident in the rules of law, such as contract enforcement and property rights, as well as the fairness of the police, the judicial system, and the legislative system.

Strikingly, Brazil and China follow similar patterns between 1996 and 2009. The correlation of WGIRL between Brazil and China is moderately high at 66.3%.[39] Both countries' starting points are relatively similar, at –0.18 points for Brazil and –0.202 points for China. The index deteriorates for both countries, reaching a nadir of –0.45 for Brazil in 2005 and –0.52 for China in 2006. Whereas Brazil's WGIRL reverses impressively to increase to –0.18 in 2009 (levels of 1996), China's WGIRL remains flat after it reached –0.33 in 2009. Overall, Brazil's WGIRL index did not improve between 1996 and 2009, whereas China's even deteriorated.

BRAZIL

The judiciary system in Brazil is institutionally well differentiated and generally free from unconstitutional interference by social interest groups or governmental institutions. In theory, human rights are guaranteed by the constitution, and the separation of powers is warranted by mutual checks and balances. In practice though the Brazilian judiciary system is overstretched and overburdened. Access to judicial organs and legal counsel is unequal and heavily skewed to wealthier segments of society. Extreme inequalities concerning access to the Brazilian law and court system, which is burdened by procedural and technical complications, restrict the availability of legal support to all citizens. Furthermore, the prosecution of human rights abuses tends to depend on the socioeconomic context. Capital crimes and drug-related violence correlate highly with the firearms-related death rate. Brazil has one of the highest homicide rates in the world. In 2003 its homicide rate stood at 33.1 per 100,000 inhabitants, in 2005 at 29.2 per 100,000, declining to 22.0 per 100,000 in 2008 (UNODC, 2011). In comparison, China's was at 1.2 per 100,000 in 2007 according to China's Statistic Buero.[40] Furthermore, Brazil's prison system is chaotic, overcrowded, and nearly anarchic. Brazilians generally feel that their human rights and personal safety are not well secured.

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[39] High significance at 0.01 (performed with PASW).

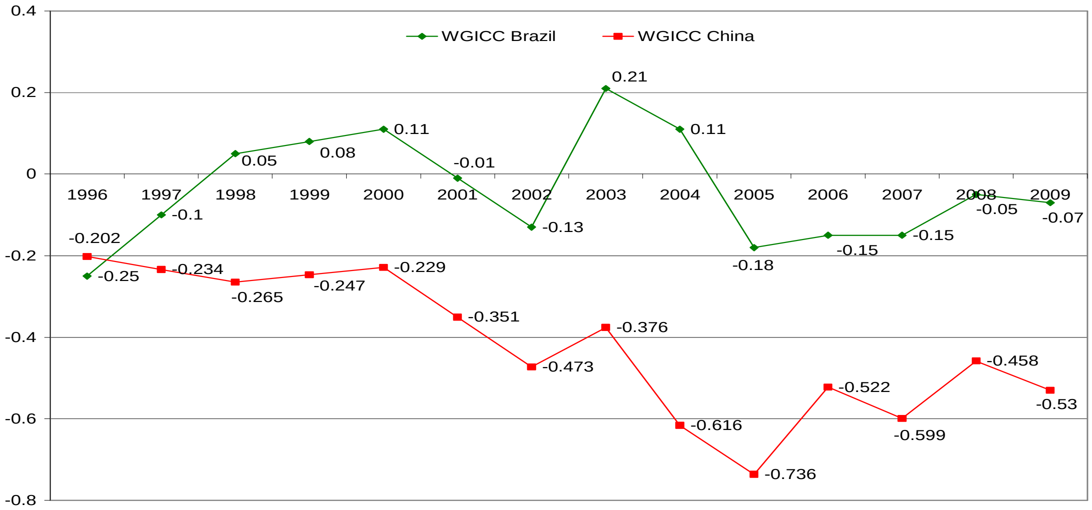
[40] In comparison, Germany's homicide rate was at 0.8 per 100,000 inhabitants in 2008. UNODC's homicide rates for China are based on data from the China Statistic Buero.

CHINA

In theory, China’s system of checks and balances subordinates political actors and state powers to the law. In practice however, the constitutional framework does not recognize a system based on separation of powers, nor is the judicial system independent, but subject to influence from local officials. Rule of law in China is perceived to be highly arbitrary. The government maintains absolute power in all socioeconomic and political realms. The CCP takes superiority over the constitution and is consequently incontestable in its decisions. Court decisions must be approved and vetted by various layers of CCP committees. Judges are appointed by local People’s Congresses and paid by local governments, which implies widespread political interference with judicial decisions. Law enforcement is politically influenced and serves to protect the interests of the party, local governments, and local party officials. To a certain extent law enforcement acts as a local and regional form of control by local authorities. Chinese official data compiled by UNODC (2011) suggests that China’s homicide rate ranks among the lowest globally. Nonetheless, judicial corruption also is common, leading to skewed law enforcement activities. Fewer lawyers take on civil or human rights cases, which further curbs citizens’ already restricted opportunities to seek judicial protections against rights violations.

3.4.1.3.7 Control of Corruption

Figure 3.11: WGI Control of Corruption



Data Source: World Bank (2010c). Figure created and arranged by the author.

The WGICC measures the extent to which public power is exercised for private gain, as well as the risk of manipulating or corrupting/seizing the state by elites and private interest groups.

Brazil’s and China’s WGICC indexes began at similar levels (–0.25 and –0.202, respectively), but whereas Brazil has managed to improve its index to neutrality, China’s index widened the gap, closing at –0.53 in 2009.

BRAZIL

The improved index for Brazil prior to 2003 is the result of perceived progression with regard to anti-corruption governance. However, such progress came to a severe halt in 2004 and 2005 due to the corruption scandals that rocked the Lula administration. Particularly disastrous was the year 2005, when it became increasingly evident that the ruling Workers Party (PT) was not only using illegal funds to finance political campaigns but also bribing allies in congress to win support. The corruption scandal caused the most serious political crisis Brazil had seen in years, and it significantly undermined the ruling Workers Party credibility and ethical aspirations in 2005 and 2006 —notions that had been its key points of differentiation from other parties in previous elections.

In general, increased media coverage about corruption made voters increasingly aware of and educated about corruption. Anti-corruption governance mechanisms had been publicly supported by the government but offered medium effectiveness at best. For example, the Fiscal Responsibility Act in theory ensures scrutiny and transparency into political actors and their fiscal performance, but in practice it lacks control effectiveness.

CHINA

In comparison with Brazil, China’s control of corruption index has significantly weakened since it was first measured in 1996. In China corruption is punishable by law. However, theory and practice are worlds apart. The CCP’s anti-corruption efforts have proven partially successful at low, small levels, whereas large-scale corruption remains an increasingly serious concern. At higher political levels corrupt officials are often shielded from punishment, except for a few showcases that attract extensive media coverage and reinforce the image that the government is committed to eradicating corruption. Corruption is rampant in both government agencies and among the ruling bodies of the CCP, which perpetuates the steady decline of China’s scores in this index.

In comparison to the deteriorating WGI control of corruption index, EFI’s corruption index on China, which is primarily based on Transparency International’s corruption perception index, improved from 21.6 in 1996 to 36.0 in 2009. That is, compared to the EFI index, the corruption index of the WGI deteriorates between 1996 and 2009. This is due to differences in the data generation; the WGI index is a composite index and based on a larger number of data providers. From a quantitative point of view, both EFI’s and WGI’s corruption indexes are very low, suggesting that corruption remains a major issue in mainland China irrespective of either index's trend lines. Nonetheless, the trend line of EFI’s and WGI's corruption index will play a role in the correlation and causality analysis in Chapter 4 and 5.

3.4.2 The Economic Freedom Index

3.4.2.1 Data Source

Overview

The economic freedom index (EFI) is provided by the Heritage Foundation, based in Washington DC (Heritage Foundation, 2009). The data is freely and publicly available. Published annually by the Heritage Foundation, the current EFI —e.g., the EFI of 2009— is based on data compiled from the prior year —e.g., 2008. In this thesis the annual EFI data for a respective year is based on the data compiled for the same year in order to maintain annual data comparability with the WGI indexes, the commodity price indexes and the macroeconomic variables.

Data Source

The EFI measures a country's governance in the context of ten different dimensions such as property rights, freedom from government regulation, and trade. Some elements of these economic freedom dimensions measure the extent of an economy’s openness to global investment or trade and are hence external in nature. However, the majority of the governance dimensions is internal and measures for example the liberty of a country’s citizens to conduct business without being limited by any government interference.

EFI governance indexes provide a good complement to the WGI indexes — which the latter are based on governance data from up to 31 independent providers— for several reasons. The EFI evaluates a wider range and more specific topics of economic freedom dimensions in the private sector. While WGI considers six dimensions of governance, EFI covers ten (this study analyzes only nine of them). The EFI labor freedom dimension has been added only very recently (in 2005), whereas all other EFI dimensions date back to 1996. Therefore, I do not include EFI labor freedom (dimension # 10) in the analysis.

The Heritage Foundation’s EFI indexes are assembled into four main classifications which include (i) rule of law (property rights index, freedom from corruption index. Recall, the WGI differentiates specifically between the rule of law index (WGIRL) and the corruption index (WGICC)), (ii) government activity (fiscal freedom index, government spending index), (iii) regulatory efficiency (business freedom index, labor freedom, monetary freedom index), and (iv) free markets (trade freedom index, investment freedom index, financial freedom index) (Heritage Foundation, 2011c).

In some cases the EFI also uses external data sources in addition to internal data sources to generate its annual governance indexes. External sources include, but are not limited to, the Organization for Economic Co-operation and Development, Eurostat, the World Bank's Macroeconomic Data Catalog, the World Bank's Doing Business Study, the International Monetary Fund, the Asian Development Bank, The Economist Intelligence Unit, and the US Department of Commerce (Heritage Foundation, 2011a).

3.4.2.2 Data Methodology

The ten individual EFI economic freedom dimensions are measured on a scale of 0 to 100, with 100 as the best score. Each governance dimension score is based on multiple factors and weighted equally. A country's overall economic freedom score is a simple average of its scores of the individual freedom dimensions. Recall that for my study the overall economic freedom score is measured on the basis of the nine individual freedom indexes described below. In order to provide an inclusive view on all EFI dimensions, this Section 3.4.2.2 also includes labor freedom for descriptive purposes; however EFI labor freedom will not be part of the empirical and econometric analysis in Chapters 3, 4 and 5. Please note that very few of the EFI's components of economic freedom indexes are themselves composites of supplementary quantifiable data measures (Heritage Foundation, 2011b), as detailed in the following sections.

The economic freedom indexes are summarized and illustrated below and based on the definition and formulation by the Heritage Foundation (Heritage Foundation, 2009, 2010, 2011a):

(1) Business Freedom is a quantitative measure that examines the ability to start, operate, and close a business. It characterizes the overall regulatory burden and regulatory efficiency of the government. The Heritage Foundation bases business freedom on ten equally weighted factors: (i) starting a business, number of procedures; (ii) starting a business, time in days; (iii) starting a business, cost (% of income per capita); (iv) starting a business, minimum capital requirement (% of income per capita); (v) obtaining a license, procedures (number); (vi) obtaining a license, time (days); (vii) obtaining a license, cost (% of income per capita); (viii) closing a business, time (years), (ix) closing a business, cost (% of estate), and (x) closing a business, recovery rate (cents on the dollar).

(2) Trade Freedom reflects the openness of an economy to imports of goods and services and exports from/to around the world and the ability of citizens to interact freely as buyers and sellers in international marketplaces. This composite index measures the absence of tariff and non-tariff barriers that affect imports and exports of goods and services. The index is based on two scores: the trade-weighted average tariff rate and non-tariff barriers (NTBs). The NTBs exert a penalty of 0 to 20 points, based on quantity (i.e., import quotas, export limitations), price, regulatory (i.e., licensing), investment (foreign exchange controls), and customs restrictions, as well as direct government intervention (i.e., subsidies and other aid, government industrial policy).

(**3) Fiscal Freedom:** This measure involves the extent to which citizens of a country and its businesses may keep and control their income and wealth stock for their own good and benefit. Fiscal freedom is a measure of the tax burden imposed by the government and includes the direct top tax burden for individuals and corporations, as well as the overall amount of tax revenue as a percentage of GDP.

(4) Government Size/Spending considers the level of government expenditures as a percentage of GDP. This index is nonlinear. Government spending close to 0 receives low penalties whereas levels of government spending that exceed 30% of GDP receive lower scores, according to the following quadratic measurement:

$$GE_i = 100 - \alpha\,(Expenditures_i)^2$$

GE_i represents country's i expenditure score. $Expenditures_i$ represents the total amount of government spending at all levels as a portion of GDP (between 0 and 100%), and α is a coefficient to control for variation among scores.[41] The burden of disproportionate government spending creates a critical economic freedom issue related to the need to generate revenue and spending. To a certain extent government spending involves capital expenditures, such as investments in infrastructure, funding for research and development, or education spending. Government spending entails a potentially significant crowding out effect and opportunity costs that rival the value of private

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[41] Set at 0.03. For more details please see Heritage Foundation (2011b).

investment and private consumption which would have materialized if the resources had been left in the private sector.

(5) Monetary Freedom measures the stability of a currency and market-determined prices, basing the score on the weighted average inflation rate for the most recent three years and price controls. The latter is a detriment, such that it can lead to the subtraction of up to 20 points from the base score.

(6) Investment Freedom evaluates a myriad of restrictions that may be imposed on investment. The ideal score of 100 points drops by 25, 15, or 5 points depending on the severity (high, medium, low) of specific restrictions in a country’s investment system. Investment restrictions include but are not limited to the national treatment of foreign investment, restrictions on landownership, foreign exchange controls, capital controls, and sectoral investment restrictions.

(7) Financial Freedom: This measure evaluates five areas: (i) the extent of government regulation of financial services, (ii) the degree of state intervention in banks and other financial firms through direct and indirect ownership, (iii) the extent of financial and capital market development, (iv) the government influence on the allocation of credit, and (v) the openness to foreign competition. Deductions to the index depend on the degree of government influence, ranging from repressive (–100 points) to negligible influence (0 points).

(8) Property Rights: The degree of property rights measures the ability of a country’s inhabitants to accumulate private property, secured by clear laws that are entirely enforceable. The more secure and stable a legal system is for protecting property, the higher the score. When private property is guaranteed by the state and its laws, the score is 100, whereas a state without private property rights receives 0 points.

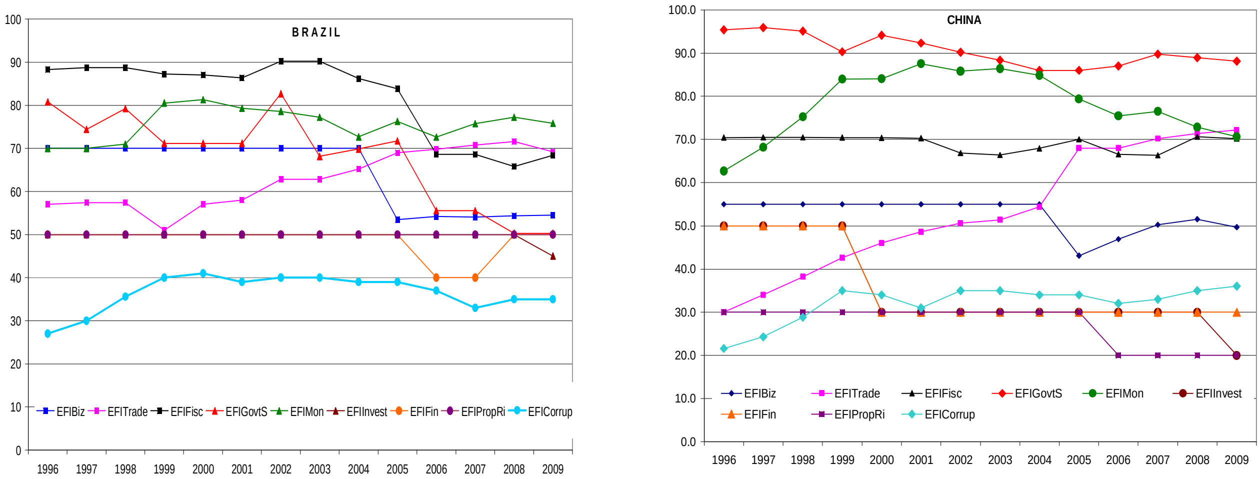
(9) Freedom from Corruption: The Heritage Foundation derives and rescales its freedom of corruption index on the basis of Transparency’s International’s corruption perception index, which rates the degree of corruption on a scale from 0 to 10 points. A score of 0 (10) indicates the highest (lowest) degree of corruption.

(10) Labor Freedom (not part of the analyses in Chapters 3, 4, and 5)**:** Finally, labor freedom is measured according to various characteristics of the legal and regulatory framework of a country’s labor market. The Heritage Foundation uses six equally weighted quantitative factors: (i) the ratio of minimum wage to the average value added per worker, (ii) restrictions on hiring employees, (iii) rigidity of hours, (iv) restricted hire and fire mentality, (v) legally mandated notice period, and (vi) mandatory severance pay.

3.4.2.3 Data Series

3.4.2.3.1 Summary View: Brazil and China

Figure 3.12: Economic Freedom Indexes — Brazil versus China



Data Source: Heritage Foundation (2009) and Heritage Foundation (2010). Figures created and arranged by the author.[42]

The economic freedom indexes (EFI) of Brazil and China draw a less conclusive picture than —in direct comparison— the world governance indexes (WGI) of Brazil and China do. The EFI instead show a relatively mixed picture. Compared to China, Brazil fares better on investment freedom, financial freedom, and property rights. China fares better on government size. In the context of business freedom, trade freedom, fiscal freedom, monetary freedom, and freedom from corruption, both maintain relatively similar governance levels. However, Brazil significantly deteriorated in several governance dimensions since 2003, such that it is now only slightly better or at par with China. Brazil's business freedom dropped from 70.0 points in 1996 to 54.5 points in 2009, and its fiscal freedom dropped from 88.3 points to 68.4 in the same period.

A sound financial and investment freedom framework and dependable property rights consist of various interdependent pillars. Institutionalized rules, accepted policies,

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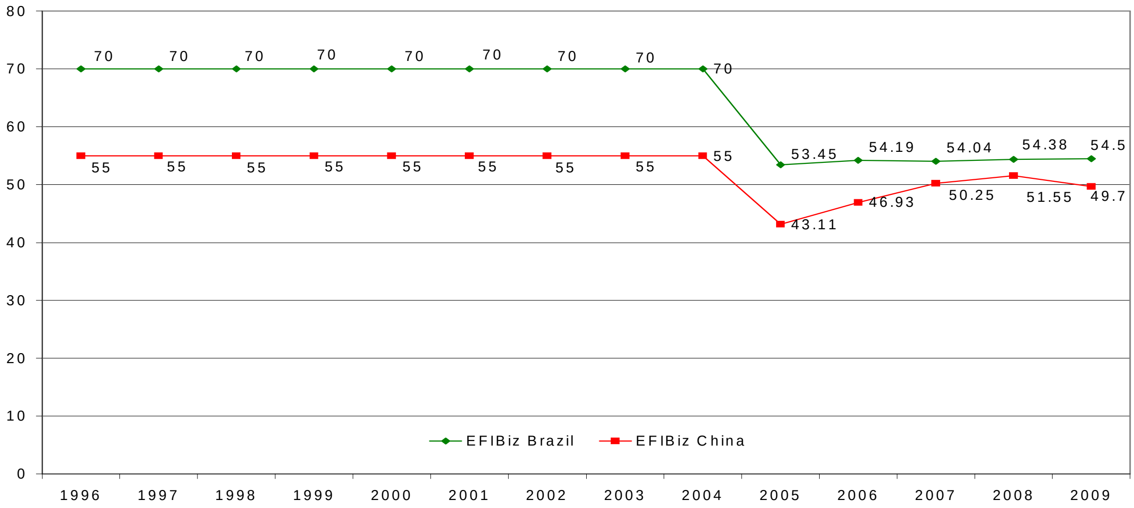
[42] The Heritage Foundation updates its data on a regular basis. Therefore, the data displayed in this study and the data online may slightly differ.

capital and reserve requirements, the enforcement of rights and contractual obligations, independent regulatory organs with a competitive market — all of these are conditiones sine quibus non for high degrees of financial and investment freedom and property rights. In financial and investment markets, the development of a high degree of financial and investment freedom together with strong property rights represents a challenging and long-winded process that demands considerable political determination and regulatory efforts. This complexity is clearly conveyed by the rigid, relatively constant shifts in the financial freedom, investment freedom, and property rights indexes for both Brazil and China. From a statistical analysis perspective, the flat and relatively rigid development of these indexes is of limited usage for correlation and causality tests (Chapter 4). However, they do offer some insights for a comparative analysis.

3.4.2.3.2 Business Freedom

Figure 3.13: EFI Business Freedom



Data Source: Heritage Foundation (2009), Heritage Foundation (2010). Figure created and arranged by the author.

Compared with other EFI indexes, the business freedom index for Brazil and China exhibits a less volatile development between 1996 and 2005. The reason for this is the apparently constant level of business governance as a result of a relatively rigid private sector framework, which does not allow for down- or up-ticks in Brazil’s and China’s business governance index.

BRAZIL

The country’s industrialization model in the 1970s and 1980s was based on a principled market economy, emphasizing private ownership and private property. Yet, the government remained closely involved in economic activities. For example, the national development plan instituted by the Geisel administration (in its second term in 1975–1979) had at its core a government-driven economic expansion, including capital expenditures in the steel and petrochemical sectors as well as investments in transportation, communication, and hydropower industries, designed as import substitution strategies. Thus, for decades Brazil’s economic infrastructure was dominated by state-owned companies and state-driven activities. This picture changed with the gradual transition toward democracy in the 1990s and demands for necessary fiscal adjustments in the mid-1990s, which led to a rapid privatization of state-owned firms and a strong shift towards a private sector framework.

As a result, the business freedom profile of Brazil between 1996 and 2009 changed for the better compared with the periods prior to 1996. Due to data restrictions, I can only analyze the period between 1996 and 2009 in this section.

In Brazil the EFI business freedom index stays at a constant 70.0 points from 1996 to 2005, reflecting the significantly improved business framework prior to 1996; then it drops to 53.5 points and stabilizes at 54.5 points in 2009. The drop from 70.0 to 54.5 points between 2004 and 2009 is due to the following factors:

As mentioned before, Brazil’s economy is characterized by free market competition, a result of the strong constitutional support for the private sector and its activities through the 1994 Competition Act. Thus, Brazil has established a consistent anti-monopoly and anti-cartel framework to strengthen its market-based economy. In 2004, Brazil’s congress approved a bankruptcy law, and in 2006 an antitrust law was sent to congress. The pricing framework in the private sector is mainly free of restrictions, and Brazil’s currency has been freely convertible since 1999.

Yet, Brazil’s relatively stable private-sector framework is undermined by its informal sector, which generated approximately 40% of Brazil’s GDP in 2009 (Global Insight, 2009). Brazil’s overburdened regulatory environment does not help either. The growing informal sector, which is a result of a number of weaknesses, such as difficulties in obtaining financing and high interest rates, poses serious threats to fiscal stability and a strong private sector because it creates massive foregone tax revenues and asymmetric competitive landscapes. This rather weak regulatory environment, which is also reflected by the deteriorating WGIRQ between 1996 and 2009, continues to deter the country's private sector. According to the International Finance Corporation's Doing Business Report (IFC, 2010, pp. 110-114), Brazil ranks only 129th out of 183 countries for ease of doing business (the lower the rank, the better). For example, in Brazil it takes 120 days to obtain a business license compared with the world average of 35 days.

CHINA

In 2010 China ranked 151 in the IFC's Doing Business Report (IFC, 2010, pp. 110-114). Although it only takes about 37 days to open a business in China, its overall starting/obtaining a business license rank is 151 of 183 (cf. 129 for Brazil), partially due to China's very high minimum capital requirement threshold of 131% of income per capita (Brazil's requirement threshold: 0%). Overall business freedom in China is heavily restricted by its detrimental regulatory environment, suffering from a lack of legal and regulatory clarity.

Even though the CCP has managed to transform its state-controlled economic framework into a semi market-based economic framework during the past 20 years, serious issues that hinder continuous private sector development remain. To put business freedom in Brazil and China into perspective it is necessary to consider the gradual transition of China's economy from a command- to a market-based model. In particular, the successful de-collectivization of rural farming and addition of partially market-based activities helped produce agricultural surpluses, which defined the initial stage of the market transition process in the late 1970s. This stage established a basic consumer marketplace. As the command-driven economy was progressively dismantled to set the stage for market pricing, state-owned enterprises (SOEs) had to adhere to market-oriented and commercial practices, which meant the demise of the pure plan economy (i.e., soft budget setting, planned price levels, and hierarchical fulfillment).

The gradual transition between 1979 and 1993 also was fueled by a dual track pricing system that allowed suppliers to sell at market prices after they reached their production plan fulfillment, creating incentives for hard budgets led by profit, contracts, and market prices (Naughton, 2007, pp. 91-95). Price controls still exist, mainly for food and energy, but less than one-tenth of consumer goods and agricultural products remain under a price control regime. Industrial goods, especially energy-intensive products, experience more intensive price controls; they have an estimated share of 10% of all industrial products.

The second wave of market transition reforms began in the mid-1990s and increased government attention to SOEs and their improvement in terms of governance and profit delivery. As natural competitors of townships and village enterprises (TVEs), SOEs had to adjust to a more competitive environment. Between 1978 and 1996 output by collectives and TVEs increased from 23% (TVEs only: 9%) to 36% (TVEs only: 28%) of GDP; output by SOE declined from 77% to 33% in the same period (Naughton, 2007, p. 300). The remainder of the production came from collective non-TVEs, such as private or foreign firms.

Despite these improvements, China's economy is far from a market-based system. Since 1996 it has emerged as a so-called tripod economy, incorporating state-owned firms, collective enterprises, and private firms.[43] Further liberalization is needed to ensure the continued reformation of China’s relatively narrow and basic financial system, which remains dominated by state-owned banks. Limited financing options are a significant barrier for many private firms, which are ready to progress along the value chain from low cost, labor-intensive to high technology and capital-intensive activities.

The transition process since the 1990s has led to the rapid decline in the number of SOEs, from 120,000 to 31,750 (Naughton, 2007, pp. 303, 313), which has also meant vast layoffs of employees from the public sector. These employees —including privately employed and self-employed citizens, rural migrant labor, and former SOE employees— have moved to the informal sector, leading to tremendous employment levels. Estimates suggest that the informal sector grew from 48 million to almost 160 million between 1990 and 2004. In comparison, the urban formal sector shrank from

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[43] The increased public offerings of SOEs must be put in context with the government’s objective to prepare former SOEs for successful transition into a market-based economy. Joint stock companies such as Sinopec and PetroChina, which are majority state-owned and listed on the Shanghai stock exchange, dominate China’s exchanges in share circulation and market capitalization. Stock market listings support initial market-based oversight systems, which ultimately may lead to better corporate governance (also referred to as the Anglo American system; Naughton, 2007, p. 320). In addition, stock listed SOEs provide more organizational autonomy, independence, de-politicization, and a stronger focus on profit maximization in comparison to traditional, non-stock listed SOEs. However, improving governance and its implementation takes time, especially considering that the majority owners of all joint stock SOEs are government agencies.

150 million in 1996 to 105.5 million in 2003, reflecting the demise in SOEs (Naughton, 2007, pp. 189-191).

Even though the CCP continuously refines and reshapes China’s economic framework by introducing new rules and requirements to grant privately held companies access to sectors that previously were dominated and controlled by SOEs (e.g., utilities, financial sector, defense), the implementation of the CCP’s policies is frequently undermined by local governments’ protectionist behavior, which can not only interfere with but even oppose central decisions, such that they favor SOEs, from which their local governments benefit directly.

Local governments’ opposition to centrally planned austerity policies, as discussed previously in the context of the WGI governance effectiveness index, also hampers the CCP’s attempts to counterbalance China’s overheated economy. This situation has resulted in significant over-investment in industries such as steel, cement, and real estate, leading to ill-guided investments and poorly performing loan ratios for state-owned banks and finance corporations. According to official Chinese data the loan loss ratio to total loans peaked at 29.8% in 2001, declining to 26% and 20.4% only two years later and then declining gradually even further to 2.4% in 2008.[44] To counterbalance local governments’ reluctance to support austerity policies, the CCP is increasingly using reserve requirements for banks, raising interest rates, and, more recently, imposing environmental requirements to curtail the overheating.

In light of the above and despite the recent deterioration, China’s degree of business freedom improved dramatically during the last four decades. However, there exists significant room for improvement.

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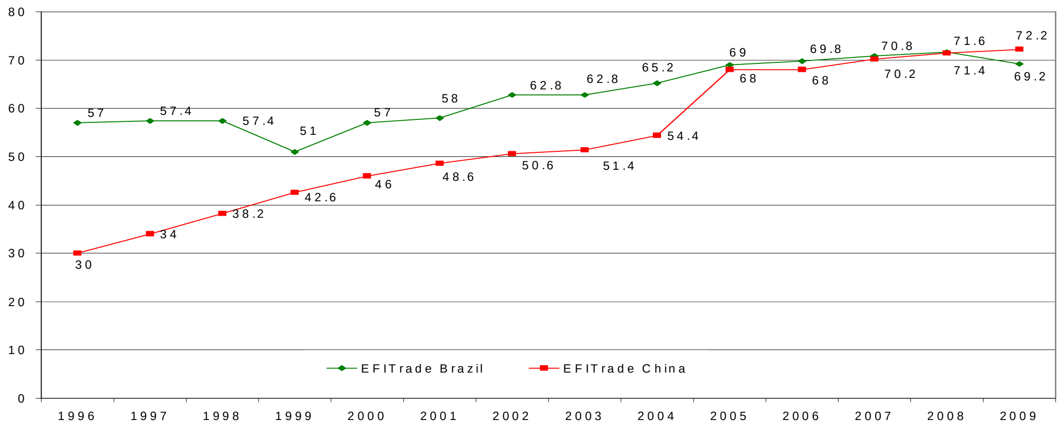
[44] The drastic decline in loan loss ratios is in large parts the result of outsourcing distressed loans to government-owned asset management companies (AMC), which absorbed a significant portion of under-performing loans from the big four state-owned banks (for more details please see the section on financial freedom).

3.4.2.3.3 Trade Freedom

Figure 3.14: EFI Trade Freedom



Data Source: Heritage Foundation (2009), Heritage Foundation (2010). Figure created and arranged by the author.

Both Brazil's and China's EFI trade freedom indexes have developed favorably over the analysis period. Among all governance indexes, trade indexes for both countries improved the most. China's EFI trade freedom index displays a more aggressive development though, from 30.0 points in 1996 to 72.2 points in 2009, compared with Brazil's development from 57.0 to 69.2 points over the same period. As of 2009, EFI's trade freedom index ranks Brazil and China almost at par, with China showing a slightly higher value.

BRAZIL

In comparison with China, Brazil has been liberalizing its economy for longer and with a greater degree of intensity. In comparison with China's economy, which started as a command economy in the 1940s, Brazil's economic model has moved from an import-substitution model to a more trade-related, external sector–oriented model, which helped solidify Brazil's manufacturing export base in recent decades. Brazil has been traditionally relatively quick to establish inclusive trade liberalization programs with strong unilateral and regional components. In roughly seven years, Brazil introduced three reforms that slashed tariffs and removed non-tariff barriers (NTBs). In the first reform in 1988, reductions in tariffs reduced the weighted average of tariffs from nearly 60% in 1987 to approximately 43% in 1988. With the 1989 reform, the weighted average of tariffs declined even further to 33%. Finally, the third reform between 1991 and 1993 continued to slash tariffs, leading to a reduction of weighted average of tariffs to 13% according to the World Bank's World Development Indicators (2011). However, this initial momentum in trade liberalization slowed in the mid-1990s due to unfavorable macroeconomic and international trends. At the turn of the century, favorable macroeconomic policies were put in place by Fernando Henrique Cardoso, Brazil's 34th president. In addition, Brazil began to enjoy the benefits of the commodity super cycle in the early 2000s.

Despite initial concerns about the new government lead by President Da Silva in 2003, actual political changes did not lead to a noteworthy economic policy reversal. Brazil's weighted average tariff continued to drop, reaching 6.7% in 2008 —a new all-time low.[45] Brazil's simple average tariff, which includes tariffs for all traded products (including exports) declined from 15.1% to 13.1% between 1996 and 2008.

From 1996 to 2009, Brazil's trade to GDP ratio improved from 14.9% to 26.1%, supported by global demand for Brazilian commodities and flanked by supportive trade tariffs and export programs. Unlike China, which is still very reliant on exports, the financial crisis had only a minimal effect on Brazil's trade to GDP ratio, judging by the slight decline from 27.41% in 2008 to 26.12% in 2009.

CHINA

Since China's accession to the WTO in 2001, foreign trade restrictions have been continuously loosened. This accession was granted in December 2001 in return for China's acceptance of regulatory changes that would allow it to blend into the global trade framework. Trade reforms and commitments to reduce tariffs and non-tariff barriers as well as trading rights were crucial to China's participation in the global trading system and established long-standing trends. Trade reforms and commitments to reduce tariffs and NTBs were crucial prerequisites of China's entry into the global trading system. The WTO-imposed reforms materialized over a 15-year period, including substantial tariff reductions and the elimination of most NTBs. Trade intervention by authorities also declined. In addition, import barriers, such as most favored nation tariffs and duty rates, were reduced together with the elimination of import quotas and trading rights (Rumbaugh and Blancher, 2004, pp. 3-7). Overall, the weighted average of tariffs declined from 32% in 1992 to 6.5% in 2003 and then to

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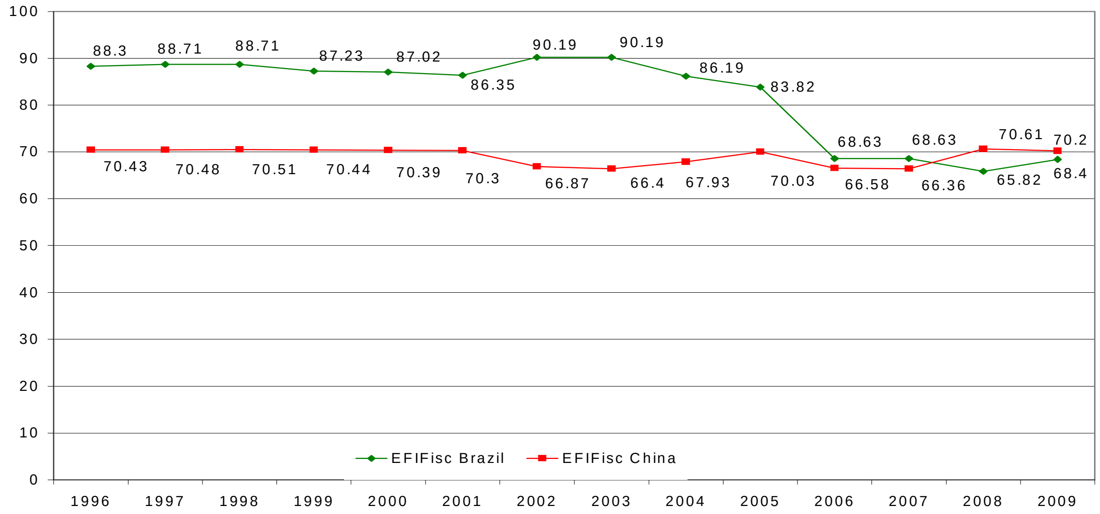
[45] Weighted average applied tariff is the average of effectively applied rates weighted by the product import shares corresponding to each partner country according to the World Bank Group.

3.9% in 2008. The simple average of tariffs, including all tariffs for all traded products, declined from 37.1% to 8.6% during the same period. In light of this favorable tariff development, China's trade to GDP ratio improved from 38.1% to 62.1% during 1996 to 2008.

3.4.2.3.4 Fiscal Freedom

Both, Brazil and China, receive relatively high marks for fiscal governance.

Figure 3.15: EFI Fiscal Freedom



Data Source: Heritage Foundation (2009) and Heritage Foundation (2010). Figure created and arranged by the author.

BRAZIL

Brazil's fiscal freedom index developed relatively flatly and at high levels, at approximately 90 points between 1996 and 2004. Then from 2004 to 2006 it dropped to the 70 points mark and maintained this level until 2009.

The presidencies of Fernando Henrique Cardoso and Luis Inácio da Silva managed to gain investor confidence through reducing external vulnerabilities to high debt levels and by maintaining a prudent fiscal policy toward government spending.

Brazil's highest marginal individual income tax rate between 2003 and 2009 was 27.5%, 17.5% lower than China's. The highest marginal corporate tax rate between 2001 and 2009 was 34%, while China's was 25% in 2008 and 2009. Nevertheless, Brazil's fiscal metrics have developed in favorable directions since 1996.

The ratio of external debt stocks to gross national income (Variable 65: ExtDebtST_GNI), which in 1996 stood at 21.9%, deteriorated to 42.97% in 1999, and then improved steadily to 16.2% in 2009. Total foreign reserves in USD as a ratio of total external debt (Variable 69: TTRes_TTExtDbt) improved significantly from 32.9% to 75.8% in the same period, and the interest rate spread (Variable 62: IRSSpread) diminished from 53.8% in 1997 to 35.59% in 2009.

As a result of the successful implementation of the Real Plan and its positive effects on Brazil's debt structure, investor confidence improved. As of 2008, Brazil's debt structure changed significantly compared with 1995, when approximately 60% of all foreign debt was supplied by commercial banks, 10% by supplier credit lines, 5% by bond investors, and the remainder by supranational entities. By 2008, the debt structure indicated 60% international bondholders, and commercial bank's exposures declined to approximately 10%, though the other figures were relatively unchanged.

In recent years the Brazilian government has thus demonstrated impressive fiscal credibility by improving its public debt management. A significant achievement of Lula's administration was the instruction of a tax reform package in 2003 that reduced tax rates from 44 items to only five, reduced sales and production tax rates, shifted gradually from production oriented to consumption oriented tax rates and transformed the temporary capital transaction tax into a permanent version thereof. Another key element was the modification of Brazil's bankruptcy law, which originally favored workers above tax authorities and creditors. The new law put creditors in a higher position, before payments to workers, which represented a major step in the effort to expand credit offered by banks to the private sector. Yet, even with these improvements, taxes on profits and capital gains deteriorated after 2003, increasing from 28.4% in 2006 to 31.3% in 2008 according to data from the World Bank (2009, 2010). These values, together with a relatively high marginal income tax, led to the deterioration of the fiscal freedom index since 2003 when President Lula first assumed office.

Rapid privatization programs in the mid-1990s, which increased government revenues from USD2 billion p.a. (1985) to more than USD35 billion p.a. in 1995 (Baer, 2008, pp. 140-144), favored a private sector framework.[46] In comparison, Lula's administration emphasized a conditional framework that would benefit people with lower income levels. The core dilemma was how to retain a good socio-economic

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[46] Careful privatization attempts became already visible at the end of the 1970s when a fiscally unsustainable position led to attempts to control state expansion by privatizing state owned firms with the help of the newly created Special Secretariat for the Control of State Enterprise (SEST) (Baer, 2008, p. 226).

balance in the context of a macro-economic policy that would be sufficiently orthodox to gain acceptance by international capital markets.

Figure 3.16: Credit Default Swaps of Brazil and China 2004–2010

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Issuer | Region | Global | Sovereign(All) | All Grades | 5Y CDS | Price

Custom | 01/04/00 - 03/04/11 | CHAN

Brazil 114.35
China 73.14

Australia 61 2 9777 8600 Brazil 5511 3048 4500 Europe 44 20 7330 7500 Germany 49 69 9204 1210 Hong Kong 852 2977 6000
Japan 81 3 3201 8900 Singapore 65 6212 1000 U.S. 1 212 318 2000 Copyright 2011 Bloomberg Finance L.P.
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Source: Bloomberg (2011d).

Lula’s administration adopted a two-pronged approach: First win the confidence of financial markets and then pursue socio-economic balance. Nonetheless, the orthodox policies ultimately may not be compatible with a significant switch to socio-economic policies if the tax, business freedom, and financial freedom scenarios have not yet reached maturity, as is still the case for Brazil.

Also, despite its orthodox policies the Lula administration increased non-discretionary spending to counter low growth in the early 2000s instead of focusing on investments in infrastructure (which were low), education, or private-sector capacity. This choice curtailed opportunities for strong future growth rates.

Nonetheless, Brazil’s continuous GDP growth in the context of its strengthening, free-floating currency, and in that of an improving macroeconomic framework have led to significant improvements in 5-years credit default swap (CDS) levels between mid-2004 and 2010, dropping from 460 basis points to approximately 100 basis points.[47]

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[47] Not taking into consideration the time period of financial stress during the unfolding of the global financial crisis at the end of 2008.

CHINA

China’s fiscal freedom index developed relatively flatly, too, oscillating around the 70 points line between 1996 and 2009. During that period there has been no significant adverse or unfavorable development in China’s fiscal policies that would warrant a significant adjustment in its fiscal freedom index according to the Heritage Foundation (2011a) chart line. China’s highest individual marginal income tax rate remained at 45% from 2003 until 2009 (World Bank, 2009, 2010). Its highest corporate marginal tax rate was 33% between 2003 and 2007 and then dropped to 25% in 2008/ 2009. Also, China promotes new technology by issuing lower tax rates to firms in high-tech sectors, as low as 15%. The data from 2007 show that taxes on income, profits, and capital gains of revenue were 16.4% and taxes on GDP were 9.9%.

China’s comparative advantage through its low labor costs, together with its export-dependent economy, led to some unprecedented favorable developments in its fiscal metrics. Total foreign reserves in USD as a ratio to total external debt stocks improved from 86.7% in 1996 to 519.8% in 2008. External debt stocks to GNI improved from 15.3% to 8.7% in the same period. Interest rate spreads remained relatively volatile, fluctuating between 260 and 360 basis points.

As Figure 3.16 above shows, China’s 5-year credit default swap level highly correlate with Brazil’s, though at lower level than Brazil’s, due to the capital markets' perception that China offers greater macroeconomic stability through the size of its economy, large foreign currency reserves —USD2.4trillion in 2009— in combination with rapid growth and a fixed foreign exchange rate.[48]

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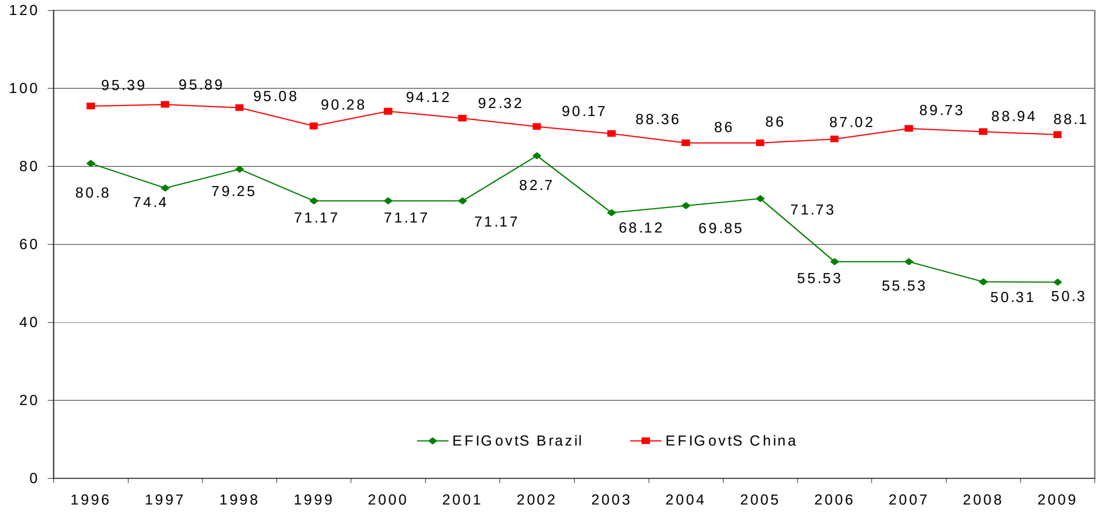
[48] This assessment is based on the author’s practical experience in New York in context of CDS trading with counterparties domiciled in New York, São Paulo, Hong Kong, and Singapore.

3.4.2.3.5 Government Size

Figure 3.17: EFI Government Size



Data Source: Heritage Foundation (2009), Heritage Foundation (2010). Figure created and arranged by the author.

The EFI Government size index considers the level of government expenditures as a percentage of GDP. Both countries' government size indexes were relatively high at the start of the analysis period. In 1996 Brazil's index measured 80.8 points, compared with 95.39 points for China. Since then both indexes have declined steadily. However, while China's government size index declined from 95.39 points in 1996 to 88.1 points in 2009 (-7.6%), Brazil's government size index declined at a much faster rate, falling from 80.8 index points in 1996 to 50.3 index points in 2009, a decline of 38%.

BRAZIL

Between 1996 and 2009 Brazil's general government final consumption expenditures to GDP measure (Variable 14: GovFinConExp_GDP) stood at a relatively moderate level of 20%, with the highest level of 20.64% in 1998 and the lowest of 19.17% in 2000. In comparison, in 1980 government final consumption expenditure to GDP was at less than 10%. Also, the government's efforts in expanding Brazil's infrastructure through fiscal expansions have received high priority despite slow actual progress in context of the PAC program. The gradual deterioration of the government's final consumption expenditures to GDP since 2002 reflects increased government spending under the Lula administration.

CHINA

China’s general government final consumption expenditures as a ratio to GDP (Variable 14: GovFinConExp_GDP) were 14.0% in 1996, oscillating by 2% over the past decade before finally improving to 11.5% in 2009. In comparison with Brazil’s, China’s general government final expenditures such as transfer payments and consumption in GDP terms are low. In the most recent year central government spending equaled 19.9% of GDP according to official data provided by World Bank. The government’s involvement in various industrial sectors is a paramount factor in China’s economy, including the still relatively large number of SOEs. For example, the banking sector still hosts mainly majority state-owned enterprises such as Bank of China, Industrial and Commercial Bank of China, Agriculture Bank of China, and China Construction Bank. The steel sector is also dominated by SOEs or firms in which the state maintains a significant share and runs a government monopoly. For example, Nanjing Iron & Steel United Co. Ltd. is 40% state owned, and the Jiangsu Shagan Group is fully state owned.[49] China’s oil industry also is entirely owned by the state through China National Offshore Oil Corporation, China National Petroleum Corporation, and Petro China Company Limited, the stock-listed subsidiary of China National Petroleum Corporation. The transport sector is dominated by China Ocean Shipping Company and China Shipping Container Lines, both of which are held by the state. Yet, a first anti-monopoly law was enacted in August 2008 by the government in order to establish the framework for yet another privatization cycle.

Therefore, given the size of the government’s current economic involvement in context to actual government spending, China’s high marks on EFIGovtS may be somewhat misleading.

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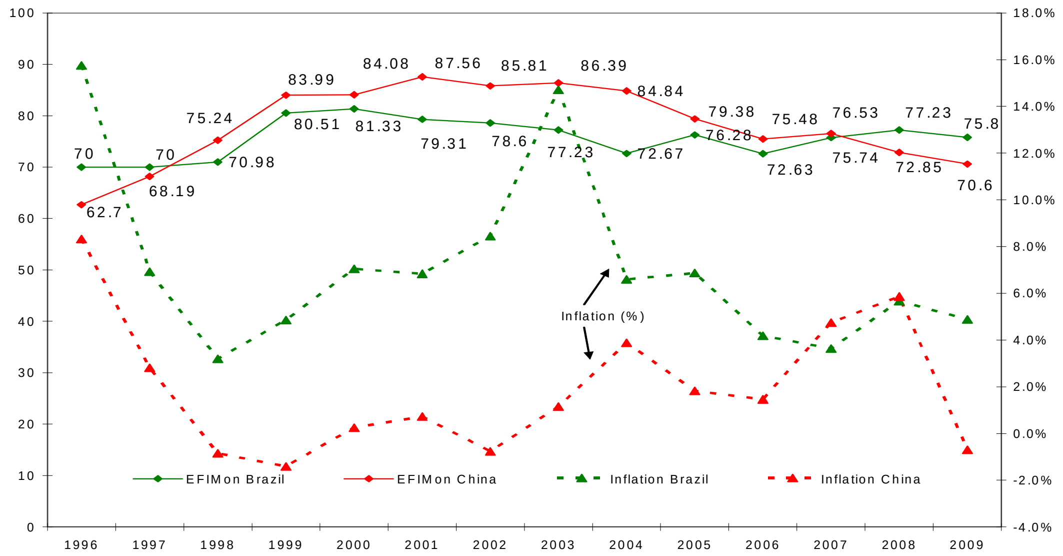
[49] The Chinese government continues to maintain de facto control of many enterprises in various sectors. For example, the Jiangsu Shagan Group was established as a village enterprise (part of the TVE sector) in 1975 and is now the largest private steel firm in China and overall the fourth largest steel firm in China. The ownership structure is a mix of the company’s labor union, CCP-related general management, and employees of the firm; all of which are controlled by the CCP (Price, A., Brightbill, T.C., Weld, C.B., Nance, D.S. (2007, pp. 1-7)).

3.4.2.3.6 Monetary Freedom

Figure 3.18: EFI Monetary Freedom and Inflation



Data Source: Heritage Foundation (2009), Heritage Foundation (2010). Figure created and arranged by the author.

BRAZIL

Brazil has a long history of hyperinflation caused by an array of correlating factors such as cost pass through, income compensation through indexation, and fiscally generated subsidized credit by the state to the private sector. In addition, Brazil's monetary and fiscal governance problem has hinged on the dilemma of who can finance the government's expansion. Historically, fiscal expansion strategies were financed through central bank funding, which increased inflation. Inflation levels thus reached extreme highs in the beginning of the 1990s and in 1994, peaking at 2,948% and 2,076%, respectively.

Austerity measures and rigid price controls in the context of the Real Plan developed by the Cardoso administration managed to contain inflation rates and stabilize Brazil's monetary and fiscal position. The Real Plan was initially not based on targeting inflation but rather consisted of a mix of open economy policies, such as spending cuts of USD7 billion p.a., high interest rates, an exchange rate anchor, tax increases, and non-central bank deficit financing. Inflation targeting started later, in 1999, after the devaluation of the Real.[50]

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[50] Inflation bands are set at Banco Central Do Brazil's internal COPOM (Meeting of the Monetary Policy Committee) meetings and regulated through resolution assemblies. For example, in 1999 upper and lower

The Real Plan was finally effective after various attempts. In 1995, inflation (Variable 59: Infltn) dropped to 66%. Two years later, inflation was at relatively acceptable levels of 6.9% and then improved further to 3.2% in 1998.

Prudent fiscal policies and rigid monetary strategies had led to a relatively stable inflation rate, fluctuating between 3.6% and 8.5% until 2009, when it settled at 4.89%. The containment of high inflation rates since 1996/1997 have improved Brazil's monetary freedom index accordingly.

Compared with other South and Central American countries, Brazil's Central Bank enjoys relatively high monetary independence. In addition, since 1995 Brazilian governments have consistently displayed a strong commitment to an inflation-targeting regime by synchronizing inflation and foreign exchange policies with other economic policy objectives. Although Brazil's Central Bank lacks full operational authority, it is responsible for monitoring inflation target results and setting interest rates on a ten-day basis. Contained inflation thus helped the Central Bank to cut the primary interest rate from a peak of about 29% in December 1998 down to 19.75% in mid-2005, to 18.0% in January 2006, 15.75% in April 2006, and as low as 8.65% as of December 2009 (Banco Central Do Brazil, 2010a). Price controls play another essential part in Brazil's anti-inflation policies. Public services such as telecommunications, utilities, and transportation have been privatized, but regulatory agencies such as the National Petroleum Agency control wholesale prices for fuel, while the government controls airfares directly.

The Brazilian Real was made fully convertible in January 1999. Since then it has experienced significant volatility swings, reaching a peak of BRL/USD 3.08 as a result of various factors, such as global volatility in commodity and equity markets, but also partially due to general investor unease as a result of the new PT administration lead by President Da Silva in 2003.

Since 2003 however, the currency has strengthened significantly against the USD improving even to BRL/USD 1.36 in mid-2007. This level reflects the prudent interest rate and monetary policy by Brazil's government and Central Bank, as well as established investor confidence after the short prelude of the Real depreciation in 2003.

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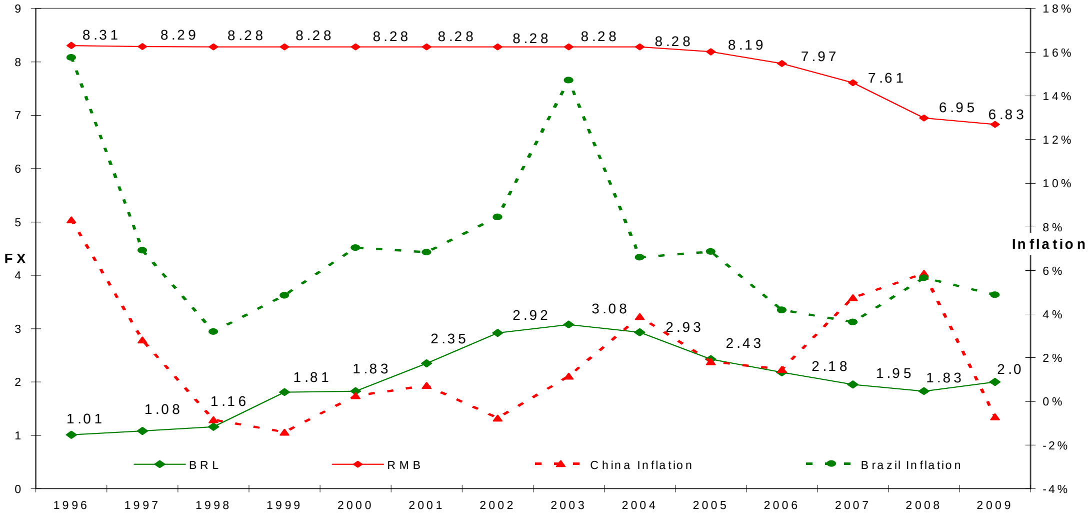
bands were agreed at 6.0%-10.0% p.a. In 2004 the target range was set between 1.25% and 6.25%. Since then and projected until 2013, the target range is set at 2.5% to 6.5% (Banco Central Do Brazil, 2010b).

Figure 3.19: FX Rates and Inflation



Data Source: World Bank (2009, 2010). Figure created and arranged by the author.

The correlation between the BRL/USD foreign exchange rate and inflation from 1996 to 2009 was 67%. Brazil's emerging domestic economy, relatively low stock market valuation, and credible stability policies have attracted large investments from institutional investors, as well as fast money.[51] At the time of writing, the BRL's 52-week range was BRL/USD 1.64–1.92.

Control of inflation remains a critical monetary governance metric for Brazil's economic and political stabilization. By containing chronically high inflation rates, the Brazilian government has fueled domestic and international investor confidence and thus spurred both internal consumption and net foreign direct investment (FDI) to GDP levels (Variable 51: FDInet_GDP). The latter improved from 0.21% of GDP in 1990 to 1.33% in 1996. It reached its peak in 2000 at 5.08%. In 2008, net FDI to GDP was 2.75%, and then dropped to 1.65% in 2009 as a result of the global financial crisis.

CHINA

The World Bank's first inflation data on China dates from 1987 and shows a relatively volatile inflation regime, especially before 1996. However, China's inflation levels (Variable 59: Infltn) were far from Brazil's peak inflation levels in the beginning of the 1990s; China's inflation highs prior to 1996 were 18.7% in 1988 and 24.2% in

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[51] Fast money is a term used for hedge funds, asset managers and non-institutional investors that have the ability to quickly react and to move large amounts of cash and cash near liquidity into and out of specific regions and asset classes, such as emerging markets and/or commodity related assets.

1994. Since 1996, China's inflation rate has been moderate, dropping from 8.3% in 1996 to even slightly negative rates of -0.8%, -1.4%, -0.77%, and -0.7% in 1998, 1999, 2002, and 2009, respectively. Inflation in 2008 was at 5.86% according to World Bank data. The government in China determines prices for energy and utilities as well as for pharmaceuticals, agricultural and other crucial products to restrain inflation pressures. Nonetheless, shares of price controlled products represent a small minority of overall products traded.

During the analysis period from 1996 to 2008, China amassed a gigantic amount of foreign reserves through its exports: USD1.966 trillion in 2008, up from USD111 billion in 1996. In 2009 total reserves climbed by 25% and reached a record of USD2.4 trillion. China's external balance of goods and services was USD17.5 billion in 1996 and reached USD349 billion in 2008, then declined to USD261.8 billion in 2009 as a result of the global financial crisis. Despite partial price controls, inflation remains a pivotal problem in China, especially considering the reported growth of M2. The M2 to GDP ratio (Variable 60: M2_GDP) grew from 90.65% in 1996 to 159.38% in 2009, which indicates high inflation pressure despite the relatively low officially publicized numbers.

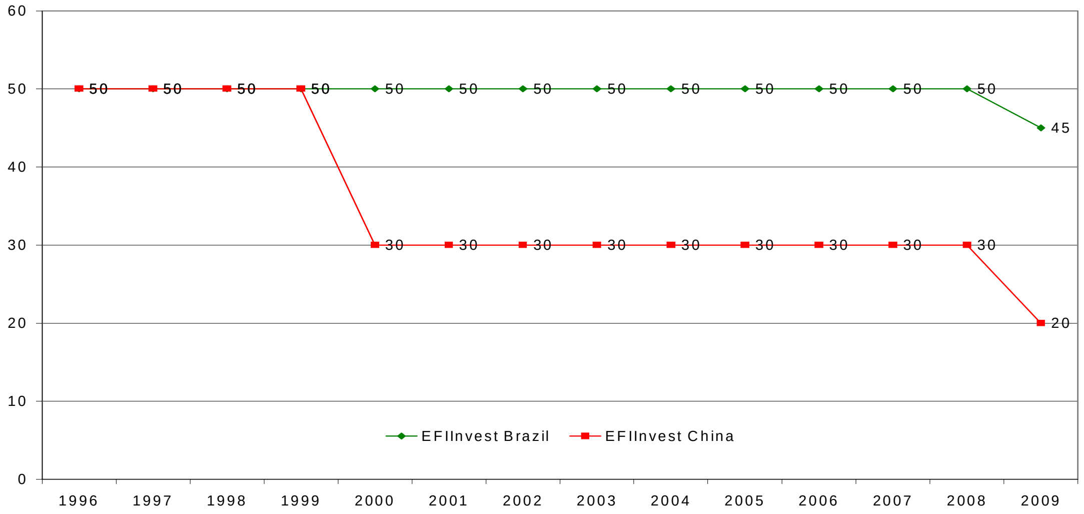
China's monetary policy entails a two-pronged strategy: targeting monetary supply through direct control measures to ensure economic growth, and controlling the exchange rate with the USD in order to maintain currency stability. The control of the monetary supply in order to meet implicit inflation targets (He and Wang, 2011, p. 10) relies on credit caps and bank reserve ratios in addition to indicative M2, fundraising and banking-system credit targets. Monetary instruments include the aforementioned bank reserve ratios, the open-market operations introduced in 2000 to control liquidity and monetary supply, and artificially set lending and deposit rates by the People's Bank of China (He and Wang, 2011, p. 10). That is, China's rates system consists of a dual-track interest-rate system in which bank deposit interest rates and lending interest rates are regulated while rates for China's money markets and bond markets are market-determined. Bank deposit as well as bank lending rates are set as deposit-rate ceiling and as a lending-rate floor in order to control competition between banks which use the deposit and lending rate as competitive differentiators. Set lending and deposit rates also ensure a profitable, easier to control formal banking sector. Nonetheless, due to the fact that overall credit and loan supply is also controlled by the Peoples Bank of China, lending rate floors are factually non-binding, as pointed out by He and Wang (2011, pp. 7-10). The rate dual-track system is a market intervening practice, which is considered to be part of the transitioning process of China's banking system, coherent and in harmony with China's general economic transitioning process (He, Wang, 2011, p. 7ff).

Generally, China has made significant progress in liberalizing its financial markets, including monetary freedom governance, since the early 1990s. China's strategy to liberalize capital and monetary markets consists of a multi-step approach which includes the liberalization of, firstly, money and bond markets and, secondly, the deposit and lending sector (He and Wang, 2011, p. 35). This has been achieved to the extent that retail customers, firms and institutions were relatively free in 2008 compared to the early 1990s in choosing their financial institutions, which in return have now higher latitude to extend credit.

Nonetheless, restrictions in rates, lending control mechanisms, regularly imposed changes in reserve requirements, as well as fixed foreign currency rates weigh on China's degree of monetary freedom. To improve China's final household consumption, the government accepted the risks of a short-term money driven overheating economy measured by high M2 to GDP growth rates since the mid-1990s and relatively high M2 to GDP levels since 2001, which also might explain the deterioration of its formerly improving monetary freedom governance index, from 87.56 points in 2001 to 70.60 points in 2009.

3.4.2.3.7 Investment Freedom

Figure 3.20: EFI Investment Freedom



Data Source: Heritage Foundation (2009) and Heritage Foundation (2010). Figure created and arranged by the author.

The EFI investment freedom indexes for Brazil and China display relatively rigid developments. Brazil’s index follows the 50-point line, dropping from 50 to 45 points in 2009. China’s index drops from initially 50 points to 30 points in 2000 and then falls to 20 points in 2009.

BRAZIL

A key legal accomplishment in support of Brazilian foreign direct investments was the amendment to the 1988 Federal Constitution that removed investment restrictions in certain industries, such as oil, mining, and local gas services. The amendment also revoked provisions that distinguished between the definition of a Brazilian company and a Brazilian company of national capital.[52] However, Brazil’s 50 point score since 1996, and 45 points in 2009, recognize the still relatively regulated investment environment. Restrictions persist in industries such as nuclear energy, health services, media, and aerospace. In general, the investment bureaucracy is not transparent, complex, and filled with administrative layers, including corruption as an additional detriment.

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[52] A Brazilian company of national capital is a firm controlled by Brazilian public entities or persons permanently residing or domiciled in Brazil (Tozzini et al, 2002).

CHINA

China’s investment regime is also heavily burdened by regulatory requirements. Whereas in Brazil investment restrictions tend to have an administrative character, investors in China are confronted with a severe lack of regulatory transparency, ever changing regulatory rules, inconsistently enforced laws and regulations, fragile protections of intellectual property rights, and investment share limits in the context of establishing domestic companies. Corruption and protective policies for local firms represent significant legal contract risks. China’s foreign investment catalog specifies the industries that are eligible or restricted from foreign investment. Furthermore, foreign investors face restrictions and limitations on expatriating their profits or cash to holding companies outside China.[53]

The rigidity of the EFI investment freedom indexes for both Brazil and China mean these data have limited applicability for the correlation and causality analysis in Chapter 4 due to its relatively static data series.

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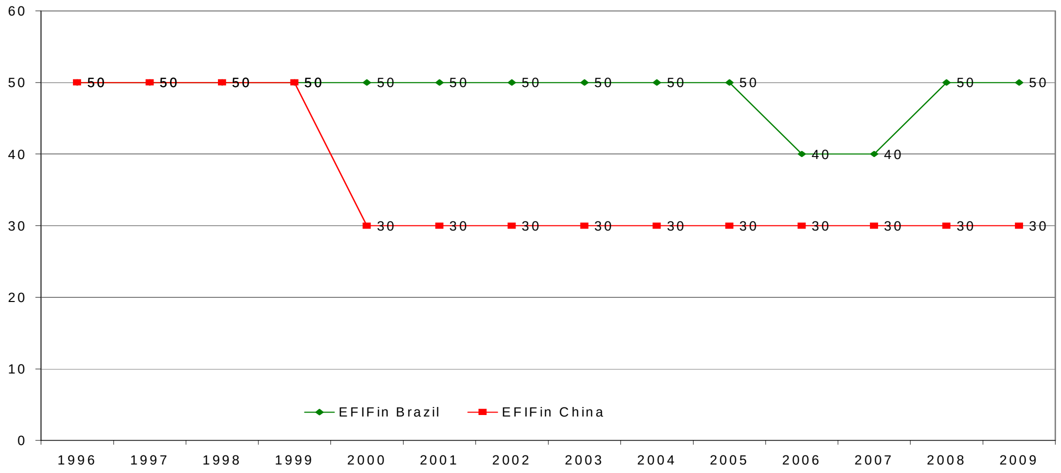
[53] This assessment is based on the author's first-hand experience in the context of distressed debt and debt to equity swap transactions at investment firms in Hong Kong with acquisition target companies domiciled in Singapore and subsidiaries across APAC, including mainland China (Guangdong and Shenzen).

3.4.2.3.8 Financial Freedom

Brazil’s and China’s EFI financial freedom indexes describe straight lines at the 50 mark for Brazil, with the exception of a drop to 40 points in 2006 and 2007, and at the 50 and the 30 mark (since 2000) for China.

Figure 3.21: EFI Financial Freedom



Data Source: Heritage Foundation (2009) and Heritage Foundation (2010). Figure created and arranged by the author.

BRAZIL

High interest rates and the disappearance of inflation meant that loan losses for banks rose from 7% to 21% from 1993 to 1995 (Baer, 2008, p. 145). To fight the crisis, Brazil's government introduced several measures, including the Credit Guarantee Fund, which encouraged mergers & acquisitions in the banking sector to reduce state involvement and to strengthen market-based practices. Since the mid-1990s, Brazil’s banking sector and capital markets have developed well, characterized by a fairly high degree of diversification and competitiveness compared with other economies in Latin America. Local currency bond markets are deep and wide and relatively liquid. Brazil’s financial markets are internationally competitive and compatible with international standards, such as enforceability of collateral in public and private debt capital markets. The system of banking supervision is efficient, and bank internal risk rating engines and risk reporting systems are effective and efficient. Capital to assets ratios have developed with relative stability, between 9% in 2001 and 10% in 2008. The nonperforming loans to total gross loans ratio was 8.5% in 2000, then declined to 3.1% in 2008. In contrast to FDI, capital markets are fully accessible to all classes of domestic and foreign capital. The financial sector is sophisticated, and systemic risk is low. Brazil’s four largest banks (Itau Unibanco, Santander Brazil, Banco De Brazil, and Banco Bradesco) accounted for more than 30% of total bank assets in the fourth quarter of 2010, with Tier I ratios of 15.7%, 23.4%, 14.3%, and 15.9%, respectively.[54]

Although access to banking products and services for the poor has increased in recent years, small business owners still have limited opportunities for accessing finance options. Furthermore, real interest rates (Variable 63: RealIR) in Brazil are among the highest in the world: 38.0% in 2009, down from 78.8% in 1998, impeding access to credit for investment and curtailing small business endeavors. Thus, financial freedom marks for Brazil remain relatively low.

CHINA

The banking and financial systems prior to the 1990s were remarkably passive. Lending decisions were made mainly on the basis of political considerations. Large retail networks of state-owned banks and rural credit cooperatives provided the only credit opportunities; medium- to long-term loans or term notes were not part of lending practices. Lending prior to the 1990s was primarily shaped by short to medium term trade credit. China’s banking industry thus displayed a relatively low degree of market-based commercial lending expertise, which may explain the high nonperforming loan ratios in the subsequent years during the transition to a more market-based economy.

Bail Outs and Nonperforming Loans Ratio

Financial and banking markets underwent heavy restructuring in the second half of the 1990s when the government established the People’s Bank of China (PBC) as a central bank, succeeded by the China Bank Regulatory Commission in 2003. The banking reform also included the establishment of nine regional branches of the PBC, in conjunction with its mandate of deploying monetary policy, which ultimately translated into more conservative lending practices for state-owned companies (Naughton, 2007, p. 103). Financial supervision gained traction through the creation of four asset management companies, which inherited nonperforming assets from the state-owned banks. Today, China displays all the pillars of a modern financial system, with the PBC

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[54] Total market capitalization of these four banks was USD304.7 billion in October 2010, with Itau Unibanco at USD113.9 billion, Santander Brazil at USD55.1 billion, Banco Do Brazil at USD56.8 billion, and Bradesco at USD78.9 billion (Citigroup, 2010, pp. 1-7).

setting the monetary policy and providing credit to commercial banks. Nonetheless, the banking market remains dominated by the big four state-owned commercial banks: Industrial and Commercial Bank of China (ICBC), Agricultural Bank of China (ABC), China Construction Bank (CCB), and Bank of China (BOC). In practice, political influence on banking markets in mainland China is still prevalent.

In the wake of the transition in the late 1990s, tighter lending standards became common practice leading to the closure of many SOEs. By the end of 2002, the nonperforming loan ratio (NPL ratio) reached 40% (or RMB2.3 trillion) of all loans in the banking system, or approximately 19% of GDP (Naughton, 2007, p. 461). By 2005, 15% of all loans in the banking system were NPL, equal to 6.7% of GDP (RMB1.2 trillion). In an unprecedented rescue effort, the government issued bonds valued at RMB270 billion to alleviate the pressure on the big four after decades of ill-guided, politically motivated lending (Naughton, 2007, p. 462). Distressed loans of up to RMB1.4 trillion were carved out and contained in special purpose vehicles; asset management companies (AMC) were created quickly to manage the distressed and toxic portfolios. Debt-to-equity swaps on distressed loans required additional government cash infusions to recapitalize the big four, after which equity ratios started to rise.

A second government-supported rescue effort in 2003 granted BOC and CCB additional cash injections of RMB373 billion (USD45 billion) after their significant write-offs of additional NPLs. Employee and branch reduction measures helped to stabilize the BOC and the CCB. Five years later in 2008, ABC received —for the first time— RMB158 billion (USD19 billion) from the government to stabilize and restructure its balance sheet.

The creation of the AMCs, which acquired NPLs at face value, were an important financial innovation in China’s finance sector, promoting structured transactions such as debt-to-equity swaps and allowing for deeper and wider capital market developments, as well as promoting distressed debt expertise, which should have benefited lending practices in the long run. The emergence of AMCs thus is —unintentionally— an integral part of the reformation of the banking system, which has displayed a more independent and profit-oriented lending governance since the end of the 1990s.

Narrow Capital Markets

In comparison to Brazil, China's capital markets are tightly controlled by the government, as reflected by China's 30-point financial freedom index. China's stock exchange system is relatively restrictive, consisting of A-shares, B-shares, H-shares, and Red-chip segments. The A- and B-shares are mainly denominated in RMB and traded at the Shanghai and Shenzhen (onshore) exchanges by local and selected international investors. H-shares and Red-chips instead are open to international investors and traded at the Hong Kong stock exchange (offshore). Red-chips represent companies headquartered in Hong Kong that operate in mainland China. H-shares instead are mainland Chinese firms that have obtained a license to list on the Hong Kong stock exchange. Due to their restrictive natures, the A- and B-share segments are far less liquid than the H- or Red-shares.

Mainland bond markets work mainly with local currency, are narrow and relatively illiquid compared to bond markets in London and New York and are largely restricted to foreign investors. Equity markets have developed and gained depth, especially since the establishment of the exchanges in Shanghai and Shenzen. However, China's structured debt markets and structured equity markets remain in their infancy in terms of complexity and are nowhere near the complexity of the markets in London or New York. Club deals, project financing, international trading, and structured transactions in debt markets continue to be sourced and marketed mainly through international banks in Hong Kong or Singapore due to the lack of structuring knowledge, legal and collateral enforceability risks in mainland China. Therefore, the Chinese capital markets will likely remain Hong Kong–centric in the medium- to long-term.[55]

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[55] The market value of bonds listed in Shanghai was at USD720 billion in 2010, USD267 billion in 2009, USD263 billion in 2008, and USD246 billion in 2007. In comparison, the bond market size in Hong Kong was at USD62.8 billion, USD50.5 billion, USD53.4 billion, and USD54.9 billion respectively. In comparison, Bovespa's market value of listed bonds was USD81.4 billion, USD74.8 billion, USD55.3 billion, and USD65.5 billion during the same periods (World Federation of Exchanges 2011c). In contrast, equity market capitalization of Bovespa was at USD465 billion as of December 2008, dropping from USD1.1 trillion as of June 2008 due to the global financial crisis (BMF Bovespa, 2011). In December 2009 and 2010, Bovespa's equity market capitalization stood at USD1.33 trillion and USD1.54 trillion. Shanghai's exchange (SSE) equity market capitalization was at USD1.4 trillion, USD2.7 trillion, and USD2.72 trillion in December 2008, 2009, and 2010, respectively. The Hang Seng's equity market capitalization was at USD1.3 trillion, USD2.3 trillion, and USD2.7 trillion during the same periods, respectively; and just for relative comparison purposes: NYSE's market capitalization stood at USD9.2 trillion, USD11.8 trillion, and USD13.4 trillion in December 2008, 2009, and 2010 (World Federation of Exchanges, 2011c).

Restrictive Bank Lending

Four of the six largest banks in China are government held. Privatization in the banking and financial sectors is not highly developed. The vast majority of non-bank financial institutions, such as life insurance, investment firms, and securities companies are also state-owned or controlled and managed by local governments. Generally, the banking system remains dominated by state banks, and the state-controlled banks have a bias against lending to private firms. As a result, private firms have to resort to saving or borrowing on the black market at very high interest rates. Credit supply is controlled by the government and primarily channeled to government-owned enterprises.

Risk Management

Risk management and internal controls in Chinese banks remain weak, as reflected by the low capital to assets ratios and large ratio of nonperforming loans to gross loans in recent years. Despite improvements observed by the end of the 1990s, risk management and internal controls in Chinese banks are also still soft. The capital to assets ratio improved slowly, from 3.8% in 2003 to 6.1% in 2008. Nonperforming loans to gross loans was estimated at a 50% peak. In 2000, this value fell to 22.4%, but climbed back to 29.8% in 2001. Since then, the ratio has improved to 20.4% in 2003, rising to 24% in 2008, according to the latest World Bank data. According to calculations from Garcia-Herrero, Gavila, and Santabarbara (2006, p. 309, pp. 357-360) the nonperforming loan amount in the Chinese financial system accumulated up to USD480bio in 2004, with many more NPL USD billions recorded between 2004 and 2008. The restructuring plan for the Industrial Commercial Bank of China (ICBC) in early 2005 alone demanded a financial support package from the government worth more than USD80 billion (Podpiera, 2006, pp. 7, 8-9). According to Podpiera (2006, p. 11) the NPL amount between 2000 and 2004 tops USD 615billion[56] (RMB 4.8trillion), even exceeding the estimates by Garcia-Herrero et al.

Also, since joining the WTO, China has gradually removed market access restrictions for foreign banks, although they still account for no more than 2% of total bank assets. Until the end of 2010, China’s equity markets were accessible to only a very small group of selected foreign investors. In January 2011, China announced it

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[56] Based on the foreign exchange rate of RMB/USD 7.8075 as of December, 2006.

would gradually liberalize equity markets in Shanghai and Shenzhen to allow foreign investor participation.[57]

In conclusion, the Chinese government seeks to reduce local governmental involvement and improve accountability by adopting provisioning and capital requirements. The Banking Regulatory Commission is responsible for enforcing these measures, though Podpiera’s (2006, pp. 3-10, pp. 18-20) analysis of the period from 1997 to 2004 is inconclusive about whether state-owned banks have significantly altered their credit risk pricing and adopted more selective and risk-averse lending practices. It appears that, despite their significant loan losses, state-owned banks continue to be driven mainly by funds availability instead of risk-and-reward practices. In conjunction with recapitalizing banks and implementing administrative controls to reduce investments in overheated sectors, the government is preparing state-owned banks for public listing. The Chinese Banking and Regulatory Commission are moving the sector toward international principles and market practices, though the rate of change is slow. Fundamental changes in the Chinese banking sector with respect to the behavior of state-owned banks will take time, even after major high-level reforms such as capital requirements and provisioning have been implemented.

A sound financial freedom framework consists of various pillars. Institutionalized rules, policies, and requirements, such as capital and reserve requirements as well as independent regulatory organs and competitive markets, are utter necessities to achieve a high degree of financial freedom. In financial markets, the development of a high degree of financial freedom is a long, evolutionary process that requires considerable political and regulatory efforts. The rigid and static EFI financial freedom indexes for both, Brazil and China, conveys the complexity of creating a sound financial freedom framework. Thus, the financial freedom index offers limited insights for the econometric analysis in Chapters 4 and 5.

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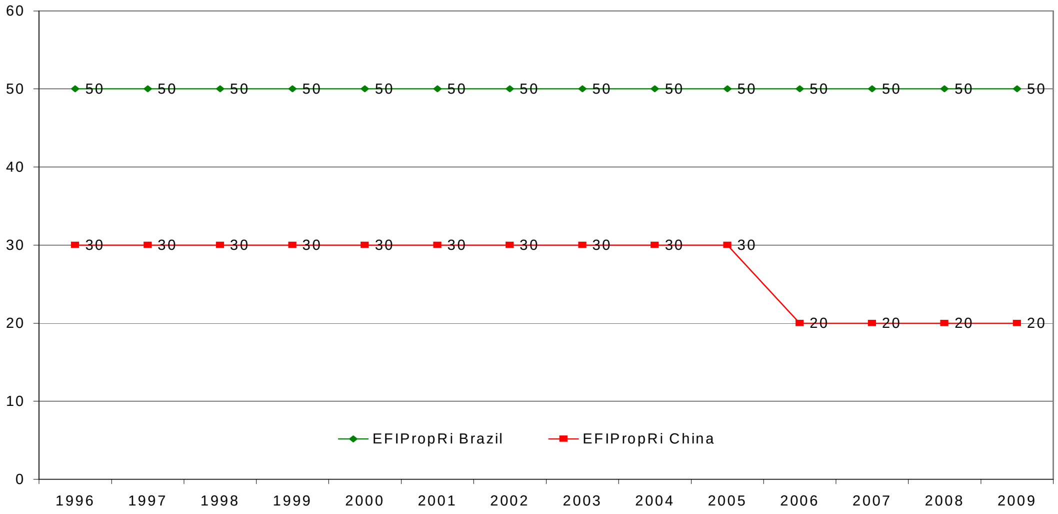
[57] The announced access to mainland stock markets may be a supportive measure for RMB appreciation, which may have a positive effect on import volume and value and ultimately potentially supporting domestic consumption —a declared target of the 12th Five-Year Plan for 2011-2015.

3.4.2.3.9 Property Rights

Figure 3.22: EFI Property Rights



Data Source: Heritage Foundation (2009), (2010). Figure created and arranged by the author.

The development of a dependable and sound regime of property rights is an evolutionary process that demands considerable political determination, regulatory resolve, and a firm judicial framework. Similar to the financial freedom and investment freedom indexes, the EFI property rights index indicates overall soundness from a holistic perspective rather than displaying single milestone achievements, which generally do not significantly change the overall status quo. The rigid and static property rights indexes for both Brazil and China thus offer limited usage for the correlation and causality analysis in Chapter 4. The EFI property rights indexes for Brazil and China are stable at 50 points and 30 to 20 points, respectively, indicating relatively inefficient and weak property rights, which are subject to political arbitrariness, at least for China.

BRAZIL

Property rights governance has seen meaningful developments since the beginning of the 1990s. Prior to 1990, Brazilian SOEs dominated nearly all economic sectors. The Collor Plan, named after Brazil's first democratically elected President (1990 to 1992) after a long line of military rulers, aimed at fighting hyperinflation.[58] To

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[58] The Collor Plan encompassed a myriad of economic reforms and stabilization measures to fight hyperinflation and the deteriorating economic landscape. The reforms included indexation of taxes, temporary wage freezes, deposit freezes for more than a year, and gradual market opening to attract

do so the plan initiated meaningful privatization momentum, leading to equity transfers to private investors of more than USD70 billion along with USD17 billion in debt, representing one of the largest privatization programs ever. This moment was the peak of the Brazilian privatization process, which halted after President Itamar Franco took office subsequent to Collor’s corruption-related impeachment. Under Cardoso’s presidency (1995–2002), the government introduced a comprehensive privatization process in line with several constitutional amendments. State monopolies in key sectors, such as mining, energy, or steel, were abolished. Formerly state-owned firms such as the National Steel Company CSN, the mining company Companhia Vale do Rio Doce, or the oil company Petróleo Brazileiro (Petrobras) were radically privatized. Thus, privatization is well established. Enforcement of property rights is advanced in many areas, such as mining, transport, banking, and telecommunications, due to the legislative framework assigned to newly established authorities that enjoy technical, financial, and administrative autonomy. Generally, property rights are well defined, and property acquisition is in theory regulated (BTI, 2008b, p. 13).

However, in practice Brazilian property rights continue to lack resources because the judicial system is so overburdened. Binding judgments by the Supreme Federal Tribunal for the protection of intellectual property have neither deteriorated nor improved noticeably in recent years. President Lula also did not maintain the momentum for implementing the privatization policies supported by his predecessors. The Lula administration rather favored an active state role in managing both economic growth and social justice (BTI, 2008b, p. 13). Instead of further sales of public assets, the Lula administration shifted the government position on privatization by establishing laws to regulate public–private partnerships in the hope of attracting private investors to support public infrastructure capital expenditures.

CHINA

China’s long-running communist culture has shaped its private property rights. Attempts to initiate a framework of private property rights in 2002 included the introduction of a bill related to the creation, transfer, and ownership of land in order to strengthen the property rights of citizens. After multiple modifications, the bill was

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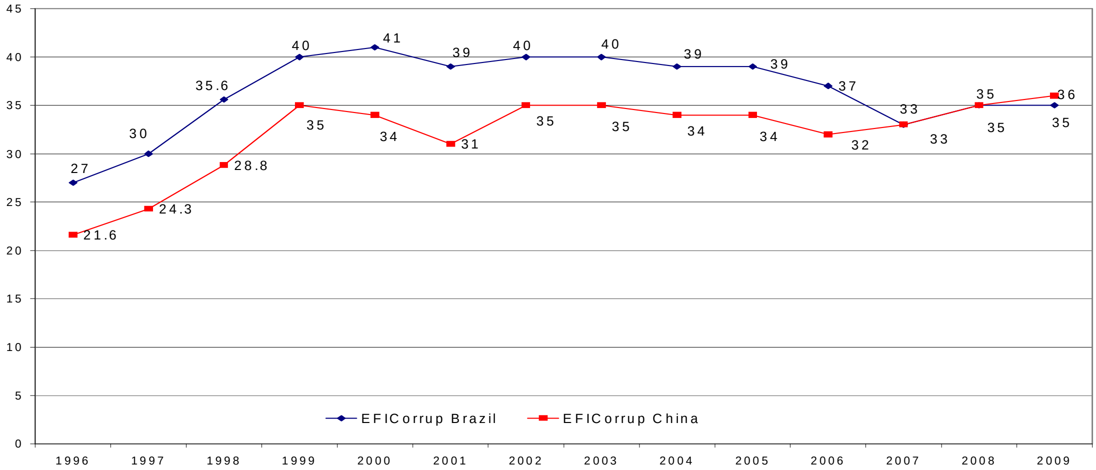
foreign investors in combination with the privatization of government-owned industries (Baer, 2008, pp. 121-123).

finally ratified in 2007 after years of raging disputes regarding the constitutional conflicts of interest between the socialist character of the PRC and the private property rights of citizens. The bill marries three types of property: private, collective, and state property. Thus, it attempts to align a traditionally socialist culture with the dynamics of the new economic system in China. The EFI property rights index of China persists at its consistently low levels though, even dropping from 30 to 20 points in 2006 due to an increasingly weak judicial system, and the unenforceability of property rights. Chinese citizens still cannot legally own land. Instead, they acquire property- and land-use rights (see Articles 39–44 of the Property Rights Law of the PRC, Lehman, Lee, and Xu, 2011). Despite the 2007 bill, China’s property law stipulates that state authorities may expropriate holdings if it is in the state’s interest. In practice, this caveat translates into frequent violations of property rights when corrupt, negligent, or ignorant local authorities take property for development ventures.

3.4.2.3.10 Freedom from Corruption

Figure 3.23: EFI Freedom from Corruption



Data Source: Heritage Foundation (2009), (2010). Figure created and arranged by the author.

BRAZIL

The Transparency International Corruption Perception index resembles the development of the WGICC, which is a composite index also incorporating the corruption perception index by Transparency International (2011). The EFI freedom from corruption index improved until 2000, and deteriorated significantly since 2005.

The index started at 27 points in 1996 and improved to 41 points in 2001. But in 2005/2006 bribery scandals dominated the public and political agendas in Brazil for more than a year, with severe negative effects on the corruption index. The Workers Party had to endure multiple defeats in Congress before Lula managed to recover electoral support and win the election in October 2006. Nevertheless, Brazil's freedom from corruption index remains very low indicating that corruption in Brazil still is substantial.

For comparison purposes, the Transparency International (2011) Corruption Perception index for Brazil was 2.96 in 1996, improving to 3.5 and 3.6 in 2008 and 2009.

CHINA

In the early years of the establishment of the PRC, from 1949 to 1966, China effectively contained the spread of corruption. Social awareness was high, with strong ethical restrictions and severe punishment by anti-corruption agencies and systems. During the Cultural Revolution (1966–1978) corruption was a means of getting by in a paralyzed state. Then, in the reconstruction phase starting in 1978 and in the industrial revolution that began in 1992, corruption remained high despite increasing education, prevention, and punishment efforts. During its transition from a planned economic system to a market economy, with the related macroeconomic transitions, corruption in China gained momentum and climbed to damaging levels in the mid-1990s.

EFI's freedom from corruption index for China still improved from 1996 to 1999, from the low 20s to 35 points, out of recognition of government efforts to fight backdoor dealing, misappropriation, and embezzlement of state-owned assets. Since 2006, the index has climbed again, in response to domestic campaigns to eradicate corruption through reforms and severe punishments, including death sentences. Even in this climate, the lack of independent investigative bodies remains a key facilitator of corruption. Thus, China's freedom from corruption index remains low compared with the levels in Asian and European democracies, such as Japan, South Korea, or Germany, which scored 75, 51, and 78 points on this index in 2009. Transparency International's Corruption Perception index for China was 2.43 in 1996 but improved to 3.6 by 2008 and maintained this level for 2009.

3.5 Conclusion

In this chapter I have introduced the data, data sources, and methodology for the dependent and independent variables that will provide the input for the empirical and econometric analysis in Chapter 4.

The dependent variables for Brazil and China include 79 identical macroeconomic variables from the World Bank Data catalog, covering topics such as economic policy & debt, private sector & trade, financial sector, environment, infrastructure, international merchandise indexes, and labor and social protection. These macroeconomic variables are displayed as share percentages (e.g., trade to GDP), change rates (e.g., GDP change rates), or indexes (e.g., trade indexes).

The independent variables refer to two sets: (1) commodity price indexes from UNCTAD and (2) governance indexes provided by (2a) The World Bank (governance index (Worldwide Governance Project)), and (2b) The Heritage Foundation (economic freedom index). The worldwide governance indexes (WGI) cover six governance dimensions, the economic freedom indexes by the Heritage Foundation cover nine. All data series are considered to be metric.

The correlation and Granger causality analysis of the six commodity price indexes in Section 3.3.3 (Commodity Price Indexes) identify the correlation groups that will be subjected to the principal component analysis in Chapter 4.

I also performed various correlation and Granger causality analyses of the six commodity price indexes and world GDP per capita as well as on China’s GDP per capita measure to identify any significant relationships and associations across measures. For example, I illustrated that almost all commodity price indexes are highly inter-correlated (sig 0.05 to 0.01). Specifically, CrudeIx and MinMetalsIx are very highly correlated (sig 0.01), and CrudeIx Granger causes MinMetalsIx. In addition, I found that the correlation among all commodity price indexes rose for the period of 1996 to 2008 compared to the period of 1971 to 2009. Furthermore, I have illustrated that world GDP per capita Granger causes commodity price indexes between 1971 and 2009 as well as between 1996 and 2008. When looking at and analyzing the period between 1971 and 2009, China shows no impact on global commodity price indexes. However, as I will show in Chapter 4 and 5, this picture changes when shortening the analysis period to 1996-2008.

Section 3.4 (Independent Variables Set 2: Governance Indexes) offers a qualitative and quantitative comparative analysis of Brazil’s and China’s governance dimensions, measured by the worldwide governance index (WGI) and the economic freedom index (EFI). The WGI framework reveals that Brazil improved its governance in all dimensions except regulatory quality and rule of law. Specifically, Brazil made great strides in improving its democracy governance, measured by the voice and accountability index, which rose from 0.018 to 0.51 from 1996 to 2009. In comparison, China’s democracy index developed relatively flatly and at very low levels, from -1.66 to -1.65, during the same period. For China, I note that all WGI indexes deteriorated except government effectiveness, which improved slightly from 0.04 to 0.12 during this period.

In terms of the economic freedom indexes, trade, monetary, and corruption governance improved for both Brazil and China. Monetary governance developed favorably from 1996 to 2009, as expressed by the rise of the EFI monetary governance index from 70.0 to 75.8 and from 62.7 to 70.6 for Brazil and China, respectively. Similarly, EFI’s corruption index improved for Brazil and China, rising from 27.0 to 35.0 and 21.6 to 36.0, respectively. The governance dimension with the largest improvement is trade governance, which rose dramatically from 57.0 to 69.2 for Brazil and from 30.0 to 72.2 for China between 1996 and 2009. As I will show in Chapter 4, trade governance represents a key governance dimension on both absolute and relative basis for the Brazilian and Chinese economy, affecting a vast number of macroeconomic variables.

4 Empirical and Econometric Analysis

4.1 Introduction

Overview

The following econometric analysis in which commodity prices and governance indexes serve as independent —exogenous— variables is the core of this study. As introduced in Chapter 3, macroeconomic variables are the dependent variables.

Main purpose of the econometric analysis is the following: First, the econometric analysis provides the means and the tools of testing the effects of governance and commodity prices on macroeconomic data. Secondly, the econometric analysis provides a comparative analysis of the macroeconomic effects of governance and commodity prices on China and Brazil and allows drawing a comparative conclusion. I am interested in examining the interdependencies between the macroeconomic measures and the two sets of independent variables represented by (1) commodities price indexes and (2) governance indexes.

Economics literature features Granger causal analyses of commodity prices and their effects on specific macroeconomic variables such as GDP or inflation. A wide array of studies identifies independent and dependent variables from a set of macroeconomic variables using correlation, Granger causality and regression methods to evaluate macroeconomic effects. However, it appears that so far no study has comparatively analyzed the effects of commodity price indexes and governance indexes on a wide range of macroeconomic variables of developing economies such as Brazil and China. This study intends to fill this gap.

Null Hypothesis H_0

Before performing multiple regression analyses, I undertook statistical diagnostic tests to validate correlation pairs and Granger causality pairs in order to examine statistical significance and usefulness of each independent and dependent variable. Unit root tests, Granger causality tests, and principal component tests are typically part of statistical diagnostic tests in academic research papers. In most statistical research papers the level of statistical significance required to reject the null hypothesis —that is, to obtain a statistically significant result— is set at 0.05 (5%) or 0.01 (1%) (Rubinfeld, 2000, pp. 430-431). The significance level (p-value) measures the probability that the null hypothesis H_0 (or H_0, or null) will be rejected incorrectly, provided H_0 is true. Generally, the lower the percentage required for statistical significance, the more problematic it is to reject H_0. The lower the observed p-value, the lower is the probability of an improper rejection of H_0. Technically speaking, the p-value is the probability of error associated with wrongly rejecting H_0, which may for example state that no correlation relationship exists between the independent and dependent variables. The lower the p-value, the higher is the probability of rightly rejecting the null hypothesis. A smaller p-value indicates a more significant correlation or causality between the independent and the dependent variables. The 5% p-value criterion is the main threshold. However, I also use the 0.01 p-value criterion to identify confidence levels at the 99% level in order to point to very strong relationship patterns.

To establish a relationship with strong association evidence I use two-tailed correlation tests; one-tailed tests produce p-values that are half the p-value of two-tailed tests. The selection of a one-tailed test makes it easier to reject a null hypothesis, whereas a two-tailed test makes a null hypothesis rejection less likely.

Establishing the null hypotheses is an essential part of the statistical diagnostic tests in this study.[59] To formulate a null hypothesis it is necessary to establish a specific proposition as a base argument. The null hypothesis can be simplified as two opposing statements: a null hypothesis denoted H_0 and an alternative hypothesis denoted H_1. The null hypothesis H_0 takes special consideration and relates to statements being tested; the alternative hypothesis H_1 relates to the statement to be accepted if the null hypothesis is rejected. The ultimate conclusion of the hypothesis tests is always given in terms of the null hypothesis: one either rejects H_0 in favor of H_1, or one does not reject H_0. The conclusion not to reject H_0 does not necessarily indicate that the null hypothesis is true; it suggests only that there is not sufficient evidence against H_0 in favor of H_1. Rejecting H_0 in turn suggests that H_1 may be accepted.

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[59] The vast majority of empirical research papers I found deployed common statistical diagnostic tests including unit root tests, co-integration tests, or Granger causality tests, depending on the objective of the research. A few of the authors of these studies are mentioned here: Olomola (2006, pp. 28-34), Aliyu (2009, pp. 13-16), Sjuib (2009, pp. 91-96), Labys and Maizels (1990, pp. 8-18), Kwon (2007, pp. 106-113). My research framework incorporates a 4-level diagnostic framework including unit root tests, correlation tests, Granger causality tests, and principal component analysis before proceeding to regression analysis.

Hypothesis testing also involves the recognition that there is an assured low probability (p-value) of wrongly rejecting the null hypothesis (Type I error).[60] To prevent making false decisions and to protect H_0, the value of the significance level should be fairly low. Therefore, as previously stated, the threshold significance level I chose must not be larger than 5% (or 0.05).

Variables Standardization

The underlying data sets in this thesis have not gone through standardization or normalization processes for several reasons: The data series used are metric in nature, and the underlying data set is nonparametric. Generally, nonparametric procedures offer good ease of use and avoid relying on estimations of parameters, such as the mean or standard deviation, to describe the distribution of the variable of interest in the data set.[61] By relieving this requirement for parameters the underlying variables become more applicable for a larger variety of tests, none of which necessitate the mean, sample size, standard deviation, or estimation of other related parameters when none of that information is available.

Structure of Chapter 4

The econometric analysis consists of four statistical diagnostic levels which are instrumental in selecting statistically significant pairs of dependent and independent variables before considering them for the multiple regression analysis in Section 4.3. The statistical diagnostic tests introduced next are based on the theory of hypothesis testing as just described. The diagnostic tests are necessary validation tests preceding multiple regression analysis and include unit root tests, correlation and Granger causality tests, and principal component analysis (multicollinearity) (Oxford Journals, 2009a, p. 46).

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[60] A type I error occurs when the null hypothesis is rejected although it is actually true, i.e. when H_0 is wrongly rejected. A type II error occurs when the null hypothesis H_0 is not rejected although it is actually false, that is H_0 is wrongly accepted. A Type I error, which is inversely related to a Type II error, is generally considered more serious and thus more important to avoid than a Type II error.

[61] Nonparametric techniques are also called parameter- or distribution-free methods.

Unit Root Analysis

The Pearson correlation and Granger causality tests in Sections 4.2.2 and 4.2.3 are preceded by tests for the presence of unit root in each of the independent and dependent variables for both Brazil and China. The statistical diagnostic tests in Section 4.2 begin with the Dickey-Fuller unit root test, in which I analyze the stability of each independent and each dependent variable. The multiple regression analysis (Section 4.3) requires that all data series are stationary in nature. However, many economic time-series are non-stationary processes. The usual approach to address this problem is to take the difference in the series. A time-series that can be made stationary by differencing has no unit root. The unit root test has been performed with SAS.

Correlation Analysis

The correlation analysis quantifies the degree of association between the dependent variable and one or more independent variables. Correlation analysis methods assume that for any set of values in a given set of conditions, variation in each variable is random and follows a normal distribution pattern. Performing correlation analysis on dependent and independent variables generates a correlation coefficient (r), reflected as adjusted R-square (or adjusted R^2) in the regression analysis. The adjusted R^2 of this statistical parameter describes the proportion of the variation in the dependent variable that is associated with the variation in the independent variable in the regression model.[62] Convention in this thesis is that an adjusted R^2 of at least 0.80 is considered evidence of strong goodness of fit for regression models. Also, in this thesis, correlation coefficients above 0.50 but lower than 0.70 represent moderate correlation, those above 0.70 and below 0.90 represent high correlation, and coefficients above 0.90 represent very high correlation. That is,

Moderate correlation: $.50 \leq r_i < .70$,
High correlation: $.70 \leq r_i < .90$, and
Very high correlation: $.90 \leq r_i \leq 1.0$, for $i = 1,\ldots, n$.[63]

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[62] In comparison to R-square, adjusted R-square is an adjustment of R-square that considers the number of independent variables in a model. The adjusted R-square —unlike R-square— improves only if the new term improves the model more than would be expected by chance.

[63] For multi regression purposes I analyse the correlation coefficients of 21 independent variables with 79 dependent variables (1,659 correlation coefficients), and 1,659 × 2 Granger causality tests (Granger 1 causality test and Granger 2 (inverse) causality test).

Section 4.2.2 (Correlation Analysis) unveils significant correlation pairs between independent and dependent variables of Brazil and China. Correlation pairs with a confidence level equal to or greater than 95% are statistically significant and selected to proceed to the next stage of statistical diagnostic tests, as represented by the Granger causality evaluation in Section 4.2.3. The selection criterion of the relevant correlation pairs in Section 4.2.2 is quantitative and not yet based on economic judgment or economic rationale. The interpretation of the economic relationship pairs and independent and dependent variables is being given in Chapter 5.

The stepwise progression of the correlation analysis for both Brazil and China in this section is as follows: First, I differentiate between positive and negative correlation pairs as examined in the correlation matrix. In a second step I examine the number of significant correlation events (counts) between dependent variables and independent variables of the commodity price index set, the WGI index set, and the EFI index set. Following the correlation count examination I identify non-significant correlation pairs between dependent variables and independent variables in order to exclude them from progression into the multiple regression analysis. Significant positive correlations are marked in green, and significant negative correlations are marked in yellow throughout this thesis, specifically in the correlation matrixes in Section 4.2.2, the Granger causality matrixes in Section 4.2.3 and the multiple regression matrixes in Section 4.3 for Brazil and China, respectively.

The study uses PASW Statistics for correlation calculation, with a focus primarily on positive correlation pairs, except for ten specified macroeconomic variables on which I also perform correlation analysis. Correlation analysis is a prerequisite for causality analysis, which examines the direction of interdependence —if any— between a dependent and an independent variable.

Causality Analysis

The causality analysis is based on the concept of Granger Causality. Granger causality analysis in Section 4.2.3 examines the direction of interdependence —if any— between a dependent and independent variable and represents the third statistical diagnostic test in the thesis. Granger causality analysis suggests an operational definition such that in a time-series the independent variable causes the dependent variable provided that the probability of the dependent variable is conditional on its own past history and the past history of the independent variable and not conditional on the dependent variable's history alone.

Granger causality testing is an integral part in macroeconomic research and has been used to reveal the possibility that an independent variable controls a dependent variable to influence a third one (efficient cause), especially in a time-series approach. Nonetheless, because Granger causality testing is based on incremental predictability rather than an efficient cause it cannot fully reflect causal interdependence between two variables. In this context, it is difficult to differentiate between a causal relationship based on incremental predictability and empirical regularities, which remains an open issue in the development of econometric studies (Kwon, 2007, pp. 5-10).

Granger causality testing is an important tool to select significant relationships between independent and dependent variables, which establishes the base for further quantitative analysis through regression analysis (Section 4.3). The confidence threshold for Granger causality tests I use is the 95% level. The tests are logical in sequence and explore the possibility of significant interdependence by exploring the possibility of a statistically significant relationship between independent and macroeconomic variables of Brazil and China, as well as the direction of the inferential relationships from the independent to the dependent variables and vice versa. In the discussion of Granger causal associations, I also selectively elaborate on inverse Granger causal relationships (i.e., negative Granger causality), in which one of the 79 macroeconomic variables causes or leads to changes in commodity prices or governance indicators. Inverse Granger causality is also part of the variable and relationship discussion in Chapter 5.

The stepwise sequence of the Granger causality analysis in this section for both Brazil and China is as follows: Firstly, I identify significant Granger causality and inverse Granger causality events as examined in the Granger causality matrix. In a second step, I examine the number of significant Granger causality and inverse Granger causality events (or associations) of dependent variables and independent variables of the commodity price index set, the WGI index set, and the EFI index set. Following the Granger causality event count examination I identify non-significant Granger causality pairs in order to exclude them from the multiple regression analysis. Significant Granger causality associations are marked in green, and significant inverse (negative) Granger causality associations are marked in yellow throughout this thesis, specifically in the Granger causality matrixes in Section 4.2.3, as well as in the multiple regression matrixes in Section 4.3.

Principal Component Analysis

Section 4.2.4 performs principal component analysis (PCA) for all independent variables in order to identify multicollinearity. This statistical occurrence in a multiple regression model indicates that more than one independent variable is highly correlated with at least one other independent variable. A high degree of multicollinearity may distort the results of the effect of a single independent variable in a regression model. A regression model with highly correlated independent variables may indicate the effect of the entire group of independent variables on a dependent variable, not the effect of one individual independent variable on any given dependent variable. In statistically significant multiple regression models, independent variables correlate highly with specific dependent variables but minimally with other nonspecific variables. Multiple regression models with these features are characterized as low noise and statistically robust. Multicollinearity does not actually distort the results, but it generates large standard errors in the respective independent variables.

The PCA in Section 4.2.4 groups independent variables together to obtain one common, newly generated independent variable that combines the highly correlated independent variables. The PCA grouping is based on the following main criteria:

(1) Correlation equal or above 69.9%, and

(2) A sensible economic categorization of governance indexes and commodity price indexes.

Throughout the entire thesis, I differentiate between the analysis of (i) change rate measures of independent index variables and change rate measures of macroeconomic variables, and (ii) index measures of independent variables and macroeconomic variables displayed in share percentages. Thus, in the PCA I also differentiate between independent variables sets with change rates and actual index levels. That means the PCA analysis is performed on each set of independent index variables and on change rates of each set of independent index variable.

Multiple Regression Analysis

Section 4.3 performs multiple regression analysis on independent and dependent variable pairs that were validated and successfully passed the statistical diagnostic tests in Section 4.2. In the regression analysis I seek to establish significant relationships between one of the 79 dependent variables and one or several independent variables of the commodity price and governance index sets.

Correlation and regression analyses are statistical techniques used extensively in various industry sectors, such as geology, finance, or marketing to examine causal relationships between variables and to reveal patterns in reserve estimates, price and metric moves, or consumer demand. In the regression analysis in Section 4.3, I measure the degree of fit in the relationship between the dependent variable and independent variables. The dependent variable should be a function of one or more independent variables. Their values are anticipated to be determined in a random, error-free manner.

Multiple regression analysis can predict the possible value of a dependent variable that corresponds to an independent variable. In this context I use adjusted R-square as a measure to identify of how well the regression equation fits the data. Convention in this study is that an adjusted R-square above 0.8 has a strong goodness of fit. The t-test associated with regression analysis also determines whether the independent variable (predictor variable) has significant predictive power on the dependent variable by measuring the proportion of variance explained. In this thesis a t-value greater than 2 is considered meaningful, suggesting strong explanatory power of the independent variable.

The sequence of the multi regression section is as follows: At first I establish the multi regression matrix based on the results of the correlation and the Granger causality examination of the previous sections. I differentiate between non-significant regression results and significant regression results, which are presented at the end of the multiple regression analysis section.

Empirical and Econometric Results

I offer key findings in light of significant correlation pairs, significant Granger causality associations, and regression results. These results are then being discussed in the context of empirical observations in Chapter 5. Chapter 5 thus represents the conclusion of the statistical analysis tests and offers a comparative interpretation of the econometric rational of the results of Chapter 4 on the selected macroeconomic variables for Brazil and China.

Econometric Software and Statistical Application Packages

Unit root tests, Granger causality tests, PCA, and multiple regression analyses throughout the thesis have been carried out with the SAS 9.1.3 Service Pack 4 XP_HOME Platform. A comprehensive overview of the SAS programming syntax and SAS output of Chapters 3, 4, and 5, can be found in the attached CD-ROM. The CD-ROM contains folders for Brazil and China with respective sub-folders for unit root tests, Granger causality tests, PCA, and multiple regression analyses. The diagnostic test files are separated by variables which are measured in percentage shares and by variables which are measured in changes rates. For reader friendliness, non-relevant SAS Output syntax (which comes automatically upon running certain diagnostic tests and regression analysis) is marked in gray letters.

The correlation analysis has been performed by PASW Statistics 18. All correlation analysis results associated with the econometric examinations in this thesis have been recorded and are presented in the correlation matrixes in Section 4.2.2 as well as specifically illustrated in Chapters 2, 3, 4, and 5.

4.2 Statistical Diagnostic Tests

4.2.1 Unit Root Analysis

4.2.1.1 Methodology and Hypothesis

The Pearson correlation and Granger causality tests in Sections 4.2.2 and 4.2.3 are preceded by tests for the presence of unit root for each of the independent and dependent variables of both Brazil and China. Unit root tests are conducted using the Dickey-Fuller technique. The Dickey-Fuller test is performed to assess whether a data time series is stationary or not. A time series is deemed to be stationary in nature if the mean and variance are constant over the passage of time. If both the mean and variance are constant over time the series has no unit root (stationary process); otherwise, the series is said to be a non-stationary process, i.e., it has a unit root. If the test statistic's p-value is less than the critical value of 0.05 then the null hypothesis H_0 (H_0: there exists unit root, that is, data is non-stationary) is rejected, which implies that the data time series has no unit root and is stationary (Dickey, 192-30, n.d.).

Macroeconomic variables often possess a stochastic trend that can be removed by differentiating the variables. The Dickey-Fuller test examines if a time series is stationary and determines the differentiation order required for such time series which are not stationary in nature. The study initiates the examination by testing for order of integration of the series using Dickey-Fuller and the respective null hypothesis of the tests. The unit root test based on the Dickey-Fuller technique can be a generalized auto-regression model and may be formulated as follows (Mohamed, 2008, pp. 1-6):

Null hypothesis H_0: Non-stationarity of time series.

Alternative hypothesis H_1: Stationarity of time series.

Model: $\Delta x_{i,t} = \kappa x_{i,t-1} + \sum_{k=1}^{n} \varpi_{i,k} \Delta x_{i,t-k} + \varepsilon_{k,t}$

$\Delta x_{i,t}$: 1st-differenced value of x

$\kappa x_{i,t-1}$: 1st-lagged value of x

$\sum_{k=1}^{n} \varpi_{i,k} \Delta x_{i,t-k}$: n-th lagged of 1st-differenced of values of x

$\varepsilon_{k,t}$: Error term

4.2.1.2 Unit Root Tests Results

To test non-stationary data I use SAS programming. The Dickey-Fuller tests for variables on Brazil and China are performed using SAS at a 0.05 significance level. Results of the unit root test for all dependent and independent variables for Brazil and China show that all p-values are below 0.01, implying that the null hypothesis, which states that each data series has a unit root (non-stationary), can be rejected for all data series. Hence, all dependent and independent variables series are stationary. Therefore, no differentiation needs to be performed on any dependent and independent variable.

4.2.2 Correlation Analysis

4.2.2.1 Correlation Methodology

In this section I illustrate the selection process of dependent variables based on significant correlation between the 21 independent variables and the 79 dependent variables for Brazil and China, respectively. The correlation analytics are based on Pearson's correlation measure r_{xy} for two variables x and y and n data points, whereas $\bar{x}$ and $\bar{y}$ represent the sample means of x and y:

$$r_{XY} = \frac{\frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^2}\sqrt{\frac{1}{n}\sum_{i=1}^{n}(y_i - \bar{y})^2}}$$

The null hypothesis (H_0) states that there is no association between the two variables; that is, the correlation is zero. The alternative hypothesis (H_1) states that there is an association between the two variables.

The key selection criterion for the dependent variables is not the fact that there is a positive or negative correlation for independent-dependent pairs, but the significance level denoted by the p-value or p-level of each correlation pair. The reason for selecting the p-value as selection criterion is the fact that a correlation can be strong and yet not significant. Conversely, a correlation relationship may be weak, but significant. The correlation matrixes of Brazil and China in Sections 4.2.2, 4.2.3, and 4.3 denote significant correlation coefficients with a single asterisk '*' and double asterisk '**'. Double asterisk '**' represents correlation at the significance level of 0.01 (2-tailed). Cells denoted with a single asterisk '*' represent correlation at the significance level of

0.05 (2-tailed). Positive correlation pairs are marked in light green whereas negative correlation pairs are marked in light yellow.

4.2.2.2 Correlation Analysis Brazil

This section describes the second statistical diagnostic test in which I select macroeconomic variables which significantly correlate with any of the 21 independent variables of Brazil. At this stage, the study performs macroeconomic variable selection solely based on the correlation significance between a dependent and independent variable.

CORRELATION MATRIX BRAZIL

Positive Correlations

The correlation display of an independent and dependent variable in the matrix in Table 4.1 contains three cells: The first cell displays the degree of correlation. The second cell denoted as ‘Sig. (2-tailed)’ right below the correlation cell reveals the correlation significance as represented by the p-value. The third cell in the column denoted as ‘N’ shows the number of data points analyzed; 13 annual data points for percentage share measures (1996-2008) and 12 annual data points for change rates (1997-2008).

For example, Brazil’s GDP per capita growth (Variable 3: GDPpCap_gr) in Table 4.2a (Correlation Matrix Brazil) positively correlates with the following three independent variables: food price index (FoodIx), agricultural raw material price index (AgriRawIx), and minerals and metals price index (MinMetalsIx).

Table 4.1: GDP Per Capita Growth Correlations Brazil

Independent Variables	Correlation Test	GDPpCap_gr (Dependent Variable)
FoodIx	Correlation	.729**
	Sig. (2-tailed)	0.007
	N	12
AgriRawIx	Correlation	.675*
	Sig. (2-tailed)	0.016
	N	12
MinMetalsIx	Correlation	.579*
	Sig. (2-tailed)	0.048
	N	12

Source: Calculated and arranged by the author.

Food price index (FoodIx) correlates with GDPpCap_gr (Variable 3: GDP per capita growth rate) at 72.9% over the evaluation period from 1996 to 2008. The p-value of this correlation pair is 0.007, that is, the significance level is better than 0.01 and thus denoted with an '**' asterisk in the correlation matrix Tables 4.2a-c. In comparison, GDPpCap_gr correlates at 67.5% and 57.9% with AgriRawIx (agricultural raw material price index) and MinMetalsIx (minerals and metals price index) at a significance level below 0.05, respectively.

Negative Correlations

The correlation matrix also includes selected macroeconomic variables that show negative correlations with independent variables. Their selection is based on the following economic rationale: Increasing commodity prices as well as specific improving governance dimensions may inversely affect specific key macroeconomic measures. For example, lower external debt levels to gross national product (Variable 65: ExtDebtST_GNI) for Brazil may be an indirect result of higher commodity prices, which may have increased Brazil's export values, generating higher tax revenues for the central government from private or majority state owned firms such as Petrobras. This in turn may translate into a higher degree of financial flexibility of the central government, leading to a higher degree of foreign currency denominated external debt reduction, reducing the developing economy's susceptibility to external shocks.[64] Similarly, the inverse relationship of real interest rates (Variable 63: RealIR) in the context of improving fiscal and monetary governance constitutes another example of negative correlation pairs worth further analysis.

The following eleven selected macroeconomic variables show negative correlation with independent variables at the example of Brazil. These variables (definition in parentheses) were selected to be part of the econometric analysis on Brazil for the following reasons:

(1) Variable 44: TariffAllweight (tariff rate applied weighted mean, all products)

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[64] In capital markets, foreign denominated credit exposure (e.g., in USD) to a developing sovereign or local firm in a developing economy (or lower rated economy) is also called wrong-way risk. If the local currency depreciates, the USD denominated debt service and repayment will be more expensive in local currency terms, exposing the creditor/lender to credit related *general* wrong way risk. Wrong-way risk carries self-reinforcing negative effects, such that the credit risk deterioration of the debtor may positively correlate with a deteriorating local macroeconomic environment including a depreciating local currency.

The study attempts to reveal significant relationships and/or associations and causalities between governance, specifically trade governance, as well as commodity prices and tariff rates. Strong trade governance is reflected through the setting of low tariffs in order to support the import industry and the generation of international currency reserves. Also, the study seeks to uncover potential causality directions between the price development of commodities and trade governance represented by tariff levels. TariffAllweight correlates very highly with simple mean tariffs, which represent all trade tariffs in an economy (including export tariffs).

(2) Variable 61: M2 growth rate (M2_gr)

The study attempts to reveal significant relationships and/or associations between M2 growth rate and governance indexes and/or commodity prices.

(3) Variable 62: IRSSpread (interest rate spread (lending rate minus deposit rate)), and

(4) Variable 63: RealIR (real interest rate)

The study seeks to reveal significant relationships and/or associations between interest rate spreads, real interest rates (RealIR) and governance indexes as well as commodity price indexes in order to uncover potential significant associations and interdependencies between the Central Bank's interest rate regime in context of changing commodity prices and overall country governance.

(5) Variable 64: ExtDebtST_ExpGSInc (external debt to exports of goods, services, income)

(6) Variable 65: ExtDebtST_GNI (external debt stocks to gross national income)

(7) Variable 66: STD_ExpGSInc (short-term debt to exports of goods, services & income)

(8) Variable 67: STD_TTExtDbt (short-term debt to total external debt)

(9) Variable 68: STD_TTResv (short-term debt to total reserves)

(10) Variable 71: MultiDebt_TTExtD (multilateral debt to total external debt)

External long-term and short-term debt stocks as a percentage of national account measures ought to decline, that is improve, in the face of increasing export values due to rising commodity prices and favorable trade governance.

Specifically, export oriented economies such as Brazil should benefit from export related revenues, which in turn positively affect national reserve accounts and debt levels. The study seeks to uncover potential significant causalities to support this notion.

(11) Variable 75: RuPp_ToTPp (rural population to total population)

I seek to reveal significant associations between rural-urban migration and improving governance dimensions and increasing commodity prices which in turn may be affected by the development and the expansion of urban areas and cities as a result of, e.g., the establishment of industry clusters.

Table 4.2a: Correlation Matrix Brazil (Variables 1-26)

	Variable No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
		GDPDefl	GDP_gr	GDPpCap_gr	Agri_GDP	Agri_gr	IndustValAd_GDP	IndustValAd_gr	ManuValAdd_GDP	ManFactValAdd_gr	GrossSav_GDP	GrossSav_GNI	GrossDomSav_GDP	GrossNatExp_GDP	GovFinConExp_GDP	GovFinConExp_gr	FinConExp_GDP	FinConExp_gr	HHFinConExp_gr	HHFinConExp_GDP	HHFinConExpPCap_gr	GroCapF_GDP	GroCapF_gr	GrossFixCapForm_GDP	GrossFixCapForm_gr	Trade_GDP	MrchTrade_GDP
FoodIx	Pearson Corr.	.612*	.697*	.729**	-0.049	0.065	-0.068	0.569	-0.415	0.500	0.3	0.292	0.231	-0.068	-0.235	0.527	-0.231	.638*	.578*	-0.193	.650*	0.398	.601*	.704**	.709**	0.128	0.161
	Sig. (2-tailed)	0.026	0.012	0.007	0.874	0.840	0.824	0.054	0.159	0.098	0.319	0.334	0.448	0.826	0.44	0.078	0.448	0.026	0.049	0.527	0.022	0.178	0.039	0.007	0.010	0.677	0.6
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13
TropBevIx	Pearson Corr.	0.155	0.526	0.535	-0.441	-0.402	-0.367	0.540	-.563*	0.357	-0.068	-0.086	-0.199	0.265	0.076	0.295	0.199	0.356	0.322	0.2	0.351	0.266	0.440	.632*	0.500	-0.418	-0.382
	Sig. (2-tailed)	0.614	0.079	0.073	0.132	0.195	0.217	0.070	0.045	0.255	0.826	0.781	0.514	0.381	0.804	0.352	0.514	0.256	0.307	0.513	0.263	0.38	0.152	0.02	0.098	0.155	0.198
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13
VegOilSeedsIx	Pearson Corr.	.583*	0.501	0.526	0.077	0.342	-0.135	0.372	-0.438	0.297	0.281	0.27	0.199	-0.077	-0.218	.759**	-0.199	0.538	0.432	-0.162	0.454	0.286	0.326	.613*	0.457	0.101	0.141
	Sig. (2-tailed)	0.037	0.097	0.079	0.801	0.276	0.66	0.234	0.134	0.349	0.353	0.372	0.516	0.802	0.474	0.004	0.516	0.071	0.160	0.597	0.138	0.344	0.302	0.026	0.135	0.742	0.645
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13
AgriRawIx	Pearson Corr.	.723**	.643*	.675*	0.004	0.170	0.106	.596*	-0.234	.592*	0.474	0.465	0.394	-0.242	-0.351	0.351	-0.394	0.510	0.474	-0.343	0.524	0.305	0.494	.564*	0.524	0.23	0.265
	Sig. (2-tailed)	0.005	0.024	0.016	0.989	0.597	0.731	0.041	0.442	0.043	0.102	0.11	0.183	0.425	0.239	0.263	0.183	0.091	0.120	0.252	0.080	0.311	0.102	0.044	0.080	0.449	0.382
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13
MinMetalsIx	Pearson Corr.	.850**	0.569	.579*	-0.043	-0.276	0.231	0.544	-0.167	0.496	0.536	0.534	0.515	-0.364	-0.334	-0.014	-0.515	0.153	0.164	-0.481	0.179	0.261	0.484	0.459	0.462	0.399	0.421
	Sig. (2-tailed)	0	0.054	0.048	0.888	0.385	0.447	0.067	0.584	0.101	0.059	0.06	0.072	0.222	0.265	0.965	0.072	0.634	0.610	0.096	0.578	0.389	0.111	0.115	0.130	0.177	0.151
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13
CrudeIx	Pearson Corr.	.922**	0.433	0.436	0.126	-0.132	0.344	0.452	-0.092	0.505	.610*	.612*	.620*	-0.459	-0.426	-0.207	-.620*	0.172	0.218	-.573*	0.246	0.254	0.383	0.407	0.164	.572*	.592*
	Sig. (2-tailed)	0	0.160	0.157	0.683	0.683	0.249	0.141	0.766	0.094	0.027	0.026	0.024	0.115	0.146	0.519	0.024	0.592	0.496	0.041	0.442	0.403	0.220	0.168	0.610	0.041	0.033
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13
WGIVA	Pearson Corr.	.934**	-0.472	-0.452	0.508	0.338	.555*	-0.461	0.272	-0.322	.839**	.841**	.832**	-.818**	-0.36	-0.092	-.832**	0.064	0.084	-.823**	0.064	-0.258	-.605*	-0.081	-0.460	.772**	.783**
	Sig. (2-tailed)	0	0.121	0.140	0.076	0.283	0.049	0.132	0.369	0.308	0	0	0	0.001	0.227	0.777	0	0.842	0.795	0.001	0.844	0.395	0.037	0.791	0.132	0.002	0.002
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13
WGIPS	Pearson Corr.	0.32	0.005	0.033	0.371	-0.169	0.467	-0.179	0.332	-0.313	0.229	0.248	0.381	-0.306	-0.528	-0.060	-0.381	0.398	0.428	-0.283	0.422	0.086	0.244	-0.333	0.418	.646*	.621*
	Sig. (2-tailed)	0.287	0.987	0.919	0.213	0.600	0.108	0.577	0.268	0.322	0.451	0.414	0.198	0.309	0.064	0.852	0.198	0.200	0.165	0.349	0.172	0.781	0.446	0.266	0.177	0.017	0.023
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13
WGIGE	Pearson Corr.	0.437	-0.035	-0.038	.741**	-0.093	.578*	-0.073	0.461	-0.114	0.483	0.494	.572*	-0.533	-.596*	0.445	-.572*	0.008	-0.072	-0.475	-0.072	-0.092	-0.162	-0.41	0.046	.750**	.750**
	Sig. (2-tailed)	0.135	0.914	0.907	0.004	0.774	0.039	0.822	0.113	0.724	0.095	0.086	0.041	0.061	0.032	0.147	0.041	0.980	0.824	0.101	0.824	0.764	0.614	0.165	0.887	0.003	0.003
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13
WGIRQ	Pearson Corr.	-.886**	-0.283	-0.307	-0.047	0.005	-.557*	-0.200	-0.185	-0.078	-.742**	-.745**	-.764**	.666*	0.217	-0.427	.764**	-0.201	-0.135	.787**	-0.231	-0.015	-0.324	-0.163	-0.412	-.598*	-.618*
	Sig. (2-tailed)	0	0.374	0.332	0.879	0.987	0.048	0.533	0.545	0.809	0.004	0.003	0.002	0.013	0.476	0.166	0.002	0.530	0.676	0.001	0.470	0.961	0.304	0.595	0.183	0.031	0.024
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13
WGIRL	Pearson Corr.	-.817**	-0.264	-0.286	-0.157	-.632*	-.604*	-0.196	-0.275	-0.287	-.682*	-.692**	-.755**	.750**	0.117	-0.160	.755**	-0.280	-0.266	.802**	-0.310	0.257	-0.210	0.168	-0.135	-.709**	-.710**
	Sig. (2-tailed)	0.001	0.408	0.368	0.608	0.027	0.029	0.541	0.363	0.366	0.01	0.009	0.003	0.003	0.703	0.620	0.003	0.378	0.404	0.001	0.327	0.396	0.512	0.582	0.676	0.007	0.007
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13
WGICC	Pearson Corr.	-0.13	0.041	0.027	0.48	0.390	0.095	0.049	0.167	0.110	-0.053	-0.05	-0.009	0.002	-0.345	0.343	0.009	-0.123	-0.189	0.101	-0.190	-0.018	-0.210	-0.373	-0.287	0.174	0.176
	Sig. (2-tailed)	0.672	0.899	0.933	0.097	0.210	0.757	0.880	0.585	0.733	0.862	0.871	0.976	0.994	0.249	0.275	0.976	0.703	0.557	0.744	0.555	0.955	0.513	0.21	0.365	0.57	0.564
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13
EFIBiz	Pearson Corr.	-.834**	0.001	-0.012	0.151	0.551	-0.345	0.034	0.059	0.072	-.565*	-.565*	-.560*	0.476	0.185	0.103	.560*	-0.047	-0.069	.569*	-0.066	-0.047	0.027	-0.254	0.028	-0.425	-0.439
	Sig. (2-tailed)	0	0.998	0.970	0.622	0.063	0.248	0.916	0.848	0.824	0.044	0.044	0.046	0.1	0.544	0.751	0.046	0.885	0.832	0.042	0.838	0.879	0.933	0.402	0.930	0.147	0.133
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13
EFITrade	Pearson Corr.	.939**	0.382	0.367	0.313	-0.415	.573*	0.495	0.219	0.506	.837**	.839**	.829**	-.730**	-0.359	-0.220	-.829**	0.148	0.197	-.821**	0.187	-0.005	0.427	0.202	0.296	.681*	.694**
	Sig. (2-tailed)	0	0.221	0.240	0.298	0.180	0.04	0.102	0.473	0.094	0	0	0	0.005	0.228	0.491	0	0.645	0.540	0.001	0.561	0.987	0.167	0.508	0.350	0.01	0.009
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13
EFIFisc	Pearson Corr.	-.806**	-0.253	-0.279	0.115	0.085	-0.177	-0.111	0.235	-0.022	-0.441	-0.441	-0.446	0.28	0.291	-0.005	0.446	-0.180	-0.188	0.416	-0.216	-0.33	-0.344	-0.478	-0.416	-0.382	-0.4
	Sig. (2-tailed)	0.001	0.427	0.380	0.709	0.793	0.562	0.732	0.44	0.947	0.131	0.131	0.126	0.355	0.335	0.988	0.126	0.576	0.558	0.157	0.500	0.27	0.274	0.099	0.178	0.198	0.175
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13
EFIGovtS	Pearson Corr.	-.826**	0.009	-0.014	-0.083	-0.106	-0.28	0.030	0.088	0.068	-0.502	-0.502	-0.511	0.345	0.535	0.336	0.511	-0.196	-0.264	0.424	-0.280	-0.307	-0.150	-0.311	-0.180	-0.505	-0.526
	Sig. (2-tailed)	0.001	0.977	0.966	0.787	0.742	0.354	0.927	0.776	0.835	0.08	0.08	0.074	0.249	0.06	0.285	0.074	0.541	0.407	0.149	0.379	0.307	0.641	0.302	0.576	0.078	0.065
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13
EFIMon	Pearson Corr.	0.147	-0.305	-0.294	0.223	0.153	0.058	-0.422	-0.044	-0.414	-0.141	-0.118	0.048	-0.019	-0.221	-0.119	-0.048	0.057	0.081	0.004	0.070	0.069	-0.218	-0.212	-0.321	0.465	0.436
	Sig. (2-tailed)	0.632	0.335	0.353	0.465	0.636	0.85	0.171	0.886	0.181	0.645	0.7	0.875	0.951	0.469	0.711	0.875	0.861	0.802	0.989	0.829	0.823	0.497	0.487	0.309	0.11	0.137
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13
EFIInvest	Pearson Corr.	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a
	Sig. (2-tailed)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13
EFIFin	Pearson Corr.	-0.526	0.154	0.165	0.236	0.139	-0.222	0.155	-0.057	0.127	-0.389	-0.387	-0.373	0.331	0.095	0.411	0.373	0.278	0.218	0.387	0.283	0.009	0.140	-0.078	0.165	-0.205	-0.202
	Sig. (2-tailed)	0.065	0.632	0.607	0.437	0.667	0.466	0.631	0.853	0.694	0.189	0.192	0.209	0.27	0.757	0.184	0.209	0.382	0.496	0.192	0.374	0.976	0.664	0.801	0.609	0.503	0.508
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13
EFIPropRi	Pearson Corr.	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a
	Sig. (2-tailed)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13
EFICorrup	Pearson Corr.	0.197	-0.575	-.590*	0.409	-0.175	0.457	-0.471	0.331	-.602*	0.177	0.199	0.354	-0.385	-0.129	-0.201	-0.354	-0.553	-0.547	-0.356	-0.522	-0.22	-0.255	-0.537	-0.384	.619*	.598*
	Sig. (2-tailed)	0.518	0.050	0.044	0.165	0.586	0.116	0.122	0.27	0.038	0.563	0.515	0.236	0.194	0.674	0.531	0.236	0.062	0.066	0.232	0.082	0.471	0.424	0.058	0.218	0.024	0.031
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13

Source: Tables 4.2a-c calculated and arranged by the author.

Table 4.2b: Correlation Matrix Brazil (Variables 27-54)

	Variable No	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
		ExpGS_GDP	ExpGS_gr	ExtBalGS_GDP	CurrACC_GDP	ImpGS_GDP	ImpGS_gr	AgRawImp_MrchImp	ManfImp_MrchImp	FuelImp_MerchImp	ExpValX	ImpValIx	ExpVolX	ImpVolIx	UnitValIxExp	UnitValIxImp	ToT	PPIxExp	TariffAllweight	HiTekExp_ManuExp	ICTExp_TTExp	ICTImp_TTImp	AgrRwExp_MerchExp	FoodExp_MrchExp	ManufExp_MrchExp	FDInet_GDP	StoxVal_GDP	FuelExp_MerchExp	MrktCapList_GDP
FoodIx	Pearson Corr.	0.114	-0.341	0.068	0.204	0.141	.667*	-0.218	-.591*	0.539	.830**	.941**	0.55	.904**	.983**	.949**	0.519	.659*	-0.431	-0.366	-.658*	-.562*	-.666*	-0.021	-.841**	-0.414	.873**	.627*	0.279
	Sig. (2-tailed)	0.711	0.278	0.826	0.504	0.646	0.018	0.474	0.033	0.058	0	0	0.051	0	0	0	0.069	0.014	0.142	0.219	0.014	0.046	0.013	0.946	0	0.159	0	0.022	0.357
	N	13	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
TropBevIx	Pearson Corr.	-0.386	-0.069	-0.265	-0.085	-0.431	0.486	0.236	-0.327	0.016	0.443	.618*	0.121	.629*	.762**	.616*	.886**	0.261	0.077	-.694**	-.788**	-0.504	-.692**	0.306	-0.502	-0.329	.732**	0.124	0.102
	Sig. (2-tailed)	0.192	0.830	0.381	0.783	0.142	0.109	0.438	0.276	0.96	0.13	0.024	0.693	0.021	0.002	0.025	0	0.39	0.804	0.008	0.001	0.079	0.009	0.309	0.08	0.273	0.004	0.687	0.741
	N	13	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
VegOilSeedsIx	Pearson Corr.	0.098	-0.324	0.077	0.197	0.095	0.384	-0.207	-.578*	0.428	.784**	.900**	0.515	.875**	.928**	.880**	0.55	.624*	-0.354	-0.443	-.799**	-.744**	-.603*	0.116	-.854**	-0.33	.884**	.568*	0.294
	Sig. (2-tailed)	0.75	0.304	0.802	0.518	0.757	0.217	0.497	0.039	0.145	0.002	0	0.072	0	0	0	0.051	0.023	0.235	0.13	0.001	0.004	0.029	0.705	0	0.271	0	0.043	0.33
	N	13	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
AgriRawIx	Pearson Corr.	0.245	-0.118	0.242	0.39	0.17	0.551	-0.261	-.739**	.663*	.900**	.936**	.685**	.901**	.972**	.973**	0.405	.775**	-.562*	-0.38	-.683*	-.614*	-.612*	-0.119	-.858**	-0.497	.886**	.712**	0.474
	Sig. (2-tailed)	0.42	0.715	0.425	0.187	0.579	0.064	0.39	0.004	0.013	0	0	0.01	0	0	0	0.169	0.002	0.046	0.2	0.01	0.026	0.026	0.698	0	0.084	0	0.006	0.102
	N	13	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
MinMetalsIx	Pearson Corr.	0.405	0.190	0.364	0.467	0.333	0.531	-0.499	-.770**	.760**	.963**	.926**	.827**	.924**	.912**	.951**	0.246	.899**	-.713**	-0.131	-0.477	-.590*	-0.496	-0.383	-.842**	-0.373	.896**	.842**	.685**
	Sig. (2-tailed)	0.169	0.554	0.222	0.107	0.266	0.076	0.083	0.002	0.003	0	0	0	0	0	0	0.418	0	0.006	0.67	0.1	0.034	0.085	0.197	0	0.21	0	0	0.01
	N	13	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
CrudeIx	Pearson Corr.	.560*	0.107	0.459	0.521	0.521	0.176	-.626*	-.691**	.860**	.990**	.935**	.888**	.908**	.882**	.962**	0.066	.935**	-.810**	0.023	-0.348	-0.478	-0.396	-0.466	-.839**	-0.334	.827**	.911**	.600*
	Sig. (2-tailed)	0.047	0.741	0.115	0.068	0.068	0.584	0.022	0.009	0	0	0	0	0	0	0	0.83	0	0.001	0.941	0.243	0.098	0.18	0.109	0	0.264	0	0	0.03
	N	13	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
WGIVA	Pearson Corr.	.823**	-0.037	.818**	.828**	.567*	-0.372	-.694**	-.626*	.842**	.822**	.604*	.924**	.565*	0.53	.664*	-0.27	.906**	-.894**	0.039	-0.216	-0.466	-0.249	-0.369	-.768**	-0.548	0.486	.940**	.646*
	Sig. (2-tailed)	0.001	0.909	0.001	0	0.044	0.233	0.008	0.022	0	0.001	0.029	0	0.044	0.062	0.013	0.372	0	0	0.9	0.478	0.109	0.412	0.214	0.002	0.053	0.092	0	0.017
	N	13	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
WGIPS	Pearson Corr.	.562*	-0.320	0.306	0.161	.737**	0.481	-.605*	0.106	0.38	0.118	-0.01	0.307	-0.02	-0.201	-0.034	-.743**	0.216	-0.407	.822**	.688**	0.39	.750**	-.733**	0.14	0.437	-0.139	0.29	0.177
	Sig. (2-tailed)	0.046	0.310	0.309	0.599	0.004	0.113	0.028	0.732	0.201	0.702	0.975	0.307	0.95	0.51	0.912	0.004	0.479	0.168	0.001	0.009	0.188	0.003	0.004	0.648	0.136	0.651	0.336	0.563
	N	13	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
WGIGE	Pearson Corr.	.712**	-0.044	0.533	0.4	.731**	-0.082	-.593*	0.071	0.429	0.206	0.05	0.415	0.017	-0.128	0.032	-.687**	0.323	-0.479	0.521	0.323	0.188	.578*	-0.417	-0.057	0.212	-0.113	0.366	0.132
	Sig. (2-tailed)	0.006	0.892	0.061	0.176	0.005	0.800	0.033	0.817	0.144	0.5	0.872	0.159	0.955	0.677	0.916	0.009	0.282	0.098	0.068	0.282	0.538	0.039	0.156	0.853	0.487	0.714	0.219	0.667
	N	13	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
WGIRQ	Pearson Corr.	-.648*	0.506	-.666*	-.706**	-0.416	-0.329	.631*	.687**	-.814**	-.871**	-.687**	-.920**	-.706**	-.645*	-.740**	0.038	-.935**	.839**	-0.002	0.312	0.46	0.477	0.468	.677*	0.381	-.639*	-.846**	-.769**
	Sig. (2-tailed)	0.017	0.093	0.013	0.007	0.157	0.296	0.021	0.01	0.001	0	0.01	0	0.007	0.017	0.004	0.903	0	0	0.996	0.299	0.114	0.1	0.107	0.011	0.199	0.019	0	0.002
	N	13	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
WGIRL	Pearson Corr.	-.755**	0.318	-.750**	-.699**	-0.521	-0.105	.795**	0.409	-.686**	-.680*	-0.423	-.855**	-0.45	-0.327	-0.461	0.314	-.822**	.797**	-0.283	-0.047	0.276	0.162	.582*	0.468	0.218	-0.369	-.779**	-.697**
	Sig. (2-tailed)	0.003	0.314	0.003	0.008	0.068	0.744	0.001	0.165	0.01	0.011	0.15	0	0.123	0.275	0.113	0.296	0.001	0.001	0.349	0.879	0.362	0.597	0.037	0.106	0.474	0.214	0.002	0.008
	N	13	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
WGICC	Pearson Corr.	0.123	-0.079	-0.002	-0.118	0.257	-0.418	-0.128	0.431	-0.209	-0.272	-0.27	-0.164	-0.26	-0.382	-0.351	-0.316	-0.216	0.157	0.29	0.219	0.265	.697**	-0.015	0.296	0.52	-0.292	-0.218	-0.209
	Sig. (2-tailed)	0.69	0.808	0.994	0.7	0.397	0.177	0.678	0.141	0.494	0.369	0.372	0.591	0.391	0.197	0.239	0.293	0.479	0.607	0.336	0.473	0.382	0.008	0.96	0.326	0.068	0.333	0.475	0.493
	N	13	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFIBiz	Pearson Corr.	-0.462	-0.114	-0.476	-0.552	-0.294	-0.030	0.541	.660*	-.749**	-.895**	-.779**	-.843**	-.772**	-.774**	-.843**	-0.106	-.885**	.738**	0.051	0.284	0.42	0.454	0.496	.703**	0.425	-.731**	-.816**	-.686**
	Sig. (2-tailed)	0.112	0.723	0.1	0.05	0.329	0.926	0.056	0.014	0.003	0	0.002	0	0.002	0.002	0	0.731	0	0.004	0.869	0.348	0.153	0.119	0.085	0.007	0.148	0.005	0.001	0.01
	N	13	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFITrade	Pearson Corr.	.728**	0.466	.730**	.789**	0.493	0.418	-.643*	-.709**	.897**	.904**	.728**	.945**	.707**	.683*	.791**	-0.096	.952**	-.867**	-0.005	-0.288	-0.475	-0.474	-0.442	-.753**	-.558*	.617*	.940**	.634*
	Sig. (2-tailed)	0.005	0.126	0.005	0.001	0.087	0.177	0.018	0.007	0	0	0.005	0	0.007	0.01	0.001	0.756	0	0	0.988	0.341	0.101	0.102	0.13	0.003	0.047	0.025	0	0.02
	N	13	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFIFisc	Pearson Corr.	-0.365	0.224	-0.28	-0.362	-0.366	-0.471	0.532	.688**	-.707**	-.924**	-.906**	-.778**	-.915**	-.879**	-.914**	-0.242	-.853**	.675*	0.034	0.382	0.504	0.432	0.431	.793**	0.247	-.869**	-.808**	-.656*
	Sig. (2-tailed)	0.22	0.484	0.355	0.224	0.218	0.122	0.061	0.009	0.007	0	0	0.002	0	0	0	0.425	0	0.011	0.912	0.197	0.079	0.141	0.141	0.001	0.415	0	0.001	0.015
	N	13	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFIGovtS	Pearson Corr.	-0.474	0.210	-0.345	-0.4	-0.502	-0.286	.590*	.607*	-.725**	-.883**	-.841**	-.790**	-.844**	-.776**	-.841**	-0.077	-.839**	.718**	-0.054	0.304	0.405	0.172	0.45	.742**	0.171	-.799**	-.794**	-.669*
	Sig. (2-tailed)	0.101	0.513	0.249	0.176	0.08	0.368	0.034	0.028	0.005	0	0	0.001	0	0.002	0	0.802	0	0.006	0.861	0.313	0.17	0.573	0.123	0.004	0.577	0.001	0.001	0.012
	N	13	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFIMon	Pearson Corr.	0.336	-0.360	0.019	-0.17	.669*	-0.380	-0.548	0.203	0.147	0.012	-0.005	0.099	-0.013	-0.206	-0.084	-.606*	0.036	-0.229	.855**	.668*	0.22	.717**	-0.535	0.088	.641*	-0.087	0.162	0.043
	Sig. (2-tailed)	0.261	0.250	0.951	0.58	0.012	0.223	0.053	0.506	0.631	0.97	0.987	0.747	0.966	0.5	0.785	0.028	0.907	0.452	0	0.013	0.471	0.006	0.06	0.776	0.018	0.777	0.598	0.888
	N	13	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFIInvest	Pearson Corr.	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a
	Sig. (2-tailed)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	N	13	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFIFin	Pearson Corr.	-0.256	-0.349	-0.331	-0.42	-0.071	0.048	0.307	.692**	-0.453	-0.537	-0.397	-.567*	-0.458	-0.403	-0.435	-0.099	-.600*	0.483	0.056	0.194	0.458	0.256	0.415	0.429	0.288	-0.517	-0.546	-.829**
	Sig. (2-tailed)	0.398	0.266	0.27	0.154	0.817	0.882	0.307	0.009	0.12	0.058	0.179	0.044	0.116	0.172	0.137	0.747	0.03	0.095	0.857	0.526	0.115	0.398	0.159	0.144	0.341	0.07	0.054	0
	N	13	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFIPropRi	Pearson Corr.	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a
	Sig. (2-tailed)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	N	13	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFICorrup	Pearson Corr.	.569*	-0.253	0.385	0.166	.641*	-0.429	-.614*	0.392	0.166	-0.064	-0.234	0.197	-0.228	-0.422	-0.274	-.750**	0.09	-0.288	.783**	.686**	0.442	.677*	-0.538	0.252	0.522	-0.371	0.149	-0.001
	Sig. (2-tailed)	0.043	0.428	0.194	0.589	0.018	0.164	0.026	0.186	0.589	0.835	0.443	0.519	0.453	0.151	0.365	0.003	0.769	0.34	0.002	0.01	0.13	0.011	0.058	0.406	0.067	0.212	0.628	0.997
	N	13	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13

Table 4.2c: Correlation Matrix Brazil (Variables 55-79)

	Variable No	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
		FoodPrdIx	CropProdIX	LivStockProdIX	CPIx	Infltn	M2_GDP	M2_gr	IRSSpread	RealIR	ExtDebtST_ExpGSInc	ExtDebtST_GNI	STD_ExpGSInc	STD_TTExtDbt	STD_TTResv	TTRes_TTExtDbt	M2_TTReserv	MultiDebt_TTExtD	EnrgyImp_Euse	GDP_UEnUKPPPOilE	GDP_UEnUPPPOilE	RuPp_ToTPp	Internet_100	Phonelines_100	Unempl_Lforce	MobileSubs_100
FoodIx	Pearson Corr.	0.43	.581*	0.284	.588*	-0.178	.563*	0.220	-0.371	-0.351	-.699**	-.801**	-0.426	0.415	-.761**	.907**	-0.452	-0.056	-0.366	.576*	.709**	-0.48	.729**	0.089	-0.55	.730**
	Sig. (2-tailed)	0.143	0.037	0.347	0.035	0.561	0.045	0.492	0.212	0.24	0.008	0.001	0.146	0.159	0.002	0	0.121	0.857	0.219	0.039	0.007	0.097	0.005	0.772	0.051	0.005
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
TropBevIx	Pearson Corr.	-0.035	0.104	-0.166	0.137	-0.292	0.103	0.243	0.162	0.222	-0.327	-.821**	0.002	.598*	-0.448	.629*	-0.273	-0.387	0.11	0.366	0.254	-0.002	0.3	-0.448	-.605*	0.287
	Sig. (2-tailed)	0.91	0.735	0.587	0.656	0.332	0.738	0.447	0.598	0.466	0.275	0.001	0.994	0.031	0.125	0.021	0.366	0.191	0.719	0.218	0.402	0.996	0.32	0.125	0.028	0.342
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
VegOilSeedsIx	Pearson Corr.	0.424	.578*	0.259	.558*	-0.221	0.524	-0.094	-0.249	-0.239	-.604*	-.704**	-0.394	0.375	-.741**	.886**	-0.55	-0.107	-0.339	0.396	.644*	-0.455	.693**	0.058	-0.4	.687**
	Sig. (2-tailed)	0.149	0.038	0.393	0.048	0.467	0.066	0.771	0.412	0.431	0.029	0.007	0.183	0.206	0.004	0	0.051	0.728	0.258	0.18	0.017	0.119	0.009	0.851	0.175	0.01
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
AgriRawIx	Pearson Corr.	.565*	.690**	0.429	.706**	-0.175	.645*	0.518	-0.478	-0.454	-.814**	-.836**	-0.543	0.383	-.855**	.951**	-0.466	0.094	-0.493	.561*	.806**	-.593*	.826**	0.184	-0.456	.817**
	Sig. (2-tailed)	0.044	0.009	0.143	0.007	0.568	0.017	0.085	0.098	0.119	0.001	0	0.055	0.196	0	0	0.108	0.761	0.087	0.046	0.001	0.033	0.001	0.546	0.117	0.001
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
MinMetalsIx	Pearson Corr.	.708**	.816**	.567*	.833**	-0.391	.834**	0.538	-.666*	-.616*	-.871**	-.757**	-.716**	0.159	-.879**	.948**	-0.321	0.4	-.674*	0.404	.914**	-.767**	.920**	0.394	-0.197	.920**
	Sig. (2-tailed)	0.007	0.001	0.043	0	0.187	0	0.071	0.013	0.025	0	0.003	0.006	0.605	0	0	0.285	0.175	0.012	0.171	0	0.002	0	0.183	0.519	0
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
CrudeIx	Pearson Corr.	.813**	.896**	.708**	.908**	-0.317	.904**	.653*	-.770**	-.737**	-.898**	-.643*	-.805**	0.029	-.851**	.887**	-0.243	0.455	-.777**	0.362	.959**	-.861**	.961**	.560*	-0.103	.976**
	Sig. (2-tailed)	0.001	0	0.007	0	0.291	0	0.021	0.002	0.004	0	0.018	0.001	0.924	0	0	0.423	0.118	0.002	0.224	0	0	0	0.046	0.737	0
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
WGIVA	Pearson Corr.	.940**	.928**	.869**	.941**	-0.058	.831**	-0.215	-.728**	-.766**	-.870**	-0.345	-.923**	-0.284	-.876**	.642*	-0.324	.710**	-.947**	0.228	.898**	-.912**	.902**	.757**	0.177	.875**
	Sig. (2-tailed)	0	0	0	0	0.85	0	0.501	0.005	0.002	0	0.248	0	0.347	0	0.018	0.281	0.007	0	0.454	0	0	0	0.003	0.562	0
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
WGIPS	Pearson Corr.	0.422	0.362	0.466	0.327	-0.058	0.45	0.425	-.572*	-.582*	-0.059	0.477	-0.391	-.639*	0.154	-0.172	0.432	0.525	-0.484	-0.415	0.215	-0.456	0.19	.703**	.725**	0.25
	Sig. (2-tailed)	0.151	0.224	0.108	0.275	0.85	0.123	0.168	0.041	0.037	0.849	0.099	0.187	0.019	0.615	0.575	0.141	0.065	0.094	0.159	0.482	0.118	0.533	0.007	0.005	0.41
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
WGIGE	Pearson Corr.	.567*	0.503	.593*	0.452	0.03	0.451	-0.369	-0.474	-0.535	-0.174	0.444	-0.517	-.691**	-0.059	-0.112	0.156	0.46	-.579*	-0.421	0.29	-0.537	0.315	.735**	.664*	0.33
	Sig. (2-tailed)	0.044	0.08	0.033	0.121	0.923	0.122	0.237	0.102	0.06	0.569	0.128	0.071	0.009	0.847	0.716	0.611	0.114	0.038	0.152	0.336	0.058	0.295	0.004	0.013	0.271
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
WGIRQ	Pearson Corr.	-.832**	-.846**	-.779**	-.886**	0.51	-.842**	0.066	.738**	.668*	.900**	.598*	.866**	0.116	.849**	-.724**	0.135	-.702**	.794**	-0.225	-.907**	.854**	-.902**	-.583*	-0.037	-.885**
	Sig. (2-tailed)	0	0	0.002	0	0.075	0	0.837	0.004	0.013	0	0.031	0	0.705	0	0.005	0.66	0.007	0.001	0.46	0	0	0	0.036	0.905	0
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
WGIRL	Pearson Corr.	-.850**	-.786**	-.848**	-.828**	0.492	-.815**	-0.320	.707**	.642*	.719**	0.258	.891**	0.457	.633*	-0.415	-0.155	-.893**	.859**	0.111	-.766**	.858**	-.751**	-.749**	-0.477	-.756**
	Sig. (2-tailed)	0	0.001	0	0	0.088	0.001	0.311	0.007	0.018	0.006	0.395	0	0.117	0.02	0.158	0.614	0	0	0.719	0.002	0	0.003	0.003	0.1	0.003
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
WGICC	Pearson Corr.	-0.029	-0.045	-0.039	-0.121	-0.002	-0.063	-.595*	0.129	0.079	0.391	.611*	0.056	-0.536	0.379	-0.421	0.192	-0.035	0.015	-.665*	-0.274	0.038	-0.211	0.169	.588*	-0.205
	Sig. (2-tailed)	0.925	0.885	0.898	0.695	0.995	0.837	0.041	0.675	0.798	0.187	0.026	0.856	0.059	0.202	0.152	0.529	0.91	0.962	0.013	0.365	0.901	0.488	0.581	0.034	0.502
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFIBiz	Pearson Corr.	-.737**	-.767**	-.675*	-.830**	0.394	-.811**	-0.212	.670*	.586*	.876**	.731**	.763**	-0.051	.814**	-.790**	0.042	-.569*	.716**	-0.307	-.879**	.776**	-.866**	-0.445	0.049	-.879**
	Sig. (2-tailed)	0.004	0.002	0.011	0	0.183	0.001	0.508	0.012	0.035	0	0.004	0.002	0.869	0.001	0.001	0.891	0.042	0.006	0.307	0	0.002	0	0.127	0.874	0
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFITrade	Pearson Corr.	.899**	.908**	.844**	.943**	-0.205	.848**	0.220	-.793**	-.769**	-.963**	-.572*	-.911**	-0.106	-.907**	.746**	-0.238	.631*	-.880**	0.43	.960**	-.896**	.942**	.670*	-0.03	.923**
	Sig. (2-tailed)	0	0	0	0	0.501	0	0.492	0.001	0.002	0	0.041	0	0.731	0	0.003	0.433	0.021	0	0.142	0	0	0	0.012	0.923	0
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFIFisc	Pearson Corr.	-.653*	-.774**	-0.502	-.786**	0.462	-.837**	-0.346	.657*	.597*	.797**	.698**	.680*	-0.096	.806**	-.904**	0.251	-0.416	.636*	-0.33	-.870**	.740**	-.876**	-0.391	0.159	-.884**
	Sig. (2-tailed)	0.016	0.002	0.08	0.001	0.112	0	0.270	0.015	0.031	0.001	0.008	0.011	0.756	0.001	0	0.407	0.157	0.019	0.271	0	0.004	0	0.187	0.603	0
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFIGovtS	Pearson Corr.	-.717**	-.823**	-.563*	-.812**	0.387	-.857**	-.684*	.691**	.669*	.751**	0.525	.710**	0.043	.729**	-.803**	0.225	-0.435	.696**	-0.159	-.839**	.783**	-.858**	-0.501	-0.039	-.870**
	Sig. (2-tailed)	0.006	0.001	0.045	0.001	0.191	0	0.014	0.009	0.012	0.003	0.066	0.007	0.888	0.005	0.001	0.461	0.137	0.008	0.603	0	0.002	0	0.081	0.899	0
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFIMon	Pearson Corr.	0.225	0.204	0.246	0.133	-0.099	0.335	0.166	-0.378	-0.408	0.169	.585*	-0.16	-0.482	0.297	-0.158	0.302	0.325	-0.278	-0.5	0.057	-0.282	0.037	0.538	.701**	0.126
	Sig. (2-tailed)	0.461	0.503	0.418	0.664	0.747	0.263	0.605	0.203	0.167	0.58	0.036	0.602	0.095	0.324	0.606	0.316	0.279	0.358	0.082	0.853	0.351	0.905	0.058	0.008	0.681
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFIInvest	Pearson Corr.	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a
	Sig. (2-tailed)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFIFin	Pearson Corr.	-0.443	-0.491	-0.319	-0.523	0.39	-0.542	-0.071	0.474	0.412	.564*	0.486	0.49	-0.029	.610*	-.594*	0.208	-.568*	0.484	-0.217	-.581*	0.498	-.562*	-0.25	-0.028	-0.531
	Sig. (2-tailed)	0.13	0.088	0.288	0.067	0.188	0.056	0.825	0.102	0.161	0.044	0.092	0.089	0.925	0.027	0.032	0.494	0.043	0.094	0.477	0.037	0.083	0.045	0.41	0.928	0.062
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFIPropRi	Pearson Corr.	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a
	Sig. (2-tailed)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFICorrup	Pearson Corr.	0.345	0.239	0.431	0.21	-0.222	0.312	-0.229	-0.324	-0.33	0.113	.663*	-0.371	-.906**	0.243	-0.426	0.539	.587*	-0.414	-.720**	0.041	-0.362	0.051	.661*	.854**	0.087
	Sig. (2-tailed)	0.248	0.432	0.141	0.491	0.467	0.3	0.473	0.28	0.271	0.713	0.013	0.212	0	0.423	0.147	0.057	0.035	0.16	0.006	0.895	0.224	0.868	0.014	0	0.778
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13

CORRELATION COUNT BRAZIL

Significant Correlation

The correlation test for Brazil reveals 352 significant correlation counts, spread over the three sets of independent variables. Table 4.3 gives an overview of the distribution of negative and positive correlations across the three sets of independent variables.

Table 4.3: Significant Correlation Counts Brazil

	Positive Correlations	Negative Correlations	Total	Total % Share
Commodity Price Indexes	**128**	**28**	**156**	**44.3%**
FoodIx	26	3	29	8.2%
TropBevIx	9	1	10	2.8%
VegOilSeedsIx	16	3	19	5.4%
AgriRawIx	25	5	30	8.5%
MinMetalsIx	23	8	31	8.8%
CrudeIx	29	8	37	10.5%
Worldwide Governance Indexes	**83**	**14**	**97**	**27.6%**
WGIVA	31	7	38	10.8%
WGIPS	9	3	12	3.4%
WGIGE	12	1	13	3.7%
WGIRQ	15	1	16	4.5%
WGIRL	13	1	14	4.0%
WGICC	3	1	4	1.1%
Economic Freedom Indexes	**87**	**12**	**99**	**28.1%**
EFIBiz	12	1	13	3.7%
EFITrade	32	8	40	11.4%
EFIFisc	11	0	11	3.1%
EFIGovtS	11	1	12	3.4%
EFIMon	7	0	7	2.0%
EFIInvest[65]	0	0	0	0.0%
EFIFin	3	1	4	1.1%
EFIPropRi	0	0	0	0.0%
EFICorrup	11	1	12	3.4%
Total	**298**	**54**	**352**	**100.0%**

Source: Calculated and arranged by the author.

From a dependent variable point of view it is observable that the largest positive correlation count within the dependent variable set pertains to the financial sector topic, the private sector, and the trade topic, specifically within the trade indexes sub topic. Trade indexes, such as ExpValx (Variable 36: export value index), ImpValIx (Variable 37: import

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[65] Data provided by The Heritage Foundation for both, EFIInvest index as well as PropRi index are held constant at 50 points over the data series period from 1996 to 2008. Thus, neither a meaningful correlation nor causality calculation can be performed. As a result, regression analysis for EFIInvest and EFI PropRi cannot be performed (displayed as ‘a’ in the matrixes).

value index) reveal a high correlation count with almost all commodity price indexes and the EFI trade index.

From a correlation perspective I note that the correlation pair with the largest correlation coefficient is represented by export value index to CrudeIx (Variable 36: export value index, Table 4.2b: Correlation Matrix Brazil), displaying a correlation of 99% at the significance level of 0.01 (corr. 99%, sig. 0.01).

Commodity Price Index

From an independent variable set point of view the vast majority of significant correlation counts (or 'events'), that is 44.3% or 156 of 352 counts, occur within the commodity price index set. This underscores the importance of Brazil's commodity sector for the economy, specifically for its trade sector. The crude index records the largest number of correlation counts within the commodity price index set, counting a total of 37 correlation events. Of 37 correlation events 8 are negative. That is, positive changes in CrudeIx go along with negative changes in these 8 dependent variables.

MinMetalsIx, AgriRawIx, and FoodIx count 31, 30, and 29 correlation events, of which 8, 5, and 3 are negative, respectively. VegOilSeedsIx and TropBevIx count 19 and 10 correlation events, suggesting a lower importance of vegetables, oils and seeds and tropical beverages for Brazil's commodity sector compared to oil, minerals and metals, food, and agricultural raw materials. It is observable that price changes in all commodity groups correlate negatively with debt level ratios such as external debt stocks to exports of goods, services and income (Variable 64: ExtDebtST_ExpGSInc)[66] and external debt stocks to gross national income (Variable 65: ExtDebtST_GNI).

Furthermore, commodity prices seem to have a profound effect on Brazil's financial and economic policy and debt sector. Oil and minerals and metals seem to have an effect on Brazil's interest rate spread (Variable 62: IRSSpread) and real interest rate (Variable 63: RealIR) judging by the negative correlation rates of 77.0% and 73.7% as well as 66.6% and 61.6%, at significance levels of 0.01 and 0.05, respectively. Then, the consumer price index (Variable 58: CPIx) significantly correlates with all commodity groups, except with

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[66] Negative correlations are significant for all commodity price indexes except for TropBevIx.

tropical beverages. All commodity price indexes do also show significant positive correlations with Brazil’s total reserves to total external debt (Variable 69: TTRes_TTExtDbt) which implies that Brazil’s improving reserve position may be associated with improving commodity prices.

Also, among others, FoodIx, AgriRawIx, and MinMetalsIx significantly correlate with the GDP change rate (i.e., growth rate) (Variable 2: GDP_gr) and the GDP per capita growth rate (Variable 3: GDPpCap_gr), suggesting that demand and export increases in food commodities, agricultural raw materials as well as mineral and metals affect GDP_gr and GDPpCap_gr of Brazil.

Furthermore, as previously stated, nearly all commodity price indexes positively correlate with high significance with trade indexes such as ExpValx, ImpValIx, ExpVolx, ImpVolIx, UnitValIxExp, UnitValIxImp (Variables 36 to 41), thus underscoring the importance of Brazil’s commodity sector for its external sector.[67] Then, all commodity price indexes significantly correlate at the 0.01 p-level with the stock value index to GDP (Variable 52: StoxVal_GDP) suggesting strong interrelations between stock market valuation and Brazil’s commodity sector.

Economic Freedom Index

The second largest number of correlation counts occurs within the economic freedom index set, which records a total of 99 correlation counts with dependent variables, or 28.1% of 352 counts. The dominant individual governance dimension with the largest correlation impacts on the 79 selected macroeconomic variables is EFITrade (trade governance), counting an astounding 40 correlation events, 8 of which are of negative nature. EFITrade is followed by EFIBiz (business index), EFIGovtS (government size), and EFICorrup (corruption index) with 13, 12, and 12 correlation counts, respectively. It is revealing that EFI corruption index displays a relative high number of correlation counts, suggesting a relatively strong impact on economic activity in Brazil, specifically on the trade sector (Variable 25: Trade_GDP, Variable 26: MrchTrade_GDP).

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[67] Exceptions: ExpValx does not significantly correlate with TropBevIx, and ExpVolx does not significantly correlate with FoodIx, TropBevIx, and VegOilSeedsIx.

With 40 significant correlation counts, trade policies are a crucial governance dimension in Brazil. Overall, EFITrade is the dominant individual independent variable among all 21 independent variables for Brazil. This finding underscores the importance of Brazilian trade policies and its effects on the country's macroeconomics, specifically on variables of the monetary sector such IRSSpread and RealIR (Variables 62 and 63), and variables of external debt and reserve accounts such as ExtDebtST_ExpGSInc (Variable 64), ExtDebtST_GNI (Variable 65), STD_ExpGSInc (Variable 66), STD_TTResv (Variable 68: short-term debt to total reserves), and TTResv_TTExtDbt (Variable 69: total reserves to total external debt), but also on food, crop, and livestock production indexes (Variable 55: FoodPrdIx, Variable 56: CropProdIx, Variable 57: LivStockProdIx).

Also, obviously, EFITrade which negatively correlates at -86.7% with TariffAllWeight at the 0.01 significance level (Variable 44: overall weighted trade tariffs) shows significant positive correlations with trade indexes such as ExpValx, ImpValIx, ExpVolx, ImpVolIx, UnitValIxExp, UnitValIxImp (Variables 36 to 41) underscoring the importance of Brazil's trade policies to its external sector. This is reflected by improving scores in ExtBalGS_GDP (Variable 29: external balance of goods and services to GDP), and CurrAcc_GDP (Variable 30: current account to GDP). Furthermore, EFITrade displays positive correlation below the significance threshold of 0.05 with StoxVal_GDP (Variable 52: Stocks traded total value to GDP) and MarktCapList_GDP (Variable 54: market capitalization of listed companies to GDP).

Worldwide Governance Index

The worldwide governance index counts 97 correlation events, or 27.6% of 352 total correlation events for Brazil. The dominant index within the WGI index subset is the WGI voice and accountability index (WGIVA), displaying a total of 38 correlation events (7 of which are negative), suggesting that a larger degree of democracy fosters macroeconomic activity and growth. Regulatory quality (WGIRQ), rule of law (WGIRL), government effectiveness (WGIGE), and political stability (WGIPS) count 16, 14, 13, and 12 correlation events, of which 1, 1, 1, and 3 correlations are negative, respectively.

It is revealing that the voice and accountability index (WGIVA), the political stability index (WGIPS), and the government effectiveness index (WGIGE) exhibit significant positive correlations with the external sector represented by Trade_GDP (Variable 25: trade to GDP) and MrchTrade_GDP (Variable 26: merchandise trade to GDP), as well as ExpGS_GDP (Variable 27: export of goods and services to GDP), and ImpGS_GDP (Variable 31: import of goods and services to GDP). Also, WGIVA correlates positively at the significance level of 0.01 with Brazil's national savings quotas such as GrossSav_GDP, GrossSav_GNI, and GrossDomSav_GDP (Variables 10-12).

Non-significant Correlation

In conclusion, the correlation tests of Brazil reveal that out of 79 dependent variables only 8 macroeconomic variables do not display any significant correlation with any of the 21 independent variables. As a result, these 8 macroeconomic variables, which are marked in red in the Correlation Matrix Brazil (Table 4.2a-c), are not qualified to proceed to the Granger causality test in Section 4.2.3 of Brazil, and will therefore be excluded from any further econometric analysis. The excluded dependent variables include the following 8 individual macroeconomic variables:

(1) Variable 5: Agri_gr (agriculture value added growth rate)

(2) Variable 8: ManuValAdd_GDP (manufacturing value added to GDP)

(3) Variable 14: GovFinConExp_GDP (general government final consumption expenditure to GDP)

(4) Variable 21: GroCapF_GDP (gross capital formation to GDP)

(5) Variable 28: ExpGS_gr (exports of goods and services growth rate)

(6) Variable 47: ICTImp_TTImp (information communication technology goods imports to total goods imports)

(7) Variable 59: Infltn (annual inflation)

(8) Variable 70: M2_TTReserv (money and quasi money (M2) to total reserves)

4.2.2.3 Correlation Analysis China

Similarly to the section on Brazil, this section represents the second statistical diagnostic test for China. At this stage, I perform macroeconomic variable selection for China solely based on significant correlation events between independent and dependent variables. The correlation matrix for China in Tables 4.5a-c highlight all significant positive and selected negative correlation pairs of independent and dependent variables.

CORRELATION MATRIX CHINA

Positive Correlations

The correlation pairings of independent and dependent variables for China in the Correlation Matrix in Tables 4.5a-c below contain three cells which are to be read in similar fashion as with the example of Brazil.

Table 4.4: Consumer Price Index Correlation China

Independent Variables	Correlation Test	Consumer Price Index (Dependent Variable)
FoodIx	Correlation	.893**
	Sig. (2-tailed)	.000
	N	13
TropBevIx	Correlation	.564*
	Sig. (2-tailed)	.045
	N	13
VegOilseedsIx	Correlation	.869**
	Sig. (2-tailed)	.000
	N	13
AgriRawIx	Correlation	.930**
	Sig. (2-tailed)	.000
	N	13
MinMetalsIx	Correlation	.951**
	Sig. (2-tailed)	.000
	N	13
CrudeIx	Correlation	.967**
	Sig. (2-tailed)	.000
	N	13
WGIGE	Correlation	.666*
	Sig. (2-tailed)	.013
	N	13
EFITrade	Correlation	.815**
	Sig. (2-tailed)	.001
	N	13

Source: Calculated and arranged by the author.

For example, as shown in Table 4.4 above, China's consumer price index (Variable 58: CPIx) in the correlation matrix for China in Table 4.5c correlates very highly with AgriRawIx, CrudeIx and MinMetalsIx, and highly with FoodIx, VegOilseedsIx, and EFITrade. It correlates only moderately with TropBevIx and WGIGE. The significance is at the 0.01 level for all variables, except for WGIGE and TropBevIx which are at the 0.05 significance level.

Negative Correlations

Similarly to Brazil, the correlation test for China also includes selected macroeconomic variables which show negative correlations to independent variables. The selection of the macroeconomic variables with negative correlation to independent variables is based on the suggestion that increasing commodity price and governance indexes may negatively affect specific macroeconomic measures whose improvement is illustrated by a negative measure development.

According to the correlation matrixes in Tables 4.5a-c below, I observe that Chinese inflation (Variable 59) correlates negatively with WGIVA and EFIMon at 66.8% and 67.7% at a significance level of below 0.05 and above 0.01 for each (p-values of 0.013 and 0.011, respectively), depicted with '*'. This suggests that Chinese inflation, which was highly volatile between 1996 and 2008 (ranging between 8.3% and -1.4% according to World Bank data), increases/decreases with a deteriorating/improving monetary governance index (EFIMon) and a deteriorating/improving voice and accountability index measured by WGIVA.

The following ten selected macroeconomic variables show negative correlations with independent variables in China. 8 of these 10 dependent variables below are identical to the Brazilian dependent variables showing negative correlations. The rationale for including the 8 identical selected macroeconomic variables below has already been provided at the example of Brazil further above in Section 4.2.2.2 (Correlation Analysis Brazil). Thus, I only illustrate the economic selection rationale for the two newly added dependent variables of the negative correlation analysis: inflation (Variable 59: Infltn) and money and quasi money to total reserves (Variable 70: M2_TTReserv).

(1) Variable 44: TariffAllweight (overall tariff rate weighted mean)

(2) Variable 59: Infltn (annual consumer price inflation)

The study seeks to uncover effects of commodity price increases and changes in governance on consumer price inflation provided by World Bank data on China. Academic research suggests that inflation is linked to the development of commodity prices (Labys and Maizels, 1990, pp. 1-14, 17-18). Through correlation analysis, Granger causality analysis, and regression analysis this study seeks to reveal significant relationships between the independent variables and inflation.

(3) Variable 62: IRSSpread (interest rate spread lending rate minus deposit rate)

(4) Variable 63: RealIR (real interest rate)

(5) Variable 64: ExtDebtST_ExpGSInc (external debt stocks to exports of goods, services, income)

(6) Variable 65 ExtDebtST_GNI (external debt stocks to GNI)

(7) Variable 67: STD_TTExtDbt (short-term debt to total external debt)

(8) Variable 70: M2_TTReserv (M2 to total reserves)

The study aims to reveal significant relationships between governance, specifically monetary policies, as well as commodity price increases and money and quasi money (M2) to total reserves.

(9) Variable 71: MultiDebt_TTExtD (multilateral debt to total external debt)

(10) Variable 75: RuPp_ToTPp (rural population to total population)

Table 4.5a: Correlation Matrix China (Variables 1-27)

	Variable No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
		GDPDefl	GDP_gr	GDPpCap_gr	Agri_GDP	Agri_gr	IndustValAd_GDP	IndustValAd_gr	ManuValAdd_GDP	ManFactValAdd_gr	GrossSav_GDP	GrossSav_GNI	GrossDomSav_GDP	GrossNatExp_GDP	GovFinConExp_GDP	GovFinConExp_gr	FinConExp_GDP	FinConExp_gr	HHFinConExp_gr	HHFinConExp_GDP	HHFinConExpPCap_gr	GroCapF_GDP	GroCapF_gr	GrossFixCapForm_GDP	GrossFixCapForm_gr	Trade_GDP	MrchTrade_GDP	ExpGS_GDP
FoodIx	Pearson Corr	.838**	0.453	0.492	-.391	.656*	.694**	0.35	.593*	.743**	.707**	.708**	.727**	-.757**	-.874**	-0.376	-.727**	0.117	0.188	-.656*	0.489	.551	0.407	.411	0.139	.433	.430	.507
	Sig. (2-tailed)	.000	0.14	0.105	.187	0.02	.009	0.265	.033	0.006	.007	.007	.005	.003	.000	0.229	.005	0.716	0.559	.015	0.107	.051	0.189	.163	0.667	.140	.142	.077
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13	13
TropBevIx	Pearson Corr	.441	0.525	0.521	.084	0.506	.775**	0.539	.588*	0.408	.448	.457	.502	-.670*	-.827**	-0.564	-.502	-0.025	0.055	-.398	0.11	.263	0.217	.015	0.254	.046	.040	.149
	Sig. (2-tailed)	.131	0.079	0.083	.784	0.093	.002	0.071	.034	0.187	.125	.116	.081	.012	.000	0.056	.081	0.939	0.866	.178	0.733	.385	0.497	.962	0.426	.881	.897	.626
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13	13
VegOilSeedsIx	Pearson Corr	.800**	.590*	.602*	-.358	0.255	.576*	.588*	.498	.680*	.662*	.664*	.682*	-.719**	-.875**	-0.413	-.682*	0.211	0.3	-.601*	0.53	.509	0.546	.382	0.485	.383	.379	.457
	Sig. (2-tailed)	.001	0.043	0.038	.230	0.423	.039	0.044	.083	0.015	.014	.013	.010	.006	.000	0.182	.010	0.51	0.344	.030	0.076	.076	0.066	.198	0.11	.196	.202	.116
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13	13
AgriRawIx	Pearson Corr	.903**	.610*	.648*	-.501	0.497	.754**	.635*	.658*	.789**	.830**	.830**	.843**	-.809**	-.926**	-0.574	-.843**	-0.058	0.029	-.782**	.583*	.693**	.675*	.566*	0.499	.598*	.596*	.663*
	Sig. (2-tailed)	.000	0.035	0.023	.081	0.1	.003	0.026	.014	0.002	.000	.000	.000	.001	.000	0.051	.000	0.858	0.928	.002	0.047	.009	0.016	.044	0.098	.031	.031	.013
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13	13
MinMetalsIx	Pearson Corr	.958**	.651*	.662*	-.711**	.633*	.662*	.629*	.478	0.197	.886**	.882**	.884**	-.925**	-.815**	-0.337	-.884**	-0.228	-0.199	-.858**	0.426	.666*	0.358	.673*	0.234	.737**	.735**	.806**
	Sig. (2-tailed)	.000	0.022	0.019	.006	0.027	.014	0.028	.099	0.54	.000	.000	.000	.000	.001	0.284	.000	0.476	0.536	.000	0.167	.013	0.253	.012	0.464	.004	.004	.001
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13	13
CrudeIx	Pearson Corr	.987**	0.146	0.174	-.810**	0.258	.544	0.119	.391	0.259	.869**	.861**	.850**	-.830**	-.711**	0.034	-.850**	0.045	0.04	-.842**	0.351	.688**	-0.048	.756**	-0.143	.794**	.792**	.841**
	Sig. (2-tailed)	.000	0.651	0.588	.001	0.418	.054	0.711	.187	0.417	.000	.000	.000	.000	.006	0.915	.000	0.889	0.902	.000	0.263	.009	0.882	.003	0.658	.001	.001	.000
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13	13
WGIVA	Pearson Corr	-.666*	0.352	0.376	.420	-0.001	-.598*	0.199	-.644*	0.039	-.735**	-.739**	-.750**	.627*	.710**	0.064	.750**	-0.146	-0.165	.723**	0.244	-.689**	0.467	-.513	0.209	-.541	-.542	-.583*
	Sig. (2-tailed)	.013	0.262	0.228	.153	0.998	.031	0.534	.018	0.904	.004	.004	.003	.022	.007	0.844	.003	0.65	0.609	.005	0.444	.009	0.126	.073	0.515	.056	.056	.036
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13	13
WGIPS	Pearson Corr	-.674*	0.169	0.186	.527	-0.197	-.759**	0.314	-.772**	0.24	-.799**	-.798**	-.804**	.648*	.687**	-0.275	.804**	-0.278	-0.261	.793**	0.045	-.757**	0.337	-.660*	0.446	-.679*	-.683*	-.709**
	Sig. (2-tailed)	.012	0.599	0.562	.064	0.54	.003	0.32	.002	0.453	.001	.001	.001	.017	.010	0.387	.001	0.382	0.413	.001	0.889	.003	0.284	.014	0.146	.011	.010	.007
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13	13
WGIGE	Pearson Corr	.708**	0.548	0.559	-.506	0.051	.399	0.527	.520	0.295	.584*	.579*	.572*	-.523	-.579*	0.246	-.572*	0.234	0.221	-.543	.613*	.491	0.284	.430	0.297	.519	.521	.547
	Sig. (2-tailed)	.007	0.065	0.059	.077	0.875	.177	0.078	.068	0.351	.036	.038	.041	.067	.038	0.44	.041	0.464	0.49	.055	0.034	.088	0.37	.143	0.349	.069	.068	.053
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13	13
WGIRQ	Pearson Corr	.047	-0.335	-0.348	.469	-0.101	.721**	-0.309	.771**	-0.306	.151	.163	.213	-.134	-.615*	0.248	-.213	0.002	-0.033	-.104	-0.155	.230	-0.284	-.181	-0.004	-.153	-.150	-.114
	Sig. (2-tailed)	.878	0.287	0.267	.106	0.755	.005	0.328	.002	0.333	.622	.595	.486	.662	.025	0.437	.486	0.994	0.919	.735	0.631	.450	0.37	.555	0.991	.619	.625	.711
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13	13
WGIRL	Pearson Corr	-.283	-0.086	-0.132	.657*	-0.275	.056	0.072	.249	-0.334	-.311	-.301	-.271	.376	-.118	-0.042	.271	-0.109	-0.12	.352	-0.436	-.131	-0.371	-.475	-0.014	-.517	-.516	-.521
	Sig. (2-tailed)	.348	0.791	0.682	.015	0.388	.856	0.824	.413	0.289	.301	.318	.371	.206	.700	0.896	.371	0.735	0.71	.238	0.156	.670	0.235	.101	0.965	.071	.071	.068
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13	13
WGICC	Pearson Corr	-.663*	-0.142	-0.141	.792**	0.139	-.212	-0.21	-.050	-0.57	-.769**	-.763**	-.730**	.501	.323	0.035	.730**	-0.411	-0.448	.793**	-0.334	-.758**	0.177	-.888**	0.061	-.897**	-.895**	-.879**
	Sig. (2-tailed)	.014	0.661	0.661	.001	0.667	.488	0.513	.871	0.053	.002	.002	.005	.081	.281	0.914	.005	0.184	0.144	.001	0.289	.003	0.582	.000	0.851	.000	.000	.000
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13	13
EFIBiz	Pearson Corr	-.597*	0.148	0.143	.592*	-0.151	-.581*	0.131	-.270	0.38	-.764**	-.761**	-.760**	.678*	.454	-0.046	.760**	0.388	0.433	.797**	0.345	-.664*	0.108	-.714**	-0.046	-.731**	-.731**	-.760**
	Sig. (2-tailed)	.031	0.646	0.658	.033	0.639	.037	0.685	.372	0.223	.002	.003	.003	.011	.119	0.886	.003	0.213	0.159	.001	0.272	.013	0.738	.006	0.887	.005	.005	.003
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13	13
EFITrade	Pearson Corr	.888**	-0.207	-0.231	-.968**	0.071	.292	-0.218	.102	-0.559	.832**	.822**	.791**	-.733**	-.433	0.356	-.791**	-0.088	-0.159	-.839**	-0.372	.670*	-0.517	.883**	-0.318	.911**	.909**	.929**
	Sig. (2-tailed)	.000	0.518	0.47	.000	0.828	.334	0.496	.741	0.059	.000	.001	.001	.004	.139	0.256	.001	0.785	0.622	.000	0.233	.012	0.085	.000	0.314	.000	.000	.000
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13	13
EFIFisc	Pearson Corr	-.290	-0.119	-0.099	.579*	0.452	.042	-0.152	-.089	0.296	-.440	-.436	-.403	.237	.066	0.018	.403	0.192	0.205	.465	0.073	-.450	-0.127	-.574*	-0.257	-.595*	-.596*	-.568*
	Sig. (2-tailed)	.336	0.713	0.759	.038	0.141	.892	0.636	.771	0.35	.133	.136	.172	.436	.830	0.955	.172	0.549	0.524	.109	0.82	.123	0.695	.040	0.421	.032	.032	.043
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13	13
EFIGovtS	Pearson Corr	-.581*	0.488	0.468	.814**	-0.025	-.076	0.467	.027	0.307	-.674*	-.668*	-.630*	.325	.181	0.14	.630*	0.356	0.364	.708**	0.173	-.738**	-0.214	-.913**	-0.034	-.861**	-.861**	-.819**
	Sig. (2-tailed)	.037	0.108	0.125	.001	0.938	.804	0.125	.931	0.332	.012	.013	.021	.279	.554	0.663	.021	0.257	0.245	.007	0.59	.004	0.504	.000	0.917	.000	.000	.001
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13	13
EFIMon	Pearson Corr	-.152	-0.551	-.591*	-.392	-0.552	-.790**	-0.494	-.742**	-0.455	-.260	-.273	-.330	.367	.709**	0.442	.330	0.278	0.232	.222	-0.368	-.232	-0.544	.161	-0.456	.135	.135	.061
	Sig. (2-tailed)	.621	0.063	0.043	.185	0.063	.001	0.102	.004	0.137	.391	.367	.270	.218	.007	0.151	.270	0.382	0.469	.465	0.239	.445	0.068	.599	0.137	.660	.660	.844
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13	13
EFIInvest	Pearson Corr	-.548	0.231	0.231	.867**	0.345	.141	0.202	.091	0.069	-.444	-.427	-.369	.237	-.063	-0.255	.369	-0.058	-0.025	.456	0.188	-.395	0.409	-.703**	0.195	-.743**	-.745**	-.699**
	Sig. (2-tailed)	.053	0.47	0.471	.000	0.272	.647	0.529	.767	0.831	.129	.146	.215	.435	.838	0.425	.215	0.857	0.939	.118	0.558	.182	0.187	.007	0.544	.004	.003	.008
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13	13
EFIFin	Pearson Corr	-.548	0.231	0.231	.867**	0.345	.141	0.202	.091	0.069	-.444	-.427	-.369	.237	-.063	-0.255	.369	-0.058	-0.025	.456	0.188	-.395	0.409	-.703**	0.195	-.743**	-.745**	-.699**
	Sig. (2-tailed)	.053	0.47	0.471	.000	0.272	.647	0.529	.767	0.831	.129	.146	.215	.435	.838	0.425	.215	0.857	0.939	.118	0.558	.182	0.187	.007	0.544	.004	.003	.008
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13	13
EFIPropRi	Pearson Corr	-.870**	-0.447	-0.442	.666*	-0.281	-.569*	-0.382	-.400	-0.125	-.778**	-.775**	-.781**	.895**	.721**	0.08	.781**	-0.015	-0.026	.757**	-0.332	-.526	-0.13	-.557*	-0.034	-.627*	-.624*	-.702**
	Sig. (2-tailed)	.000	0.146	0.15	.013	0.377	.042	0.22	.176	0.698	.002	.002	.002	.000	.005	0.804	.002	0.964	0.937	.003	0.292	.065	0.688	.048	0.916	.022	.023	.007
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13	13
EFICorrup	Pearson Corr	.384	-0.424	-0.449	-.752**	-0.257	-.403	-0.395	-.492	-0.185	.235	.220	.167	-.141	.212	0.24	-.167	0.334	0.321	-.251	-0.09	.152	-0.537	.543	-0.338	.510	.507	.476
	Sig. (2-tailed)	.195	0.17	0.143	.003	0.421	.172	0.203	.088	0.564	.440	.470	.586	.646	.487	0.453	.586	0.289	0.31	.408	0.782	.620	0.072	.055	0.282	.075	.077	.100
	N	13	12	12	13	12	13	12	13	12	13	13	13	13	13	12	13	12	12	13	12	13	12	13	12	13	13	13

Source: Tables 4.5a-c is computed and arranged by the author.

Table 4.5b: **Correlation Matrix China** (Variables 28-54)

Variable No		28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
		ExpGS_gr	ExtBalGS_GDP	CurrACC_GDP	ImpGS_GDP	ImpGS_gr	AgRawImp_MrchImp	ManfImp_MrchImp	FuelImp_MerchImp	ExpValX	ImpValIx	ExpVolX	ImpVolIx	UnitValIxExp	UnitValIxImp	ToT	PPIxExp	TariffAllweight	HiTekExp_ManuExp	ICTExp_TTExp	ICTImp_TTImp	AgrRwExp_MercExp	FoodExp_MrchExp	ManufExp_MrchExp	FDInet_GDP	StoxVal_GDP	FuelExp_MerchExp	MrktCapList_GDP
FoodIx	Parson Corr	-0.431	.757**	.738**	.329	-0.563	-.401	-.861**	.761**	.800**	.767**	.763**	.644*	.880**	.898**	-.700**	.703**	-.433	.322	.257	-.022	-.356	-.432	.398	.098	.608*	-.280	.408
	Sig. (2-tailed)	0.162	.003	.004	.272	0.057	.175	.000	.003	.001	.002	.002	.018	.000	.000	.008	.007	.139	.283	.396	.944	.233	.141	.178	.749	.027	.354	.166
	N	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
TropBevIx	Parson Corr	0.02	.670*	.548	-.084	-0.308	-.031	-.480	.351	.402	.343	.360	.205	.935**	.530	-.237	.297	-.046	-.133	-.195	-.428	.097	.007	-.038	.556*	.412	.004	.201
	Sig. (2-tailed)	0.951	.012	.053	.784	0.33	.921	.097	.239	.173	.251	.227	.501	.000	.063	.435	.324	.881	.664	.523	.145	.752	.983	.902	.049	.162	.989	.510
	N	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
VegOilSeedsIx	Parson Corr	-0.341	.719**	.700**	.282	-0.443	-.502	-.762**	.647*	.762**	.728**	.724**	.613*	.848**	.830**	-.624*	.671*	-.442	.308	.241	-.024	-.361	-.415	.412	.144	.667*	-.354	.432
	Sig. (2-tailed)	0.277	.006	.008	.351	0.149	.081	.002	.017	.002	.005	.005	.026	.000	.000	.023	.012	.130	.306	.428	.939	.225	.159	.162	.638	.013	.236	.140
	N	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
AgriRawIx	Parson Corr	-0.137	.809**	.825**	.503	-0.233	-.498	-.897**	.810**	.879**	.857**	.854**	.765**	.822**	.946**	-.802**	.811**	-.568*	.471	.410	.116	-.472	-.554*	.521	.011	.686**	-.409	.534
	Sig. (2-tailed)	0.671	.001	.001	.080	0.467	.083	.000	.001	.000	.000	.000	.002	.001	.000	.001	.001	.043	.105	.164	.705	.103	.050	.068	.971	.010	.165	.060
	N	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
MinMetalsIx	Parson Corr	0.278	.925**	.949**	.635*	0.09	-.636*	-.931**	.894**	.962**	.941**	.953**	.882**	.632*	.965**	-.910**	.929**	-.718**	.641*	.587*	.388	-.655*	-.742**	.718**	-.178	.787**	-.653*	.752**
	Sig. (2-tailed)	0.382	.000	.000	.020	0.781	.019	.000	.000	.000	.000	.000	.000	.020	.000	.000	.000	.006	.018	.035	.190	.015	.004	.006	.561	.001	.016	.003
	N	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
CrudeIx	Parson Corr	0.195	.830**	.900**	.718**	0.186	-.718**	-.972**	.963**	.986**	.980**	.978**	.932**	.537	.987**	-.971**	.956**	-.801**	.745**	.694**	.502	-.756**	-.834**	.806**	-.347	.694**	-.668*	.643*
	Sig. (2-tailed)	0.544	.000	.000	.006	0.564	.006	.000	.000	.000	.000	.000	.000	.058	.000	.000	.000	.001	.003	.008	.080	.003	.000	.001	.245	.009	.013	.018
	N	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
WGIVA	Parson Corr	0.018	-.627*	-.660*	-.477	0.077	.334	.571*	-.513	-.666*	-.654*	-.664*	-.628*	-.505	-.654*	.594*	-.655*	.478	-.423	-.405	-.146	.391	.394	-.389	-.092	-.516	.304	-.516
	Sig. (2-tailed)	0.955	.022	.014	.099	0.812	.265	.042	.073	.013	.015	.013	.022	.079	.015	.032	.015	.099	.150	.170	.635	.186	.182	.189	.764	.071	.313	.071
	N	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
WGIPS	Parson Corr	0.223	-.648*	-.712**	-.626*	0.249	.392	.642*	-.638*	-.699**	-.699**	-.707**	-.689**	-.435	-.708**	.710**	-.702**	.583*	-.532	-.515	-.288	.455	.510	-.481	.146	-.449	.393	-.518
	Sig. (2-tailed)	0.487	.017	.006	.022	0.434	.185	.018	.019	.008	.008	.007	.009	.137	.007	.007	.007	.036	.061	.072	.340	.118	.075	.096	.634	.124	.184	.070
	N	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
WGIGE	Parson Corr	-0.23	.523	.574*	.474	-0.207	-.304	-.712**	.646*	.706**	.697**	.698**	.660*	.447	.706**	-.677*	.679*	-.457	.443	.415	.214	-.419	-.477	.454	-.116	.736**	-.313	.673*
	Sig. (2-tailed)	0.473	.067	.040	.102	0.519	.313	.006	.017	.007	.008	.008	.014	.126	.007	.011	.011	.117	.129	.158	.483	.154	.100	.119	.706	.004	.298	.012
	N	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
WGIRQ	Parson Corr	-0.28	.134	.057	-.197	-0.234	.419	-.141	-.033	.004	-.024	-.027	-.121	.717**	.185	.046	-.078	.336	-.389	-.419	-.696**	.481	.396	-.442	.683*	.130	.467	-.081
	Sig. (2-tailed)	0.378	.662	.855	.518	0.464	.154	.647	.915	.989	.939	.929	.693	.006	.545	.883	.799	.262	.189	.154	.008	.096	.180	.130	.010	.673	.108	.792
	N	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
WGIRL	Parson Corr	0.31	-.376	-.431	-.500	0.174	.533	.229	-.376	-.358	-.370	-.398	-.452	.374	-.211	.430	-.442	.560*	-.580*	-.587*	-.769**	.603*	.625*	-.638*	.641*	-.271	.726**	-.552
	Sig. (2-tailed)	0.326	.206	.141	.082	0.588	.061	.451	.205	.229	.214	.178	.121	.209	.488	.143	.130	.047	.038	.035	.002	.029	.022	.019	.018	.371	.005	.050
	N	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
WGICC	Parson Corr	0.257	-.501	-.661*	-.899**	0.259	.740**	.512	-.586*	-.682*	-.725**	-.719**	-.816**	.069	-.552	.734**	-.771**	.862**	-.900**	-.898**	-.785**	.857**	.839**	-.833**	.471	-.317	.720**	-.449
	Sig. (2-tailed)	0.419	.081	.014	.000	0.416	.004	.073	.035	.010	.005	.006	.001	.822	.051	.004	.002	.000	.000	.000	.001	.000	.000	.000	.104	.291	.006	.124
	N	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFIBiz	Parson Corr	-0.227	-.678*	-.738**	-.678*	-0.133	.517	.542	-.589*	-.625*	-.633*	-.650*	-.660*	-.184	-.593*	.682*	-.666*	.637*	-.634*	-.617*	-.512	.575*	.626*	-.601*	.193	-.251	.562*	-.394
	Sig. (2-tailed)	0.478	.011	.004	.011	0.679	.070	.056	.034	.022	.020	.016	.014	.547	.033	.010	.013	.019	.020	.025	.074	.040	.022	.030	.528	.409	.045	.183
	N	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFITrade	Parson Corr	0.158	.733**	.852**	.868**	0.051	-.862**	-.807**	.875**	.914**	.931**	.933**	.958**	.135	.822**	-.949**	.951**	-.939**	.932**	.904**	.823**	-.939**	-.976**	.967**	-.590*	.575*	-.860**	.668*
	Sig. (2-tailed)	0.624	.004	.000	.000	0.876	.000	.001	.000	.000	.000	.000	.000	.659	.001	.000	.000	.000	.000	.000	.001	.000	.000	.000	.034	.040	.000	.013
	N	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFIFisc	Parson Corr	-0.482	-.237	-.360	-.616*	-0.512	.466	.104	-.210	-.354	-.385	-.399	-.509	.344	-.156	.362	-.468	.610*	-.622*	-.660*	-.660*	.588*	.526	-.563*	.464	-.302	.586*	-.553*
	Sig. (2-tailed)	0.112	.436	.226	.025	0.089	.109	.735	.491	.236	.194	.177	.076	.250	.611	.224	.107	.027	.023	.014	.014	.035	.065	.045	.110	.315	.035	.050
	N	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFIGovtS	Parson Corr	0.04	-.325	-.520	-.895**	-0.239	.808**	.427	-.542	-.617*	-.673*	-.655*	-.772**	.217	-.494	.719**	-.705**	.883**	-.920**	-.929**	-.866**	.854**	.851**	-.862**	.758**	-.141	.797**	-.306
	Sig. (2-tailed)	0.902	.279	.069	.000	0.454	.001	.145	.056	.025	.012	.015	.002	.477	.086	.006	.007	.000	.000	.000	.000	.000	.000	.000	.003	.646	.001	.308
	N	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFIMon	Parson Corr	-0.066	-.367	-.242	.225	0.126	-.331	.212	-.057	-.113	-.064	-.077	.055	-.823**	-.274	-.002	-.019	-.269	.371	.406	.669*	-.403	-.341	.377	-.740**	-.176	-.359	-.001
	Sig. (2-tailed)	0.838	.218	.427	.460	0.697	.270	.487	.853	.714	.835	.802	.859	.001	.364	.994	.951	.375	.212	.169	.012	.173	.255	.204	.004	.564	.228	.997
	N	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFIInvest	Parson Corr	-0.356	-.237	-.411	-.781**	-0.306	.592*	.524	-.657*	-.576*	-.623*	-.608*	-.710**	.311	-.445	.680*	-.651*	.753**	-.838**	-.848**	-.861**	.840**	.816**	-.793**	.792**	-.304	.563*	-.445
	Sig. (2-tailed)	0.256	.435	.162	.002	0.333	.033	.066	.015	.039	.023	.028	.007	.302	.128	.011	.016	.003	.000	.000	.000	.000	.001	.001	.001	.313	.045	.127
	N	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFIFin	Parson Corr	-0.356	-.237	-.411	-.781**	-0.306	.592*	.524	-.657*	-.576*	-.623*	-.608*	-.710**	.311	-.445	.680*	-.651*	.753**	-.838**	-.848**	-.861**	.840**	.816**	-.793**	.792**	-.304	.563*	-.445
	Sig. (2-tailed)	0.256	.435	.162	.002	0.333	.033	.066	.015	.039	.023	.028	.007	.302	.128	.011	.016	.003	.000	.000	.000	.000	.001	.001	.001	.313	.045	.127
	N	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFIPropRi	Parson Corr	0.008	-.895**	-.888**	-.518	0.095	.579*	.841**	-.814**	-.886**	-.855**	-.877**	-.793**	-.566*	-.875**	.819**	-.851**	.630*	-.550	-.501	-.364	.588*	.668*	-.657*	.189	-.785**	.650*	-.792**
	Sig. (2-tailed)	0.98	.000	.000	.070	0.769	.038	.000	.001	.000	.000	.000	.001	.044	.000	.001	.000	.021	.052	.081	.222	.034	.013	.015	.536	.001	.016	.001
	N	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFICorrup	Parson Corr	-0.162	.141	.281	.540	-0.059	-.748**	-.308	.442	.424	.459	.447	.525	-.404	.295	-.511	.480	-.674*	.699**	.701**	.844**	-.725**	-.735**	.773**	-.825**	.189	-.753**	.291
	Sig. (2-tailed)	0.615	.646	.353	.057	0.856	.003	.306	.131	.149	.115	.126	.066	.171	.327	.074	.097	.011	.008	.008	.000	.005	.004	.002	.001	.537	.003	.335
	N	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13

Table 4.5c: Correlation Matrix China (Variables 55-79)

	Variable No	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
		FoodPrdIx	CropProdIX	LivStock ProdIX	CPIx	Infltn	M2_GDP	M2_gr	IRSSpread	RealIR	ExtDebtST_ExpGSInc	ExtDebtST_GNI	STD_ExpGSInc	STD_TTExtDbt	STD_TTResv	TTRes_TTExtDbt	M2_TTReserv	MultiDebt_TTExtD	EnrgyImp_Euse	GDP_UEnUKPPPOilE	GDP_UEnUPPPOilE	RuPp_ToTPp	Internet_100	Phonelines_100	Unempl_Lforce	MobileSubs_100
FoodIx	Parson Corr	.497	.533	.425	.893**	.681*	.136	0.229	-.313	-.611*	-.534	-.654*	-.002	.492	-.270	.801**	-.677*	-.723**	.647*	.291	.514	-.536	.805**	.420	.305	.675*
	Sig. (2-	.084	.061	.148	.000	.010	.657	0.475	.297	.026	.060	.015	.995	.088	.372	.001	.011	.005	.017	.334	.072	.059	.001	.153	.311	.011
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
TropBevIx	Parson Corr	.049	.063	.002	.564*	.458	-.292	.701*	-.570*	-.056	-.083	-.173	-.264	.069	-.345	.391	-.355	-.440	.273	-.229	.002	-.060	.353	-.028	-.167	.208
	Sig. (2-	.874	.838	.994	.045	.116	.334	0.011	.042	.856	.788	.573	.384	.822	.248	.186	.234	.133	.367	.452	.994	.845	.236	.928	.586	.495
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
VegOilSeedsIx	Parson Corr	.472	.497	.408	.869**	.604*	.151	0.303	-.413	-.567*	-.497	-.648*	-.081	.436	-.374	.778**	-.657*	-.672*	.623*	.276	.486	-.509	.785**	.382	.300	.639*
	Sig. (2-	.104	.084	.167	.000	.029	.623	0.338	.161	.043	.084	.017	.791	.137	.208	.002	.015	.012	.023	.361	.092	.076	.001	.198	.319	.019
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
AgriRawIx	Parson Corr	.615*	.647*	.542	.930**	.714**	.261	0.22	-.226	-.720**	-.660*	-.699**	.061	.620*	-.279	.875**	-.801**	-.835**	.756**	.343	.589*	-.645*	.862**	.563*	.420	.774**
	Sig. (2-	.025	.017	.056	.000	.006	.389	0.493	.457	.006	.014	.008	.843	.024	.357	.000	.001	.000	.003	.252	.034	.017	.000	.045	.153	.002
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
MinMetalsIx	Parson Corr	.790**	.806**	.744**	.951**	.485	.491	0.317	.074	-.710**	-.799**	-.792**	.069	.717**	-.352	.938**	-.850**	-.865**	.891**	.559*	.768**	-.806**	.917**	.735**	.525	.883**
	Sig. (2-	.001	.001	.004	.000	.093	.089	0.315	.809	.007	.001	.001	.824	.006	.238	.000	.000	.000	.000	.047	.002	.001	.000	.004	.065	.000
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
CrudeIx	Parson Corr	.872**	.888**	.830**	.967**	.447	.615*	-0.262	.164	-.814**	-.886**	-.897**	.117	.771**	-.333	.981**	-.865**	-.850**	.926**	.689**	.865**	-.891**	.974**	.815**	.655*	.947**
	Sig. (2-	.000	.000	.000	.000	.126	.025	0.411	.592	.001	.000	.000	.703	.002	.266	.000	.000	.000	.000	.009	.000	.000	.000	.001	.015	.000
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
WGIVA	Parson Corr	-.479	-.534	-.396	-.621*	-.668*	-.209	0.152	.224	.538	.511	.411	-.520	-.709**	-.263	-.648*	.724**	.779**	-.453	-.280	-.473	.514	-.649*	-.508	-.497	-.636*
	Sig. (2-	.098	.060	.181	.023	.013	.493	0.637	.462	.058	.074	.163	.068	.007	.385	.017	.005	.002	.120	.354	.103	.072	.016	.076	.084	.019
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
WGIPS	Parson Corr	-.560*	-.576*	-.517	-.617*	-.551	-.342	0.16	-.020	.564*	.636*	.488	-.294	-.683*	-.005	-.673*	.728**	.776**	-.609*	-.287	-.493	.583*	-.642*	-.606*	-.506	-.669*
	Sig. (2-	.047	.039	.071	.025	.051	.253	0.619	.949	.044	.019	.091	.329	.010	.986	.012	.005	.002	.027	.342	.087	.036	.018	.028	.078	.012
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
WGIGE	Parson Corr	.533	.589*	.446	.666*	.702**	.284	-0.341	.058	-.723**	-.586*	-.605*	.289	.602*	.045	.685**	-.609*	-.637*	.588*	.467	.601*	-.579*	.724**	.519	.434	.672*
	Sig. (2-	.060	.034	.126	.013	.007	.347	0.278	.850	.005	.035	.029	.339	.029	.885	.010	.027	.019	.035	.107	.030	.038	.005	.069	.138	.012
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
WGIRQ	Parson Corr	-.333	-.284	-.418	.121	.790**	-.646*	-0.298	-.639*	-.066	.236	.232	-.121	-.133	.034	-.012	-.066	-.187	-.103	-.633*	-.414	.318	-.044	-.309	-.402	-.149
	Sig. (2-	.266	.347	.155	.695	.001	.017	0.347	.019	.829	.438	.446	.694	.665	.912	.969	.830	.541	.738	.020	.159	.289	.885	.304	.174	.626
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
WGIRL	Parson Corr	-.576*	-.511	-.656*	-.203	.519	-.714**	0.411	-.728**	.134	.527	.402	.076	-.337	.368	-.322	.277	.213	-.526	-.589*	-.542	.545	-.286	-.571*	-.399	-.420
	Sig. (2-	.040	.074	.015	.506	.069	.006	0.184	.005	.663	.064	.174	.805	.260	.216	.283	.360	.486	.065	.034	.056	.054	.343	.042	.177	.153
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
WGICC	Parson Corr	-.851**	-.861**	-.836**	-.562*	-.122	-.791**	-0.288	-.309	.684**	.814**	.545	-.543	-.883**	-.068	-.691**	.833**	.760**	-.664*	-.623*	-.727**	.821**	-.641*	-.898**	-.848**	-.789**
	Sig. (2-	.000	.000	.000	.046	.690	.001	0.363	.305	.010	.001	.054	.055	.000	.824	.009	.000	.003	.013	.023	.005	.001	.018	.000	.000	.001
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFIBiz	Parson Corr	-.657*	-.654*	-.657*	-.537	-.116	-.498	0.193	-.210	.402	.640*	.412	-.239	-.660*	.117	-.599*	.697**	.701**	-.602*	-.352	-.515	.624*	-.519	-.690**	-.508	-.630*
	Sig. (2-	.015	.015	.015	.058	.705	.084	0.548	.492	.173	.018	.162	.432	.014	.704	.031	.008	.008	.030	.239	.071	.023	.069	.009	.077	.021
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFITrade	Parson Corr	.987**	.981**	.983**	.815**	.114	.876**	-0.185	.445	-.756**	-.959**	-.859**	.259	.860**	-.255	.910**	-.856**	-.797**	.912**	.853**	.954**	-.983**	.890**	.962**	.827**	.960**
	Sig. (2-	.000	.000	.000	.001	.710	.000	0.564	.128	.003	.000	.000	.392	.000	.401	.000	.000	.001	.000	.000	.000	.000	.000	.000	.000	.000
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFIFisc	Parson Corr	-.527	-.527	-.524	-.156	.048	-.627*	-0.293	-.336	.334	.535	.301	-.515	-.622*	-.216	-.344	.487	.413	-.368	-.483	-.488	.524	-.338	-.601*	-.660*	-.478
	Sig. (2-	.064	.064	.066	.611	.877	.022	0.355	.262	.265	.060	.317	.072	.023	.478	.250	.092	.160	.216	.094	.091	.066	.259	.030	.014	.099
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFIGovtS	Parson Corr	-.841**	-.826**	-.844**	-.467	.022	-.887**	0.062	-.518	.649*	.796**	.570*	-.433	-.801**	.028	-.640*	.731**	.650*	-.702**	-.660*	-.721**	.816**	-.602*	-.880**	-.882**	-.752**
	Sig. (2-	.000	.001	.000	.108	.943	.000	0.849	.070	.016	.001	.042	.139	.001	.927	.018	.005	.016	.008	.014	.005	.001	.030	.000	.000	.003
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFIMon	Parson Corr	.261	.214	.337	-.237	-.677*	.606*	-0.179	.739**	-.032	-.185	-.153	.107	.068	-.001	-.089	.148	.267	.051	.552	.321	-.244	-.054	.264	.358	.065
	Sig. (2-	.389	.483	.260	.435	.011	.028	0.579	.004	.918	.546	.618	.728	.826	.997	.773	.630	.378	.867	.050	.286	.422	.862	.384	.229	.834
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFIInvest	Parson Corr	-.793**	-.796**	-.800**	-.428	.015	-.858**	0.482	-.610*	.711**	.811**	.702**	-.410	-.707**	-.049	-.583*	.535	.427	-.602*	-.870**	-.826**	.799**	-.607*	-.815**	-.806**	-.719**
	Sig. (2-	.001	.001	.001	.144	.960	.000	0.113	.027	.006	.001	.007	.164	.007	.875	.036	.059	.145	.029	.000	.000	.001	.028	.001	.001	.006
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFIFin	Parson Corr	-.793**	-.796**	-.800**	-.428	.015	-.858**	0.482	-.610*	.711**	.811**	.702**	-.410	-.707**	-.049	-.583*	.535	.427	-.602*	-.870**	-.826**	.799**	-.607*	-.815**	-.806**	-.719**
	Sig. (2-	.001	.001	.001	.144	.960	.000	0.113	.027	.006	.001	.007	.164	.007	.875	.036	.059	.145	.029	.000	.000	.001	.028	.001	.001	.006
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFIPropRi	Parson Corr	-.713**	-.721**	-.678*	-.862**	-.370	-.452	-0.488	-.125	.576*	.707**	.739**	-.010	-.616*	.361	-.851**	.728**	.752**	-.827**	-.558*	-.730**	.734**	-.842**	-.647*	-.437	-.800**
	Sig. (2-	.006	.005	.011	.000	.213	.121	0.107	.685	.039	.007	.004	.974	.025	.226	.000	.005	.003	.000	.048	.005	.004	.000	.017	.135	.001
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFICorrup	Parson Corr	.686**	.644*	.736**	.310	-.452	.862**	-0.013	.692**	-.384	-.631*	-.661*	-.036	.388	-.392	.455	-.312	-.169	.587*	.814**	.712**	-.673*	.475	.633*	.627*	.543
	Sig. (2-	.010	.017	.004	.302	.121	.000	0.968	.009	.195	.021	.014	.906	.191	.185	.118	.300	.580	.035	.001	.006	.012	.101	.020	.022	.055
	N	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13

CORRELATION COUNT CHINA

Significant Correlation

The correlation test for China reveals 440 significant correlation counts, spread out over the three sets of independent variables. In comparison, Brazil shows 352 significant correlation counts.

Table 4.6: Significant Correlation Counts China

	Positive Correlations	Negative Correlations	Total	Total % Share
Commodity Price Indexes	**177**	**30**	**207**	**47.0%**
FoodIx	25	4	29	6.6%
TropBevIx	7	1	8	1.8%
VegOilSeedsIx	26	4	30	6.8%
AgriRawIx	39	7	46	10.5%
MinMetalsIx	42	7	49	11.1%
CrudeIx	38	7	45	10.2%
Worldwide Governance indexes	**69**	**12**	**81**	**18.4%**
WGIVA	8	2	10	2.3%
WGIPS	12	1	13	3.0%
WGIGE	24	6	30	6.8%
WGIRQ	5	1	6	1.4%
WGIRL	6	1	7	1.6%
WGICC	14	1	15	3.4%
Economic Freedom Indexes	**132**	**20**	**152**	**34.5%**
EFIBiz	13	1	14	3.2%
EFITrade	39	7	46	10.5%
EFIFisc	4	1	5	1.1%
EFIGovtS	16	1	17	3.9%
EFIMon	4	1	5	1.1%
EFIInvest[68]	12	2	14	3.2%
EFIFin	12	2	14	3.2%
EFIPropRi	18	1	19	4.3%
EFICorrup	14	4	18	4.1%
Total	**378**	**62**	**440**	**100.0%**

Source: Calculated and arranged by the author.

Table 4.6 gives an overview of the distribution of negative and positive correlation counts across the three sets of independent variables. From a dependent variable point of view it is observable that the largest positive correlation count within the dependent variable set refers to the private sector & trade topic —specifically within the trade indexes

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[68] Data provided by The Heritage Foundation for the EFIInvest index as well as PropRi index is held constant at 50 points over the data series period (1996 to 2008). Thus, neither a meaningful correlation nor causality calculation can be performed. As a result, there will be no regression analysis performed for EFIInvest and EFIPropRi.

sub topic—, international merchandise topic, and the financial sector topic. The highest correlation coefficient is between CrudeIx (crude price index) and GDPDefl (Variable 1: GDP deflator), between CrudeIx and UnitValIxImp (Variable 41: unit value index imports), and between EFITrade and FoodProdIx (Variable 55: food production index); all three pairs correlate at 98.7% below the 0.01 significance level.

Commodity Price Index

Commodities are a pivotal and vital ingredient for China's economic and military expansion strategy. As a result, it is not surprising that composite commodity price indexes display high/very high correlations to many of the specific 79 economic variables of China. The correlation analysis validates this notion. From an independent variable set point of view it is observable that the vast majority of significant positive correlation counts, 47.0% or 207 of 440 events, occur within the commodity price index set. Within the commodity price index set minerals and metals price index (MinMetalsIx) records the largest number of significant correlations, 49 counts, followed by AgriRawIx, and CrudeIx with 46 and 45 significant correlation counts, respectively. Price movements of tropical beverages show the lowest correlation association (8 counts) with the dependent variables.

Changes in commodity price indexes seem to predominantly affect dependent variables of the private and trade sector, the international merchandise indexes topic, as well as the environmental sector, the financial sector, and the economic policy & debt sector (mainly GDP composition variables). For example, all commodities except tropical beverages mainly show significant positive correlation to trade indexes (Variables 35 to 41), trade variables such as Trade_GDP, MrchTrade_GDP, and ExpGS_GDP (Variables 25 to 27), ExtBalGS_GDP (Variable 29), and CurrAccount_GDP (Variable 30). Also, StoxVal_GDP (Variable 52) shows positive correlation to all commodity price indexes, except to TropBevIx. MarketCapList_GDP in contrast significantly correlates with MinMetalsIx and CrudeIx only. Furthermore, all commodity price indexes except TropBevIx show positive correlations with Chinese savings quotas such as GrossSav_GDP, GrossSav_GNI, and GrossDomSav_GDP (Variables 10 to 12).

Price changes in agricultural raw materials, minerals and metals, and crude oil positively correlate with capital formation variables such as GroCapF_GDP (Variable 21: gross capital formation to GDP), and GrossFixCapForm_GDP (Variable 23: gross fix capital formation to GDP) at significance levels of 0.05 and 0.01. Also, commodity price indexes of vegetables, oils and seeds, agricultural raw materials and minerals and metals correlate positively with GDP_gr (Variable 2), and GDPpcap_gr (Variable 3).

Similarly to Brazil, the consumer price index (Variable 58: CPIx) correlates positively with all commodity price indexes at the 0.01 significance level.

Economic Freedom Index

The economic freedom index set provides the second largest number of significant correlation counts (152 out of 440). The freedom of trade index (EFITrade) is the dominant independent variable within the EFI index set, revealing an overwhelming significant correlation count of 46, followed by freedom of property rights (EFIPropRi) with 19 counts, and freedom of corruption (EFICorrup) with 18 counts.

The correlation analysis validates the importance of the CCP’s trade governance for the Chinese economy. Also, the correlation analysis reveals that property rights as well as government activities may have sizable effects on economic activities in China. Nonetheless, the correlation effects of government related activities and of property rights on the Chinese economy are notably lower than the correlation effects of trade governance.

Trade governance (EFITrade) correlates positively at significance levels between 0.05 and 0.01 with nearly all trade indexes (Variables 36 to 41), as well as trade related variables such as Trade_GDP (Variable 25), MrchTrade_GDP (Variable 26), ExpGS_GDP (Variable 27), ExtBalGS_GDP (Variable 29), CurrACC_GDP (Variable 30), and ImpGS_GDP (Variable 31), exports of high technology products (Variable 45: HiTekExp_ManuExp), and exports and imports of information and communication products (Variables 46 and 47). Also, environmental variables show significant correlation values with EFITrade, suggesting that improving trade governance affects domestic production in food (Variable 55: FoodProdIx), crops (Variable 56: CropProdIx), and livestock (Variable 57: LiveStockProdIx). In addition, EFITrade displays significant negative correlations to variables of the financial sector such as RealIR (Variable 63), ExtDebtSsT_ExpGSInc (Variable 64), ExtDebtST_GNI (Variable 65), and positive correlation to TTRes_TTExtDbt (Variable 69), suggesting that improving trade governance may have an effect on lower debt levels and an increasing reserve account. Also, EFITrade reveals positive correlations to China's savings quotas represented by GrossSav_GDP, GrossSav_GNI, and GrossDomSav_GDP (Variables 10 to 12), as well as to China's gross capital formation measured by GroCapF_GDP (Variable 21), and GrossFixCapForm_GDP (Variable 23).

Finally, monetary governance (EFIMon) reveals significant negative correlation with inflation (Variable 59), suggesting that positive governance in monetary policy may have an effect on improving inflation levels.

Worldwide Governance Index

With 81 counts, the worldwide governance index set shows the fewest significant correlation counts with the selected 79 dependent variables. Government effectiveness measured by WGIGE is the leading governance dimension within the WGI index set measured by correlation counts (30 significant correlation counts), followed by WGI's corruption index (WGICC) with 15, and political stability (WGIPS) with 13 correlation counts. Regulatory quality (WGIRQ) and rule of law (WGIRL) in China seem to have a relatively low effect on general economic activities in China as indicated by only 6 and 7 significant correlation counts.

Non-significant Correlation

The correlation analysis on China also reveals that out of 79 dependent variables only (and coincidentally to Brazil) 8 dependent variables do not display any significant correlation to any of the 21 independent variables. The 8 macroeconomic variables are marked in red in the correlation matrix and do not proceed to the causality test in Section 4.2.3. The 8 variables below will thus be excluded from being subject of any further econometric analysis.

(1) Variable 15: GovFinConExp_gr (government final consumption expenditure growth rate)

(2) Variable 17: FinConExp_gr (final consumption expenditure growth rate)

(3) Variable 18: HHFinConExp_gr (household final consumption expenditure growth rate)

(4) Variable 24: GrossFixCapForm_gr (gross fixed capital formation growth rate)

(5) Variable 28: ExpGS_gr (exports of goods and services growth rate)

(6) Variable 32: ImpGS_gr (imports of goods and services growth rate)

(7) Variable 66: STD_ExpGSInc (short-term debt to exports of goods services and income)

(8) Variable 68: STD_TTResv (short-term debt to total reserves)

Only one of the excluded dependent variables is identical for Brazil and China in context of the correlation analysis: Variable 28 (exports of goods and services growth rate) does not show significant correlation for either Brazil or China.

4.2.3 Causality Analysis

4.2.3.1 Causality Methodology and Hypothesis

Granger Causality

In this section I analyze causality effects of all those independent variables to dependent variables which passed the previous correlation tests. That is, Granger causality analysis in this section is performed on only those pairs of independent and dependent variables which showed positive as well as negative correlation with a significance of at least 0.05. I am testing independent and dependent variables on the possibility of causal relationships in order to reveal significant interdependencies between them. The specific objective of this section is to reveal significant effects from changes in independent variables to cause changes on dependent variables.

The concept of Granger causality leans on the idea that the cause of an event that changes a variable must occur before the effect on that variable. The Granger causality analysis is a statistical diagnostic test in which a dependent variable is lagged on past values of itself and then regressed on lagged or past values of the independent variable; in this study I use a time lag of twelve months because data series are based on annual data points. This procedure is then performed in reverse order. The methodology of causal influence on data series has been firstly introduced by Wiener-Granger. In academic research literature it is common to state that a variable x_t Granger causes y_t, that is, the past of x_t helps to forecast or predict y_t (Hurlin, 2004, pp. 1-5).

$$y_t = {}_1^n\sum \beta_i y_{t-i} + {}_1^n\sum \alpha_i x_{t-i} + \varepsilon_t$$

Granger tests are based on the null hypothesis H_0 of non-causality. H_0: x_t does not cause $y_{t.}$(Chao, Corradi, and Swanson, 2000, pp. 1-4). That is, in the model above $a_i = 0$, with a being a polynomial lag operator defining the magnitude of the explained variation based on the past of y_t relative to x_t. β_i represents the best linear predictor variable for y_t based on its history, and ε_t is the prediction error (Chao, Corradi, and Swanson 2000, pp. 4, 12). When a_i is zero, the null hypothesis of non-causality H_0 cannot be rejected.

In the Granger causality analysis, changes in commodity price indexes and changes in governance indexes are said to cause changes in the dependent variables if the current value of the dependent variable is better predicted from past values of the dependent and the independent variable than by past values of the dependent variable alone. The p-value threshold for significant causal relationships between independent and dependent variables is set at 0.05 —similarly to the p-level in the correlation analysis—, which implies a confidence level of 95%. That is, the p-value is the probability of error associated with wrongly rejecting the null hypothesis H_0 which states that there is a non-causality relationship between the independent and dependent variable. Put differently, the lower the p-value is, the higher is the probability of rightly rejecting the null hypothesis. The smaller the p-value is, the more significant is the causal relationship between the independent and the dependent variable.

The Granger causality test in this section deploys two types of Granger tests: Granger causality test 1 (Test 1, or Granger 1), and Granger causality test 2 (Test 2, or Granger 2). The null hypothesis of Granger 1 states: the independent variable is affected by itself only, and not by the dependent variable. A p-value above 0.05 leads to no rejection of the H_0. That is, the independent variable is not affected by the dependent variable. Granger 2 in contrast is significant at p-values below 0.05 and states that the dependent variable is affected by itself and not affected by the independent variable. That is, a p-value at or below 0.05 allows the rejection of the null hypothesis, i.e., the dependent variable is caused by the independent variable.

Example: The following Granger 1 and Granger 2 test (Test 1, Test 2) exemplify Granger causality tests in SAS syntax at the example of Brazil’s GDP change rate, i.e., GDP growth rate (Variable 2: GDP_gr), in comparison to the minerals and metals price index (MinMetalsIx).

The p-value for MinMetalsIx of Granger 1 test is 0.2638. The null hypothesis H_0 (H_0: changes in MinMetalsIx are only affected by itself and not by GDP_gr) can hence not be rejected. The p-value of Granger 2 test is 0.0161; the null hypothesis can be rejected. The null hypothesis of Test 2 states that GDP_gr is only affected by itself and not by changes in MinMetalsIx. Thus, changes in the global minerals and metals price index cause changes in Brazil’s GDP change rate.

The syntax below is an illustration of the SAS output syntax in the CD–ROM attachment of Granger analysis on change rates for macroeconomic variables and change rates of independent variables at the example of change rates of GDP (i.e., GDP_gr) and MinMetalsIx for Brazil.

Figure 4.1: SAS Syntax Granger Causality Example — GDP_gr and changes in MinMetalsIx

```
        Granger-Causality Wald Test

      Test         DF     Chi-Square     Pr > ChiSq

         1          1           1.25         0.2638

         2          1           5.79         0.0161


      Test 1:  Group 1 Variables:  MinMetalsIx

               Group 2 Variables:  GDP_gr


      Test 2:  Group 1 Variables:  GDP_gr

               Group 2 Variables:  MinMetalsIx
```

Source: Calculated by the author with SAS 9.1.3. Service Pack 4 XP_HOME Platform.

Inverse Granger Causality

This thesis primarily analyzes effects of changes in governance and commodity prices on selected macroeconomic variables leading subsequently to regression analysis. I do not perform an explicit regression analysis on inverse Granger causal relationships between independent and dependent variables. Reasons for not performing an inverse regression analysis are as follows: First, as discussed in Section 1.5, it is questionable to suggest that macroeconomic variables affect governance indicators on a broad and sustainable scale due to the fact that governance frameworks are designed, formulated and established by ruling institutions and state organs. Secondly, Brazil’s and China’s expanding economies are in themselves too small to cause commodity prices to rise when for example economies of the US and Europe stall or contract.

However, for complementary purposes in context of correlation and Granger causality analysis I discuss inverse Granger causalities between macroeconomic variables, commodity price indexes, and governance indexes in Chapter 5 only (Comparative Econometric Result Analysis of Selected Variables). That is, Chapter 5 includes the discussion of Granger causality by illustrating the effects of changes in macroeconomic variables on governance indexes and commodity price indexes. The objective of inverse Granger causality analysis is to identify macroeconomic variables which either affect commodity prices —primarily at the example of China— or affect governance dimensions. In several cases, inverse Granger causalities do not always offer a sound economic rationale, especially when looking at governance dimensions. However, there exist some examples of persuasive inverse Granger causalities in which changes in macroeconomic variables cause changes in —foremost— commodity price indexes and in a few specific governance dimensions (e.g., trade governance (EFITrade), political stability (WGIPS), degree of democracy (WGIVA)).

4.2.3.2 Causality Analysis Brazil

This section carries out the third statistical diagnostic test for Brazil by selecting dependent variables on basis of significant Granger causal relationships in which independent variables Granger cause dependent variables. The selection of those dependent variables which proceed to the regression analysis is solely based on significant Granger causality results. The Granger causality matrix for Brazil in Table 4.8a-c illustrates the direction of all significant interdependencies between an independent variable and the 79 macroeconomic variables.

GRANGER CAUSALITY MATRIX BRAZIL

The pair-wise Granger causality tests are performed on significant correlation pairs only and test whether the respective dependent variable is an endogenous variable, affected by commodity price indexes and/or governance indexes. Dependent variables Granger caused by commodity price indexes or governance indexes are marked in green in the matrixes in Table 4.8a-c. Inverse Granger causalities, i.e., dependent variables Granger causing independent variables, are marked in yellow. Cells of Granger 1 and Granger 2 tests showing no significant Granger causal relationship between independent and dependent variables are kept either blank or white.

Significant and simultaneous results of Granger 1 and Granger 2 tests represent feedback (both-ways) results. Feedback results are displayed in bold letters and also marked in green. Causality pairs with p-values below 0.05 for Granger 1 and Granger 2 tests are —by convention— interpreted as if the independent variables Granger cause the dependent variables. The Granger causality tests in this study shall be interpreted as within-sample causality tests due to the fact that they only indicate the Granger endogeneity of the dependent variable within the sample period from 1996 to 2008.

The Granger causality display in Table 4.7 below exemplifies the display of a Granger causality result of the Matrix in Table 4.8a-c at the example of GDP_gr (Variable 2). For each independent-dependent variable pair the Granger causality Matrix in Table 4.8a-c shows three cells. The first cell displays correlation and respective p-value level (* or **) of the correlated variable pair. The second cell displays the p-value of Granger 1 test. The third cell below shows the p-value of Granger 2 test. The null hypothesis of Granger 1 states that the independent variable is only affected by itself and not affected by the dependent variable. The null hypothesis of Granger 2 states that the dependent variable is only affected by itself and not by the independent variable.

For example: FoodIx and GDP_gr (Variable 2) correlate with 69.7% at a p-value significance of 0.05. The correlation field is marked green because the correlation is both positive and significant. The Granger 1 null hypothesis H_0 states that FoodIx is only affected by itself and not by Brazil’s GDP_gr. This null hypothesis H_0 cannot be rejected due to a Granger 1 p-value of 0.4079; the p-value is above the 0.05 threshold. In other words, wrongly rejecting the null hypothesis bears a probability of 40.79%. In contrast, the Granger 2 null hypothesis states that GDP_gr is only affected by itself and not by FoodIx. The p-value of 0.0486, which is below the p-value threshold of 0.05, prompts me to reject the null hypothesis with a minimum confidence level of 95%. In conclusion, GDP_gr is indeed affected by FoodIx, and not vice versa. In summary, I can say that the results of the Granger causality tests lend statistical credence to the suggestion that GDP_gr in Brazil is caused by changes in global food prices, even though correlation is only moderate and significant at the 0.05-level. Due to the fact that Brazil is an exporter of food products it may be sensible to presume that rising food prices cause Brazil’s GDP growth; they may perhaps not be the only cause, but are a statistically validated one. Due to the acceptable correlation coefficient in conjunction with the significant Granger causality results, I chose to include FoodIx and GDP_gr in the regression analysis on Brazil. In this context it is worth mentioning that an in-depth discussion and economic interpretation of correlation, causality and regression relationships (including inverse Granger causal observations) is performed at length in Chapter 5 for selected macroeconomic variables, one of which is GDP_gr (GDP change rate).

Similarly, AgriRawIx and GDP_gr correlate at 64.3% with a significance level of 0.05 (sig. 0.05). P-values of Granger 1 and Granger 2 are at 0.7507 and at 0.0003, suggesting that GDP_gr is also caused by changes in AgriRawIx. Therefore, I also include AgriRawIx in the regression analysis on Brazil.

Table 4.7: Granger Causality GDP_gr Brazil

Independent Variables	Test Type	GDP_gr (Dependent Variable)
FoodIx	Correlation	.697*
	Granger 1	.4079
	Granger 2	.0486
AgriRawIx	Correlation	.643*
	Granger 1	.7507
	Granger 2	.0003
MinMetalsIx	Correlation	.569*
	Granger 1	.2638
	Granger 2	.0161

Source: Calculated and arranged by the author. *) significance of 0.05, **) significance of 0.01.

MinMetalsIx and GDP_gr correlate positively at 56.9* (sig. 0.05). The respective Granger 1 test (p-value of 0.2638) statistically indicates that changes in MinMetalsIx are caused/affected by itself only and not by GDP_gr. Granger 2 test (p-value of 0.0161) indicates that the H_0 (GDP_gr is only affected by itself and not by MinMetalsIx) can be rejected with high confidence. I therefore also include MinMetalsIx in the regression analysis of GDP_gr for Brazil.

In conclusion, the Granger 1 and Granger 2 tests above in Table 4.7 indicate that changes in Brazil’s GDP_gr are not only caused by MinMetalsIx, but also by AgriRawIx, and FoodIx. In light of this statistical proposition, Granger results seem plausible from an empirical point of view.

Table 4.8a: Granger Causality Matrix Brazil (Variables 1-29)

Variable No		1	2	3	4	6	7	9	10	11	12	13	15	16	17	18	19	20	22	23	24	25	26	27	29
		GDPDefl	GDP_gr	GDPpCap_gr	Agri_GDP	IndustValAd_GDP	IndustValAd_gr	ManFactValAdd_gr	GrossSav_GDP	GrossSav_GNI	GrossDomSav_GDP	GrossNatExp_GDP	GovFinConExp_gr	FinConExp_GDP	FinConExp_gr	HHFinConExp_gr	HHFinConExp_GDP	HHFinConExpPCap_gr	GroCapF_gr	GrossFixCapForm_GDP	GrossFixCapForm_gr	Trade_GDP	MrchTrade_GDP	ExpGS_GDP	ExtBalGS_GDP
FoodIx	Pearson Correlat	.612*	.697*	.729**	-0.049	-0.068	0.569	0.500	0.3	0.292	0.231	-0.068	0.527	-0.231	.638*	.578*	-0.193	.650*	.601*	.704**	.709**	0.128	0.161	0.114	0.068
	Granger1	0.0001	0.4079	0.3097											0.0217	0.0406		0.0359	0.9313	0.1722	0.9920				
	Granger2	0.0854	0.0486	0.0654											0.0860	0.1379		0.1621	0.3689	0.0167	0.1732				
TropBevIx	Pearson Correlat	0.155	0.526	0.535	-0.441	-0.367	0.540	0.357	-0.068	-0.086	-0.199	0.265	0.295	0.199	0.356	0.322	0.2	0.351	0.440	.632*	0.500	-0.418	-0.382	-0.386	-0.265
	Granger1																			0.9801					
	Granger2																			0.2357					
VegOilSeedsIx	Pearson Correlat	.583*	0.501	0.526	0.077	-0.135	0.372	0.297	0.281	0.27	0.199	-0.077	.759**	-0.199	0.538	0.432	-0.162	0.454	0.326	.613*	0.457	0.101	0.141	0.098	0.077
	Granger1	0.0098											0.7009							0.8049					
	Granger2	0.2183											0.0237							0.1587					
AgriRawIx	Pearson Correlat	.723**	.643*	.675*	0.004	0.106	.596*	.592*	0.474	0.465	0.394	-0.242	0.351	-0.394	0.510	0.474	-0.343	0.524	0.494	.564*	0.524	0.23	0.265	0.245	0.242
	Granger1	**<0.0001**	0.751	0.837			0.2817	0.3953											0.102	0.062					
	Granger2	**0.0273**	0.000	0.001			<0.0001	0.003											12	0.0075					
MinMetalsIx	Pearson Correlat	.850**	0.569	.579*	-0.043	0.231	0.544	0.0025	0.536	0.534	0.515	-0.364	-0.014	-0.515	0.153	0.164	-0.481	0.179	0.484	0.459	0.462	0.399	0.421	0.405	0.364
	Granger1	0.002	0.2638	0.3105																					
	Granger2	0.0999	0.0161	0.0246																					
CrudeIx	Pearson Correlat	.922**	0.433	0.436	0.126	0.344	0.452	0.505	.610*	.612*	.620*	-0.459	-0.207	-.620*	0.172	0.218	-.573*	0.246	0.383	0.407	0.164	.572*	.592*	.560*	0.459
	Granger1	0.0639							0.5163	0.5168	0.4964											0.4102	0.3404	0.343	
	Granger2	0.123							0.4902	0.4452	0.2658											0.7935	0.9704	0.1979	
WGIVA	Pearson Correlat	.934**	-0.472	-0.452	0.508	.555*	-0.461	-0.322	.839**	.841**	.832**	-.818**	-0.092	-.832**	0.064	0.084	-.823**	0.064	-.605*	-0.081	-0.460	.772**	.783**	.823**	.818**
	Granger1	0.0405							0.3349	0.2595	0.0223								0.696			0.0126	0.0169	0.0122	0.1532
	Granger2	0.7449							0.062	0.0771	0.1801								1			0.884	0.7419	0.5829	0.7123
WGIPS	Pearson Correlat	0.32	0.005	0.033	0.371	0.467	-0.179	-0.313	0.229	0.248	0.381	-0.306	-0.060	-0.381	0.398	0.428	-0.283	0.422	0.244	-0.333	0.418	.646*	.621*	.562*	0.306
	Granger1																					0.9861	0.99	0.9301	
	Granger2																					0.0205	0.049	0.0176	
WGIGE	Pearson Correlat	0.437	-0.035	-0.038	.741**	.578*	-0.073	-0.114	0.483	0.494	.572*	-0.533	0.445	-.572*	0.008	-0.072	-0.475	-0.072	-0.162	-0.41	0.046	.750**	.750**	.712**	0.533
	Granger1				0.2146	0.1476					0.6068											0.6113	0.6744	0.7369	
	Granger2				0.7016	0.0011					0.005											0.1337	0.1528	0.0323	
WGIRQ	Pearson Correlat	-.886**	-0.283	-0.307	-0.047	-.557*	-0.200	-0.078	-.742**	-.745**	-.764**	.666*	-0.427	.764**	-0.201	-0.135	.787**	-0.231	-0.324	-0.163	-0.412	-.598*	-.618*	-.648*	-.666*
	Granger1											**0.0116**		**0.0037**			**0.0307**								
	Granger2											**0.0466**		**0.0322**			**0.0137**								
WGIRL	Pearson Correlat	-.817**	-0.264	-0.286	-0.157	-.604*	-0.196	-0.287	-.682*	-.692**	-.755**	.750**	-0.160	.755**	-0.280	-0.266	.802**	-0.310	-0.210	0.168	-0.135	-.709**	-.710**	-.755**	-.750**
	Granger1											0.0141		<0.0001			<0.0001								
	Granger2											0.6355		0.8917			0.8451								
WGICC	Pearson Correlat	-0.13	0.041	0.027	0.48	0.095	0.049	0.110	-0.053	-0.05	-0.009	0.002	0.343	0.009	-0.123	-0.189	0.101	-0.190	-0.210	-0.373	-0.287	0.174	0.176	0.123	-0.002
	Granger1																								
	Granger2																								
EFIBiz	Pearson Correlat	-.834**	0.001	-0.012	0.151	-0.345	0.034	0.072	-.565*	-.565*	-.560*	0.476	0.103	.560*	-0.047	-0.069	.569*	-0.066	0.027	-0.254	0.028	-0.425	-0.439	-0.462	-0.476
	Granger1													0.0004			0.0015								
	Granger2													0.3095			0.2183								
EFITrade	Pearson Correlat	.939**	0.382	0.367	0.313	.573*	0.495	0.506	.837**	.839**	.829**	-.730**	-0.220	-.829**	0.148	0.197	-.821**	0.187	0.427	0.202	0.296	.681*	.694**	.728**	.730**
	Granger1	0.0018				0.0719			0.1071	0.0835	0.0129											0.0032	0.002	0.004	0.0729
	Granger2	0.9108				0.4037			0.7321	0.6253	0.2566											0.5735	0.8794	0.2431	0.2855
EFIFisc	Pearson Correlat	-.806**	-0.253	-0.279	0.115	-0.177	-0.111	-0.022	-0.441	-0.441	-0.446	0.28	-0.005	0.446	-0.180	-0.188	0.416	-0.216	-0.344	-0.478	-0.416	-0.382	-0.4	-0.365	-0.28
	Granger1																								
	Granger2																								
EFIGovtS	Pearson Correlat	-.826**	0.009	-0.014	-0.083	-0.28	0.030	0.068	-0.502	-0.502	-0.511	0.345	0.336	0.511	-0.196	-0.264	0.424	-0.280	-0.150	-0.311	-0.180	-0.505	-0.526	-0.474	-0.345
	Granger1																								
	Granger2																								
EFIMon	Pearson Correlat	0.147	-0.305	-0.294	0.223	0.058	-0.422	-0.414	-0.141	-0.118	0.048	-0.019	-0.119	-0.048	0.057	0.081	0.004	0.070	-0.218	-0.212	-0.321	0.465	0.436	0.336	0.019
	Granger1																								
	Granger2																								
EFIInvest	Pearson Correlat	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a
	Granger1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Granger2	13	12	12	13	13	12	12	13	13	13	13	12	13	12	12	13	12	12	13	12	13	13	13	13
EFIFin	Pearson Correlat	-0.526	0.154	0.165	0.236	-0.222	0.155	0.127	-0.389	-0.387	-0.373	0.331	0.411	0.373	0.278	0.218	0.387	0.283	0.140	-0.078	0.165	-0.205	-0.202	-0.256	-0.331
	Granger1																								
	Granger2																								
EFIPropRi	Pearson Correlat	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a
	Granger1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Granger2	13	12	12	13	13	12	12	13	13	13	13	12	13	12	12	13	12	12	13	12	13	13	13	13
EFICorrup	Pearson Correlat	0.197	-0.575	-.590*	0.409	0.457	-0.471	-.602*	0.177	0.199	0.354	-0.385	-0.201	-0.354	-0.553	-0.547	-0.356	-0.522	-0.255	-0.537	-0.384	.619*	.598*	.569*	0.385
	Granger1			0.4788				0.7250														0.0859	0.1026	0.0529	
	Granger2			0.0128				0.0585														0.0822	0.1707	0.0211	

Source: Tables 4.8a-c calculated and arranged by the author.

Table 4.8b: Granger Causality Matrix Brazil (Variables 30-54)

Variable No		30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	48	49	50	51	52	53	54
		CurrACC_GDP	ImpGS_GDP	ImpGS_gr	AgRawImp_MrchImp	ManfImp_MrchImp	FuelImp_MerchImp	ExpValX	ImpValIx	ExpVolX	ImpVolIx	UnitValIx Exp	UnitValIx Imp	ToT	PPIxExp	TariffAll weight	HiTekExp_ManuExp	ICTExp_TTExp	AgrRwExp_Merch Exp	FoodExp_MrchExp	ManufExp_MrchExp	FDInet_GDP	StoxVal_GDP	FuelExp_MerchExp	MrktCapList_GDP
FoodIx	Pearson Correlat	0.204	0.141	.667*	-0.218	-.591*	0.539	.830**	.941**	0.55	.904**	.983**	.949**	0.519	.659*	-0.431	-0.366	-.658*	-.666*	-0.021	-.841**	-0.414	.873**	.627*	0.279
	Granger1			0.9629				<0.0001	<0.0001		0.0101	0.0546	<0.0001		0.0003								**0.0262**	0.0004	
	Granger2			0.1753				0.2327	0.8612		0.085	0.6693	0.068		0.1019								**0.0034**	0.5125	
TropBevIx	Pearson Correlat	-0.085	-0.431	0.486	0.236	-0.327	0.016	0.443	.618*	0.121	.629*	.762**	.616*	.886**	0.261	0.077	-.694**	-.788**	-.692**	0.306	-0.502	-0.329	.732**	0.124	0.102
	Granger1								0.0513		0.2055	**0.0029**	0.004	0.2431	0.0717								0.2257		
	Granger2								0.2765		0.9695	**0.0013**	0.0916	0.0115	0.0136								0.9524		
VegOilSeedsIx	Pearson Correlat	0.197	0.095	0.384	-0.207	-.578*	0.428	.784**	.900**	0.515	.875**	.928**	.880**	0.55	.624*	-0.354	-0.443	-.799**	-.603*	0.116	-.854**	-0.33	.884**	.568*	0.294
	Granger1							0.0013	0.0003		0.0069	0.007	0.0008		0.0069								0.025	0.000	
	Granger2							0.9985	0.7073		0.4434	0.6546	0.5276		0.0547								0.577	0.361	
AgriRawIx	Pearson Correlat	0.39	0.17	0.551	-0.261	-.739**	.663*	.900**	.936**	.685**	.901**	.972**	.973**	0.405	.775**	-.562*	-0.38	-.683*	-.612*	-0.119	-.858**	-0.497	.886**	.712**	0.474
	Granger1						0.0049	<0.0001	0.0482	**<0.0001**	0.2468	0.6773	0.006		<0.0001	<0.0001							0.609	<0.0001	
	Granger2						0.4334	0.6151	0.3037	**0.0064**	0.0006	0.0216	0.5112		0.2222	0.3945							<0.0001	0.681	
MinMetalsIx	Pearson Correlat	0.467	0.333	0.531	-0.499	-.770**	.760**	.963**	.926**	.827**	.924**	.912**	.951**	0.246	.899**	-.713**	-0.131	-0.477	-0.496	-0.383	-.842**	-0.373	.896**	.842**	.685**
	Granger1						0.0224	<0.0001	0.2836	**0.0004**	0.0968	0.357	0.1435		**0.000**	0.0067							**0.038**	0.039	0.470
	Granger2						0.9938	0.1912	0.0449	**0.00**	<0.0001	0.0006	0.1817		**0.0226**	0.6615							**<0.0001**	0.761	0.087
CrudeIx	Pearson Correlat	0.521	0.521	0.176	-.626*	-.691**	.860**	.990**	.935**	.888**	.908**	.882**	.962**	0.066	.935**	-.810**	0.023	-0.348	-0.396	-0.466	-.839**	-0.334	.827**	.911**	.600*
	Granger1						0.8649	0.0052	0.6434	0.096	0.7192	0.7746	0.899		0.0351	0.404							0.655	0.434	**0.015**
	Granger2						0.6839	0.8525	0.0487	0.0009	0.0008	0.0001	0.0557		0.3925	0.968							0.004	0.143	**0.000**
WGIVA	Pearson Correlat	.828**	.567*	-0.372	-.694**	-.626*	.842**	.822**	.604*	.924**	.565*	0.53	.664*	-0.27	.906**	-.894**	0.039	-0.216	-0.249	-0.369	-.768**	-0.548	0.486	.940**	.646*
	Granger1	0.4996	0.0335				**0.0199**	0.4633	0.8335	0.052	0.7586		0.9378		0.1819	0.0065								**0.001**	0.973
	Granger2	0.4973	0.7951				**0.0276**	0.0075	0.0136	0.0462	0.0374		0.0147		0.0016	0.2435								**0.028**	0.022
WGIPS	Pearson Correlat	0.161	.737**	0.481	-.605*	0.106	0.38	0.118	-0.01	0.307	-0.02	-0.201	-0.034	-.743**	0.216	-0.407	.822**	.688**	.750**	-.733**	0.14	0.437	-0.139	0.290	0.177
	Granger1		0.8461														0.3614	0.9283	0.2579						
	Granger2		0.0658														0.3366	0.7126	0.2669						
WGIGE	Pearson Correlat	0.4	.731**	-0.082	-.593*	0.071	0.429	0.206	0.05	0.415	0.017	-0.128	0.032	-.687**	0.323	-0.479	0.521	0.323	.578*	-0.417	-0.057	0.212	-0.113	0.366	0.132
	Granger1		0.4346																0.6106						
	Granger2		0.5819																0.5257						
WGIRQ	Pearson Correlat	-.706**	-0.416	-0.329	.631*	.687**	-.814**	-.871**	-.687**	-.920**	-.706**	-.645*	-.740**	0.038	-.935**	.839**	-0.002	0.312	0.477	0.468	.677*	0.381	-.639*	-.846**	-.769**
	Granger1				0.6577	0.849										0.0272					0.9963				
	Granger2				0.3501	0.0049										0.9541					0.0086				
WGIRL	Pearson Correlat	-.699**	-0.521	-0.105	.795**	0.409	-.686**	-.680*	-0.423	-.855**	-0.45	-0.327	-0.461	0.314	-.822**	.797**	-0.283	-0.047	0.162	.582*	0.468	0.218	-0.369	-.779**	-.697**
	Granger1				0.7745											0.0408				0.738					
	Granger2				0.6606											0.1579				0.1644					
WGICC	Pearson Correlat	-0.118	0.257	-0.418	-0.128	0.431	-0.209	-0.272	-0.27	-0.164	-0.26	-0.382	-0.351	-0.316	-0.216	0.157	0.29	0.219	.697**	-0.015	0.296	0.52	-0.292	-0.218	-0.209
	Granger1																		0.8433						
	Granger2																		0.4195						
EFIBiz	Pearson Correlat	-0.552	-0.294	-0.030	0.541	.660*	-.749**	-.895**	-.779**	-.843**	-.772**	-.774**	-.843**	-0.106	-.885**	.738**	0.051	0.284	0.454	0.496	.703**	0.425	-.731**	-.816**	-.686**
	Granger1					0.3364										0.0242					0.7023				
	Granger2					0.0119										0.8619					0.0141				
EFITrade	Pearson Correlat	.789**	0.493	0.418	-.643*	-.709**	.897**	.904**	.728**	.945**	.707**	.683*	.791**	-0.096	.952**	-.867**	-0.005	-0.288	-0.474	-0.442	-.753**	-.558*	.617*	.940**	.634*
	Granger1	0.1915					<0.0001	0.3061	0.9051	0.0009	0.7487	0.3916	0.9333		0.0457	<0.0001							0.6545	0.011	0.1374
	Granger2	0.5055					0.8938	0.5846	0.2811	0.632	0.1166	0.0096	0.2013		0.4262	0.4547							0.0396	0.9593	0.0238
EFIFisc	Pearson Correlat	-0.362	-0.366	-0.471	0.532	.688**	-.707**	-.924**	-.906**	-.778**	-.915**	-.879**	-.914**	-0.242	-.853**	.675*	0.034	0.382	0.432	0.431	.793**	0.247	-.869**	-.808**	-.656*
	Granger1					0.4128										0.1116					0.6057				
	Granger2					0.0163										0.7437					0.0079				
EFIGovtS	Pearson Correlat	-0.4	-0.502	-0.286	.590*	.607*	-.725**	-.883**	-.841**	-.790**	-.844**	-.776**	-.841**	-0.077	-.839**	.718**	-0.054	0.304	0.172	0.45	.742**	0.171	-.799**	-.794**	-.669*
	Granger1				0.551	**0.0736**										0.1505					0.1374				
	Granger2				0.0323	**0.0451**										0.9195					0.1892				
EFIMon	Pearson Correlat	-0.17	.669*	-0.380	-0.548	0.203	0.147	0.012	-0.005	0.099	-0.013	-0.206	-0.084	-.606*	0.036	-0.229	.855**	.668*	.717**	-0.535	0.088	.641*	-0.087	0.162	0.043
	Granger1		0.8585														0.4927	0.6403	0.9537			<0.0001			
	Granger2		0.0823														0.1213	0.1842	0.6027			0.0862			
EFIInvest	Pearson Correlat	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a
	Granger1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Granger2	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFIFin	Pearson Correlat	-0.42	-0.071	0.048	0.307	.692**	-0.453	-0.537	-0.397	-.567*	-0.458	-0.403	-0.435	-0.099	-.600*	0.483	0.056	0.194	0.256	0.415	0.429	0.288	-0.517	-0.546	-.829**
	Granger1					0.6229																			
	Granger2					0.0246																			
EFIPropRi	Pearson Correlat	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a
	Granger1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Granger2	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFICorrup	Pearson Correlat	0.166	.641*	-0.429	-.614*	0.392	0.166	-0.064	-0.234	0.197	-0.228	-0.422	-0.274	-.750**	0.09	-0.288	.783**	.686**	.677*	-0.538	0.252	0.522	-0.371	0.149	-0.001
	Granger1		0.4115														0.8648	0.5633	0.8501						
	Granger2		0.4032														0.271	0.2469	0.2546						

Table 4.8c: Granger Causality Matrix Brazil (Variables 55-79)

Variable No		55	56	57	58	60	61	62	63	64	65	66	67	68	69	71	72	73	74	75	76	77	78	79
		FoodPrdIx	CropProdIX	LivStock ProdIX	CPIx	M2_GDP	M2_gr	IRSSpread	RealIR	ExtDebtST_ExpGSInc	ExtDebtST_GNI	STD_ExpGSInc	STD_TTExtDbt	STD_TTResv	TTRes_TTExtDbt	MultiDebt_TTExtD	EnrgyImp_Euse	GDP_UEnUKPPPOilE	GDP_UEnUPPPOilE	RuPp_ToTPp	Internet_100	Phonelines_100	Unempl_Lforce	MobileSubs_100
FoodIx	Pearson Correlat	0.43	.581*	0.284	.588*	.563*	0.220	-0.371	-0.351	-.699**	-.801**	-0.426	0.415	-.761**	.907**	-0.056	-0.366	.576*	.709**	-0.48	.729**	0.089	-0.55	.730**
	Granger1		<0.0001		0.0003	<0.0001				**0.0196**	0.198			0.0463	<0.0001			0.3718	**0.0001**		0.0003			<0.0001
	Granger2		0.7523		0.074	0.0538				**0.0035**	0.275			0.4086	0.8854			0.5755	**0.0029**		0.1693			0.5966
TropBevIx	Pearson Correlat	-0.035	0.104	-0.166	0.137	0.103	0.243	0.162	0.222	-0.327	-.821**	0.002	.598*	-0.448	.629*	-0.387	0.11	0.366	0.254	-0.002	0.3	-0.448	-.605*	0.287
	Granger1										0.001		0.1099		0.0008									
	Granger2										0.1328		0.5536		0.3488									
VegOilSeedsIx	Pearson Correlat	0.424	.578*	0.259	.558*	0.524	-0.094	-0.249	-0.239	-.604*	-.704**	-0.394	0.375	-.741**	.886**	-0.107	-0.339	0.396	.644*	-0.455	.693**	0.058	-0.4	.687**
	Granger1				0.0133					0.004	0.3836			**0.0018**	<0.0001				0.0006		0.0036			0.0039
	Granger2				0.243					0.2541	0.4547			**0.0248**	0.0826				0.0822		0.3155			0.2318
AgriRawIx	Pearson Correlat	.565*	.690**	0.429	.706**	.645*	0.518	-0.478	-0.454	-.814**	-.836**	-0.543	0.383	-.855**	.951**	0.094	-0.493	.561*	.806**	-.593*	.826**	0.184	-0.456	.817**
	Granger1	<0.0001	<0.0001		**<0.0001**	**<0.0001**				0.0103	**0.0031**			0.0027	0.0441			0.2172	<0.0001	<0.0001	<0.0001			<0.0001
	Granger2	0.165	0.9416		**0.0374**	**0.0068**				0.106	**0.001**			0.5518	0.3324			0.2054	0.0704	0.0723	0.161			0.8554
MinMetalsIx	Pearson Correlat	.708**	.816**	.567*	.833**	.834**	0.538	-.666*	-.616*	-.871**	-.757**	-.716**	0.159	-.879**	.948**	0.4	-.674*	0.404	.914**	-.767**	.920**	0.394	-0.197	.920**
	Granger1	0.002	0.0286	<0.0001	0.001	0.1429		0.2861	0.3082	0.0011	0.8797	0.0032		0.0797	0.2249				0.0051	**0.0148**	0.0013			0.001
	Granger2	0.495	0.4046	0.4641	0.0859	0.0243		0.7758	0.7615	0.4021	0.1152	0.466		0.6565	<0.0001				0.1945	**0.0208**	0.1644			0.6289
CrudeIx	Pearson Correlat	.813**	.896**	.708**	.908**	.904**	.653*	-.770**	-.737**	-.898**	-.643*	-.805**	0.029	-.851**	.887**	0.455	-.777**	0.362	.959**	-.861**	.961**	.560*	-0.103	.976**
	Granger1	0.110	0.0336	0.3165	0.1093	0.2738	0.9533	0.6332	0.8357	0.7675	0.3511	0.3829		0.3271	0.5059				0.2647	0.1732	0.231	0.519		**0.0052**
	Granger2	0.366	0.2941	0.3144	0.1194	0.0025	0.5080	0.493	0.537	0.5753	0.0297	0.9834		0.0212	<0.0001				0.9815	0.0002	0.982	0.4613		**0.0267**
WGIVA	Pearson Correlat	.940**	.928**	.869**	.941**	.831**	-0.215	-.728**	-.766**	-.870**	-0.345	-.923**	-0.284	-.876**	.642*	.710**	-.947**	0.228	.898**	-.912**	.902**	.757**	0.177	.875**
	Granger1	0.016	0.055	0.015	0.0473	0.0878		0.0066	0.0101	0.3089		0.0076		0.8067	0.8014	0.0317			0.0571	0.0113	0.1946	0.0115		0.1443
	Granger2	0.944	0.311	0.6135	0.6822	0.3506		0.3334	0.4661	0.0228		0.4515		0.0174	0.01	0.4282			0.2744	0.8715	0.0159	0.0324		0.1432
WGIPS	Pearson Correlat	0.422	0.362	0.466	0.327	0.45	0.425	-.572*	-.582*	-0.059	0.477	-0.391	-.639*	0.154	-0.172	0.525	-0.484	-0.415	0.215	-0.456	0.19	.703**	.725**	0.25
	Granger1							0.2962	0.2618				0.0933									0.9878	0.0026	
	Granger2							0.0842	0.0699				0.638									0.0006	0.9942	
WGIGE	Pearson Correlat	.567*	0.503	.593*	0.452	0.451	-0.369	-0.474	-0.535	-0.174	0.444	-0.517	-.691**	-0.059	-0.112	0.46	-.579*	-0.421	0.29	-0.537	0.315	.735**	.664*	0.33
	Granger1	0.8758		0.8939									0.1879									0.4669	0.0424	
	Granger2	0.4177		0.007									0.5165									0.155	0.8042	
WGIRQ	Pearson Correlat	-.832**	-.846**	-.779**	-.886**	-.842**	0.066	.738**	.668*	.900**	.598*	.866**	0.116	.849**	-.724**	-.702**	.794**	-0.225	-.907**	.854**	-.902**	-.583*	-0.037	-.885**
	Granger1							0.2189	0.1831	0.0004	0.9401	0.0104		0.251		0.1884	0.027			0.0501				
	Granger2							0.6021	0.5662	0.9663	0.0528	0.4988		0.1241		0.3587	0.6207			0.1291				
WGIRL	Pearson Correlat	-.850**	-.786**	-.848**	-.828**	-.815**	-0.320	.707**	.642*	.719**	0.258	.891**	0.457	.633*	-0.415	-.893**	.859**	0.111	-.766**	.858**	-.751**	-.749**	-0.477	-.756**
	Granger1							0.1803	0.1882	0.1033		0.0008		0.6388		0.2629	0.1682			0.0842				
	Granger2							0.2127	0.1353	0.3729		0.7675		0.026		0.8728	0.2737			0.192				
WGICC	Pearson Correlat	-0.029	-0.045	-0.039	-0.121	-0.063	-.595*	0.129	0.079	0.391	.611*	0.056	-0.536	0.379	-0.421	-0.035	0.015	-.665*	-0.274	0.038	-0.211	0.169	.588*	-0.205
	Granger1						0.0196				0.0935												0.8342	
	Granger2						0.1481				0.8518												0.1784	
EFIBiz	Pearson Correlat	-.737**	-.767**	-.675*	-.830**	-.811**	-0.212	.670*	.586*	.876**	.731**	.763**	-0.051	.814**	-.790**	-.569*	.716**	-0.307	-.879**	.776**	-.866**	-0.445	0.049	-.879**
	Granger1								0.2328	0.0013	0.8001	0.0326		0.114		0.2885	0.1565			0.0617				
	Granger2								0.5	0.4579	0.1921	0.5614		0.1393		0.2224	0.5682			<0.0001				
EFITrade	Pearson Correlat	.899**	.908**	.844**	.943**	.848**	0.220	-.793**	-.769**	-.963**	-.572*	-.911**	-0.106	-.907**	.746**	.631*	-.880**	0.43	.960**	-.896**	.942**	.670*	-0.03	.923**
	Granger1	0.001	0.0025	0.0057	0.0016	0.0925		0.0109	0.0003	0.0992	0.2137	0.0794		0.9627	0.9027	0.1002			0.0037	0.0101	0.0333	**0.0239**		0.0222
	Granger2	0.9437	0.2096	0.5168	0.8756	0.1548		0.8048	0.9008	0.5199	0.0313	0.7554		<0.0001	0.0019	0.6034			0.1057	0.0625	0.3356	**0.0315**		0.7987
EFIFisc	Pearson Correlat	-.653*	-.774**	-0.502	-.786**	-.837**	-0.346	.657*	.597*	.797**	.698**	.680*	-0.096	.806**	-.904**	-0.416	.636*	-0.33	-.870**	.740**	-.876**	-0.391	0.159	-.884**
	Granger1							0.3743	0.5338	0.0066	0.2778	0.0465		0.1173			0.0813			0.0726				
	Granger2							0.5899	0.4965	0.5208	0.3933	0.2432		0.8113			0.4472			0.0369				
EFIGovtS	Pearson Correlat	-.717**	-.823**	-.563*	-.812**	-.857**	-.684*	.691**	.669*	.751**	0.525	.710**	0.043	.729**	-.803**	-0.435	.696**	-0.159	-.839**	.783**	-.858**	-0.501	-0.039	-.870**
	Granger1						0.2105	0.4057	0.6048	0.0303		0.0435		0.017			0.052			0.0429				
	Granger2						0.6351	0.1623	0.3728	0.7477		0.6823		0.7242			0.1884			0.4663				
EFIMon	Pearson Correlat	0.225	0.204	0.246	0.133	0.335	0.166	-0.378	-0.408	0.169	.585*	-0.16	-0.482	0.297	-0.158	0.325	-0.278	-0.5	0.057	-0.282	0.037	0.538	.701**	0.126
	Granger1										0.7262												0.2104	
	Granger2										0.713												0.8805	
EFIInvest	Pearson Correlat	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a
	Granger1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Granger2	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFIFin	Pearson Correlat	-0.443	-0.491	-0.319	-0.523	-0.542	-0.071	0.474	0.412	.564*	0.486	0.49	-0.029	.610*	-.594*	-.568*	0.484	-0.217	-.581*	0.498	-.562*	-0.25	-0.028	-0.531
	Granger1									0.0411				0.2602		0.0572								
	Granger2									0.5379				0.8203		0.0001								
EFIPropRi	Pearson Correlat	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a
	Granger1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Granger2	13	13	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFICorrup	Pearson Correlat	0.345	0.239	0.431	0.21	0.312	-0.229	-0.324	-0.33	0.113	.663*	-0.371	-.906**	0.243	-0.426	.587*	-0.414	-.720**	0.041	-0.362	0.051	.661*	.854**	0.087
	Granger1										0.0372		0.728			**0.0066**						0.0804	0.2477	
	Granger2										0.377		0.1006			**0.0343**						0.0031	0.0102	

GRANGER CAUSALITY COUNT BRAZIL

Significant Granger Causality

The Granger causality analysis for Brazil identifies a total of 224 significant counts of Granger causal relationships, of which only 95 (or 42.4% of total counts) indicate that changes in dependent variables are Granger caused by changes in independent variables. In contrast, 129 counts (or 57.6% of total counts) indicate that dependent variables are Granger causing the change of independent variables (inverse Granger causality). For example, household final consumption expenditure growth rate (Table 4.8a, Variable 18: HHFinConExp_gr) correlates at 57.8% (*sig. 0.05) with the food price index (FoodIx). Granger 1 and Granger 2 tests reveal that changes in FoodIx are caused by changes in HHFinConExp_gr, and not vice versa.

Table 4.9: Significant Granger Causality Counts Brazil

	Granger Causality	Inverse Granger Causality	Total	Total % Share
Commodity Price Indexes	**46**	**67**	**113**	**50.4%**
FoodIx	6	16	22	9.8%
TropBevIx	2	3	5	2.2%
VegOilSeedsIx	2	15	17	7.6%
AgriRawIx	13	16	29	12.9%
MinMetalsIx	11	14	25	11.2%
CrudeIx	12	3	15	6.7%
Worldwide Governance Indexes	**27**	**28**	**55**	**24.6%**
WGIVA	13	16	29	12.9%
WGIPS	4	1	5	2.2%
WGIGE	4	1	5	2.2%
WGIRQ	5	4	9	4.0%
WGIRL	1	5	6	2.7%
WGICC	0	1	1	0.4%
Economic Freedom Indexes	**22**	**34**	**56**	**25.0%**
EFIBiz	3	5	8	3.6%
EFITrade	7	20	27	12.1%
EFIFisc	3	2	5	2.2%
EFIGovtS	2	4	6	2.7%
EFIMon	0	1	1	0.4%
EFIInvest	0	0	0	0.0%
EFIFin	2	1	3	1.3%
EFIPropRi	0	0	0	0.0%
EFICorrup	5	1	6	2.7%
Total	**95**	**129**	**224**	**100.0%**

Source: Calculated and arranged by the author.

At the example of HHFinConExp_gr (Variable 18) I observe inverse Granger causality. As stated earlier, inverse Granger causality analysis (or negative Granger causality) will be part of the economic discussion in Chapter 5. The inverse causal nature of HHFinConExp_gr on FoodIx prompts me to exclude HHFinConExp_gr from the regression analysis on Brazil.

There are 22 pairs of Granger causal feedback relationships within the commodity price index set (16 counts), WGI set (5 counts), and EFI set (1 counts) which display significant p-values for the Granger 1 test and Granger 2 test. These 22 feedback (two-way) Granger causalities are marked in bold letters. They predominantly appear within the financial sector topic, private sector and trade topic. Feedback Granger causalities will be regarded as Granger causalities of independent variables causing dependent variables. That is, feedback Granger causalities will be part of the regression analysis by convention (if not otherwise explicitly stated) by rejecting the H_0 of Granger 2 and not rejecting the H_0 of Granger 1.[69]

Commodity Price Index

The commodity price index set discloses a total count of 113 Granger causalities (50.4% of total Granger causalities) of which 46 consist of independent variables Granger causing dependent variables. And 67 counts reveal inverse Granger causality (46 Granger causalities: 67 inverse Granger causalities).

The largest numbers of causality counts within the commodity price index occur within AgriRawIx (13:16), followed by CrudeIx (12:3), MinMetalsIx (11:14), FoodIx (6:16), VegOilSeedsIx (2:15), and TropBevIx (2:3).

According to the Granger causality findings I also note that commodity prices in Brazil predominantly affect dependent variables within the private & trade sector (Variables 37-40), such as import volume index and export volume index, and within the

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[69] For example, export volume index (Table 4.8b, Variable 38: ExpVolx) positively correlates at 82.7% (sig. 0.01) with MinMetalsIx. Granger causality analysis reveals feedback results. Granger 1 test and Granger 2 test are both significant below the 0.01-level (sig. 0.01). Granger 1 indicates that prices of minerals and metals are caused by increasing export volumes, whereas Granger 2 indicates that export volumes are caused by increasing minerals and metals prices (MinMetalsIx). By convention, ExpVolx (Variable 38) is therefore caused by MinMetalsIx and thus included in the regression analysis.

economic policy & debt topic such as GDP_gr and GDPpCap_gr (Variables 2 and 3). GDP_gr and GDPpCap_gr correlate positively with AgriRawIx and MinMetalsIx, suggesting that Brazil's vast reserves and wealth in iron ores as well as in agricultural commodities, and external demand thereof, affect GDP_gr and GDPpCap_gr. Granger causality analysis supports this suggestion by revealing that GDP_gr and GDPpCap_gr are Granger caused by MinMetalsIx and AgriRawIx. Similarly, it appears that increases in AgriRawIx cause IndustValAd_gr (Variable 7) and ManFactValAdd_gr (Variable 9). Also, government final consumption expenditures growth rate (Variable 15: GovFinConExp_gr) is driven by rising VegOilseedsIx. Then, increasing commodity prices in food (FoodIx) and agricultural raw materials (AgriRawIx) seem to Granger cause gross fixed capital formation to GDP (Variable 23: GrossFixCapForm_GDP).

Trade indexes (Variables 36 to 41) display a large concentration of Granger causality counts. Half of it is of inverse nature. For example, export value index (Variable 36: ExpValx) displays inverse Granger causality to all commodity price indexes except to tropical beverages (TropBevIx). This suggests that rising Brazilian export values are causing/affecting global commodity prices, specifically those of soy and iron ores, which are exported in large volumes by Brazil to China. China's import value index and import volume index (Variables 37, 39: ImpValIx, ImpVolIx) in turn show significant Granger 1 results and significant Granger 2 results (both p-values are below 0.05) to nearly all commodity price indexes. This suggests that commodity demand by China, reflected by high global commodity import shares to China, affect commodity prices on a global scale between 1996 and 2008. Significant Granger 1 and Granger 2 results of Brazil's ExpVolx (Variable 38) with AgriRawIx (p-value1 0.0001, p-value2 0.0064), with MinMetalsIx (p-value1 0.0004, p-value2 0.0005), and with CrudeIx (p-value1 0.096, p-value2 0.0009) support the argument that increased demand for these commodities, especially from China, causes Brazilian ExpVolx to rise. Therefore, in this case, p-values of Granger 1 test of the Chinese import volume index (Variable 39: ImpVolIx) may be accepted, i.e., Granger 1 H_0 would have to be rejected for all commodity price indexes except TropBevIx, and Granger 2 H_0 (despite p-values below 0.05) of Chinese ImpVolIx may not be rejected for all commodity price indexes except TropBevIx (Table 4.11b: Granger Causality Matrix China). The feedback relationship will be disregarded in favor of the hypothesis that imports to China cause changes in relevant commodity prices. This relationship will be assessed in more depth in Section 5.2.8 (Trade Indexes).

Also, the Granger 1 and Granger 2 tests for stock value to GDP (Variable 52: StoxVal_GDP) reveal that commodity prices of food, agricultural raw materials, minerals and metals as well as oil Granger cause StoxVal_GDP. Market capitalization to GDP (Variable 54: MrktCapList_GDP) however is affected by CrudeIx only. M2_GDP (Variable 60: money and quasi money (M2) to GDP) is caused by agricultural raw materials, minerals and metals as well as crude oil prices (CrudeIx). Rising CrudeIx together with MinMetalsIx cause the rise of Brazil’s total reserves to external debt ratio (Variable 69). Furthermore, declining ExtdebtSt_ExpGS (Variable 64) seem to be Granger caused by rising food prices, showing a high significant negative correlation of 69.9%.

The declining rural population to total population ratio (Variable 75: RuPp_ToTPp) appears to be Granger caused by MinMetalsIx and CrudeIx, showing a high and significant negative correlation of -76.7% and -86.1%. This suggests that there exists an association between rural migration and increasing commodity prices in conjunction with an increasing commodities export sector in industrial centers such as São Paulo, Rio De Janeiro, Salvador De Bahia, or Porto Alegre.

In conclusion, commodity price indexes display the largest number of causality counts compared to all sets of independent variables, underscoring the importance of all commodity groups for Brazil’s economy, especially food, vegetables, oils and seeds, agricultural raw materials, minerals and metals, and oil.

Economic Freedom Index

EFI index shows 56 significant Granger causalities of which 34 are of inverse (negative) nature. Trade governance (EFITrade) is the dominant governance dimension within the EFI set and one of the most dominant individual independent variables overall, counting 27 Granger causalities (12.1% of all causality counts for Brazil), 20 of which are of inverse nature. This is remarkable and suggests that trade governance in Brazil may be caused by macroeconomic variables which reflect on the improving macroeconomic dynamics between 1996 and 2008. Deteriorating business governance (EFIBiz), down from

70.0 index points to 54.4 index points between 1996 and 2008, is the second strongest governance index of Brazil, counting 8 Granger causalities, five of which are of inverse nature. This illustrates the low intensity of Granger causality effects from EFIBiz to the dependent variables.

The Brazilian EFITrade (trade governance), which improved from 57.0 to 71.6 points from 1996 to 2008, reveals significant Granger causal effects in the context of significant negative correlations with debt related variables such as external debt stocks to gross national income (Variable 65: ExtDebST_GNI), short-term debt to total reserves (Variable 68: STD_TTRsv), and a positive correlation with total reserves to total external debt (Variable 69: TTRes_TTExtDbt). The latter indicates that improving trade governance causes lower external debt and higher reserves positions for Brazil. This indication is underscored by the significantly negative correlation of EFITrade with ExtDebtST_ExpGSInc (Variable 64) and STD_ExpGSInc (Variable 66), correlating at 96.3% and 91.1%, respectively, in context of a significant positive correlation with unit value of exports index (Variable 40: UnitValIxExp), which as well is Granger caused by trade governance (EFITrade) at the 0.01 significance level.

The improved trade governance seems to also positively affect stock market related variables such as StoxVal_GDP (Variable 52: total value of stocks traded to GDP) and MrktCapList_GDP (Variable 54: market capitalization of listed companies to GDP), indicating that an increasingly open Brazilian economy attracted stock market investors into the IBOVESPA index and its constituents, which are primarily lead by commodity firms in the oil, and minerals and metals sector (e.g., Petrobras, Companhia Vale Do Rio Doce).

The declining freedom of business governance on the other hand reveals significant Granger causal effects on declining manufactured exports to total merchandise exports (Variable 50: ManExp_MrchExp). This provides statistical evidence that an expanding domestic export oriented commodity sector impinges the development of the domestic manufacturing sector, leading to lower exports and imports of manufactured goods as a result of redirected resources into the commodity sector.[70] Imports of manufactured products to total merchandise imports (Variable: 34) also displayed moderately high correlations to declining fiscal governance (EFIFisc index), increasing government involvement (i.e., declining EFIGovtS index), and declining freedom of finance governance (EFIFin index) at significant levels. Granger causality indicates that ManfImp_MerchImp seems to be negatively affected by the decline of EFIBiz, EFIFisc, and EFIFin.

Worldwide Governance Index

The WGI index set shows 55 significant Granger causality counts. More than half (28 counts) are of inverse nature. The dominant independent variable within the WGI (and also within the entire independent variable sets) is the voice and accountability index (WGIVA) counting 29 significant Granger causalities, 16 of which are of inverse nature. It is remarkable that trade variables such as Trade_GDP, Mrchtrade_GDP, and ExpGS_GDP (Variables 25-27) are Granger caused by political stability (WGIPS), showing positive correlations of 64.6%, 62.1%, and 56.2% below the significance level of 0.05.

Equally remarkable is the following: Trade_GDP, MrchTrade_GDP, and ExpGS_GDP Granger cause the voice and accountability index (WGIVA, i.e., degree of democracy index) at significance levels close to 0.01, displaying correlations of 77.2%, 78.3%, and 82.3% also at significance levels close to 0.01. This suggests the following: The improving degree of democracy index (WGIVA) is caused by improving trade openness represented by rising Variables 25 to 27. In this context it is revealing that MarktCapList_GDP is Granger caused by not only minerals and metals and oil prices but also by WGIVA at significant levels with a correlation of 64.6% (sig. 0.05). Furthermore, the causality analysis reveals that improving trade indexes (Variables 36-39, 41) are in turn Granger caused by WGIVA at significant levels (sig. 0.05). Also revealing is that an improving degree of democracy (WGIVA) seems to Granger cause the increase in internet connections (Variable 76: Internet_100 (internet lines per 100 households)) which stood at

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[70] The declining economic freedom index of business correlates positively at a high significance level with ManfImp_MerchImp (Variable 34: manufactured imports to merchandise imports), and ManufExp_MerchExp (Variable 50: manufactured exports to merchandise exports). Variable 50 (manufactured exports to merchandise exports) declined from 53.8% in 1998 to 44.9% in 2008. Variable 34 (manufactured imports to merchandise imports) was relatively flat at 70% at the end of 1996 and 2008.

0.45% in 1996 and 37.52% in 2008 in Brazil (in comparison to 0.01% and 22.5% in China during the same period). However, this measure does not necessarily reveal sufficient information about the degree of critical political dialog and content issued through the internet, which in turn may serve in itself as a measure of the degree of democracy (e.g., freedom of speech).

In contrast, deteriorating regulatory quality governance (WGIRQ) —down from 0.36 to 0.07 between 1996 and 2008— appears to Granger cause the decline of the following variables: GrossNatExp_GDP (Variable 13), FinConExp (Variable 16), HHFinConExp_GDP (Variable 19), ManfImp_MrchImp (Variable 34), ManuExp_MrchExp (Variable 50) at significant levels (< sig. 0.05 for Variables 13, 16, 19, and < sig. 0.01 for Variables 34, 50).

Non-significant Granger Causality

The Granger causality analysis in this section reveals that there are a number of dependent variables which show significant inverse Granger causality to an independent variable. The purpose of this section is not only the identification of Granger caused dependent variables, but also the elimination of dependent variables which are not significantly Granger caused by any of the independent variables. The elimination of these dependent variables is a further selection step as I proceed towards the regression analysis. Dependent variables which are not significantly Granger caused by any independent variable are marked in red in the Granger Causality Matrix Brazil (Table 4.8a-c) and include the following 27 dependent variables:

(1) Variable 4: Agri_GDP (agriculture value added to GDP)

(2) Variable 10: GrossSav_GDP (gross savings to GDP)

(3) Variable 11: GrossSav_GNI (gross savings to gross national income)

(4) Variable 17: FinConExp_gr (final consumption expenditure growth rate)

(5) Variable 18: HHFinConExp_gr (household final consumption expenditure growth rate)

(6) Variable 20: HHFinConExpPCap_gr (household final consumption expenditure per capita growth rate)

(7) Variable 22: GroCapF_gr (gross capital formation growth rate)

(8) Variable 24: GrossFixCapForm_gr (gross fixed capital formation growth rate)

(9) Variable 29: ExtBalGS_GDP (external balance of goods and services to GDP)

(10) Variable 30: CurrACC_GDP (current account to GDP)

(11) Variable 31: ImpGS_GDP (imports of goods and services to GDP)

(12) Variable 32: ImpGS_gr (imports of goods and services growth rate)

(13) Variable 44: TariffAllweight (weighted tariff rate all products)

(14) Variable 45: HiTekExp_ManuExp (high technology exports to manufactured exports)

(15) Variable 46: ICTExp_TTExp (information communication technology exports to merchandise exports)

(16) Variable 48: AgrRwExp_MerchExp (agricultural raw material exports to merchandise exports)

(17) Variable 49: FoodExp_MrchExp (food exports to merchandise exports)

(18) Variable 51: FDInet_GDP (net foreign direct investment to GDP)

(19) Variable 55: FoodPrdIx (food production index)

(20) Variable 56: CropProdIx (crop production index)

(21) Variable 61: M2_gr (money and quasi money growth)

(22) Variable 62: IRSSpread (interest rate spread)

(23) Variable 63: RealIR (real interest rate)

(24) Variable 66: STD_ExpGSInc (short-term debt to exports of goods, services, and income)

(25) Variable 67: STD_TTExtDbt (short-term debt to total external debt)

(26) Variable 72: EnrgyImp_Euse (energy imports to energy use)

(27) Variable 73: GDP_UEnUKPPPOilE (GDP per unit of energy use (USD per kg of oil equivalent))

4.2.3.3 Causality Analysis China

This section represents the third stage of statistical diagnostic tests for China. The dependent variables are selected based on independent variables Granger causing dependent variables. Similarly to the selection process applied at the example of Brazil, the selection of dependent variables for regression analysis is solely based on significant positive Granger causality. Non-Granger causal dependent variables or inverse (or negative) causal dependent variables will not be part of the regression analysis. The Granger causality matrix for China in Table 4.10 below illustrates the Granger causality framework in this thesis at the example of China.

GRANGER CAUSALITY MATRIX CHINA

Similarly to the example of Brazil, the Granger matrix Tables 4.11a-c display dependent variables Granger caused by independent variables (marked in green). Inverse or negative Granger causalities are marked in yellow; the null hypothesis of Granger 1 test can be rejected based on a significance value threshold of 0.05, whereas the null hypothesis of Granger 2 test may not be rejected. Granger causality result fields without any significance are either kept blank or in white.

Granger causality pairs showing a significant Granger 1 test result as well as a significant Granger 2 test result are marked in bold letters (feedback results, both p-values are below 0.05). Per convention, causality pairs which display p-values below 0.05 for Granger 1 test and Granger 2 test will be interpreted as independent variables Granger causing dependent variables and therefore be part of the regression analysis. The Granger matrix Table 4.11 below shows Granger causality results for each independent-dependent variable pair and their respective p-values.

Example 1: Trade_GDP (Variable 25: trade to GDP) exemplifies the interpretation of the Granger causality matrix in Tables 4.11a-c of China. AgriRawIx, MinMetalsIx, and

CrudeIx correlate at 59.8%*, 73.7%**, and 79.4%** with Trade_GDP at significant levels (*sig. 0.05, **sig. 0.01). CrudeIx displays a Granger 1 test p-value of 0.4343 and a Granger 2 test p-value of 0.0010 indicating that the changes in CrudeIx Granger cause changes in trade to GDP. Both, AgriRawIx and MinMetalsIx show p-values below 0.05 for Granger 1 and Granger 2 test. The respective p-values displayed in bold for Granger 1 test and Granger 2 test are at 0.0007 and 0.0002 for AgriRawIx, and 0.0001 for both Granger 1 test and Granger 2 test for MinMetalsIx. I observe feedback (two-way) Granger causality for AgriRawIx and MinMetalsIx. P-values below 0.05 of Granger 1 and Granger 2 test suggest that there exists positive and negative Granger causality between the independent and dependent variables. As stated before, convention in this thesis dictates that feedback results (simultaneously significant Granger 1 and Granger 2 test results) will be treated as independent variables Granger causing the dependent variable. That is, in case of feedback results the Granger 1 test null hypothesis will not be rejected while the Granger 2 test null hypothesis will be rejected. Therefore, AgriRawIx, MinMetalsIx, as well as CrudeIx ought to Granger cause changes in Trade_GDP. AgriRawIx and MinMetalsIx are thus included in the regression analysis, as is CrudeIx.

Table 4.10: Granger Causality Trade_GDP China

Independent Variables	Test Type	Trade_GDP (Dependent Variable)
AgriRawIx	Correlation	.598*
	Granger 1	**0.0007**
	Granger 2	**0.0002**
MinMetalsIx	Correlation	.737**
	Granger 1	**<0.0001**
	Granger 2	**<0.0001**
CrudeIx	Correlation	.794**
	Granger 1	0.4343
	Granger 2	0.0010
EFITrade	Correlation	.911**
	Granger 1	0.0103
	Granger 2	0.9239

Source: Calculated and arranged by the author.

Trade_GDP and EFITrade are inversely Granger causal as implied by the Granger 1 test p-value of 0.0103 and Granger 2 test p-value of 0.9239. The null hypothesis of Granger 1 is: the independent variable is only affected by itself and not affected by the dependent variable. I reject this null due to its p-value of 0.0103. The null hypothesis of Granger 2 test states that the dependent variable (Trade_GDP) is only affected by itself and not by the EFITrade index. The null of Granger 2 must not be rejected as the p-value is above 0.05 and very high. From an economical perspective this statistical result implies —if true— that an increasing trade to GDP ratio in China implies reactive moves in China's trade governance. That is, trade to GDP causes trade governance. A sensible economic explanation for this may point to the dynamics of a growing external sector in China which has been the catalyst for continuous and gradually improving trade governance changes imposed by the central government in order to fully comply with WTO provisions and in order to capitalize on China's comparative —export related— advantages.

Due to the inverse Granger causality, EFITrade is not included in the regression analysis of Trade_GDP for China.

Example 2: GDP growth rate (Variable 2: GDP_gr) serves as another example for the result interpretation of the Granger causality matrix. VegOilSeedsIx and GDP_gr correlate at 59.0%* (* p-value sig. 0.05). The correlation field is marked in green in order to flag the high significance of the correlation test. Granger 1's null hypothesis states that VegOilSeedsIx is only affected by itself and not by China's GDP_gr (H_0: no Granger causality). The null can be rejected due to a p-value of 0.0272. The probability of wrongly rejecting the null hypothesis is at 2.72 %. In contrast, Granger 2 H_0 states that GDP_gr is only affected by itself and not by VegOilSeedsIx. Due to a p-value of 0.1281, which is above the p-value threshold of 0.05, I choose to not reject the null hypothesis at a high confidence level (above 95%). That is, GDP_gr is not Granger caused by VegOilSeedsIx. In summary I can say GDP growth in China Granger causes global VegOilSeedsIx based on the Granger causality tests performed. However, the correlation is only moderate. In light of China's imports of vegetables, oils and seeds compared to world imports it may be valid to state that China's GDP growth helped to drive global VegOilSeedsIx between 1996 and 2008. Due to the inverse Granger causality I cannot include VegOilseedsIx in the multiple regression analysis of GDP_gr for China.

Similarly, AgriRawIx and GDP_gr correlate at 61% at a significance level of 0.05 (sig. 0.05). P-values of Granger 1 and Granger 2 are above 0.05 and thus Granger causality does not exist, or is at least unclear. Thus, AgriRawIx is not included in the regression analysis of GDP_gr for China.

Lastly, MinMetalsIx and Chinese GDP_gr correlate positively at 65.1% (sig. 0.05). Granger 1 test (p-value of 0.8333) indicates that changes in MinMetalsIx are caused/affected by itself only and not by GDP_gr. Granger 2 test (p-value of 0.0007) indicates that the H_0 (H_0: GDP_gr is only affected by itself and not by MinMetalsIx) can be rejected. That is, Granger 1 and Granger 2 tests indicate that changes in MinMetalsIx lead/cause changes in GDP_gr. I therefore include MinMetalsIx in the regression analysis of GDP_gr for China.

Table 4.11a: Granger Causality Matrix China (Variables 1-29)

	Variable No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	16	19	20	21	22	23	25	26	27	29
		GDPDefl	GDP_gr	GDPpCap_gr	Agri_GDP	Agri_gr	IndustValAd_GDP	IndustValAd_gr	ManuValAdd_GDP	ManFactValAdd_gr	GrossSav_GDP	GrossSav_GNI	GrossDomSav_GDP	GrossNatExp_GDP	GovFinConExp_GDP	FinConExp_GDP	HHFinConExp_GDP	HHFinConExpPCap_gr	GroCapF_GDP	GroCapF_gr	GrossFixCapForm_GDP	Trade_GDP	MrchTrade_GDP	ExpGS_GDP	ExtBalGS_GDP
FoodIx	Pearson Corr.	.838**	0.453	0.492	-0.3910	.656*	.694**	0.35	.593*	.743**	.707**	.708**	.727**	-.757**	-.874**	-.727**	-.656*	0.489	0.5510	0.407	0.4110	0.4330	0.4300	0.5070	.757**
	Granger1	<0.0001				0.5768	0.2266		0.4307	0.0105	**0.0310**	**0.0396**													0.0833
up	Granger2	0.3955				0.2272	0.4421		0.2440	0.3951	**0.0305**	**0.0382**													0.0731
TropBevIx	Pearson Corr.	0.4410	0.525	0.521	0.0840	0.506	.775**	0.539	.588*	0.408	0.4480	0.4570	0.5020	-.670*	-.827**	-0.5020	-0.3980	0.11	0.2630	0.217	0.0150	0.0460	0.0400	0.1490	.670*
	Granger1						0.0062		0.0067																0.2802
up	Granger2						0.1851		0.5120																0.7582
VegOilSeedsIx	Pearson Corr.	.800**	.590*	.602*	-0.3580	0.255	.576*	.588*	0.4980	.680*	.662*	.664*	.682*	-.719**	-.875**	-.682*	-.601*	0.53	0.5090	0.546	0.3820	0.3830	0.3790	0.4570	.719**
	Granger1	0.0011	0.0272	0.0243			0.3759	0.0956		0.1064	0.0141	0.0162	0.0194												0.0060
up	Granger2	0.4853	0.1281	0.1050			0.2947	0.4863		0.2784	0.0675	0.0696	0.1138												0.8845
AgriRawIx	Pearson Corr.	.903**	.610*	.648*	-0.5010	0.497	.754**	.635*	.658*	.789**	.830**	.830**	.843**	-.809**	-.926**	-.843**	-.782**	.583*	.693**	.675*	.566*	.598*	.596*	.663*	.809**
	Granger1	<0.0001	0.192	0.1447			0.0050	0.324	0.0322	0.349	0.0050	0.0079	0.0236					0.0628	0.2371	0.2702	0.0025	**0.0007**	**0.0008**	**0.0002**	0.1833
up	Granger2	0.7343	0.2426	0.2651			0.0617	0.2882	0.1027	0.873	0.0757	0.0938	0.1819					0.5471	0.2080	0.8969	0.0529	**0.0002**	**<0.0001**	**0.0073**	0.0041
MinMetalsIx	Pearson Corr.	.958**	.651*	.662*	-.711**	.633*	.662*	.629*	0.4780	0.197	.886**	.882**	.884**	-.925**	-.815**	-.884**	-.858**	0.426	.666*	0.358	.673*	.737**	.735**	.806**	.925**
	Granger1	0.0035	0.8333	0.7473		0.5301	0.9345	0.6061			<0.0001	<0.0001	0.0008						0.0011		<0.0001	**<0.0001**	**<0.0001**	**<0.0001**	0.7980
up	Granger2	0.9508	0.0007	0.0015		0.4119	0.3542	0.0112			0.1050	0.1407	0.2771						0.7645		0.1143	**<0.0001**	**<0.0001**	**<0.0001**	0.0281
CrudeIx	Pearson Corr.	.987**	0.146	0.174	-.810**	0.258	0.5440	0.119	0.3910	0.259	.869**	.861**	.850**	-.830**	-.711**	-.850**	-.842**	0.351	.688**	-0.048	.756**	.794**	.792**	.841**	.830**
	Granger1	0.0018				0.418					0.5430	0.5453	0.6144						0.5486		0.3156	0.4343	0.4500	0.3931	0.9130
up	Granger2	0.2964				12					0.7318	0.6604	0.4401						0.5437		0.2997	0.0010	0.0010	0.0027	0.0189
WGIVA	Pearson Corr.	-.666*	0.352	0.376	0.4200	-0.001	-.598*	0.199	-.644*	0.039	-.735**	-.739**	-.750**	.627*	.710**	.750**	.723**	0.244	-.689**	0.467	-0.5130	-0.5410	-0.5420	-.583*	-.627*
	Granger1													0.3451	0.6177	0.1199	0.0441								
down	Granger2													0.1658	0.0002	0.8012	0.8295								
WGIPS	Pearson Corr.	-.674*	0.169	0.186	0.5270	-0.197	-.759**	0.314	-.772**	0.24	-.799**	-.798**	-.804**	.648*	.687**	.804**	.793**	0.045	-.757**	0.337	-.660*	-.679*	-.683*	-.709**	-.648*
	Granger1													0.2330	0.6291	0.0017	0.0001								
down	Granger2													0.0491	0.0020	0.8763	0.4947								
WGIGE	Pearson Corr.	.708**	0.548	0.559	-0.5060	0.051	0.3990	0.527	0.5200	0.295	.584*	.579*	.572*	-0.5230	-.579*	-.572*	-0.5430	.613*	0.4910	0.284	0.4300	0.5190	0.5210	0.5470	0.5230
	Granger1	0.0103									0.0611	0.0697	0.0836					0.0006							
up	Granger2	0.2592									0.5592	0.5396	0.5379					0.8808							
WGIRQ	Pearson Corr.	0.0470	-0.335	-0.348	0.4690	-0.101	.721**	-0.309	.771**	-0.306	0.1510	0.1630	0.2130	-0.1340	-.615*	-0.2130	-0.1040	-0.155	0.2300	-0.284	-0.1810	-0.1530	-0.1500	-0.1140	0.1340
down	Granger1						0.1717		0.1011																
	Granger2						0.8254		0.7190																
WGIRL	Pearson Corr.	-0.2830	-0.086	-0.132	.657*	-0.275	0.0560	0.072	0.2490	-0.334	-0.3110	-0.3010	-0.2710	0.3760	-0.1180	0.2710	0.3520	-0.436	-0.1310	-0.371	-0.4750	-0.5170	-0.5160	-0.5210	-0.3760
	Granger1				0.8599																				
down	Granger2				0.5328																				
WGICC	Pearson Corr.	-.663*	-0.142	-0.141	.792**	0.139	-0.2120	-0.21	-0.0500	-0.57	-.769**	-.763**	-.730**	0.5010	0.3230	.730**	.793**	-0.334	-.758**	0.177	-.888**	-.897**	-.895**	-.879**	-0.5010
	Granger1				0.1329											0.8965	0.9308								
down	Granger2				0.0149											0.0001	0.0001								
EFIBiz	Pearson Corr.	-.597*	0.148	0.143	.592*	-0.151	-.581*	0.131	-0.2700	0.38	-.764**	-.761**	-.760**	.678*	0.4540	.760**	.797**	0.345	-.664*	0.108	-.714**	-.731**	-.731**	-.760**	-.678*
	Granger1				0.3609									0.7254		0.1298	0.0850								
down	Granger2				0.3182									0.0200		0.8855	0.8253								
EFITrade	Pearson Corr.	.888**	-0.207	-0.231	-.968**	0.071	0.2920	-0.218	0.1020	-0.559	.832**	.822**	.791**	-.733**	-0.4330	-.791**	-.839**	-0.372	.670*	-0.517	.883**	.911**	.909**	.929**	.733**
	Granger1	0.4302									0.4059	0.4054	0.4751						0.1274		0.0320	0.0103	0.0123	0.0427	0.5095
up	Granger2	0.4468									0.1579	0.1500	0.1073						0.0791		0.7087	0.9239	0.8846	0.7568	0.2613
EFIFisc	Pearson Corr.	-0.2900	-0.119	-0.099	.579*	0.452	0.0420	-0.152	-0.0890	0.296	-0.4400	-0.4360	-0.4030	0.2370	0.0660	0.4030	0.4650	0.073	-0.4500	-0.127	-.574*	-.595*	-.596*	-.568*	-0.2370
	Granger1				0.1291																				
up	Granger2				0.2007																				
EFIGovtS	Pearson Corr.	-.581*	0.488	0.468	.814**	-0.025	-0.0760	0.467	0.0270	0.307	-.674*	-.668*	-.630*	0.3250	0.1810	.630*	.708**	0.173	-.738**	-0.214	-.913**	-.861**	-.861**	-.819**	-0.3250
	Granger1				0.1827											0.6703	0.7608								
down	Granger2				0.0640											0.0135	0.0283								
EFIMon	Pearson Corr.	-0.1520	-0.551	-.591*	-0.3920	-0.552	-.790**	-0.494	-.742**	-0.455	-0.2600	-0.2730	-0.3300	0.3670	.709**	0.3300	0.2220	-0.368	-0.2320	-0.544	0.1610	0.1350	0.1350	0.0610	-0.3670
	Granger1														0.0014										
up	Granger2														0.0757										
EFIInvest	Pearson Corr.	-0.5480	0.231	0.231	.867**	0.345	0.1410	0.202	0.0910	0.069	-0.4440	-0.4270	-0.3690	0.2370	-0.0630	0.3690	0.4560	0.188	-0.3950	0.409	-.703**	-.743**	-.745**	-.699**	-0.2370
	Granger1				0.2182																				
down	Granger2				0.8988																				
EFIFin	Pearson Corr.	-0.5480	0.231	0.231	.867**	0.345	0.1410	0.202	0.0910	0.069	-0.4440	-0.4270	-0.3690	0.2370	-0.0630	0.3690	0.4560	0.188	-0.3950	0.409	-.703**	-.743**	-.745**	-.699**	-0.2370
	Granger1				0.2182																				
down	Granger2				0.8988																				
EFIPropRi	Pearson Corr.	-.870**	-0.447	-0.442	.666*	-0.281	-.569*	-0.382	-0.4000	-0.125	-.778**	-.775**	-.781**	.895**	.721**	.781**	.757**	-0.332	-0.5260	-0.13	-.557*	-.627*	-.624*	-.702**	-.895**
	Granger1				0.1340									0.0047	0.3827	0.0024	**0.0008**								
down	Granger2				0.6497									0.8885	0.0974	0.1560	**0.0360**								
EFICorrup	Pearson Corr.	0.3840	-0.424	-0.449	-.752**	-0.257	-0.4030	-0.395	-0.4920	-0.185	0.2350	0.2200	0.1670	-0.1410	0.2120	-0.1670	-0.2510	-0.09	0.1520	-0.537	0.5430	0.5100	0.5070	0.4760	0.1410
	Granger1																								
up	Granger2																								

Source: Tables 4.11a-c calculated and arranged by the author.

Table 4.11b: Granger Causality Matrix China (Variables 30-54)

Variable No		30	31	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
		CurrACC_GDP	ImpGS_GDP	AgRawImp_MrchImp	ManfImp_MrchImp	FuelImp_MerchImp	ExpValX	ImpValIx	ExpVolX	ImpVolIx	UnitValIxExp	UnitValIxImp	ToT	PPIxExp	TariffAllweight	HiTekExp_ManuExp	ICTExp_TTExp	ICTImp_TTImp	AgrRwExp_MerchExp	FoodExp_MrchExp	ManufExp_MrchExp	FDInet_GDP	StoxVal_GDP	FuelExp_MerchExp	MrktCapList_GDP
FoodIx	Pearson Corr.	.738**	0.3290	-0.4010	-.861**	.761**	.800**	.767**	.763**	.644*	.880**	.898**	-.700**	.703**	-0.4330	0.3220	0.2570	-0.0220	-0.3560	-0.4320	0.3980	0.0980	.608*	-0.2800	0.4080
	Granger1	0.0064				0.0107	<0.0001	**<0.0001**	<0.0001	**<0.0001**	**0.0187**	<0.0001		<0.0001									0.0002		
up	Granger2	0.4952				0.4571	0.1004	**0.0208**	0.0673	**0.0036**	**<0.0001**	0.3017		0.0985									0.0861		
TropBevIx	Pearson Corr.	0.5480	-0.0840	-0.0310	-0.4800	0.3510	0.4020	0.3430	0.3600	0.2050	.935**	0.5300	-0.2370	0.2970	-0.0460	-0.1330	-0.1950	-0.4280	0.0970	0.0070	-0.0380	.556*	0.4120	0.0040	0.2010
	Granger1										0.0039											0.9910			
up	Granger2										0.4098											0.4143			
VegOilSeedsIx	Pearson Corr.	.700**	0.2820	-0.5020	-.762**	.647*	.762**	.728**	.724**	.613*	.848**	.830**	-.624*	.671*	-0.4420	0.3080	0.2410	-0.0240	-0.3610	-0.4150	0.4120	0.1440	.667*	-0.3540	0.4320
	Granger1	0.0013				0.0015	0.0007	0.0023	**0.0010**	**0.0064**	0.6984	0.0018		**0.0018**									0.0359		
up	Granger2	0.7377				0.0838	0.0794	0.2491	**0.0340**	**0.0022**	0.0019	0.2384		**0.0026**									0.8403		
AgriRawIx	Pearson Corr.	.825**	0.5030	-0.4980	-.897**	.810**	.879**	.857**	.854**	.765**	.822**	.946**	-.802**	.811**	-.568*	0.4710	0.4100	0.1160	-0.4720	-.554*	0.5210	0.0110	.686**	-0.4090	0.5340
	Granger1	0.0050				0.0280	<0.0001	**<0.0001**	<0.0001	**<0.0001**	**<0.0001**	0.0002		<0.0001	<0.0001								0.1671		
up	Granger2	0.1438				0.1351	0.1870	**0.0141**	0.1144	**0.0005**	**<0.0001**	0.6115		0.1048	0.6920								0.0556		
MinMetalsIx	Pearson Corr.	.949**	.635*	-.636*	-.931**	.894**	.962**	.941**	.953**	.882**	.632*	.965**	-.910**	.929**	-.718**	.641*	.587*	0.3880	-.655*	-.742**	.718**	-0.1780	.787**	-.653*	.752**
	Granger1	0.1027	**0.0003**			0.2659	**0.0018**	**0.0008**	**0.0012**	**0.0016**	0.1626	<0.0001		**0.0020**	0.0025	**0.0015**	**0.0019**				0.0182		0.0618		0.1487
up	Granger2	0.3612	**0.0034**			0.0364	**0.0155**	**0.0423**	**0.0049**	**0.0143**	<0.0001	0.9714		**0.0355**	0.6121	**<0.0001**	**<0.0001**				0.9673		<0.0001		0.0005
CrudeIx	Pearson Corr.	.900**	.718**	-.718**	-.972**	.963**	.986**	.980**	.978**	.932**	0.5370	.987**	-.971**	.956**	-.801**	.745**	.694**	0.5020	-.756**	-.834**	.806**	-0.3470	.694**	-.668*	.643*
	Granger1	0.7915	0.4839			**0.0480**	<0.0001	0.0002	<0.0001	0.0247		0.5594		0.0018	0.1444	0.1995	0.2642				0.0550		0.2751		0.3145
up	Granger2	0.0207	0.0094			**<0.0001**	0.9461	0.0770	0.6273	0.0951		0.5137		0.6723	0.9090	<0.0001	<0.0001				0.8851		0.0035		0.0016
WGIVA	Pearson Corr.	-.660*	-0.4770	0.3340	.571*	-0.5130	-.666*	-.654*	-.664*	-.628*	-0.5050	-.654*	.594*	-.655*	0.4780	-0.4230	-0.4050	-0.1460	0.3910	0.3940	-0.3890	-0.0920	-0.5160	0.3040	-0.5160
	Granger1				0.0034								0.0002												
down	Granger2				0.3448								0.5830												
WGIPS	Pearson Corr.	-.712**	-.626*	0.3920	.642*	-.638*	-.699**	-.699**	-.707**	-.689**	-0.4350	-.708**	.710**	-.702**	.583*	-0.5320	-0.5150	-0.2880	0.4550	0.5100	-0.4810	0.1460	-0.4490	0.3930	-0.5180
	Granger1				0.0957								0.0006		0.0060										
down	Granger2				0.2767								0.1691		0.7969										
WGIGE	Pearson Corr.	.574*	0.4740	-0.3040	-.712**	.646*	.706**	.697**	.698**	.660*	0.4470	.706**	-.677*	.679*	-0.4570	0.4430	0.4150	0.2140	-0.4190	-0.4770	0.4540	-0.1160	.736**	-0.3130	.673*
	Granger1	0.0184				0.0099	0.0024	0.0035	0.0018	0.0061		0.0075		0.0029									0.4388		0.0293
up	Granger2	0.3918				0.2994	0.5838	0.6279	0.3249	0.2887		0.8644		0.4003									0.4803		0.7722
WGIRQ	Pearson Corr.	0.0570	-0.1970	0.4190	-0.1410	-0.0330	0.0040	-0.0240	-0.0270	-0.1210	.717**	0.1850	0.0460	-0.0780	0.3360	-0.3890	-0.4190	-.696**	0.4810	0.3960	-0.4420	.683*	0.1300	0.4670	-0.0810
down	Granger1										0.6360											0.2727			
	Granger2										0.7984											0.0105			
WGIRL	Pearson Corr.	-0.4310	-0.5000	0.5330	0.2290	-0.3760	-0.3580	-0.3700	-0.3980	-0.4520	0.3740	-0.2110	0.4300	-0.4420	.560*	-.580*	-.587*	-.769**	.603*	.625*	-.638*	.641*	-0.2710	.726**	-0.5520
	Granger1														0.4969				0.6279	0.5392		0.6325		0.4223	
down	Granger2														0.1290				0.9827	0.2637		0.5182		0.5765	
WGICC	Pearson Corr.	-.661*	-.899**	.740**	0.5120	-.586*	-.682*	-.725**	-.719**	-.816**	0.0690	-0.5520	.734**	-.771**	.862**	-.900**	-.898**	-.785**	.857**	.839**	-.833**	0.4710	-0.3170	.720**	-0.4490
	Granger1			0.6548									0.5282		0.0456				0.0184	0.0864				0.8992	
down	Granger2			0.0929									0.0857		0.0844				0.9106	0.3567				0.0426	
EFIBiz	Pearson Corr.	-.738**	-.678*	0.5170	0.5420	-.589*	-.625*	-.633*	-.650*	-.660*	-0.1840	-.593*	.682*	-.666*	.637*	-.634*	-.617*	-0.5120	.575*	.626*	-.601*	0.1930	-0.2510	.562*	-0.3940
	Granger1												0.1270		0.0757				0.1076	0.0881				0.4184	
down	Granger2												0.6042		0.7164				0.9893	0.9598				0.0992	
EFITrade	Pearson Corr.	.852**	.868**	-.862**	-.807**	.875**	.914**	.931**	.933**	.958**	0.1350	.822**	-.949**	.951**	-.939**	.932**	.904**	.823**	-.939**	-.976**	.967**	-.590*	.575*	-.860**	.668*
	Granger1	0.7941	0.0061			0.7118	0.5565	0.2291	0.4770	0.0417		0.7350		0.2902	0.0400	0.0067	0.0221	0.5035			0.0419		0.8209		0.6498
up	Granger2	0.2458	0.9922			0.0134	0.0488	0.0952	0.0378	0.0957		0.1387		0.0648	0.6980	0.1020	0.1250	0.0467			0.6046		0.0625		0.0170
EFIFisc	Pearson Corr.	-0.3600	-.616*	0.4660	0.1040	-0.2100	-0.3540	-0.3850	-0.3990	-0.5090	0.3440	-0.1560	0.3620	-0.4680	.610*	-.622*	-.660*	-.660*	.588*	0.5260	-.563*	0.4640	-0.3020	.586*	-.553*
	Granger1														0.3311				0.1482					0.7466	
up	Granger2														0.2616				0.4586					0.8506	
EFIGovtS	Pearson Corr.	-0.5200	-.895**	.808**	0.4270	-0.5420	-.617*	-.673*	-.655*	-.772**	0.2170	-0.4940	.719**	-.705**	.883**	-.920**	-.929**	-.866**	.854**	.851**	-.862**	.758**	-0.1410	.797**	-0.3060
	Granger1			0.0822									0.7639		0.1399				0.0040	0.2365		0.3814		0.7664	
down	Granger2			0.8120									0.0683		0.5497				0.6655	0.0332		0.5625		0.3894	
EFIMon	Pearson Corr.	-0.2420	0.2250	-0.3310	0.2120	-0.0570	-0.1130	-0.0640	-0.0770	0.0550	-.823**	-0.2740	-0.0020	-0.0190	-0.2690	0.3710	0.4060	.669*	-0.4030	-0.3410	0.3770	-.740**	-0.1760	-0.3590	-0.0010
	Granger1																	**0.0097**							
up	Granger2																	**0.0239**							
EFIInvest	Pearson Corr.	-0.4110	-.781**	.592*	0.5240	-.657*	-.576*	-.623*	-.608*	-.710**	0.3110	-0.4450	.680*	-.651*	.753**	-.838**	-.848**	-.861**	.840**	.816**	-.793**	.792**	-0.3040	.563*	-0.4450
	Granger1			0.2292									0.6010		0.5704				0.6090	0.2833		0.0183		0.0794	
down	Granger2			0.1177									0.9986		0.0555				0.0179	0.8927		0.4857		0.3420	
EFIFin	Pearson Corr.	-0.4110	-.781**	.592*	0.5240	-.657*	-.576*	-.623*	-.608*	-.710**	0.3110	-0.4450	.680*	-.651*	.753**	-.838**	-.848**	-.861**	.840**	.816**	-.793**	.792**	-0.3040	.563*	-0.4450
	Granger1			0.2292									0.6010		0.5704				0.6090	0.2833		0.0183		0.0794	
down	Granger2			0.1177									0.9986		0.0555				0.0179	0.8927		0.4857		0.3420	
EFIPropRi	Pearson Corr.	-.888**	-0.5180	.579*	.841**	-.814**	-.886**	-.855**	-.877**	-.793**	-.566*	-.875**	.819**	-.851**	.630*	-0.5500	-0.5010	-0.3640	.588*	.668*	-.657*	0.1890	-.785**	.650*	-.792**
	Granger1			0.1714	0.0204								0.0039		0.0698				0.1423	0.0800				0.2378	
down	Granger2			0.2393	0.1276								0.8555		0.6763				0.8833	0.6858				0.9646	
EFICorrup	Pearson Corr.	0.2810	0.5400	-.748**	-0.3080	0.4420	0.4240	0.4590	0.4470	0.5250	-0.4040	0.2950	-0.5110	0.4800	-.674*	.699**	.701**	.844**	-.725**	-.735**	.773**	-.825**	0.1890	-.753**	0.2910
	Granger1														0.8651	0.9959	0.9342	0.7056			0.6044				
up	Granger2														0.8236	0.0346	0.0329	0.3259			0.1675				

Table 4.11c: Granger Causality Matrix China (Variables 55-79)

	Variable No	55	56	57	58	59	60	61	62	63	64	65	67	69	70	71	72	73	74	75	76	77	78	79
		FoodPrdIx	CropProdIX	LivStockProdIX	CPIx	Infltn	M2_GDP	M2_gr	IRSSpread	RealIR	ExtDebtST_ExpGSInc	ExtDebtST_GNI	STD_TTExtDbt	TTRes_TTExtDbt	M2_TTReserv	MultiDebt_TTExtD	EnrgyImp_Euse	GDP_UEnUKPPPOilE	GDP_UEnUPPPOilE	RuPp_ToTPp	Internet_100	Phonelines_100	Unempl_Lforce	MobileSubs_100
FoodIx	Pearson Corr.	0.4970	0.5330	0.4250	.893**	.681*	0.1360	0.229	-0.3130	-.611*	-0.5340	-.654*	0.4920	.801**	-.677*	-.723**	.647*	0.2910	0.5140	-0.5360	.805**	0.4200	0.3050	.675*
	Granger1				<0.0001	0.7371				0.0116		<0.0001		<0.0001	0.0158	0.0326	0.0007				<0.0001			**<0.0001**
up	Granger2				0.5155	0.1564				0.7917		0.1781		0.9867	0.0966	0.3890	0.5781				0.3590			**0.0018**
TropBevIx	Pearson Corr.	0.0490	0.0630	0.0020	.564*	0.4580	-0.2920	.701*	-.570*	-0.0560	-0.0830	-0.1730	0.0690	0.3910	-0.3550	-0.4400	0.2730	-0.2290	0.0020	-0.0600	0.3530	-0.0280	-0.1670	0.2080
	Granger1				0.0614			0.776	0.7067															
up	Granger2				0.3841			0.0369	0.1978															
VegOilSeedsIx	Pearson Corr.	0.4720	0.4970	0.4080	.869**	.604*	0.1510	0.303	-0.4130	-.567*	-0.4970	-.648*	0.4360	.778**	-.657*	-.672*	.623*	0.2760	0.4860	-0.5090	.785**	0.3820	0.3000	.639*
	Granger1				0.0031	0.6959				0.1579		0.0621		0.0036	**0.0223**	0.0058	0.0573				0.0010			**0.0037**
up	Granger2				0.7790	0.2759				0.8270		0.1368		0.7080	**0.0088**	0.3043	0.2097				0.9664			**0.0018**
AgriRawIx	Pearson Corr.	.615*	.647*	0.5420	.930**	.714**	0.2610	0.22	-0.2260	-.720**	-.660*	-.699**	.620*	.875**	-.801**	-.835**	.756**	0.3430	.589*	-.645*	.862**	.563*	0.4200	.774**
	Granger1	<0.0001	<0.0001		0.0018	0.0619				0.1031	<0.0001	<0.0001	0.0008	<0.0001	0.0020	0.0207	0.0015		<0.0001	**<0.0001**	<0.0001	**<0.0001**		**<0.0001**
up	Granger2	0.8502	0.5913		0.1393	0.0099				0.8906	0.6897	0.1786	0.1390	0.8031	0.1524	0.7834	0.4914		0.0808	**0.0042**	0.6809	**<0.0001**		**0.0006**
MinMetalsIx	Pearson Corr.	.790**	.806**	.744**	.951**	0.4850	0.4910	0.317	0.0740	-.710**	-.799**	-.792**	.717**	.938**	-.850**	-.865**	.891**	.559*	.768**	-.806**	.917**	.735**	0.5250	.883**
	Granger1	0.0074	0.0071	0.0127	0.1441					0.1311	0.0102	0.2814	0.0056	0.0012	0.0006	0.0098	0.0903	0.3751	0.1716	**0.0131**	**0.0466**	**0.0011**		0.0039
up	Granger2	0.2747	0.5309	0.7512	0.0292					0.1818	0.9769	0.0186	0.4505	0.7334	0.4497	0.8648	0.4443	0.0381	0.0035	**0.0011**	**0.0071**	**<0.0001**		0.2789
CrudeIx	Pearson Corr.	.872**	.888**	.830**	.967**	0.4470	.615*	-0.262	0.1640	-.814**	-.886**	-.897**	.771**	.981**	-.865**	-.850**	.926**	.689**	.865**	-.891**	.974**	.815**	.655*	.947**
	Granger1	0.1338	0.1535	0.2050	0.1175		0.2592			0.4263	0.4366	0.3115	0.5053	<0.0001	0.2161	0.4927	0.1241	0.4451	0.2706	0.1285	0.0011	0.2477	0.3339	0.0505
up	Granger2	0.3248	0.5862	0.9027	0.0336		0.1687			0.0588	0.9065	0.0415	0.7781	0.9937	0.6140	0.1095	0.2735	0.0687	0.0021	0.0136	0.1836	<0.0001	0.9299	0.6047
WGIVA	Pearson Corr.	-0.4790	-0.5340	-0.3960	-.621*	-.668*	-0.2090	0.152	0.2240	0.5380	0.5110	0.4110	-.709**	-.648*	.724**	.779**	-0.4530	-0.2800	-0.4730	0.5140	-.649*	-0.5080	-0.4970	-.636*
	Granger1					0.7456							0.0026		0.0442	0.0648								
down	Granger2					0.0086							0.1585		0.7330	0.7571								
WGIPS	Pearson Corr.	-.560*	-.576*	-0.5170	-.617*	-0.5510	-0.3420	0.16	-0.0200	.564*	.636*	0.4880	-.683*	-.673*	.728**	.776**	-.609*	-0.2870	-0.4930	.583*	-.642*	-.606*	-0.5060	-.669*
	Granger1									0.0430	0.0031		0.0016		0.0004	0.0091				0.0034				
down	Granger2									0.2580	0.8454		0.7116		0.5045	0.4043				0.1464				
WGIGE	Pearson Corr.	0.5330	.589*	0.4460	.666*	.702**	0.2840	-0.341	0.0580	-.723**	-.586*	-.605*	.602*	.685**	-.609*	-.637*	.588*	0.4670	.601*	-.579*	.724**	0.5190	0.4340	.672*
	Granger1		0.0051		0.0593	0.0949				0.3948	0.0089	0.0049	0.0746	**0.0072**	0.1253	0.1579	0.0051		0.0014	0.0021	0.0044			0.0033
up	Granger2		0.5994		0.0029	0.0012				0.6221	0.8905	0.4010	0.8295	**0.0164**	0.2431	0.3663	0.6711		0.8372	0.9827	0.5034			0.7716
WGIRQ	Pearson Corr.	-0.3330	-0.2840	-0.4180	0.1210	.790**	-.646*	-0.298	-.639*	-0.0660	0.2360	0.2320	-0.1330	-0.0120	-0.0660	-0.1870	-0.1030	-.633*	-0.4140	0.3180	-0.0440	-0.3090	-0.4020	-0.1490
down	Granger1					0.1893			0.7408															
	Granger2					0.0604			0.1164															
WGIRL	Pearson Corr.	-.576*	-0.5110	-.656*	-0.2030	0.5190	-.714**	0.411	-.728**	0.1340	0.5270	0.4020	-0.3370	-0.3220	0.2770	0.2130	-0.5260	-.589*	-0.5420	0.5450	-0.2860	-.571*	-0.3990	-0.4200
	Granger1								0.8073															
down	Granger2								0.2217															
WGICC	Pearson Corr.	-.851**	-.861**	-.836**	-.562*	-0.1220	-.791**	-0.288	-0.3090	.684**	.814**	0.5450	-.883**	-.691**	.833**	.760**	-.664*	-.623*	-.727**	.821**	-.641*	-.898**	-.848**	-.789**
	Granger1									0.0329	0.0957		0.0946		0.6165	0.8423				0.1376				
down	Granger2									0.3311	0.1344		0.5284		0.3721	0.0752				0.6082				
EFIBiz	Pearson Corr.	-.657*	-.654*	-.657*	-0.5370	-0.1160	-0.4980	0.193	-0.2100	0.4020	.640*	0.4120	-.660*	-.599*	.697**	.701**	-.602*	-0.3520	-0.5150	.624*	-0.5190	-.690**	-0.5080	-.630*
	Granger1										0.0918		0.0867		0.0240	0.0962				0.1458				
down	Granger2										0.9156		0.8139		0.6406	0.6614				0.0250				
EFITrade	Pearson Corr.	.987**	.981**	.983**	.815**	0.1140	.876**	-0.185	0.4450	-.756**	-.959**	-.859**	.860**	.910**	-.856**	-.797**	.912**	.853**	.954**	-.983**	.890**	.962**	.827**	.960**
	Granger1	<0.0001	0.0017	0.0240	0.5366		0.2813			**0.0185**	0.0631	0.8511	0.3092	0.2810	0.1463	0.3684	0.1093	0.6577	0.9583	0.0153	0.5125	0.0038	0.2463	0.1147
up	Granger2	0.2772	0.5962	0.7280	0.6096		0.5409			**0.0036**	0.0557	0.0189	0.2355	0.9935	0.2177	0.0870	0.0352	0.1254	0.0119	0.1222	0.8521	0.1630	0.6040	0.0162
EFIFisc	Pearson Corr.	-0.5270	-0.5270	-0.5240	-0.1560	0.0480	-.627*	-0.293	-0.3360	0.3340	0.5350	0.3010	-.622*	-0.3440	0.4870	0.4130	-0.3680	-0.4830	-0.4880	0.5240	-0.3380	-.601*	-.660*	-0.4780
	Granger1												0.1729											
up	Granger2												0.5468											
EFIGovtS	Pearson Corr.	-.841**	-.826**	-.844**	-0.4670	0.0220	-.887**	0.062	-0.5180	.649*	.796**	.570*	-.801**	-.640*	.731**	.650*	-.702**	-.660*	-.721**	.816**	-.602*	-.880**	-.882**	-.752**
	Granger1									0.5025	0.3329	0.2880	0.4103		0.8170	0.7622				0.2767				
down	Granger2									0.0302	0.0009	0.3737	0.2476		0.1252	0.1365				0.8919				
EFIMon	Pearson Corr.	0.2610	0.2140	0.3370	-0.2370	-.677*	.606*	-0.179	.739**	-0.0320	-0.1850	-0.1530	0.0680	-0.0890	0.1480	0.2670	0.0510	0.5520	0.3210	-0.2440	-0.0540	0.2640	0.3580	0.0650
	Granger1					0.0010	0.0081		0.2325															
up	Granger2					0.3181	0.1961		0.0520															
EFIInvest	Pearson Corr.	-.793**	-.796**	-.800**	-0.4280	0.0150	-.858**	0.482	-.610*	.711**	.811**	.702**	-.707**	-.583*	0.5350	0.4270	-.602*	-.870**	-.826**	.799**	-.607*	-.815**	-.806**	-.719**
	Granger1								<0.0001	0.5908	0.8313	0.3862	0.6261							0.4507				
down	Granger2								0.9231	0.0944	0.8811	0.4134	<0.0001							<0.0001				
EFIFin	Pearson Corr.	-.793**	-.796**	-.800**	-0.4280	0.0150	-.858**	0.482	-.610*	.711**	.811**	.702**	-.707**	-.583*	0.5350	0.4270	-.602*	-.870**	-.826**	.799**	-.607*	-.815**	-.806**	-.719**
	Granger1								<0.0001	0.5908	0.8313	0.3862	0.6261							0.4507				
down	Granger2								0.9231	0.0944	0.8811	0.4134	<0.0001							<0.0001				
EFIPropRi	Pearson Corr.	-.713**	-.721**	-.678*	-.862**	-0.3700	-0.4520	-0.488	-0.1250	.576*	.707**	.739**	-.616*	-.851**	.728**	.752**	-.827**	-.558*	-.730**	.734**	-.842**	-.647*	-0.4370	-.800**
	Granger1									0.3348	0.0543	0.3222	0.0546		0.0151	0.0151				0.0640				
down	Granger2									0.0843	0.8879	0.0198	0.5460		0.7478	0.9892				0.0337				
EFICorrup	Pearson Corr.	.686**	.644*	.736**	0.3100	-0.4520	.862**	-0.013	.692**	-0.3840	-.631*	-.661*	0.3880	0.4550	-0.3120	-0.1690	.587*	.814**	.712**	-.673*	0.4750	.633*	.627*	0.5430
	Granger1	0.8112	0.9096	0.6558			0.5910		0.4854		0.7259	0.7820					0.7508	0.2618	0.4947	0.7787		0.9796	0.8663	
up	Granger2	0.8966	0.4611	0.4734			0.8127		0.0129		0.2343	0.9775					0.8516	0.9630	0.5688	0.1204		0.0070	0.2856	

GRANGER CAUSALITY COUNT CHINA

Significant Granger Causality

The Granger causality analysis in Granger matrix Table 4.11a-c above on China identifies 267 counts of significant Granger causal relationships. Out of these 267 significant causalities, 158 counts (or 59.2%) are of inverse nature, which means there are 158 inverse Granger causal dependencies in which dependent variables Granger cause independent variables. Similarly to Brazil, the causality tests on China reveal that the majority of Granger causalities are of inverse nature; 109 Granger causalities vs. 158 (∑267) inverse Granger causalities (Brazil: 95 Granger causalities vs. 129 inverse Granger causalities).

Table 4.12: Significant Granger Causality Counts China

	Granger Causality	Inverse Granger Causality	Total	Total % Share
Commodity Price Indexes	**66**	**92**	**158**	**59.2%**
FoodIx	6	17	23	8.6%
TropBevIx	1	3	4	1.5%
VegOilSeedsIx	6	19	25	9.4%
AgriRawIx	11	26	37	13.9%
MinMetalsIx	26	18	44	16.5%
CrudeIx	16	9	25	9.4%
Worldwide governance indexes	**12**	**36**	**48**	**18.0%**
WGIVA	2	5	7	2.6%
WGIPS	2	10	12	4.5%
WGIGE	3	18	21	7.9%
WGIRQ	1	0	1	0.4%
WGIRL	0	0	0	0.0%
WGICC	4	3	7	2.6%
Economic Freedom Indexes	**31**	**30**	**61**	**22.8%**
EFIBiz	2	1	3	1.1%
EFITrade	10	15	25	9.4%
EFIFisc	0	0	0	0.0%
EFIGovtS	5	1	6	2.2%
EFIMon	1	3	4	1.5%
EFIInvest	3	2	5	1.9%
EFIFin	3	2	5	1.9%
EFIPropRi	3	6	9	3.4%
EFICorrup	4	0	4	1.5%
Total	**109**	**158**	**267**	**100.0%**

Source: Calculated and arranged by the author.

I note that there is an inverse Granger causal cluster effect of GrossSav_GDP (Variable 10), GrossSav_GNI (Variable 11), and GrossDomSav_GDP (Variable 12)

Granger causing VegOilSeedsIx, AgriRawIx, and MinMetalsIx. That is, changes in gross savings and gross domestic savings relative to GDP and GNI cause statistically speaking changes in price indexes for vegetables, oil seeds and oils (VegOilSeedsIx), agricultural raw materials (AgriRawIx), and minerals and metals (MinMetalsIx). Furthermore, the Granger 1 and Granger 2 tests reveal that a few macroeconomic variables of the financial sector topic such as TTres_TTExtDbt (Variable 69) Granger cause all commodity price indexes except that for tropical beverages (TropBevIx).

39 variable pairs show significant p-values of Granger 1 as well as of Granger 2 test (marked in bold letters in Granger Matrix Tables 4.11a-c).[71] These 39 feedback (two-way) causalities, 35 of which reside within the commodity price index set, affect predominantly macroeconomic variables within the financial sector topic as well as the private sector and trade topic. As already discussed at the example of Brazil, convention is that feedback causalities are treated as Granger causalities in which independent variables cause dependent variables.

Commodity Price Index

Similarly to Brazil, commodity price indexes (except TropBevIx) play a predominant role in revealing significant causalities between independent and dependent variables of China. Of overall 267 significant Granger causality counts, 158 counts (or 59.2%) reside within the commodity price index set, and 92 of these are of inverse nature. For example, Granger 1 and Granger 2 tests on GDP growth rate and GDP per capita growth rate (Variable 2: GDP_gr, Variable 3: GDPpCap_gr) reveal that changes in VegOilSeedsIx are Granger caused by GDP_gr and GDPpcap_gr, indicating that the economic expansion by China measured by GDP_gr and GDPpCap_gr may be a driver for prices of vegetables, oils and seed products.

The dominance of commodity price indexes in the context of causality testing unveils the major role commodities play for China's economic expansion. Within the commodity price index set, the largest count is MinMetalsIx (44 counts), followed by

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[71] 35 feedback (or two-way) causalities appear within the commodity price index set, three occur within the EFI index set, and one occurs within the WGI index set.

AgriRawIx (37 counts), VegOilSeedsIx and CrudeIx (25 counts each), FoodIx (23 counts), and TropBevIx (4 counts).

AgriRawIx, MinMetalsIx, and CrudeIx Granger cause macroeconomic variables particularly within the Economic Policy & Debt Topic such as Trade_GDP (Variable 25) and within the private sector and trade sector such as MerchTrade_GDP (Variable 26), ExpGS_GDP (Variable 27), and ExtBalGS_GDP (Variable 29). Also, the increase of AgriRawIx, MinMetalsIx, and CrudeIx Granger causes the decline of rural population as percentage to total population (Variable 75: RuPp_ToTPp).

Increasing demand for minerals and metals as well as for agricultural raw materials, food, vegetables, oils, and seeds represented by the increasing import value and import volume index (Variable 37: ImpValIx, Variable 39: ImpVolIx) appear to Granger cause the increase of global prices for these commodities. However, the feedback causalities between Variables 37 and 39 and their respective commodity price indexes also imply that ImpValIx (Variable 37) and ImpVolIx (Variable 39) increase as a result of higher commodity prices. Correlations between ImpValIx and ImpVolIx and FoodIx, VegOilSeedsIx, AgriRawIx, and MinMetalsIx are moderately high and very high between 61.3% and 94.1% at significance levels of 0.01 (except for the ImpVolIx and VegOilSeedsIx pair (sig. 0.05)) and also display significant feedback (two-way) Granger causalities (except for VegOilSeedsIx, CrudeIx and ImpValIx). Similarly, MinMetalsIx and CrudeIx seem to affect the value increase in ImpGS_GDP (Variable 31). However, there also exists a significant association between an increasing value of imports (ImpGS_GDP) and MinMetalsIx, revealing a correlation at 63.5% and a significant inverse Granger causality, which implies that Chinese imports (ImpGS_GDP) cause/affect global prices for minerals and metals.

Increasing MinMetalsIx and CrudeIx seem to also drive stock market valuation measured by StoxValIx and MrktCapList_GDP (Variables 52 and 54), which rose from 29.9 index points to 120.7 index points and from 13.3 index points to 61.6 index points respectively between 1996 and 2008. Furthermore, increased oil and minerals and metals prices seem to positively affect (Granger cause) China’s energy-production efficiency measured by the purchase price parity GDP per one unit of energy use per kilogram of oil equivalent (Variable 74: GDP_UEnUPPPOilE (at the significance level of 0.01)). The correlation of CrudeIx, MinMetalsIx and GDP_UEnUPPPOilE is at 76.8%, and 86.5% (sig. 0.01). Also, rising CrudeIx and MinMetalsIx seem to Granger cause the consumer price index in China (Variable 58: CPIx).

Economic Freedom Index

The EFI index set reveals 61 counts of significant Granger causalities, of which more than half (31 events) are Granger causalities and 30 are inverse Granger causalities. EFITrade is the dominant governance dimension within the EFI index set, Granger causing 10 dependent variables of the private sector and trade topic as well as of the financial sector topic (Variables: 35, 36, 38, 47, 54, 63, 65, 72, 74, 79). In turn, fifteen dependent variables cause EFITrade (trade governance). That is, these macroeconomic variables from the private sector & trade topic such as trade to GDP (Variable 25: Trade_GDP) or fuel imports to merchandise imports (Variable 35: FuelImp_MerchImp) cause changes in trade governance (EFITrade).

It is also observable that freedom in EFIPropRi (property rights) is second to EFITrade, Granger causing 3 dependent variables, whereas EFIPropRi is Granger caused by 6 dependents variables (Variables 13, 16, 34, 42, 70, 71). EFIGovtS shows 6 causality counts, one of which is an inverse Granger causality. Specifically, increasing government size, that is deteriorating government size governance seems to significantly (sig. 0.05) Granger cause decreasing final consumption expenditure to GDP (Variable 16: FinConExp_GDP) and household final consumption expenditure to GDP (Variable 19: HHFinConExp_GDP).

Worldwide Governance Index

Within the Worldwide Governance index set there are 48 significant Granger causalities, 36 of which are of inverse nature. Causality tests suggest that among all WGI governance dimensions WGIGE and WGIPS play dominant roles within the Chinese economy, counting 21 and 12 significant Granger causality events, 18 and 10 of which are of inverse nature.

Intriguingly, deterioration in corruption governance measured by WGICC (4 Granger causalities vs. 3 inverse Granger causalities) seems to affect Agri_GDP (Variable 4), which declined from 19.7% in 1998 to 10.7% in 2008, as well as FinConExp_GDP (Variable 16), and HHFinConExp_GDP (Variable 19), which declined from 57.5% to 49.8%, and from 43.5% to 36.8% between 1996 and 2008, respectively.

Non-significant Granger Causality

The Granger causality analysis in this section reveals that there are 22 dependent variables which do not show any significant Granger dependency to independent variables. That is, 22 dependent variables are not Granger caused by any of the 21 independent variables of the commodity price index set, the EFI and WGI governance index sets. In comparison, Brazil's Granger causality analysis reveals 27 dependent variables that are not Granger caused by any of the independent variables. The dependent variables which have been identified of not being Granger caused by independent variables are marked in red in the Granger Causality Matrix China (Tables 4.11a-c). The following 22 dependent variables are therefore excluded from the regression analysis:

(1) Variable 1: GDPDefl (gross domestic product deflator)

(2) Variable 5: Agri_gr (agriculture value added growth rate)

(3) Variable 6: IndustValAd_GDP (industry value added to GDP)

(4) Variable 8: ManuValAdd_GDP (manufacturing value added to GDP)

(5) Variable 9: ManFactValAdd_gr (manufacturing value added growth rate)

(6) Variable 12: GrossDomSav_GDP (gross domestic saving to GDP)

(7) Variable 20: HHFinConExpPCap_gr (household final consumption expenditure per capita growth rate)

(8) Variable 21: GroCapF_GDP (gross capital formation to GDP)

(9) Variable 22: GroCapF_gr (gross capital formation growth rate)

(10) Variable 23: GrossFixCapForm_GDP (gross fixed capital formation to GDP)

(11) Variable 33: AgRawImp_MrchImp (agricultural raw material imports to merchandise imports)

(12) Variable 34: ManfImp_MrchImp (manufactured imports to merchandise imports)

(13) Variable 41: UnitValIxImp (unit value index of imports)

(14) Variable 42: ToT (terms of trade)

(15) Variable 44: TariffAllweight (tariff rate weighted mean of all products)

(16) Variable 50: ManufExp_MrchExp (manufactured export to merchandise exports)

(17) Variable 55: FoodProdIx (food production index)

(18) Variable 56: CropProdIx (crop production index)

(19) Variable 57: LiveStockProdIx (livestock production index)

(20) Variable 60: M2_GDP (money and quasi money to GDP)

(21) Variable 71: MultiDebt_TTExtDbt (multilateral debt to total external debt)

(22) Variable 78: Unempl_Lforce (unemployment to total labor force)

4.2.4 Principal Component Analysis

4.2.4.1 Methodology

Principal Component Analysis (PCA) is used to discard the effects of multicollinearity. Multicollinearity in a regression analysis model is a statistical occurrence in which two or more independent variables are observed to be highly correlated. Multicollinearity does neither diminish the reliability nor reduce the predictive power of a regression model as a whole within a given data set. This is due to the fact that high correlation among two or more variables suggests that they are measuring the same phenomenon or construct. In other words, highly correlated variables convey the same information. Multiple regression fits a model to predict a dependent variable from several independent variables. If the regression model fits the data series, the overall R^2 value will be high and the corresponding p-value will be low.[72] As for the p-value of an individual variable, the overall p-value for a multiple regression represents the level of significance for the entire regression analysis. A low p-value indicates that a particular independent variable significantly improves the fit of the model. The individual p-value is calculated by evaluating the goodness-of-fit of the model as a whole to the goodness-of-fit in case the specific independent variable is not included, that is, omitted. In specific cases, results of multiple regression analysis may seem conflicting. Even though the overall multiple regression results' p-value is low, all of the individual p-values are high. That is, the model fits the data well despite of the high p-values of the independent variables, which indicates statistical insignificance on predicting a single dependent variable alone. In such a case, no single independent variable contributes significantly to the model. But together they contribute a lot, suggesting that the regression model is exposed to multicollinearity.

Multicollinearity has an effect on calculations with respect to independent variables only. Multiple regression models with highly correlated independent variables demonstrate how well the entire collection of independent variables predicts the dependent ones, however it does not necessarily give valid results about any individual independent

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[72] The adjusted R^2 coefficient is used as a statistical metric to reveal the goodness of fit of a model. In regression analysis an adjusted R^2 coefficient demonstrates how well the regression line approximates real data points with each newly added variable. An adjusted R^2 of 1.0 means the regression line perfectly fits the data series.

variable, or about which independent variables are redundant. In regression analysis, multicollinearity is an unwanted condition in which correlations among the independent variables are strong to the extent that multiple regression results may seem inconsistent or paradoxical. For instance, a regression model fits the data well represented by a high F-test (joint significance) even though none of the independent variables has a statistically significant effect on explaining or predicting the dependent variable. That is, multicollinearity generates statistical insignificance among variables while they should be otherwise significant. Multicollinearity can be either perfect or imperfect. Perfect multicollinearity is established when two or more independent variables have an error free linear relationship. However, perfect multicollinearity contradicts the classic assumption that no independent variable is a perfect linear function of other independent variables. As a result, the assumption of perfect multicollinearity within econometrics is of very low significance at best. Nonetheless, imperfect multicollinearity, i.e., a strong linear functional relationship between two or more independent variables, occurs often —as it does in this econometric study.

Commodity price indexes and governance indexes are compared to macroeconomic variables measured as percentage shares and change rates.[73] The principal component analysis in this study will therefore differentiate between change rates of independent index variables and index values of independent index variables. Section 4.2.4.2 performs PCA on commodity price indexes, Sections 4.2.4.3 and 4.2.4.4 perform PCA on worldwide governance indexes and economic freedom indexes.

Prevalent literature suggests that the following propositions (a) and (b) are adequate to sense or to suspect the existence of multicollinearity within a data set:

(a) The correlation between independent variables is equal or greater than 70.0%.

The modified correlation threshold at which the study performs the principle component analysis in the context of proposition (a) is 69.9%, 0.1% lower than the

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[73] The following macroeconomic variables are measured as percentage change rates: GDP_gr (Variable 2), GDPpCap_gr (Variable 3), Agri_gr (Variable 5), IndustValAd_gr (Variable 7), ManFactValAdd_gr (Variable 9), GovFinConExp_gr (Variable 15), FinConExp_gr (Variable 17), HHFinConExp_gr (Variable 18), HHFinConExpPCap_gr (Variable 20), GroCapF_gr (Variable 22), GrossFixCapForm_gr (Variable 24), ExpGS_gr (Variable 28), ImpGS_gr (Variable 32), M2_gr (Variable 61).

suggested threshold of 70% in statistics literature. This is to include border line cases which may reveal promising multiple regression results.

(b) The correlation coefficient between independent variables is larger than the correlation coefficient between the dependent and independent variables.

In order to detect multicollinearity I apply proposition (a), which I view as key proposition, and proposition (b) for completeness purposes.

Commodity Price Indexes

Principal Component Analysis Approach for Commodity Price Indexes

Commodity prices are affected by a myriad of global factors. The principal component analysis on commodity price indexes can thus not be confined to a regional view on commodity price indexes in Brazil or China. Fourteen of the seventy-nine macroeconomic variables are measured in change rates. As a result, I will carry out the PCA on commodity price indexes in two stages, differentiating commodity prices into (i) commodity price indexes, and into (ii) change rates of commodity price indexes in order to establish comparability to the dependent variables which itself are measured in percentage shares and change rates.

Multicollinearity Criteria for Commodity Price Indexes

In a first step of the PCA I will apply the above mentioned proposition (a) in order to detect multicollinearity of commodity price indexes and their change rates. In a second step, I aim to reduce the impact of multicollinearity by also considering proposition (b) which states that the correlation coefficient between independent variables is larger than the correlation coefficient between dependent and independent variables.

One way to reduce the impact of multicollinearity is to increase the sample size by adding more data points in conjunction with narrower confidence intervals. Due to the annual data point limitations (12 change rates and 13 percentage share data points, respectively) this approach has to be disregarded. Instead, I bundle independent variables of a given set based on high correlation coefficients and on economic rationale. I therewith create a composite independent interaction term, the product of the bundled independent variables.

Governance Indexes

Principal Component Analysis Approach for Governance Indexes

Commodity price indexes are a quantitative composite measure based on reported individual commodity composite constituents. Commodity price indexes are transparent and observable on a daily basis. Commodities, which emerged as a separate asset class in the early 2000s, tend to trend in pairings, responding to idiosyncratic economic causes, expectations and a myriad of market factors including liquidity and technical factors.

In contrast, governance indexes cover a wide area of governance dimensions which in itself are fragmented in a high number of quantitative and qualitative assessments, which in turn are measured by a large number of qualitative components. Also, governance indexes move slower than commodity price indexes due to their annual assessment cycles, whereas commodity price indexes can be observed and measured daily. Furthermore, governance indexes may impose interdependent effects on each other due to overlapping causes. For example, political stability (WGIPS) may be affected by the degree of democracy (WGIVA) of a country, which in turn may be affected by the political stability (WGIPS) of a political system. Similarly, large government spending, i.e., large and costly governmental expenditures and activities (EFIGovtS) —as witnessed for example in 2009 in the aftermath of the financial crisis in 2008 in the US and China in order to dampen the negative effects of the financial crisis— may affect and impact fiscal governance (EFIFisc) of a state. While commodities tend to move in positively correlating patterns, highly correlating governance indexes do not necessarily imply similar causes. The correlation may be purely random or based on a strong Granger causality between governance dimensions.

Due to the diversity and complexity of governance dimensions used in this thesis the PCA analysis for governance indexes is at best of limited usefulness. However, in order to apply the same statistical tests on all independent variables I will also apply PCA on all governance indexes and on changes of governance indexes, provided that the interpretation of combining two governance indexes is empirically and/or economically sensible.

Multicollinearity Criteria for Governance Indexes

In order to take into account the qualitatively structural differences between governance indexes compared to commodity price indexes I will add two additional selection criteria (a’) and (a’’) to the above mentioned modified multicollinearity detection propositions (a) (The correlation threshold is 69.9%) and (b) (the correlation coefficient between independent variables is larger than the correlation coefficient between dependent and independent variables).

The multicollinearity criterion for governance index sets, which includes the modified correlation threshold of 69.9%, will be expanded by the two following additional criteria (a’) and (a’’):
(a’) Correlation confidence level is equal or above 99.0% (sig. 0.01), and
(a’’) The independent variable pair with the highest correlation within a governance index set will be selected for PCA.

The additional multicollinearity selection criteria for governance indexes, supplementing the 69.9% correlation threshold criterion used for commodity price indexes, serve to keep the number of newly created independent PCA variables at a minimum of one per governance set in order to acknowledge and consider the wide array of qualitative differences within the governance indexes.

4.2.4.2 Principal Component Analysis of Commodity Prices

4.2.4.2.1 Principal Component Analysis of Commodity Price Indexes

In the context of the principal component analysis, the correlation analysis in Table 4.13 of commodity price indexes reveals that multicollinearity exists across the entire set of commodity price indexes except for TropBevIx on MinMetalsIx and CrudeIx. The multicollinearity pairs are displayed in bold letters and green shading.

Table: 4.13 Pearson Correlation of Commodity Price Indexes 1996 – 2008

1996-2008		**FoodIx**	**TropBevIx**	**VegOil SeedsIx**	**AgriRawIx**	**Min MetalsIx**	**CrudeIx**
FoodIx	Pearson	1	**.753****	**.929****	**.969****	**.859****	**.838****
	Sig.		**0.003**	**0**	**0**	**0**	**0**
	N	13	**13**	**13**	**13**	**13**	**13**
TropBevIx	Pearson	.753**	1	**.762****	**.699****	0.55	0.42
	Sig.	0.003		**0.002**	**0.008**	0.052	0.153
	N	13	13	**13**	**13**	13	13
VegOilSeedsIx	Pearson	.929**	.762**	1	**.917****	**.787****	**.755****
	Sig.	0	0.002		**0**	**0.001**	**0.003**
	N	13	13	13	**13**	**13**	**13**
AgriRawIx	Pearson	.969**	.699**	.917**	1	**.923****	**.895****
	Sig.	0.00	0.008	0		**0**	**0**
	N	13	13	13	13	**13**	**13**
MinMetalsIx	Pearson	.859**	0.55	.787**	.923**	1	**.958****
	Sig.	0	0.052	0.001	0		**0.00000**
	N	13	13	13	13	13	**13**
CrudeIx	Pearson	.838**	0.42	.755**	.895**	.958**	1
	Sig.	0	0.153	0.003	0	0.00000	
	N	13	13	13	13	13	13

Source: Calculated and arranged by the author.

The table above shows the Pearson correlation coefficients (Pearson) including the significance level (Sig.) and the number of observations (N). Crucial correlations range above 69.9%. All confidence levels ranging at or above 99% are marked by '**'. FoodIx and AgriRawIx show the highest correlation with 96.9% within the commodity price index with a confidence level of above 99%. Significant correlations between all other composite commodity price indexes range between 69.9% and 96.9%, displaying confidence levels of 99%. It is observable that TropBevIx does not correlate significantly with CrudeIx and MinMetalsIx. However, TropBevIx does correlate with all other commodity price indexes with correlation coefficients above 69.9%. CrudeIx and MinMetalsIx display the second largest correlation at 95.8%, while their confidence level is the highest at almost 100% (sig. 0.0000).

Soft Commodity Subset and Oil and Metals Subset

The commodity price indexes will be bundled into two subsets: The oil and metals subset and the soft commodity subset. The oil and metals subset comprises CrudeIx and MinMetalsIx, whereas the soft commodity subset comprises FoodIx, TropBevIx, VegOilSeesIx, and AgriRawIx. The rationale behind segregating the commodity price indexes is twofold: The correlation and significance levels above reveal a strong pattern between CrudeIx and MinMetalsIx on one hand, and a significant correlation pattern within the soft commodity subset on the other hand. The relationship between oil and metals shows long dated historical price patterns, as revealed by the correlation comparisons between 1971 and 2009 in Section 3.3 in Chapter 3 (Independent Variables Set 1: Commodity Price Indexes). Also, as established in Chapter 3, I note that CrudeIx is Granger causing MinMetalsIx, which additionally supports the distinction between the oil and metals subset on one hand and the soft commodity subset on the other hand.

Newly Created Principal Components

As a result of the PCA for commodities price indexes I have created six artificial independent variables, three for each Brazil and China, in order to address the multicollinearity problem. The newly created independent variables derived from the PCA are as follows:

Table 4.14: PCA of Commodity Price Indexes — Newly Created Independent Variables

New MCA Independent Variable	Commodity Composite Combination	Country
BMca1MetOil	CrudeIx & MinMetalsIx	Brazil
BMca2FdAg	FoodIx & AgriRawIx	Brazil
BMca3BevAg	TropBevIx &AgriRawIx	Brazil
CMca1MetOil	CrudeIx & MinMetalsIx	China
CMca2FdAg	FoodIx & AgriRawIx	China
CMca3FdVegAg	FoodIx & VegOilSeedsIx & AgriRawIx	China

Source: Calculated and arranged by the author.

Each newly created independent variable reflects a specific combination of commodity price indexes based on significant results derived from the correlation and

Granger causality analysis carried out (Section 4.2.3) on Brazil and China. The BMca1MetOil of Brazil and CMca1MetOil of China reflect the result of the PCA in the context of the combination of CrudeIx and MinMetalsIx.[74] BMca2FdAg, BMca3BevAg, CMca2FdAg, and CMca3FdVegAg stand for the new independent variables derived from the soft-commodity subset of Brazil (B) and China (C).[75]

The multiple regression analysis will use these newly created independent variables provided that there is more than one commodity price index significantly affecting a dependent variable based on correlation and Granger causality analysis. If correlation and Granger causality tests do not display more than one commodity price index within each commodity subset affecting a dependent variable, then the respective individual commodity price index is kept in its original form (i.e., CrudeIx, MinMetalsIx, AgriRawIx, FoodIx, TropBevIx, VegOilSeedsIx).

For example, if there is only one relevant commodity price index left in the context of correlation and Granger causality tests on a specific macro-variable, then there is no need to create a new independent variable because PCA does not apply. If however there are two or more than two relevant commodity price indexes, and neither is CrudeIx nor MinMetalsIx, then there is the need to create a new PCA variable. The same applies if the two independent variables are CrudeIx and MinMetalsIx, for which I create a new PCA independent variable combining CrudeIx and MinMetalsIx. If there are two variables one of which is CrudeIx and the other a soft commodity price index, I will not create a new PCA independent variable.

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[74] Abbreviations: B=Brazil, C= China, PCA= principal component analysis, 1= ordinal measure (the first new multicollinearity (M) generated independent variable for Brazil), MetOil=CrudeIx and MinMetalsIx. The newly created independent variables BMca1MetOil and CMca1MetOil represent the combination of CrudeIx and MinMetalsIx for Brazil (B), and China (C).

[75] Abbreviations continued: BMca2FdAg and CMca2FdAg have the same vector and represent the new independent variables for Brazil (B) and China (C), combining FoodIx (Fd) and AgriRawIx (Ag). BMca3BevAg stands for the third (3) multicollinearity (M) driven principal component (c) analysis (a) on TropBevIx (Bev) and AgriRawIx (Ag) for Brazil (B); BMca3BevAg. CMca3FdVegAg stands for the new, third, independent variable combining FoodIx, VegOilSeedsIx, and AgriRawIx for China.

4.2.4.2.2 Principal Component Analysis of Changes in Commodity Price Indexes

The principal component analysis of changes in commodity price indexes is necessary due to the fact that correlation and Granger causality analysis has been performed on dependent variables measured in change rates in context of changes in commodity price indexes.

Change rates of MinMetalsIx and AgriRawIx correlate below the 69.9% threshold criterion established for the PCA analysis. As such MinMetalsIx and AgriRawIx do not pose a multicollinearity problem. Also, as already established in Chapter 3, CrudeIx and MinMetalsIx form a historical and economically validated correlation pair. Therefore, there is no conclusive reason to combine MinMetalsIx and AgriRawIx into a new independent variable.

Table 4.15 reveals that the multicollinearity problem affects AgriRawIx and FoodIx which correlate at 83% (sig. 0.01) above the principal component threshold criterion of 69.9% (marked in green shading and bold letters).

Table 4.15: Pearson Correlation of Changes in Commodity Price Indexes 1996 - 2008

1996-2008		**FoodIx**	**TropBevIx**	**VegOil SeedsIx**	**AgriRawIx**	**Min MetalsIx**	**CrudeIx**
FoodIx	Pearson	1	0.47	0.481	**.830****	0.491	0.374
	Sig.		0.123	0.113	**0.001**	0.105	0.231
	N	12	12	12	**12**	12	12
TropBevIx	Pearson	0.47	1	0.454	0.413	0.352	0.105
	Sig.	0.123		0.138	0.182	0.262	0.745
	N	12	12	12	12	12	12
VegOilSeedsIx	Pearson	0.481	0.454	1	0.568	0.055	-0.256
	Sig.	0.113	0.138		0.054	0.864	0.421
	N	12	12	12	12	12	12
AgriRawIx	Pearson	.830**	0.413	0.568	1	**.624***	0.454
	Sig.	0.001	0.182	0.054		**0.03**	0.138
	N	12	12	12	12	**12**	12
MinMetalsIx	Pearson	0.491	0.352	0.055	.624*	1	0.507
	Sig.	0.105	0.262	0.864	0.03		0.092
	N	12	12	12	12	12	12
CrudeIx	Pearson	0.374	0.105	-0.256	0.454	0.507	1
	Sig.	0.231	0.745	0.421	0.138	0.092	
	N	12	12	12	12	12	12

Source: Calculated and arranged by the author.

The Granger causality analysis in Tables 4.8 and 4.11 for Brazil and China uncover that the multicollinearity problem of changes in AgriRawIx and changes in FoodIx only affects GDP_gr (Variable 2) of Brazil. The new PCA-derived independent variable combining changes in AgriRawIx and FoodIx is thus labeled as BgrMcaFoodAg (‘gr’ stands for growth rate). Therefore BgrMcaFoodAg will be included in the multiple regression analysis for Brazil. The multi regression analysis will, however, reveal that BgrMcaFoodAg does not significantly affect GDP_gr, as I will show in Chapter 4.3 and 5.

Table 4.16: PCA of Changes in Commodity Price Indexes: Newly Created Independent Variable

New PCA independent Variable	Commodity Composite Combination	Country
BgrMcaFoodAg	FoodIx & AgriRawIx	Brazil

Source: Calculated and arranged by the author.

4.2.4.3 Principal Component Analysis of Worldwide Governance

4.2.4.3.1 Principal Component Analysis of Worldwide Governance Indexes

BRAZIL

Each WGI index represents a different governance dimension, which at first sight implies that statistically significant correlations among individual WGI indexes may be random and not related to intrinsic information similarities.

Table 4.17: Pearson Correlation of Worldwide Governance Indexes Brazil 1996 - 2008

1996-2008		WGIVA	WGIPS	WGIGE	WGIRQ	WGIRL	WGICC
WGIVA	Pearson	1	0.261	0.442	-.772**	-.789**	-0.109
	Sig.		0.389	0.13	0.002	0.001	0.724
	N	13	13	13	13	13	13
WGIPS	Pearson	0.261	1	**.823****	-0.04	-0.333	.553*
	Sig.	0.389		**0.001**	0.896	0.267	0.05
	N	13	13	**13**	13	13	13
WGIGE	Pearson	0.442	.823**	1	-0.1	-0.34	**.749****
	Sig.	0.13	0.001		0.745	0.256	**0.003**
	N	13	13	13	13	13	**13**
WGIRQ	Pearson	-.772**	-0.04	-0.1	1	**.839****	0.39
	Sig.	0.002	0.896	0.745		**0.000**	0.188
	N	13	13	13	13	**13**	13
WGIRL	Pearson	-.789**	-0.333	-0.34	.839**	1	0.159
	Sig.	0.001	0.267	0.256	0		0.603
	N	13	13	13	13	13	13
WGICC	Pearson	-0.109	.553*	.749**	0.39	0.159	1
	Sig.	0.724	0.05	0.003	0.188	0.603	
	N	13	13	13	13	13	13

Source: Calculated and arranged by the author.

However, certain pairs of WGI indexes not only correlate but also may affect each other. For example, political stability (WGIPS) and voice and accountability (WGIVA, i.e., degree of democracy) represent governance dimensions which may affect each other even though correlation is non-significant. Similarly, control of corruption (WGICC) may affect the effectiveness of government services (WGIGE); WGICC and WGIGE correlate at 74.9% (sig. 0.003). Likewise, regulatory quality (WGIRQ) may be affected by judicial decisions and the rule of law (WGIRL); both correlate at 83.9% (sig. 0.01).

According to the PCA correlation threshold criterion of 69.9%, the following WGI pairs would have to be combined in order to avoid multicollinearity: (1) WGIGE and WGICC (74.9%, sig. 0.003), (2) WGIPS and WGIGE (correlation of 82.3%, sig. 0.01), and (3) WGIRQ and WGIRL (correlation of 83.9%, sig. 0.0001). By convention, WGIRQ and WGIRL need to be paired for principal component analysis. However, Granger causality analysis on Brazil revealed that there is no WGIRL-WGIRQ pair displaying significant causality to any dependent variable. Therefore, I will not apply principal component analysis on WGI indexes. PCA on WGIRQ and WGIRL in this case is redundant and does not render any additional conclusions.

Even though WGIGE and WGIPS as well as WGIGE and WGICC do show significant positive correlation above 69.9% I chose not to generate a new independent variable combining them due to either the qualitatively relatively unrelated nature and dissimilar scope of the respective governance dimensions (e.g., WGIGE and WGIPS), or due not significant Granger causality results between them (WGIGE and WGICC; Granger 1 p-0.1978; Granger 2 p-value 0.8632).

CHINA

Table 4.18 below reveals that for China the only significant correlation pair found is WGIVA-WGIPS, which correlates at 77% (sig. 0.01), above the 69.9%-threshold.

Table 4.18: Pearson Correlation of Worldwide Governance Indexes China 1996 - 2008

1996-2008		WGIVA	WGIPS	WGIGE	WGIRQ	WGIRL	WGICC
WGIVA	Pearson	1	**.770****	-.812**	-.333	-.107	.421
	Sig.		**.002**	.001	.267	.728	.152
	N	13	**13**	13	13	13	13
WGIPS	Pearson	.770**	1	-.625*	-.340	.254	.400
	Sig.	.002		.022	.256	.403	.176
	N	13	13	13	13	13	13
WGIGE	Pearson	-.812**	-.625*	1	.242	.018	-.321
	Sig.	.001	.022		.426	.952	.286
	N	13	13	13	13	13	13
WGIRQ	Pearson	-.333	-.340	.242	1	**.620***	.258
	Sig.	.267	.256	.426		**.024**	.395
	N	13	13	13	13	**13**	13
WGIRL	Pearson	-.107	.254	.018	.620*	1	.389
	Sig.	.728	.403	.952	.024		.189
	N	13	13	13	13	13	13
WGICC	Pearson	.421	.400	-.321	.258	.389	1
	Sig.	.152	.176	.286	.395	.189	
	N	13	13	13	13	13	13

Source: Calculated and arranged by the author.

The WGIVA-WGIPS pair appears to be significant at the example of government final consumption expenditure (Variable 14: GovFinConExp_GDP). The multiple regression analysis for China on GovFinConExp_GDP and individually counting in WGIVA and WGIPS does not provide a statistically meaningful result. However, creating a new independent variable CMca4WvAPs, combining WGIVA and WGIPS, does render a statistically meaningful result in the multiple regression analysis. This implies that WGIVA and WGIPS individually are too weak to generate a significant multi regression result. Because of that I need to incorporate CMca4WvAPs in the multi regression analysis for GovFinConExp_GDP (Variable 14) for China.

Table 4.19: PCA of WGI China — Newly Created Independent Variable

New PCA Independent Variable	WGI Composite Combination	Country
CMca4WvAPs	WGIVA & WGIPS	China

Source: Calculated and arranged by the author.

WGIRQ and WGIRL also display significant correlation but do not reach the 69.9% threshold to qualify for the PCA. As such no new independent variable will be created by combining WGIRL and WGIRQ.

4.2.4.3.2 Principal Component Analysis of Changes in Worldwide Governance Indexes

BRAZIL

Table 4.20: Pearson Correlation of Changes in Worldwide Governance Indexes Brazil 1996-2008

1996-2008		**WGIVA**	**WGIPS**	**WGIGE**	**WGIRQ**	**WGIRL**	**WGICC**
WGIVA	Pearson	1	-0.123	-0.147	0.22	0.181	0.1
	Sig.		0.703	0.649	0.493	0.573	0.756
	N	12	12	12	12	12	12
WGIPS	Pearson	-0.123	1	0.208	-0.051	0.067	-.803**
	Sig.	0.703		0.516	0.875	0.836	0.002
	N	12	12	12	12	12	12
WGIGE	Pearson	-0.147	0.208	1	0.129	0.49	-0.067
	Sig.	0.649	0.516		0.688	0.106	0.835
	N	12	12	12	12	12	12
WGIRQ	Pearson	0.22	-0.051	0.129	1	0.355	0.019
	Sig.	0.493	0.875	0.688		0.258	0.953
	N	12	12	12	12	12	12
WGIRL	Pearson	0.181	0.067	0.49	0.355	1	-0.058
	Sig.	0.573	0.836	0.106	0.258		0.858
	N	12	12	12	12	12	12
WGICC	Pearson	0.1	-.803**	-0.067	0.019	-0.058	1
	Sig.	0.756	0.002	0.835	0.953	0.858	
	N	12	12	12	12	12	12

Source: Calculated and arranged by the author.

The correlation matrix of changes in worldwide governance indexes in Table 4.20 shows no positive significant correlation within the WGI set for Brazil. In addition, correlation and Granger causality tests carried out for Brazil reveal that none of the dependent variables measured in change rates is affected by any corresponding WGI variable measured in change rates. As a result, no new PCA independent variables have been created.

CHINA

Table 4.21 below reveals no correlation among changes in WGI indexes for China. As a result there is no necessity to create a new PCA independent variable.

Table 4.21: Pearson Correlation of Changes of Worldwide Governance Indexes China 1996-2008

1996-2008		WGIVA	WGIPS	WGIGE	WGIRQ	WGIRL	WGICC
WGIVA	Pearson	1	.173	.162	-.266	-.326	.143
	Sig.		.590	.615	.403	.301	.657
	N	12	12	12	12	12	12
WGIPS	Pearson	.173	1	.204	-.282	.325	-.532
	Sig.	.590		.526	.374	.302	.075
	N	12	12	12	12	12	12
WGIGE	Pearson	.162	.204	1	.144	-.287	.026
	Sig.	.615	.526		.655	.365	.935
	N	12	12	12	12	12	12
WGIRQ	Pearson	-.266	-.282	.144	1	.250	.020
	Sig.	.403	.374	.655		.433	.950
	N	12	12	12	12	12	12
WGIRL	Pearson	-.326	.325	-.287	.250	1	-.371
	Sig.	.301	.302	.365	.433		.235
	N	12	12	12	12	12	12
WGICC	Pearson	.143	-.532	.026	.020	-.371	1
	Sig.	.657	.075	.935	.950	.235	
	N	12	12	12	12	12	12

Source: Calculated and arranged by the author.

4.2.4.4 Principal Component Analysis of Economic Freedom

4.2.4.4.1 Principal Component Analysis of Economic Freedom Indexes

BRAZIL

Table 4.22 below shows five pairs of EFI governance indexes positively correlating above 69.9% with confidence levels above 99%. The pairs of independent variables displaying a positive correlation above the 69.9% threshold are marked in bold letters and green shading.

The following EFI-pairs pass the 69.9% correlation threshold: (1) EFIBiz-EFIFisc, (2) EFIBiz-EFIGovtS, (3) EFIFisc-EFIGovtS, (4) EFIFisc-EFIFin, and (5) EFIMon-EFICorrup. EFIFisc-EFIGovtS displays the highest correlation at 91.7% (sig. 0.000) and the highest confidence level within the set. Also, cause and effect between the EFIFisc-EFIGovtS are more plausible than cause and effect among the remaining four correlation pairs. Hence, I combine EFIFisc and EFIGovtS.

Table 4.22: Pearson Correlation of Economic Freedom Indexes Brazil 1996-2008

1996-2008		EFI Biz	EFI Trade	EFI Fisc	EFI GovtS	EFI Mon	EFI Invest	EFI Fin	EFI PropRi	EFI Corrup
EFIBiz	Pearson	1	-.843**	**.867****	**.759****	0.018	na	.634*	na	0.089
	Sig.		0	**0.000**	**0.003**	0.953	.	0.02	.	0.772
	N	13	13	**13**	**13**	13	13	13	13	13
EFITrade	Pearson	-.843**	1	-.758**	-.694**	-0.095	na	-0.54	na	0
	Sig.	0		0.003	0.008	0.758	.	0.057	.	1
	N	13	13	13	13	13	13	13	13	13
EFIFisc	Pearson	.867**	-.758**	1	**.917****	0.013	na	**.716****	na	0.168
	Sig.	0.000	0.003		**0.000**	0.967	.	**0.006**	.	0.584
	N	13	13	13	**13**	13	13	**13**	13	13
EFIGovtS	Pearson	.759**	-.694**	.917**	1	-0.139	na	**.615***	na	-0.023
	Sig.	0.003	0.008	0.000		0.65	.	**0.025**	.	0.941
	N	13	13	13	13	13	13	**13**	13	13
EFIMon	Pearson	0.018	-0.095	0.013	-0.139	1	na	0.157	na	**.744****
	Sig.	0.953	0.758	0.967	0.65		.	0.609	.	**0.004**
	N	13	13	13	13	13	13	13	13	**13**
EFIInvest	Pearson	na	na	na	na	na	na	na	na	na
	Sig.	.	.	.	.	.	.	.	.	.
	N	13	13	13	13	13	13	13	13	13
EFIFin	Pearson	.634*	-0.54	.716**	.615*	0.157	na	1	na	0.163
	Sig.	0.02	0.057	0.006	0.025	0.609	.		.	0.595
	N	13	13	13	13	13	13	13	13	13
EFIPropRi	Pearson	na	na	na	na	na	na	na	na	na
	Sig.	.	.	.	.	.	.	.	.	.
	N	13	13	13	13	13	13	13	13	13
EFICorrup	Pearson	0.089	0	0.168	-0.023	.744**	na	0.163	na	1
	Sig.	0.772	1	0.584	0.941	0.004	.	0.595	.	
	N	13	13	13	13	13	13	13	13	13

Source: Calculated and arranged by the author.

EFIFisc measures the governance level of Brazil's tax regime. EFIGovtS measures the size of government activities within the economy. It appears that increasing governmental activities and spending correlate with a deteriorating tax regime in Brazil. Furthermore, Granger causality reveals (not shown in the table) that a deteriorating fiscal tax regime (higher taxes) Granger causes deteriorating EFIGovtS. That is, a heavier tax regime may lead governmental spending measured by EFIGovtS. EFIFisc-EFIGovtS passes the PCA criteria. Thus I create the new independent variable BMca4EfscGvt which combines EFIFisc and EFIGovts.

Table 4.23: PCA of EFI Brazil — Newly Created Independent Variable

New PCA independent variable	EFI Composite Combination	Country
BMca4EfscGvt	EFIFisc & EFIGovtS	Brazil

Source: Calculated and arranged by the author.

In the multiple regression model, however, BMca4EfscGvt is not affecting ManfImp_MrchImp (Variable 34), neither on a single constituent basis (EFIFisc, EFIGovtS) nor on a combined basis (BMca4EfscGvt).

CHINA

Table 4.24 below shows six pairs of EFI governance indexes positively correlating with each other at the significance of 0.05 and 0.01. The six EFI indexes pairs are: (1) EFIBiz-EFIGovts, (2) EFIInvest-EFIGovts, (3) EFIFin-EFIGovts, (4) EFICorrup-EFITrade, (5) EFICorrup-EFIMon, and (6) EFIFin-EFIInvest.

Table 4.24: Pearson Correlation of Economic Freedom Indexes China 1996-2008

1996-2008		**EFI Biz**	**EFI Trade**	**EFI Fisc**	**EFI GovtS**	**EFI Mon**	**EFI Invest**	**EFI Fin**	**EFI PropRi**	**EFI Corrup**
EFIBiz	Pearson	1	-.734**	.174	**.588***	.135	.388	.388	.479	-.228
	Sig.		.004	.569	**.034**	.660	.190	.190	.097	.454
	N	13	13	13	**13**	13	13	13	13	13
EFITrade	Pearson	-.734**	1	-.456	-.796**	.219	-.772**	-.772**	-.734**	**.658***
	Sig.	.004		.117	.001	.473	.002	.002	.004	**.015**
	N	13	13	13	13	13	13	13	13	**13**
EFIFisc	Pearson	.174	-.456	1	.551	-.316	.540	.540	.362	-.386
	Sig.	.569	.117		.051	.294	.057	.057	.224	.192
	N	13	13	13	13	13	13	13	13	13
EFIGovtS	Pearson	.588*	-.796**	.551	1	-.440	**.676***	**.676***	.347	-.717**
	Sig.	.034	.001	.051		.132	**.011**	**.011**	.246	.006
	N	13	13	13	13	13	**13**	**13**	13	13
EFIMon	Pearson	.135	.219	-.316	-.440	1	-.556*	-.556*	.277	**.783****
	Sig.	.660	.473	.294	.132		.049	.049	.359	**.002**
	N	13	13	13	13	13	13	13	13	**13**
EFIInvest	Pearson	.388	-.772**	.540	.676*	-.556*	1	**1.000****	.365	-.690**
	Sig.	.190	.002	.057	.011	.049		**.000**	.220	.009
	N	13	13	13	13	13	13	**13**	13	13
EFIFin	Pearson	.388	-.772**	.540	.676*	-.556*	1.000**	1	.365	-.690**
	Sig.	.190	.002	.057	.011	.049	.000		.220	.009
	N	13	13	13	13	13	13	13	13	13
EFIPropRi	Pearson	.479	-.734**	.362	.347	.277	.365	.365	1	-.208
	Sig.	.097	.004	.224	.246	.359	.220	.220		.495
	N	13	13	13	13	13	13	13	13	13
EFICorrup	Pearson	-.228	.658*	-.386	-.717**	.783**	-.690**	-.690**	-.208	1
	Sig.	.454	.015	.192	.006	.002	.009	.009	.495	
	N	13	13	13	13	13	13	13	13	13

Source: Calculated and arranged by the author.

Only two of the following pairs display a correlation above 69.9%: EFIFin-EFIInvest shows a correlation of 100% at a significance level of <0.000, and EFICorrup-

EFIMon[76] shows a correlation of 78.3% at a significance level of 0.002. Due to the selection criteria for governance indexes I will create CMca5EInvFin which combines EFIFin and EFIInvest. The Heritage Foundation applied the same yearly grading points for EFIFin and EFIInvest for China. This implies that the governance dimensions EFIFin and EFIInvest are idiosyncratic in scope and scale.

Table 4.25: PCA of EFI China — Newly Created Independent Variable

New PCA independent variable	EFI Composite Combination	Country
CMca5EInvFin	EFIInv & EFIFin	China

Source: Calculated and arranged by the author.

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[76] The Granger causality analysis shows that there is no dependent variable affected by EFIMon and EFICorrup at the same time. As such a newly created independent variable combining EFIMon and EFICorrup is redundant.

4.2.4.4.2 Principal Component Analysis of Changes in Economic Freedom Indexes

BRAZIL

Table 4.26 below reveals that there is no significant correlation above 69.9% among changes in EFI indexes of Brazil. As a result there is no necessity to create a new PCA independent variable.

Table 4.26: Pearson Correlation of Changes in Economic Freedom Indexes Brazil 1996-2008

1996-2008		**EFI Biz**	**EFI Trade**	**EFI Fisc**	**EFI GovtS**	**EFI Mon**	**EFI Invest**	**EFI Fin**	**EFI PropRi**	**EFI Corrup**
EFIBiz	Pearson	1	-0.22	-0.029	-0.213	-0.267	na	-0.004	na	0.086
	Sig.		0.493	0.929	0.506	0.401	.	0.99	.	0.792
	N	12	12	12	12	12	12	12	12	12
EFITrade	Pearson	-0.22	1	0.063	0.161	-0.574	na	-0.009	na	-0.368
	Sig.	0.493		0.847	0.617	0.051	.	0.978	.	0.24
	N	12	12	12	12	12	12	12	12	12
EFIFisc	Pearson	-0.029	0.063	1	.653*	0.296	na	0.464	na	0.288
	Sig.	0.929	0.847		0.021	0.35	.	0.128	.	0.365
	N	12	12	12	12	12	12	12	12	12
EFIGovtS	Pearson	-0.213	0.161	.653*	1	0.022	.a	0.205	na	0.102
	Sig.	0.506	0.617	0.021		0.945	.	0.523	.	0.752
	N	12	12	12	12	12	12	12	12	12
EFIMon	Pearson	-0.267	-0.574	0.296	0.022	1	.a	0.259	na	0.385
	Sig.	0.401	0.051	0.35	0.945		.	0.416	.	0.217
	N	12	12	12	12	12	12	12	12	12
EFIInvest	Pearson	na	na	na	na	na	na	na	na	na
	Sig.	.	.	.	.	.	.	.	.	.
	N	12	12	12	12	12	12	12	12	12
EFIFin	Pearson	-0.004	-0.009	0.464	0.205	0.259	Na	1	na	0.272
	Sig.	0.99	0.978	0.128	0.523	0.416	.	.	.	0.393
	N	12	12	12	12	12	12	12	12	12
EFIPropRi	Pearson	na	na	na	na	na	na	na	na	na
	Sig.	.	.	.	.	.	.	.		.
	N	12	12	12	12	12	12	12	12	12
EFICorrup	Pearson	0.086	-0.368	0.288	0.102	0.385	.a	0.272	.a	1
	Sig.	0.792	0.24	0.365	0.752	0.217	.	0.393	.	
	N	12	12	12	12	12	12	12	12	12

Source: Calculated and arranged by the author.

CHINA

The correlation analysis of changes in economic freedom indexes for China reveals that there is only one pair of EFI governance indexes with a significant correlation above 69.9%: EFIFin-EFIInvest.

Table 4.27: Pearson Correlation of Changes in Economic Freedom Indexes China 1996-2008

1996-2008		**EFI Biz**	**EFI Trade**	**EFI Fisc**	**EFI GovtS**	**EFI Mon**	**EFI Invest**	**EFI Fin**	**EFI PropRi**	**EFI Corrup**
EFIBiz	Pearson	1	-.858**	-.383	.136	.196	-.011	-.011	-.388	.000
	Sig.		.000	.220	.673	.541	.973	.973	.213	.999
	N	12	12	12	12	12	12	12	12	12
EFITrade	Pearson	-.858**	1	.305	-.037	.189	-.013	-.013	.346	.278
	Sig.	.000		.335	.910	.556	.968	.968	.271	.381
	N	12	12	12	12	12	12	12	12	12
EFIFisc	Pearson	-.383	.305	1	-.056	-.114	.013	.013	.510	-.017
	Sig.	.220	.335		.862	.724	.967	.967	.090	.959
	N	12	12	12	12	12	12	12	12	12
EFIGovtS	Pearson	.136	-.037	-.056	1	-.289	-.587*	-.587*	-.212	-.389
	Sig.	.673	.910	.862		.362	.045	.045	.509	.212
	N	12	12	12	12	12	12	12	12	12
EFIMon	Pearson	.196	.189	-.114	-.289	1	.068	.068	.327	.639*
	Sig.	.541	.556	.724	.362		.833	.833	.300	.025
	N	12	12	12	12	12	12	12	12	12
EFIInvest	Pearson	-.011	-.013	.013	-.587*	.068	1	**1.000****	-.091	.237
	Sig.	.973	.968	.967	.045	.833		**.000**	.779	.459
	N	12	12	12	12	12	12	**12**	12	12
EFIFin	Pearson	-.011	-.013	.013	-.587*	.068	1.000**	1	-.091	.237
	Sig.	.973	.968	.967	.045	.833	.000		.779	.459
	N	12	12	12	12	12	12	12	12	12
EFIPropRi	Pearson	-.388	.346	.510	-.212	.327	-.091	-.091	1	.334
	Sig.	.213	.271	.090	.509	.300	.779	.779		.289
	N	12	12	12	12	12	12	12	12	12
EFICorrup	Pearson	.000	.278	-.017	-.389	.639*	.237	.237	.334	1
	Sig.	.999	.381	.959	.212	.025	.459	.459	.289	
	N	12	12	12	12	12	12	12	12	12

Source: Calculated and arranged by the author.

Both governance indexes combined do neither reveal any Granger causality nor any other association to any dependent variable for China. As a result there is no necessity to create a new PCA independent variable.

4.3 Multiple Regression Analysis

4.3.1 Methodology

Multiple regression analysis goes beyond the computation of correlations. Multiple regression analysis is an econometric method in which a regression line is calculated to transmit the average value of the dependent variable to the values of one or more than one predictor or independent variable.[77] Multiple regression analysis observes and explores the quality of these relationships (Sykes, 1992, pp. 5-10, 15-20). Given a dependent Y and several independent (or regressor) variables X, multiple regression fits a model to assess the relationships between these variables through the following equation:

$Y_a = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_i X_{i,}$

whereas β_i represents the regression coefficient (also referred to as beta coefficient) of each independent variable X_i (i=1 …, n; in this study n=21) for each dependent variable Y_a (a=1,…, 79). In the equation above, β_0 is the intercept of the line with the y-axis when X equals 0, and β_i is the slope —the amount of vertical change in the line for each unit of X_i. Estimates (beta coefficients) in the multiple regression analysis measure the contribution of the independent variables to the model. Large beta coefficients indicate that a unit change in an individual independent variable causes a large effect on the dependent variable.

The null hypothesis states that the slope is zero, H_0: $\beta_i = 0$. If that is true, then the regression coefficient is zero and there is no significant correlation; that is, a linear regression with X_i cannot be established. The p-value’s significance threshold is 0.05, so estimates with p-values equal or below 0.05 are considered to be significant; the null hypothesis can be rejected and a regression with X_i can be established.

The adjusted R^2 is a statistical measure of variation in the dependent variable that is accounted for by all the regressor variables. It provides a measure of the overall goodness-of-fit of the multiple regression equation (Garson, 2009). If the model fits the data well, the adjusted R^2 (R-square) value will be high, and the corresponding overall p-value will be low, in which case the good fit is unlikely to be a coincidence. In addition to the overall p-

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[77] The multiple regression line is typically calculated by applying the standard method of least squares in which the values of the coefficients β_0 and β_i are calculated so that the sum of the squared deviations of the points from the line is minimized. As such, positive deviations and negative deviations of equal size are counted equally, and large deviations count more than small deviations.

value, the multiple regression analysis also delivers an individual p-value for each independent variable (Berger, 2003, pp. 1-3). A low individual p-value indicates that the independent variable significantly improves the fit of the model. The p-value for a regressor (or independent) variable is calculated by comparing the goodness-of-fit of the entire model to the goodness-of-fit when the individual regressor variable is excluded or omitted. If the fit is much worse without that specific regressor variable, then its individual p-value has a significant impact on the model.

In this time-series correlation study I illustrate the movement of composite commodity prices as well as governance indexes with macroeconomic variables between 1996 and 2008. Due to the fact that commodity price indexes and macroeconomic variables tend to have substantial growth lines or trends in common, adjusted R^2 tends to be larger as a result of correlation. In this study an adjusted R^2 of higher than 50% but lower than 80% is considered to imply that the overall goodness-of-fit of the multiple regression equation is moderate, whereas an R^2 above 80% is considered to represent a high degree or strong goodness of fit.

T-values indicate the degree of impact of the explanatory variable, and p-values measure the significance of the regression results. A large absolute t-value and small p-value proposes that an independent variable is having a large impact on the dependent variable (Oxford Journals, 2009b, pp. 19-29). In this study I follow the standard approach in academic literature on multiple regression analysis application (Rubinfeld, 2000, pp. 417-468, Oxford Journals, 2009a, 2009b).

4.3.2 Multiple Regression Analysis Brazil

4.3.2.1 Multiple Regression Matrix Brazil

The statistical diagnostic tests for Brazil revealed that out of seventy-nine selected dependent variables forty-four dependent variables show significant correlation and Granger causality results to at least one commodity price or governance index. As a result, these forty-four macroeconomic variables qualify for the multiple regression analysis in this section. The statistical diagnostic tests also reveal that the following governance indexes do not show any effect on any dependent variable. These governance indexes are hence redundant for the multiple regression analysis for Brazil.

(1) EFIPropRi

(2) EFIInvest

(3) EFIMon

(4) WGICC

Tables 4.28a-b give an overview of those dependent variables which show positive results in the correlation and Granger causality tests to specific individual independent variables. Tables 4.28a-b (I. Correlation-Granger Causality Matrix and II. Multiple Regression Matrix) display all significant correlation and Granger causality pairs for specific dependent variables and their respective independent variables. The multi regression matrix in Tables 4.28a-b (II. Multiple Regression Matrix) displays the structural results of the multiple regression analysis for each dependent variable by displaying the respective independent variables of each regression line. Independent variables marked in red represent insignificant regression results. The Brazil-China flag marks the dependent variables which proceed to the regression analysis for both countries. 'Brazil' and/or 'China' marked in red means that the country's respective regression results on the identical dependent variable do not reveal comparable significant regression results.

Table 4.28a (I. Correlation-Granger Causality Matrix and II. Multiple Regression Matrix Brazil) is to be read in a similar way as the preceding correlation and Granger causality matrixes. For example: (i) GDPDefl (Variable 1) show a moderate to high positive correlation to all commodity price indexes except to TropBevIx. The Granger causality analyses for AgriRawIx and GDPDefl show feedback causalities because the Granger 1 and Granger 2 tests display p-values of below 0.05 (p-value Granger 1 <0.0001, p-value Granger 2 0.0273). According to my statistical findings, household final consumption expenditures to GDP (Variable 19: HHFinConExp_GDP) correlate at 78.7% with and seem to be Granger caused by WGIRQ for Brazil (Granger 1 p-value of 0.0307, Granger 2 p-value of 0.0137). For China, HHFinConExp_GDP (Variable 19) seems to be significantly affected by EFIPropRi correlating at 75.7% with a Granger 1 p-value of 0.0008 and a Granger 2 p-value of 0.0360 (Table 4.32a).

Identical dependent variables which show significant results for both Brazil and China are marked with a light blue background (e.g., Brazil&China) in the Tables 4.28a-b (I. Correlation-Granger Causality Matrix and II. Multiple Regression Matrix Brazil).[78] Black letters indicate that the multiple regression results for an identical dependent variable are positive in conjunction with at least one independent variable for both Brazil and China. Red letters (e.g., Brazil&China) indicate that the multiple regression analysis shows no significant relationships with independent variables for a country (China in this example).

Consider final consumption expenditure to GDP (Variable 16: FinConExp_GDP) for Brazil and China. FinConExp_GDP for Brazil shows a significant regression relationship with WGIRQ at a correlation 76.4% (Granger 1 p-value 0.0037, Granger 2 p-value 0.0322). For China, FinConExp_GDP (Variable 16) shows no significant regression results with any independent variable, even though WGICC and EFIGovts indicate significant correlations of 73% and 63% with Granger 1 p-values of 0.8965 and 0.6703 and Granger 2 p-values of 0.0001 and 0.0135, respectively. Thus, FinConExp_GDP is marked as Brazil&China (China in red letters).

The entire sets of regression results computed with SAS are provided in the attached CD-ROM.

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[78] Tables 4.28a-b represent key matrixes for Brazil in this thesis, combining correlation analysis, Granger causality analysis and PCA analysis. Tables 4.28a-b have been computed, compiled, arranged by the author.

Table 4.28a: I. Correlation-Granger Causality Matrix and II. Multi Regression Matrix Brazil

Variable No		1	2	3	6	7	9	12	13	15	16	19	23	25	26	27	33	34	35	36	37	38	39
I. Correlation / Granger Matrix		GDPDefl	GDP_gr	GDPpCap_gr	IndustValAd_GDP	IndustValAd_gr	ManFactValAdd_gr	GrossDomSav_GDP	GrossNatExp_GDP	GovFinConExp_gr	FinConExp_GDP	HHFinConExp_GDP	GrossFixCapForm_GDP	Trade_GDP	MrchTrade_GDP	ExpGS_GDP	AgRawImp_MrchImp	ManfImp_MrchImp	FuelImp_MerchImp	ExpValx	ImpValIx	ExpVolX	ImpVolIx
FoodIx	Pearson Correl	.612*	.697*	.729**	-0.068	0.569	0.500	0.231	-0.068	0.527	-0.231	-0.193	.704**	0.128	0.161	0.114	-0.218	-.591*	0.539	.830**	.941**	0.55	.904**
	Granger1	0.0001	0.4079	0.3097									0.1722							<0.0001	<0.0001		0.0101
	Granger2	0.0854	0.0486	0.0654									0.0167							0.2327	0.8612		0.085
TropBevIx	Pearson Correl	0.155	0.526	0.535	-0.367	0.540	0.357	-0.199	0.265	0.295	0.199	0.2	.632*	-0.418	-0.382	-0.386	0.236	-0.327	0.016	0.443	.618*	0.121	.629*
	Granger1												0.9801								0.0513		0.2055
	Granger2												0.2357								0.2765		0.9695
VegOilSeedsIx	Pearson Correl	.583*	0.501	0.526	-0.135	0.372	0.297	0.199	-0.077	.759**	-0.199	-0.162	.613*	0.101	0.141	0.098	-0.207	-.578*	0.428	.784**	.900**	0.515	.875**
	Granger1	0.0098								0.7009			0.8049							0.0013	0.0003		0.0069
	Granger2	0.2183								0.0237			0.1587							0.9985	0.7073		0.4434
AgriRawIx	Pearson Correl	.723**	.643*	.675*	0.106	.596*	.592*	0.394	-0.242	0.351	-0.394	-0.343	.564*	0.23	0.265	0.245	-0.261	-.739**	.663*	.900**	.936**	.685**	.901**
	Granger1	**<0.0001**	0.7507	0.8374		0.2817	0.3953						0.062						0.0049	<0.0001	0.0482	**<0.0001**	0.2468
	Granger2	**0.0273**	0.0003	0.0006		<0.0001	0.0025						0.0075						0.4334	0.6151	0.3037	**0.0064**	0.0006
MinMetalsIx	Pearson Correl	.850**	0.569*	.579*	0.231	0.544	0.0025	0.515	-0.364	-0.014	-0.515	-0.481	0.459	0.399	0.421	0.405	-0.499	-.770**	.760**	.963**	.926**	.827**	.924**
	Granger1	0.002	0.2638	0.3105															0.0224	<0.0001	0.2836	**0.0004**	0.0968
	Granger2	0.0999	0.0161	0.0246															0.9938	0.1912	0.0449	**0.0005**	<0.0001
CrudeIx	Pearson Correl	.922**	0.433	0.436	0.344	0.452	0.505	.620*	-0.459	-0.207	-.620*	-.573*	0.407	.572*	.592*	.560*	-.626*	-.691**	.860**	.990**	.935**	.888**	.908**
	Granger1	0.0639						0.4964						0.4102	0.3404	0.343			0.8649	0.0052	0.6434	0.096	0.7192
	Granger2	0.123						0.2658						0.7935	0.9704	0.1979			0.6839	0.8525	0.0487	0.0009	0.0008
WGIVA	Pearson Correl	.934**	-0.472	-0.452	.555*	-0.461	-0.322	.832**	-.818**	-0.092	-.832**	-.823**	-0.081	.772**	.783**	.823**	-.694**	-.626*	.842**	.822**	.604*	.924**	.565*
	Granger1	0.0405			0.1128			0.0223						0.0126	0.0169	0.0122			**0.0199**	0.4633	0.8335	**0.052**	0.7586
	Granger2	0.7449			0.3913			0.1801						0.884	0.7419	0.5829			**0.0276**	0.0075	0.0136	**0.0462**	0.0374
WGIPS	Pearson Correl	0.32	0.005	0.033	0.467	-0.179	-0.313	0.381	-0.306	-0.060	-0.381	-0.283	-0.333	.646*	.621*	.562*	-.605*	0.106	0.38	0.118	-0.01	0.307	-0.02
	Granger1													0.9861	0.99	0.9301							
	Granger2													0.0205	0.049	0.0176							
WGIGE	Pearson Correl	0.437	-0.035	-0.038	.578*	-0.073	-0.114	.572*	-0.533	0.445	-.572*	-0.475	-0.41	.750**	.750**	.712**	-.593*	0.071	0.429	0.206	0.05	0.415	0.017
	Granger1				0.1476			0.6068						0.6113	0.6744	0.7369							
	Granger2				0.0011			0.005						0.1337	0.1528	0.0323							
WGIRQ	Pearson Correl	-.886**	-0.283	-0.307	-.557*	-0.200	-0.078	-.764**	.666*	-0.427	.764**	.787**	-0.163	-.598*	-.618*	-.648*	.631*	.687**	-.814**	-.871**	-.687**	-.920**	-.706**
	Granger1								**0.0116**		**0.0037**	**0.0307**					0.6577	0.849					
	Granger2								**0.0466**		**0.0322**	**0.0137**					0.3501	0.0049					
WGIRL	Pearson Correl	-.817**	-0.264	-0.286	-.604*	-0.196	-0.287	-.755**	.750**	-0.160	.755**	.802**	0.168	-.709**	-.710**	-.755**	.795**	0.409	-.686**	-.680*	-0.423	-.855**	-0.45
	Granger1								0.0141		<0.0001	<0.0001					0.7745						
	Granger2								0.6355		0.8917	0.8451					0.6606						
WGICC	Pearson Correl	-0.13	0.041	0.027	0.095	0.049	0.110	-0.009	0.002	0.343	0.009	0.101	-0.373	0.174	0.176	0.123	-0.128	0.431	-0.209	-0.272	-0.27	-0.164	-0.26
	Granger1																						
	Granger2																						
EFIBiz	Pearson Correl	-.834**	0.001	-0.012	-0.345	0.034	0.072	-.560*	0.476	0.103	.560*	.569*	-0.254	-0.425	-0.439	-0.462	0.541	.660*	-.749**	-.895**	-.779**	-.843**	-.772**
	Granger1										0.0004	0.0015						0.3364					
	Granger2										0.3095	0.2183						0.0119					
EFITrade	Pearson Correl	.939**	0.382	0.367	.573*	0.495	0.506	.829**	-.730**	-0.220	-.829**	-.821**	0.202	.681*	.694**	.728**	-.643*	-.709**	.897**	.904**	.728**	.945**	.707**
	Granger1	0.0018			0.0719			0.0129						0.0032	0.002	0.004			<0.0001	0.3061	0.9051	0.0009	0.7487
	Granger2	0.9108			0.4037			0.2566						0.5735	0.8794	0.2431			0.8938	0.5846	0.2811	0.632	0.1166
EFIFisc	Pearson Correl	-.806**	-0.253	-0.279	-0.177	-0.111	-0.022	-0.446	0.28	-0.005	0.446	0.416	-0.478	-0.382	-0.4	-0.365	0.532	.688**	-.707**	-.924**	-.906**	-.778**	-.915**
	Granger1																	0.4128					
	Granger2																	0.0163					
EFIGovtS	Pearson Correl	-.826**	0.009	-0.014	-0.28	0.030	0.068	-0.511	0.345	0.336	0.511	0.424	-0.311	-0.505	-0.526	-0.474	.590*	.607*	-.725**	-.883**	-.841**	-.790**	-.844**
	Granger1																0.551	0.0736					
	Granger2																0.0323	0.0451					
EFIMon	Pearson Correl	0.147	-0.305	-0.294	0.058	-0.422	-0.414	0.048	-0.019	-0.119	-0.048	0.004	-0.212	0.465	0.436	0.336	-0.548	0.203	0.147	0.012	-0.005	0.099	-0.013
	Granger1																						
	Granger2																						
EFIInvest	Pearson Correl	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a
	Granger1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Granger2	13	12	12	13	12	12	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13
EFIFin	Pearson Correl	-0.526	0.154	0.165	-0.222	0.155	0.127	-0.373	0.331	0.411	0.373	0.387	-0.078	-0.205	-0.202	-0.256	0.307	.692**	-0.453	-0.537	-0.397	-.567*	-0.458
	Granger1																	0.6229					
	Granger2																	0.0246					
EFICorrup	Pearson Correl	0.197	-0.575	-.590*	0.457	-0.471	-.602*	0.354	-0.385	-0.201	-0.354	-0.356	-0.537	.619*	.598*	.569*	-.614*	0.392	0.166	-0.064	-0.234	0.197	-0.228
	Granger1			0.4788			0.7250							0.0859	0.1026	0.0529							
	Granger2			0.0128			0.0585							0.0822	0.1707	0.0211							

Brazil&China FLAG			Brazil & China					Brazil & China		Brazil & China	Brazil & China		Brazil & China	Brazil & China	Brazil & China			Brazil & China	Brazil & China	Brazil & China	Brazil & China	Brazil & China
Variable No	1	2	3	6	7	9	12	13	15	16	19	23	25	26	27	33	34	35	36	37	38	39
II. Multiple Regr. Matrix Dependents	GDPDefl	GDP_gr	GDPpCap_gr	IndustValAd_GDP	IndustValAd_gr	ManFactValAdd_gr	GrossDomSav_GDP	GrossNatExp_GDP	GovFinConExp_gr	FinConExp_GDP	HHFinConExp_GDP	GrossFixCapForm_GDP	Trade_GDP	MrchTrade_GDP	ExpGS_GDP	AgRawImp_MrchImp	ManfImp_MrchImp	FuelImp_MerchImp	ExpValx	ImpValIx	ExpVolx	ImpVolIx
Independents																						
FoodIx												BMca2FdAg										
TropBevIx																						
VegOilSeedsIx									VegOilSeedsIx													
AgriRawIx	AgriRawIx	BgrMcaFoodAg	AgriRawIx		AgriRawIx	AgriRawIx															AgriRawIx	AgriRawIx
MinMetalsIx		MinMetalsIx	MinMetalsIx																	BMca1MetOil	BMca1MetOil	BMca1MetOil
CrudeIx																						
WGIVA																		WGIVA	WGIVA	WGIVA	WGIVA	WGIVA
WGIPS													WGIPS	WGIPS	WGIPS							
WGIGE				WGIGE			WGIGE								WGIGE							
WGIRQ								WGIRQ		WGIRQ	WGIRQ						WGIRQ					
WGIRL																						
WGICC																						
EFIBiz																	EFIBiz					
EFITrade																						
EFIFisc																	BMca4EFscGvt					
EFIGovtS																EFIGovtS						
EFIMon																						
EFIInvest																						
EFIFin																	EFIFin					
EFIPropRi																						
EFICorrup															EFICorrup							

Source: Tables 4.28a-b calculated and arranged by the author

Table 4.28b: I. Correlation-Granger Causality Matrix and II. Multi Regression Matrix Brazil

I. Correlation / Granger Matrix	Variable No	40	41	42	43	50	52	53	54	57	58	60	64	65	68	69	71	74	75	76	77	78	79
		UnitValIxExp	UnitValIxImp	ToT	PPIxExp	ManufExp_MrchExp	StoxVal_GDP	FuelExp_MerchExp	MrktCapList_GDP	LivStockProdIX	CPIx	M2_GDP	ExtDebtST_ExpGSInc	ExtDebtST_GNI	STD_TTResv	TTRes_TTExtDbt	MultiDebt_TTExtD	GDP_UEnUPPPOilE	RuPp_ToTPp	Internet_100	Phonelines_100	Unempl_Lforce	MobileSubs_100
FoodIx	Pearson Correla	.983**	.949**	0.519	.659*	-.841**	.873**	.627*	0.279	0.284	.588*	.563*	-.699**	-.801**	-.761**	.907**	-0.056	.709**	-0.48	.729**	0.089	-0.55	.730**
	Granger1	0.0546	<0.0001		0.0003		**0.0262**	0.0004			0.0003	<0.0001	**0.0196**	0.198	0.0463	<0.0001		**0.0001**		0.0003			<0.0001
	Granger2	0.6693	0.068		0.1019		**0.0034**	0.5125			0.074	0.0538	**0.0035**	0.275	0.4086	0.8854		**0.0029**		0.1693			0.5966
TropBevIx	Pearson Correla	.762**	.616*	.886**	0.261	-0.502	.732**	0.124	0.102	-0.166	0.137	0.103	-0.327	-.821**	-0.448	.629*	-0.387	0.254	-0.002	0.3	-0.448	-.605*	0.287
	Granger1	**0.0029**	0.004	0.2431	0.0717		0.2257							0.001		0.0008							
	Granger2	**0.0013**	0.0916	0.0115	0.0136		0.9524							0.1328		0.3488							
VegOilSeedsIx	Pearson Correla	.928**	.880**	0.55	.624*	-.854**	.884**	.568*	0.294	0.259	.558*	0.524	-.604*	-.704**	-.741**	.886**	-0.107	.644*	-0.455	.693**	0.058	-0.4	.687**
	Granger1	0.007	0.0008		0.0069		0.0246	0.0002			0.0133		0.004	0.3836	**0.0018**	<0.0001		0.0006		0.0036			0.0039
	Granger2	0.6546	0.5276		0.0547		0.5765	0.3605			0.243		0.2541	0.4547	**0.0248**	0.0826		0.0822		0.3155			0.2318
AgriRawIx	Pearson Correla	.972**	.973**	0.405	.775**	-.858**	.886**	.712**	0.474	0.429	.706**	.645*	-.814**	-.836**	-.855**	.951**	0.094	.806**	-.593*	.826**	0.184	-0.456	.817**
	Granger1	0.6773	0.006		<0.0001		0.6087	<0.0001			**<0.0001**	**<0.0001**	0.0103	**0.0031**	0.0027	0.0441		<0.0001	<0.0001	<0.0001			<0.0001
	Granger2	0.0216	0.5112		0.2222		<0.0001	0.6811			**0.0374**	**0.0068**	0.106	**0.0008**	0.5518	0.3324		0.0704	0.0723	0.161			0.8554
MinMetalsIx	Pearson Correla	.912**	.951**	0.246	.899**	-.842**	.896**	.842**	.685**	.567*	.833**	.834**	-.871**	-.757**	-.879**	.948**	0.4	.914**	-.767**	.920**	0.394	-0.197	.920**
	Granger1	0.357	0.1435		**0.0004**		**0.0377**	0.0386	0.4704	<0.0001	0.001	0.1429	0.0011	0.8797	0.0797	0.2249		0.0051	**0.0148**	0.0013			0.001
	Granger2	0.0006	0.1817		**0.0226**		**<0.0001**	0.761	0.0865	0.4641	0.0859	0.0243	0.4021	0.1152	0.6565	<0.0001		0.1945	**0.0208**	0.1644			0.6289
CrudeIx	Pearson Correla	.882**	.962**	0.066	.935**	-.839**	.827**	.911**	.600*	.708**	.908**	.904**	-.898**	-.643*	-.851**	.887**	0.455	.959**	-.861**	.961**	.560*	-0.103	.976**
	Granger1	0.7746	0.899		0.0351		0.6548	0.4338	**0.0149**	0.3165	0.1093	0.2738	0.7675	0.3511	0.3271	0.5059		0.2647	0.1732	0.231	0.519		**0.0052**
	Granger2	0.0001	0.0557		0.3925		0.0035	0.1429	**0.0004**	0.3144	0.1194	0.0025	0.5753	0.0297	0.0212	<0.0001		0.9815	0.0002	0.982	0.4613		**0.0267**
WGIVA	Pearson Correla	0.53	.664*	-0.27	.906**	-.768**	0.486	.940**	.646*	.869**	.941**	.831**	-.870**	-0.345	-.876**	.642*	.710**	.898**	-.912**	.902**	.757**	0.177	.875**
	Granger1		0.9378		0.1819			**0.0006**	0.9732	0.015	0.0473	0.0878	0.3089		0.8067	0.8014	0.0317	0.0571	0.0113	0.1946	0.0115		0.1443
	Granger2		0.0147		0.0016			**0.0281**	0.0222	0.6135	0.6822	0.3506	0.0228		0.0174	0.01	0.4282	0.2744	0.8715	0.0159	0.0324		0.1432
WGIPS	Pearson Correla	-0.201	-0.034	-.743**	0.216	0.14	-0.139	0.29	0.177	0.466	0.327	0.45	-0.059	0.477	0.154	-0.172	0.525	0.215	-0.456	0.19	.703**	.725**	0.25
	Granger1																				0.9878	0.0026	
	Granger2																				0.0006	0.9942	
WGIGE	Pearson Correla	-0.128	0.032	-.687**	0.323	-0.057	-0.113	0.366	0.132	.593*	0.452	0.451	-0.174	0.444	-0.059	-0.112	0.46	0.29	-0.537	0.315	.735**	.664*	0.33
	Granger1									0.8939											0.4669	0.0424	
	Granger2									0.007											0.155	0.8042	
WGIRQ	Pearson Correla	-.645*	-.740**	0.038	-.935**	.677*	-.639*	-.846**	-.769**	-.779**	-.886**	-.842**	.900**	.598*	.849**	-.724**	-.702**	-.907**	.854**	-.902**	-.583*	-0.037	-.885**
	Granger1					0.9963							0.0004	0.9401	0.251		0.1884		0.0501				
	Granger2					0.0086							0.9663	0.0528	0.1241		0.3587		0.1291				
WGIRL	Pearson Correla	-0.327	-0.461	0.314	-.822**	0.468	-0.369	-.779**	-.697**	-.848**	-.828**	-.815**	.719**	0.258	.633*	-0.415	-.893**	-.766**	.858**	-.751**	-.749**	-0.477	-.756**
	Granger1												0.1033		0.6388		0.2629		0.0842				
	Granger2												0.3729		0.026		0.8728		0.192				
WGICC	Pearson Correla	-0.382	-0.351	-0.316	-0.216	0.296	-0.292	-0.218	-0.209	-0.039	-0.121	-0.063	0.391	.611*	0.379	-0.421	-0.035	-0.274	0.038	-0.211	0.169	.588*	-0.205
	Granger1													0.0935								0.8342	
	Granger2													0.8518								0.1784	
EFIBiz	Pearson Correla	-.774**	-.843**	-0.106	-.885**	.703**	-.731**	-.816**	-.686**	-.675*	-.830**	-.811**	.876**	.731**	.814**	-.790**	-.569*	-.879**	.776**	-.866**	-0.445	0.049	-.879**
	Granger1					0.7023							0.0013	0.8001	0.114		0.2885		0.0617				
	Granger2					0.0141							0.4579	0.1921	0.1393		0.2224		<0.0001				
EFITrade	Pearson Correla	.683*	.791**	-0.096	.952**	-.753**	.617*	.940**	.634*	.844**	.943**	.848**	-.963**	-.572*	-.907**	.746**	.631*	.960**	-.896**	.942**	.670*	-0.03	.923**
	Granger1	0.3916	0.9333		0.0457		0.6545	0.011	0.1374	0.0057	0.0016	0.0925	0.0992	0.2137	0.9627	0.9027	0.1002	0.0037	0.0101	0.0333	**0.0239**		0.0222
	Granger2	0.0096	0.2013		0.4262		0.0396	0.9593	0.0238	0.5168	0.8756	0.1548	0.5199	0.0313	<0.0001	0.0019	0.6034	0.1057	0.0625	0.3356	**0.0315**		0.7987
EFIFisc	Pearson Correla	-.879**	-.914**	-0.242	-.853**	.793**	-.869**	-.808**	-.656*	-0.502	-.786**	-.837**	.797**	.698**	.806**	-.904**	-0.416	-.870**	.740**	-.876**	-0.391	0.159	-.884**
	Granger1					0.6057							0.0066	0.2778	0.1173				0.0726				
	Granger2					0.0079							0.5208	0.3933	0.8113				0.0369				
EFIGovtS	Pearson Correla	-.776**	-.841**	-0.077	-.839**	.742**	-.799**	-.794**	-.669*	-.563*	-.812**	-.857**	.751**	0.525	.729**	-.803**	-0.435	-.839**	.783**	-.858**	-0.501	-0.039	-.870**
	Granger1					0.1374							0.0303		0.017				0.0429				
	Granger2					0.1892							0.7477		0.7242				0.4663				
EFIMon	Pearson Correla	-0.206	-0.084	-.606*	0.036	0.088	-0.087	0.162	0.043	0.246	0.133	0.335	0.169	.585*	0.297	-0.158	0.325	0.057	-0.282	0.037	0.538	.701**	0.126
	Granger1													0.7262								0.2104	
	Granger2													0.713								0.8805	
EFIInvest	Pearson Correla	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a
	Granger1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Granger2	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
EFIFin	Pearson Correla	-0.403	-0.435	-0.099	-.600*	0.429	-0.517	-0.546	-.829**	-0.319	-0.523	-0.542	.564*	0.486	.610*	-.594*	-.568*	-.581*	0.498	-.562*	-0.25	-0.028	-0.531
	Granger1												0.0411		0.2602		0.0572						
	Granger2												0.5379		0.8203		0.0001						
EFICorrup	Pearson Correla	-0.422	-0.274	-.750**	0.09	0.252	-0.371	0.149	-0.001	0.431	0.21	0.312	0.113	.663*	0.243	-0.426	.587*	0.041	-0.362	0.051	.661*	.854**	0.087
	Granger1													0.0372			**0.0066**				0.0804	0.2477	
	Granger2													0.377			**0.0343**				0.0031	0.0102	

Brazil&China FLAG	Brazil & China			Brazil & China		Brazil & China	Brazil & China	Brazil & China		Brazil & China		Brazil & China	Brazil & China		Brazil & China		Brazil & China	Brazil & China	Brazil & China	Brazil & China		Brazil & China
Variable No	40	41	42	43	50	52	53	54	57	58	60	64	65	68	69	71	74	75	76	77	78	79
II. Multiple Regr. Matrix / Dependents	UnitValIxExp	Unit ValIxImp	ToT	PPIxExp	ManufExp_MrchExp	StoxVal_GDP	FuelExp_MerchExp	MrktCapList_GDP	LivStockProdIX	CPIx	M2_GDP	ExtDebtST_ExpGSInc	ExtDebtST_GNI	STD_TTResv	TTRes_TTExtDbt	MultiDebt_TTExtD	GDP_UEnUPPPOilE	RuPp_ToTPp	Internet_100	Phonelines_100	Unempl_Lforce	MobileSubs_100
Independents																						
FoodIx						BMca2FdAg						FoodIx					FoodIx					
TropBevIx	BMca3BevAg		TropBevIx	TropBevIx																		
VegOilSeedsIx														VegOilSeedsIx								
AgriRawIx										AgriRawIx	AgriRawIx		AgriRawIx									
MinMetalsIx	BMca1MetOil			MinMetalsIx		BMca1MetOil					BMca1MetOil				BMca1MetOil			BMca1MetOil				
CrudeIx								CrudeIx					CrudeIx	CrudeIx								CrudeIx
WGIVA		WGIVA		WGIVA			WGIVA	WGIVA				WGIVA		WGIVA	WGIVA				WGIVA			
WGIPS																				WGIPS		
WGIGE									WGIGE													
WGIRQ					WGIRQ																	
WGIRL														WGIRL								
WGICC																						
EFIBiz					EFIBiz													EFIBiz				
EFITrade	EFITrade					EFITrade		EFITrade					EFITrade	EFITrade	EFITrade					EFITrade		
EFIFisc					EFIFisc													EFIFisc				
EFIGovtS																						
EFIMon																						
EFIInvest																						
EFIFin																EFIFin						
EFIPropRi																						
EFICorrup																EFICorrup				EFICorrup	EFICorrup	

Non-significant Multi Regression Dependent Variables

The multiple regression analysis for Brazil reveals that out of the 44 dependent variables that passed the statistical diagnostic tests, only 9 do not show significant multiple regression results. These 9 dependent variables are marked in red letters in the regression matrix in Tables 4.28a-b and are listed below:

(1) Variable 2: GDP_gr

(2) Variable 3: GDPpCap_gr

(3) Variable 27: ExpGS_GDP

(4) Variable 34: ManfImp_MrchImp

(5) Variable 50: ManufExp_MrchExp

(6) Variable 52: StoxVal_GDP

(7) Variable 54: MrktCapList_GDP

(8) Variable 68: STD_TTResv

(9) Variable 75: RuPp_ToTPp

For example, Table 4.28a-b I. (Correlation-Granger Causality Matrix) shows GDP_gr (Variable 2) displaying significant correlations of 69.7%, 64.3%, and 56.9% to FoodIx, AgriRawIx, and MinMetalsIx. Also, Granger causality tests suggest that GDP_gr is Granger caused by FoodIx (p-values: Granger 1 0.4079, Granger 2 0.0486), AgriRawIx (p-values: Granger 1 0.757, Granger 2 0.0003), and MinMetalsIx (p-values: Granger 1 0.2638, Granger 2 0.0161) displaying a Granger 1 p-value for each above 0.05. Granger 2 tests for the same independent variables display a p-value below 0.05. However, Table 4.28a-b (II. Multiple Regression Matrix Brazil) indicates that the multiple regression analysis does not reveal any significant conclusion regarding the relationship of GDP_gr (Variable 2) and its predictor variables MinMetalsIx and BgrMcaFoodAg (newly created PCA independent variable combining FoodIx and AgriRawIx). BgrMcaFoodAg and MinMetalsIx are marked in red letters to indicate that there are no positive regression results. The table below shows the typical regression result display in the matrix, here at the example of GDP_gr.

Table 4.29: Parameter Estimates for GDP_gr Brazil

Independent	Label	DF	Estimate	Standard Error	t-Value	Pr>|t|
Intercept	Intercept	2	2.42192	0.01059	4.74	0.0011
AgriRawIx	AgriRawIx		0.06426	2.04	0.0713	0.0713
MinMetalsIx	MinMetalsIx		0.02305	0.90	0.3938	0.3938

Source: Calculated and arranged by the author.

The regression calculus for GDP_gr (change rate variable) shows a low estimate for the change rates of AgriRawIx and MinMetalsIx, indicating that the contribution of each independent variable in the model is low. In contrast a large value would indicate that a unit change in the predictor variable has a large effect on the dependent variable. The t-value and Pr>|t| value (p-value) give an indication of the impact and the significance of each independent variable. A big absolute t-value and small Pr>|t| (below 0.05) suggest that an independent variable has a large impact on the dependent variable. As shown above, no independent variable has a strong and significant effect on GDP_gr because the p-values are all above 0.05, except for the intercept. Nonetheless, statistical non-significance does not imply empirical non-significance. Significant correlation and causality results on GDP_gr itself suggest strong empirical associations as I illustrate in Chapter 5.

Significant Multi Regression Dependent Variables

Table 4.30: Significant Multiple Regression Dependent Variables for Brazil

Dependent Variables	No.	Dependent Variables	No.	Dependent Variables	No.
GDPDefl	1	AgRawImp_MrchImp	33	**CPIx***	**58**
IndustValAd_GDP	6	**FuelImp_MerchImp***	**35**	M2_GDP	60
IndustValAd_gr	**7**	**ExpValx***	**36**	**ExtDebtST_ExpGSInc***	**64**
ManFactValAdd_gr	9	**ImpValIx***	**37**	ExtDebtST_GNI	65
GrossDomSav_GDP	12	**ExpVolx***	**38**	**TTRes_TTExtDbt***	**69**
GrossNatExp_GDP	13	**ImpVolIx***	**39**	MultiDebt_TTExtD	71
GovFinConExp_gr	15	**UnitValIxExp***	**40**	**GDP_UEnUPPPOilE***	**74**
FinConExp_GDP	16	UnitValIxImp	41	**Internet_100***	**76**
HHFinConExp_GDP*	**19**	ToT	42	**Phonelines_100***	**77**
GrossFixCapForm_GDP	23	**PPIxExp***	**43**	Unempl_Lforce	78
Trade_GDP*	**25**	**FuelExp_MerchExp***	**53**	**MobileSubs_100***	**79**
MrchTrade_GDP*	**26**	LivStockProdIx	57		

Source: Calculated and arranged by the author.

The 35 dependent variables in Table 4.30 above represent all dependent variables with significant regression analysis results for Brazil. There are 19 variables, displayed in bold letters in Table 4.30, that also show significant multiple regression results for China.

4.3.2.2 Multiple Regression Results Brazil

Table 4.31 below provides an overview of all significant multiple regression results for Brazil including the estimated values of each intercept and the respective independent variables that affect each specific dependent variable. Table 4.31 also displays the standard errors, t-values, and p-values for each of the 35 dependent variables that appear to have significant relationships with at least one of the 21 independent variables. These multiple regression results refer to a significance level of 0.05. The t-value is the estimated value divided by its standard error, which is an estimate of the standard deviation of the coefficient. The standard error is the amount the estimated value varies across cases. Standard error offers a measure of the precision of the multiple regression estimates.

For example, unit value index of exports (Variable 40: UnitValIxExp) has an intercept estimate value of 62.1 and a standard error of 29.3 which translates into a t-value of 2.12. That is, the multiple regression estimate is large (2.12x) compared with its standard error, so it is probably different from 0. The significance level measured by the p-value is slightly above the 0.05 threshold. Similarly, UnitValIxExp for Brazil appears to be significantly affected by BMca3BevAg (combining TropBevIx and AgriRawIx) and by BMca1MetOil (combining CrudeIx and MinMetalsIx) at a high confidence level (sig. 0.0002, and sig. 0.0029, respectively), with high t-values of 6.14 and 4.05. Furthermore, the adjusted R^2 is impressively high at 0.9651, indicating a strong goodness of fit to the model and fairly low dispersion around the linear model line.

The dependent variables and the respective regression results including adjusted R^2, estimate values (Estimate), standard errors (St. Err.), t-value (t-Val), p-value (Pr>|t|), and degree of freedom (DF) marked in green in the Table 4.31 indicate that the identical dependent variable for Brazil also yields multiple regression results for China.

Table 4.31 gives an overview; it does not discuss the multiple regression results. The economic analysis and discussion of the correlation, causality, and multiple regression results of selected dependent variables is carried out in Chapter 5. Chapter 5 also features comparative correlation, causality and regression analyses for identical dependent variables for Brazil and China, supported by empirical evidence.

Table 4.31 shows significant regression results below the p-value threshold of 0.05 only. Therefore the number of DFs (Degree of Freedom) may differ from the number of independent variables displayed. Regression non-significant independent variables are not shown in Table 4.31. For information purposes, the Multi-Regression Matrix of Brazil above in Table 4.28 shows all independent variables, be they significant or not significant.

Table 4.31: Multiple Regression Results Brazil

Nr. / Dependent Variable	Independent	DF	Estimate	St. Err.	t-Val	Pr>|t|
1. GDPDefl	Intercept	1	10.97512	34.3335	0.32	0.7552
Adjusted R^2: 0.4799	AgriRawIx		0.92872	0.26727	3.47	0.0052
6. IndustValAd_GDP	Intercept	1	27.4237	0.32711	83.84	<0.0001
Adjusted R^2: 0.2730	WGIGE		6.52444	2.78071	2.35	0.0387
7. IndustValAd_gr	Intercept	2	1.76534	0.78645	2.24	0.0486
Adjusted R^2: 0.2910	AgriRawIx		0.16294	0.06939	2.35	0.0408
9. ManFactValAdd_gr	Intercept	1	1.39367	0.89006	1.57	0.1485
Adjusted R^2: 0.2854	AgriRawIx		0.18239	0.07853	2.32	0.0426
12. GrossDomSav_GDP	Intercept	1	17.64167	0.49108	35.92	<0.0001
Adjusted R^2: 0.2657	WGIGE		9.64856	4.17457	2.31	0.0412
13. GrossNatExp_GDP	Intercept	1	97.3890	0.88437	110.12	<0.0001
Adjusted R^2: 0.3931	WGIRQ		10.34665	3.49298	2.96	0.0129
15. GovFinConExp_gr	Intercept	1	2.39553	0.36061	6.64	<0.0001
Adjusted R^2: 0.5334	VegOilSeedsIx		0.05836	0.01584	3.68	0.0042
16. FinConExp_GDP	Intercept	1	80.3169	0.67117	119.67	<0.0001
Adjusted R^2: 0.5466	WGIRQ		10.4254	2.65094	3.93	0.0023
19. HHFinConExp_GDP	Intercept	1	60.6214	0.58274	104.03	<0.0001
Adjusted R^2: 0.5840	WGIRQ		9.72341	2.30165	4.22	0.0014
23.GrossFixCapForm_GDP	Intercept	1	14.7016	0.70821	20.76	<0.0001
Adjusted R^2: 0.3649	BMca2FdAg		0.01066	0.00379	2.81	0.0170
25. Trade_GDP	Intercept	1	25.5441	1.36854	18.67	<0.0001
Adjusted R^2: 0.3649	WGIPS		16.2497	5.78328	2.81	0.0170
26. MrchTrade_GDP	Intercept	1	21.2115	1.17252	18.09	<0.0001
Adjusted R^2: 0.3299	WGIPS		13.0228	4.95491	2.63	0.0235
33. AgRawImp_MrchImp	Intercept	1	-0.26961	0.87167	-0.31	0.7629
Adjusted R^2: 0.2891	EFIGovtS		0.03019	0.01245	2.43	0.0337
35. FuelImp_MerchImp	Intercept	1	8.51882	1.40588	6.06	<0.0001
Adjusted R^2: 0.6830	WGIVA		21.0123	4.05501	5.18	0.0003
36. ExpValx	Intercept	1	-16.9339	40.2147	-0.42	0.6818
Adjusted R^2: 0.6455	WGIVA		554.517	115.991	4.78	0.0006
37. ImpValIx	Intercept	2	52.9087	15.6127	3.39	0.0069
Adjusted R^2: 0.9022	BMca1MetOil		0.59613	0.07318	8.15	<0.0001
	WGIVA		-137.942	69.4435	-1.99	0.0751
38. ExpVolx	Intercept	3	88.0242	30.5481	2.88	0.0181
Adjusted R^2: 0.9197	AgriRawIx		-0.63431	0.33216	-1.91	0.0885
	BMca1MetOil		0.30272	0.09726	3.11	0.0125
	WGIVA		186.986	46.4208	4.03	0.0030
39. ImpVolIx	Intercept	3	69.4808	22.3424	3.11	0.0125
Adjusted R^2: 0.8806	BMca1MetOil		0.22410	0.07113	3.15	0.0117
40. UnitValIxExp	Intercept	3	62.11105	29.3025	2.12	0.0631
Adjusted R^2: 0.9651	BMca3BevAg		0.36438	0.05933	6.14	0.0002
	BMca1MetOil		0.13112	0.03235	4.05	0.0029
41. UnitValIxImp	Intercept	1	76.54313	13.2397	5.78	0.0001
Adjusted R^2: 0.3905	WGIVA		112.5595	38.1874	2.95	0.0133
42. ToT	Intercept	1	38.18749	3.46626	23.90	<0.0001
Adjusted R^2: 0.7645	TropBevIx		0.16980	0.02686	6.32	<0.0001
43. PPIxExp	Intercept	3	56.50018	20.8194	2.71	0.0238
Adjusted R^2: 0.9362	MinMetalsIx		0.33709	0.07934	4.25	0.0021
	WGIVA		159.36138	45.4372	3.51	0.0066
53. FuelExp_MerchExp	Intercept	1	-2.85967	0.82979	-3.45	0.0055
Adjusted R^2: 0.8729	WGIVA		21.86121	2.39337	9.13	<0.0001
57. LivStockProdIx	Intercept	1	108.49841	3.57750	30.33	<0.0001
Adjusted R^2: 0.2924	WGIGE		74.23133	30.4113	2.44	0.0328
58. CPIx	Intercept	1	18.68374	19.3163	0.97	0.3542
Adjusted R^2: 0.4529	AgriRawIx		0.49724	0.15037	3.31	0.0070
60. M2_GDP	Intercept	2	55.75252	4.39282	12.69	<0.0001
Adjusted R^2: 0.9271	AgriRawIx		-0.27855	0.05296	-5.26	0.0004
	BMca1MetOil		0.11779	0.05296	9.28	<0.0001
64. ExtDebtST_ExpGSInc	Intercept	2	561.87833	47.7221	11.77	<0.0001
Adjusted R^2: 0.8221	FoodIx		-1.00240	0.39507	-2.54	0.0295
	WGIVA		-552.1464	111.562	-4.95	0.0006
65. ExtDebtST_GNI	Intercept	3	107.54336	35.7335	3.01	0.0147
Adjusted R^2: 0.6910	AgriRawIx		-0.50672	0.13661	-3.71	0.0049
69. TTRes_TTExtDbt	Intercept	3	27.28311	59.4909	0.46	0.6574
Adjusted R^2: 0.8318	BMca1MetOil		0.18978	0.04051	4.69	0.0011
71. MultiDebt_TTExtD	Intercept	2	13.38581	3.76011	3.56	0.0052
Adjusted R^2: 0.7557	EFIFin		-0.33064	0.07017	-4.71	0.0008
	EFICorrup		0.29450	0.06103	4.83	0.0007
74. GDP_UEnUPPPOilE	Intercept	1	5.08494	0.54056	9.41	<0.0001
Adjusted R^2: 0.4572	FoodIx		0.01327	0.00398	3.33	0.0067
76. Internet_100	Intercept	1	-14.92810	4.37635	-3.41	0.0058
Adjusted R^2: 0.7957	WGIVA		87.22483	12.6227	6.91	<0.0001
77. Phonelines_100	Intercept	3	-28.17987	10.3396	-2.73	0.0234
Adjusted R^2: 0.8732	EFITrade		0.46651	0.07638	6.11	0.0002
	EFICorrup		0.49176	0.21304	2.31	0.0464
78. Unempl_Lforce	Intercept	1	2.55921	1.15230	2.22	0.0483
Adjusted R^2: 0.7050	EFICorrup		0.17048	0.03130	5.45	0.0002
79. MobileSubs_100	Intercept	1	-8.78313	2.95785	-2.97	0.0128
Adjusted R^2: 0.9483	CrudeIx		0.27233	0.01831	14.87	<0.0001

Source: Calculated and arranged by the author.

4.3.3 Multiple Regression Analysis China

4.3.3.1 Multiple Regression Matrix China

The statistical diagnostic tests for China revealed that out of the 79 selected dependent variables 49 showed significant correlation and Granger causality results to at least one independent variable from the commodity price or governance index sets. Therefore, similarly to the diagnostic test section for Brazil, these 49 macroeconomic variables will be included in the multiple regression analysis for China. The diagnostic tests also reveal that the following governance indexes do not have any effect on any of the dependent variables. Thus, these variables are not subject of the multiple regression analysis:

1. WGIRL
2. EFIFisc

(In comparison, recall that four governance indexes were redundant for Brazil: EFIPropRi, EFIInvest, EFIMon, and WGICC.)

Tables 4.32a-b[79] (I. Correlation-Granger Causality Matrix and II. Multi Regression Matrix China) display the results of the correlation tests and Granger causality tests for all 79 dependent variables for China; it is similar to Brazil's Tables 4.28a-b (I. Correlation-Granger Causality Matrix and II. Multi Regression Matrix). Significant positive correlation results between the dependent and independent variables are marked in green, as are the dependent variables Granger caused by independent variables. When macroeconomic variables Granger cause the independent variables, the table shows them with yellow shading.

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[79] Tables 4.32a-b represent key matrixes in this thesis for China combining correlation analysis, Granger causality analysis and PCA analysis. Tables 4.32a-b have been calculated and arranged by the author.

Table 4.32a: I. Correlation-Granger Causality Matrix and II. Multi Regression Matrix China

I. Correlation / Granger Matrix	Variable No	2	3	4	7	10	11	13	14	16	19	25	26	27	29	30	31	35	36	37	38	39	40	43	45	46
		GDP_gr	GDPpCap_gr	Agri_GDP	IndustValAd_gr	GrossSav_GDP	GrossSav_GNI	GrossNatExp_GDP	GovFinConExp_GDP	FinConExp_GDP	HHFinConExp_GDP	Trade_GDP	MrchTrade_GDP	ExpGS_GDP	ExtBalGS_GDP	CurrACC_GDP	ImpGS_GDP	FuelImp_MerchImp	ExpValX	ImpValIx	ExpVolX	ImpVolIx	UnitValIxExp	PPIxExp	HiTekExp_ManuExp	ICTExp_TTExp
FoodIx	Pearson Correl	0.453	0.492	-0.3910	0.35	.707**	.708**	-.757**	-.874**	-.727**	-.656*	0.4330	0.4300	0.5070	.757**	.738**	0.3290	.761**	.800**	.767**	.763**	.644*	.880**	.703**	0.3220	0.2570
	Granger1					**0.0310**	**0.0396**								0.0833	0.0064		0.0107	<0.0001	**<0.0001**	<0.0001	**<0.0001**	**0.0187**	<0.0001		
	Granger2					**0.0305**	**0.0382**								0.0731	0.4952		0.4571	0.1004	**0.0208**	0.0673	**0.0036**	**<0.0001**	0.0985		
TropBevIx	Pearson Correl	0.525	0.521	0.0840	0.539	0.4480	0.4570	-.670*	-.827**	-0.5020	-0.3980	0.0460	0.0400	0.1490	.670*	0.5480	-0.0840	0.3510	0.4020	0.3430	0.3600	0.2050	.935**	0.2970	-0.1330	-0.1950
	Granger1														0.2802								0.0039			
	Granger2														0.7582								0.4098			
VegOilSeedsIx	Pearson Correl	.590*	.602*	-0.3580	.588*	.662*	.664*	-.719**	-.875**	-.682*	-.601*	0.3830	0.3790	0.4570	.719**	.700**	0.2820	.647*	.762**	.728**	.724**	.613*	.848**	.671*	0.3080	0.2410
	Granger1	0.0272	0.0243		0.0956	0.0141	0.0162								0.0060	0.0013		0.0015	0.0007	0.0023	**0.0010**	**0.0064**	0.6984	**0.0018**		
	Granger2	0.1281	0.1050		0.4863	0.0675	0.0696								0.8845	0.7377		0.0838	0.0794	0.2491	**0.0340**	**0.0022**	0.0019	**0.0026**		
AgriRawIx	Pearson Correl	.610*	.648*	-0.5010	.635*	.830**	.830**	-.809**	-.926**	-.843**	-.782**	.598*	.596*	.663*	.809**	.825**	0.5030	.810**	.879**	.857**	.854**	.765**	.822**	.811**	0.4710	0.4100
	Granger1	0.192	0.1447		<0.0001	0.0050	0.0079					**0.0007**	**0.0008**	**0.0002**	0.1833	0.0050		0.0280	<0.0001	**<0.0001**	<0.0001	**<0.0001**	**<0.0001**	<0.0001		
	Granger2	0.2426	0.2651		0.0264	0.0757	0.0938					**0.0002**	**<0.0001**	**0.0073**	0.0041	0.1438		0.1351	0.1870	**0.0141**	0.1144	**0.0005**	**<0.0001**	0.1048		
MinMetalsIx	Pearson Correl	.651*	.662*	-.711**	.629*	.886**	.882**	-.925**	-.815**	-.884**	-.858**	.737**	.735**	.806**	.925**	.949**	.635*	.894**	.962**	.941**	.953**	.882**	.632*	.929**	.641*	.587*
	Granger1	0.8333	0.7473		0.6061	<0.0001	<0.0001					**<0.0001**	**<0.0001**	**<0.0001**	0.7980	0.1027	**0.0003**	0.2659	**0.0018**	**0.0008**	**0.0012**	**0.0016**	0.1626	**0.0020**	**0.0015**	**0.0019**
	Granger2	0.0007	0.0015		0.0112	0.1050	0.1407					**<0.0001**	**<0.0001**	**<0.0001**	0.0281	0.3612	**0.0034**	0.0364	**0.0155**	**0.0423**	**0.0049**	**0.0143**	<0.0001	**0.0355**	**<0.0001**	**<0.0001**
CrudeIx	Pearson Correl	0.146	0.174	-.810**	0.119	.869**	.861**	-.830**	-.711**	-.850**	-.842**	.794**	.792**	.841**	.830**	.900**	.718**	.963**	.986**	.980**	.978**	.932**	0.5370	.956**	.745**	.694**
	Granger1					0.5430	0.5453					0.4343	0.4500	0.3931	0.9130	0.7915	0.4839	**0.0480**	<0.0001	0.0002	<0.0001	**0.0247**		0.0018	0.1995	0.2642
	Granger2					0.7318	0.6604					0.0010	0.0010	0.0027	0.0189	0.0207	0.0094	**<0.0001**	0.9461	0.0770	0.6273	**0.0951**		0.6723	<0.0001	<0.0001
WGIVA	Pearson Correl	0.352	0.376	0.4200	0.199	-.735**	-.739**	.627*	.710**	.750**	.723**	-0.5410	-0.5420	-.583*	-.627*	-.660*	-0.4770	-0.5130	-.666*	-.654*	-.664*	-.628*	-0.5050	-.655*	-0.4230	-0.4050
	Granger1							0.3451	0.6177	0.1199	0.0441															
	Granger2							0.1658	0.0002	0.8012	0.8295															
WGIPS	Pearson Correl	0.169	0.186	0.5270	0.314	-.799**	-.798**	.648*	.687**	.804**	.793**	-.679*	-.683*	-.709**	-.648*	-.712**	-.626*	-.638*	-.699**	-.699**	-.707**	-.689**	-0.4350	-.702**	-0.5320	-0.5150
	Granger1							0.2330	0.6291	0.0017	0.0001															
	Granger2							0.0491	0.0020	0.8763	0.4947															
WGIGE	Pearson Correl	0.548	0.559	-0.5060	0.527	.584*	.579*	-0.5230	-.579*	-.572*	-0.5430	0.5190	0.5210	0.5470	0.5230	.574*	0.4740	.646*	.706**	.697**	.698**	.660*	0.4470	.679*	0.4430	0.4150
	Granger1					0.0611	0.0697									0.0184		0.0099	0.0024	0.0035	0.0018	0.0061		0.0029		
	Granger2					0.5592	0.5396									0.3918		0.2994	0.5838	0.6279	0.3249	0.2887		0.4003		
WGIRQ	Pearson Correl	-0.335	-0.348	0.4690	-0.309	0.1510	0.1630	-0.1340	-.615*	-0.2130	-0.1040	-0.1530	-0.1500	-0.1140	0.1340	0.0570	-0.1970	-0.0330	0.0040	-0.0240	-0.0270	-0.1210	.717**	-0.0780	-0.3890	-0.4190
	Granger1																						0.6360			
	Granger2																						0.7984			
WGIRL	Pearson Correl	-0.086	-0.132	.657*	0.072	-0.3110	-0.3010	0.3760	-0.1180	0.2710	0.3520	-0.5170	-0.5160	-0.5210	-0.3760	-0.4310	-0.5000	-0.3760	-0.3580	-0.3700	-0.3980	-0.4520	0.3740	-0.4420	-.580*	-.587*
	Granger1			0.8599																						
down	Granger2			0.5328																						
WGICC	Pearson Correl	-0.142	-0.141	.792**	-0.21	-.769**	-.763**	0.5010	0.3230	.730**	.793**	-.897**	-.895**	-.879**	-0.5010	-.661*	-.899**	-.586*	-.682*	-.725**	-.719**	-.816**	0.0690	-.771**	-.900**	-.898**
	Granger1			0.1329						0.8965	0.9308															
	Granger2			0.0149						0.0001	0.0001															
EFIBiz	Pearson Correl	0.148	0.143	.592*	0.131	-.764**	-.761**	.678*	0.4540	.760**	.797**	-.731**	-.731**	-.760**	-.678*	-.738**	-.678*	-.589*	-.625*	-.633*	-.650*	-.660*	-0.1840	-.666*	-.634*	-.617*
	Granger1			0.3609				0.7254		0.1298	0.0850															
	Granger2			0.3182				0.0200		0.8855	0.8253															
EFITrade	Pearson Correl	-0.207	-0.231	-.968**	-0.218	.832**	.822**	-.733**	-0.4330	-.791**	-.839**	.911**	.909**	.929**	.733**	.852**	.868**	.875**	.914**	.931**	.933**	.958**	0.1350	.951**	.932**	.904**
	Granger1					0.4059	0.4054					0.0103	0.0123	0.0427	0.5095	0.7941	0.0061	0.7118	0.5565	0.2291	0.4770	0.0417		0.2902	0.0067	0.0221
	Granger2					0.1579	0.1500					0.9239	0.8846	0.7568	0.2613	0.2458	0.9922	0.0134	0.0488	0.0952	0.0378	0.0957		0.0648	0.1020	0.1250
EFIFisc	Pearson Correl	-0.119	-0.099	.579*	-0.152	-0.4400	-0.4360	0.2370	0.0660	0.4030	0.4650	-.595*	-.596*	-.568*	-0.2370	-0.3600	-.616*	-0.2100	-0.3540	-0.3850	-0.3990	-0.5090	0.3440	-0.4680	-.622*	-.660*
	Granger1			0.1291																						
	Granger2			0.2007																						
EFIGovtS	Pearson Correl	0.488	0.468	.814**	0.467	-.674*	-.668*	0.3250	0.1810	.630*	.708**	-.861**	-.861**	-.819**	-0.3250	-0.5200	-.895**	-0.5420	-.617*	-.673*	-.655*	-.772**	0.2170	-.705**	-.920**	-.929**
	Granger1			0.1827						0.6703	0.7608															
	Granger2			0.0640						0.0135	0.0283															
EFIMon	Pearson Correl	-0.551	-.591*	-0.3920	-0.494	-0.2600	-0.2730	0.3670	.709**	0.3300	0.2220	0.1350	0.1350	0.0610	-0.3670	-0.2420	0.2250	-0.0570	-0.1130	-0.0640	-0.0770	0.0550	-.823**	-0.0190	0.3710	0.4060
	Granger1								0.0014																	
	Granger2								0.0757																	
EFIInvest	Pearson Correl	0.231	0.231	.867**	0.202	-0.4440	-0.4270	0.2370	-0.0630	0.3690	0.4560	-.743**	-.745**	-.699**	-0.2370	-0.4110	-.781**	-.657*	-.576*	-.623*	-.608*	-.710**	0.3110	-.651*	-.838**	-.848**
	Granger1			0.2182																						
	Granger2			0.8988																						
EFIFin	Pearson Correl	0.231	0.231	.867**	0.202	-0.4440	-0.4270	0.2370	-0.0630	0.3690	0.4560	-.743**	-.745**	-.699**	-0.2370	-0.4110	-.781**	-.657*	-.576*	-.623*	-.608*	-.710**	0.3110	-.651*	-.838**	-.848**
	Granger1			0.2182																						
	Granger2			0.8988																						
EFIPropRi	Pearson Correl	-0.447	-0.442	.666*	-0.382	-.778**	-.775**	.895**	.721**	.781**	.757**	-.627*	-.624*	-.702**	-.895**	-.888**	-0.5180	-.814**	-.886**	-.855**	-.877**	-.793**	-.566*	-.851**	-0.5500	-0.5010
	Granger1			0.1340				0.0047	0.3827	0.0024	**0.0008**															
	Granger2			0.6497				0.8885	0.0974	0.1560	**0.0360**															
EFICorrup	Pearson Correl	-0.424	-0.449	-.752**	-0.395	0.2350	0.2200	-0.1410	0.2120	-0.1670	-0.2510	0.5100	0.5070	0.4760	0.1410	0.2810	0.5400	0.4420	0.4240	0.4590	0.4470	0.5250	-0.4040	0.4800	.699**	.701**
	Granger1																								0.9959	0.9342
	Granger2																								0.0346	0.0329

Brazil&China FLAG		Brazil & China					Brazil & China		Brazil & China	Brazil & China	Brazil & China	Brazil & China	Brazil & China				Brazil & China	Brazil & China	Brazil & China	Brazil & China	Brazil & China	Brazil & China	Brazil & China		
Variable No	2	3	4	7	10	11	13	14	16	19	25	26	27	29	30	31	35	36	37	38	39	40	43	45	46
II. Multiple Regr. Matrix Dependents	GDP_gr	GDPpCap_gr	Agri_GDP	IndustValAd_gr	GrossSav_GDP	GrossSav_GNI	GrossNatExp_GDP	GovFinConExp_GDP	FinConExp_GDP	HHFinConExp_GDP	Trade_GDP	MrchTrade_GDP	ExpGS_GDP	ExtBalGS_GDP	CurrACC_GDP	ImpGS_GDP	FuelImp_MerchImp	ExpValx	ImpValIx	ExpVolx	ImpVolIx	UnitValIxExp	PPIxExp	HiTekExp_ManuExp	ICTExp_TTExp
Independents																									
FoodIx					FoodIx	FoodIx													CMca2FdAg		CMca3FdVegAg	CMca3FdVegAg			
TropBevIx																									
VegOilSeedsIx																				VegOilSeedsIx			VegOilSeedsIx		
AgriRawIx				AgriRawIx							AgriRawIx	AgriRawIx	AgriRawIx	AgriRawIx											
MinMetalsIx	MinMetalsIx	MinMetalsIx									CMca1MetOil	CMca1MetOil	CMca1MetOil	CMca1MetOil		CMca1MetOil	CMca1MetOil	MinMetalsIx	MinMetalsIx	MinMetalsIx	MinMetalsIx	MinMetalsIx	MinMetalsIx	CMca1MetOil	CMca1MetOil
CrudeIx															CrudeIx										
WGIVA								CMca4WVaPs																	
WGIPS							WGIPS																		
WGIGE																									
WGIRQ																									
WGIRL																									
WGICC			WGICC						WGICC	WGICC															
EFIBiz							EFIBiz																		
EFITrade																	EFITrade	EFITrade		EFITrade					
EFIFisc																									
EFIGovtS									EFIGovtS	EFIGovtS															
EFIMon																									
EFIInvest																									
EFIFin																									
EFIPropRi										EFIPropRi															
EFICorrup																								EFICorrup	EFICorrup

Source: Tables 4.32a-b calculated and arranged by the author.

Table 4.32b: I. Correlation-Granger Causality Matrix and II. Multi Regression Matrix China

I. Correlation / Granger Matrix	Variable No	47	48	49	51	52	53	54	58	59	61	62	63	64	65	67	69	70	72	73	74	75	76	77	79
		ICTImp_TTImp	AgrRwExp_MerchExp	FoodExp_MrchExp	FDInet_GDP	StoxVal_GDP	FuelExp_MerchExp	MrktCapList_GDP	CPIx	Infltn	M2_gr	IRSSpread	RealIR	ExtDebtST_ExpGSInc	ExtDebtST_GNI	STD_TTExtDbt	TTRes_TTExtDbt	M2_TTReserv	EnrgyImp_Euse	GDP_UEnUKPPPOilE	GDP_UEnUPPPOilE	RuPp_ToTPp	Internet_100	Phonelines_100	MobileSubs_100
FoodIx	Pearson Correl	-0.0220	-0.3560	-0.4320	0.0980	.608*	-0.2800	0.4080	.893**	.681*	0.229	-0.3130	-.611*	-0.5340	-.654*	0.4920	.801**	-.677*	.647*	0.2910	0.5140	-0.5360	.805**	0.4200	.675*
	Granger1					0.0002			<0.0001	0.7371			0.0116		<0.0001		<0.0001	0.0158	0.0007				<0.0001		**<0.0001**
	Granger2					0.0861			0.5155	0.1564			0.7917		0.1781		0.9867	0.0966	0.5781				0.3590		**0.0018**
TropBevIx	Pearson Correl	-0.4280	0.0970	0.0070	.556*	0.4120	0.0040	0.2010	.564*	0.4580	.701*	-.570*	-0.0560	-0.0830	-0.1730	0.0690	0.3910	-0.3550	0.2730	-0.2290	0.0020	-0.0600	0.3530	-0.0280	0.2080
	Granger1				0.9910				0.0614		0.776	0.7067													
	Granger2				0.4143				0.3841		0.0369	0.1978													
VegOilSeedsIx	Pearson Correl	-0.0240	-0.3610	-0.4150	0.1440	.667*	-0.3540	0.4320	.869**	.604*	0.303	-0.4130	-.567*	-0.4970	-.648*	0.4360	.778**	-.657*	.623*	0.2760	0.4860	-0.5090	.785**	0.3820	.639*
	Granger1					0.0359			0.0031	0.6959			0.1579		0.0621		0.0036	**0.0223**	0.0573				0.0010		**0.0037**
	Granger2					0.8403			0.7790	0.2759			0.8270		0.1368		0.7080	**0.0088**	0.2097				0.9664		**0.0018**
AgriRawIx	Pearson Correl	0.1160	-0.4720	-.554*	0.0110	.686**	-0.4090	0.5340	.930**	.714**	0.22	-0.2260	-.720**	-.660*	-.699**	.620*	.875**	-.801**	.756**	0.3430	.589*	-.645*	.862**	.563*	.774**
	Granger1					0.1671			0.0018	0.0619			0.1031	<0.0001	<0.0001	0.0008	<0.0001	0.0020	0.0015		<0.0001	**<0.0001**	<0.0001	**<0.0001**	**<0.0001**
	Granger2					0.0556			0.1393	0.0099			0.8906	0.6897	0.1786	0.1390	0.8031	0.1524	0.4914		0.0808	**0.0042**	0.6809	**<0.0001**	**0.0006**
MinMetalsIx	Pearson Correl	0.3880	-.655*	-.742**	-0.1780	.787**	-.653*	.752**	.951**	0.4850	0.317	0.0740	-.710**	-.799**	-.792**	.717**	.938**	-.850**	.891**	.559*	.768**	-.806**	.917**	.735**	.883**
	Granger1					0.0618		0.1487	0.1441				0.1311	0.0102	0.2814	0.0056	0.0012	0.0006	0.0903	0.3751	0.1716	**0.0131**	**0.0466**	**0.0011**	0.0039
	Granger2					<0.0001		0.0005	0.0292				0.1818	0.9769	0.0186	0.4505	0.7334	0.4497	0.4443	0.0381	0.0035	**0.0011**	**0.0071**	**<0.0001**	0.2789
CrudeIx	Pearson Correl	0.5020	-.756**	-.834**	-0.3470	.694**	-.668*	.643*	.967**	0.4470	-0.262	0.1640	-.814**	-.886**	-.897**	.771**	.981**	-.865**	.926**	.689**	.865**	-.891**	.974**	.815**	.947**
	Granger1					0.2751		0.3145	0.1175				0.4263	0.4366	0.3115	0.5053	<0.0001	0.2161	0.1241	0.4451	0.2706	0.1285	0.0011	0.2477	0.0505
	Granger2					0.0035		0.0016	0.0336				0.0588	0.9065	0.0415	0.7781	0.9937	0.6140	0.2735	0.0687	0.0021	0.0136	0.1836	<0.0001	0.6047
WGIVA	Pearson Correl	-0.1460	0.3910	0.3940	-0.0920	-0.5160	0.3040	-0.5160	-.621*	-.668*	0.152	0.2240	0.5380	0.5110	0.4110	-.709**	-.648*	.724**	-0.4530	-0.2800	-0.4730	0.5140	-.649*	-0.5080	-.636*
	Granger1									0.7456						0.0026		0.0442							
	Granger2									0.0086						0.1585		0.7330							
WGIPS	Pearson Correl	-0.2880	0.4550	0.5100	0.1460	-0.4490	0.3930	-0.5180	-.617*	-0.5510	0.16	-0.0200	.564*	.636*	0.4880	-.683*	-.673*	.728**	-.609*	-0.2870	-0.4930	.583*	-.642*	-.606*	-.669*
	Granger1												0.0430	0.0031		0.0016		0.0004				0.0034			
	Granger2												0.2580	0.8454		0.7116		0.5045				0.1464			
WGIGE	Pearson Correl	0.2140	-0.4190	-0.4770	-0.1160	.736**	-0.3130	.673*	.666*	.702**	-0.341	0.0580	-.723**	-.586*	-.605*	.602*	.685**	-.609*	.588*	0.4670	.601*	-.579*	.724**	0.5190	.672*
	Granger1					0.4388		0.0293	0.0593	0.0949			0.3948	0.0089	0.0049	0.0746	**0.0072**	0.1253	0.0051		0.0014	0.0021	0.0044		0.0033
	Granger2					0.4803		0.7722	0.0029	0.0012			0.6221	0.8905	0.4010	0.8295	**0.0164**	0.2431	0.6711		0.8372	0.9827	0.5034		0.7716
WGIRQ	Pearson Correl	-.696**	0.4810	0.3960	.683*	0.1300	0.4670	-0.0810	0.1210	.790**	-0.298	-.639*	-0.0660	0.2360	0.2320	-0.1330	-0.0120	-0.0660	-0.1030	-.633*	-0.4140	0.3180	-0.0440	-0.3090	-0.1490
	Granger1				0.2727					0.1893		0.7408													
	Granger2				0.0105					0.0604		0.1164													
WGIRL	Pearson Correl	-.769**	.603*	.625*	.641*	-0.2710	.726**	-0.5520	-0.2030	0.5190	0.411	-.728**	0.1340	0.5270	0.4020	-0.3370	-0.3220	0.2770	-0.5260	-.589*	-0.5420	0.5450	-0.2860	-.571*	-0.4200
	Granger1		0.6279	0.5392	0.6325		0.4223					0.8073													
down	Granger2		0.9827	0.2637	0.5182		0.5765					0.2217													
WGICC	Pearson Correl	-.785**	.857**	.839**	0.4710	-0.3170	.720**	-0.4490	-.562*	-0.1220	-0.288	-0.3090	.684**	.814**	0.5450	-.883**	-.691**	.833**	-.664*	-.623*	-.727**	.821**	-.641*	-.898**	-.789**
	Granger1		0.0184	0.0864			0.8992						0.0329	0.0957		0.0946		0.6165				0.1376			
	Granger2		0.9106	0.3567			0.0426						0.3311	0.1344		0.5284		0.3721				0.6082			
EFIBiz	Pearson Correl	-0.5120	.575*	.626*	0.1930	-0.2510	.562*	-0.3940	-0.5370	-0.1160	0.193	-0.2100	0.4020	.640*	0.4120	-.660*	-.599*	.697**	-.602*	-0.3520	-0.5150	.624*	-0.5190	-.690**	-.630*
	Granger1		0.1076	0.0881			0.4184							0.0918		0.0867		0.0240				0.1458			
	Granger2		0.9893	0.9598			0.0992							0.9156		0.8139		0.6406				0.0250			
EFITrade	Pearson Correl	.823**	-.939**	-.976**	-.590*	.575*	-.860**	.668*	.815**	0.1140	-0.185	0.4450	-.756**	-.959**	-.859**	.860**	.910**	-.856**	.912**	.853**	.954**	-.983**	.890**	.962**	.960**
	Granger1	0.5035				0.8209		0.6498	0.5366				**0.0185**	0.0631	0.8511	0.3092	0.2810	0.1463	0.1093	0.6577	0.9583	0.0153	0.5125	0.0038	0.1147
	Granger2	0.0467				0.0625		0.0170	0.6096				**0.0036**	0.0557	0.0189	0.2355	0.9935	0.2177	0.0352	0.1254	0.0119	0.1222	0.8521	0.1630	0.0162
EFIFisc	Pearson Correl	-.660*	.588*	0.5260	0.4640	-0.3020	.586*	-.553*	-0.1560	0.0480	-0.293	-0.3360	0.3340	0.5350	0.3010	-.622*	-0.3440	0.4870	-0.3680	-0.4830	-0.4880	0.5240	-0.3380	-.601*	-0.4780
	Granger1		0.1482				0.7466									0.1729									
	Granger2		0.4586				0.8506									0.5468									
EFIGovtS	Pearson Correl	-.866**	.854**	.851**	.758**	-0.1410	.797**	-0.3060	-0.4670	0.0220	0.062	-0.5180	.649*	.796**	.570*	-.801**	-.640*	.731**	-.702**	-.660*	-.721**	.816**	-.602*	-.880**	-.752**
	Granger1		0.0040	0.2365	0.3814		0.7664						0.5025	0.3329	0.2880	0.4103		0.8170				0.2767			
	Granger2		0.6655	0.0332	0.5625		0.3894						0.0302	0.0009	0.3737	0.2476		0.1252				0.8919			
EFIMon	Pearson Correl	.669*	-0.4030	-0.3410	-.740**	-0.1760	-0.3590	-0.0010	-0.2370	-.677*	-0.179	.739**	-0.0320	-0.1850	-0.1530	0.0680	-0.0890	0.1480	0.0510	0.5520	0.3210	-0.2440	-0.0540	0.2640	0.0650
	Granger1	**0.0097**								0.0010		0.2325													
	Granger2	**0.0239**								0.3181		0.0520													
EFIInvest	Pearson Correl	-.861**	.840**	.816**	.792**	-0.3040	.563*	-0.4450	-0.4280	0.0150	0.482	-.610*	.711**	.811**	.702**	-.707**	-.583*	0.5350	-.602*	-.870**	-.826**	.799**	-.607*	-.815**	-.719**
	Granger1		0.6090	0.2833	0.0183		0.0794					<0.0001	0.5908	0.8313	0.3862	0.6261						0.4507			
	Granger2		0.0179	0.8927	0.4857		0.3420					0.9231	0.0944	0.8811	0.4134	<0.0001						<0.0001			
EFIFin	Pearson Correl	-.861**	.840**	.816**	.792**	-0.3040	.563*	-0.4450	-0.4280	0.0150	0.482	-.610*	.711**	.811**	.702**	-.707**	-.583*	0.5350	-.602*	-.870**	-.826**	.799**	-.607*	-.815**	-.719**
	Granger1		0.6090	0.2833	0.0183		0.0794					<0.0001	0.5908	0.8313	0.3862	0.6261						0.4507			
	Granger2		0.0179	0.8927	0.4857		0.3420					0.9231	0.0944	0.8811	0.4134	<0.0001						<0.0001			
EFIPropRi	Pearson Correl	-0.3640	.588*	.668*	0.1890	-.785**	.650*	-.792**	-.862**	-0.3700	-0.488	-0.1250	.576*	.707**	.739**	-.616*	-.851**	.728**	-.827**	-.558*	-.730**	.734**	-.842**	-.647*	-.800**
	Granger1		0.1423	0.0800			0.2378						0.3348	0.0543	0.3222	0.0546		0.0151				0.0640			
	Granger2		0.8833	0.6858			0.9646						0.0843	0.8879	0.0198	0.5460		0.7478				0.0337			
EFICorrup	Pearson Correl	.844**	-.725**	-.735**	-.825**	0.1890	-.753**	0.2910	0.3100	-0.4520	-0.013	.692**	-0.3840	-.631*	-.661*	0.3880	0.4550	-0.3120	.587*	.814**	.712**	-.673*	0.4750	.633*	0.5430
	Granger1	0.7056										0.4854		0.7259	0.7820				0.7508	0.2618	0.4947	0.7787		0.9796	
	Granger2	0.3259										0.0129		0.2343	0.9775				0.8516	0.9630	0.5688	0.1204		0.0070	

Brazil&China FLAG						Brazil & China	Brazil & China	Brazil & China	Brazil & China					Brazil & China	Brazil & China		Brazil & China				Brazil & China	Brazil & China	Brazil & China	Brazil & China	Brazil & China
	Variable No	47	48	49	51	52	53	54	58	59	61	62	63	64	65	67	69	70	72	73	74	75	76	77	79
II. Multiple Regr. Matrix	Dependents	ICTImp_TTImp	AgrRwExp_MerchExp	FoodExp_MrchExp	FDInet_GDP	StoxVal_GDP	FuelExp_MerchExp	MrktCapList_GDP	CPIx	Infltn	M2_gr	IRSSpread	RealIR	ExtDebtST_ExpGSInc	ExtDebtST_GNI	STD_TTExtDbt	TTRes_TTExtDbt	M2_TTReserv	EnrgyImp_Euse	GDP_UEnUKPPPOilE	GDP_UEnUPPPOilE	RuPp_ToTPp	Internet_100	Phonelines_100	MobileSubs_100
Independents																									
FoodIx																									
TropBevIx											TropBevIx														
VegOilSeedsIx																		VegOilSeedsIx							CMca3FdVegAg
AgriRawIx										AgriRawIx												AgriRawIx			
MinMetalsIx						CMca1MetOil		CMca1MetOil	CMca1MetOil						CMca1MetOil					MinMetalsIx	CMca1MetOil	CMca1MetOil	MinMetalsIx	CMca1MetOil	
CrudeIx																									
WGIVA										WGIVA															
WGIPS																									
WGIGE									WGIGE	WGIGE							WGIGE								
WGIRQ					WGIRQ																				
WGIRL																									
WGICC							WGICC																		
EFIBiz																						EFIBiz			
EFITrade		EFITrade						EFITrade					EFITrade		EFITrade				EFITrade		EFITrade				EFITrade
EFIFisc																									
EFIGovtS				EFIGovtS									EFIGovtS	EFIGovtS											
EFIMon		EFIMon																							
EFIInvest			CMca5EInvFin													CMca5EInvFin						CMca5EInvFin			
EFIFin																									
EFIPropRi															EFIPropRi							EFIPropRi			
EFICorrup												EFICorrup												EFICorrup	

Non-significant Multi Regression Dependent Variables

Out of the 49 dependent variables included in the multiple regression analysis, 7 do not show any significant multiple regression results, as marked in red letters in Table 4.32a-b. These variables are listed here:

(1) Variable 13: GrossNatExp_GDP

(2) Variable 16: FinConExp_GDP

(3) Variable 54: MrktCapList_GDP

(4) Variable 59: Infltn

(5) Variable 63: RealIR

(6) Variable 65: ExtDebtST_GNI

(7) Variable 75: RuPp_ToTPp

For example, Tables 4.32a-b (I. Correlation-Granger Causality Matrix and II. Multi Regression Matrix) for China show that gross national expenditures to GDP (Variable 13: GrossNatExp_GDP) has significant correlations of 64.8% and 67.8% with political stability (WGIPS) and business governance (EFIBiz). The Granger causality tests suggest that WGIPS and EFIBiz Granger cause GrossNatExp_GDP: The Granger 1 test displays a p-value greater than 0.05 for each independent variable (0.2330, 0.7254), and the Granger 2 p-value is below 0.05 for each (0.0491, 0.0200). However, the multiple regression matrix in Tables 4.32a-b indicates no significant conclusion about the relationship between GrossNatExp_GDP and its predictor variables WGIPS and EFIBiz. Therefore, GrossNatExp_GDP appears in red letters.

Table 4.33: Parameter Estimates for GrossNatExp_GDP China

Independent	Label	DF	Estimate	Standard Error	t Value	Pr>|t|
Intercept	Intercept	2	83.44054	10.75955	7.76	<0.0001
WGIPS	WGIPS		8.49673	6.73703	1.26	0.2359
EFIBiz	EFIBiz		0.27937	0.17766	1.57	0.1469

Source: Calculated and arranged by the author.

The p-values show that the multiple regression results for GrossNatExp_GDP are not significant for WGIPS or EFIBiz.

Significant Multi Regression Dependent Variables

The statistical diagnostic tests revealed that of the 79 dependent variables analyzed for China, 42 show significant multiple regression results. The Table 4.34 displays all those 42. As stated in the previous section, there are 19 dependent variables (displayed in bold) with significant multiple regression results for both China and Brazil.

Table 4.34: Significant Multiple Regression Dependent Variables for China

Dependent Variables	No.	Dependent Variables	No.	Dependent Variables	No.
GDP_gr	2	**FuelImp_MerchImp**	**35**	**FuelExp_MerchExp**	**53**
GDPpCap_gr	3	**ExpValx**	**36**	**CPIx**	**58**
Agri_GDP	4	**ImpValIx**	**37**	M2_gr	61
IndustValAd_gr	**7**	**ExpVolx**	**38**	IRSSpread	62
GrossSav_GDP	10	**ImpVolIx**	**39**	**ExtDebtST_ExpGSInc**	**64**
GrossSav_GNI	11	**UnitValIxExp**	**40**	STD_TTExtDbt	67
GovFinConExp_GDP	14	**PPIxExp**	**43**	**TTRes_TTExtDbt**	**69**
HHFinConExp_GDP	**19**	HiTekExp_ManuExp	45	M2_TTReserv	70
Trade_GDP	**25**	ICTExp_TTExp	46	EnrgyImp_Euse	72
MrchTrade_GDP	**26**	ICTImp_TTImp	47	GDP_UEnUKPPPOilE	73
ExpGS_GDP	27	AgrRwExp_MerchExp	48	**GDP_UEnUPPPOilE**	**74**
ExtBalGS_GDP	29	FoodExp_MrchExp	49	**Internet_100**	**76**
urrACC_GDP	30	FDInet_GDP	51	**Phonelines_100**	**77**
ImpGS_GDP	31	StoxVal_GDP	52	**MobileSubs_100**	**79**

Source: Calculated and arranged by the author.

For example, multiple regression results reveal associations between ICTImp_TTImp (Variable 47), EFITrade and EFIMon. ICTImp_TTImp (Variable 47) correlates at 82.3% (sig. 0.01) with EFITrade and at 66.9% (sig. 0.05) with EFIMon. Granger 1 and Granger 2 test results for EFITrade and EFIMon show p-values of 0.5035 and 0.0467 (EFITrade) as well as 0.0097 and 0.0239 (EFIMon), respectively. These results suggest that EFITrade and EFIMon cause increasing shares of information and communication technology imports as a portion of total imports (Variable 47), which rose from 12.1% to 23.2% between 1996 and 2008.

FDInet_GDP (Variable 51) provides an example of a case in which a dependent variable is affected by only one independent variable, WGIRQ. The Granger causality matrix for China in Tables 4.11a-c and the Correlation-Granger Causality Matrix and Multi Regression Matrix for China in Tables 4.32a-b reveal a correlation of 68.3% (sig. 0.05). Granger 1 and Granger 2 p-values of 0.2727 and 0.0105, respectively, suggest that WGIRQ Granger causes FDInet_GDP, and not vice versa.

Similarly to the previous section's Tables 4.28a-b for Brazil, the dependent variables in Table 4.32a-b with significant results for China are marked with a light blue background. Black letters (e.g., Brazil&China) indicate that the multiple regression results for at least one dependent variable are significant for both Brazil and China; and red letters (e.g., Brazil&China) indicate that the multiple regression shows (e.g.) a significant relationship with an independent variable for China but not for Brazil.

For example StoxVal_GDP (Variable 52) of China shows a significant relationship with CMca1MetOil, the newly created PCA independent variable combining CrudeIx and MinMetalsIx, which correlate at 78.7% and 69.4% (sig. 0.01) with Variable 52. The respective Granger causality tests 1 and 2 show that CrudeIx and MinMetalsIx Granger cause StoxVal_GDP due to p-values of 0.0618 and <0.000 for MinMetalsIx and 0.2751 and 0.0035 for CrudeIx, respectively. However, the adjusted R-square is moderate at 0.5205, and the t-value for CMca1MetOil is 3.75.

In comparison, StoxVal_GDP of Brazil shows no significant multiple regression results for any independent variable, even though FoodIx and AgriRawIx (PCA combined into BMca2FdAg) as well as MinMetalsIx and CrudeIx (PCA combined into BMca1MetOil) show correlations of 87.3%, 88.6% as well as 89.6% and 82.7% (sig. 0.01), respectively. Granger causality tests for Brazil suggest that the independent variables FoodIx and AgriRawIx as well as CrudeIx and MinMetalsIx Granger cause StoxVal_GDP at significance levels of 99% with corresponding Granger 1 and Granger 2 p-values of 0.0262 and 0.0034 (FoodIx), 0.6087 and <0.0001 (AgriRawIx), 0.0377 and <0.0001 (MinMetalsIx), and 0.6548 and 0.0035 (CrudeIx), respectively.

4.3.3.2 Multiple Regression Results China

Table 4.35 below shows the multiple regression estimates, including the p-values (Pr>|t|) for each of the 42 dependent variables that have significant regression relationships with at least one of the 21 independent variables. Table 4.35 also displays the standard errors (St. Err.), adjusted R-square, t-values (t-val), and degree of freedom (DF) for each of these statistically significant relationships for China. Dependent variables and their regression results marked in green indicate that the identical dependent variable for China reveals also significant multi regression results for Brazil.

Please note that Table 4.35 contains an overview only and does not discuss multiple regression results. As noted previously, the economic analysis and discussion on correlation, causality, and multiple regression results of selected dependent variables is carried out in Chapter 5. Table 4.35 shows significant regression results below the p-value threshold of 0.05 only. Therefore the number of DFs may differ from the number of independent variables shown due to the fact that non-significant independent variables are not shown. For information purposes the multi regression matrix in Table 4.32 shows all dependent related independent variables, significant or not significant.

Table 4.35: Multiple Regression Results China

Nr. / Dependent Variable	Independent	DF	Estimate	St. Err.	t-Val	Pr>|t|
2. GDP_gr	Intercept	1	9.19088	0.52254	17.59	<0.0001
Adjusted R^2: 0.3661	MinMetalsIx		0.05877	0.02167	2.71	0.0219
3. GDPpCap_gr	Intercept	1	8.37182	0.54662	15.32	<0.0001
Adjusted R^2: 0.3819	MinMetalsIx		0.06331	0.02267	2.79	0.0190
4. Agri_GDP	Intercept	1	19.8011	1.37844	14.36	<0.0001
Adjusted R^2: 0.5928	WGICC		13.4277	3.12425	4.30	0.0013
7. IndustValAd_gr	Intercept	1	10.3056	0.53655	19.21	<0.0001
Adjusted R^2: 0.3441	AgriRawIx		0.12319	0.04734	2.60	0.0264
10. GrossSav_GDP	Intercept	1	29.5527	4.59586	6.43	<0.0001
Adjusted R^2: 0.4546	FoodIx		0.11231	0.03386	3.32	0.0069
11. GrossSav_GNI	Intercept	1	30.7093	4.29282	7.15	<0.0001
Adjusted R^2: 0.4559	FoodIx		0.10516	0.03163	3.32	0.0068
14. GovFinConExp_GDP	Intercept	1	20.4751	1.59885	12.81	<0.0001
Adjusted R^2: 0.5518	CMca4WVaPs		4.56957	1.23998	3.69	0.0036
19. HHFinConExp_GDP	Intercept	3	24.5065	26.2592	0.93	0.3750
Adjusted R^2: 0.8254	EFIPropRi		0.48779	0.12120	4.02	0.0030
25. Trade_GDP	Intercept	2	60.6869	16.4971	3.68	0.0043
Adjusted R^2: 0.6161	CMca1MetOil		0.15130	0.04766	3.17	0.0099
26. MrchTrade_GDP	Intercept	2	55.3132	15.9942	3.46	0.0061
Adjusted R^2: 0.6117	CMca1MetOil		0.14550	0.04621	3.15	0.0104
27. ExpGS_GDP	Intercept	2	30.8325	8.06714	3.82	0.0034
Adjusted R^2: 0.7093	CMca1MetOil		0.08445	0.02331	3.62	0.0047
29. ExtBalGS_GDP	Intercept	2	0.97801	2.44797	0.40	0.6979
Adjusted R^2: 0.7444	CMca1MetOil		0.01760	0.00707	2.49	0.0320
30. CurrACC_GDP	Intercept	1	-0.19977	0.80781	-0.25	0.8092
Adjusted R^2: 0.7918	CrudeIx		0.03416	0.00500	6.83	<0.0001
31. ImpGS_GDP	Intercept	1	17.3073	2.48217	6.97	<0.0001
Adjusted R^2: 0.4187	CMca1MetOil		0.03223	0.01038	3.11	0.0100
35. FuelImp_MerchImp	Intercept	2	1.70527	1.64034	1.04	0.3230
Adjusted R^2: 0.8780	CMca1MetOil		0.01882	0.00521	3.61	0.0047
36. ExpValx	Intercept	2	-222.941	36.5020	-6.11	0.0001
Adjusted R^2: 0.9727	MinMetalsIx		1.22214	0.15522	7.87	<0.0001
	EFITrade		4.80615	1.00925	4.76	0.0008
37. ImpValIx	Intercept	2	8.02266	86.4750	0.09	0.9279
Adjusted R^2: 0.8666	MinMetalsIx		1.76027	0.38908	4.52	0.0011
38. ExpVolx	Intercept	3	299.633	29.0287	-10.3	<0.0001
Adjusted R^2: 0.9910	VegOilSeedsIx		0.55036	0.14743	3.73	0.0047
	MinMetalsIx		0.59382	0.13331	4.45	0.0016
	EFITrade		6.33121	0.60427	10.48	<0.0001
39. ImpVolIx	Intercept	2	85.6178	61.2405	1.40	0.1923
Adjusted R^2: 0.7681	MinMetalsIx		1.29113	0.30279	4.26	0.0017
40. UnitValIxExp	Intercept	2	86.1891	2.80472	30.73	<0.0001
Adjusted R^2: 0.7733	CMca3FdVegAg		0.08557	0.01834	4.67	0.0009
43. PPIxExp	Intercept	2	28.3374	41.1000	0.69	0.5062
Adjusted R^2: 0.8458	MinMetalsIx		1.32019	0.23060	5.73	0.0002
45. HiTekExp_ManuExp	Intercept	2	-11.0589	8.36167	-1.32	0.2154
Adjusted R^2: 0.6953	CMca1MetOil		0.02992	0.00939	3.19	0.0097
	EFICorrup		0.86945	0.27361	3.18	0.0099
46. ICTExp_TTExp	Intercept	2	-11.4453	9.23140	-1.24	0.2433
Adjusted R^2: 0.6335	CMca1MetOil		0.02678	0.01037	2.58	0.0273
	EFICorrup		0.90802	0.30207	3.01	0.0132
47. ICTImp_TTImp	Intercept	2	-18.7046	4.60260	-4.06	0.0023
Adjusted R^2: 0.9150	EFITrade		0.26697	0.03240	8.24	<0.0001
	EFIMon		0.35174	0.05905	5.96	0.0001
48. AgrRwExp_MerchExp	Intercept	1	-0.35555	0.24292	-1.46	0.1713
Adjusted R^2: 0.6778	CMca5EInvFin		0.02358	0.00460	5.12	0.0003
49. FoodExp_MrchExp	Intercept	1	-35.0947	7.44300	-4.72	0.0006
Adjusted R^2: 0.6987	EFIGovtS		0.44021	0.08199	5.37	0.0002
51. FDInet_GDP	Intercept	1	4.15388	0.23066	18.01	<0.0001
Adjusted R^2: 0.4193	WGIRQ		2.58594	0.83179	3.11	0.0099
52. StoxVal_GDP	Intercept	1	-10.7347	21.1128	-0.51	0.6212
Adjusted R^2: 0.5205	CMca1MetOil		0.33070	0.08829	3.75	0.0032
53. FuelExp_MerchExp	Intercept	1	3.82186	0.36057	10.60	<0.0001
Adjusted R^2: 0.4743	WGICC		2.81037	0.81725	3.44	0.0055
58. CPIx	Intercept	2	87.2376	1.37754	63.33	<0.0001
Adjusted R^2: 0.9332	CMca1MetOil		0.04945	0.00520	9.52	<0.0001
61. M2_gr	Intercept	1	16.5825	0.72074	23.01	<0.0001
Adjusted R^2: 0.4410	TropBevIx		0.12845	0.04129	3.11	0.0110
62. IRSSpread	Intercept	1	1.49300	0.55792	2.68	0.0216
Adjusted R^2: 0.4322	EFICorrup		0.05547	0.01742	3.18	0.0087
64. ExtDebtST_ExpGSInc	Intercept	1	-310.932	82.3324	-3.78	0.0031
Adjusted R^2: 0.5999	EFIGovts		3.95229	0.90694	4.36	0.0011
67. STD_TTExtDbt	Intercept	1	79.9782	14.4535	5.53	0.0002
Adjusted R^2: 0.4541	CMca5EInvFin		-0.90763	0.27390	-3.31	0.0069
69. TTRes_TTExtDbt	Intercept	1	259.355	32.3981	8.01	<0.0001
Adjusted R^2: 0.4185	WGIGE		626.894	201.940	3.10	0.0100
70. M2_TTReserv	Intercept	1	10.2962	1.44783	7.11	<0.0001
Adjusted R^2: 0.3802	VegOilSeedsIx		-0.02546	0.00881	-2.89	0.0147
72. EnrgyImp_Euse	Intercept	1	-7.90432	1.51872	-5.20	0.0003
Adjusted R^2: 0.8157	EFITrade		0.20872	0.02837	7.36	<0.0001
73. GDP_UEnUKPPPOilE	Intercept	1	2.69077	0.20129	13.37	<0.0001
Adjusted R^2: 0.2507	MinMetalsIx		0.00254	0.00113	2.24	0.0467
74. GDP_UEnUPPPOilE	Intercept	2	0.69177	0.29140	2.37	0.0390
Adjusted R^2: 0.8920	EFITrade		0.04217	0.00835	5.05	0.0005
76. Internet_100	Intercept	1	-4.44480	1.60933	-2.76	0.0185
Adjusted R^2: 0.8269	MinMetalsIx		0.06917	0.00906	7.64	<0.001
77. Phonelines_100	Intercept	2	-20.6007	9.81135	-2.10	0.0621
Adjusted R^2: 0.7368	CMca1MetOil		0.04591	0.01102	4.17	0.0019
	EFICorrup		0.88717	0.32104	2.76	0.0200
79. MobileSubs_100	Intercept	2	-45.6785	3.74648	-12.1	<0.0001
Adjusted R^2: 0.9643	CMca3FdVegAg		0.06225	0.01529	4.07	0.0022
	EFITrade		0.95760	0.07516	12.74	<0.0001

Source: Calculated and arranged by the author.

4.4 Conclusion

4.4.1 Conclusion Correlation Analysis

The correlation analysis for Brazil’s and China’s identical 79 dependent variables reveals 440 significant correlation counts for China, and 352 significant correlation counts for Brazil.

Independent Variables Set

From an independent variable set perspective, I note that the commodity price index set dominates the significant correlation count, with 47% and 44.3% of all significant correlation events for China and Brazil, respectively. The economic freedom index set displays the second largest significant correlation count, representing 34.5% of all significant correlation counts for China and 28.1% for Brazil. With 18.4% of all counts for China and 27.6% of all counts for Brazil, the WGI index set trails the other two sets.

These results suggest that supply and demand for commodities and the changes in commodity prices exhibit a far greater association with economic activities measured by the 79 dependent variables than governance which is measured by the EFI and/or the WGI indexes. Commodity price indexes capture the largest number of significant correlations. Because EFI and WGI complement each other, it is even more remarkable that the commodity price indexes record the largest amount of significant correlation counts for both China and Brazil.

Individual Independent Variables

BRAZIL: From an individual independent variable point of view the correlation results reveal that trade governance in Brazil, which is measured by EFITrade, shows the largest number of significant correlation counts (40 counts or 11.4%), followed by WGIVA —voice and accountability index— with 38 counts (or 10.8%), CrudeIx with 37 counts (or 10.5%), MinMetalsIx with 31 counts (or 8.8%), and AgriRawIx with 30 counts (or 8.5%). That is, trade governance for Brazil appears to play a key governance role in context of economic activity, followed by voice and accountability (WGIVA), which suggests major associations with economic activity in Brazil. Furthermore, from a governance point of view, regulatory quality (WGIRQ 16 counts, 4.5%) and rule of law (WGIRL 14 counts, 4.0%) as well as business governance (EFIBiz: 13 counts, 3.7%) suggest strong interdependence with economic activity.

CHINA: The commodity price indexes lead the correlation count. Minerals and metals prices (MinMetalsIx: 49 counts, or 11.1%) lead the ranking, followed by agricultural raw materials (AgriRawIx: 46 counts, or 10.5%), and oil prices (CrudeIx: 45 counts, or 10.2%). From a governance perspective, EFITrade —like for Brazil— leads the correlation count (46 counts, or 10.5% of total correlation counts), followed by government effectiveness measured by WGIGE (30 counts, or 6.8%), freedom of property rights (EFIPropRi: 19 counts, or 4.3%), and freedom of corruption (EFICorrup: 18 counts, or 4.1%). Surprisingly, EFIBiz, which measures business governance in China, trails EFITrade with 14 correlation counts (or 3.2%), respectively.

Cluster Effects

Cluster effects refer to the occurrence of several commodity price indexes and/or several WGI indexes and/or several EFI indexes affecting the same dependent variable or a group of similar dependent variables in the correlation matrix or in the Granger causality matrix.[80]

BRAZIL: Cluster effects occur mainly with commodity price indexes. Soft commodity price indexes (FoodIx, AgriRawIx) but also minerals and metals (MinMetalsIx) display strong correlations to GDP_gr and GDPpCap_gr. Nearly all commodity price indexes show strong correlations with trade indexes such as ExpValx, ExpVolx, ImpValIx, ImpVolIx, as well as with unit value and unit volume related trade indexes (Variables 36-41). In comparison to China's export surplus, Brazil's export surplus is driven mainly by commodities and to a smaller extent by manufactured goods, whereas China's export surplus is driven mainly by manufactured goods.

Furthermore, it appears that changes in commodity price indexes cause changes in Brazil's value of stocks traded to GDP (Variable 52). These and other observations will be discussed in more depth in Chapter 5. Also, the correlation analysis suggests that there exists a cluster effect between commodity price indexes and food, crop, as well as livestock production (Variables 55-57). Changes in commodity prices seem to affect population migration measured by RuPp_toTPp (Variable 75: rural population to total

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[80] Cluster effects occur in the context of the causality matrixes and multiple regression matrixes in Section 4.2.3 (Causality Analysis) and Section 4.3 (Multiple Regression Analysis).

population), and improving degrees of communication coverage measured by Internet_100 (Variable 76), Phonelines_100 (Variable 77), and MobilSubs_100 (Variable 79). Last but not least, rising commodity price indexes correlate with improving energy efficiency measured by energy efficiency variables such as GDP_UEnUKPPPOilE and GDP_UEnUPPPOilE (Variables 73, 74).

Commodity price indexes reveal associations with a wide array of macroeconomic variables. But governance indexes show a more narrow correlation association to macroeconomic variables. WGIVA, WGIPS, and WGIGE display cluster effects on trade variables such as Trade_GDP and MrchTrade_GDP (Variables 25, 26), whereas WGIRQ and WGIRL show cluster associations with rates and debt variables (Variables 62-66, 68). EFIBiz, EFITrade, EFIFisc, and EFIGovtS exhibit cluster associations with debt variables (Variables 62-66, 68) only.

CHINA: Similar to Brazil, the commodity price indexes show large cluster effects on macroeconomic variables for China. In addition to cluster associations on GDP metrics (Variables 2-3), debt and reserve ratios (Variables 64-65, 67, 69-71), soft commodity production indexes (Variables 55-57), and trade indexes (Variables 36-41), correlation cluster effects in China also include GDP composition variables (Variables 6-12) such as IndustryValAd_GDP and GrossSav_GDP, and trade variables such as Trade_GDP, MrchTrade_GDP, and ExpGS_GDP (Variables 25-27, and 29-31).

The WGI indexes do not reveal any significant correlation cluster effects. And EFI indexes, primarily EFITrade, EFIGovtS, EFIFin, EFIInv, and EFIPropRi appear to exhibit cluster effects on rates and debt ratios only (Variables 62-65, 67).

4.4.2 Conclusion Causality Analysis

The Granger causality analyses on Brazil’s and China’s 79 dependent variables reveal 267 significant Granger causality counts for China and 224 for Brazil. Remarkably, the count ranking is the same for both. The commodity price index set is leading the count (China: 59.2% of all counts, Brazil: 50.4%), followed by the economic freedom index set (China: 22.8%, Brazil: 25.0%) and the WGI index set (China: 18.0%, Brazil 24.6%).

Independent Variables Set

Commodity Price Index Set

The commodity price index set dominates the Granger causality count with 59.6% and 50.4% of all counts for China and Brazil, respectively.

For **BRAZIL**, AgriRawIx (29 counts), MinMetalsIx (25 counts), and FoodIx (22 counts) lead the causality count, followed by VegOilSeedsIx (17 counts), CrudeIx (15 counts), and TropBevIx (5 counts). I note also, more than half of the counts for these commodities is of inverse causality nature. Only CrudeIx shows more Granger causalities than inverse causalities.

For **CHINA**, the largest count within the commodity price index set resides within MinMetalsIx (44 counts), AgriRawIx (37 counts), CrudeIx and VegOilSeedsIx (each 25 counts), followed by FoodIx (23 counts), and TropBevIx (4 counts). The inverse Granger count is more than half of the counts for AgriRawIx (11 Granger causalities : 26 inverse causalities), VegOilSeedsIx (6 : 19), FoodIx (6 : 17), and TropBevIx (1 : 3).

Economic Freedom Index Set

The economic freedom index set displays the second largest causality count for both China and Brazil showing 22.8% of a total of 267 counts for China and 25.0% of a total of 224 counts for Brazil. It is revealing that for both **CHINA** and **BRAZIL** the EFITrade index is the dominating governance index within the EFI index set with 25 and 27 causality counts of which 15 and 20 are of inverse causality nature, respectively. For both countries, trade governance measured by EFITrade emerges as one of the key governance dimensions. Second and third largest governance index count for China is EFIPropRi (Freedom of Property Rights) with 9 counts and EFIGovtS (government size governance) with 6 counts, of which 6 and 1 are of inverse nature, respectively. In contrast, second and third largest governance counts for Brazil are EFIBiz (Freedom of Business) with 8 counts (of which are 5 inverse), and EFICorrup (freedom of corruption) jointly with EFIGovtS (government size) with 6 counts each.

Worldwide Governance Index Set

The WGI indexes rank as the third largest governance set by significant causality counts. **CHINA** provides a total causality count of 48 (18.0%), whereas **BRAZIL** displays 55 (24.6%). For China, WGIGE is the dominant governance index with 21 counts (18 of which are of inverse nature), followed by WGIPS with 12 counts (10 of which are inverse). In contrast, for Brazil WGIVA dominates the causality count with 29 counts (16 of which are inverse) followed by WGIRQ with 9 counts (4 of which are inverse).

Overall, above results suggest that supply and demand for commodities and subsequent changes in commodity prices do show a far greater association with economic activities measured by the 79 dependent variables than changes of the EFI or the WGI indexes. These results are congruent with the findings of the correlation analysis in which the commodity price indexes dominate the correlation count for both, China and Brazil, followed by the EFI index set and the WGI index set. As in the correlation analysis, commodity price indexes capture the largest number of significant causality counts. In light of the fact that the EFI and the WGI indexes do complement each other, it is remarkable that the commodity price indexes capture 59.2% of all significant causality counts for China (or 158 events, 92 of which are of inverse nature), and 50.4% for Brazil (113 events, 67 of which are of inverse nature).

Individual Independent Variables

BRAZIL: From and individual independent variable point of view the Granger causality analysis reveals that within the commodity price index set, AgriRawIx displays the largest causality count (29 counts, or 12.9% of total), followed by MinMetalsIx (25 counts, or 11.2%), FoodIx (22 counts, or 9.8%), VegOilSeedsIx (17 counts, or 7.6%), CrudeIx (15 counts, or 6.7%), and TropBevIx (5 counts, or 2.2%).

From a governance dimension point of view, voice and accountability governance (WGIVA: degree of democracy) shows the largest causality count at 29 events, 16 of which are of inverse nature. Trade governance for Brazil measured by EFITrade shows the second largest number of significant causality events (27 counts or 12.1% of total) within all governance dimensions, followed by WGIRQ (9 counts), and EFIBiz (8 counts). As already indicated in the correlation analysis, WGIVA and trade governance for Brazil seem to play key governance roles in context of economic activity in Brazil. Furthermore, regulatory quality (WGIRQ, 9 counts) and rule of law (WGIRL, 6 counts) as well as business governance (EFIBiz, 8 counts) suggest some interdependence with economic activity.

CHINA: As for Brazil, the commodity price indexes lead the causality count. The minerals and metals price index (MinMetalsIx: 44 counts or 16.5%) leads the ranking, followed by the agricultural raw materials price index (AgriRawIx: 37 counts or 13.9%), CrudeIx (25 counts or 9.4%), VegOilSeedsIx (25 counts or 9.4%), FoodIx (23 counts or 8.6%) and TropBevIx (4 counts or 1.5%). The Granger causality tests on China reveal an inverse causality ratio of 58.2% (92 counts) within the commodity price indexes.

From a governance perspective, EFITrade —similarly to Brazil— is the dominating governance dimension within the causality analysis displaying 25 significant Granger causality counts, followed by WGIGE, which displays a Granger causality count of 21. WGIPS, EFIPropRi, WGIVA, and WGICC rank third, fourth and fifth, representing 12, 9 and 7 causality counts, respectively. Similarly to Brazil, trade governance (EFITrade) appears to play a key role in China’s economy.

Cluster Effects

BRAZIL: Cluster effects of Granger (including inverse) causality are driven mainly by commodity price indexes. It is observable that soft commodity price indexes (FoodIx, AgriRawIx) as well as minerals and metals price indexes (MinMetalsIx) display associations with GDP_gr and GDPpCap_gr. Nearly all commodity price indexes show associations with trade indexes such as ExpValX, ExpVolX, ImpVolIx, ImpValIx, and unit value and unit volume related trade indexes (Variables 36-41). Furthermore, it appears that changes in commodity price indexes are associated (Granger cause) with large changes in Brazil’s stocks value traded to GDP (Variable 52). Also, the causality analysis suggests that there exists a cluster effect between commodity price indexes and crop production (Variable 56), in addition to cluster effects on debt ratios (Variables 64, 65, 68, 69). Last but not least, rising commodity price indexes show some interaction with energy efficiency variables such as GDP_UEnUPPPOilE (Variable 74), and rural migration and communication variables (Variables 75-77, 79).

Similarly to the correlation findings in the section above, it appears that while commodity price indexes reveal associations with a wide array of macroeconomic variables, governance indexes show a more narrow causality association to macroeconomic variables. WGIVA, WGIPS, and WGIGE display cluster effects on trade variables such as Trade_GDP and MrchTrade_GDP (Variables 25-26), whereas WGIRL and WGIRQ show cluster associations with a debt variable (Variable 66). EFIBiz, EFIFisc, and EFIGovtS show signs of cluster associations with debt variables (Variables 64, 66, 68 (EFIFisc excluded)).

CHINA: Similarly to Brazil, commodity price indexes show large causality cluster effects on macroeconomic variables for China. In particular, savings quota variables (Variables 10-12), trade variables (Variables 25-31, 35-41) as well as debt variables (Variables 64, 65, 69-71) and communication variables (Variables 76, 77, 79) show strong causality associations. In comparison to Brazil, causality cluster effects of WGI or EFI indexes in relation to macroeconomic variables are less pronounced, not to say non-existent.

4.4.3 Conclusion Principal Component Analysis

In Section 4.2.4 I performed principal component analysis (PCA) in order to eliminate multicollinearity among independent variables. Upon detecting potential pairs of independent variables subject to multicollinearity, I applied PCA in order to combine those pairs. The result of this procedure is the creation of a number of new independent variables.

The principal component analysis has been applied on commodity price indexes, WGI and EFI governance indexes, as well as on respective changes in commodity price indexes and changes in governance indexes in consideration of dependent variables measured in percentage shares and change rates.

Commodity Price Indexes

The price indexes for commodities have been divided in two subsets. (1) The soft commodity subset includes FoodIx, TropBevIx, AgriRawIx, and VegOilSeedsIx. (2) The metals and oil subset in contrast includes the composite base, minerals and precious metals price index (MinMetalsIx) and the composite oil price index (CrudeIx).

The differentiation of the soft commodity subset and the minerals and metals and crude subset is based on an array of considerations such as correlation associations and Granger causality associations. The latter is specifically relevant for MinMetalsIx and CrudeIx as revealed in Chapter 3. Both, MinMetalsIx and CrudeIx, are a sub asset class within commodities which tends to correlate relatively close to one another. Furthermore, in capital markets both oil and base metal commodities commonly serve as leading indicators of general global economic activity, broad stock market index moves, general consumer demand, and as leading indicators of inflation. In addition, base metals and oil hold a considerable, strong correlation with specific foreign exchange markets. MinMetalsIx and CrudeIx tend to trend with fundamental factors that for example also affect commodity currencies (e.g., New Zealand dollar (NZD), Australian dollar (AUD), Canadian dollar (CAD)[81]).

The rules which I apply to bundle commodity price index pairs within each commodity subset in order to create a new principal component independent variable are based on the following: (a) A significant (sig. 0.05) correlation of at least 69.9%, and (b) the correlation of the respective commodity price indexes pair must be above the correlation of a dependent variable with a commodity price index. As a result, this methodology produced the following new commodity price index variables for the regression analysis of Brazil and China:

(1) BMca1MetOil: CrudeIx & MinMetalsIx, Brazil

(2) BMca2FdAg: FoodIx & AgriRawIx, Brazil

(3) BMca3BevAg: TropBevIx &AgriRawIx, Brazil

(4) BgrMcaFoodAg: Change rates of FoodIx & Change rates of AgriRawIx, Brazil

(5) CMca1MetOil: MinMetalsIx & CrudeIx, China

(6) CMca2FdAg: FoodIx & AgriRawIx, China

(7) CMca3FdVegAg: FoodIx & VegOilSeedsIx & AgriRawIx, China

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[81] Also referred to as commodity currencies due to the strong correlation with commodity prices.

Governance Indexes

Governance indexes provided by the World Bank (WGI indexes) and the Heritage Foundation (EFI indexes) represent aggregate indicators which embody and combine the examination and observation of a large number of companies, enterprises, supranational entities, individuals, and expert survey participants in industrialized and developed economies as well as in developing countries. Because the individual data sources that underlie the aggregate indicators are collected and assembled from diverse think tanks, survey institutions, nongovernmental organizations, and international organizations, governance dimensions are highly heterogeneous which poses a challenge when applying multicollinearity detection methods on governance index pairs.

To address these distinctive challenges and features I amended the multicollinearity approach by adding two new criteria: (a') the correlation confidence level must be greater than 99% (sig. 0.01), and (a'') there can be only one newly created governance index pair per set of independent governance variables.

As a result of this amended methodology, the following new governance indexes have been established for the regression analysis of Brazil and China:

(1) CMca4WvAPs: WGIVA & WGIPS, China

(2) BMca4EfscGvt: EFIFisc & EFIGovtS, Brazil

(3) CMca5EinvFin: EFIInv & EFIFin, China

These newly established independent variables have been incorporated in the regression analysis in Section 4.3.

4.4.4 Conclusion Multiple Regression Analysis

BRAZIL: 44 macroeconomic variables out of the total of 79 analyzed for Brazil passed the statistical diagnostic tests and proceeded into the regression analysis. The results of the regression analysis revealed that of these 44 variables only 9 dependent variables failed to exhibit significant regression results. These are:

(1) Variable 2: GDP_gr

(2) Variable 3: GDPpCap_gr

(3) Variable 27: ExpGS_GDP

(4) Variable 34: ManfImp_MrchImp

(5) Variable 50: ManufExp_MrchExp

(6) Variable 52: StoxVal_GDP

(7) Variable 54: MrktCapList_GDP

(8) Variable 68: STD_TTResv

(9) Variable 75: RuPp_ToTPp

It is worth to note that the regression analysis of Brazil revealed the following governance indexes which play no role in the regression analysis:

(1) EFIPropRi

(2) EFIInvest

(3) EFIMon

(4) WGICC

CHINA: In comparison with Brazil, the statistical diagnostic tests for China revealed that of the 79 selected dependent variables 49 made it into regression tests. Of those 49 dependent variables, 7 do not show any significant multiple regression results.

(1) Variable 13: GrossNatExp_GDP

(2) Variable 16: FinConExp_GDP

(3) Variable 54: MrktCapList_GDP

(4) Variable 59: Infltn

(5) Variable 63: RealIR

(6) Variable 65: ExtDebtST_GNI

(7) Variable 75: RuPp_ToTPp

From a governance angle, regression tests reveal that the following indexes do not have any effect on any dependent variable analyzed for China:

(1) WGIRL

(2) EFIFisc

Furthermore, of the regression significant variables for Brazil (35 variables) and China (42 variables), there are 19 identical dependent variables that reveal regression significance for both Brazil and China. These 19 dependent variables can be found in Table 4.31 (Regression Results Brazil) for Brazil and Table 4.35 (Regression Results China) for China. It is worth noting that for Brazil the number of significant governance regressor variables is larger than it is for China.

5 Comparative Econometric Result Analysis of Selected Variables

5.1 Introduction

Overview

Chapter 5 offers economic interpretations of the results of the correlation, causality, and regression analysis carried out in the previous chapters. All data in the tables in this chapter have been computed and arranged by the author. The relevant statistical results are based on the results from Chapter 4, while the macroeconomic data is based on the data series provided by the World Bank (2009, 2010) introduced in Chapter 3.

The objective is to uncover economically sensible associations between dependent and independent variables and to reveal economic pattern differences or similarities between Brazil and China. Such associations between dependent and independent variables which do not allow for sensible interpretations from an economic point of view are either kept in gray shaded letters in the tables and/or not further discussed. By association I mean a relationship that entails significant correlation results, and/or significant Granger causality results (including inverse), and/or significant regression results.

The following regression significant variables of Tables 4.31 and 4.35 for Brazil and China have been chosen to perform econometric analysis on in this section.

The macroeconomic variables of Table 4.31 for Brazil include: GDP growth rate (Variable 2), GDP per capita growth rate (Variable 3), trade to GDP (Variable 25), exports of goods and services to GDP (Variable 27), imports of goods and services to GDP (Variable 31), export value index (Variable 36), export volume index (Variable 38), unit value index of exports (Variable 40), net foreign direct investment (Variable 51), stock value to GDP (Variable 52), consumer price index (Variable 58), M2 to GDP (Variable 60), energy efficiency (Variable 74: GDP_UEnUPPPOilE), and communication variables (Variable 76: Internet_100, Variable 79: MobileSubs_100).

The macroeconomic variables of Table 4.35 for China include: industry value added to GDP (Variable 6), gross fixed capital formation to GDP (Variable 23), trade to GDP (Variable 25), export value index (Variable 36), import value index (Variable 37), export volume index (Variable 38), import volume index (Variable 39), unit value index imports (Variable 41), consumer price index (Variable 58), energy efficiency (Variable

74: GDP_UEnUPPPOilE), and communication variables (Variable 76: Internet_100, Variable 79: MobileSubs_100).

For each dependent variable I comparatively illustrate the effects for Brazil and China. Also, Section 5.2 includes variables which are not displayed in Table 4.31 (Regression Results Brazil) and Table 4.35 (Regression Results China) but nonetheless offer sufficient empirical grounds for further examination. These variables include manufacturing value added to GDP (Variable 8), manufacturing exports to merchandise exports (Variable 50), manufacturing imports to merchandise imports (Variable 34), trade tariffs (Variable 44), and rural population to total population (Variable 75).

I do not discriminate between dependent variables that reveal significant regression results and those that do not. My criteria for selecting additional dependent variables in this section are based on empirical significance, as well as on correlation significance, and/or causality significance. A dependent variable must reveal at least significant correlation results and yield sufficient empirical evidence to enter analyses. The objective is to reveal meaningful macroeconomic variables and to draw comparisons on surfacing explanatory variables at the example of Brazil and China. The length of explanatory illustrations and elaborations on empirical relationships between dependent and independent variables varies depending on the scope of empirical findings for each macroeconomic variable.

Structure of Chapter 5

Sections 5.2.1 to 5.2.15: Approach and Method

In Sections 5.2.1 to 5.2.15, I display regression metrics for Brazil and China in an introductory table on a selected dependent variable and indicate significance levels, correlation levels, regression results including adjusted R-square (labeled as R^2), and — case by case— t- and p-values.[82] The econometrics and statistics of the selected macroeconomic variables are based on and have been imported from the Granger causality and regression analyses of the matrixes of Tables 4.8a-c (Granger Causality Matrix Brazil), Tables 4.28a-b (Correlation-Granger Causality and Multiple Regression

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[82] Adjusted R-square levels, correlation and t-values as well as p-values are rounded up or down to the second decimal digit.

Matrix Brazil) and Table 4.31 (Multiple Regression Results Brazil) for Brazil as well as the respective matrixes for China (Tables 4.11a-c, Tables 4.32a-b, and Table 4.35).

Empty fields marked with ‘ – ‘ in the tables indicate that correlation, causality, or regression significance is low and not relevant. The correlation fields showing asterisks ‘*‘ or ‘**‘ represent correlation results that are significant at the 95% confidence level (sig. 0.05) or at the 99% confidence level (sig. 0.01), respectively. The Granger fields in the table displayed as ‘Causal’ mean that the independent variable is Granger causing the macroeconomic variable. If the respective cell is labeled as ‘Iv’ or ‘Inverse’ it means that the causality runs from the macroeconomic variable (the dependent variable) to the independent variable (governance dimension, and/or commodity price index), that is there exists an inverse causality phenomenon. If the cell is labeled as ‘Causal/Iv’ then the confidence levels of both, Granger 1 and Granger 2 tests are at least at a level of 95% (sig. 0.05), i.e., there exists feedback causality. The regression fields labeled as ‘Regr. Sig’ indicate whether a dependent variable has significant regression results. In order to yield significant regression results a macroeconomic variable must exhibit significant correlation and causality results. That is, the pre-condition for regression significance is correlation and causality significance. When a macroeconomic variable does not exhibit regression significance, then the ‘Regr. Sig’ cell displays ‘No’. If the ‘Regr. Sig-cell’ displays ‘Yes’, then the macroeconomic variable displays significant regression results. Each ‘Regr. Sig’ cell which is labeled ‘Yes’ also contains the respective adjusted R-square.

After displaying the econometric parameters of a correlation significant relationship, causality or regression significant relationship, I seek to utilize these results and findings to support these with empirical and economic observations. That is, I seek to discuss empirical results, observations and findings for selected macroeconomic variables by underlining and supporting these with significant statistical evidence, e.g., correlation and causality significance as well as regression significance as established in Chapter 4.

As already stated in the introduction in Section 1.5, I have chosen not to perform a full scale inverse regression analysis. Consequently, inverse Granger causal relationships have not been tested on regression significance due to the implicitly questionable underlying suggestion that changes in macroeconomic variables (treated as exogenous variables in the case of inverse Granger causality) of China and Brazil cause changes in the two sets of governance dimensions and in commodity price indexes, and that the cause and effect associations are observable on a long-term basis. As illustrated in Section 1.5, the rational for not performing inverse regression analysis is as follows:

(1) The objective in this thesis is to reveal long-term regression associations in which macroeconomic variables are affected (Granger caused) by commodity prices and/or governance architecture.

(2) Governance dimensions are complex, politically, socially and economically multifaceted and subject to long-term evolutionary processes in order to be effective. Governance structures and governance architectures are established, formulated, shaped and influenced at top central and/or local authority levels, and are thus exogenous. As such, it is problematic to envision that governance architecture (i.e., governance indexes) is caused by one or more than one (or a set of) macroeconomic variable(s).

(3) Commodity prices are exogenous due to market size and due to the number of market participants. Commodity prices trend with the general state of the global economy and not solely with the trend of a single economy such as China's. Undoubtedly, China's economic expansion in tandem with global growth affected global commodity prices. Nonetheless, China's global import share (Table 2.9) and global GDP share (Table 2.2) itself is too small to solely positively affect commodity prices in case the economies of the US and/or of the European Union stall or run into a decline.[83]

However, I acknowledge significant inverse causality relationships on a selective basis and offer economic and empirical arguments and evidence to lend credence to the rationale of an inverse causal relationship between macroeconomic variables and commodity price indexes and/or governance dimensions.

Conclusion

The conclusion in Section 5.3 summarizes the objective of this thesis and outlines the econometric approach and methods applied. The conclusion also summarizes significant findings of this chapter.

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[83] Table 2.2 (China GDP Relative to world GDP 1970-2009): China's global GDP share was 8.56% in 2009. Table 2.9 (Import Structure China 1995-2009): China's global import share was 7.9% in 2009.

5.2 Selected Macroeconomic Variables

5.2.1 GDP Growth Rate

Table 5.1: GDP Growth Rate

Variable 2	**GDP_gr**, Brazil			**GDP_gr** China		
Independents	Corr %	Granger	Regr. Sig	Corr %	Granger	Regr. Sig
FoodIx	69.7*	Causal	No	-	-	-
VegOilSeedsIx	-	-	-	59.0*	Inverse	-
AgriRawIx	64.3*	Causal	No	61.0*	-	-
MinMetalsIx	56.9*	Causal	No	65.1*	Causal	Yes: R^2 .37

Source: This table and all following tables in this section have been created, calculated and arranged by the author.

BRAZIL: GDP_gr, which stood at an average of 3.0% p.a. between 1996 and 2008 (however volatile, ranging between 0.038% and 6.1%), correlates moderately positive at 69.7%, 64.3%, and 56.9% (each sig. 0.05) with FoodIx, AgriRawIx, and MinMetalsIx.[84] Granger causality analysis reveals that GDP_gr is Granger caused by FoodIx, AgriRawIx, and MinMetalsIx. Please see Table 4.8a-c for details

Rationale: There exist strong associations between Brazil's GDP growth rate and Brazil's commodities exports, as outlined in Chapter 2, specifically in iron ores, manganese as well as other minerals and metals, soy products and agricultural raw materials. These exports appear to have positive effects on Brazil's output. Granger causality is significant in all cases, supporting empirical evidence with statistical significance that rising commodity prices cause GDP_gr. Between 1995 and 2009, Brazilian export shares of the respective commodity groups to total exports developed as follows: Food exports rose from 28.5% to 33.9%, fuels exports rose from 0.9% to 8.9%, and ores and metals rose from 11.3% to 13.4% (Table 2.6: Export Structure Brazil). Nonetheless, the regression analysis discloses no significant relationship between the dependent variable and commodity prices, which may be due to the relatively small data sample of 13 data points from 1996 to 2008.

CHINA: GDP_gr of China averaged at 9.87% p.a. between 1996 and 2008, with its low at 7.6% in 1999 and its high at 14.2% in 2007, dropping to 9.6% in 2008. GDP_gr shows significant positive correlations of 59.0%, 61.0%, and 65.1% with VegOilSeedsIx, AgriRawIx, and MinMetalsIx. Granger causality analysis suggests that

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[84] Correlation qualification r_i: moderate ($50.0\% \leq r_i < 70.0\%$), high ($70.0\% \leq r_i < 90.0\%$), very high ($90.0\% \leq r_i \leq 100.0\%$).

MinMetalsIx causes GDP_gr, but the regression association is questionable according to the low adjusted R-square of 0.37.

Rationale: In contrast with Brazil, it appears that GDP_gr in China is Granger causing changes in VegOilSeedsIx suggesting that Chinese GDP growth affects the respective commodity price index as a result of large import volumes, specifically soy products from Brazil. Also, the multiple regression analysis reveals that there exists a significant relationship between MinMetalsIx causing GDP growth. The demand in base metals due to an increasing capital formation to GDP ratio in context of an expanding infrastructure and growing industry clusters affects the prices. The increasing infrastructure coverage and growing industry clusters in turn positively affect output, which translates into positive GDP growth rate effects, which in turn affect the consumption of base metals. China's global import share of base metals and iron ore grew from 2.5% to 16% between 1995 and 2009, as shown in Table 2.9 (Import Structure China, Chapter 2). Therefore, Granger causality indicating that base metal prices lead or Granger cause GDP_gr is not plausible. At 0.37, the adjusted R-square (R^2) is low, which reveals weak (at best) explanatory power of the independent variable.

5.2.2 GDP Per Capita Growth Rate

Table 5.2: GDP Per Capita Growth Rate

Variable 3	**GDPpCap_gr** Brazil			**GDPpCap_gr** China		
Independents	Corr %	Granger	Regr. Sig	Corr %	Granger	Regr. Sig
FoodIx	72.9**	-	-	-	-	-
VegOilSeedsIx	-	-	-	60.2*	Inverse	-
AgriRawIx	67.5*	Causal	No	64.8*	-	-
MinMetalsIx	57.9*	Causal	No	66.2*	Causal	Yes: R^2 .38
EFICorrup	-59.0*	Causal	No	-	-	-

Source: Calculated and arranged by the author.

BRAZIL: GDPpCap_gr was at 1.67% p.a. on average between 1996 and 2008, showing high volatility between a negative growth rate of -1.45% in 1998 and a positive growth rate of 4.12% in 2008 (max 5.0% in 2007). GDPpCap_gr shows a similar pattern as GDP_gr, which correlates moderately with FoodIx (sig. 0.01), VegOilSeedsIx, and MinMetalsIx. The Granger causality analysis reveals that GDPpCap_gr is Granger caused by AgriRawIx, MinMetalsIx, and by EFICorrup.

Rationale: Granger causality validates the strong associations between the importance of Brazil's economic expansion measured by GDPpCap_gr and the rising prices of commodity exports, specifically iron ores, manganese as well as other minerals and metals, and agricultural raw materials, despite insignificance of regression analysis results. No association can be established between the slightly improving EFICorrup between 1996 and 2008 and the GDP per capita change rate.

CHINA: The GDP per capita change rate was at 9.05% on average p.a. between 1996 and 2008, ranging between 6.7% in 1999 and 13.6% in 2007, and then dropping to 9.04% in 2008. GDPpCap_gr shows significant moderately positive correlations with VegOilSeedsIx, AgriRawIx, and MinMetalsIx.

Rationale: Similarly to the example of GDP_gr, it appears that GDPpCap_gr of China is Granger causing changes in VegOilSeedsIx. And again, multiple regression reveals that MinMetalsIx is causing GDPpCap_gr, and that there exists a significant regression relationship between MinMetalsIx and GDPpCap_gr. Similarly to GDP_gr, adjusted R^2 for GDPpCap_gr is low at 0.38. The same rationale applies as for GDP_gr.

5.2.3 Industry Value Added to GDP

Table 5.3: Industry Value Added to GDP

Variable 6	**IndustValAd_GDP** Brazil			**IndustValAd_GDP** China		
Independent	Corr %	Granger	Regr. Sig	Corr %	Granger	Regr. Sig
FoodIx	-	-	-	69.4**	-	-
TropBevIx	-	-	-	77.5*	Inverse	-
VegOilSeedsIx	-	-	-	57.6*	-	-
AgriRawIx	-	-	-	75.4**	Inverse	-
MinMetalsIx	-	-	-	66.2*	-	-
WGIVA	55.5*	-	-	-	-	-
WGIGE	57.8*	Causal	Yes: R^2 .27	-	-	-
WGIRQ	-	-	-	72.1**	-	-
EFITrade	57.3*	-	-	-	-	-

Source: Calculated and arranged by the author.

BRAZIL: IndustValAd_GDP ranged between 25.7% and 30.1% between 1996 and 2008, closing at 26.7% by the end of 2008. IndustValAd_GDP shows moderate positive correlation (each sig. 0.05) with WGIVA, WGIGE, and EFITrade, suggesting that there exist significant associations to WGIVA (voice and accountability, i.e., level of democracy), trade governance, and government effectiveness. Surprisingly, the regression analysis revealed that WGIGE is significantly affecting the dependent variable. However, model fit displayed by adjusted R^2 is low at 0.27.

Rationale: There is no plausible rationale regarding the improving government effectiveness (WGIGE) and the rise of IndustValAd_GDP. The correlations are low and do not yield sufficient statistical support to draw a conclusive empirical summary.

CHINA: The correlation of TropBevIx (sig. 0.05) and AgriRawIx (sig. 0.01) with industry value added to GDP is high, and the inverse Granger causality is significant. The correlation with FoodIx (sig. 0.01), VegOilSeedsIx (sig. 0.05), and MinMetalsIx (sig. 0.05) is moderate.

Rationale: In comparison to Brazil it appears that the development of Chinese industry value added to GDP is Granger causing prices of tropical beverages (TropBevIx) and agricultural raw materials (AgriRawIx). The correlations are high at 77.5% and 75.4% respectively, suggesting that price increases in global commodity prices may be also driven by China's absolute and relative expansion of its industrial sector relative to GDP, which ranged between 44.8% and 47.95% from 1996 to 2008 relative to a growing Chinese GDP.

5.2.4 Manufacturing Value Added to GDP

Table 5.4: Manufacturing Value Added to GDP

Variable 8	**ManuValAdd_GDP** Brazil			**ManuValAdd_GDP** China		
Independents	Corr %	Granger	Regr. Sig	Corr %	Granger	Regr. Sig
FoodIx	-	-	-	59.3*	-	-
TropBevIx	-	-	-	58.8*	Inverse	-
AgriRawIx	-	-	-	65.8*	Inverse	-
WGIRQ	-	-	-	77.1*	-	-

Source: Calculated and arranged by the author.

BRAZIL: ManuValAdd_GDP shows no meaningful correlation or causality to any of the independent variables.

Rationale: ManuValAdd_GDP was at 16.8% in 1996, declining to 15.3% in 2008. Brazil's manufacturing sector was shrinking during the analysis period, supporting the argument that the commodity export sector is growing at the expense of Brazil's manufacturing base as described in Chapter 2.

CHINA: ManuValAdd_GDP was almost twice the size of Brazil's metric and stood at 33.5% in 1996 and 33.9% in 2008. The lowest point during this period was at

31.4% in 2002. There exists a moderate but significant (sig. 0.05) correlation between the dependent variable and commodity price indexes such as FoodIx, TropBevIx and AgriRawIx, suggesting that the increasing metric may affect the increase in TropBevIx, and AgriRawIx (inverse Granger causality). Also, WGIRQ shows high correlation with ManuValAdd_GDP, suggesting that improving regulatory quality plays a favorable role for the manufacturing sector.

Rationale: Similarly to the rational regarding industry value added to GDP, the rise in manufacturing added value to GDP represents a pull effect on prices for agricultural raw materials and tropical beverages judging by significant correlation in context of inverse Granger causality. Even though the ratio remains relatively stable around the 32% and 33% mark between 1996 and 2003, its absolute impact in contrast rises due to the significantly growing denominator (GDP) from USD872 billion in 1996 to USD2.69 trillion in 2008 (constant USD), inherently increasing demand for commodities.

5.2.5 Gross Fixed Capital Formation to GDP

Table 5.5: Gross Fixed Capital Formation to GDP

Variable 23	**GrossFixCapForm_GDP** Brazil			**GrossFixCapForm_GDP** China		
Independents	Corr %	Granger	Regr. Sig	Corr %	Granger	Regr. Sig
FoodIx	70.4*	Causal	Yes: R^2 .36	-	-	-
TropBevIx	63.2*	-	-	-	-	-
VegOilSeedsIx	61.3*	-	-	-	-	-
AgriRawIx	56.4*	Causal	Yes: R^2 .36	56.6*	Inverse	-
MinMetalsIx	-	-	-	67.3*	Inverse	-
CrudeIx	-	-	-	75.6**	-	-
EFITrade	-	-	-	88.3*	Inverse	-

Source: Calculated and arranged by the author.

BRAZIL: GrossFixCapForm_GDP shows moderate correlation at the 95% confidence level with all soft commodity price indexes except with FoodIx, which correlates highly at 70.4%, and except MinMetalsIx and CrudeIx for which there appears to be no correlation. AgriRawIx and FoodIx —combined to BMca2FdAg— appear to Granger cause GrossFixCapForm_GDP. The multi regression results unveil a low adjusted R^2 of 36.5%, suggesting that a move of the dependent variable (criterion variable) is impacted by only 36.5% by the move of Bmca2FdAG, the new principal component independent variable (predictor variable) combining food and agricultural raw material price indexes.

Rationale: Gross fix capital formation to GDP developed relatively sluggishly from 16.9% to 18.3% between 1996 and 2008. From 2001 to 2003, GrossFixCapForm_GDP declined even from 17% to 15.3% driven by supply side shortcomings which resulted in a relatively low capacity utilization ratio of Brazil's industrial sector. Gross fix capital formation growth rate was at -0.34% in 1998 and -0.82% in 1999, then at -5.23% in 2002 and -4.59% in 2003. The problem of capacity utilization gaps has not been addressed by the Lula administration's first and second term. The improving capacity utilization in Brazil and the subsequently rising gross fixed capital formation from 15.3% in 2003 to 18.3% in 2008 was primarily a result of a buoyant global economy and accelerating global demand for commodities. It was not so much attributable to the initially weak domestic GDP growth rate of 1.15% in 2003 which then gradually improved to 3.16% in 2005 and 5.14% in 2008. Baer (2008, p. 157) notes that even though gross fixed capital formation improved after 2003, a significant portion of the growth in gross fixed capital formation has been due to a significant increase in capital goods prices in heavy industries due to the buoyant global economy. Therefore, the low correlation of TropBevIx and VegOilSeedsIx in addition to a low adjusted R^2 for FoodIx and AgriRawIx suggests that the explanatory power of the predictor variables is weak in explaining the rise of gross fixed capital formation to GDP in Brazil between 1996 and 2008.

CHINA: The Granger causalities of China's GrossFixCapForm_GDP are of inverse nature to agricultural raw materials prices, minerals and metals prices, and EFITrade. The increase in gross fixed capital formation to GDP from 33.8% in 1996 to 40.2% in 2008 is causing AgriRawIx, MinMetalsIx, and EFITrade. There is no indication of inverse causality to CrudeIx, which highly correlates with the dependent variable (sig. 0.01).

Rationale: These results are not surprising considering China's large infrastructure investments in the transport sector, telecom sector, and energy sector which were at 2% of GDP in 1991, then increased to over 8% of GDP in 2004 and reached as high as almost 9% of GDP in 2008 (Naughton, 2007, pp. 446). In comparison, Brazil spent only 1% of its GDP on infrastructure improvements, potentially undermining ongoing economic expansion.[85] China's expanding infrastructure investments in transport (e.g., ports, airports, and road network), telecommunication, industry parks, and utility grids carries immense demand for related commodities (especially base metals), causing rising commodity prices in specific commodities sub-segments. This empirical observation is supported by statistical evidence such as inverse Granger causality to MinMetalsIx and AgriRawIx, indicating that as a result of China's expanding economy, e.g., expanding GrossFixCapForm_GDP, demand in these commodities rose, affecting respective prices accordingly (Table 2.9: Import Structure China 1995-2009). This rationale also applies for CrudeIx in context of China's rising share of global fuel imports from 1.6% to 6.7% between 1995 and 2009 (Table 2.9: Import Structure China 1995-2009), which is also due to the increasing fixed capital formation base during the same period. China's share of fuel imports to total merchandise imports rose from 4.97% to 16.25% between 1996 and 2008, thereafter dropping to 13.4% in 2009 due to the global financial crisis.

GrossFixCapForm_GDP not only correlates high at 88.3% (sig. 0.05) with EFITrade, it also causes (inverse Granger causality) EFITrade (trade governance) which improved dramatically from 30.0 to 71.4 index points between 1996 and 2008. This suggests that China's growing demand in commodities influenced trade governance to the better in order to facilitate access to commodity rich regions outside of China. Statistical evidence such as high correlation and inverse Granger causality of gross fixed capital formation to GDP with trade governance supports empirical observations which suggest that trade governance is a passive agent in the context of (i) increasing import volumes between 1996 and 2008, and (ii) China's admission into the WTO in December 2001, which was subject to improving trade governance provisions imposed on China (e.g., reducing trade tariffs and non-tariff-barriers).

Also, it is worth to mention that China's terms of trade (Variable 42) deteriorated from 105.9 index points in 1996 to 73.9 index points in 2008, correlating moderately and highly negative with all commodity price indexes except for TropBevIx. This suggests that China's economic expansion, reflected by expanding GrossFixCapForm_GDP between 1996 and 2008, has a positive effect on commodity

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[85] In comparison, investments in infrastructure of developed economies can reach up to 2% to GDP p.a. (Naughton, 2007, pp. 446ff).

prices, which in turn negatively impact China’s terms of trade due to China’s massive imports of commodities on an absolute and relative basis as illustrated in Chapter 2.

5.2.6 Trade Variables

Table 5.6.1: Trade to GDP

Variable 25	**Trade_GDP** Brazil			**Trade_GDP** China		
Independents	Corr %	Granger	Regr. Sig	Corr %	Granger	Regr. Sig
AgriRawIx	-	-	-	59.8*	Causal/Iv	No
MinMetalsIx	-	-	-	73.7**	Causal/Iv	Yes: R^2 .62
CrudeIx	57.2*	-	-	79.4**	Causal	Yes: R^2 .62
WGIVA	77.2**	Inverse	-	-	-	-
WGIPS	64.6*	Causal	Yes: R^2 .36	-	-	-
WGIGE	75.0**	-	-	-	-	-
WGICC	-	-	-	-89.7**	-	-
EFITrade	68.1*	Inverse	-	91.1**	Inverse	-
EFICorrup	61.9*	-	-	-	-	-

Source: Tables 5.6.1 - 5.6.3 calculated and arranged by the author.

Table 5.6.2: Exports of Goods and Services to GDP

Variable 27	**ExpGS_GDP** Brazil			**ExpGS_GDP** China		
Independents	Corr %	Granger	Regr. Sig	Corr %	Granger	Regr. Sig
AgriRawIx	-	-	-	66.3*	Causal/Iv	No
MinMetalsIx	-	-	-	80.6**	Causal/Iv	Yes: R^2 .71
CrudeIx	56.0*	-	-	84.1**	Causal	Yes: R^2 .71
WGIVA	82.3*	Inverse	-	-	-	-
WGIPS	56.2*	Causal	No	-	-	-
WGIGE	71.2*	Causal	No	-	-	-
WGICC	-	-	-	-87.9**	-	-
EFITrade	72.8*	Inverse	-	92.9**	Inverse	No
EFICorrup	56.9*	Causal	No	-	-	-

Table 5.6.3: Imports of Goods and Services to GDP

Variable 31	**ImpGS_GDP** Brazil			**ImpGS_GDP** China		
Independents	Corr %	Granger	Regr. Sig	Corr %	Granger	Regr. Sig
MinMetalsIx	-	-	-	63.5*	Causal/Iv	Yes: R^2 .42
CrudeIx	-	-	-	71.8**	Causal	Yes: R^2 .42
WGIVA	56.7*	Inverse	-	-	-	-
WGIPS	73.7**	-	-	-	-	-
WGIGE	73.1**	-	-	-	-	-
WGICC	-	-	-	-89.9**	-	-
EFITrade	-	-	-	86.8**	Inverse	-
EFIGovtS	-	-	-	-89.5**	-	-
EFIMon	66.9*	-	-	-	-	-
EFICorrup	64.1*	-	-	-	-	-

In this section trade variables are represented by Trade_GDP (Variable 25), ExpGS_GDP (Variable 27), and ImpGS_gr (Variable 31). Change rates of exports and imports (Exp_gr, Imp_gr) do not show any significant statistics for Brazil or China.

However, trade to GDP and exports of goods and services to GDP display some statistical similarities for both Brazil and China. Therefore I will mainly elaborate on Trade_GDP, which will serve as proxy argumentation for exports of goods and services to GDP for both Brazil and China. Imports to GDP will be discussed separately due to the fact that the statistical results and the empirical findings differ by nature in comparison to exports of goods and services to GDP.

BRAZIL: Trade governance measured by EFITrade improved significantly for Brazil, rising from 57.0 to 71.6 index points between 1996 and 2008. In the same period, trade to GDP rose from 14.9% to 27.4%, correlating at 68.1% and (inversely) causing EFITrade. Remarkably, trade to GDP correlates highly positive with the degree of democracy (WGIVA) and even Granger causing the degree of democracy of Brazil. Also, the correlation to WGIGE is highly positive at 75%. Furthermore, increasing trade to GDP correlates with political stability (WGIPS) and freedom of corruption (EFICorrup), while the correlation to crude is surprisingly low at 57.2%. The regression results reveal that WGIPS is Granger causing Trade_GDP, but goodness of fit measured by adjusted R^2 is low at 0.36, including a low explanatory power value of 2.8 for the t-variable.

The statistical results for ExpGS_GDP, which grew from 6.6% to 13.8% between 1996 and 2008, are similar to those of trade to GDP while the correlation coefficients and the adjusted R^2 ratio are slightly less pronounced at the example of exports of goods and services to GDP compared to trade to GDP.

Imports of goods and services to GDP, which rose from 8.4% to 13.6% between 1996 and 2008, reveal positive correlations with WGIVA, WGIPS and WGIGE (both high correlation, sig. 0.01), EFIMon, and with EFICorrup, but —remarkably— not with EFITrade.

Rationale: The external sector has historically been a key sector for Brazil’s economy. Trade policies were a central tool used by Brazilian governments since the 1950s, which gained even more importance in the 1970s for the support of Brazil’s growing export base. State export taxes were eliminated and administrative procedures for exporters reduced and simplified on an ongoing basis since the mid-1950s, and export incentives such as subsidized credits were installed (albeit then eliminated in the mid-1980s).

It is therefore conclusive to observe that statistically growing Trade_GDP leads trade policy development (EFITrade), judging by the moderately positive correlation of 68.1% (sig. p-value 0.05) and the significant inverse Granger causality (Granger 1 sig. 0.0032, Granger 2 sig. 0.5735). Brazil's growing external sector, specifically between 1996 and 2008, had a profound effect on shaping and improving trade policies. Between 1996 and 2001 Brazil's external balance (Variable 29: ExpGS_GDP) was negative, ranging between -1.32% and -2.2%, as a result of trade liberalization following the implementation of the Real Plan, which subsequently led to an appreciation of the Real and eventually to rising import shares relative to export shares to GDP. The turnaround of the negative external balance of goods and services to GDP (Variable 29: ExpGS_GDP) in 2002 was attributable to the Real devaluation which took place three years earlier in conjunction with occasional import restrictions and a generally low GDP growth rate from 2001 to 2003, all of which encouraged exports in commodities and reduced imports.

The statistical analysis validates the empirical observations and importance of trade governance to trade variables. Trade_GDP —similar to ExpGS_GDP— correlates positively with CrudeIx, WGIVA, WGIPS, WGIGE, and —as discussed— with EFITrade. The multi regression analysis of Trade_GDP reveals significant causal associations to WGIPS only though. However, as mentioned, adjusted R^2 is low at 0.36. That is, the predictor variable WGIPS (political stability) explains by only 36% the variance of Trade_GDP. The explanatory power of this regression model is therefore rather low.

It is remarkable that there exists Granger causality from trade to GDP to the degree of democracy (WGIVA) which improved from 0.183 index points to 0.48 index points between 1996 and 2008, suggesting that the improving degree of democracy is caused by improving trade openness measured by the rising trade to GDP from 14.9% to 27.4%. And expressed in terms of imports and exports to GDP: Imports to GDP grew from 8.3% to 13.6%, while exports to GDP rose from 6.6% to 13.8%. This supports the hypothesis that for Brazil improving degrees of democracy are supported by trade openness, specifically by exports of goods and services.

On the import side I note that Imp_GDP (Variable 31) shows fewer and less pronounced statistical flags with independent variables than ExpGS_GDP or Trade_GDP show. Imp_GDP shows moderate to high correlations to improving indexes of WGIVA, WGIPS, WGIGE, EFIMon, and EFICorrup, but surprisingly not to EFITrade. It is, however, revealing that rising imports to GDP —similarly to exports to GDP— Granger cause the degree of democracy (WGIVA) in Brazil, underscoring the above argument that trade openness positively influences the degree of democracy.

CHINA: In contrast to Brazil's moderate trade to GDP ratio, China's trade to GDP ratio (Trade_GDP) grew from 38.1% to 62.1% between 1996 and 2008. China's trade to GDP ratio was more than twice the size of Brazil's in 2008.

It is remarkable that the Chinese Trade_GDP and ExpGS_GDP is only Granger caused by commodity prices and not by any governance dimension. Based on the statistical analysis, Trade_GDP is inversely Granger causing trade governance. The same applies to ExpGS_GDP which also Granger causes trade governance (correlation: 92.9% (sig. 0.01)). Also, AgriRawIx and MinMetalsIx show feedback causalities with Trade_GDP and ExpGS_GDP. The regression results of exports of goods and services to GDP and trade to GDP are solid, displaying an adjusted R^2 of 0.71 and 0.62, respectively. The corresponding t-values are 3.62 and 3.17 respectively. The adjusted R^2 for trade to GDP is lower than the adjusted R^2 for exports of goods and services to GDP due to a larger dispersion of Chinese imports to GDP (which are included in trade to GDP) compared to Chinese exports of goods and services to GDP between 1996 and 2008.

Imports of goods and services to GDP (Variable 31) rose from 18.0% to 27.2% between 1996 and 2008 and are Granger caused by crude and base metals, correlating moderately at 63.5% with minerals and metals prices (MinMetalsIx) and correlating highly at 71.8% with crude prices (CrudeIx). Also, the regression results are highly significant (p-value: 0.01), too, yet the goodness of fit is relatively weak considering the adjusted R^2 of 0.4187 (PCA combined t-value for minerals and metals and crude is 3.11). Also remarkable is the following: In comparison to Brazil, Chinese ImpGS_GDP inversely Granger causes EFITrade, correlating at 86.8% (sig. 0.01). It is also noteworthy to observe a high correlation of -89.5% between imports and government size (EFIGovtS) and a high correlation of -89.9% between imports and control of corruption (WGICC), which deteriorated from -0.20 to -0.46 between 1996 and 2008.

Rationale: Similarly to Brazil, trade governance has been the centerpiece of economic policy in China in the context of its gradual transition to a market economy.

By the end of the 1970s, China established Special Economic Zones (SEZ) as main trading hubs —resembling the economic framework of treaty ports in China set up by Britain in the mid-1850s. SEZ imports were tax free as long as the imports were used to produce goods for exports.

By the end of the 1970s, two SEZs had been established in Guangdong as well as one each in Fujian, and Shenzen (1992).[86] The proximity of Guangdong to Hong Kong transformed Guangdong into one of China's export powerhouses. In the context of newly created SEZ's, the central government allowed the establishment of foreign trade companies, which facilitated trade between foreign firms and treaty ports. Local governments and the SEZs itself were allowed to create foreign trading companies (FTC). By 1990 there were approximately 5,000 foreign trading companies residing in China's SEZs; all were state owned. The picture has changed by the end of 2005 when a significant part of foreign trading companies were privately held. Foreign trading companies were instrumental in seeking the most price competitive suppliers and producers, which were often TVEs.

The SEZs often served as laboratories for experimental reforms, which were applied slowly and gradually to record results and effects. Once a reform proved to be successful, it would be gradually applied on a nationwide level. Critiques state that SEZ's were often considered to foster corruption and illegal trade activities. Statistically this is reflected by the very high and significant (sig. 0.01) negative correlations of -89.7%, -87.9%, and -89.9% between Trade_GDP, ExpGS_GDP, and ImpGS_GDP and the WGICC corruption index.

The key trade regions in China are along the shorelines of the South East, the Far South and the North Coast. As of 2005 the lower Yangtze area, the Far South, and the North Coast contributed about 38%, 36% and 18% to Chinas total exports, with only 8% remaining for the rest of China (Naughton, 2007, p. 396). Guangdong and the lower Yangtze region have very high agriculture and base metals related trade to GDP ratios of 175% and 90%, resembling those of Malaysia and reaching the average of East Asia. The rest of China has a much lower trade to GDP ratio of approximately 25%, resembling the ratio of Brazil in 2008. As discussed above, statistical findings validate the importance of trade governance for China's economy. The causality analysis

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[86] The involvement and lobbyism of local officials were key elements in the establishment of SEZs, particularly at the example of Guangdong in 1978.

revealed that China's trade to GDP is Granger caused by AgriRawIx, MinMetalsIx, and CrudeIx. The correlation is relatively high and at confidence levels of 99% in case of MinMetalsIx and CrudeIx. The regression analysis confirms the significant effect of CrudeIx and MinMetalsIx on Trade_GDP, showing an adjusted R^2 of 62%.

The regression analysis results combined with the relatively strong adjusted R^2 lend credence to the argument that Trade_GDP is to a larger extent affected by ExpGS_GDP than by ImpGS_GDP in regards to MinMetalsIx. As shown in Chapter 2 and Chapter 3 (Tables 3.3a and 3.3b), exports of goods and services to GDP (ExpGS_GDP) grew from 20.1% to 34.9% between 1996 and 2008, representing a larger share in China's Trade_GDP than imports of goods and services (ImpGS_GDP).[87] Imports of goods and services to GDP grew from 18.0% to 27.2% in the same period.

The regression and empirical analysis reveals that ImpGS_GDP is significantly affected by prices of minerals and metals and crude, which are combined into CMca1MetOil in the principal component analysis. The adjusted R^2 is low at 0.42 though. The analysis of ImpGS_GDP for China also reveals a very high correlation of 86.8% with improved trade governance, which in turn is caused by ImpGS_GDP. In comparison, Brazil imports show no relationship to trade governance. The regression analysis for ExpGS_GDP on the other hand reveals that CMca1MetOil significantly affects ExpGS_GDP displaying an adjusted R^2 of 0.71. That is, 71% is the portion in the variance of ExpGS_GDP which can be explained by CMca1MetOil.

Overall, considering the causality convention in this thesis, I observe that the significant regression results on commodity prices Granger causing trade to GDP and export of goods and services to GDP are supported by empirical data. Higher commodity prices cause larger export and import values relative to GDP. Without improved trade governance, China's trade profile would look differently today in size and shape, with possible lower effects on global commodity prices as result of lower commodity related trade activities with its top trade partners. Also, feedback causalities express that the WTO-imposed Chinese trade openness paved the way for immense Chinese external demand for energy and agricultural commodities, as well as base metals and ores, which are pivotal factors for the expansion of the Chinese capital formation and manufacturing base (e.g., infrastructure in energy, telecommunication,

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[87] Imports of goods and services (ImpGS_GDP) and exports of goods and services to GDP (ExpGS_GDP) combined equal trade to GDP (Trade_GDP).

and industrial parks). Rising trade to GDP causes the rise of global commodity prices, especially those of base metals, and energy. This is empirically and statistically validated, despite the significant regression results above. That is, the inverse causality from trade variables to commodity prices is empirically and statistically significant.

5.2.7 Manufacturing Trade Variables

(1) Manufacturing Exports to Merchandise Exports

Table 5.7.1: Manufacturing Exports to Merchandise Exports

Variable 50	**ManufExp_MrchExp** Brazil			**ManufExp_MrchExp** China		
Independents	Corr %	Granger	Regr. Sig	Corr %	Granger	Regr. Sig
FoodIx	-84.1**	-	-	-	-	-
TropBevIx	-50.2	-	-	-	-	-
VegOilSeedsIx	-85.4**	-	-	-	-	-
AgriRawIx	-85.8**	-	-	-	-	-
MinMetalsIx	-84.2**	-	-	71.8**	Inverse	-
CrudeIx	-83.9**	-	-	80.6**	-	-
WGIRQ	67.7*	Causal	No	-	-	-
EFIBiz	70.3**	Causal	No	-	-	-
EFITrade	-75.3**	-	-	96.7**	Inverse	-
EFIFisc	79.3**	Causal	No	-56.3*	-	-
EFIGovtS	74.2**	-	-	-86.2**	-	-
EFICorrup	-	-	-	77.3**	-	-

Source: Calculated and arranged by the author.

BRAZIL: All commodity price indexes correlate highly negatively (except TropBevIx: moderately negative) between -83.9% and -85.8% with manufactured exports to total merchandise exports (Variable 50). Despite improving trade governance, exports of manufactured products to total merchandise exports declined from 53.8% in 1996 to 44.9% in 2008. Furthermore, there exists a Granger causal relationship from deteriorating business freedom (EFIBiz), deteriorating regulatory quality (WGIRQ), deteriorating fiscal governance (EFIFisc), and deteriorating government size (EFIGovtS) to declining exports of manufactured products to merchandise exports between 1996 and 2008.

Rationale: As already indicated in Chapter 2, key export products of Brazil are commodities. Commodity exports rise at the expense of exports of manufactured products, judging by the declining trend of exported manufactured products to exports from 53.8% to 44.9% between 1996 and 2008 (negative correlation). This relationship is also illustrated by the highly negative (sig. 0.01) correlation between falling

ManufExp_MrchExp and rising commodity price indexes. The rise of commodity exports at the expense of manufacturing exports may potentially lead to the Dutch Disease risk, induced by neglecting the domestic manufacturing base while favoring commodity related export sectors, as discussed in Chapter 2. Table 2.6 (Export Structure Brazil) in Chapter 2 illustrates that Brazil's export of manufactured goods to total exports declined from 52.8% to 44.9% between 1995 and 2008, then dropped to 38.2% in 2009. In contrast, export shares for fuels rose from 0.9% to 8.9% between 1995 and 2009, while ores and metals exports rose from 11.3% to 13.4% and food exports rose from 28.5% to 33.9%.

This empirical observation is supported by significant statistical results such as negative correlations between ManufExp_MrchExp and all commodity price indexes (except TropBevIx (correlating moderately negative)), and positive correlations of ManufExp_MrchExp with deteriorating government size governance (EFIGovtS), deteriorating regulatory quality (WGIRQ), deteriorating business governance (EFIBiz), and deteriorating fiscal freedom (EFIFisc); WGIRQ, EFIBiz, and EFIFisc Granger cause the decline of ManufExp_MrchExp. Furthermore, despite improving trade governance, exports in manufactured products to merchandise exports correlate negatively at -75.3% with trade governance. All these correlation coefficients are significant at the 0.01 level (except WGIRQ sig. 0.05, and TropBevIx sig. >0.05). However, —surprisingly— none of these relationships are regression significant at the confidence level of 95%.

CHINA: In comparison to Brazil, China's ManufExp_MrchExp (Variable 50) grew from 84.4% in 1996 to 92.9% in 2008, more than twice that of Brazil in 2008. There are significant positive correlations between ManufExp_MrchExp and MinMetalsIx (71.8%), CrudeIx (80.6%), and EFITrade (96.7%). Remarkably, ManufExp_MrchExp (inversely) Granger causes EFITrade and MinMetalsIx. The Granger 1 (Granger 2) test result for CrudeIx and ManufExp_MrchExp is at 0.055 (0.8851) and slightly above the 0.05 threshold.

Rationale: China's export model is validated by the strong correlation association and inverse causality between ManufExp_MrchExp and trade governance. Also, the correlation and the inverse Granger causality to MinMetalsIx and CrudeIx suggest a strong pull effect on commodity prices as a result of China's expanding manufacturing base which relies on input factors such as oil and base metals. The inverse Granger causality on MinMetalsIx supports this hypothesis. The Granger causality results for CrudeIx have borderline character due to the Granger 1 (Granger 2) test result of 0.055 (0.8851). The statistical findings are conclusive with empirical findings.

It is revealing that China’s high tech exports to manufacturing exports (Variable 45: HiTekExp_ManuExp) and information/technology/communication exports to total exports (Variable 46: ICTExp_TTExp) show very high correlations of 93.2% (sig. 0.01) and 90.4% (sig. 0.01) with trade governance (EFITrade). HiTekExp_ManuExp and ICTExp_TTExp grew from 12% to 28.7% and from 12.3% to 27.5% between 1996 and 2008, respectively. The inverse causality running from Variables 45 and 46 to EFITrade indicates that the rise of Variables 45 and 46 affect improving trade governance. This observation validates China’s aggressive promotion strategies supporting the gradual export of high technology products made by Chinese companies. These promotion strategies include tax breaks for research and development (R&D) as well as imports of high tech products, subsidized credits, and procurement subsidies from government owned firms. In comparison, for Brazil there exists no significant correlation of trade governance with high technology exports to total merchandise exports.

The rapid growth of high technology exports, which are part of overall merchandise exports, highly correlate with China’s rising research and development capacity in the private enterprise sector. High tech products in China are part of an integrated international assembly line for companies such as Quanta (Taiwan), Motorola (US), IBM (US), Dell (US), BenQ (Taiwan), Intel (US), and Seagate (US).[88] Gradually, China shifted its competence from an assembly line focused export strategy to a high technology focused export strategy. Policy makers support and specifically emphasize research and development activities in China, which is manifested by the impressive number of engineering and technical graduates, which stood at 920,000 in 2004, since then growing by 6.5% each year. Also, research and development expenditures signal a strong private sector involvement. In 2003, 63% of research and development expenses

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[88] As production capacity moved into industry clusters to mainland China, especially from Hong Kong and from Taiwan, both Hong Kong and Taiwan de-industrialized from low technology production to the extent that Hong Kong moved up the specialization ladder providing for higher skilled labor activities. Today, the majority of Hong Kong’s GDP is generated by service industries such as finance and insurance, telecommunication and transport. Taiwan on the other hand moved out of low technology production into a higher degree of high technology manufacturing production.

were shouldered by the private sector which employed 60% of researchers, resembling the ratios of developed economies (Naughton, 2007, pp. 350-362).[89]

(2) Manufacturing Imports to Merchandise Imports

Table 5.7.2: Manufacturing Imports to Merchandise Imports

Variable 34	**ManfImp_MrchImp** Brazil			**ManfImp_MrchImp** China		
Independents	Corr %	Granger	Regr. Sig	Corr %	Granger	Regr. Sig
WGIVA	-62.6*	-	-	57.1*	Inverse	-
WGIPS	-	-	-	64.2*	-	-
WGIRQ	68.7**	Causal	No	-	-	-
EFIBiz	66.0*	Causal	No	-	-	-
EFIFisc	68.8**	Causal	No	-	-	-
EFIGovtS	60.7*	Causal	No	-	-	-
EFIFin	69.2**	Causal	No	-	-	-
EFIPropRi	-	-	-	84.1*	Inverse	-

Source: Calculated and arranged by the author.

BRAZIL: ManufImp_MrchImp increased from 70.0% in 1996 to 75.96% in 2001, thereafter declining gradually to 70.2% in 2008. The dependent variable correlates positively with the following deteriorating governance dimensions: Regulatory quality (WGIRQ), business governance (EFIBiz), fiscal governance (EFIFisc), government size (EFIGovtS), and financial freedom (EFIFin). The dependent variable correlates negatively with WGIVA. There are no significant regression results.

Rationale: All positively correlating governance indexes Granger cause the dependent variable.[90] The significant Granger causality suggests that there exist plausible and valid associations between the declining dependent variable since 2001 and the deteriorating governance dimensions above, which is detrimental to the business sector and negatively affecting it.

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[89] In 2004, China's number of graduates stood at six million, half of which graduated in science and engineering, and 25% in each economics and law. However, 50% of these graduates come from 3-year technical schools, which are comparable with community colleges in the US (Naughton, 2007, p. 362). As such the large number of graduates may not be comparable in the context of academic and practical standards compared to peers in Europe or the US. Nonetheless, the ambition of China's policy makers in view of seeding research and development capabilities becomes obvious considering the faculty composition and sheer number of annual Chinese technical graduates.

[90] Due to the relatively strong run up of ManufImp_MrchImp from 69.95% in 1996 to 75.96% in 2001, the declining metrics to 70.2% in 2008 may be also seen as a mean reversion effect judging by the ManufImp_MrchImp 13-year average of 72.2% and the 19-year average of 69.1%.

CHINA: ManufImp_MrchImp declined from 79.1% in 1996 to 61.9% in 2008, after peaking at 79.6% in 2002. ManufImp_MrchImp Granger inversely causes the following deteriorating governance dimensions: WGIVA (democracy index), and EFIPropRi (property rights governance).

Rationale: ManufImp_MrchImp has been relatively volatile during the analysis period of thirteen years with annual changes of 3-6% (in 2000 and 2008), indicating a relative volatile share percentage within the group of merchandise imports. The correlations with WGIVA and WGIPS are moderate only. The statistical validation of any empirical observation is therefore rather weak.

5.2.8 Trade Indexes

The following four variable pairs represent each country's opposite trade variable counterpart. The objective is to illustrate the correlation and causality associations for Brazil and China:

(1) Export value index Brazil is compared with import value index China.

(2) Export volume index Brazil is compared with import volume index China.

(3) Unit value index exports Brazil is compared with unit value index imports China.

(4) Export value index China is compared with export volume index China in order to demonstrate the closely aligned directional results of volume and value correlation, causality, and regression results for China only.

(1) Export Value Index Brazil / Import Value Index China

Table 5.8.1: Export Value Index Brazil / Import Value Index China

Variable 36 / 37	**36 ExpValx** Brazil			**37 ImpValIx** China		
Independents	Corr %	Granger	Regr. Sig	Corr %	Granger	Regr. Sig
FoodIx	83.0**	Inverse	-	76.7**	Causal/Iv	No
VegOilSeedsIx	78.4**	Inverse	-	72.8**	Inverse	-
AgriRawIx	90.0**	Inverse	-	85.7**	Causal/Iv	No
MinMetalsIx	96.3**	Inverse	-	94.1**	Causal/Iv	Yes: R^2 .87
CrudeIx	99.0**	Inverse	-	98.0**	Inverse	-
WGIVA	82.2**	Causal	Yes: R^2 .65	-65.4*	-	-
WGIGE	-	-	-	69.7**	Inverse	-
EFIBiz	-89.5**	-	-	-63.3*	-	-
EFITrade	90.4**	-	-	93.1**	-	-

Source: Calculated and arranged by the author.

BRAZIL: ExpValx, which grew from 86.6 index points to 359.1 index points between 1996 and 2008, is Granger causing all commodity price indexes, showing high/very high significant positive correlations. WGIVA Granger causes ExpValx; the goodness of fit is rather modest as expressed by the adjusted R-square of 0.65 (t-value of 4.78).

Rationale: The statistical findings on trade indexes such as export value index reveal one of the strongest correlation and causality associations in the econometric analysis. As illustrated in Chapter 4 and earlier in Chapter 5, there is a strong statistical indication that commodity related export values of Brazil Granger cause the rise in commodity prices, especially when exports are China-related. The increasing export value index due to rising commodity exports of food, vegetables oils and seeds, agricultural raw materials, and minerals and metals is mainly driven by China's expansion. As indicated earlier, there appears to be inverse causality from Trade_GDP to WGIVA. It is therefore remarkable to observe that now WGIVA appears to Granger cause ExpValx. The regression results are significant for Brazil's democracy governance (WGIVA), however, the adjusted R^2 is rather low. I note that there exist significant statistical relationships between WGIVA and trade indexes, and trade related variables such as Trade_GDP and ExpGS_GDP.

CHINA: The regression results for the import value index (ImpValIx) are significant for MinMetalsIx: The adjusted R^2 is at 0.87 and significant, and the t-value is at 4.52. Furthermore, all commodity price indexes reveal feedback causality to ImpValIx. The correlation is highly significant at p-values below 0.01. EFITrade correlates very high at 93.1% (sig. 0.01).

Rationale: These results summarize the findings of the previous sections. Namely, China's improved trade openness and trade governance is reflected by the increased ImpValIx which rose from 61.7 to 502.7 index points between 1996 and 2008 and appears to lead (inversely Granger cause) all commodity price indexes. China's global import share in virtually all main commodity groups increased between 1996 and 2008, as illustrated in Table 2.9 (Import Structure China). Even though there are feedback causality effects, there are clear empirical indications that ImpValIx Granger causes commodity price indexes. This has been statistically validated by Granger causality significance. Rising commodity prices in turn affect import values. This association is reflected by the adjusted R^2 of 0.87 on MinMetalsIx.

(2) Export Volume Index Brazil / Import Volume Index China

Table 5.8.2: Export Volume Index Brazil / Import Volume Index China

Variable 38 / 39	38 ExpVolx Brazil			39 ImpVolIx China		
Independents	Corr %	Granger	Regr. Sig	Corr %	Granger	Regr. Sig
FoodIx	-	-	-	64.4**	Causal/Iv	No
VegOilSeedsIx	-	-	-	61.3**	Causal/Iv	No
AgriRawIx	68.5**	Causal/Iv	No	76.5**	Causal/Iv	-
MinMetalsIx	82.7**	Causal/Iv	Yes: R^2 .92	88.2**	Causal/Iv	Yes: R^2 .77
CrudeIx	88.8**	Causal	Yes: R^2 .92	93.2**	Inverse	-
WGIVA	92.4**	Causal	Yes: R^2 .92	-62.8*	-	-
WGIGE	-	-	-	66.0**	Inverse	-
EFITrade	94.5**	Inverse	-	95.8**	Inverse	-

Source: Calculated and arranged by the author.

BRAZIL: The adjusted R^2 is high at 0.92 for ExpVolx in relation to the explanatory variables MinMetalsIx, CrudeIx, and WGIVA. The goodness of fit is strong. Also, the t-values for PCA-combined MinMetalsIx and CrudeIx, and WGIVA are fairly high at 3.11 and 4.03, suggesting high reliability of the predictive power of both independent variables. Brazil's export volume inversely Granger causes agricultural raw material prices and minerals and metals prices.

Rationale: The Brazilian export volume index (ExpVolx) grew from 74.1 to 190.5 index points between 1996 and 2008. The majority of agricultural raw materials and minerals and metals exports went to China, which has been Brazil's top trading partner since 2009 (Table 2.10: Top 10 export Trading Partners Brazil). For agricultural raw material prices and minerals and metals prices Granger causality directions go both ways (feedback causality); p-values for Granger 1 and Granger 2 are below 0.05. The causality acknowledges foremost the effects of commodity prices to ExpVolx. Trade governance shows a very high and significant correlation to ExpVolx, which causes trade governance.

CHINA: The adjusted R^2 for China's ImpVolIx is 0.77 (MinMetalsIx only), and the t-value stands at 4.26, indicating a strong model fit. Similarly to Variable 37 (ImpValIx), Chinese ImpVolIx rose dramatically, from 61.07 to 328.6 index points between 1996 and 2008. The causality results also indicate feedback effects on all commodity prices, as well as on WGIGE and EFITrade. The correlation coefficients range between moderate and very high at 0.01 significance levels.

Rationale: The rising import volumes between 1996 and 2008 lead all commodity price indexes. These results are congruent with China's import value index (Variable 37: ImpValIx). It is remarkable that the regression analysis yields results for MinMetalsIx on both dependent variables, ImpVolIx and ImpValIx. This indicates that the prices of minerals and metals are a very large factor in affecting value and volume of Chinese imports. Trade governance is caused by ImpVolIx and correlates very highly at high significance levels with ImpVolIx, highlighting the key role of trade governance for China's economy.

(3) Unit Value Index Exports Brazil / Unit Value Index Imports China

Table 5.8.3: Unit Value Index Exports Brazil / Unit Value Index Imports China

Variable 40 / 41	**40 UnitValIxExp** Brazil			**41 UnitValIxImp** China		
Independents	Corr %	Granger	Regr. Sig	Corr %	Granger	Regr. Sig
FoodIx	98.3**	-	-	89.8**	Inverse	-
TropBevIx	76.2**	Causal/Iv	Yes: R^2 .97	-	-	-
VegOilSeedsIx	92.8**	Inverse	-	83.0**	Inverse	-
AgriRawIx	97.2**	Causal	Yes: R^2 .97	94.6**	Inverse	-
MinMetalsIx	91.2**	Causal	Yes: R^2 .97	96.5**	Inverse	-
CrudeIx	88.2**	Causal	Yes: R^2 .97	98.7**	-	-
WGIGE	-	-	-	70.6*	Inverse	-
EFIBiz	-77.4*	-	-	-59.3*	-	-
EFITrade	68.3*	Causal	No	82.2**	-	-

Source: Calculated and arranged by the author.

BRAZIL: The rise of all commodity prices is regression significant for UnitValExpIx. The adjusted R^2 is very high at 0.9651, and the t-values for BMca3BevAg (PCA variable: TropBevIx & AgriRawIx) and BMca1MetOil (PCA variable: MinMetalsIx & CrudeIx) of 6.14 and 4.05 suggest strong explanatory power.

Rationale: The regression results summarize the effects on Variable 36 (ExpValx) and Variable 38 (ExpVolx), as discussed earlier in 5.2.8(1) and 5.2.8(2). The unit value index of exports rose from 117.0 to 188.96 index points between 1996 and 2008 and is Granger caused by the rise of all commodity price indexes (except food and vegetables oils and seeds) as well as trade governance. The adjusted R-square of 0.97 statistically validates the empirical significance of commodity price effects on trade related variables such as UnitValIxExp.

CHINA: All commodity price indexes (except TropBevIx) correlate highly with UnitValIx. Chinese UnitValIxImp Granger causes all commodity prices (except TropBevIx and CrudeIx) at high/very high correlation and very high confidence levels. This underscores and validates the observed global price effects of Chinese commodity imports such as minerals and metals, and food, vegetables oils and seeds, and agricultural raw materials. Also, the correlation with trade governance is high.

Rationale: Generally, the above findings support the claim that Brazil is directly benefiting from increased commodity demand by China, which affects global commodity prices on a broad scale judging by the inverse causality of Chinese UnitValIxImp to commodity prices in context of the relevant empirical data in Chapter 2. This underscores and validates once again that the prices of commodities such as minerals and metals, food prices, vegetables oils and seeds, and agricultural raw materials are affected by Chinese imports of these commodities.

(4) Export Value Index China / Export Volume Index China

Table 5.8.4: Export Value Index China / Export Volume Index China

Variable 36 / 38	**36 ExpValx** China			**38 ExpVolx** China		
Independents	Corr %	Granger	Regr. Sig	Corr %	Granger	Regr. Sig
FoodIx	80.0**	Inverse	-	76.3**	Inverse	-
TropBevIx	-	-	-	-	-	-
VegOilSeedsIx	76.2**	Inverse	-	72.4**	Causal	Yes: R^2 .99
AgriRawIx	87.9**	Inverse	-	85.4**	Inverse	-
MinMetalsIx	96.2**	Causal	Yes: R^2 .97	95.3**	Causal	Yes: R^2 .99
CrudeIx	98.6**	Inverse	-	97.8**	Inverse	-
WGIGE	70.6**	Inverse	-	69.8**	Inverse	-
EFITrade	91.4**	Causal	Yes: R^2 .97	93.3**	Causal	Yes: R^2 .99

Source: Calculated and arranged by the author.

CHINA: The regression results reveal a strong goodness of fit. The adjusted R-square is 0.97 for ExpValx. The t-values for MinMetalsIx and EFITrade of 7.87 and 4.76 are high. The regression results for ExpVolx also reveal a strong adjusted R^2 of 0.99. The high t-values of 3.73, 4.45, and 10.48 for VegOilSeeds, MinMetalsIx, and for EFITrade suggest a strong explanatory power of the independent variables. Furthermore, the correlation results are significant at the 99% confidence level, showing high/very high correlations across the board with trade governance and all commodity price indexes except with tropical beverages (China produces tea mainly for domestic consumption).

Rationale: The explanatory power of the coefficients of the predictor variables MinMetalsIx and EFITrade is very high for ExpValx. Similarly, for ExpVolx the explanatory power is high for VegOilSeedsIx, MinMetalsIx, and EFITrade. Their t-values are high at 3.73, 4.45, and 10.48. EFITrade's t-value at 10.48 is supporting the key finding that trade governance is one of the dominating governance dimensions in China's governance architecture. The R-square for ExpVolx is very high, almost 1. China's rising ExpValx from 60.6 to 573.3 index points and rising ExpVolx from 56.7 to 507.3 index points between 1996 and 2008 are interlinked with China's growing economic expansion. Empirical observations are supported by statistical significance considering the feedback (both ways) Granger causalities from previous sections. China's improved trade governance from 30.0 to 71.4 index points between 1996 and 2008 furthermore reveals its importance on China's external sector, Granger causing export values and export volumes.

5.2.9 Trade Tariffs

Table 5.9: Weighted Tariffs Brazil / China

Variable 44	**TariffAllweight** Brazil			**TariffAllweight** China		
Independents	Corr %	Granger	Regr. Sig	Corr %	Granger	Regr. Sig
AgriRawIx	-56.2*	Inverse	-	-56.8*	Inverse	-
MinMetalsIx	-71.3**	Inverse	-	-71.8**	Inverse	-
CrudeIx	-81.0**	-	-	-80.1**	-	-
WGIVA	-89.4**	Inverse	-	-	-	-
WGIPS	-	-	-	58.3*	Inverse	-
WGIRQ	83.9**	Inverse	-	-	-	-
WGIRL	79.7**	Inverse	-	56.0*	-	-
WGICC	-	-	-	86.2**	Inverse	-
EFIBiz	73.8**	Inverse	-	63.7*	-	-
EFITrade	-86.7**	Inverse	-	-93.9**	Inverse	-
EFIFisc	67.5*	-	-	61.0*	-	-
EFIGovtS	71.8**	-	-	88.3*	-	-
EFIPropRi	-	-	-	63.0*	-	-
EFICorrup	-	-	-	-67.4*	-	-

Source: Calculated and arranged by the author.

BRAZIL / CHINA: Trade tariffs are an integral instrument of trade governance. The table above shows the effect of weighted tariffs (which correlate very high with simple average tariffs) on commodities and governance dimensions including EFITrade and EFIBiz. The weighted tariffs for both Brazil and China negatively correlate and inversely Granger cause AgriRawIx and MinMetalsIx. CrudeIx correlates negatively with Brazil's TariffAllweight; however, the Granger causality results are insignificant.

Rationale: Lower tariffs in China and Brazil support trade flow and subsequently support pull demand for commodities in China. The EFITrade index, which rose from 57 to 71.6 index points for Brazil and from 30 to 71.4 index points for China in the period between 1996 and 2008, is inversely Granger caused by TariffAllweight. This suggests that changes in tariffs are leading trade governance. It is remarkable that declining tariffs in Brazil inversely Granger cause deteriorating business governance (EFIBiz), which has fallen from 70.0 to 54.4 index points between 1998 and 2008.

Trade governance encompasses various instruments. Tariffs are one of them, and favorable changes in tariffs constitute favorable changes in trade governance. It is therefore coherent that TariffsAllWeight inversely Granger cause trade governance represented by EFITrade. As established earlier, EFITrade significantly correlates with all trade variables and trade indexes of Brazil and China. Even though the regression analysis results are insignificant for EFITrade, the strong correlation of EFITrade with nearly all trade variables and trade indexes suggests that trade governance remains the key policy dimension for Brazil's and China's economic policy tool set.

5.2.10 Foreign Direct Investment

Table 5.10: Foreign Direct Investment

Variable 51	**FDInet_GDP** Brazil			**FDInet_GDP** China		
Independents	Corr %	Granger	Regr. Sig	Corr %	Granger	Regr. Sig
TropBevIx	-	-	-	55.6*	-	-
WGIRQ	-	-	-	68.3*	Causal	Yes: R^2 .41
WGIRL	-	-	-	64.1*	-	-
EFIGovtS	-	-	-	75.8**	-	-
EFIMon	64.1*	Inverse	-	-74.0**	-	-
EFIInvest	-	-	-	79.2**	Inverse	-
EFIFin	-	-	-	79.2**	Inverse	-

Source: Calculated and arranged by the author.

BRAZIL: The correlation with EFIMon is moderate at the significance level of 0.05.

Rationale: FDInet_GDP grew from 1.33% in 1996 to 2.75% in 2008 (peak at 5.08% in 2000) and shows no notable correlation and causality results to any of the independent variables except to monetary policy (EFIMon). Applying neo-liberalization policies in the early 1990s, Brazil attracted large amounts of foreign direct investments as shown in Chapter 2. The inverse Granger causality indicates that EFIMon is caused by FDInet_GDP, which is economically neither plausible nor intuitive. An alternative and more conclusive rationale for the moderate correlation with EFIMon may be the positive effects of the Plano Real and the subsequent positive development of the consumer price index (Variable 58) and inflation (Variable 59) in light of improving monetary policy governance.

CHINA: FDInet_GDP in China declined from 4.7% to 3.3% between 1996 and 2008. Regulatory quality (WGIRQ), which deteriorated from 0.195 to -0.15 during that time span, appears to affect FDINet_GDP.

Rationale: The correlation and causality analysis does not yield plausible results in light of the declining net FDI to GDP ratio from 4.7% to 3.3% during the analysis period. The regression result on regulatory quality is significant but economically inconclusive considering a rather volatile WGIRQ development from 0.195 index points in 1996 to -0.49 in 2002 and to -0.15 in 2008. R-square, the goodness of fit, is low at 0.419.

Trade and FDI are closely linked in China. In comparison to other North East Asian countries, which displayed a net FDI to GDP ratio of 1% to 2% over the last 20 years, China's relative and absolute net FDI is impressive (see also Section 2.5 for illustrations on FDI in China).[91] Specifically the regions of Guangdong, Fujian and lower Yangtze were main recipients of FDI.

The Chinese government began to selectively open its markets for FDI in the early 1990s. Key structural element for rising FDI in China was the development and emergence of industrial clusters in suburban areas. Typical industrial clusters consist of tens if not hundreds of small firms that compete with each other but also cooperate in establishing a complete production line for a small number of large firms within an industry segment. For example, the sock cluster in Zhuji produces approximately 35%

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[91] China's peers such as Thailand and Vietnam recorded similar FDI ratios during the analysis period as a result of their relatively low cost environment.

of the world socks output (Naughton, 2007, p. 293). Townships and village enterprises (TVEs) —from a legacy communist command economy point of view— benefited from an existing institutional and financial support framework, which represented a crucial competitive advantage in the emergence of industry clusters. Many TVEs, which were originally pivotal elements of the rural command industry, developed and transformed into private firms in light of China's transforming economy from a command style to a more market based economy.[92]

China has a relatively favorable FDI climate today. This is constituted by low taxes, investment protection agreements —in theory— , arbitration mechanisms, and adequate legal provision frameworks, which the latter at least exist on paper. Nonetheless, there are severe practical enforcement obstacles and repatriation barriers for cash accounts of foreign subsidiaries and branches of foreign firms. That is, existing investment protection agreements and arbitration mechanisms are still in need of significant improvements. China's FDInet_GDP declined slowly and gradually from 4.7% to 3.3% between 1996 and 2008. However, this decline does not signify a less favorable FDI climate in China, but may instead be explained by the rapid growth rate of GDP relative to FDI during that period.

Based on the fact that the diagnostic tests carried out above do not reveal meaningful Granger causalities on FDInet_GDP, I conclude that neither in the case of China nor Brazil do governance policies or commodity prices affect FDInet_GDP in the analysis period of 1996 to 2008.

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[92] The Asian crisis in 1997-1998 triggered an increasingly prudent lending practice by government owned banks, which in turn was driven by improved government oversight. The result was that banks were more cautious to lend to TVE's, which were less and less backed by local governments due to liquidity constraints in context of the economic transition into a more market based framework. As a result, TVEs were required to seek additional sources of funding, which in many cases led to successful initial public offerings, or, in the worst case, to bankruptcies and subsequent restructuring.

5.2.11 Stocks Traded Total Value to GDP

Table 5.11: Stocks Traded Total Value to GDP

Variable 52	**StoxVal_GDP** Brazil			**StoxVal_GDP** China		
Independents	Corr %	Granger	Regr. Sig	Corr %	Granger	Regr. Sig
FoodIx	87.3**	Causal/Iv	No	60.8*	Inverse	-
TropBevIx	73.2**	-	-	-	-	-
VegOilSeedsIx	88.4**	Inverse	-	66.7*	Inverse	-
AgriRawIx	88.6**	Causal	No	68.6**	-	-
MinMetalsIx	89.6**	Causal/Iv	No	78.7**	Causal	Yes: R^2 .52
CrudeIx	82.7**	Causal	No	69.4**	Causal	Yes: R^2 .52
WGIGE	-	-	-	73.6**	-	-
EFITrade	61.7**	Causal	No	57.5*	-	-

Source: Calculated and arranged by the author.

BRAZIL: The dependent variable's high correlation is significant with all commodity price indexes except with EFITrade, which correlates only moderately with StoxVal_GDP. StoxVal_GDP is Granger caused by trade governance, and by all commodity prices except TropBevIx and VegOilSeedsIx.

Rationale: In the mid-1960s the then government introduced a myriad of institutional settings to encourage the establishment of bond and stock markets as alternate sources for state and private funding, in addition to the promotion of investment banks as intermediaries. Brazil's capital markets have since then improved significantly.

The I-Bovespa (or Bovespa index), Brazil's main composite index, consists of more than 50 constituents (whose exact number varies). Its market capitalization is dominated by more than 50% of energy and minerals and metals stocks, e.g., represented by shares of Petrobras and Vale Do Rio Doce, two of many formerly state owned firms. In addition, the Bovespa index consists of a number of commodity firms which further solidify the percentage share of energy and base metal firms in the index.[93] Therefore, it is plausible that the rise of oil prices, metal prices as well as other commodity prices positively affected the market value of —specifically— stock listed Brazilian commodity firms due to a generally buoyant world economy between 1996 and 2008. This rationale has been validated by the Granger causality analysis, which supports the empirical observation that the rise of the Brazilian Bovespa index is Granger caused by rising commodity prices of food, vegetables oils and seeds,

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[93] Including Braskem and Mineracão e Metálicos SA, among others.

agricultural raw materials, minerals and metals and crude. Similarly, improving trade governance measured by EFITrade appears to also affect Brazil's stock market index to GDP (StoxVal_GDP).

StoxVal_GDP, which rose from 13.4% to 44.4% between 1996 and 2008 correlates highly with all commodity price indexes (sig. 0.01). Commodity prices significantly correlate (sig.: 0.01, 0.05) with World GDP and World GDP per capita, as established in Chapter 3. Therefore, rising global demand in commodities, especially from China, benefited Brazilian stock listed exporters, especially those in the commodity sector, which in turn had a positive impact on Brazil's StoxVal_GDP. Even though the regression analysis results are not significant, highly significant correlation results and highly significant Granger causality results (except for VegOilSeedsIx, which displays inverse Granger causality) provide sufficient statistical support to state that the rise of the I-Bovespa between 1996 and 2008 is caused by rising commodity prices. Similarly, market capitalization of listed firms to GDP rose from 25.8% to 100.3% between 1996 and 2007. The drop to 35.9% at year-end 2008 was due to the global financial crisis.

CHINA: In comparison to Brazil, China's StoxVal_GDP correlates to a much lower degree with commodity price indexes. Nonetheless, the regression analysis' p-value for MinMetalsIx and CrudeIx is significant with an adjusted R^2 however of only 0.52, but with a high t-value of 3.75.

Rationale: At the beginning of 2000, 90% of initial public offerings (IPOs) were associated with SOEs. In the context of the economic transition, focus on trade openness, and additional funding opportunities, the government's policy aimed to convert as many viable SOEs into publicly traded, albeit state controlled firms. Sinopec and Petrochina are prominent examples of successful SOE IPOs.[94] China's main stock index, the Shanghai Composite index SSE which consists of about 50 names, is dominated by state controlled energy conglomerates, base metal firms, as well as soft

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[94] The stock structure of publicly traded, state controlled firms in China can be separated in circulating and non-circulating shares. The government majority is usually represented by classified, non-circulating shares. The establishment of exchanges in Shanghai and Shenzen allowed Chinese investors to acquire circulating A and B shares, the latter being denominated in foreign currency. H shares are traded in Hong Kong and part of the Hang Seng stock index.

commodity companies.[95] Approximately 50% of the SSE index' market capitalization is constituted by oil, energy, and commodity companies. Therefore, a similar correlation and Granger causality rationale applies as is the case with Brazil (despite inverse causality for FoodIx and VegOilseedsIx). China's rising stock indexes are certainly attributable to the fast paced growth of the economy during the last decades. However, rising commodity price indexes played a role in Granger causing China's StoxVal_GDP, which rose from 29.9% to 222.3% between 1996 and 2007. The drop to 120.7% in 2008 was due to the financial crisis.

Compared to Brazil's stock market, China has an on-shore market (Shanghai, Shenzen) and an off-shore market (Hong Kong). Both markets are subject to idiosyncratic features due to double-listing and macroeconomic dependency to China. For example, on-shore stock markets in mainland China are characterized by a relatively small number of circulating shares per issuer and a relatively strong domestic investor demand in light of the absence of international investors. The mainland's stock markets have been relatively closed markets and not commonly accessible for international investors. Also, mainland's stock exchanges are relatively narrow in flow volume. The average price earnings ratios of the indexes at mainland China's stock exchanges are higher compared to the indexes of the off-shore markets in Hong Kong (e.g., Hang Seng index). In addition, low disclosure standards in mainland China, policy driven stock investments by institutional entities and relatively inexperienced domestic asset managers and traders are a source of high daily price volatilities.[96]

At the end of 1996, StoxVal_GDP in China was low at 29.9%, but surging to 222% in 2007, then declining to 120.7% at the end of 2008 due to the global financial crisis. Chinese market capitalization to GDP of companies traded increased from 13.3% in 1996 to 61.6% in 2008, peaking at 177.6% in 2007. In comparison, Brazil's stock value traded to GDP increased only from 13.4% to 44.4% between 1996 and 2008, and its market capitalization to GDP ratio increased from 25.8% in 1996 to 35.9% in 2008, peaking at 100.3% in 2007. In comparison, stock value traded to GDP (StoxVal_GDP) in the United States during the same period increased from 92% to 255% between 1996

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[95] E.g., for energy and metals: Patrician (oil), CNOOC (oil), Sinopec (oil), Chalco (Aluminum), Handan Iron & Steel, Jiangxi Copper, Shanghai Petrochemical, and Wuhan Iron Steel.

[96] The standard deviation of prices and/or of economic measures is often referred to as volatility by market practitioners. Volatility is segregated in different concepts such as observed (past) volatility and implied volatility. In the context of this thesis I utilize the concept of observed volatility in order to refer to standard deviations of indexes and macroeconomic measures (Please see also Appendix 3.15).

and 2008, peaking at 307% in 2007. The United States market capitalization to United States GDP increased from 109% in 1996 to 143% in 2007, dropping to 82% in 2008 due to the global financial crisis.

China's stock market valuation relative to GDP is relatively high compared to Brazil's and also to the US' stock market valuation. This suggests that China's mainland stock markets may be overvalued given their closed nature, relative small flow volume and the absence of alternative investment opportunities for mainland retail investors —excluding real estate— compared to the large scale of investment opportunities for investors in Brazil and the US.[97] Also, in comparison to Hong Kong's Hang Seng index, the SSE's price earnings ratio (P/E) has been higher between 1996 and 2008. Furthermore, stock markets in mainland China are narrow in equity derivatives transactions even though the SSE is larger in size than Brazil's Bovespa.[98]

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[97] Shanghai Stock exchange (SSE) indexes include the SSE 50 index and the SSE 180 index. SSE index shares consist of A shares and B shares as already illustrated in Chapter 3. H shares are traded in the Hong Kong Hang Seng index whose main index contains about 50 shares. The P/E (price to earnings) ratio of the SSE is usually significantly higher than Hang Seng's P/E ratio due to various factors such as limited capital investment opportunities in mainland China for retail investors compared to more viable investment opportunities for investors based in Hong Kong, and rigid foreign exchange and currency expatriation policies in mainland China which deter outflows of the RMB. Also, the mainland China investor base/mix is more retail driven, whereas in Hong Kong the investor base is more institutionally driven. The relatively closed stock markets of mainland China are therefore the primary place for investment participation in capital markets despite the qualified foreign institutional investor and qualified domestic institutional investor scheme introduced by mainland regulators at the beginning of the 2000s. In addition, the number of free float A and B shares at mainland China exchanges is usually much lower than the free float of H shares at the Hang Seng index in Hong Kong. This conclusion is also supported by Seah, Tan, Hsiang (2005, pp. 5-16) who analyzed P/E ratio differences between the SSE index and the Hang Seng index. In conclusion, the P/E ratios of mainland China stock markets have been historically significantly higher compared to the P/E ratios of the Hang Seng index, which is constituted to a large extent by the same firms listed at the SSE or the Shenzen stock exchange (double-listing). The SSE's P/E ratio was at a yearly average of 21.6x in 2010, 28.7x in 2009, 14.9x in 2008, and 59.2x in 2007; in comparison, Hang Seng's P/E ratio was at 16.7x, 18.1x, 7.3x, and 22.5x during the same period, respectively. For comparison purposes: Brazil's I-Bovespa average P/E ratio was 45.8x in 2010, 17.2x in 2009, 32.7x in 2008, and 15.6x in 2007 (Data Source: World Federation of Exchanges, 2011a. Empirical observations: Made by the author in context of credit portfolio risk management for corporates, high yield and acquisition finance transactions domiciled in APAC).

[98] The equity market capitalization of the Bovespa index was at USD465 bio as of December 2008, dropping from USD1.1 trio as of June 2008 due to the global financial crisis (BMFBovespa, 2011). In December 2009 and 2010 Bovespa's market capitalization stood at USD1.33 trio and USD1.54 trio. In comparison, SSE's equity market capitalization was at USD1.4 trio, USD2.7 trio, and USD2.72 trio in December 2008, 2009, and 2010, respectively. Hang Seng's equity market capitalization was at USD1.3 trio, USD2.3 trio, and USD2.7 trio during the same periods, respectively, and NYSE's equity market capitalization stood at USD9.2 trio, USD11.8 trio, and USD13.4 trio in December 2008, 2009, and 2010 (World Federation Of Exchanges, 2011b). The number of listed companies for 2008 / 2009 / 2010 was as follows: Hang Seng index 1,414 / 1,319 / 1,261, Shanghai index 894 / 870 / 864, and I-Bovespa 381 / 386 / 392 (Data Source: World Federation of Exchanges, 2011c).

Also, M2 to GDP in China increased substantially from 90.7% in 1996 to 139.9% in 2008, adding even more pressure on investment markets, specifically stock markets.

5.2.12 Consumer Price Index and M2 to GDP

In this section I illustrate the associations of commodity prices and governance with (1) CPIx and (2) M2 to GDP. Both variables constitute monetary metrics.

(1) Consumer Price Index

The commodity boom starting in 2000, specifically between 2005 and 2008, was one of the longest and broadest commodity booms of the post-World War II period. Apart from the strong and sustained global economic growth, the recent boom was fueled by numerous factors such as lax monetary policy in the US and Europe and a general buoyant global demand. At the same time, the combination of adverse weather conditions and the diversion of specific food commodities such as sugar cane into the production of biofuels fueled shortage in soft commodities resulting in price increases.

This section includes a brief correlation and Granger causality analysis of the United States CPIx, and M2 to GDP in context of commodity prices in order to put into perspective the CPIx and M2 to GDP associations of Brazil and China.

Table 5.12.1: US CPIx and US M2 to GDP and Commodity Price Indexes

Commodity	Correlation &	1971-2009		1996-2008	
Class	Causality	US CPIx	US M2_GDP	US CPIx	US M2_GDP
FoodIx	**Pearson Corr**	**.364***	**.380***	**.627***	**.582***
	Granger 1	0.4369	0.1889	<.0001	<.0001
	Granger 2	0.4016	0.111	0.8388	0.0143
TropBevIx	**Pearson Corr**	**-0.135**	**0.073**	**0.152**	**0.044**
	Granger 1	0.3868	0.9899	0.1163	0.2183
	Granger 2	0.1424	0.4002	0.6299	0.0059
VegOilSeedsIx	**Pearson Corr**	**.327***	**0.283**	**.585***	**.567***
	Granger 1	0.4447	0.6552	0.0042	0.0086
	Granger 2	0.6748	0.005	0.2237	0.0905
AgriRawIx	**Pearson Corr**	**.728****	**.319***	**.722****	**.629***
	Granger 1	0.1875	0.2836	<.0001	<.0001
	Granger 2	0.0818	0.1453	0.4342	0.0308
MinMetalsIx	**Pearson Corr**	**.678****	**.546****	**.863****	**.755****
	Granger 1	0.2003	0.9733	0.0142	0.1966
	Granger 2	0.3892	0.0007	0.5392	0.0001
CrudeIx	**Pearson Corr**	**.669****	**.594****	**.937****	**.869****
	Granger 1	0.2275	0.5168	0.1379	0.1903
	Granger 2	0.6574	<.0001	0.4497	0.0049

Source: Calculated and arranged by the author.

UNITED STATES: The run-up of energy commodity prices, base metal prices, and soft commodity prices from 1971 until the end of the 1980s and from the early 1990s until late 1990s, and then once again from the early 2000s until the financial crisis in late 2008, is subject of a large number of publications which analyze the implications of global commodity price increases on inflation and monetary policy of the United States (US). Clearly, higher prices of energy and soft commodities have an effect on US consumer price inflation measured by US CPIx. Since the mid-1980s, nonetheless, sharp increases and decreases in energy commodity, base metals and soft commodity prices have had little, if any, impact on CPIx in the US as shown above in light of the only moderate correlation coefficients in the period from 1971 to 2009. Prevalent academic literature is ambiguous on the question if rising global commodity prices are inflationary in nature, thus requiring a tightening US monetary policy, or if rising commodity prices are not inflationary by nature, therefore not requiring a US monetary policy response prior to the crisis of 2009. The embedded proposition in this question suggests that expansionary US monetary policy indeed affects global commodity prices.[99]

The table above reveals that between 1971 and 2009 US consumer goods prices measured by CPIx and commodity prices show mostly low and moderate correlations (sig. 0.05 to sig. 0.01). Also, the inverse Granger causality calculations show no significant results. In addition, the correlation of US money expansion measured by M2_GDP and all commodity price indexes during the same period is low to moderate, ranging from 7.3% (TropBevIx) to 59.4% (CrudeIx). Also, not shown in the table, the correlation analysis revealed that US M2_GDP and US CPIx correlate at 28.4% (negligibly low correlation) between 1971 and 2009 (non sig. >0.05). These findings, based on annual data points, suggest that evidence is weak of US M2_GDP affecting global commodity prices in the long run over a period of almost 40 years. It also reveals that commodity price increases in the long run do not significantly affect US CPIx.

The picture changes considerably when shortening the time horizon from 1971-2009 to 1996-2008. Empirical findings, as shown above, reveal that correlation between global commodity prices and US CPIx as well as US M2_GDP increased significantly

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[99] I point out that the focus of this study is not the research of effects of US monetary policy on commodity prices. The above discussion of US M2_GDP and US CPIx on commodity price indexes serves as a comparison only in order to illustrate and contrast the significant correlation of Chinese CPIx to commodity price indexes.

between 1996 and 2008. For example, US M2_GDP and CrudeIx correlate at 59.4% (sig. 0.01) between 1971 and 2009. Between 1996 and 2008, however, US M2_GDP and CrudeIx correlate much higher at 86.9% (sig. 0.01) than between 1971 and 2009. Similarly, higher correlation is also observable between US M2_GDP and (i) FoodIx, (ii) VegOilSeedsIx, (iii) AgriRawIx and (iv) MinMetalsIx from 1996-2008 compared to 1971-2009.

These findings support the suggestion that there may exist a significant relationship between commodity prices indexes and US M2_GDP between 1996 and 2008, especially when taking Granger causality results into consideration and the high correlation between US M2_GDP and US CPIx (not shown in the table), which increased from 28.4% between 1971 and 2009 to 94.9% (sig. 0.01) between 1996 and 2008. US M2_GDP rose from 62% to 83% between 1996 and 2008. Rising M2_GDP in the US between 1996 and 2008 seems to have affected global commodity price indexes much stronger than it did between 1971 and 2009. This supports the first standard monetarist proposition on commodity prices, which links the increase of money supply to the increase of commodity prices (at least when considering the period from 1996 to 2008).

Nonetheless**,** as the table below reveals, between 1996 and 2008 China's CPIx correlates stronger with commodity prices than the US CPIx does. That is, there exist commodity price effects on CPIx in China which may not be explained by US M2, especially when taking the CPIx of Brazil into consideration, which correlates lower with commodity price indexes in contrast to China's CPIx.

Table 5.12.2: CPIx Brazil and China

Variable 58	**CPIx** Brazil			**CPIx** China		
Independents	Corr %	Granger	Regr. Sig	Corr %	Granger	Regr. Sig
FoodIx	58.8*	Inverse	-	89.3**	Inverse	-
TropBevIx	-	-	-	56.4*	-	-
VegOilSeedsIx	55.8*	Inverse	-	86.9**	Inverse	-
AgriRawIx	70.6*	Causal/Iv	Yes: R2 .45	93.0**	Inverse	-
MinMetalsIx	83.3**	Inverse	-	95.1**	Causal	Yes: R^2 .93
CrudeIx	90.8**	-	-	96.7**	Causal	Yes: R^2 .93
WGIVA	94.1**	Inverse	-	-62.1*	-	-
WGIGE	-	-	-	66.6**	Causal	No
EFITrade	94.3**	Inverse	-	81.5**	-	-

Source: Calculated and arranged by the author.

BRAZIL: The correlation between the Brazilian CPIx and FoodIx and VegOilSeedsIx is moderate at 58.8% and 55.8% (sig. 0.05). The CPIx correlation is high at 70.6% and 83.3% with AgriRawIx and MinMetalsIx. The correlation is very high and above 90% (sig. 0.01) with CrudeIx, WGIVA and EFITrade. Nonetheless, the Brazilian CPIx correlation with commodity price indexes is lower than correlation between the Chinese CPIx and commodity price indexes. The Brazilian CPIx correlates at 94.9% with Brazilian M2_GDP (sig. 0.001, not shown in table), revealing a strong affinity to Brazilian M2.[100]

Rationale: Brazil's CPIx is less in tune with rising commodity prices than China's, but rather in sync with expansive Brazilian M2 to GDP, which grew from 31.4% to 59.1% between 1996 and 2008. It appears that the inflationary push through effect from commodities in Brazil is not as pronounced as this is the case for China, which gives credence to the suggestion that Brazil's economy is far less susceptible to imported commodity related inflation than it is the case with China.

CHINA: The regression analysis results show that MinMetalsIx and CrudeIx, combined to CMca1MetOil, Granger cause China's CPIx with an adjusted R^2 of 0.93 (estimate: 0.049, t-val 9.52, sig. <0.0001). Chinese CPIx and all commodity prices except TropBevIx correlate high/very high between 86.9% and 96.7% (sig. 0.01), whereas correlation between US CPIx and commodity prices ranged lower between 58.5% and 93.7%. This finding weighs particularly strong given the fact that Chinese M2_GDP apparently has had little effect on Chinese CPIx judging by the low and insignificant correlation of 51.9% (sig> 0.05) between 1996 and 2008 (not displayed in the table). The Chinese M2_GDP grew by 18% p.a. on average from 90.7% in 1996 to 139.9% in 2008, and correlated high at 83% (sig. 0.01) with US M2_GDP. However, the correlation analysis shows little to none effect of Chinese M2_GDP on commodity price indexes, as shown in Table 5.12.3 below.

Rationale: The relationship between global commodity prices and consumer good prices, expressed by CPIx, is vastly discussed in academic literature in the context of commodity prices inflating consumer good prices through cost-push mechanisms, specifically when taking into consideration the velocity of commodity demand. The

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[100] In comparison, the Brazilian CPIx correlates at 91% (sig. 0.001) with the US M2_GDP between 1996 and 2008 (Source: Separate correlation analysis by the author, not shown in the tables above).

above findings suggest that the rising Chinese CPIx is to a lesser extent affected by Chinese M2_GDP expansion than by strong demand related commodity push-through effects in domestic China, which in turn affect commodity prices. This suggests that prices of food, vegetables and oil seeds, agricultural raw materials as well as minerals and metals lead CPIx in China. The Granger causality analyses of prices of minerals and metals and oil, key import commodities for China as seen in Chapter 2 (Table 2.9 Import Structure China), support this rationale. The adjusted R-square is highly significant at 0.93, and the t-value of MinMetalsIx and CrudeIx is high at 9.52.

In conclusion, China's increasing importance on global commodity import markets, which is represented by China's rising global import shares in virtually all commodity categories between 1995 and 2009, has driven prices of minerals and metals, food products, seeds and oils, agricultural raw materials, and fuels.[101] China's total global import share rose from 2.5% in 1995 to 6.1% in 2005, then to 7.9% in 2009 (Table 2.9: Import Structure China 1995-2009). In comparison, US global import share declined overall from 14.7% in 1995 to 12.8% in 2009.

(2) M2 to GDP

Table 5.12.3: M2 to GDP Brazil and China

Variable 60	**M2_GDP** Brazil			**M2_GDP** China		
Independents	Corr %	Granger	Regr. Sig	Corr %	Granger	Regr. Sig
FoodIx	56.3*	Inverse	-	-	-	-
AgriRawIx	64.5**	Causal/Iv	Yes: R^2 .93	-	-	-
MinMetalsIx	83.4**	Causal	Yes: R^2 .93	-	-	-
CrudeIx	90.4**	Causal	Yes: R^2 .93	61.5*	-	-
WGIVA	83.1**	-	-	-	-	-
EFITrade	84.8**	-	-	87.6**	-	-
EFIMon	-	-	-	60.6*	Inverse	-
EFICorrup	-	-	-	86.2**	-	-

Source: Calculated and arranged by the author.

BRAZIL: The rising M2_GDP in Brazil appears to be Granger caused by rising commodity prices such as AgriRawIx, MinMetalsIx, and CrudeIx. The regression analysis results are significant on all three commodity price indexes, displaying a high

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[101] See also Section 2.4.3.2 for China's (and the United States) commodities import structure, illustrating the sharp increase of commodity related imports to China. Between 1996 and 2009 global Chinese import shares in iron ores were up from 2.5% to 16.0%, foods and seeds and oils up from 2.3% to 4.6%, agricultural raw materials up from 5.5% to 18.2%, and fuels up from 1.6% to 6.7% (Source: Chapter 2, Section 2.4.3.2, Table 2.9: Import Structure China 1995-2009).

adjusted R^2 of 0.93 for AgriRawIx and BMca1MetOil, which combines CrudeIx and MinMetalsIx.

Rationale: This finding may imply that M2_GDP, which rose from 31.4% in 1996 to 59.1% in 2008, was induced by relaxed monetary governance to maintain relatively stable monetary supply during times when monetary policies sought to accommodate Brazilian GDP in the context of higher commodity prices. This rationale supports the Neo-Structuralist view that money supply can be a passive agent due to price increases by monopolistic entities, or in this case by external factors such as commodity price effects due to China's significant demand in commodities.

CHINA: Chinese M2_GDP correlates to 60.6% (sig. 0.05) with EFIMon. M2_GDP appears to inversely Granger cause monetary governance. Monetary governance improved from 62.7 to 72.9 index points between 1996 and 2008.

Rationale: Inflation has been very volatile in China. Transport and energy bottlenecks were frequently accompanied by inflation. Based on the above inverse Granger causality it appears that monetary policy has not been an effective instrument in moderating inflation. However, based on the improved and relatively low annual inflation data observed since 1996, it appears that monetary governance was indeed effective. The findings in the previous paragraphs in context of the significant regression results on prices for oil and minerals and metals suggest that monetary governance has adapted gradually to a changing, more open macroeconomic environment.

5.2.13 Energy Efficiency

Table 5.13: Energy Efficiency (GDP_UEnUPPPOilE)

Variable 74	**GDP_UEnUPPPOilE** Brazil			**GDP_UEnUPPPOilE** China		
Independents	Corr %	Granger	Regr. Sig	Corr %	Granger	Regr. Sig
FoodIx	70.9**	Causal/Iv	Yes: R^2 .46	-	-	-
VegOilSeedsIx	64.4**	Inverse	-	-	-	-
AgriRawIx	80.6**	Inverse	-	58.9*	Inverse	-
MinMetalsIx	91.4**	Inverse	-	76.8**	Causal	No
CrudeIx	95.9**	-	-	86.5**	Causal	No
WGIVA	89.8**	-	-	-	-	-
WGIGE	-	-	-	60.1*	Inverse	-
EFITrade	96.0**	Inverse	-	95.4**	Causal	Yes: R^2 .89
EFICorrup	-	-	-	71.2**	-	-

Source: Calculated and arranged by the author.

BRAZIL: The correlation of energy efficiency measured by GDP_UEnUPPPOilE[102] with VegOilseedsIx is moderate, high with FoodIx, AgriRawIx, and WGIVA, and very high with MinMetalsIx, CrudeIx, and trade governance. The regression analysis reveals a weak adjusted R^2 of 0.46 for FoodIx.

Rationale: The inverse Granger causality is questionable since higher energy efficiency measured in GDP_UEnUPPPOilE is not a catalyst for higher commodity prices. Typically, it should be the way around. Brazil's energy efficiency measured by GDP_UEnUPPPOilE improved from 6.17 to 8.06 Purchasing Power Parity (PPP) GDP per one kilogram of oil equivalent of energy use between 1996 and 2008 (or, 0.16 kg oil equivalent per 1USD GDP in 1996 to 0.12 kg oil equivalent per USD1 GDP in 2008). Brazil's improved energy efficiency may be attributed to its relatively new and efficient production and manufacturing base. Brazil's energy efficiency fares relatively well compared to that of other developed and industrialized economies, which range between 0.15 and 0.2 kg oil equivalent per 1USD GDP. For example, Germany's energy efficiency measured in PPP GDP per kilogram of oil equivalent of energy use was at 5.41 in 1996, improving to 9.10 in 2008, whereas the United States' energy efficiency improved only from 3.67 to 6.26 during the same period.

The Brazilian energy efficiency correlates very high at 91.4% and 95.9% (sig. 0.01) with rising prices of minerals and metals as well as with oil. Even though the results of Granger (inverse) causality are not plausible, the relationship represented by very high positive correlation between improving energy efficiency and rising commodity prices is economically plausible.

CHINA: The regression results show a strong goodness of fit with an R-square of 0.89 for EFITrade with a t-value of 5.05, indicating strong explanatory power of the independent variable. Also, CrudeIx and MinMetalsIx correlate highly at the significance level of 0.01 with the dependent variable. All three explanatory variables are Granger causing GDP_UEnUPPPOilE.

Rationale: China is the second largest electricity producer after the US. China predominantly depends on coal. Compared with Brazil's energy efficiency, China's energy efficiency is low due to its relative old state of manufacturing facilities

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[102] GDP_UEnUPPPOilE= Purchasing Power Parity (PPP) GDP per one kilogram of oil equivalent of energy use (PPP US$ per one kg of oil equivalent).

compared with Brazil’s. China’s energy efficiency measured by GDP_UEnUPPPOilE nonetheless improved significantly between 1996 and 2008 in relative terms. It grew by 166.7% from 1.8 to 3.9 units purchasing power parity of GDP per one kilogram of oil equivalent of energy use (or, 0.55 to 0.26 kg oil equivalent for USD1 GDP from 1996 to 2008). Energy efficiency measured by GDP_UEnUPPPOilE for China is correlating highly (sig. 0.01) with rising minerals and metals prices as well as with rising crude prices. Increasing commodity prices Granger cause GDP_UEnUPPPOilE, suggesting that China’s energy efficiency improved due to rising prices of oil and base metals, which are key input factors for a variety of sectors (infrastructure, energy, oil, automotive, petrochem).

China’s improving energy efficiency may be due to the following factors: Firstly, energy prices in China are mainly marked at market prices due to increasing competition among utility firms. Secondly, China’s open economy and its increased access to markets overseas enabled Chinese companies to purchase state of the art production technology from Europe and the US, which is more efficient than existing Chinese manufacturing technology. Obviously, China benefits from the FDI trade with energy efficient manufacturing imports. Thirdly: The expansion of China’s energy-intensive industries such as steel, construction and petrochemical industry, the higher use of air-conditioning and heating, and the below expectation hydro power output weigh heavily on China’s energy consumption, all of which serves as motivation for a more efficient use of energy. Furthermore, volatile coal imports from Inner Mongolia, relatively weak power transmission grids and capacity, as well as recurring summer energy consumption peaks force Chinese municipalities to impose energy rations in order to maintain a continuous electricity supply. As a result, energy efficiency is compelled to significantly improve further. This association is represented by rising prices of minerals and metals and crude which Granger cause GDP_UEnUPPPOilE.

5.2.14 Rural Migration

Table 5.14: Rural Migration

Variable 75	**RuPp_ToTPp** Brazil			**RuPp_ToTPp** China		
Independents	Corr %	Granger	Regr. Sig	Corr %	Granger	Regr. Sig
AgriRawIx	-59.3*	Inverse	-	-64.5*	Causal/Iv	No
MinMetalsIx	-76.7**	Causal/Iv	No	-80.6**	Causal/Iv	No
CrudeIx	-86.1**	Causal	No	-89.1**	Causal	No
WGIVA	-91.2**	Inverse	-	-	-	-
WGIPS	-	-	-	58.3*	Inverse	-
WGIGE	-	-	-	-57.9*	Inverse	-
WGIRQ	85.4**	-	-	-	-	-
WGIRL	85.8**	-	-	-	-	-
WGICC	-	-	-	82.1**	-	-
EFIBiz	77.6**	Causal	No	62.4*	Causal	No
EFITrade	-89.6**	Inverse	-	-98.3**	Inverse	-
EFIFisc	74.0**	Causal	No	-	-	-
EFIGovtS	78.3**	Inverse	-	81.6**	-	-
EFIInvest	-	-	-	79.9**	Causal	No
EFIFin	-	-	-	79.9**	Causal	No
EFIPropRi	-	-	-	73.4**	Causal	No
EFICorrup	-	-	-	-67.3*	-	-

Source: Calculated and arranged by the author.

BRAZIL: Rural population to total population declined from 21.5% in 1996 to 14.4% in 2008 (please see also Appendix 2.1f: Macroeconomic Figures 1996 – 2008). The dependent variable correlates negatively with AgriRawIx, CrudeIx (sig. 0.01), and MinMetalsIx (sig. 0.01), as well as with WGIVA and EFITrade. It is Granger caused by CrudeIx and MinMetalsIx. Also, deteriorating business and fiscal governance Granger cause rural migration; the correlation is at 77.6% and 74.0% and highly significant. In addition, improving trade governance correlates highly negatively, at almost 90%, with rural migration. That is, improving trade governance moves in an opposite direction compared with the rural population to total population ratio. However, inverse causality from RuPp_ToTPp to EFITrade is not plausible.

Rationale: Rural migration is typically a result of specific push factors, including —but not limited to— limited employment diversification, lower wage levels compared to urban wage levels, and high taxes. Pull factors in contrast are generally adverse conditions in the place of origin such as economic hardship, poverty, and unemployment. Industry clusters in the Brazilian industry centers offered better labor opportunities, which represent a main pull factor for rural migration. Advances in communication and transportation technology, which emerged in the late 1950s, also supported rural migration trends.

Brazil underwent profound changes since the great depression. It developed from an exporter of a small number of primary products to a large scale trader and exporter of commodities. In the same time, its population —originally predominantly rural— became increasingly urbanized. Brazil's population density varies significantly between regions. In 2000 the population density ranged between two and three inhabitants per square kilometer in the Amazon region, whereas it was above 30 in the North East and above 150 in the state of São Paulo (Baer, 2008, p. 250). One distinctive feature of Brazil’s population distribution is the degree of concentration within a few hundred kilometers of the seacoast. Rural migration and its unfavorable side effects represented by the emergence of favelas, which in turn radiated significant criminal activities, gained momentum in the context of import substitution programs in the 1950s and 1970s. Workers were drawn from infrastructure-weak regions to trade hubs and industrial centers in the East and South East such as Fortaleza, Recife, São Paulo, and Rio de Janeiro. Furthermore, improvements in communication supported rural migration trends. An example of wanted rural migration to the inner regions of Brazil was the greenfield construction project of the federal capital Brasilia, inaugurated in 1960. The objective was to promote and industrialize the inner regions of Brazil and to counterbalance rural migration to the shore lines by generating rural migration to the interior.[103]

The empirical observations above are statistically validated by a highly negative correlation of -89.6% of rural population to total population with EFITrade. It is also remarkable to observe that the dependent variable rural population to total population is Granger causing (inverse causality) the degree of democracy index WGIVA. This suggests that a rising percentage of urban population to total population is positively affecting democracy development in Brazil.

CHINA: Similarly to Brazil, there exists a highly negative correlation between rural population to total population and rising commodity prices (MinMetalsIx, CrudeIx: sig. 0.05) as well as improving trade governance (negative correlation of

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[103] Brasilia, which resembles and reflects ‘aesthetics of randomness and utilitarian simplicity’ (Philippou, 2008, p. 2), was designed and constructed by world renowned architect Oscar Niemeyer under the presidency of Juscelino Kupitschek in an attempt to urbanize inner Brazilian landscapes.

almost 1, sig. 0.01). All associations appear to be Granger causing the dependent variable, which declined from 67.7% in 1996 to 56.9% in 2008.

Rationale: Brazil’s disparity between rural and urban population is more pronounced than China’s. For example, rural migration in Brazil set in at the end/beginning of the 1930s/1940s. By 1960 rural population to total population of Brazil stood at 55%, whereas it was at 84% in China in the same year (World Bank, 2009, 2010). As of 2008, rural population to total population was at 14.4% for Brazil and 56.9% for China. This distinctive feature underscores China’s historical economic structure, which has often been labeled as bottom heavy. The emergence of the communist era helped to cultivate the historic roots in China’s sociological disparity. Urban population has been seen as the vanguard of socialism, whereas rural population was instrumental for delivering agricultural products and food. As a result, China’s society has been systematically divided into urban and rural societies.

Since the 1950s, different administrative and governance structures and different systems of rights and privileges —favoring urban population— have shaped China’s society, practically leading to two kinds of citizenship: one urban and one rural. The latter was granted weaker rights with respect to property and health care benefits.

The rural and urban divide has been maintained through strict mobility controls since the end of the 1950s until the end of the 1970s. Mobility controls have been lifted only very selectively. Since the late 1980s and the early 1990s, however, the picture has changed significantly with the CCP granting controlled and gradual migration development, which has been identified as a major factor in industrial and export productivity in the context of China’s outwards oriented assembly economy. As a result, rural population to total population started to gradually decline from 80.4% in 1980 to 70% by 1993 and 56.9% in 2008. Rural migration affected particularly the cities of Kumming (Southwest), Guangzhou and Shenzen (Far South), Shanghai (South East), Guangdong (Pearl River Delta), Congqing (Upper Yangtze), and Beijing (North). These cities symbolize the rise and the success of the SEZ’s and industrial cluster centers, which in turn transformed these cities in industrial powerhouses, benefiting directly from open trade policies, which in turn attracted rural migrant workers in large numbers. This empirical significance is statistically validated by the very high and negative correlation of -98.3% (sig. 0.01) of the dependent variable with Chinese EFITrade — inverse Granger causality is not plausible though. It is also remarkable that rural population to total population inversely Granger causes deteriorating political stability expressed by a declining WGIPS index from -0.35 to -0.39 points between 1996 and 2008. This statistical finding is empirically validated by the rising number of violent protests in urban areas by migrant workers and also traditional urban residents.

Rural migration of the past 50 years has significantly changed China's population spread. Today, only approximately 6% of China's inhabitants live in the dry, mountainous West of China, whereas approximately 94% live in the eastern and most developed part of China —the Yangtze macro area which Shanghai is the center of. 10% of China's population lives in Lower Yangtze, which produces about 25% of the country's GDP, the Northeast has about 10% of China's population, which cultivates about 20% of the country's arable land (Naughton, 2007, pp. 113-135).

Rationale **BRAZIL/CHINA** *continued*: In addition to the above rational, and despite non-significant regression results on rural migration, the correlation and the causality analysis reveal additional significant results for both Brazil and China. Freedom of business declined for both during the observation period and appears to represent a pull factor. This observation is statistically validated by the correlations of RuPp_ToTPp with deteriorating EFIBiz at 77.6% (sig. 0.01) for Brazil and at 62.4% (sig. 0.05) for China. Rising prices for commodities, especially those of price inelastic energy commodities, minerals and metals, and agricultural raw materials seem to also represent a pull factor for rural migration in Brazil and China. Correlations between RuPp_ToTPp and CrudeIx, MinMetalsIx and AgriRawIx are negative at -59.3%, -76.7% and -86.1% for Brazil, and negative at -64.5%, -80.6%, and -89.1% for China, respectively. Granger causality is significant for both Brazil (except for agricultural raw materials) and China. Furthermore, the declining regulatory quality governance and the declining rule of law governance seem to play a role also for rural migration in Brazil, judging by the significant and high correlation of 85.4% with WGIRQ and 85.8% with WGIRL.

In conclusion, improving trade governance in Brazil and China and increasing trade flows may represent one of the main factors for rural migration analyzed in this study; this is validated by the statistical significance of the revealed associations above.

5.2.15 Communication Coverage: Internet and Mobile Coverage

(1) Internet

Table 5.15.1: Internet Coverage

Variable 76	**Internet_100** Brazil			**Internet_100** China		
Independents	Corr %	Granger	Regr. Sig	Corr %	Granger	Regr. Sig
FoodIx	72.9**	Inverse	-	80.5**	Inverse	-
VegOilSeedsIx	69.3**	Inverse	-	78.5**	Inverse	-
AgriRawIx	82.6**	Inverse	-	86.2**	Inverse	-
MinMetalsIx	92.0**	Inverse	-	91.7**	Causal/Iv	Yes R^2.83
CrudeIx	96.1**	-	-	97.4**	Inverse	-
WGIVA	90.2**	Causal	Yes: R^2.796	-64.9*	-	-
WGIGE	-	-	-	72.4**	Inverse	-
EFITrade	94.2**	Inverse	-	89.0**	-	-

Source: Calculated and arranged by the author.

BRAZIL: Internet coverage per hundred inhabitants increased from 0.45% to 37.5% between 1996 and 2008. The regression analysis yields an adjusted R^2 of 0.796 with WGIVA, which implies strong explanatory power (t-value >6). Trade governance correlates highly at 94.2% (sig. 0.01). The inverse Granger causality of EFITrade, however, is not plausible. The correlation with VegOilSeedsIx, FoodIx, AgriRawIx, and MinMetalsIx and with CrudeIx is moderate, high, and very high. However, the inverse Granger causality to the respective commodity price indexes is questionable.

CHINA: In contrast to Brazil, the democracy index in China, which is very low, has no effect on the increasing internet coverage which rose from 1% to 22.5% between 1996 and 2008. Improved trade governance shows a high correlation at 89% (sig. 0.01) with internet coverage.

(2) Mobile Coverage

Table 5.15.2: Mobile Coverage

Variable 79	**MobileSubs_100** Brazil			**MobileSubs_100** China		
Independents	Corr %	Granger	Regr. Sig	Corr %	Granger	Regr. Sig
FoodIx	73.0**	Inverse	-	67.5*	Causal/Iv	Yes: R^2 .96
VegOilSeedsIx	68.7**	Inverse	-	63.9*	Causal/Iv	Yes: R^2 .96
AgriRawIx	81.7**	Inverse	-	77.4**	Causal/Iv	Yes: R^2 .96
MinMetalsIx	92.0**	Inverse	-	88.3**	Inverse	-
CrudeIx	97.6**	Causal/Iv	Yes: R^2 .95	94.7**	-	-
WGIVA	87.5**	-	-	-63.6*	-	-
WGIGE	-	-	-	67.2*	Inverse	-
EFITrade	92.3**	Inverse	-	96.0**	Causal	Yes: R^2 .96

Source: Calculated and arranged by the author.

BRAZIL: The correlation with EFITrade is significant (sig. 0.01) and very high at 92.3% for Brazil. The inverse Granger Causality is questionable. Regression results on mobile coverage are significant, but economically not plausible and questionable in context of CrudeIx affecting mobile coverage in Brazil. Similarly, mobile phone coverage shows high and very high correlations (sig. 0.01) respectively with voice and accountability (87.5%) and trade governance (92.3%), whereby inverse Granger causality of the dependent variable is questionable. Similarly, inverse Granger causality to FoodIx, VegOilseedsIx, AgriRawIx, and MinMetalsIx by the dependent variable is not plausible.

Rationale for BRAZIL for Variables 76 and 79: For Brazil, improving trade governance, measured by improving EFITrade, correlates highly with internet and mobile coverage (significance of 0.01 each); the inverse Granger causality is questionable. The increased internet and mobile coverage penetration in Brazil is a result of consolidation activities in the telecom sector and improved investments in telecommunications infrastructure by telecom firms such Telebras. Mobile coverage in Brazil increased from 1.5% to 78.5% between 1996 and 2008. It is also revealing to observe statistical significance between increasing internet penetration and mobile coverage with WGIVA which correlate at 90.2% and 87.5% (sig. 0.01), lending credence to the suggestion that improving degrees of democracy (WGIVA) in Brazil positively affect internet coverage (R^2 0.796) and mobile communication coverage, which rose significantly between 1996 and 2008.

CHINA: Similarly, mobile phone penetration shows very high correlation (significance of 0.01) with EFITrade. Also, the correlation with specific commodity price indexes ranges between moderate (FoodIx, VegOilSeedsIx) and very high (CrudeIx), whereby all independent variables (except MinMetalsIx and WGIGE) appear to Granger cause the dependent variable (MobileSubs_100). The regression results reveal an adjusted R^2 of 0.96 and a t-value of 4.07 for all PCA combined commodities (food, vegetables and oils, agricultural raw materials) and 12.74 for EFITrade, implying strong explanatory weight of the independent variables.

Rationale for CHINA for Variables 76 and 79: Prior to 1994, the phone line penetration was very low, at 1%. In wake of China's market transition, China's Ministry of Phone and Telecommunications (MPT) split its regulatory and operational activities into two competing entities: China Telecom and China United Telecom. China United Telecom went public as joint investment company in 1994. The regulatory oversight remained with the MPT. Due to these two newly created competitive entities, phone pricing and waiting periods for phone line connections changed favorably. Due to a better market based pricing, telecom investments soared from 0.2% relative to GDP in 1980 to 1.5% in 1993. The fiber optic network improved to approximately 650,000km in 2008, with more than 220million people having internet access. Today, China is the largest telecom market in the world with more than 700mio users. Phone penetration improved from 1% in 1989 to 25.7% in 2008. The internet and mobile phone coverage rose impressively from 0.01% to 22.5% and from 0.6% to 48.4% during that period. Nonetheless, the dependent variable's association to commodity price indexes is not plausible. But the empirical significance of trade governance, which positively affects internet and mobile phone coverage, is statistically validated by the high correlation of EFITrade at 89.0% with Internet_100 and at 96.0% with MobileSubs_100. The latter displays a very high adjusted R-square of 0.96 and a t-value of 12.74.

5.3 Conclusion

Objective of Chapter 5

The objective of this thesis is to investigate the effects of commodity prices and governance on seventy-nine identical macroeconomic variables for Brazil and China between 1996 and 2008, and to identify significant regression relationships between the dependent variables and the explanatory variables. The latter are represented by commodity price indexes and governance indexes. Chapter 5 is based on the regression results and statistical findings for Brazil and China of Chapter 4.

In Chapter 5 I selected a number of meaningful economic measurements based on significant statistical results in Chapter 4. It is easy and convenient to confound the significance of statistical results with empirical and economic significance. Empirical observations or relationships do not require statistical significance in order to be valid or true. The statistical results are therefore neither necessary nor sufficient to qualify an empirical relationship as essential, significant, or relevant. However, statistical and econometric analysis can be helpful in detecting and underscoring the existence of significant empirical relationships.

In Chapter 5 I intended to support empirical observations by adding statistical and econometric findings in order to lend credence to the claim of empirical significance of associations between dependent and independent variables for Brazil and China. The econometric analysis of specific dependent variables has been performed in a comparative fashion, contrasting the observations of Brazil and China.

Approach and Method

The key statistical methods applied in Section 5 in order to establish an inferential analysis on the economies of Brazil and China include (i) Pearson correlation analysis, (ii) Granger causality analysis, (iii) principal component analysis, and (iv) multiple regression analysis. All relevant data series are based on data provided by the World Bank (2009, 2010).

Findings

A large number of statistical findings in Chapter 4 seem to have found validation by empirical observations throughout Chapter 2, 3, and Chapter 5. Specifically, I note that for China I present a large number of examples in which macroeconomic variables seem to inversely Granger cause changes in commodity price indexes and to some extent governance indexes.

The findings on econometric associations have been illustrated and demonstrated throughout the entire thesis, especially throughout Chapters 4 and 5. To avoid repetition I will therefore refrain from again elaborating on each single specific finding for Brazil and China. Nonetheless, for completeness purposes, I provide major findings of the econometric analysis below.

For Brazil I observed the following:

Governance

(1) Trade governance is a key governance dimension within Brazil's governance architecture and trade policies have been effective instruments to support the external sector. The importance of trade governance in Brazil's governance architecture has on average not come at the expense of the quality and development of other governance dimensions (e.g., WGIVA, WGIPS).

(2) Voice and accountability (WGIVA, i.e., degree of democracy) appears to be affected by an improving trade openness measured by trade to GDP.

(3) Rural migration Granger causes improving degree of democracy (WGIVA).

Commodity Prices

(4) GDP growth appears to be positively affected by increasing commodity prices.

(5) Foreign reserves are greatly affected by a commodity biased external sector.

(6) The external sector is dominated by the export of commodities.

(7) The commodity export sector grows at the expense of exports and imports of manufactured products, which deteriorated significantly, potentially undermining Brazil's manufacturing and industrial base in the long-run, especially in light of increasing Chinese imports to Brazil. In this context, the business governance (EFIBiz) deteriorated.

(8) Terms of trade: Surprisingly, improving terms of trade do not reveal any significant correlation to any commodity price indexes except to TropBevIx.

(9) Trade indexes and trade variables show strong associations to rising commodity price indexes.

(10) Stock market value to GDP shows strong associations with rising commodity price indexes.

For China I observed the following key relationships:

Governance

(1) Trade governance is the centerpiece of China's governance architecture and trade policies are a key policy instrument to support China's manufacturing base, which, however, is greatly dependent on FDI. China's emphasis on trade governance as a centerpiece of its governance architecture though comes —on average— at the expense of the remaining governance dimensions, which either deteriorated or were of poor quality to begin with.

(2) Rural migration negatively affects (inverse Granger causality) political stability expressed by a declining WGIPS.

Commodity Prices

(3) FDI in China is promoted by improved and favorable trade governance and a relatively supportive regulatory framework which is confined within the framework of SEZs.

(4) Gross domestic savings to GDP are rising and household final consumption to GDP is declining in light of the absence of a countrywide social security and retirement scheme —among others— and in light of deteriorating business governance.

(5) China's economic expansion measured by rising gross fixed capital formation to GDP Granger causes the rise of global commodity prices.

(6) The correlation of the Chinese CPIx with commodity prices indexes is higher than the correlation of the Brazilian CPIx with commodity price indexes.

(7) China's terms of trade show highly negative correlations with commodity price indexes, which are affected by China's economic expansion. China's requires significant import volumes of such commodities on an absolute and relative basis as illustrated in Chapter 2.

(8) Chinese M2 to GDP shows little correlation with commodity price indexes.

(9) Similar to Brazil, China's stock market value to GDP shows strong associations with the rise of commodity price indexes.

(10) Trade indexes and trade variables correlate with commodity prices and Granger cause commodity prices.

Limitations

In this section, I point out some limitations in regards to the performed analysis and respective results.

Firstly, this thesis analyzes the effects of governance and commodity prices on macroeconomic variables. It also recognizes significant inter-relations among dependent variables such as trade to GDP and FDI. However, the ramifications of these effects between dependent, endogenous variables are neither being analyzed nor accounted for as this is not objective of the thesis and as this would be too large a task to perform within the boundaries of this thesis.

Secondly, the size of observation samples is relatively small. A larger sample size and a higher degree of data granularity could potentially have improved the accuracy of correlation coefficients, Granger causality p-values, beta coefficients and adjusted R-square in a number of cases, and could also potentially have diminished the multicollinearity problem. However, due to limitations in governance data supplied by the World Bank (2009, 2010), I only observed and analyzed annual data points between 1996 and 2008. Consistent World Bank governance data exists since 1996 only, whereas EFI data dates back to 1994. In addition, governance indexes are observable on an annual basis only.

Thirdly, the findings and results of the econometric analysis are confined to the time span of 1996 and 2008. As is the case with time series analysis, the empirical observations and statistical validations yield point in time observations only. Observations and conclusions should therefore not be extrapolated beyond 2008.

Fourthly, governance indexes and commodity price indexes are quantitatively highly aggregated metrics, consisting of a wide array of specific governance architecture elements and price constituents. The macroeconomic variables applied in this thesis are highly aggregated metrics itself. They illustrate and measure the effects of governance and commodity prices on the socio-economic landscape of Brazil and China only in a highly aggregated fashion. Therefore, one has to be careful not to draw wrong conclusions regarding the effects of specific governance dimension subsets and commodity price constituents on the Brazilian and Chinese socio-economic landscape as a whole and specific facets and characteristics of it and vice versa.

Having said all that, because the stated objective of this thesis is to measure the mentioned effects on a highly aggregated basis, the selected commodity price and governance indexes as well as the selected macroeconomic variables applied are acceptable and fit well; they comply with my data and methodology requirements.

6. Conclusion

In this concluding chapter I will first supply an executive summary of my key findings in the section Overall Conclusion. In the Sectional Summaries I will then give a more detailed summary of each chapter and section before finally providing suggestions for potential future research in the final remarks.

Overall Conclusion

Scope and Objective

The macroeconomic variables I chose in the comparative analysis in this thesis represented a meaningful macroeconomic topic-mix.

As illustrated and rationalized in Sections 1.3 and 1.5, macroeconomic variables serve as dependent (endogenous) variables, and commodity price and governance indexes serve as independent (exogenous) variables.

The main objective of this thesis has been to investigate the effects of commodity prices and governance architecture from a holistic viewpoint, with reference to a set of 79 identical multi-topic macroeconomic variables for Brazil and China between 1996 and 2008. The goal was to identify significant correlation, causality and regression relationships between these macroeconomic variables and the explanatory variables, represented by six commodity indexes and two sets of governance indexes of which each has nine and six governance dimensions, respectively.

The thesis' research does not include annual data points from 2009 onwards due to the global financial crisis unfolding at the end of 2008 and effectively materializing in 2009. The extraordinary negative effects on global macroeconomics also hit commodity price indexes, which experienced a flash crash between 2008 and 2009, e.g., MinMetalsIx -30.2%, CrudeIx -36.3%.[104] Due to the crisis-related distorting effects on macroeconomics and on governance, I refrained from including annual 2009 data in the econometric analysis. For example, between 2008 and 2009 trade governance in China improved from 71.4 to 72.2 index points and voice and accountability in Brazil improved from 0.48 to 0.51 index points. However, due to the global financial crisis

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[104] Extreme annual price changes between 2008 and 2009 were observed for (i) Manganese Ore (metallurgical FOB ($/mtu Mn)): -61.3%, and (ii) Phosphate Rock (Khouribga, 70% BPL, contract, FAS Casablanca): -64.8%. Source: UNCTAD 2010 (Free market commodity price indexes, Annual, 1960-2009).

China’s trade to GDP declined from 62.1% to 47.1% between 2008 and 2009, and Brazil’s trade to GDP declined from 27.4% to 26.1% in the same period. Brazil’s GDP growth rate was negative at -0.19% in 2009, but China’s GDP growth rate was positive at 9.1%.

As an overall result the thesis thus provides a comparative overview for identical macroeconomic variables of Brazil and China. This thesis also offers a coherent view of the macroeconomic dynamics between Brazil and China, which are both dominating powers in their respective regions. And, it illustrates the trade related interdependencies between Brazil and China by analyzing the countries’ external sector structures and trade profiles. Chapter 5 offered such a contrasting analysis on identical dependent variables for Brazil and China in light of econometric results and empirical observations.

Key Research Findings and Observations

The conclusions that emerge from the econometric analysis of Chapters 2 to 5 for the period of 1996 to 2008 include significant effects from governance, especially trade governance, and commodities on dependent variables. I note that there are a significant number of examples for China in which macroeconomic variables seem to (inversely) Granger cause and lead changes in commodity price indexes and to a smaller extent governance dimensions.

For Brazil I observed the following key points:

Governance

- Trade governance is a key governance dimension within Brazil’s governance architecture and trade policies (e.g., import and export tariffs) have been effective instruments to support the external sector. The importance of trade governance in Brazil’s governance architecture has on average not come at the expense of the quality and development of other governance dimensions (e.g., WGIVA, WGIPS) in comparison to China.
- The voice and accountability index (democracy index) appears to be positively affected by improving economic and trade openness measured by trade to GDP.
- Rural migration Granger causes improving degree of democracy (WGIVA).

Commodity Prices

- GDP growth appears to be positively affected by increasing commodity prices and increasing exports of commodities.
- Foreign reserve ratios are positively affected by commodity price increases, especially by oil and minerals and metals prices.
- The external sector represented by trade indexes and trade variables is dominated by the export of commodities.
- The commodity export sector grows at the expense of exports of manufactured products, which deteriorated notably, potentially undermining Brazil’s manufacturing and industrial base in the long-run, especially in light of increasing Chinese manufactured imports to Brazil. In this context, business governance deteriorated.
- Improving terms of trade do not reveal any significant correlation with any commodity price index except with the tropical beverages price index (TropBevIx).
- Trade indexes and trade variables show strong associations to rising commodity price indexes.
- Stock market values are positively affected by increasing commodity prices which in turn support Brazil’s growing commodity export sector.

For China I observed the following key points:

Governance

- Trade governance is the centerpiece of China’s governance architecture and trade policies are key policy instruments to support China’s manufacturing base. Nonetheless, China’s emphasis on trade governance as a centerpiece of its governance architecture comes at the expense of the remaining governance dimensions, which either deteriorated or were at low quality rating levels to begin with.
- Rural migration negatively affects political stability expressed by a declining WGIPS index.

Commodity Prices

- FDI in China is promoted by favorable trade policies and a relatively supportive regulatory framework which, however, is limited within the framework of SEZs.
- Gross domestic savings to GDP is increasing, and household final consumption to GDP is declining due to the absence of a country-wide social security and retirement scheme —among others— and due to relatively unfavorable business governance which includes high barriers of entry (e.g., capital requirements) for entrepreneurs and small businesses.
- China’s economic expansion as, e.g., reflected by increasing gross capital formation to GDP affects rising (Granger causes) global commodity prices.
- The correlation of the Chinese CPIx with commodity price indexes is higher than the correlation of the Brazilian CPIx with commodity price indexes.
- Terms of trade declined as a result of rising commodity prices (significant, highly negative correlations) which are affected by China’s economic expansion.
- Chinese M2 to GDP shows little correlation with commodity price indexes.
- Stock market values reveal strong positive associations with rising commodity prices.
- Trade indexes and trade variables show significant causalities with increasing global commodity price indexes.

Sectional Summaries

Regional Analysis

Brazil and China have undergone significant economic changes and integration development over the past 50 years, specifically over the last two decades. From the mid-1990s to the early 2000s, Brazil and China offered general trade complementarities in their export structures. Brazil has largely benefited from its vast natural resources, which have dominated the country’s export structure. That structure in turn has been shaped by China’s immense demand for soft, energy, minerals and metals commodities since the late 1990s in order to ensure economic growth. China benefited from its vast and skilled labor base, coupled with low wages in high density areas, which attracted FDI to its SEZs and enabled the country to serve as an ‘assembly bench’ for export markets mainly in Europe and in the United States.

Then, starting in the early 2000s, a new trading pattern emerged. The Chinese trade deficit with Brazil narrowed from 47% in 2003 to 22% in 2008 (Table 2.13 Trade Balance Brazil and China 2000–2008), suggesting that Chinese exports to Brazil increased in value. Meanwhile, Brazil’s export balance of goods and services to GDP declined even though it retained a relatively strong position as a global provider of natural resources. The increasingly tight trade relations between Brazil and China have resulted from their complementarities: Brazil’s abundance of commodities and China’s dynamic industrialization strategy. Brazil’s continued structural weaknesses, coupled with increasing Chinese exports of manufactured products to Brazil suggest a major threat to Brazil’s industrial base, one that haunts public discussions about Brazilian job losses and a potential return to a commodity-based economy. Furthermore, Chinese acquisitions and investments in the Brazilian commodity sector appear likely to increase significantly in the future considering China’s need to import commodities to maintain its domestic growth. Brazil’s concentration on exporting commodities and the threat of rising Chinese manufactured imports as described in Chapter 2 have led to significant concerns and apprehensions in Brazil among policy makers, economic advisors and the general public. Brazil faces the risk to become locked into a role as a commodity exporter, which can undermine the positive trends of a widening industrial base and increased exports. Together with increasing dependence on exported primary products, the Sino-Brazilian relationship has fundamental effects and consequences for the Brazilian development paradigm and for the domestic support of the idea of stronger relations with China. The main question revolves around the direction and quality of the developing relationship between the two countries. Will Brazil and China develop as partners, continue to forge joint ventures and enter mutually beneficial FDI agreements —and achieve balanced trade relations? Or will the two countries emerge as competitors on both regional and global levels?

Key factors in Brazil's economic expansion have been its commodity biased export basis but also improved governance in a number of governance dimensions represented by World Bank governance indicators (WGI) and economic freedom indexes (EFI). China on the other hand requires imports of urgently needed base metals, energy and agricultural raw materials in order to fuel its economic expansion, which benefited greatly from improved trade governance.

Governance Analysis

The qualitative and quantitative comparative analysis of Brazil's and China's governance dimensions, measured by the worldwide governance index and the economic freedom index, revealed that Brazil improved its governance architecture measured by the WGI in all dimensions except regulatory quality and rule of law. Specifically, Brazil made great strides in improving its democracy governance, measured by the voice and accountability index (WGIVA), which rose from 0.18 to 0.51 index points between 1996 and 2009. In comparison, China's democracy index (WGIVA) developed relatively flatly and at very low levels, from -1.66 to -1.65 index points during the same period. For China, I also note that all WGI indexes deteriorated except government effectiveness (WGIGE), which improved slightly from 0.04 to 0.12 between 1996 and 2009.

In terms of the economic freedom indexes, trade, monetary, and corruption governance improved for both Brazil and China. Monetary governance developed favorably between from 1996 to 2009, as expressed by the improving monetary governance indexes (EFIMon) which rose from 70.0 to 75.8 index points and from 62.7 to 70.6 index points for Brazil and China, respectively. Similarly, EFI's corruption index (EFICorrup) improved for Brazil and China, rising from 27.0 to 35.0 and 21.6 to 36.0, respectively. The key governance dimension with the widest econometric effect on macroeconomic variables for both, Brazil and China, is trade governance (EFITrade), which rose dramatically from 57.0 to 69.2 for Brazil and from 30.0 to 72.2 for China between 1996 and 2009.

Correlation Analysis

The correlation analysis of Brazil’s and China’s identical 79 dependent variables revealed that there exist 440 significant correlation counts for China, and 352 significant correlation counts for Brazil.

Independent Variable Set

From an independent variable set perspective I note that the commodity price index set dominates the significant correlation count with 47.0% and 44.3% of all significant correlation events for China and Brazil, respectively. The economic freedom index set displays the second largest significant correlation count, representing 34.5% of all significant correlation counts for China and 28.1% of all significant correlation counts for Brazil. With 18.4% of all counts for China and 27.6% of all counts for Brazil, the WGI index set trails the commodity price index set and the EFI index set.

Individual Independent Variables

From an individual, independent variable point of view the correlation results revealed that trade governance in Brazil measured by EFITrade shows the largest number of significant individual correlation counts, followed by WGIVA —voice and accountability index—, CrudeIx, MinMetalsIx, and AgriRawIx. That is, trade governance for Brazil seems to be a key governance factor for economic activity, followed by the voice and accountability governance. Furthermore, regulatory quality and rule of law as well as business governance suggest strong interdependence with economic activity.

For China, commodity price indexes lead the correlation count with the 79 selected macroeconomic variables. The minerals and metals price index leads the ranking, followed by the agricultural raw materials index and the oil price index. From a governance perspective, trade governance (EFITrade) —similarly to Brazil— leads the correlation count for China, followed by government effectiveness measured by WGIGE, property rights governance (EFIPropRi), and freedom from corruption (EFICorrup).

Cluster Effects

For Brazil, cluster effects are mainly represented by commodity price indexes. It is observable that soft commodity price indexes but also minerals and metals price indexes display associations to key measures such as GDP growth rate (GDP_gr) and GDP per capita growth rate (GDPpCap_gr). Nearly all commodity price indexes show associations with export and import value and volume trade indexes such as ExpValx, ExpVolx, ImpValIx, ImpVolIx, and unit value as well as unit volume related trade indexes, underscoring the importance of commodity exports for Brazil's economy. Furthermore, it appears that changes in commodity prices are key drivers for Brazil's booming stock exchanges. While commodity price indexes reveal associations with a wide array of macroeconomic variables, it appears that governance indexes show a more narrow correlation association to macroeconomic variables. Voice and accountability (WGIVA), political stability (WGIPS), and government effectiveness (WGIGE) display cluster effects on trade variables such as trade to GDP (Trade_GDP) and merchandise trade to GDP (MrchTrade_GDP), whereas regulatory quality (WGIRQ) and rule of law (WGIRL) show cluster associations with interest rates and debt variables. EFIBiz, EFITrade, EFIFisc, and EFIGovtS exhibit cluster associations with debt variables.

For China, the commodity price indexes show large cluster effects on GDP ratios, debt and reserve ratios, soft commodity production indexes, and trade indexes. The correlation cluster effects for China also include GDP composition variables such as industry value added to GDP (IndustryValAd_GDP), gross savings to GDP (GrossSav_GDP), and trade variables such as Trade_GDP, MrchTrade_GDP, and ExpGS_GDP. The WGI governance indexes do not reveal any significant correlation cluster effects. The EFI indexes, primarily EFITrade, EFIGovtS, financial and investment freedom (EFIFin, EFIInv), and property rights (EFIPropRi) appear to exhibit cluster effects on rates and debt ratios only.

Granger Causality Analysis

The Granger causality analysis of Brazil and China reveals 267 significant Granger causality counts for China and 224 for Brazil. Remarkably, the count ranking is the same for both, with the commodity price index set leading the count (China: 59.2% of all counts, Brazil: 50.4%), followed by the economic freedom index set (China: 22.8%, Brazil: 25.0%) and the WGI index set (China: 18.0%, Brazil 24.6%).

Independent Variable Sets

From an independent variable set perspective I note that the commodity price index set dominates the Granger causality count with 59.2% and 50.4% of all counts for China and Brazil, respectively. For Brazil, AgriRawIx, MinMetalsIx, FoodIx, lead the causality count, followed by VegOilSeedsIx, CrudeIx, and TropBevIx. I note also that more than half of the counts for these commodities is of inverse causality nature, except for CrudeIx, which shows more Granger causalities than inverse Granger causalities. For China, the largest counts within the commodity price index set reside within MinMetalsIx, AgriRawIx, and CrudeIx and VegOilSeedsIx, followed by FoodIx, and TropBevIx. The inverse Granger count is more than half for AgriRawIx, VegOilSeedsIx, FoodIx, and TropBevIx.

The economic freedom index set displays the second largest causality count for both, China and Brazil. It is revealing that for both China and Brazil the EFITrade index is the dominating governance index within the EFI index set with 25 and 27 causality counts, of which 15 and 20 are of inverse causality nature, respectively. For both countries trade governance measured by EFITrade emerges as one of the key governance dimensions.

The WGI governance index set ranks as the third largest set measured by significant causality counts. For China, improved WGIGE is the dominant WGI governance index with 21 counts (of which 18 are of inverse nature). For Brazil in contrast, it is the improved WGIVA index which dominates the causality count with 29 counts (of which 16 are of inverse nature).

Overall, these results suggest that commodity prices show a far greater association with economic activities measured by the 79 dependent variables than the EFI index or the WGI index does. These results are congruent with the findings of the correlation analysis, in which the commodity price index dominates the correlation count for both China and Brazil, followed by the EFI index set and the WGI index set.

Individual Independent Variables

The Granger causality analysis reveals that within the commodity price index set for Brazil, AgriRawIx displays the largest causality count, followed by individual price indexes such as MinMetalsIx, FoodIx, VegOilSeedsIx, CrudeIx, and TropBevIx. From a governance dimension point of view, the voice and accountability index shows the largest causality count. Trade governance for Brazil shows the second largest number of significant causality counts within all governance dimensions. Voice and accountability and trade governance seem to play key roles in context of economic activity in Brazil. Furthermore, from a governance point of view I found that deteriorating regulatory quality and rule of law as well as deteriorating business governance affect economic activity. For China, commodity price indexes lead the causality count with the minerals and metals price index dominating the overall ranking, followed by AgriRawIx, CrudeIx, VegOilSeedsIx, FoodIx and TropBevIx. From a governance perspective, EFITrade —similarly to Brazil— is the most dominating governance dimension within the causality analysis for China, followed by WGIGE, WGIPS, EFIPropRi, and WGIVA and WGICC.

Cluster Effects

For Brazil, cluster effects are mainly driven by commodity price indexes. Nearly all commodity price indexes show associations with trade indexes. While commodity price indexes reveal associations with a wide array of macroeconomic variables, it appears that governance indexes show a more narrow correlation association with macroeconomic variables; mainly WGIVA, WGIPS, and WGIGE display cluster effects on trade variables. EFIBiz, EFITrade, EFIFisc, and EFIGovtS exhibit cluster associations with debt variables only. For China, as for Brazil, commodity price indexes show large cluster effects on macroeconomic variables. However, cluster effects for China are larger in scope. The WGI indexes do not reveal any significant correlation cluster effects. And EFI indexes, primarily EFITrade, EFIGovtS, EFIFin/EFIInv, and EFIPropRi appear to exhibit cluster effects on interest rates and debt ratios only.

Principal Component Analysis

The principal component analysis has been applied on commodity price indexes, WGI and EFI governance indexes, as well as on changes in commodity price indexes and changes in governance indexes in consideration of dependent variables measured in growth rates. The key propositions to sense multicollinearity include (a) a minimum correlation between independent variables of at least 69.9%, and (b) the correlation coefficient between independent variables is larger than the correlation coefficient between dependent and independent variables.

Commodity Price Indexes

The differentiation of the commodity indexes into the soft commodity subset, and the minerals and metals and crude subset is based on an array of considerations such as correlation associations and Granger causality associations. The latter is specifically relevant for MinMetalsIx and CrudeIx as revealed in Chapter 3. MinMetalsIx and CrudeIx are sub asset classes within commodities which tend to correlate relatively closely with each other. Both oil and base metals prices commonly serve as leading indicators of general global economic activity, broad stock market index moves, and general consumer demand. They are also leading indicators of inflation.

Governance Indexes

Governance dimensions are highly heterogeneous in nature. There are a high number of individual data sources from think tanks, survey institutions, non-governmental organizations, and international organizations, which underlay the aggregate indicators. It was thus challenging to apply multi-collinearity detection on governance index pairs. In order to consider these distinctive features of governance indexes I amended the multicollinearity approach by considering two additional criteria (a’) and (a’’) to the criteria (a) and (b) mentioned above: (a’) The significance level has to be larger than 99.9%, and (a’’) the variable pair with the highest correlation coefficient only can proceed to the principal component analysis. As a result, the following independent governance pairs were selected: WGIVA-WGIPS and EFIInv-EFIFin for China, and EFIFisc-EFIGovtS for Brazil.

Multiple Regression Analysis

Out of 79 macroeconomic variables for Brazil, 44 dependent variables passed the statistical diagnostic tests with significant results and progressed to the regression analysis. The results of the regression analysis revealed that of these 44 dependent variables only nine dependent variables —and four independent variables— played no significant role in the regression analysis. That is, 35 dependent variables revealed regression significance for Brazil.

The statistical diagnostic tests of China revealed that out of the identical 79 dependent variables a total of 49 dependent variables progressed to the multiple regression analysis, of which seven dependent variables —and two independent variables— do not show any significant multiple regression results. That is, 42 variables revealed regression significance for China. Furthermore, out of the 35 and 42 regression significant dependent variables for Brazil and China, there are 19 identical dependent variables which do reveal simultaneous regression significance for both Brazil and China. These variables are:

(1) Industry value added growth rate (Variable 7: IndustValAd_gr)

(2) Household final consumption expenditure (Variable 19: HHFinConExp_GDP)

(3) Trade to GDP (Variable 25: Trade_GDP)

(4) Merchandise trade to GDP (Variable 26: MrchTrade_GDP)

(5) Fuel imports to merchandise imports (Variable 35: FuelImp_MerchImp)

(6) Export value index (Variable 36: ExpValx)

(7) Import value index (Variable 37: ImpValIx)

(8) Export volume index (Variable 38: ExpVolx)

(9) Import volume index (Variable 39: ImpVolIx)

(10) Unit value index exports (Variable 40: UnitValIxExp)

(11) Purchasing power index of exports (Variable 43: PPIxExp)

(12) Fuel exports to merchandise exports (Variable 53: FuelExp_MerchExp)

(13) Consumer price index (Variable 58: CPIx)

(14) External debt stocks to exports of goods, services and income (Variable 64: ExtDebtST_ExpGSInc)

(15) Total reserves to total external debt (Variable 69: TTRes_TTExtDbt)

(16) GDP per unit of energy use in USD purchase power parity per kg of oil equivalent (Variable 74: GDP_UEnUPPPOilE)

(17) Internet per 100 (Variable 76: Internet_100)

(18) Phonelines per 100 (Variable 77: Phonelines_100)

(19) Mobile users per 100 (Variable 79: MobileSubs_100)

It is worth to note that almost all of these 19 identical dependent variables for Brazil and China are affected by different regressors.

From a commodity point of view the regression analysis yields the following findings: For Brazil, the commodity price regressor variables mainly include oil, minerals and metals and agricultural raw materials, whereas for China the commodity price regressor variables include mainly oil and minerals and metals.

From a governance point of view it is striking that for Brazil these 19 identical dependent variables are affected 23 times by governance regressor variables, whereas it is only 18 times for China. It is also remarkable that for Brazil governance regressor variables mainly include voice and accountability governance (WGIVA/democracy index), whereas for China it is mainly trade governance (EFITrade).

Final Remarks and Future Research

This thesis' objective was to unveil significant empirical observations by supporting them with significant statistical findings at the example of Brazil and China. The majority of my econometric analysis was based on the standard approach used in prevalent literature. The multiple regression frameworks within the econometric analysis provided an evaluation method to measure the effectiveness of governmental policies, governance architecture and commodity prices on developing economies at the example of Brazil and China. My results are robust to the choice of methodology to calculate correlation, Granger causality, and regression analysis results of Brazil and China.

I find evidence supporting the view of many economic researchers that exports cause the GDP of emerging economies. I also do find statistical evidence with the example of Brazil that the degree of democracy is positively affected by the degree of trade openness. I furthermore find empirical evidence supported by statistical significance that China's economic expansion does affect specific commodity prices. I document these results by mapping out the direction of Granger causalities which is based on significant correlation results between macro variables and commodity prices as well as governance indexes.

My research objectives and findings contribute to and fit well into the discussion of prevalent academic studies which analyze the interaction between commodity prices and macroeconomic variables as well as between governance architecture and macroeconomic variables. Overall, this thesis offers a promising framework and grounds for additional research of the effects of commodity prices and governance on emerging as well as developed economies.

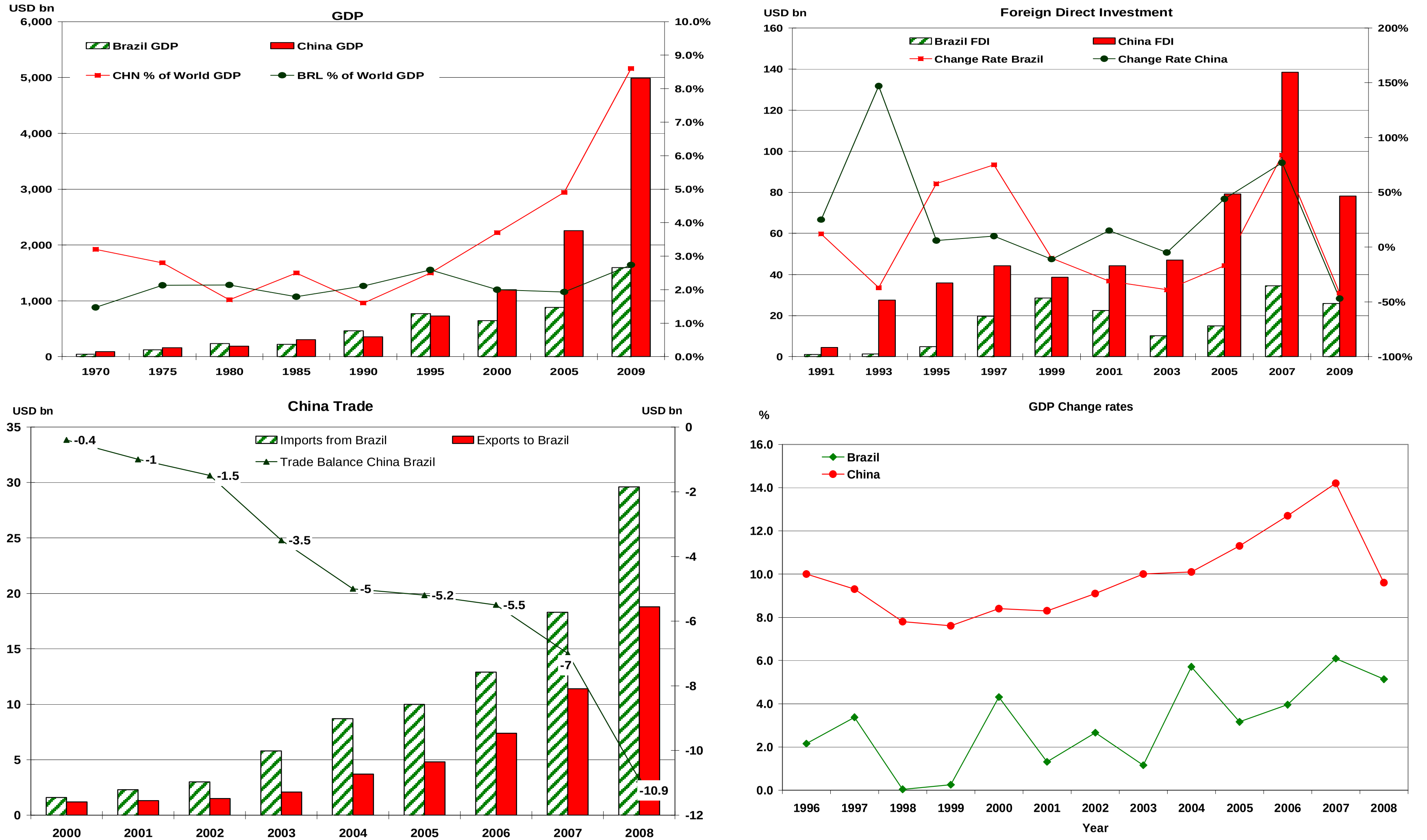
The thesis also offers ideas for additional research topics. Further similar research may for example be carried out on Canada and Australia. The Canadian dollar and the Australian dollar currencies are commonly labeled as commodity currencies. Canada and Australia are leading global commodity exporting economies. In comparison to the emerging economies of Brazil and China, both Australia and Canada are mature, developed economies with already established governance architectures. A comparative analysis of the effects of commodity prices and governance on Australia and Canada may therefore potentially lead to differing results compared to the analysis on Brazil and China. Australia's and Canada's governance architecture is more developed, mature, and established, which may be the dominant cause —and not commodities— for the countries’ stable macroeconomic development. In comparison, Brazil’s and China’s governance architectures are still developing and —compared to Australia and Canada— to an extent still in a trial-and-error stage. A similar econometric analysis of the effects of commodity prices and governance on the Australian and the Canadian economy may therefore render complementary findings relative to the analysis of Brazil and China.

APPENDIXES

Appendix 2.1: Macroeconomic Figures 1996–2008

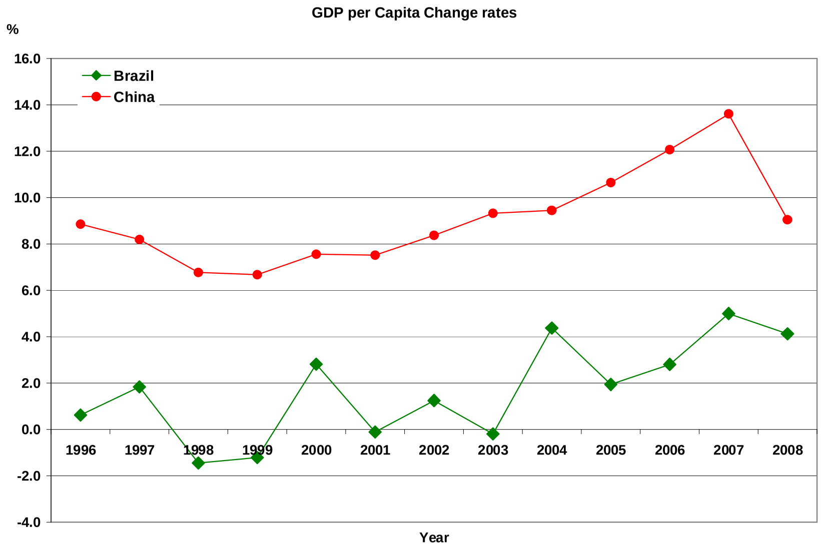
Data Source for Appendixes 2.1a-g: World Bank (2009, 2010). Figures calculated, created and arranged by the author.

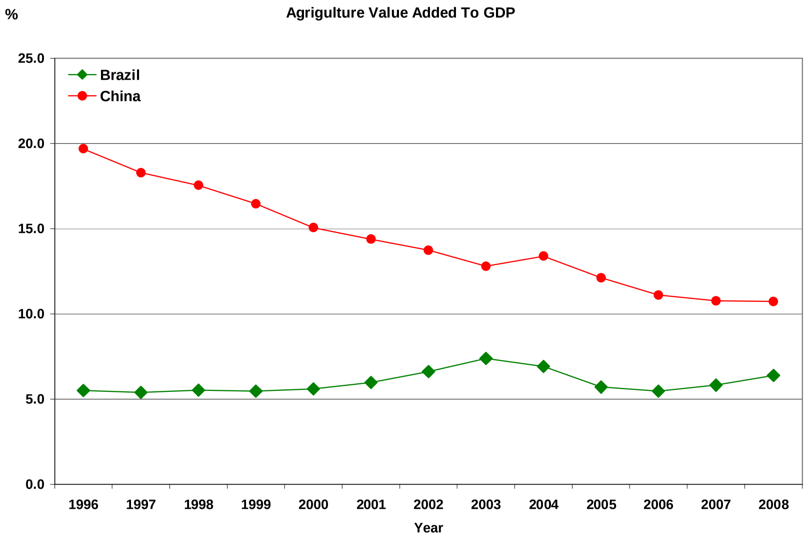
Appendix 2.1a: Macroeconomic Figures 1996–2008 — GDP, FDI, China Trade

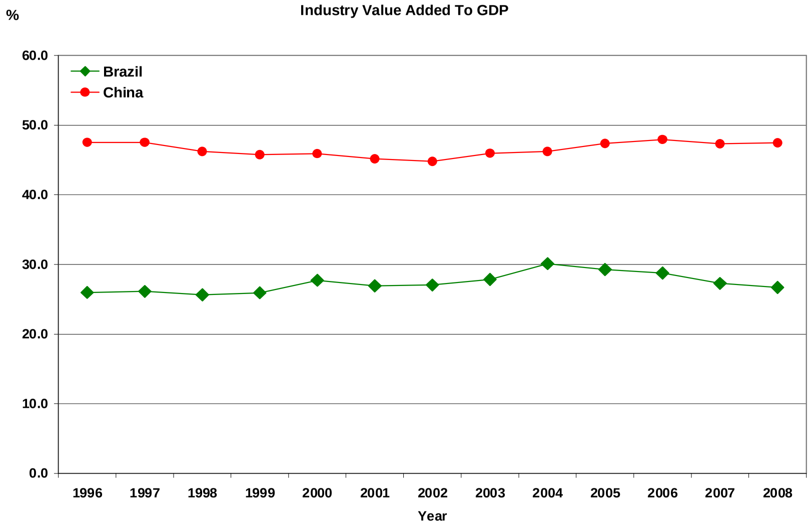


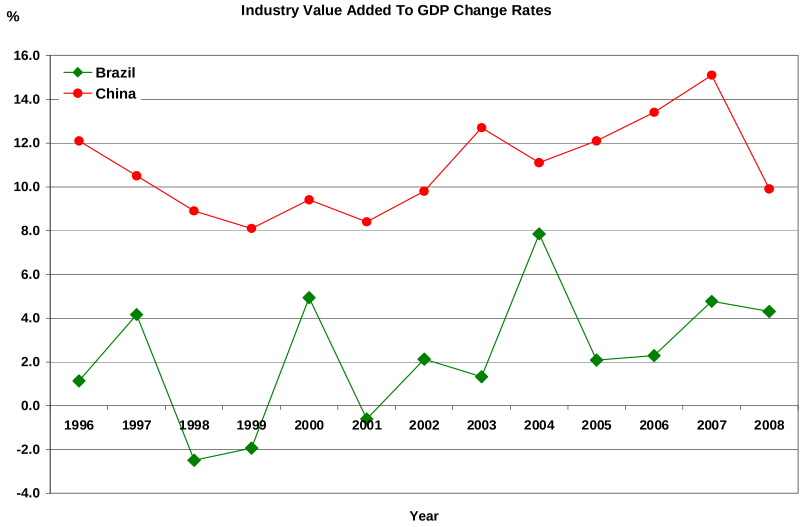
Data Source for Appendixes 2.1a-g: World Bank (2009, 2010). Figures calculated, created and arranged by the author.

Appendix 2.1b: Macroeconomic Figures 1996-2008 — GDP Composition

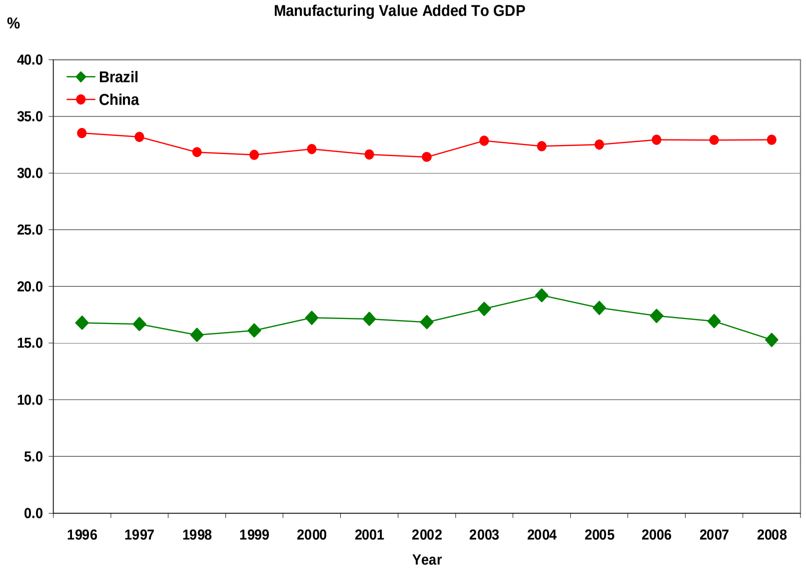

GDP per Capita Change rates

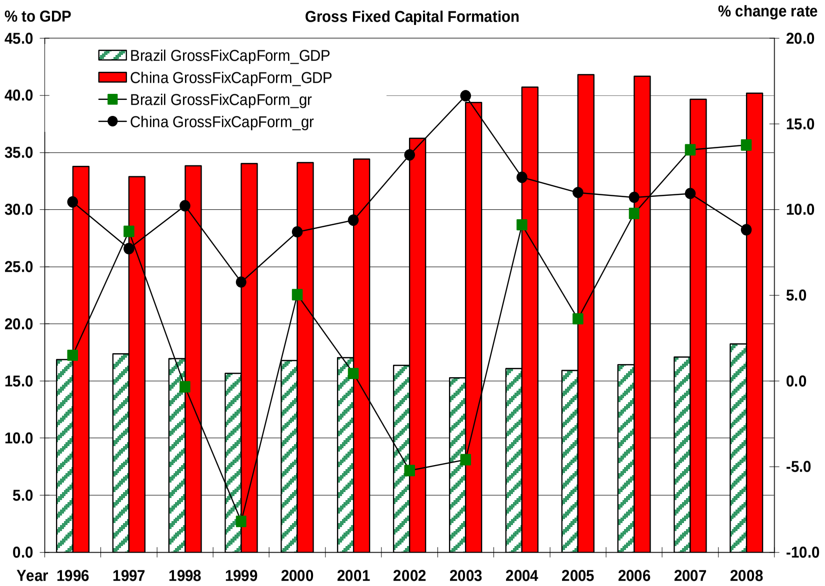

Agrigulture Value Added To GDP

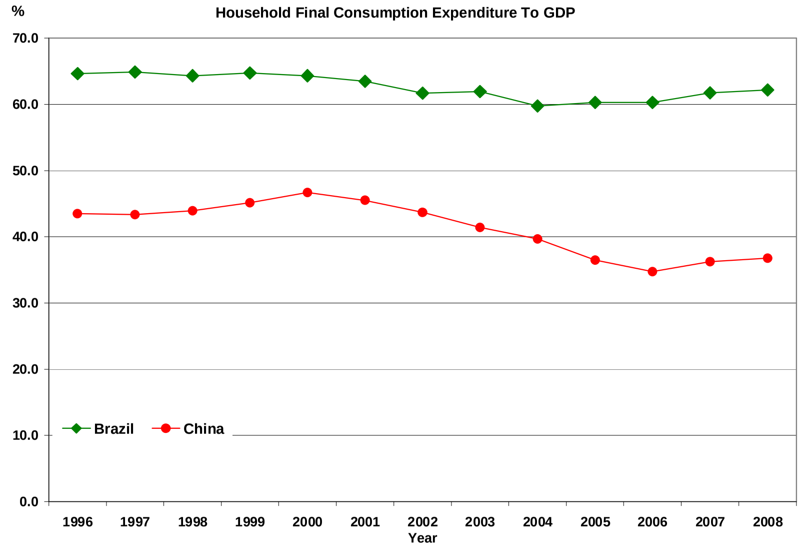

Industry Value Added To GDP

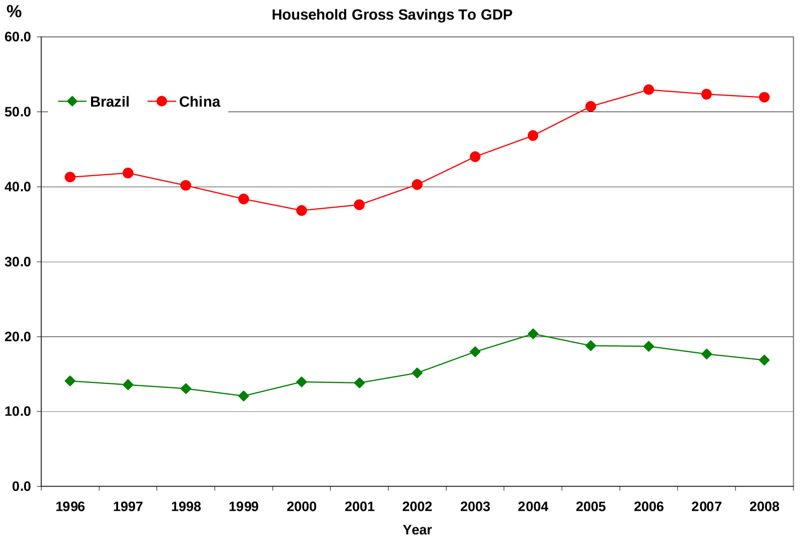

Industry Value Added To GDP Change Rates

Appendix 2.1c: Macroeconomic Figures 1996-2008 — GDP Composition

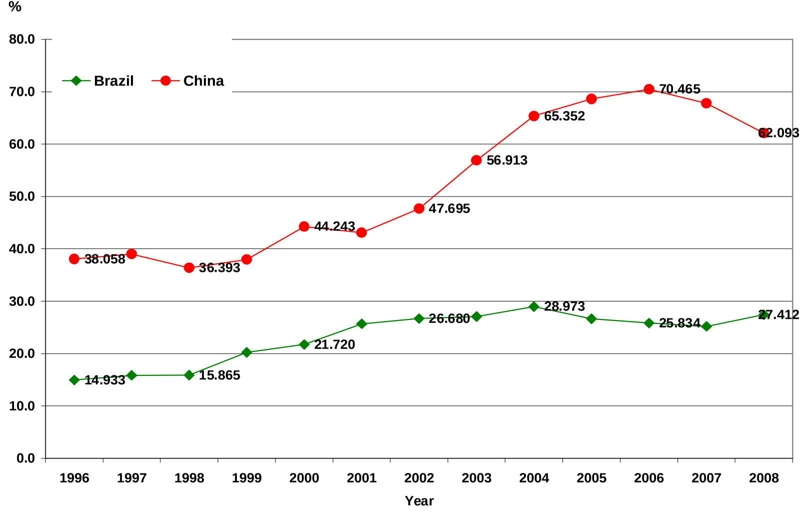

Manufacturing Value Added To GDP

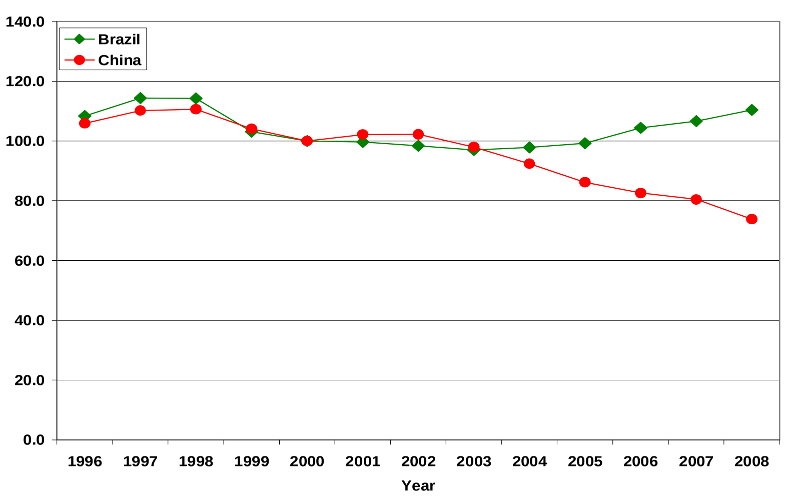

Gross Fixed Capital Formation

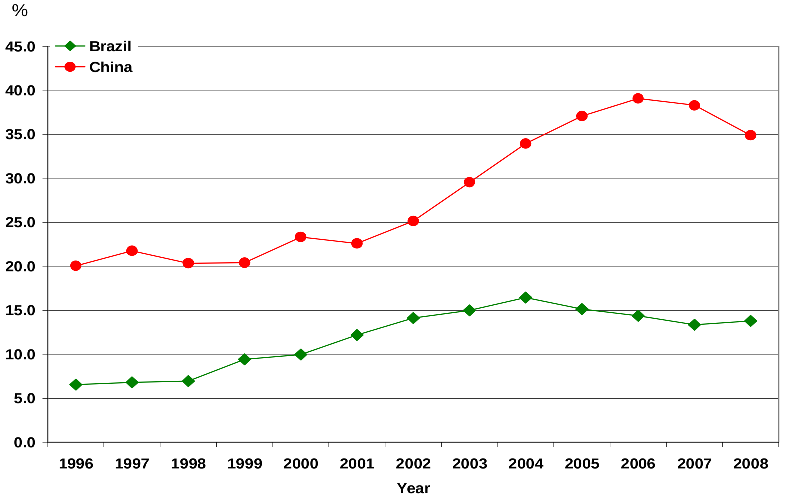

Household Final Consumption Expenditure To GDP

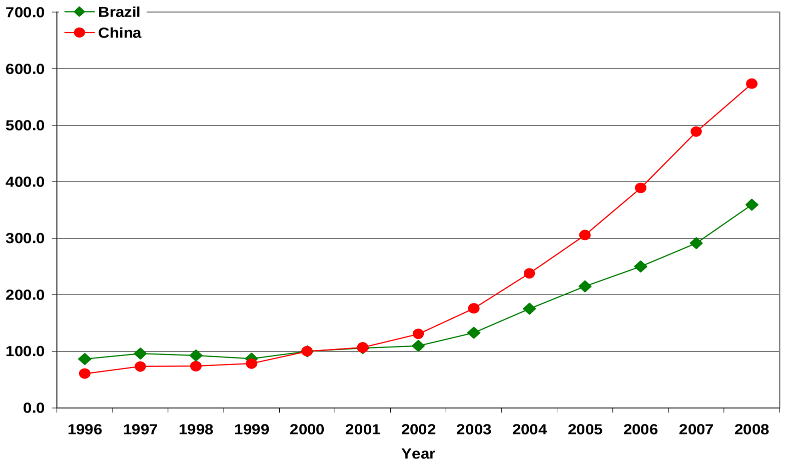

Household Gross Savings To GDP

Appendix 2.1d: Macroeconomic Figures 1996-2008 — Trade, Exports

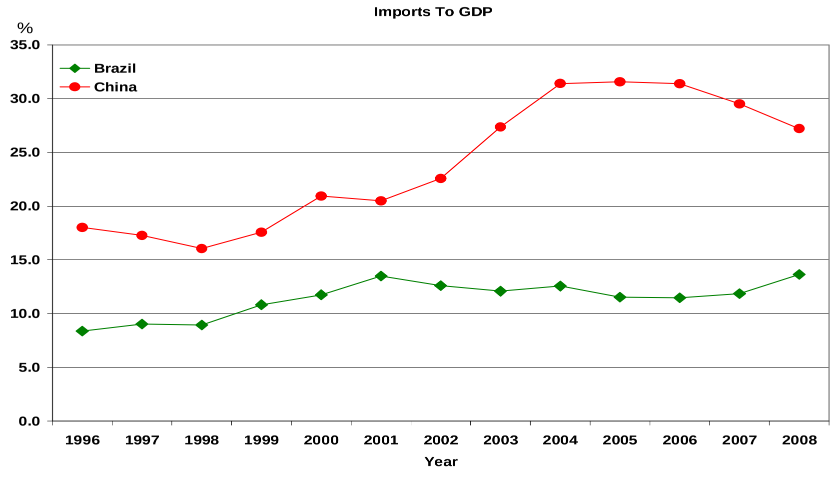

Trade To GDP

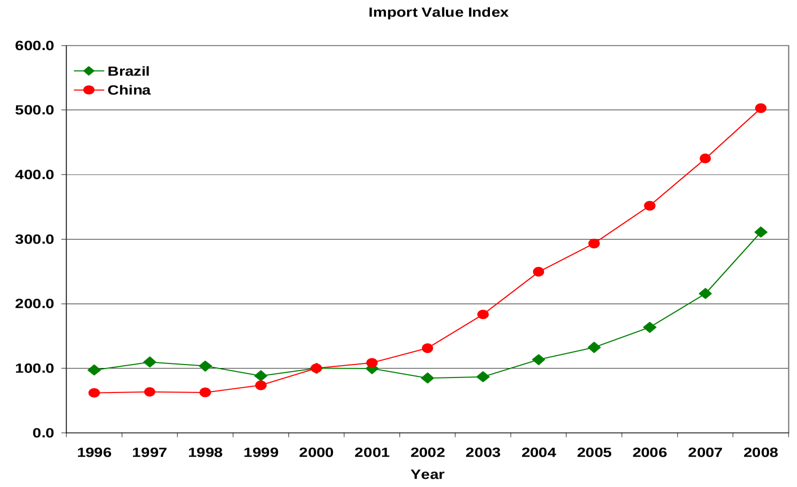

Terms Of Trade

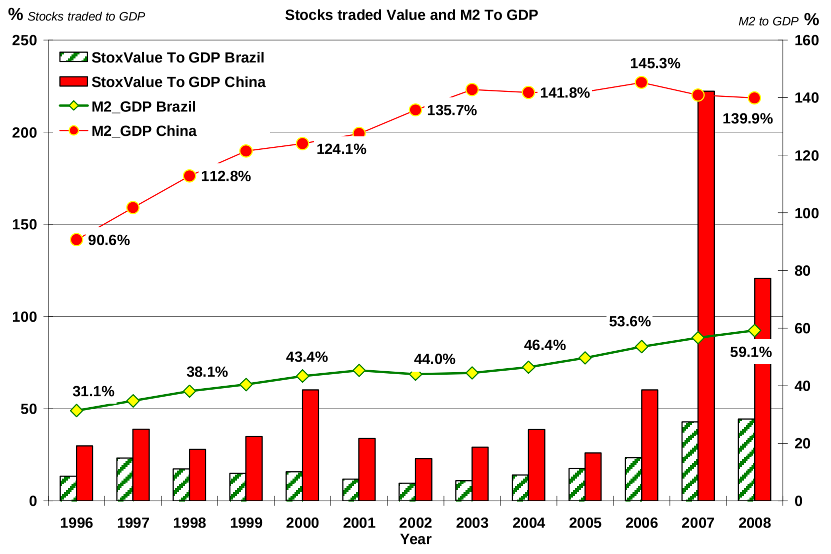

Exports To GDP

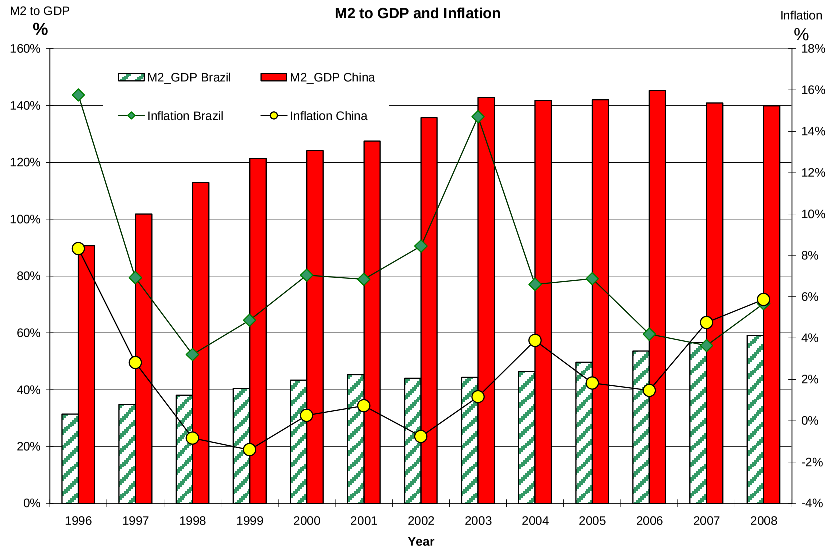

Export Value Index

Appendix 2.1e: Macroeconomic Figures 1996-2008 — Imports, Stocks, M2



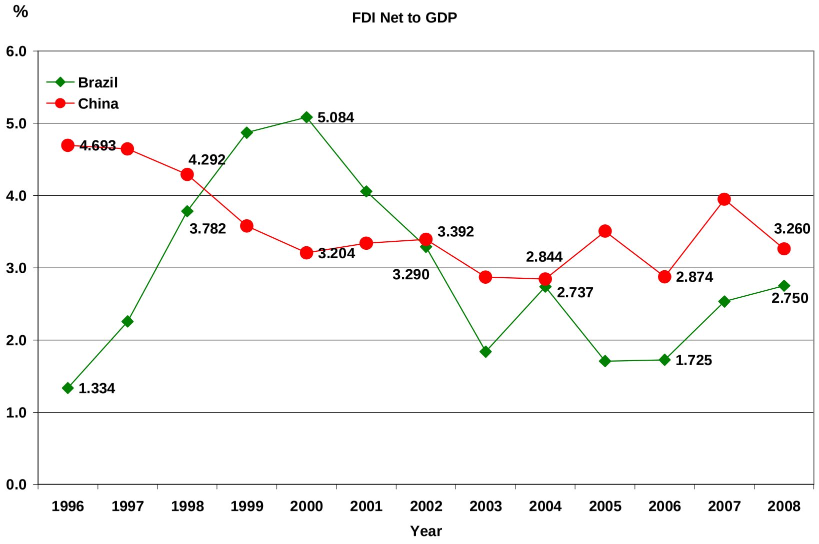




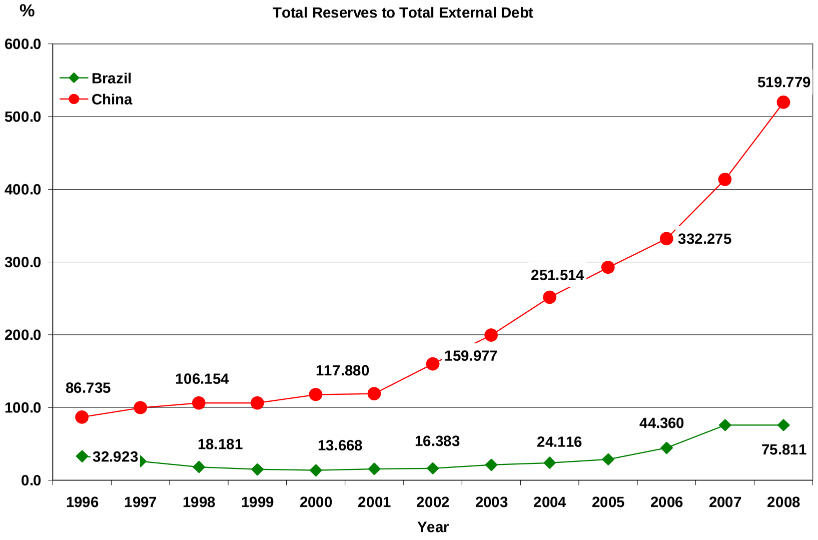


Appendix 2.1f: Macroeconomic Figures 1996-2008 — FDI, Reserves, Energy

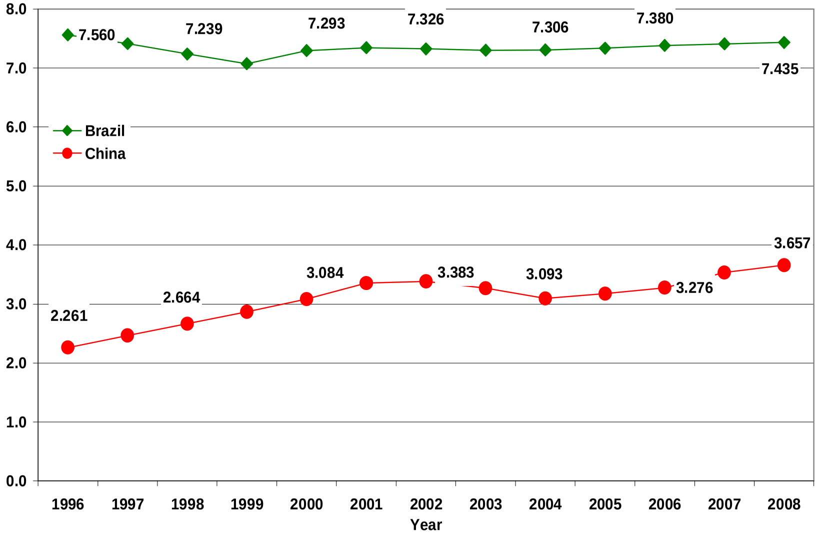
FDI Net to GDP



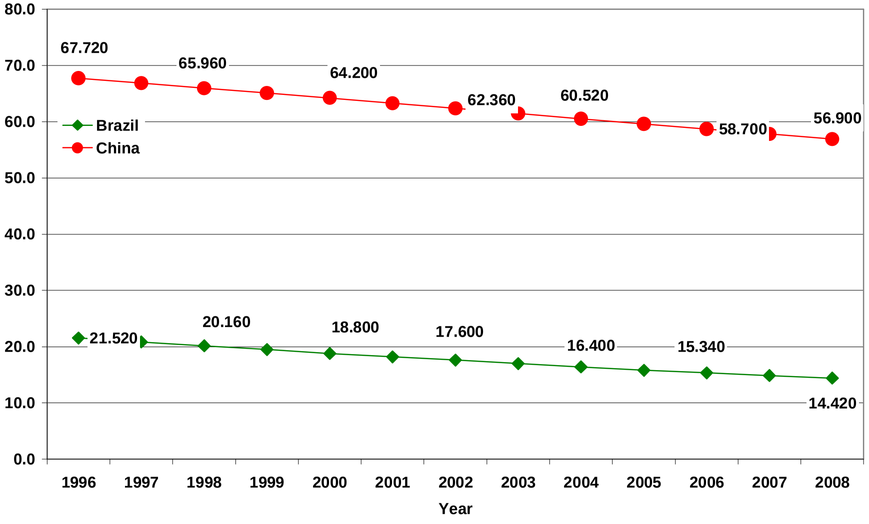
Total Reserves to Total External Debt



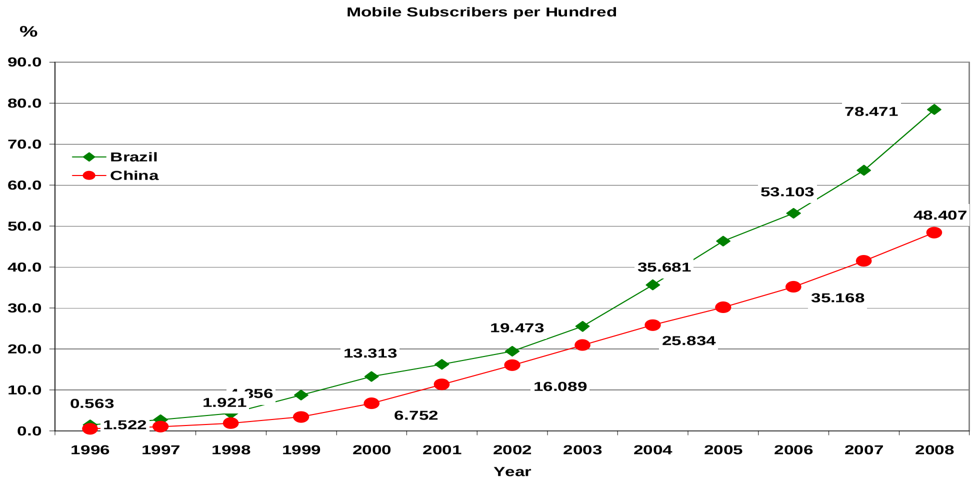
Units GDP per energy used in 1KG Oil Equivalent
(Energy Efficiency)



Rural Population to Total Population



Appendix 2.1g: Macroeconomic Figures 1996-2008 — Mobile Subscribers



Appendix 3.1: Definition Macroeconomic (Dependent) Variables

Source for Appendix 3.1: World Bank (2009, 2010), Data Catalog, World Bank data. Tables created and arranged by the author.

Appendix 3.1a: Definition Macroeconomic (Dependent) Variables (1/26)

INDICATORS	DEFINITION / COMMENTS	ABBREVIATION
Indicator Name	**Agricultural raw materials exports (% of merchandise exports)**	**AgrRwExp_MerchExp**
Long definition	Agricultural raw materials comprise SITC section 2 (crude materials except fuels) excluding divisions 22, 27 (crude fertilizers and minerals excluding coal, petroleum, and precious stones), and 28 (metalliferous ores and scrap).	
Source	World Bank staff estimates from the Comtrade database maintained by the United Nations Statistics Division.	
Topic	Private Sector & Trade: Exports	
Periodicity	Annual	
Aggregation method	Weighted average	
General comments	Merchandise export shares may not sum to 100 percent because of unclassified trade.	
Indicator Name	**Agriculture, value added (% of GDP)**	**Agri_GDP**
Long definition	Agriculture corresponds to ISIC divisions 1-5 and includes forestry, hunting, and fishing, as well as cultivation of crops and livestock production. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3. Note: For VAB countries, gross value added at factor cost is used as the denominator.	
Source	World Bank national accounts data, and OECD National Accounts data files.	
Topic	Economic Policy & Debt: National accounts: Shares of GDP & other	
Periodicity	Annual	
Aggregation method	Weighted average	
Indicator Name	**Agriculture, value added (annual % growth)**	**Agri_gr**
Long definition	Annual growth rate for agricultural value added based on constant local currency. Aggregates are based on constant 2000 U.S. dollars. Agriculture corresponds to ISIC divisions 1-5 and includes forestry, hunting, and fishing, as well as cultivation of crops and livestock production. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3.	
Source	World Bank national accounts data, and OECD National Accounts data files.	
Topic	Economic Policy & Debt: National accounts: Growth rates.	
Periodicity	Annual.	
Aggregation method	Weighted average.	

Source for Appendix 3.1: World Bank (2009, 2010), Data Catalog, World Bank data. Tables created and arranged by the author.

Appendix 3.1b: Definition Macroeconomic (Dependent) Variables (2/26)

INDICATORS	DEFINITION / COMMENTS	ABBREVIATION
Indicator Name	**Agricultural raw materials imports (% of merchandise imports)**	**AgRawImp_MrchImp**
Long definition	Agricultural raw materials comprise SITC section 2 (crude materials except fuels) excluding divisions 22, 27 (crude fertilizers and minerals excluding coal, petroleum, and precious stones), and 28 (metalliferous ores and scrap).	
Source	World Bank staff estimates from the Comtrade database maintained by the United Nations Statistics Division.	
Topic	Private Sector & Trade: Imports.	
Periodicity	Annual.	
Aggregation method	Weighted average.	
General comments	Merchandise import shares may not sum to 100 percent because of unclassified trade.	
Indicator Name	**Current account balance (% of GDP)**	**CurrACC_GDP**
Long definition	Current account balance is the sum of net exports of goods, services, net income, and net current transfers.	
Source	International Monetary Fund, Balance of Payments Statistics Yearbook and data files, and World Bank and OECD GDP estimates.	
Topic	Economic Policy & Debt: Balance of payments: Current account: Balances.	
Periodicity	Annual.	
Indicator Name	**Consumer price index (2005 = 100)**	**CPIx**
Long definition	Consumer price index reflects changes in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. The Laspeyres formula is generally used.	
Source	International Monetary Fund, International Financial Statistics and data files.	
Topic	Financial Sector: Exchange rates & prices.	
Periodicity	Annual.	
Base Period	2005.	
Aggregation method	Median.	

Appendix 3.1c: Definition Macroeconomic (Dependent) Variables (3/26)

INDICATORS	DEFINITION / COMMENTS	ABBREVIATION
Indicator Name	**Crop production index (1999-2001 = 100)**	**CropProdIX**
Short definition	Crop production index shows agricultural production for each year relative to the base period 1999-2001. It includes all crops except fodder crops. Regional and income group aggregates for the FAO's production indexes are calculated from the underlying values in international dollars, normalized to the base period 1999-2001.	
Long definition	Crop production index shows agricultural production for each year relative to the base period 1999-2001. It includes all crops except fodder crops. Regional and income group aggregates for the FAO's production indexes are calculated from the underlying values in international dollars, normalized to the base period 1999-2001.	
Source	Food and Agriculture Organization, electronic files and web site.	
Topic	Environment: Agricultural production.	
Periodicity	Annual.	
Base Period	1999-2001.	
Aggregation method	Weighted average.	
Indicator Name	**Energy imports, net (% of energy use)**	**EnrgyImp_Euse**
Long definition	Net energy imports are estimated as energy use less production, both measured in oil equivalents. A negative value indicates that the country is a net exporter. Energy use refers to use of primary energy before transformation to other end-use fuels, which is equal to indigenous production plus imports and stock changes, minus exports and fuels supplied to ships and aircraft engaged in international transport.	
Source	International Energy Agency and United Nations, Energy Statistics Yearbook.	
Topic	Environment: Energy production & use.	
Periodicity	Annual.	
Aggregation method	Weighted average.	
Indicator Name	**Exports of goods and services (% of GDP)**	**ExpGS_GDP**
Long definition	Exports of goods and services represent the value of all goods and other market services provided to the rest of the world. They include the value of merchandise, freight, insurance, transport, travel, royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government services. They exclude compensation of employees and investment income (formerly called factor services) and transfer payments.	
Source	World Bank national accounts data, and OECD National Accounts data files.	
Topic	Economic Policy & Debt: National accounts: Shares of GDP & other.	
Periodicity	Annual.	
Aggregation method	Weighted average.	

Appendix 3.1d: Definition Macroeconomic (Dependent) Variables (4/26)

INDICATORS	DEFINITION / COMMENTS	ABBREVIATION
Indicator Name	**Exports of goods and services (annual % growth)**	**ExpGS_gr**
Long definition	Annual growth rate of exports of goods and services based on constant local currency. Aggregates are based on constant 2000 U.S. dollars. Exports of goods and services represent the value of all goods and other market services provided to the rest of the world. They include the value of merchandise, freight, insurance, transport, travel, royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government services. They exclude compensation of employees and investment income (formerly called factor services) and transfer payments.	
Source	World Bank national accounts data, and OECD National Accounts data files.	
Topic	Economic Policy & Debt: National accounts: Growth rates.	
Periodicity	Annual.	
Aggregation method	Weighted average.	
Indicator Name	**Export value index (2000 = 100)**	**ExpValX**
Long definition	Export values are the current value of exports (f.o.b.) converted to U.S. dollars and expressed as a percentage of the average for the base period (2000). UNCTAD's export value indexes are reported for most economies. For selected economies for which UNCTAD does not publish data, the export value indexes are derived from export volume indexes (line 72) and corresponding unit value indexes of exports (line 74) in the IMF's International Financial Statistics.	
Source	United Nations Conference on Trade and Development, Handbook of Statistics and data files, and International Monetary Fund, International Financial Statistics.	
Topic	Private Sector & Trade: Trade indexes.	
Periodicity	Annual. Base Period: 2000.	
Indicator Name	**Export volume index (2000 = 100)**	**ExpVolX**
Long definition	Export volume indexes are derived from UNCTAD's volume index series and are the ratio of the export value indexes to the corresponding unit value indexes. Unit value indexes are based on data reported by countries that demonstrate consistency under UNCTAD quality controls, supplemented by UNCTAD's estimates using the previous year's trade values at the Standard International Trade Classification three-digit level as weights. For economies for which UNCTAD does not publish data, the export volume indexes (lines 72) in the IMF's International Financial Statistics are used.	
Source	United Nations Conference on Trade and Development, Handbook of Statistics and data files, and International Monetary Fund, International Financial Statistics.	
Topic	Private Sector & Trade: Trade indexes.	
Periodicity	Annual.	
Base Period	2000.	

Appendix 3.1e: Definition Macroeconomic (Dependent) Variables (5/26)

INDICATORS	DEFINITION / COMMENTS	ABBREVIATION
Indicator Name	**External balance on goods and services (% of GDP)**	**ExtBalGS_GDP**
Long definition	External balance on goods and services (formerly resource balance) equals exports of goods and services minus imports of goods and services (previously nonfactor services).	
Source	World Bank national accounts data, and OECD National Accounts data files.	
Topic	Economic Policy & Debt: National accounts: Shares of GDP & other.	
Periodicity	Annual.	
Aggregation method	Weighted average.	
Indicator Name	**External debt stocks (% of exports of goods, services and income)**	**ExtDebtST_ExpGSInc**
Long definition	Total external debt stocks to exports of goods, services and income (including workers' remittances).	
Source	World Bank, Global Development Finance.	
Topic	Economic Policy & Debt: External debt: Debt ratios & other items.	
Periodicity	Annual.	
Aggregation method	Weighted average.	
Indicator Name	**External debt stocks (% of GNI)**	**ExtDebtST_GNI**
Long definition	Total external debt stocks to gross national income. Total external debt is debt owed to nonresidents repayable in foreign currency, goods, or services. Total external debt is the sum of public, publicly guaranteed, and private non-guaranteed long-term debt, use of IMF credit, and short-term debt. Short-term debt includes all debt having an original maturity of one year or less and interest in arrears on long-term debt. GNI (formerly GNP) is the sum of value added by all resident producers plus any product taxes (less subsidies) not included in the valuation of output plus net receipts of primary income (compensation of employees and property income) from abroad.	
Source	World Bank, Global Development Finance.	
Topic	Economic Policy & Debt: External debt: Debt ratios & other items.	
Periodicity	Annual. Aggregation method: Weighted average.	
Indicator Name	**Final consumption expenditure, etc. (% of GDP)**	**FinConExp_GDP**
Long definition	Final consumption expenditure (formerly total consumption) is the sum of household final consumption expenditure (private consumption) and general government final consumption expenditure (general government consumption). This estimate includes any statistical discrepancy in the use of resources relative to the supply of resources.	
Source	World Bank national accounts data, and OECD National Accounts data files.	
Topic / Periodicity	Economic Policy & Debt: National accounts: Shares of GDP & other / Annual	

Appendix 3.1f: Definition Macroeconomic (Dependent) Variables (6/26)

INDICATORS	DEFINITION / COMMENTS	ABBREVIATION
Indicator Name	**Final consumption expenditure, etc. (annual % growth)**	**FinConExp_gr**
Long definition	Average annual growth of final consumption expenditure based on constant local currency. Aggregates are based on constant 2000 U.S. dollars. Final consumption expenditure (formerly total consumption) is the sum of household final consumption expenditure (formerly private consumption) and general government final consumption expenditure (formerly general government consumption). This estimate includes any statistical discrepancy in the use of resources relative to the supply of resources.	
Source	World Bank national accounts data, and OECD National Accounts data files.	
Topic	Economic Policy & Debt: National accounts: Growth rates.	
Periodicity	Annual.	
Aggregation method	Weighted average.	
Indicator Name	**Foreign direct investment, net inflows (% of GDP)**	**FDInet_GDP**
Long definition	Foreign direct investment are the net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. This series shows net inflows (new investment inflows less disinvestment) in the reporting economy from foreign investors, and is divided by GDP.	
Source	International Monetary Fund, International Financial Statistics and Balance of Payments databases, World Bank, Global Development Finance, and World Bank and OECD GDP estimates.	
Topic	Economic Policy & Debt: Balance of payments: Capital & financial account.	
Periodicity	Annual.	
Aggregation method	Weighted average.	
Indicator Name	**Food production index (1999-2001 = 100)**	**FoodPrdIx**
Long definition	Food production index covers food crops that are considered edible and that contain nutrients. Coffee and tea are excluded because, although edible, they have no nutritive value.	
Source	Food and Agriculture Organization, electronic files and web site.	
Topic	Environment: Agricultural production.	
Periodicity	Annual.	
Base Period	1999-2001.	
Aggregation method	Weighted average.	

Appendix 3.1g: Definition Macroeconomic (Dependent) Variables (7/26)

INDICATORS	DEFINITION / COMMENTS	ABBREVIATION
Indicator Name	**Food exports (% of merchandise exports)**	**FoodExp_MrchExp**
Long definition	Food comprises the commodities in SITC sections 0 (food and live animals), 1 (beverages and tobacco), and 4 (animal and vegetable oils and fats) and SITC division 22 (oil seeds, oil nuts, and oil kernels).	
Source	World Bank staff estimates from the Comtrade database maintained by the United Nations Statistics Division.	
Topic	Private Sector & Trade: Exports	
Periodicity	Annual.	
Aggregation method	Weighted average.	
General comments	Merchandise export shares may not sum to 100 percent because of unclassified trade.	
Indicator Name	**Fuel exports (% of merchandise exports)**	**FuelExp_MerchExp**
Long definition	Fuels comprise SITC section 3 (mineral fuels).	
Source	World Bank staff estimates from the Comtrade database maintained by the United Nations Statistics Division.	
Topic	Private Sector & Trade: Exports.	
Periodicity	Annual.	
Aggregation method	Weighted average.	
General comments	Merchandise export shares may not sum to 100 percent because of unclassified trade.	
Indicator Name	**Fuel imports (% of merchandise imports)**	**FuelImp_MerchImp**
Long definition	Fuels comprise the commodities in SITC section 3 (mineral fuels).	
Source	World Bank staff estimates from the Comtrade database maintained by the United Nations Statistics Division.	
Topic	Private Sector & Trade: Imports.	
Periodicity	Annual.	
Aggregation method	Weighted average.	
Indicator Name	**GDP deflator (base year varies by country)**	**GDPDefl**
Long definition	The GDP implicit deflator is the ratio of GDP in current local currency to GDP in constant local currency. The base year varies by country.	
Source	World Bank national accounts data, and OECD National Accounts data files.	
Topic	Financial Sector: Exchange rates & prices.	
Periodicity	Annual.	
Base Period	Varies by country.	

Appendix 3.1h: Definition Macroeconomic (Dependent) Variables (8/26)

INDICATORS	DEFINITION / COMMENTS	ABBREVIATION
Indicator Name	**GDP growth (annual %)**	**GDP_gr**
Long definition	Annual percentage growth rate of GDP at market prices based on constant local currency. Aggregates are based on constant 2000 U.S. dollars. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources.	
Source	World Bank national accounts data, and OECD National Accounts data files.	
Topic	Economic Policy & Debt: National accounts: Growth rates.	
Periodicity	Annual. Aggregation method:Weighted average.	

Indicator Name	**GDP per capita growth (annual %)**	**GDPpCap_gr**
Long definition	Annual percentage growth rate of GDP per capita based on constant local currency. GDP per capita is gross domestic product divided by midyear population. GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources.	
Source	World Bank national accounts data, and OECD National Accounts data files.	
Topic	Economic Policy & Debt: National accounts: Growth rates.	
Periodicity	Annual.	
Aggregation method	Weighted average.	

Indicator Name	**GDP per unit of energy use (constant 2005 PPP $ per kg of oil equivalent)**	**GDP_UEnUKPPPOilE**
Short definition	GDP per unit of energy use is the PPP GDP per kilogram of oil equivalent of energy use. PPP GDP is gross domestic product converted to 2005 constant international dollars using purchasing power parity rates. An international dollar has the same purchasing power over GDP as a U.S. dollar has in the United States.	
Long definition	GDP per unit of energy use is the PPP GDP per kilogram of oil equivalent of energy use. PPP GDP is gross domestic product converted to 2005 constant international dollars using purchasing power parity rates. An international dollar has the same purchasing power over GDP as a U.S. dollar has in the United States.	
Source	International Energy Agency, and World Bank PPP data.	
Topic	Environment: Energy production & use.	
Periodicity	Annual.	
Base Period	2005.	
Aggregation method	Weighted average.	

Appendix 3.1i: Definition Macroeconomic (Dependent) Variables (9/26)

INDICATORS	DEFINITION / COMMENTS	ABBREVIATION
Indicator Name	**GDP per unit of energy use (PPP $ per kg of oil equivalent)**	**GDP_UEnUPPPOilE**
Short definition	GDP per unit of energy use is the PPP GDP per kilogram of oil equivalent of energy use. PPP GDP is gross domestic product converted to current international dollars using purchasing power parity rates. An international dollar has the same purchasing power over GDP as a U.S. dollar has in the United States.	
Long definition	GDP per unit of energy use is the PPP GDP per kilogram of oil equivalent of energy use. PPP GDP is gross domestic product converted to current international dollars using purchasing power parity rates. An international dollar has the same purchasing power over GDP as a U.S. dollar has in the United States.	
Source	International Energy Agency, and World Bank PPP data.	
Topic	Environment: Energy production & use.	
Periodicity	Annual.	
Aggregation method	Weighted average.	
Indicator Name	**General government final consumption expenditure (% of GDP)**	**GovFinConExp_GDP**
Long definition	General government final consumption expenditure (formerly general government consumption) includes all government current expenditures for purchases of goods and services (including compensation of employees). It also includes most expenditures on national defense and security, but excludes government military expenditures that are part of government capital formation.	
Source	World Bank national accounts data, and OECD National Accounts data files.	
Topic	Economic Policy & Debt: National accounts: Shares of GDP & other.	
Periodicity	Annual.	
Aggregation method	Weighted average.	
Indicator Name	**General government final consumption expenditure (annual % growth)**	**GovFinConExp_gr**
Long definition	Annual percentage growth of general government final consumption expenditure based on constant local currency. Aggregates are based on constant 2000 U.S. dollars. General government final consumption expenditure (general government consumption) includes all government current expenditures for purchases of goods and services (including compensation of employees). It also includes most expenditures on national defense and security, but excludes government military expenditures that are part of government capital formation.	
Source	World Bank national accounts data, and OECD National Accounts data files.	
Topic	Economic Policy & Debt: National accounts: Growth rates.	
Periodicity	Annual.	
Aggregation method	Weighted average.	

Appendix 3.1j: Definition Macroeconomic (Dependent) Variables (10/26)

INDICATORS	DEFINITION / COMMENTS	ABBREVIATION
Indicator Name	**Gross capital formation (% of GDP)**	**GroCapF_GDP**
Long definition	Gross capital formation (formerly gross domestic investment) consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. Fixed assets include land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. Inventories are stocks of goods held by firms to meet temporary or unexpected fluctuations in production or sales, and “work in progress." According to the 1993 SNA, net acquisitions of valuables are also considered capital formation.	
Source	World Bank national accounts data, and OECD National Accounts data files.	
Topic	Economic Policy & Debt: National accounts: Shares of GDP & other.	
Periodicity	Annual.	
Aggregation method	Weighted average.	
Indicator Name	**Gross capital formation (annual % growth)**	**GroCapF_gr**
Long definition	Annual growth rate of gross capital formation based on constant local currency. Aggregates are based on constant 2000 U.S. dollars. Gross capital formation (formerly gross domestic investment) consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. Fixed assets include land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. Inventories are stocks of goods held by firms to meet temporary or unexpected fluctuations in production or sales, and "work in progress." According to the 1993 SNA, net acquisitions of valuables are also considered capital formation.	
Source	World Bank national accounts data, and OECD National Accounts data files.	
Topic	Economic Policy & Debt: National accounts: Growth rates.	
Periodicity	Annual.	
Aggregation method	Weighted average.	
Indicator Name	**Gross domestic savings (% of GDP)**	**GrossDomSav_GDP**
Long definition	Gross domestic savings are calculated as GDP less final consumption expenditure (total consumption).	
Source	World Bank national accounts data, and OECD National Accounts data files.	
Topic	Economic Policy & Debt: National accounts: Shares of GDP & other.	
Periodicity	Annual.	
Aggregation method	Weighted average.	

Appendix 3.1k: Definition Macroeconomic (Dependent) Variables (11/26)

INDICATORS	DEFINITION / COMMENTS	ABBREVIATION
Indicator Name	**Gross fixed capital formation (% of GDP)**	**GrossFixCapForm_GDP**
Long definition	Gross fixed capital formation (formerly gross domestic fixed investment) includes land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. According to the 1993 SNA, net acquisitions of valuables are also considered capital formation.	
Source	World Bank national accounts data, and OECD National Accounts data files.	
Topic	Economic Policy & Debt: National accounts: Shares of GDP & other.	
Periodicity	Annual.	
Aggregation method	Weighted average.	
Indicator Name	**Gross fixed capital formation (annual % growth)**	**GrossFixCapForm_gr**
Long definition	Average annual growth of gross fixed capital formation based on constant local currency. Aggregates are based on constant 2000 U.S. dollars. Gross fixed capital formation (formerly gross domestic fixed investment) includes land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. According to the 1993 SNA, net acquisitions of valuables are also considered capital formation.	
Source	World Bank national accounts data, and OECD National Accounts data files.	
Topic	Economic Policy & Debt: National accounts: Growth rates.	
Periodicity	Annual.	
Aggregation method	Weighted average.	
Indicator Name	**Gross national expenditure (% of GDP)**	**GrossNatExp_GDP**
Long definition	Gross national expenditure (formerly domestic absorption) is the sum of household final consumption expenditure (formerly private consumption), general government final consumption expenditure (formerly general government consumption), and gross capital formation (formerly gross domestic investment).	
Source	World Bank national accounts data, and OECD National Accounts data files.	
Topic	Economic Policy & Debt: National accounts: Shares of GDP & other.	
Periodicity	Annual.	
Aggregation method	Weighted average.	

Appendix 3.1l: Definition Macroeconomic (Dependent) Variables (12/26)

INDICATORS	DEFINITION / COMMENTS	ABBREVIATION
Indicator Name	**Gross savings (% of GDP)**	**GrossSav_GDP**
Long definition	Gross savings are calculated as gross national income less total consumption, plus net transfers.	
Source	World Bank national accounts data, and OECD National Accounts data files.	
Topic	Economic Policy & Debt: National accounts: Shares of GDP & other.	
Periodicity	Annual.	
Aggregation method	Weighted average.	
Indicator Name	**Gross savings (% of GNI)**	**GrossSav_GNI**
Short definition	Gross savings are calculated as gross national income less total consumption, plus net transfers.	
Long definition	Gross savings are calculated as gross national income less total consumption, plus net transfers.	
Source	World Bank national accounts data, and OECD National Accounts data files.	
Topic	Economic Policy & Debt: National accounts: Shares of GDP & other.	
Periodicity	Annual.	
Aggregation method	Weighted average.	
Indicator Name	**High-technology exports (% of manufactured exports)**	**HiTekExp_ManuExp**
Long definition	High-technology exports are products with high R&D intensity, such as in aerospace, computers, pharmaceuticals, scientific instruments, and electrical machinery.	
Source / Topic	United Nations, Comtrade database / Infrastructure: Technology.	
Periodicity	Annual. Aggregation method: Weighted average.	
Indicator Name	**Household final consumption expenditure, etc. (annual % growth)**	**HHFinConExp_gr**
Long definition	Annual percentage growth of household final consumption expenditure is based on constant local currency. Aggregates are based on constant 2000 U.S. dollars. Household final consumption expenditure (formerly private consumption) is the market value of all goods and services, including durable products (such as cars, washing machines, and home computers), purchased by households. It excludes purchases of dwellings but includes imputed rent for owner-occupied dwellings. It also includes payments and fees to governments to obtain permits and licenses. Here, household consumption expenditure includes the expenditures of nonprofit institutions serving households, even when reported separately by the country. Item includes statistical discrepancy in the use of resources relative to the supply of resources.	
Source	World Bank national accounts data, and OECD National Accounts data files.	
Topic	Economic Policy & Debt: National accounts: Growth rates.	
Periodicity/Method	Annual. Weighted average.	

Appendix 3.1m: Definition Macroeconomic (Dependent) Variables (13/26)

INDICATORS	DEFINITION / COMMENTS	ABBREVIATION
Indicator Name	**Household final consumption expenditure per capita growth (annual %)**	**HHFinConExpPCap_gr**
Long definition	Annual percentage growth of household final consumption expenditure per capita, which is calculated using household final consumption expenditure in constant 2000 prices and World Bank population estimates. Household final consumption expenditure (private consumption) is the market value of all goods and services, including durable products (such as cars, washing machines, and home computers), purchased by households. It excludes purchases of dwellings but includes imputed rent for owner-occupied dwellings. It also includes payments and fees to governments to obtain permits and licenses. Here, household consumption expenditure includes the expenditures of nonprofit institutions serving households, even when reported separately by the country.	
Source	World Bank national accounts data, and OECD National Accounts data files.	
Topic	Economic Policy & Debt: National accounts: Growth rates.	
Periodicity	Annual.	
Aggregation method	Weighted average.	
Indicator Name	**Household final consumption expenditure, etc. (% of GDP)**	**HHFinConExp_GDP**
Long definition	Household final consumption expenditure (formerly private consumption) is the market value of all goods and services, including durable products (such as cars, washing machines, and home computers), purchased by households. It excludes purchases of dwellings but includes imputed rent for owner-occupied dwellings. It also includes payments and fees to governments to obtain permits and licenses. Here, household consumption expenditure includes the expenditures of nonprofit institutions serving households, even when reported separately by the country. This item also includes any statistical discrepancy in the use of resources relative to the supply of resources.	
Source	World Bank national accounts data, and OECD National Accounts data files.	
Topic	Economic Policy & Debt: National accounts: Shares of GDP & other.	
Periodicity	Annual.	
Aggregation method	Weighted average.	
Indicator Name	**ICT goods exports (% of total goods exports)**	**ICTExp_TTExp**
Long definition	Information and communication technology goods exports include telecommunications, audio and video, computer and related equipment; electronic components; and other information and communication technology goods. Software is excluded.	
Source	United Nations Statistics Division's Commodity Trade (Comtrade) database.	
Topic	Infrastructure: Communications.	
Periodicity	Annual.	
Aggregation method	Weighted average.	

Appendix 3.1n: Definition Macroeconomic (Dependent) Variables (14/26)

INDICATORS	DEFINITION / COMMENTS	ABBREVIATION
Indicator Name	**ICT goods imports (% total goods imports)**	**ICTImp_TTImp**
Short definition	Information and communication technology goods imports include telecommunications, audio and video, computer and related equipment; electronic components; and other information and communication technology goods. Software is excluded.	
Long definition	Information and communication technology goods imports include telecommunications, audio and video, computer and related equipment; electronic components; and other information and communication technology goods. Software is excluded.	
Source	United Nations Statistics Division's Commodity Trade (Comtrade) database.	
Topic	Infrastructure: Communications.	
Periodicity	Annual.	
Aggregation method	Weighted average.	
Indicator Name	**Import value index (2000 = 100)**	**ImpValIx**
Long definition	Import value indexes are the current value of imports (c.i.f.) converted to U.S. dollars and expressed as a percentage of the average for the base period (2000). UNCTAD's import value indexes are reported for most economies. For selected economies for which UNCTAD does not publish data, the import value indexes are derived from import volume indexes (line 73) and corresponding unit value indexes of imports (line 75) in the IMF's International Financial Statistics.	
Source	United Nations Conference on Trade and Development, Handbook of Statistics and data files, and International Monetary Fund, International Financial Statistics.	
Topic	Private Sector & Trade: Trade indexes.	
Periodicity	Annual.	
Base Period	2000.	
Indicator Name	**Import volume index (2000 = 100)**	**ImpVolIx**
Long definition	Import volume indexes are derived from UNCTAD's volume index series and are the ratio of the import value indexes to the corresponding unit value indexes. Unit value indexes are based on data reported by countries that demonstrate consistency under UNCTAD quality controls, supplemented by UNCTAD's estimates using the previous year's trade values at the Standard International Trade Classification three-digit level as weights. For economies for which UNCTAD does not publish data, the import volume indexes (lines 73) in the IMF's International Financial Statistics are used.	
Source	United Nations Conference on Trade and Development, Handbook of Statistics and data files, and International Monetary Fund, International Financial Statistics.	
Topic	Private Sector & Trade: Trade indexes.	
Periodicity	Annual. Base Period: 2000.	

Appendix 3.1o: Definition Macroeconomic (Dependent) Variables (15/26)

INDICATORS	DEFINITION / COMMENTS	ABBREVIATION
Indicator Name	**Imports of goods and services (% of GDP)**	**ImpGS_GDP**
Long definition	Imports of goods and services represent the value of all goods and other market services received from the rest of the world. They include the value of merchandise, freight, insurance, transport, travel, royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government services. They exclude compensation of employees and investment income (formerly called factor services) and transfer payments.	
Source	World Bank national accounts data, and OECD National Accounts data files.	
Topic	Economic Policy & Debt: National accounts: Shares of GDP & other.	
Periodicity	Annual.	
Aggregation method	Weighted average.	

Indicator Name	**Imports of goods and services (annual % growth)**	**ImpGS_gr**
Long definition	Annual growth rate of imports of goods and services based on constant local currency. Aggregates are based on constant 2000 U.S. dollars. Imports of goods and services represent the value of all goods and other market services received from the rest of the world. They include the value of merchandise, freight, insurance, transport, travel, royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government services. They exclude compensation of employees and investment income (formerly called factor services) and transfer payments.	
Source	World Bank national accounts data, and OECD National Accounts data files.	
Topic	Economic Policy & Debt: National accounts: Growth rates.	
Periodicity	Annual.	
Aggregation method	Weighted average.	

Indicator Name	**Industry, value added (% of GDP)**	**IndustValAd_GDP**
Long definition	Industry corresponds to ISIC divisions 10-45 and includes manufacturing (ISIC divisions 15-37). It comprises value added in mining, manufacturing (also reported as a separate subgroup), construction, electricity, water, and gas. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3. Note: For VAB countries, gross value added at factor cost is used as the denominator.	
Source	World Bank national accounts data, and OECD National Accounts data files.	
Topic	Economic Policy & Debt: National accounts: Shares of GDP & other.	
Periodicity	Annual.	
Aggregation method	Weighted average.	

Appendix 3.1p: Definition Macroeconomic (Dependent) Variables (16/26)

INDICATORS	DEFINITION / COMMENTS	ABBREVIATION
Indicator Name	**Industry, value added (annual % growth)**	**IndustValAd_gr**
Long definition	Annual growth rate for industrial value added based on constant local currency. Aggregates are based on constant 2000 U.S. dollars. Industry corresponds to ISIC divisions 10-45 and includes manufacturing (ISIC divisions 15-37). It comprises value added in mining, manufacturing (also reported as a separate subgroup), construction, electricity, water, and gas. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3.	
Source	World Bank national accounts data, and OECD National Accounts data files.	
Topic	Economic Policy & Debt: National accounts: Growth rates.	
Periodicity	Annual.	
Aggregation method	Weighted average.	
Indicator Name	**Inflation, consumer prices (annual %)**	**Infltn**
Long definition	Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. The Laspeyres formula is generally used.	
Source	International Monetary Fund, International Financial Statistics and data files.	
Topic	Financial Sector: Exchange rates & prices.	
Periodicity	Annual.	
Indicator Name	**Interest rate spread (lending rate minus deposit rate, %)**	**IRSSpread**
Long definition	Interest rate spread is the interest rate charged by banks on loans to prime customers minus the interest rate paid by commercial or similar banks for demand, time, or savings deposits.	
Source	International Monetary Fund, International Financial Statistics and data files.	
Topic	Financial Sector: Interest rates.	
Periodicity	Annual.	
Aggregation method	Median.	

Appendix 3.1q: Definition Macroeconomic (Dependent) Variables (17/26)

INDICATORS	DEFINITION / COMMENTS	ABBREVIATION
Indicator Name	**Livestock production index (1999-2001 = 100)**	**LivStockProdIx**
Short definition	Livestock production index includes meat and milk from all sources, dairy products such as cheese, and eggs, honey, raw silk, wool, and hides and skins.	
Long definition	Livestock production index includes meat and milk from all sources, dairy products such as cheese, and eggs, honey, raw silk, wool, and hides and skins.	
Source	Food and Agriculture Organization, electronic files and web site.	
Topic	Environment: Agricultural production.	
Periodicity	Annual.	
Base Period	1999-2001.	
Aggregation method	Weighted average.	
Indicator Name	**Manufacturing, value added (% of GDP)**	**ManuValAdd_GDP**
Long definition	Manufacturing refers to industries belonging to ISIC divisions 15-37. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3. Note: For VAB countries, gross value added at factor cost is used as the denominator.	
Source	World Bank national accounts data, and OECD National Accounts data files.	
Topic	Economic Policy & Debt: National accounts: Shares of GDP & other.	
Periodicity	Annual.	
Aggregation method	Weighted average.	
Indicator Name	**Manufactures exports (% of merchandise exports)**	**ManufExp_MrchExp**
Long definition	Manufactures comprise commodities in SITC sections 5 (chemicals), 6 (basic manufactures), 7 (machinery and transport equipment), and 8 (miscellaneous manufactured goods), excluding division 68 (non-ferrous metals).	
Source	World Bank staff estimates from the Comtrade database maintained by the United Nations Statistics Division.	
Topic	Private Sector & Trade: Exports.	
Periodicity	Annual.	
Aggregation method	Weighted average.	
General comments	Merchandise export shares may not sum to 100 percent because of unclassified trade.	

Appendix 3.1r: Definition Macroeconomic (Dependent) Variables (18/26)

INDICATORS	DEFINITION / COMMENTS	ABBREVIATION
Indicator Name	**Manufactures imports (% of merchandise imports)**	**ManfImp_MrchImp**
Long definition	Manufactures comprise the commodities in SITC sections 5 (chemicals), 6 (basic manufactures), 7 (machinery and transport equipment), and 8 (miscellaneous manufactured goods), excluding division 68 (nonferrous metals).	
Source	World Bank staff estimates from the Comtrade database maintained by the United Nations Statistics Division.	
Topic	Private Sector & Trade: Imports.	
Periodicity	Annual.	
Aggregation method	Weighted average.	
General comments	Merchandise import shares may not sum to 100 percent because of unclassified trade.	
Indicator Name	**Merchandise trade (% of GDP)**	**MrchTrade_GDP**
Long definition	Merchandise trade as a share of GDP is the sum of merchandise exports and imports divided by the value of GDP, all in current U.S. dollars.	
Source	World Trade Organization and World Bank GDP estimates.	
Topic	Private Sector & Trade: Total merchandise trade.	
Periodicity	Annual.	
Aggregation method	Weighted average.	
Indicator Name	**Manufacturing, value added (annual % growth)**	**ManFactValAdd_gr**
Long definition	Annual growth rate for manufacturing value added based on constant local currency. Aggregates are based on constant 2000 U.S. dollars. Manufacturing refers to industries belonging to ISIC divisions 15-37. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3.	
Source	World Bank national accounts data, and OECD National Accounts data files.	
Topic	Economic Policy & Debt: National accounts: Growth rates.	
Periodicity	Annual.	
Aggregation method	Weighted average.	

Appendix 3.1s: Definition Macroeconomic (Dependent) Variables (19/26)

INDICATORS	DEFINITION / COMMENTS	ABBREVIATION
Indicator Name	**Market capitalization of listed companies (% of GDP)**	**MrktCapList_GDP**
Long definition	Market capitalization (also known as market value) is the share price times the number of shares outstanding. Listed domestic companies are the domestically incorporated companies listed on the country's stock exchanges at the end of the year. 'Listed companies' does not include investment companies, mutual funds, or other collective investment vehicles.	
Source	Standard & Poor's, Emerging Stock Markets Factbook and supplemental S&P data, and World Bank and OECD GDP estimates.	
Topic	Financial Sector: Capital markets.	
Periodicity	Annual.	
Aggregation method	Weighted average.	
Indicator Name	**Money and quasi money (M2) as % of GDP**	**M2_GDP**
Long definition	Money and quasi money comprise the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of resident sectors other than the central government. This definition of money supply is frequently called M2; it corresponds to lines 34 and 35 in the International Monetary Fund's (IMF) International Financial Statistics (IFS).	
Source	International Monetary Fund, International Financial Statistics and data files, and World Bank and OECD GDP estimates.	
Topic	Financial Sector: Monetary holdings (liabilities).	
Periodicity	Annual.	
Aggregation method	Weighted average.	
Indicator Name	**Money and quasi money growth (annual %)**	**M2_gr**
Long definition	Average annual growth rate in money and quasi money. Money and quasi money comprise the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of resident sectors other than the central government. This definition is frequently called M2; it corresponds to lines 34 and 35 in the International Monetary Fund's (IMF) International Financial Statistics (IFS). The change in the money supply is measured as the difference in end-of-year totals relative to the level of M2 in the preceding year.	
Source	International Monetary Fund, International Financial Statistics and data files.	
Topic	Financial Sector: Monetary holdings (liabilities).	
Periodicity	Annual.	

Appendix 3.1t: Definition Macroeconomic (Dependent) Variables (20/26)

INDICATORS	DEFINITION / COMMENTS	ABBREVIATION
Indicator Name	**Money and quasi money (M2) to total reserves ratio**	**M2_TTReserv**
Short definition	Money and quasi money comprise the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of resident sectors other than the central government. This definition is frequently called M2; it corresponds to lines 34 and 35 in the International Monetary Fund's (IMF) International Financial Statistics (IFS). Total reserves comprise holdings of monetary gold, special drawing rights, reserves of IMF members held by the IMF, and holdings of foreign exchange under the control of monetary authorities. The gold component of these reserves is valued at year-end (December 31) London prices.	
Long definition	Money and quasi money comprise the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of resident sectors other than the central government. This definition is frequently called M2; it corresponds to lines 34 and 35 in the International Monetary Fund's (IMF) International Financial Statistics (IFS). Total reserves comprise holdings of monetary gold, special drawing rights, reserves of IMF members held by the IMF, and holdings of foreign exchange under the control of monetary authorities. The gold component of these reserves is valued at year-end (December 31) London prices.	
Source	International Monetary Fund, International Financial Statistics and data files.	
Topic	Financial Sector: Monetary holdings (liabilities).	
Periodicity	Annual.	

Indicator Name	**Multilateral debt (% of total external debt)**	**MultiDebt_TTExtD**
Short definition	Multilateral debt to total external debt stocks.	
Long definition	Multilateral debt to total external debt stocks.	
Source	World Bank, Global Development Finance.	
Topic	Economic Policy & Debt: External debt: Debt ratios & other items.	
Periodicity	Annual. Aggregation method:Weighted average.	

Indicator Name	**Ores and metals exports (% of merchandise exports)**	**OresMetExp_MrchExp**
Long definition	Ores and metals comprise the commodities in SITC sections 27 (crude fertilizer, minerals metals); 28 (metalliferous ores, scrap); and 68 (non-ferrous metals).	
Source	World Bank staff estimates from the Comtrade database maintained by the United Nations Statistics Division.	
Topic	Private Sector & Trade: Exports.	
Periodicity	Annual.	
Aggregation method	Weighted average.	
General comments	Merchandise export shares may not sum to 100 percent because of unclassified trade.	

Appendix 3.1u: Definition Macroeconomic (Dependent) Variables (21/26)

INDICATORS	DEFINITION / COMMENTS	ABBREVIATION
Indicator Name	**Purchasing power indexes of exports**	**PPIxExp**
Long definition	The value index of exports deflated by the import unit value index.	
Source	UNCTAD.	
Topic	International Merchandise Indexes.	
Periodicity	Annual.	
Base year	2000.	
Indicator Name	**Real interest rate (%)**	**RealIR**
Long definition	Real interest rate is the lending interest rate adjusted for inflation as measured by the GDP deflator.	
Source	International Monetary Fund, International Financial Statistics and data files using World Bank data on the GDP deflator.	
Topic	Financial Sector: Interest rates.	
Periodicity	Annual.	
Indicator Name	**Rural population (% of total population)**	**RuPp_ToTPp**
Long definition	Rural population refers to people living in rural areas as defined by national statistical offices. It is calculated as the difference between total population and urban population.	
Source	World Bank Staff estimates based on United Nations, World Urbanization Prospects.	
Topic	Environment: Density & urbanization.	
Periodicity	Annual.	
Aggregation method	Weighted average.	
Indicator Name	**Short-term debt (% of exports of goods, services and income)**	**STD_ExpGSInc**
Long definition	Short-term external debt is defined as debt that has an original maturity of one year or less. Available data permit no distinction between public and private non-guaranteed short-term debt. Exports of goods, services and income includes workers' remittances.	
Source	World Bank, Global Development Finance.	
Topic	Economic Policy & Debt: External debt: Debt ratios & other items.	
Periodicity	Annual.	
Aggregation method	Weighted average.	

Appendix 3.1v: Definition Macroeconomic (Dependent) Variables (22/26)

INDICATORS	DEFINITION / COMMENTS	ABBREVIATION
Indicator Name	**Short-term debt (% of total external debt)**	**STD_TTExtDbt**
Long definition	Short-term debt includes all debt having an original maturity of one year or less and interest in arrears on long-term debt. Total external debt is debt owed to nonresidents repayable in foreign currency, goods, or services. Total external debt is the sum of public, publicly guaranteed, and private non-guaranteed long-term debt, use of IMF credit, and short-term debt.	
Source	World Bank, Global Development Finance.	
Topic	Economic Policy & Debt: External debt: Debt ratios & other items.	
Periodicity	Annual.	
Aggregation method	Weighted average.	
Indicator Name	**Short-term debt (% of total reserves)**	**STD_TTResv**
Long definition	Short-term debt includes all debt having an original maturity of one year or less and interest in arrears on long-term debt. Total reserves includes gold.	
Source	World Bank, Global Development Finance.	
Topic	Economic Policy & Debt: External debt: Debt ratios & other items.	
Periodicity	Annual.	
Aggregation method	Weighted average.	
Indicator Name	**Stocks traded, total value (% of GDP)**	**StoxVal_GDP**
Long definition	Stocks traded refers to the total value of shares traded during the period. This indicator complements the market capitalization ratio by showing whether market size is matched by trading.	
Source	Standard & Poor's, Emerging Stock Markets Factbook and supplemental S&P data, and World Bank and OECD GDP estimates.	
Topic	Financial Sector: Capital markets.	
Periodicity	Annual.	
Aggregation method	Weighted average.	

Appendix 3.1w: Definition Macroeconomic (Dependent) Variables (23/26)

INDICATORS	DEFINITION / COMMENTS	ABBREVIATION
Indicator Name	**Tariff rate, applied, simple mean, all products (%)**	**TariffAllsimple**
Long definition	Simple mean applied tariff is the unweighted average of effectively applied rates for all products subject to tariffs calculated for all traded goods. Data are classified using the Harmonized System of trade at the six- or eight-digit level. Tariff line data were matched to Standard International Trade Classification (SITC) revision 3 codes to define commodity groups. Effectively applied tariff rates at the six- and eight-digit product level are averaged for products in each commodity group. When the effectively applied rate is unavailable, the most favored nation rate is used instead. To the extent possible, specific rates have been converted to their ad valorem equivalent rates and have been included in the calculation of simple mean tariffs.	
Source	World Bank staff estimates using the World Integrated Trade Solution system, based on data from United Nations Conference on Trade and Development's Trade Analysis and Information System (TRAINS) database.	
Topic	Private Sector & Trade: Tariffs.	
Periodicity	Annual.	
Indicator Name	**Tariff rate, applied, weighted mean, all products (%)**	**TariffAllweight**
Long definition	Weighted mean applied tariff is the average of effectively applied rates weighted by the product import shares corresponding to each partner country. Data are classified using the Harmonized System of trade at the six- or eight-digit level. Tariff line data were matched to Standard International Trade Classification (SITC) revision 3 codes to define commodity groups and import weights. To the extent possible, specific rates have been converted to their ad valorem equivalent rates and have been included in the calculation of weighted mean tariffs. Import weights were calculated using the United Nations Statistics Division's Commodity Trade (Comtrade) database. Effectively applied tariff rates at the six- and eight-digit product level are averaged for products in each commodity group. When the effectively applied rate is unavailable, the most favored nation rate is used instead.	
Source	World Bank staff estimates using the World Integrated Trade Solution system, based on tariff data from the United Nations Conference on Trade and Development's Trade and Development's Trade Analysis and Information System (TRAINS) database and global imports data from the United Nations Statistics Division's Comtrade database.	
Topic	Private Sector & Trade: Tariffs.	
Periodicity	Annual.	
Indicator Name	**Terms of trade indexes**	**ToT**
Long definition	The "net barter" terms of trade, defined as the ratio of the export unit value index to the import unit value index.	
Source	UNCTAD.	
Topic	International Merchandise Indexes.	
Periodicity	Annual. Base year: 2000.	

Appendix 3.1x: Definition Macroeconomic (Dependent) Variables (24/26)

INDICATORS	**DEFINITION / COMMENTS**	**ABBREVIATION**
Indicator Name	**Total debt service (% of exports of goods, services and income)**	**TTDServ_ExpGSInc**
Long definition	Total debt service is the sum of principal repayments and interest actually paid in foreign currency, goods, or services on long-term debt, interest paid on short-term debt, and repayments (repurchases and charges) to the IMF. Exports of goods and services includes income and workers' remittances.	
Source	World Bank, Global Development Finance.	
Topic	Economic Policy & Debt: External debt: Debt ratios & other items.	
Periodicity	Annual.	
Aggregation method	Weighted average.	
Indicator Name	**Total debt service (% of GNI)**	**TTDServ_GNI**
Long definition	Total debt service is the sum of principal repayments and interest actually paid in foreign currency, goods, or services on long-term debt, interest paid on short-term debt, and repayments (repurchases and charges) to the IMF.	
Source	World Bank, Global Development Finance.	
Topic	Economic Policy & Debt: External debt: Debt ratios & other items.	
Periodicity	Annual.	
Aggregation method	Weighted average.	
Indicator Name	**Total reserves (% of total external debt)**	**TTRes_TTExtDbt**
Long definition	International reserves to total external debt stocks.	
Source	World Bank, Global Development Finance.	
Topic	Economic Policy & Debt: Balance of payments: Reserves & other items.	
Periodicity	Annual.	
Aggregation method	Weighted average.	
Indicator Name	**Trade (% of GDP)**	**Trade_GDP**
Long definition	Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product.	
Source	World Bank national accounts data, and OECD National Accounts data files.	
Topic	Economic Policy & Debt: National accounts: Shares of GDP & other.	
Periodicity	Annual.	
Aggregation method	Weighted average.	

Appendix 3.1y: Definition Macroeconomic (Dependent) Variables (25/26)

INDICATORS	DEFINITION / COMMENTS	ABBREVIATION
Indicator Name	**Unit value indexes of exports**	**UnitValIxExp**
Long definition	Unit value index: To improve data coverage, especially for the latest periods, the following procedure was used in the calculation of unit value indexes: A set of average prices indexes at SITC (Revision 3, 3-digit) group level was constructed using UNCTAD Commodity Price Statistics, international and national sources and UNCTAD secretariat estimates. At the country level, unit value indexes were calculated using previous year's trade values at the SITC 3-digit level, available in table 3.2 as weights. In some instances these indexes may differ from the estimates published in official sources, since the main aim is to provide tentative estimates for most developing countries on a comparable basis.	
Source / Topic	UNCTAD / International Merchandise Indexes.	
Periodicity	Annual. Base year: 2000.	
Indicator Name	**Unit value indexes of imports**	**UnitValIxImp**
Long definition	Unit value index: To improve data coverage, especially for the latest periods, the following procedure was used in the calculation of unit value indexes: A set of average prices indexes at SITC (Revision 3, 3-digit) group level was constructed using UNCTAD Commodity Price Statistics, international and national sources and UNCTAD secretariat estimates. At the country level, unit value indexes were calculated using previous year's trade values at the SITC 3-digit level, available in table 3.2 as weights. In some instances these indexes may differ from the estimates published in official sources, since the main aim is to provide tentative estimates for most developing countries on a comparable basis.	
Source	UNCTAD.	
Topic	International Merchandise Indexes.	
Periodicity	Annual.	
Base year	2000.	
Indicator Name	**Internet users (per 100 people)**	**Internet_100**
Short definition	Internet users are people with access to the worldwide network.	
Long definition	Internet users are people with access to the worldwide network.	
Source	Int’l Telecomm. Union, World Telecommunication/ICT Development Report and database, and World Bank estimates.	
Topic	Infrastructure: Communications.	
Periodicity	Annual.	
Aggregation method	Weighted average.	
General comments	For data sources please see also the International Telecommunication Union (www.itu.int/ITU-D/ict/datacollection/).	

Appendix 3.1z: Definition Macroeconomic (Dependent) Variables (26/26)

INDICATORS	DEFINITION / COMMENTS	ABBREVIATION
Indicator Name	**Telephone lines (per 100 people)**	**Phonelines_100**
Short definition	Telephone lines are fixed telephone lines that connect a subscriber's terminal equipment to the public switched telephone network and that have a port on a telephone exchange. Integrated services digital network channels and fixed wireless subscribers are included.	
Long definition	Telephone lines are fixed telephone lines that connect a subscriber's terminal equipment to the public switched telephone network and that have a port on a telephone exchange. Integrated services digital network channels and fixed wireless subscribers are included.	
Source	International Telecommunication Union, World Telecommunication/ICT Development Report and database, and World Bank estimates.	
Topic	Infrastructure: Communications.	
Periodicity	Annual.	
Aggregation method	Weighted average.	
General comments	For data sources please see also the International Telecommunication Union (www.itu.int/ITU-D/ict/datacollection/).	
Indicator Name	**Unemployment, total (% of total labor force)**	**Unempl_Lforce**
Short definition	Unemployment refers to the share of the labor force that is without work but available for and seeking employment. Definitions of labor force and unemployment differ by country.	
Long definition	Unemployment refers to the share of the labor force that is without work but available for and seeking employment. Definitions of labor force and unemployment differ by country.	
Source	International Labor Organization, Key Indicators of the Labor Market database.	
Topic	Labor & Social Protection: Unemployment.	
Periodicity	Annual. Aggregation method: Weighted average.	
Indicator Name	**Mobile cellular subscriptions (per 100 people)**	**MobileSubs 100**
Short definition	Mobile cellular telephone subscriptions are subscriptions to a public mobile telephone service using cellular technology, which provide access to the public switched telephone network. Post-paid and prepaid subscriptions are included.	
Long definition	Mobile cellular telephone subscriptions are subscriptions to a public mobile telephone service using cellular technology, which provide access to the public switched telephone network. Post-paid and prepaid subscriptions are included.	
Source	International Telecommunication Union, World Telecommunication/ICT Development Report&, World Bank estimates.	
Topic / Periodicity	Infrastructure: Communications / Annual.	
Aggregation method	Weighted average.	
General comments	For data sources please see also the International Telecommunication Union (www.itu.int/ITU-D/ict/datacollection/).	

Appendix 3.2: Macroeconomic Topics

Economic Policy & Debt: National accounts: Shares of GDP & other
Economic Policy & Debt: National accounts: Growth rates
Economic Policy & Debt: Balance of payments: Current account: Balances
Economic Policy & Debt: Balance of payments: Capital & financial account
Economic Policy & Debt: External debt: Debt ratios & other items
Economic Policy & Debt: Balance of payments: Reserves & other items

Private Sector & Trade: Trade indexes
Private Sector & Trade: Exports
Private Sector & Trade: Imports
Private Sector & Trade: Total merchandise trade
Private Sector & Trade: Tariffs

Environment: Agricultural production
Environment: Energy production & use
Environment: Density & urbanization

Infrastructure: Technology
Infrastructure: Communications

Financial Sector: Interest rates
Financial Sector: Capital markets
Financial Sector: Monetary holdings (liabilities)
Financial Sector: Exchange rates & prices

International Merchandise Indexes

Labor & Social Protection: Unemployment

Source: World Bank (2009, 2010). Table created and arranged by the author.

Appendix 3.3: Commodity Price Index

Source for Appendix 3.3: UNCTAD (2009). Table created and arranged by the author.

Appendix 3.3a: Commodity Price Index — Food, Tropical Beverages, Vegetables

INDICATORS	DEFINITION / COMMENTS	ABBREVIATION
Indicator Name	**FOOD**	**FoodIx**
Dimension	Composite	
Source	UNCTAD Commodity price Bulletin	
Topic	Commodity Price Index	
Periodicity	Annual Averages	
Base Year	PRICE INDEXES 2000=100	
Indicator Name	**TROPICAL BEVERAGES**	**TropBevIx**
Dimension	Composite	
Source	UNCTAD Commodity price Bulletin	
Topic	Commodity Price Index	
Periodicity	Annual Averages	
Base Year	PRICE INDEXES 2000=100	
Indicator Name	**VEGETABLE OILSEEDS AND OILS**	**VegOilSeedsIx**
Definition	Composite	
Source	UNCTAD Commodity price Bulletin	
Topic	Commodity Price Index	
Periodicity	Annual Averages	
Base Year	PRICE INDEXES 2000=100	

Source: UNCTAD (2009). Table created and arranged by the author.

Appendix 3.3b: Commodity Price Index — Agri, Oil, Minerals and Metals

INDICATORS	DEFINITION / COMMENTS	ABBREVIATION
Indicator Name	**AGRICULTURAL RAW MATERIALS**	**AgriRawIx**
Definition	Composite	
Source	UNCTAD Commodity price Bulletin	
Topic	Commodity Price Index	
Periodicity	Annual Averages	
Base Year	PRICE INDEXES 2000=100	
Indicator Name	**ORES, MINERALS AND METALS**	**MinMetalsIx**
Definition	Composite	
Source	UNCTAD Commodity price Bulletin	
Topic	Commodity Price Index	
Periodicity	Annual Averages	
Base Year	PRICE INDEXES 2000=100	
Indicator Name	**CRUDE** Petroleum, average of Dubai/Brent/Texas equally weighted ($/barrel)	**CrudeIx**
Definition	Composite	
Source	UNCTAD Commodity price Bulletin	
Topic	Commodity Price Index	
Periodicity	Annual Averages	
Base Year	PRICE INDEXES 2000=100	

Source: UNCTAD (2009). Table created and arranged by the author.

Appendix 3.4: Commodity Price Index Constituents

Source: UNCTAD (2009), Definition Section. Arranged by the author.

Appendix 3.4a: Commodity Price Index Constituents — Food

FOOD INDEX

Wheat: *1.* Argentina, Trigo Pan Upriver FOB. (International Grains Council (IGC), London, U.K.). *2.* United States, n° 2, Hard Red Winter (ordinary), FOB Gulf. (International Grains Council (IGC), London, U.K.).

Maize: *1.* Argentina, Rosario FOB. (International Grains Council (IGC), London, U.K.). *2.* US, yellow n° 3, FOB Gulf. (International Grains Council (IGC), London, U.K.).

Rice: Thailand, white milled, 5% broken, nominal price quotes, FOB Bangkok, including export duty. (International Monetary Fund (IMF), Washington D.C., U.S.A.).

Sugar (¢/lb.): In bulk, average of I.S.A. daily prices (calculated in accordance with article 61 of the International Sugar Agreement, 1992), FOB stowed Caribbean ports. (International Sugar Organization, London, U.K.).

Beef (¢/lb.)**:** Australia and New Zealand, frozen boneless, 85% visible lean meat, U.S. import price, FOB, port of entry. Prior to December 1975: 90% visible lean meat. (International Monetary Fund (IMF), Washington D.C., U.S.A.).

Bananas (¢/lb.): Central America and Ecuador, first class quality tropical pack, Chiquita, Dole and Del Monte, U.S. importer's price, FOB U.S. ports. (International Monetary Fund (IMF), Washington D.C., U.S.A.).

Pepper: White Sarawak/Muntok, European market. (*The Public Ledger*, London, U.K.). Prior to June 2003, white Sarawak, closing quotations, Singapore. (*Market News Service*, ITC, UNCTAD/WTO, Geneva, Switzerland).

Soybean meal: Hamburg, in bulk, 44/45% protein, Hamburg FOB ex-mill (*Oil World*, Hamburg, Germany).

Fish meal: Any origin, in bulk, 64/65% protein, Bremen, free carrier price. Prior to March 2006, any origin, 64/65% proteins, cost and freight, Hamburg (calculated from the Hamburg wholesale price), *Oil World*, Hamburg, Germany.

Appendix 3.4b: Commodity Price Index Constituents — Tropical Beverages

TROPICAL BEVERAGES INDEX

Coffee (¢/lb.)**:** Average of daily prices. As from October 2001, I.C.A. 2001: *1. Ex-dock New York: Colombian mild Arabicas:* Excelso, UGQ, screen size 14. 2. Ex-dock New York: Brazilian and other natural Arabicas: Santos 4. 3. Other mild Arabicas, weighted average of: -3.1. Ex-dock New York: El Salvador Central Standard, Guatemala Prime Washed, Mexico Prime Washed and Costa Rica Hard Bean. - 3.2. Ex-dock Bremen/Hamburg: El Salvador Strictly High Grown, Guatemala Hard Bean, Nicaragua Strictly High Grown and Costa Rica Hard Bean. 4. Robustas, weighted average of: - 4.1. Ex-dock New York: Côte d'Ivoire Grade 2, Uganda Standard, Indonesia EK Grade 4 and Vietnam Grade 2. - 4.2. Ex-dock Le Havre/Marseilles: Côte d'Ivoire Grade 2, Cameroon Grade 1, Indonesia EK Grade 4, Uganda Standard and Vietnam Grade 2. 5. Composite indicator price 1976 version, arithmetic mean of: -Ex-dock New York: Other mild Arabicas -Ex-dock New York: Robustas. As from October 2009, I.C.A. 2001:*6. ICO Composite indicator price*, weighted as follows:

-13% Colombian milds	(45% New York and 55% Bremen/Hamburg)
-23% Other mild Arabicas	(40% New York and 60% Bremen/Hamburg)
-30% Brazilian naturals	(23% New York and 77% Bremen/Hamburg)
-34% Robustas	(17% New York and 83% Le Havre/Marseilles)

For previous weights of I.C.A. 2001, please refer to the International Coffee Organization's (ICO) website. (International Coffee Organization (ICO), London, U.K.).

Cocoa (¢/lb.): Average of the daily prices of the nearest three active future trading months on the London Terminal Market and on the New York Coffee, Sugar and Cocoa Exchange at time of the London close (Article 26 of the International Cocoa Agreement, 1993). The average price expressed in US dollars is converted into SDR equivalent at the appropriate daily official US dollar/SDR exchange rate published by the IMF. Estimates for the years 1971 to 1985 are calculated using the monthly averages of the US dollar/SDR exchange rate (International Cocoa Organization (ICCO), London, U.K.).

Tea (¢/kg): Kenya, Best Pekoe Fannings 1, Mombasa auction prices. (International Monetary Fund (IMF), Washington D.C., U.S.A.).

Appendix 3.4c: Commodity Price Index Constituents — Vegetables

VEGETABLES OILSEEDS AND OILS INDEX

Soybeans: In bulk, n° 2 yellow, United States, CIF Rotterdam. (*Oil World,* Hamburg, Germany).

Soybean oil Crude, in bulk, The Netherlands, FOB ex-mill. Prior to April 1973: The Netherlands, any origin, ex-tank, Rotterdam. (*Oil World*, Hamburg, Germany).

Sunflower oil: In bulk, European Union, FOB North Western European ports. (*Oil World*, Hamburg, Germany).

Groundnut oil: In bulk, any origin, CIF Rotterdam. (*Oil World*, Hamburg, Germany).

Copra: In bulk, Philippines/Indonesia, CIF North Western European ports. (*Oil World*, Hamburg, Germany).

Coconut oil: In bulk, Philippines, CIF Rotterdam. Prior to 1973: Sri Lanka, 1% bulk, CIF European ports. (*Oil World*, Hamburg, Germany).

Palm kernel oil: in bulk, Malaysia, CIF Rotterdam. Prior to September 1980: Dutch, FOB ex-mill. (*Oil World*, Hamburg, Germany).

Palm oil: In bulk, Malaysia/Indonesian origin, 5% ffa (free fatty acid), CIF North Western European ports. (*Oil World*, Hamburg, Germany*)*.

Cottonseed oil: In bulk, United States, Prime Bleachable Summer Yellow (PBSY), FOB Gulf. Prior to October 1994: United States, P.B.S.Y., CIF Rotterdam. (*Oil World*, Hamburg, Germany*)*.

Appendix 3.4d: Commodity Price Index Constituents — Agricultural Raw Materials

AGRICULTURAL RAW MATERIALS INDEX

Linseed oil: In bulk, any origin, ex-tank Rotterdam. Prior to January 1977: any origin, CIF London/Hull. Prior to 15 September 1969: Argentina, bulk, CIF United Kingdom. (*Oil World*, Hamburg, Germany).

Tobacco: Unmanufactured, import unit value based on United States Department of Agriculture (USDA), Foreign Agriculture Service (FAS) trade data (UNCTAD secretariat). Prior to March 2003: United States, unmanufactured tobacco, general import price. (International Monetary Fund (IMF), Washington D.C., U.S.A.).

Cotton (¢/lb.): *1.* Long staple: Sudan Barakat, X4B CFR Far Eastern quotations. Prior to August 2005: CIF North Europe quotations. *2.* Medium staple: U.S., Memphis/Eastern, Middling 1-3/32", CFR, Far Eastern quotations. Prior to August 2008: Medium staple: U.S. Memphis Territory, Middling 1-3/32", CIF North Europe quotations. *3.* Short staple: U.S., Memphis/Orleans/Texas, Midd. 1-3/32", CFR Far Eastern quotations. Prior to June 2005: U.S. Orleans/Texas, Midd. 1-3/32", CIF North Europe quotations. *4.* Pakistan, Sind/Punjab, Afzal 1-1/32",CIF North Europe quotations. *5.* Cotton Outlook Index A FE, CFR Far Eastern quotations, Middling 1-3/32". Prior to August 2004: Cotton Outlook Index A NE, CIF North Europe quotations. *6.* Cotton Outlook Index B NE (coarse count), CIF North Europe quotations. The Cotlook North European B Index is discontinued as from August 1, 2008. *7.* Extra long: Egypt, Giza 88, Good +3/8, CFR Far Eastern quotations. Prior to August 2005: Egypt, Giza 70, Good +3/8, FOB. *(*Cotton Limited, Liverpool, U.K.).

Wool: *1.* Fine wool, 19 micron, Australia. (International Monetary Fund (IMF), Washington D.C., U.S.A.). *2.* Coarse wool, 23 micron, Australia. (International Monetary Fund (IMF), Washington D.C., U.S.A.).

Jute: Bangladesh, BWD (Bangladesh White D), FOB Mongla. Revised series since 2004. (Food and Agricultural Organisation (FAO), Rome, Italy). (Prior to 2004: *The Public Ledger*, London, U.K.). Prior to March 1980: Chittagong-Chalna, minimum export price. (Ministry of Jute, Bangladesh).

Sisal: *1.* Tanzania/Kenya, N° 2 & 3 long, FOB. Revised series since 2004. (Food and Agricultural Organisation (FAO), Rome, Italy). Prior to 2007: CIF main European ports. (Prior to 2004: *The Public Ledger,* London, U.K.). *2.* Tanzania/Kenya N° 3 & UG, FOB. Revised series since 2004. (Food and Agricultural Organisation (FAO), Rome, Italy). Prior to 2007: CIF main European ports. (Prior to 2004: *The Public Ledger,* London, U.K.).

Cattle hides (¢/lb.): United States, Chicago packer's heavy native steers, over 53 lbs, wholesale dealer's price, FOB shipping point. (International Monetary Fund (IMF), Washington D.C., U.S.A.).

Non-coniferous woods ($ equivalent): Imported, sawn or chipped lengthwise, sliced or peeled of a thickness exceeding 6mm, UK import price index (2005=100), dollar equivalent.(Office for National Statistics, Newport, Wales, U.K.).

Tropical logs ($/m3): *1.* Sapelli, loyal and marchand, U.K. import price, FOB. (International Tropical Timber Organization, Yokohama, Japan). Prior to June 2000: FOB Cameroon. Prior to 1979: Niangon, FOB, Côte d'Ivoire. (International Tropical Timber Organization, Yokohama, Japan; prior to January 1995: *Market News Service*, ITC/UNCTAD/GATT, Geneva, Switzerland). *2.* Okoume, Gabon, superior quality, FOB. (International Tropical Timber Organization, Yokohama, Japan). Prior to September 2007: loyal et marchand, FOB. (Société Nationale des Bois du Gabon, SNBG; prior to May 2006, *Marchés tropicaux et méditerranéens*, Paris, France).

Tropical sawn wood ($/m3): Malaysia, Meranti, select and better, CIF plus commission U.K. (International Tropical Timber Organization, Yokohama, Japan). Prior to August 2008: Dark Red Meranti, Malaysia, select and better, CIF French ports. (*Marchés tropicaux et méditerranéens*, Paris, France).

Plywood (¢/sheet): Southeast Asia, Lauan, 3-ply, Extra, 182 cm x 91 cm x 4 mm, wholesale price, spot Tokyo. (World Bank, Washington D.C., USA; prior to January 2002: Ministry of Agriculture, Forestry and Fisheries, Tokyo, Japan).

Rubber (SGD/kg): ***1.*** In bales, n° 1 RSS, FOB Singapore. Discontinued series by SICOM. (Singapore Commodity Exchange Limited, Singapore). ***2.*** TSR 20, New York. (International Rubber Study Group, London, U.K.). ***3.*** N° 3 RSS, monthly average of weighted daily future prices. (Singapore Commodity Exchange Limited, Singapore).

Appendix 3.4e: Commodity Price Index Constituents — Ores, Minerals, Metals

ORES, MINERALS AND METALS INDEX

Phosphate rock: Khouribga, 70% BPL, contract, FAS Casablanca. (World Bank, Washington D.C., U.S.A.).

Manganese ore ($/mtu Mn): 48/50% Mn, max 0.1%P, metallurgical FOB. (*Metal Bulletin* Limited, London, U.K.).

Iron ore (¢/Fe unit): 1**.** Brazilian to Europe, Vale, Itabira, Southern and South-eastern System Fines (SSF), 64.5% Fe content, FOB. (The *Tex Report*, Tokyo, Japan). ***2.*** Australian to Japan, fines, 64% Fe content, Hamersley, FOB. As of April 2004, prices are in dry metric ton. Prior to April 2004: the price was quoted in dry long tons units. (The *Tex Report*, Tokyo, Japan).

Aluminium: London Metal Exchange, high grade, cash (*Metal Bulletin* Ltd. London, UK).

Copper (£/t): *1.* London Metal Exchange, grade A, electrolytic wire bars and cathodes, cash. (*Metal Bulletin* Limited, London, U.K.). *2.* US Producer/Refinery, FOB (Quotation is US producer/delivered prices less 1.4¢ shipping cost). (*Platts*, *Metals Week*, New York, U.S.A.).

Nickel (£/t): *1.* London Metal Exchange, cash (*Metal Bulletin*, London, U.K.). *2.* New York dealer, cathodes 4X4 , 99.9% Ni, FOB North American shipping point; spot, estimated market price. (*Platts*, *Metals Week*, New York, U.S.A.).

Lead ($/t, £/t): *1.* London Metal Exchange, settlement and cash seller's price in warehouse excluding duty, range main U.K. ports; Purity 99.97% Pb. (*Metal Bulletin* Limited, London, U.K.). *2.* North America, Producer. The weighted average, based on 1993 production figures, of the list prices of those North American (Canadian and United States) primary and secondary producers still quoting list prices, in addition to those producers who have switched to London Metal Exchange pricing, the LME cash price plus appropriate market premiums or discounts. Prior to 9 December 1971: US domestic price in New York, refined lead. (*Platts*, *Metals Week*, New York, U.S.A.).

Zinc (¢/lb.,): *1.* London Metal Exchange, settlement and cash seller's price in warehouse excluding duty, range main U.K ports; Virgin zinc, special high grade. Prior to November 1988: high grade. (*Metal Bulletin* Limited, London, U.K.). *2.* North America, special high grade. Price based on London Metal Exchange base price plus premiums or discounts, depending on market conditions. From January 1971 to September 1980: US Prime Western delivered. Prior to January 1971: US Prime Western FOB East St Louis. (*Platts*, *Metals Week*, New York, U.S.A.).

Tin (Mal$/kg): 1. London Metal Exchange, high grade, cash. Prior to August 1989: United Kingdom, free market, spot, minimum 99.85% Sn, London. (*Metal Bulletin* Limited, London, U.K.). *2.* Kuala Lumpur Tin Market (KLTM), ex-smelter (International Tin Council reference price since 4 July 1972). Tin trade was suspended between 24 October 1985 and end of January 1986. (*Metal Bulletin* Limited, London, U.K.).

Tungsten ore ($/mtu Wo3)**:** Wolframite and scheelite, minimum content of WO3: 65%, CIF Europe. Prior to April 1992: wolfram. (*Metal Bulletin* Limited, London, U.K.).

Gold ($/troy ounce): United Kingdom, 99.5% fine, London afternoon fixing, average of daily rates. (*Metal Bulletin* Limited, London, U.K.).

Silver Handy & Harman, (¢/troy ounce): 99.9% grade refined, average of sellers daily prices, New York. (*Metal Bulletin* Limited, London, U.K.).

Appendix 3.4f: Commodity Price Index Constituents — Crude Index

CRUDE INDEX

Average of United Kingdom Brent (light), Dubai (medium), and West Texas Intermediate (heavy) crude prices, reflecting relatively equal consumption of light, medium, and heavy crudes worldwide. - United Kingdom: Brent Blend 38- API, spot, FOB, United Kingdom ports; - Dubai: Fateh 32- API, spot, FOB Dubai; - United States: West Texas Intermediate 40- API, spot, FOB, Midland Texas. (International Monetary Fund (IMF), Washington D.C., U.S.A.).

Appendix 3.5: Commodity Price Indexes Weights

Commodity	Weights (%)		Commodity	Weights (%)	
ALL FOOD			**AGRICULTURAL RAW MATERIALS**		
FOOD AND TROPICAL BEVERAGES			Linseed oil	0.07	0.01
Food			Tobacco	20.08	2.72
Wheat	6.56	4.04	Cotton		
Maize	6.95	4.28	Extra long	1.24	0.17
Rice	16.17	9.96	Long	1.65	0.22
Sugar	13.68	8.43	Medium/long	13.95	1.88
Bovine meat	6.06	3.73	short	3.09	0.42
Bananas	9.08	5.59	Wool		
Pepper	2.53	1.56	Fine	0.61	0.08
Soybean meal	14.91	9.18	Coarse	0.84	0.11
Fish meal	3.72	2.29	Jute	0.45	0.06
Tropical beverages			Sisal		
Coffee			3L	0.05	0.01
Colombian mild Arabicas	0.99	0.61	UG	0.13	0.02
Brazilian and other Arabicas	1.37	0.85	Hides and skins	6.21	0.84
Other mild Arabicas	1.97	1.21	Tropical logs	31.40	4.25
Robustas	1.20	0.74	Rubber	20.23	2.73
Cocoa beans	1.68	1.03	Total	100.0	13.52
Tea	1.82	1.12			
Vegetable oilseeds and oils			**MINERALS, ORES AND METALS**		
Soybeans	3.14	1.93	Phosphate rock	2.67	0.66
Soybean oil	1.88	1.16	Manganese ore	1.20	0.30
Sunflower oil	0.69	0.42	Iron ore	13.65	3.40
Groundnut oil	0.14	0.09	Aluminium	23.93	5.96
Copra	0.06	0.04	Copper	38.89	9.68
Coconut oil	0.66	0.41	Nickel	6.70	1.67
Palm kernel oil	0.55	0.34	Lead	2.10	0.52
Palm oil	4.19	2.58	Zinc	7.22	1.80
Total	100.0	61.59	Tin	3.62	0.90
			Tungsten ore	0.02	0.0
			Total	**100.0**	24.89
			Price Index - all groups		**100.0**

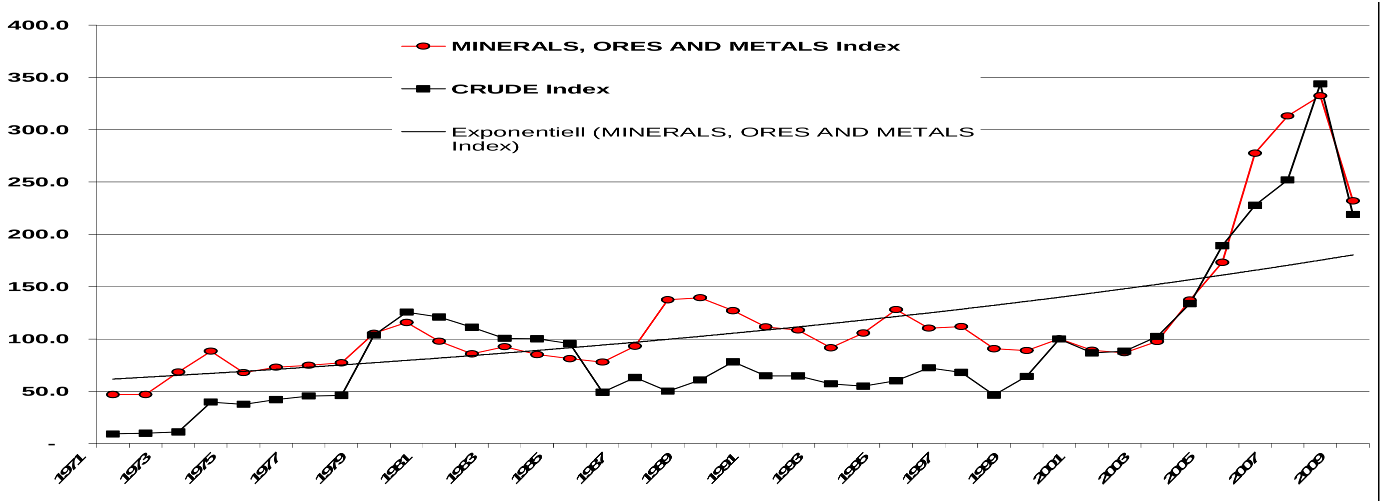
Data Source: UNCTAD (2009), Section Product Information. Table created and arranged by the author.

Appendix 3.6: Commodity Price Index and Constituents 1971-2009 — Figures

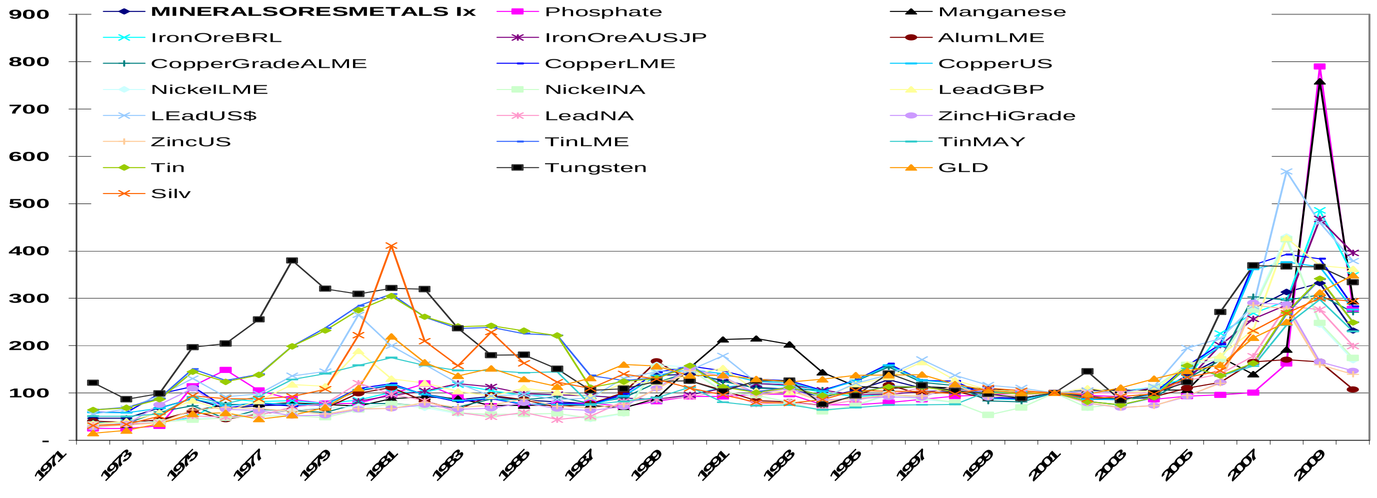
Data Source: UNCTAD (2009). Figures created and arranged by the author.

Appendix 3.6a: Crude & Minerals and Metals Index Constituents

Crude Index & Minerals and Metals Index

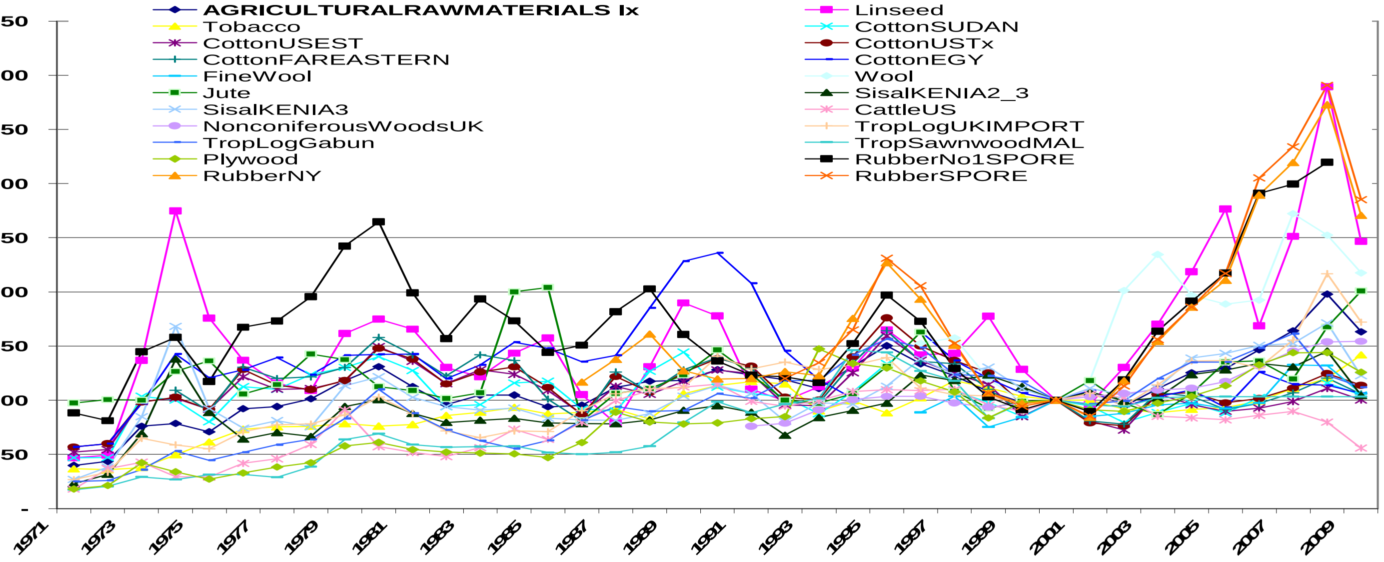


Minerals and Metals Index and Constituents

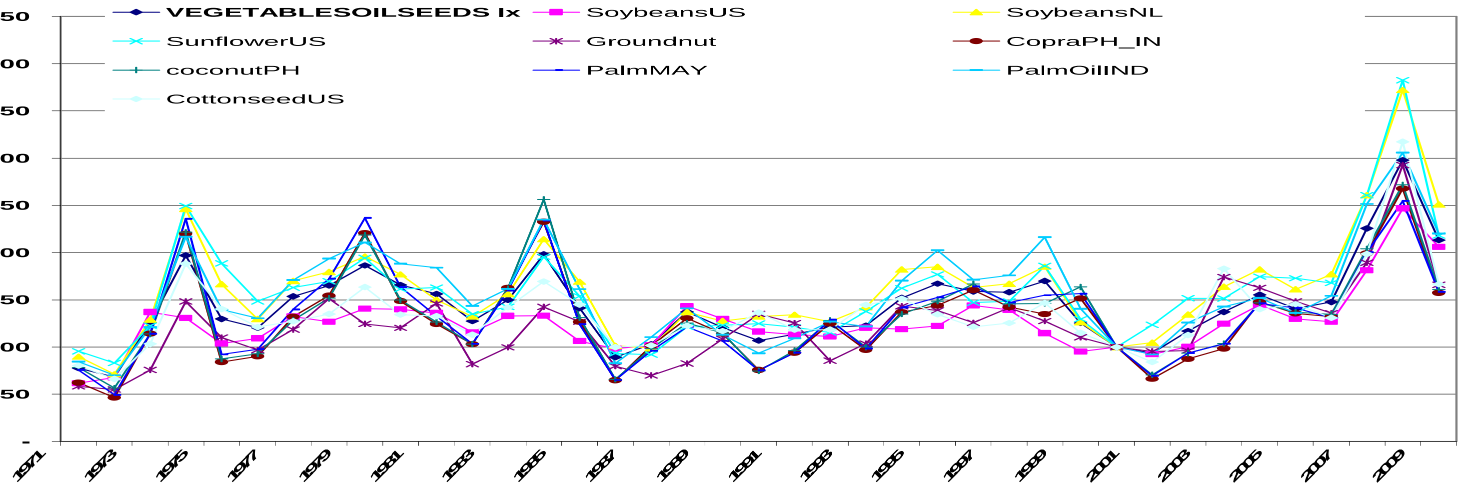


Appendix 3.6b: Agricultural Raw Materials and Vegetables Oils Seeds Index Constituents

Agricultural Raw Materials Index and Constituents

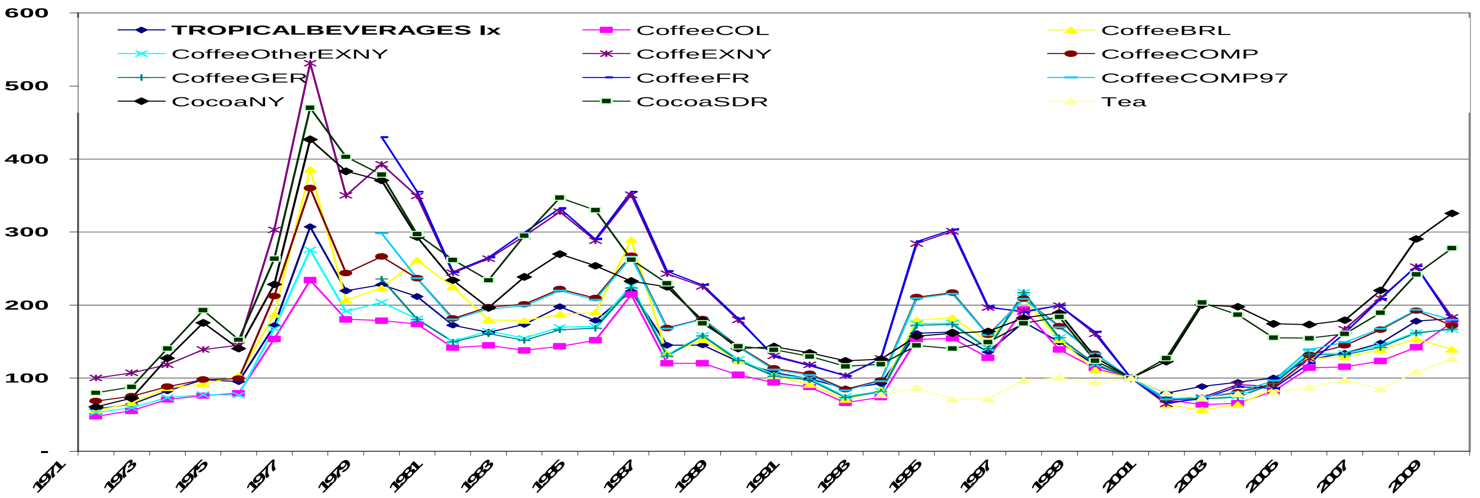


Vegetables Oils Seeds Index and Constituents

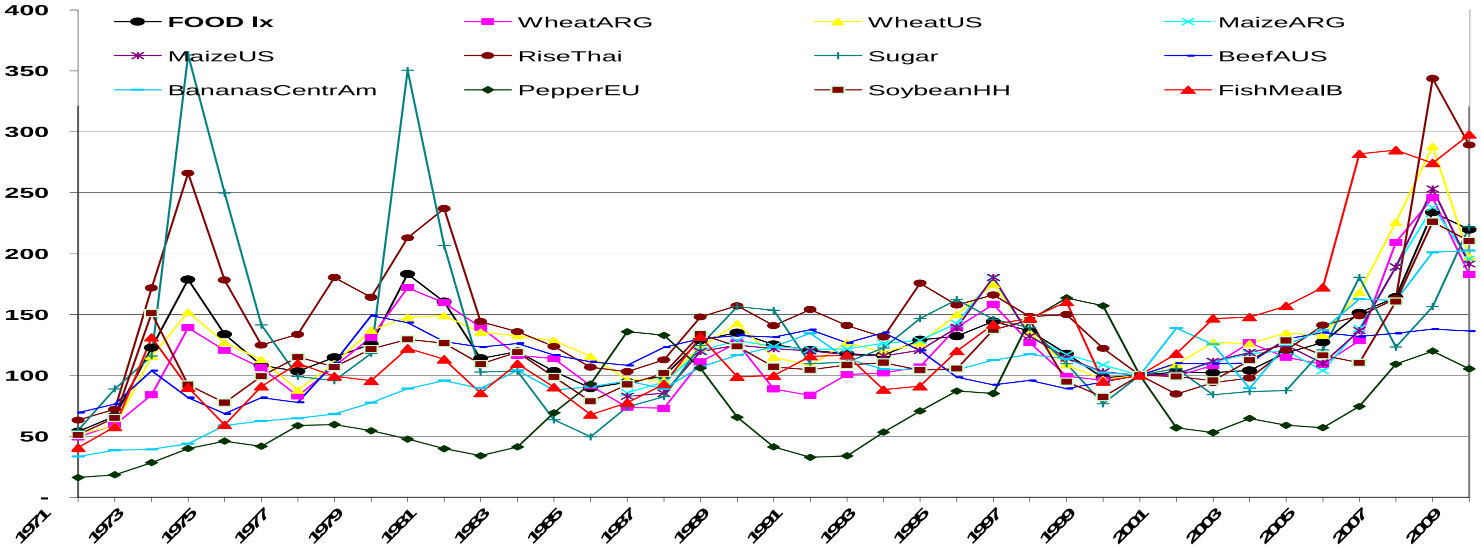


Appendix 3.6c: Tropical Beverages and Food Index and Constituents

Tropical Beverages Index and Constituents



Food Index and Constituents



Appendix 3.7: Pearson Correlations of Commodity Price Index Constituents 1996-2008 / 1971-2009

Source for Appendix 3.7: Data and Table calculated and arranged by the author.

Appendix 3.7a: Pearson Correlations of Commodity Price Index Constituents 1996-2008 — Ores, Minerals and Metals

		MINERALSOI	Phosphate	Manganese	IronOreBRL	IronOreAUSJ	AlumLME	CopperGrade	CopperLME	CopperUS	NickelLME	NickelNA	LeadGBP	LEadUS$	LeadNA	ZincHiGrade	ZincUS	TinLME	TinMAY	Tin	Tungsten	GLD	Silv
MINERALSOI	Pearson Correlat	1	.657*	.702**	.931**	.906**	.947**	.984**	.995**	.993**	.898**	.905**	.929**	.945**	.964**	.852**	.840**	.919**	.917**	.922**	.960**	.878**	.951**
	Sig. (2-tailed)		0.011	0.005	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Phosphate	Pearson Correlat	.657*	1	.994**	.832**	.817**	0.527	.596*	.585*	.578*	0.343	0.36	.621*	.605*	.698**	0.228	0.21	.814**	.776**	.811**	.554*	.695**	.685**
	Sig. (2-tailed)	0.011		0	0	0	0.053	0.025	0.028	0.03	0.23	0.207	0.018	0.022	0.005	0.434	0.472	0	0.001	0	0.04	0.006	0.007
Manganese	Pearson Correlat	.702**	.994**	1	.871**	.851**	.574*	.643*	.633*	.626*	0.391	0.407	.658*	.643*	.731**	0.271	0.253	.837**	.801**	.835**	.615*	.729**	.720**
	Sig. (2-tailed)	0.005	0		0	0	0.032	0.013	0.015	0.017	0.167	0.148	0.011	0.013	0.003	0.348	0.383	0	0.001	0	0.019	0.003	0.004
IronOreBRL	Pearson Correlat	.931**	.832**	.871**	1	.991**	.796**	.917**	.900**	.898**	.704**	.718**	.891**	.873**	.913**	.627*	.608*	.948**	.945**	.948**	.911**	.936**	.954**
	Sig. (2-tailed)	0	0	0		0	0.001	0	0	0	0.005	0.004	0	0	0	0.016	0.021	0	0	0	0	0	0
IronOreAUSJ	Pearson Correlat	.906**	.817**	.851**	.991**	1	.739**	.908**	.876**	.875**	.667**	.682**	.901**	.866**	.896**	.599*	.580*	.945**	.941**	.944**	.895**	.966**	.966**
	Sig. (2-tailed)	0	0	0	0		0.003	0	0	0	0.009	0.007	0	0	0	0.024	0.03	0	0	0	0	0	0
AlumLME	Pearson Correlat	.947**	0.527	.574*	.796**	.739**	1	.910**	.952**	.950**	.923**	.925**	.799**	.854**	.882**	.900**	.896**	.787**	.787**	.792**	.889**	.684**	.807**
	Sig. (2-tailed)	0	0.053	0.032	0.001	0.003		0	0	0	0	0	0.001	0	0	0	0	0.001	0.001	0.001	0	0.007	0
CopperGrade	Pearson Correlat	.984**	.596*	.643*	.917**	.908**	.910**	1	.990**	.992**	.865**	.873**	.923**	.918**	.923**	.863**	.852**	.885**	.881**	.888**	.974**	.908**	.962**
	Sig. (2-tailed)	0	0.025	0.013	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CopperLME	Pearson Correlat	.995**	.585*	.633*	.900**	.876**	.952**	.990**	1	1.000**	.911**	.918**	.917**	.932**	.942**	.891**	.881**	.884**	.884**	.887**	.965**	.864**	.941**
	Sig. (2-tailed)	0	0.028	0.015	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
CopperUS	Pearson Correlat	.993**	.578*	.626*	.898**	.875**	.950**	.992**	1.000**	1	.910**	.916**	.915**	.929**	.937**	.893**	.883**	.879**	.879**	.883**	.967**	.864**	.941**
	Sig. (2-tailed)	0	0.03	0.017	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
NickelLME	Pearson Correlat	.898**	0.343	0.391	.704**	.667**	.923**	.865**	.911**	.910**	1	1.000**	.849**	.903**	.887**	.906**	.899**	.755**	.775**	.761**	.849**	.679**	.794**
	Sig. (2-tailed)	0	0.23	0.167	0.005	0.009	0	0	0	0		0	0	0	0	0	0	0.002	0.001	0.002	0	0.008	0.001
NickelNA	Pearson Correlat	.905**	0.36	0.407	.718**	.682**	.925**	.873**	.918**	.916**	1.000**	1	.859**	.912**	.896**	.902**	.895**	.768**	.787**	.774**	.857**	.694**	.804**
	Sig. (2-tailed)	0	0.207	0.148	0.004	0.007	0	0	0	0	0		0	0	0	0	0	0.001	0.001	0.001	0	0.006	0.001
LeadGBP	Pearson Correlat	.929**	.621*	.658*	.891**	.901**	.799**	.923**	.917**	.915**	.849**	.859**	1	.989**	.969**	.741**	.724**	.945**	.928**	.946**	.895**	.928**	.955**
	Sig. (2-tailed)	0	0.018	0.011	0	0	0.001	0	0	0	0	0		0	0	0.002	0.003	0	0	0	0	0	0
LEadUS$	Pearson Correlat	.945**	.605*	.643*	.873**	.866**	.854**	.918**	.932**	.929**	.903**	.912**	.989**	1	.987**	.783**	.768**	.938**	.926**	.941**	.891**	.877**	.932**
	Sig. (2-tailed)	0	0.022	0.013	0	0	0	0	0	0	0	0	0		0	0.001	0.001	0	0	0	0	0	0
LeadNA	Pearson Correlat	.964**	.698**	.731**	.913**	.896**	.882**	.923**	.942**	.937**	.887**	.896**	.969**	.987**	1	.772**	.756**	.957**	.947**	.959**	.896**	.870**	.937**
	Sig. (2-tailed)	0	0.005	0.003	0	0	0	0	0	0	0	0	0	0		0.001	0.002	0	0	0	0	0	0
ZincHiGrade	Pearson Correlat	.852**	0.228	0.271	.627*	.599*	.900**	.863**	.891**	.893**	.906**	.902**	.741**	.783**	.772**	1	1.000**	.621*	.632*	.626*	.839**	.610*	.748**
	Sig. (2-tailed)	0	0.434	0.348	0.016	0.024	0	0	0	0	0	0	0.002	0.001	0.001		0	0.018	0.015	0.017	0	0.021	0.002
ZincUS	Pearson Correlat	.840**	0.21	0.253	.608*	.580*	.896**	.852**	.881**	.883**	.899**	.895**	.724**	.768**	.756**	1.000**	1	.603*	.613*	.608*	.827**	.590*	.731**
	Sig. (2-tailed)	0	0.472	0.383	0.021	0.03	0	0	0	0	0	0	0.003	0.001	0.002	0		0.022	0.02	0.021	0	0.026	0.003
TinLME	Pearson Correlat	.919**	.814**	.837**	.948**	.945**	.787**	.885**	.884**	.879**	.755**	.768**	.945**	.938**	.957**	.621*	.603*	1	.984**	1.000**	.842**	.920**	.946**
	Sig. (2-tailed)	0	0	0	0	0	0.001	0	0	0	0.002	0.001	0	0	0	0.018	0.022		0	0	0	0	0
TinMAY	Pearson Correlat	.917**	.776**	.801**	.945**	.941**	.787**	.881**	.884**	.879**	.775**	.787**	.928**	.926**	.947**	.632*	.613*	.984**	1	.985**	.856**	.910**	.951**
	Sig. (2-tailed)	0	0.001	0.001	0	0	0.001	0	0	0	0.001	0.001	0	0	0	0.015	0.02	0		0	0	0	0
Tin	Pearson Correlat	.922**	.811**	.835**	.948**	.944**	.792**	.888**	.887**	.883**	.761**	.774**	.946**	.941**	.959**	.626*	.608*	1.000**	.985**	1	.844**	.920**	.946**
	Sig. (2-tailed)	0	0	0	0	0	0.001	0	0	0	0.002	0.001	0	0	0	0.017	0.021	0	0		0	0	0
Tungsten	Pearson Correlat	.960**	.554*	.615*	.911**	.895**	.889**	.974**	.965**	.967**	.849**	.857**	.895**	.891**	.896**	.839**	.827**	.842**	.856**	.844**	1	.875**	.934**
	Sig. (2-tailed)	0	0.04	0.019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0
GLD	Pearson Correlat	.878**	.695**	.729**	.936**	.966**	.684**	.908**	.864**	.864**	.679**	.694**	.928**	.877**	.870**	.610*	.590*	.920**	.910**	.920**	.875**	1	.970**
	Sig. (2-tailed)	0	0.006	0.003	0	0	0.007	0	0	0	0.008	0.006	0	0	0	0.021	0.026	0	0	0	0		0
Silv	Pearson Correlat	.951**	.685**	.720**	.954**	.966**	.807**	.962**	.941**	.941**	.794**	.804**	.955**	.932**	.937**	.748**	.731**	.946**	.951**	.946**	.934**	.970**	1
	Sig. (2-tailed)	0	0.007	0.004	0	0	0	0	0	0	0.001	0.001	0	0	0	0.002	0.003	0	0	0	0	0	

Appendix 3.7b: Pearson Correlations of Commodity Price Index Constituents 1996-2008 — Agricultural Raw Materials

	AGRIRAWIX	Linseed	Tobacco	CottonSUDAN	CottonUSEST	CottonUSTx	CottonFAREA	CottonEGY	FineWool	Wool	Jute	SisalKENIA2_	SisalKENIA3	CattleUS	Nonconiferous	TropLogUKIM	TropLogGabu	TropSawnwoo	Plywood	RubberNo1SP	RubberNY	RubberSPOR
AGRIRAWIX	**1**	.856**	.577*	.744**	0.328	0.452	0.457	0.217	.819**	.716**	.744**	.708**	.845**	-.557*	.899**	.939**	0.527	0.315	.926**	.926**	.971**	.973**
		0	0.031	0.006	0.252	0.105	0.1	0.456	0	0.004	0.002	0.005	0	0.039	0	0	0.053	0.273	0	0	0	0
Linseed	.856**	1	0.381	0.482	0.136	0.262	0.251	-0.131	.684**	.713**	.537*	.685**	.802**	-.640*	.776**	.926**	0.38	0.033	.690**	.793**	.828**	.819**
	0		0.18	0.113	0.644	0.365	0.388	0.657	0.007	0.004	0.048	0.007	0.001	0.014	0.001	0	0.18	0.911	0.006	0.001	0	0
Tobacco	.577*	0.381	1	.666*	0.337	0.442	0.408	0.201	0.417	0.157	.661*	0.145	0.231	-0.44	.543*	0.531	-0.02	0.104	0.441	0.232	0.425	0.434
	0.031	0.18		0.018	0.239	0.113	0.148	0.491	0.138	0.593	0.01	0.62	0.426	0.115	0.045	0.051	0.947	0.723	0.115	0.446	0.13	0.121
CottonSUDAN	.744**	0.482	.666*	1	.710**	.735**	.761**	.641*	.729**	0.23	0.563	0.537	.583*	-0.216	0.534	.651*	0.247	0.421	.671*	0.507	.627*	.635*
	0.006	0.113	0.018		0.01	0.006	0.004	0.025	0.007	0.473	0.057	0.072	0.047	0.5	0.074	0.022	0.439	0.173	0.017	0.111	0.029	0.026
CottonUSEST	0.328	0.136	0.337	.710**	1	.970**	.970**	.799**	0.157	0.012	0.265	0.322	0.319	0.19	-0.04	0.13	0.401	.621*	0.232	0.124	0.2	0.213
	0.252	0.644	0.239	0.01		0	0	0.001	0.592	0.967	0.359	0.262	0.266	0.516	0.893	0.657	0.155	0.018	0.424	0.686	0.494	0.465
CottonUSTx	0.452	0.262	0.442	.735**	.970**	1	.974**	.804**	0.23	0.086	0.363	0.444	0.446	0.075	0.079	0.244	0.502	.623*	0.349	0.228	0.324	0.335
	0.105	0.365	0.113	0.006	0		0	0.001	0.428	0.77	0.201	0.112	0.11	0.798	0.788	0.4	0.067	0.017	0.221	0.453	0.259	0.242
CottonFAREASTERN	0.457	0.251	0.408	.761**	.970**	.974**	1	.776**	0.33	0.154	0.317	0.396	0.41	0.122	0.091	0.26	0.448	.687**	0.368	0.247	0.334	0.343
	0.1	0.388	0.148	0.004	0	0		0.001	0.249	0.598	0.269	0.161	0.146	0.677	0.757	0.37	0.108	0.007	0.195	0.416	0.243	0.23
CottonEGY	0.217	-0.131	0.201	.641*	.799**	.804**	.776**	1	-0.006	-0.111	0.279	0.369	0.322	0.411	-0.109	-0.058	0.508	.697**	0.248	0.12	0.151	0.169
	0.456	0.657	0.491	0.025	0.001	0.001	0.001		0.983	0.705	0.334	0.194	0.261	0.144	0.71	0.844	0.064	0.006	0.393	0.695	0.607	0.565
FineWool	.819**	.684**	0.417	.729**	0.157	0.23	0.33	-0.006	1	.732**	0.403	0.47	.593*	-0.346	.790**	.790**	0.37	0.266	.842**	.769**	.816**	.810**
	0	0.007	0.138	0.007	0.592	0.428	0.249	0.983		0.003	0.153	0.09	0.025	0.226	0.001	0.001	0.193	0.357	0	0.002	0	0
Wool	.716**	.713**	0.157	0.23	0.012	0.086	0.154	-0.111	.732**	1	0.348	0.372	.575*	-0.506	.780**	.712**	0.448	0.156	.669**	.806**	.794**	.783**
	0.004	0.004	0.593	0.473	0.967	0.77	0.598	0.705	0.003		0.222	0.191	0.031	0.065	0.001	0.004	0.108	0.595	0.009	0.001	0.001	0.001
Jute	.744**	.537*	.661*	0.563	0.265	0.363	0.317	0.279	0.403	0.348	1	0.337	0.492	-.535*	.723**	.701**	0.216	0.422	.679**	.645*	.672**	.687**
	0.002	0.048	0.01	0.057	0.359	0.201	0.269	0.334	0.153	0.222		0.239	0.074	0.049	0.003	0.005	0.458	0.133	0.008	0.017	0.008	0.007
SisalKENIA2_3	.708**	.685**	0.145	0.537	0.322	0.444	0.396	0.369	0.47	0.372	0.337	1	.961**	-0.134	0.447	.606*	.718**	0.206	.672**	.813**	.713**	.712**
	0.005	0.007	0.62	0.072	0.262	0.112	0.161	0.194	0.09	0.191	0.239		0	0.648	0.109	0.022	0.004	0.48	0.009	0.001	0.004	0.004
SisalKENIA3	.845**	.802**	0.231	.583*	0.319	0.446	0.41	0.322	.593*	.575*	0.492	.961**	1	-0.304	.637*	.757**	.737**	0.248	.786**	.893**	.856**	.855**
	0	0.001	0.426	0.047	0.266	0.11	0.146	0.261	0.025	0.031	0.074	0		0.291	0.014	0.002	0.003	0.392	0.001	0	0	0
CattleUS	-.557*	-.640*	-0.44	-0.216	0.19	0.075	0.122	0.411	-0.346	-0.506	-.535*	-0.134	-0.304	1	-.730**	-.679**	-0.096	0.198	-0.435	-.617*	-.559*	-.555*
	0.039	0.014	0.115	0.5	0.516	0.798	0.677	0.144	0.226	0.065	0.049	0.648	0.291		0.003	0.008	0.745	0.497	0.12	0.025	0.038	0.04
NonconiferousWoods	.899**	.776**	.543*	0.534	-0.04	0.079	0.091	-0.109	.790**	.780**	.723**	0.447	.637*	-.730**	1	.910**	0.335	0.085	.863**	.946**	.918**	.917**
	0	0.001	0.045	0.074	0.893	0.788	0.757	0.71	0.001	0.001	0.003	0.109	0.014	0.003		0	0.241	0.773	0	0	0	0
TropLogUKIMPORT	.939**	.926**	0.531	.651*	0.13	0.244	0.26	-0.058	.790**	.712**	.701**	.606*	.757**	-.679**	.910**	1	0.302	0.109	.804**	.856**	.897**	.894**
	0	0	0.051	0.022	0.657	0.4	0.37	0.844	0.001	0.004	0.005	0.022	0.002	0.008	0		0.294	0.711	0.001	0	0	0
TropLogGabun	0.527	0.38	-0.02	0.247	0.401	0.502	0.448	0.508	0.37	0.448	0.216	.718**	.737**	-0.096	0.335	0.302	1	0.451	.636*	.713**	.606*	.609*
	0.053	0.18	0.947	0.439	0.155	0.067	0.108	0.064	0.193	0.108	0.458	0.004	0.003	0.745	0.241	0.294		0.106	0.015	0.006	0.022	0.021
TropSawnwoodMAL	0.315	0.033	0.104	0.421	.621*	.623*	.687**	.697**	0.266	0.156	0.422	0.206	0.248	0.198	0.085	0.109	0.451	1	0.432	0.249	0.287	0.298
	0.273	0.911	0.723	0.173	0.018	0.017	0.007	0.006	0.357	0.595	0.133	0.48	0.392	0.497	0.773	0.711	0.106		0.123	0.411	0.32	0.3
Plywood	.926**	.690**	0.441	.671*	0.232	0.349	0.368	0.248	.842**	.669**	.679**	.672**	.786**	-0.435	.863**	.804**	.636*	0.432	1	.926**	.953**	.957**
	0	0.006	0.115	0.017	0.424	0.221	0.195	0.393	0	0.009	0.008	0.009	0.001	0.12	0	0.001	0.015	0.123		0	0	0
RubberNo1SPORE	.926**	.793**	0.232	0.507	0.124	0.228	0.247	0.12	.769**	.806**	.645*	.813**	.893**	-.617*	.946**	.856**	.713**	0.249	.926**	1	.986**	.985**
	0	0.001	0.446	0.111	0.686	0.453	0.416	0.695	0.002	0.001	0.017	0.001	0	0.025	0	0	0.006	0.411	0		0	0
RubberNY	.971**	.828**	0.425	.627*	0.2	0.324	0.334	0.151	.816**	.794**	.672**	.713**	.856**	-.559*	.918**	.897**	.606*	0.287	.953**	.986**	1	.999**
	0	0	0.13	0.029	0.494	0.259	0.243	0.607	0	0.001	0.008	0.004	0	0.038	0	0	0.022	0.32	0	0		0
RubberSPORE	.973**	.819**	0.434	.635*	0.213	0.335	0.343	0.169	.810**	.783**	.687**	.712**	.855**	-.555*	.917**	.894**	.609*	0.298	.957**	.985**	.999**	1
	0	0	0.121	0.026	0.465	0.242	0.23	0.565	0	0.001	0.007	0.004	0	0.04	0	0	0.021	0.3	0	0	0	

Appendix 3.7c: Pearson Correlations of Commodity Price Index Constituents 1996-2008 — Vegetables Oils Seeds

	VEGOILSEEDSI	SoybeansUS	SoybeansNL	SunflowerUS	Groundnut	CopraPH_IN	coconutPH	PalmMAY	PalmOilIND	CottonseedU
VEGOILSEEDSIX	1	.954**	.990**	.958**	.907**	.925**	.921**	.920**	.976**	.910**
		0	0	0	0	0	0	0	0	0
SoybeansUS	.954**	1	.957**	.901**	.896**	.860**	.839**	.829**	.879**	.861**
	0		0	0	0	0	0	0	0	0
SoybeansNL	.990**	.957**	1	.979**	.936**	.893**	.884**	.878**	.949**	.937**
	0	0		0	0	0	0	0	0	0
SunflowerUS	.958**	.901**	.979**	1	.926**	.874**	.866**	.856**	.915**	.945**
	0	0	0		0	0	0	0	0	0
Groundnut	.907**	.896**	.936**	.926**	1	.846**	.828**	.813**	.831**	.976**
	0	0	0	0		0	0	0	0	0
CopraPH_IN	.925**	.860**	.893**	.874**	.846**	1	.997**	.992**	.897**	.833**
	0	0	0	0	0		0	0	0	0
coconutPH	.921**	.839**	.884**	.866**	.828**	.997**	1	.996**	.905**	.826**
	0	0	0	0	0	0		0	0	0
PalmMAY	.920**	.829**	.878**	.856**	.813**	.992**	.996**	1	.916**	.812**
	0	0	0	0	0	0	0		0	0
PalmOilIND	.976**	.879**	.949**	.915**	.831**	.897**	.905**	.916**	1	.859**
	0	0	0	0	0	0	0	0		0
CottonseedUS	.910**	.861**	.937**	.945**	.976**	.833**	.826**	.812**	.859**	1
	0	0	0	0	0	0	0	0	0	

Appendix 3.7d: Pearson Correlations of Commodity Price Index Constituents 1996-2008 — Food

	FOODIX	WheatARG	WheatUS	MaizeARG	MaizeUS	RiseThai	Sugar	BeefAUS	BananasCent	PepperEU	SoybeanHH	FishMealB
FOODIX	1	.896**	.912**	.928**	.926**	.964**	.822**	.617*	.894**	0.189	.952**	.850**
		0	0	0	0	0	0	0.019	0	0.517	0	0
WheatARG	.896**	1	.979**	.970**	.977**	.838**	.575*	.561*	.745**	0.136	.909**	.772**
	0		0	0	0	0	0.031	0.037	0.002	0.643	0	0.001
WheatUS	.912**	.979**	1	.955**	.970**	.847**	.612*	.640*	.806**	0.06	.888**	.822**
	0	0		0	0	0	0.02	0.014	0	0.84	0	0
MaizeARG	.928**	.970**	.955**	1	.995**	.891**	.670**	0.462	.748**	0.216	.911**	.757**
	0	0	0		0	0	0.009	0.096	0.002	0.459	0	0.002
MaizeUS	.926**	.977**	.970**	.995**	1	.895**	.637*	0.492	.748**	0.176	.919**	.743**
	0	0	0	0		0	0.014	0.074	0.002	0.548	0	0.002
RiseThai	.964**	.838**	.847**	.891**	.895**	1	.732**	0.495	.816**	0.321	.916**	.722**
	0	0	0	0	0		0.003	0.072	0	0.263	0	0.004
Sugar	.822**	.575*	.612*	.670**	.637*	.732**	1	0.453	.769**	0.099	.706**	.767**
	0	0.031	0.02	0.009	0.014	0.003		0.103	0.001	0.735	0.005	0.001
BeefAUS	.617*	.561*	.640*	0.462	0.492	0.495	0.453	1	.778**	-0.411	.587*	.774**
	0.019	0.037	0.014	0.096	0.074	0.072	0.103		0.001	0.144	0.027	0.001
BananasCentrAm	.894**	.745**	.806**	.748**	.748**	.816**	.769**	.778**	1	-0.016	.802**	.876**
	0	0.002	0	0.002	0.002	0	0.001	0.001		0.957	0.001	0
PepperEU	0.189	0.136	0.06	0.216	0.176	0.321	0.099	-0.411	-0.016	1	0.136	0.013
	0.517	0.643	0.84	0.459	0.548	0.263	0.735	0.144	0.957		0.643	0.964
SoybeanHH	.952**	.909**	.888**	.911**	.919**	.916**	.706**	.587*	.802**	0.136	1	.737**
	0	0	0	0	0	0	0.005	0.027	0.001	0.643		0.003
FishMealB	.850**	.772**	.822**	.757**	.743**	.722**	.767**	.774**	.876**	0.013	.737**	1
	0	0.001	0	0.002	0.002	0.004	0.001	0.001	0	0.964	0.003	

Appendix 3.7e: Pearson Correlations of Commodity Price Index Constituents 1996-2008 — Tropical Beverages

	TROPBEVIX	CoffeeCOL	CoffeeBRL	CoffeeOtherE	CoffeEXNY	CoffeeCOMP	CoffeeGER	CoffeeFR	CoffeeCOMP9	CocoaNY	CocoaSDR	Tea
TROPBEVIX	1	.941**	.895**	.941**	.904**	.965**	.942**	.892**	.974**	.683**	.624*	.700**
		0	0	0	0	0	0	0	0	0.007	0.017	0.005
CoffeeCOL	.941**	1	.938**	.975**	.794**	.938**	.978**	.785**	.944**	0.469	0.424	.690**
	0		0	0	0.001	0	0	0.001	0	0.09	0.131	0.006
CoffeeBRL	.895**	.938**	1	.983**	.848**	.967**	.981**	.841**	.962**	0.311	0.254	0.489
	0	0		0	0	0	0	0	0	0.279	0.382	0.076
CoffeeOtherEXNY	.941**	.975**	.983**	1	.836**	.972**	1.000**	.826**	.974**	0.433	0.383	.583*
	0	0	0		0	0	0	0	0	0.122	0.176	0.029
CoffeEXNY	.904**	.794**	.848**	.836**	1	.942**	.834**	.999**	.935**	0.53	0.452	0.517
	0	0.001	0	0		0	0	0	0	0.051	0.105	0.058
CoffeeCOMP	.965**	.938**	.967**	.972**	.942**	1	.971**	.935**	.998**	0.492	0.428	.580*
	0	0	0	0	0		0	0	0	0.074	0.126	0.03
CoffeeGER	.942**	.978**	.981**	1.000**	.834**	.971**	1	.825**	.973**	0.434	0.387	.590*
	0	0	0	0	0	0		0	0	0.121	0.172	0.026
CoffeeFR	.892**	.785**	.841**	.826**	.999**	.935**	.825**	1	.926**	0.512	0.435	0.506
	0	0.001	0	0	0	0	0		0	0.061	0.12	0.065
CoffeeCOMP97	.974**	.944**	.962**	.974**	.935**	.998**	.973**	.926**	1	0.52	0.453	.600*
	0	0	0	0	0	0	0	0		0.057	0.103	0.023
CocoaNY	.683**	0.469	0.311	0.433	0.53	0.492	0.434	0.512	0.52	1	.982**	.547*
	0.007	0.09	0.279	0.122	0.051	0.074	0.121	0.061	0.057		0	0.043
CocoaSDR	.624*	0.424	0.254	0.383	0.452	0.428	0.387	0.435	0.453	.982**	1	0.496
	0.017	0.131	0.382	0.176	0.105	0.126	0.172	0.12	0.103	0		0.071
Tea	.700**	.690**	0.489	.583*	0.517	.580*	.590*	0.506	.600*	.547*	0.496	1
	0.005	0.006	0.076	0.029	0.058	0.03	0.026	0.065	0.023	0.043	0.071	

Appendix 3.7f: Pearson Correlations of Commodity Price Index Constituents 1971-2009 — Ores, Minerals and Metals

	MINMETALSIX	Phosphate	Manganese	IronOreBRL	IronOreAUSJ	AlumLME	CopperGrade	CopperLME	CopperUS	NickelLME	NickelNA	LeadGBP	LEadUS$	LeadNA	ZincHiGrade	ZincUS	TinLME	TinMAY	Tin	Tungsten	**GLD**	Silv	
MINMETALSIX	1	.678**	.738**	.924**	.896**	.836**	.975**	.990**	.991**	.920**	.929**	.930**	.920**	.940**	.875**	.875**	.471**	.757**	.482**	.554**	.831**	.634**	.878**
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.002	0	0.002	0	0	0	0
Phosphate	.678**	1	.940**	.827**	.827**	.435**	.609**	.618**	.617**	.435**	.449**	.646**	.630**	.674**	.346*	.339*	.502**	.687**	.506**	.430**	.616**	.478**	.695**
	0		0	0	0	0.006	0	0	0	0.006	0.004	0	0	0	0.031	0.034	0.001	0	0.001	0.006	0	0.002	0.006
Manganese	.738**	.940**	1	.857**	.827**	.521**	.698**	.689**	.689**	.509**	.526**	.681**	.648**	.722**	.448**	.447**	.392*	.616**	.399*	.335*	.670**	.417**	.729**
	0	0		0	0	0.001	0	0	0	0.001	0.001	0	0	0	0.004	0.004	0.014	0	0.012	0.037	0	0.008	0.003
IronOreBRL	.924**	.827**	.857**	1	.993**	.669**	.902**	.890**	.900**	.759**	.774**	.892**	.850**	.896**	.685**	.700**	.507**	.804**	.517**	.564**	.845**	.627**	.936**
	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0.001	0	0.001	0	0	0	0
IronOreAUSJP	.896**	.827**	.827**	.993**	1	.574**	.887**	.869**	.871**	.696**	.711**	.885**	.832**	.863**	.634**	.620**	.495**	.796**	.504**	.680**	.887**	.563**	.966**
	0	0	0	0		0.001	0	0	0	0	0	0	0	0	0	0	0.005	0	0.004	0	0	0.001	0
AlumLME	.836**	.435**	.521**	.669**	.574**	1	.815**	.799**	.807**	.819**	.827**	.738**	.711**	.792**	.771**	.805**	.346*	.561**	.355*	.319*	.760**	.580**	.684**
	0	0.006	0.001	0	0.001		0	0	0	0	0	0	0	0	0	0	0.031	0	0.027	0.048	0	0	0.007
CopperGradeALME	.975**	.609**	.698**	.902**	.887**	.815**	1	.977**	.981**	.886**	.898**	.903**	.855**	.901**	.883**	.887**	.361*	.669**	.373*	.459**	.831**	.552**	.908**
	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0.024	0	0.019	0.003	0	0	0
CopperLME	.990**	.618**	.689**	.890**	.869**	.799**	.977**	1	.997**	.920**	.928**	.906**	.903**	.914**	.901**	.888**	.404*	.694**	.415**	.533**	.785**	.581**	.864**
	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0.011	0	0.009	0	0	0	0
CopperUS	.991**	.617**	.689**	.900**	.871**	.807**	.981**	.997**	1	.924**	.932**	.912**	.902**	.920**	.895**	.896**	.412**	.704**	.424**	.546**	.798**	.592**	.864**
	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0.009	0	0.007	0	0	0	0
NickelLME	.920**	.435**	.509**	.759**	.696**	.819**	.886**	.920**	.924**	1	.998**	.858**	.871**	.882**	.900**	.907**	.346*	.644**	.360*	.481**	.672**	.494**	.679**
	0	0.006	0.001	0	0	0	0	0	0		0	0	0	0	0	0	0.031	0	0.024	0.002	0	0.001	0.008
NickelNA	.929**	.449**	.526**	.774**	.711**	.827**	.898**	.928**	.932**	.998**	1	.864**	.873**	.889**	.903**	.910**	.342*	.646**	.356*	.463**	.696**	.506**	.694**
	0	0.004	0.001	0	0	0	0	0	0	0		0	0	0	0	0	0.033	0	0.026	0.003	0	0.001	0.006
LeadGBP	.930**	.646**	.681**	.892**	.885**	.738**	.903**	.906**	.912**	.858**	.864**	1	.976**	.954**	.760**	.770**	.576**	.823**	.583**	.608**	.844**	.676**	.928**
	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0
LEadUS$	.920**	.630**	.648**	.850**	.832**	.711**	.855**	.903**	.902**	.871**	.873**	.976**	1	.942**	.757**	.752**	.612**	.827**	.617**	.666**	.778**	.696**	.877**
	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
LeadNA	.940**	.674**	.722**	.896**	.863**	.792**	.901**	.914**	.920**	.882**	.889**	.954**	.942**	1	.782**	.795**	.443**	.755**	.454**	.519**	.798**	.613**	.870**
	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0.005	0	0.004	0.001	0	0	0
ZincHiGrade	.875**	.346*	.448**	.685**	.634**	.771**	.883**	.901**	.895**	.900**	.903**	.760**	.757**	.782**	1	.982**	0.229	.500**	0.241	.390*	.624**	.423**	.610*
	0	0.031	0.004	0	0	0	0	0	0	0	0	0	0	0		0	0.161	0.001	0.14	0.014	0	0.007	0.021
ZincUS	.875**	.339*	.447**	.700**	.620**	.805**	.887**	.888**	.896**	.907**	.910**	.770**	.752**	.795**	.982**	1	0.256	.524**	0.269	.407*	.655**	.450**	.590*
	0	0.034	0.004	0	0	0	0	0	0	0	0	0	0	0	0		0.116	0.001	0.098	0.01	0	0.004	0.026
TinLME	.471**	.502**	.392*	.507**	.495**	.346*	.361*	.404*	.412**	.346*	.342*	.576**	.612**	.443**	0.229	0.256	1	.881**	.998**	.795**	.579**	.835**	.920**
	0.002	0.001	0.014	0.001	0.005	0.031	0.024	0.011	0.009	0.031	0.033	0	0	0.005	0.161	0.116		0	0	0	0	0	0
TinMAY	.757**	.687**	.616**	.804**	.796**	.561**	.669**	.694**	.704**	.644**	.646**	.823**	.827**	.755**	.500**	.524**	.881**	1	.889**	.779**	.760**	.835**	.910**
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.001	0.001	0		0	0	0	0	0
Tin	.482**	.506**	.399*	.517**	.504**	.355*	.373*	.415**	.424**	.360*	.356*	.583**	.617**	.454**	0.241	0.269	.998**	.889**	1	.797**	.585**	.836**	.920**
	0.002	0.001	0.012	0.001	0.004	0.027	0.019	0.009	0.007	0.024	0.026	0	0	0.004	0.14	0.098	0	0		0	0	0	0
Tungsten	.554**	.430**	.335*	.564**	.680**	.319*	.459**	.533**	.546**	.481**	.463**	.608**	.666**	.519**	.390*	.407*	.795**	.779**	.797**	1	.457**	.689**	.875**
	0	0.006	0.037	0	0	0.048	0.003	0	0	0.002	0.003	0	0	0.001	0.014	0.01	0	0	0		0.003	0	0
GLD	.831**	.616**	.670**	.845**	.887**	.760**	.831**	.785**	.798**	.672**	.696**	.844**	.778**	.798**	.624**	.655**	.579**	.760**	.585**	.457**	1	.805**	1
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.003		0	
Silv	.634**	.478**	.417**	.627**	.563**	.580**	.552**	.581**	.592**	.494**	.506**	.676**	.696**	.613**	.423**	.450**	.835**	.835**	.836**	.689**	.805**	1	.970**
	0	0.002	0.008	0	0.001	0	0	0	0	0.001	0.001	0	0	0	0.007	0.004	0	0	0	0	0		0

Appendix 3.7g: Pearson Correlations of Commodity Price Index Constituents 1971-2009 — Agricultural Raw Materials

	AGRIRAWIX	Linseed	Tobacco	CottonSUDAN	CottonUSEST	CottonUSTx	CottonFAREA	CottonEGY	FineWool	Wool	Jute	SisalKENIA2_	SisalKENIA3	CattleUS	Nonconiferou	TropLogUKIM	TropLogGabu	TropSawnwoo	Plywood	RubberNo1SF	**RubberNY**	RubberSPOR
AGRIRAWIX	1	.654**	.762**	.578**	.500**	.598**	0.285	0.294	.819**	.716**	.378*	.677**	.711**	.535**	.754**	.924**	.798**	.717**	.797**	.726**	.936**	.959**
		0	0	0	0.001	0	0.092	0.073	0	0.004	0.018	0	0	0	0	0	0	0	0	0	0	0
Linseed	.654**	1	.335*	.340*	0.208	0.27	0.007	0.084	.684**	.713**	.427**	.749**	.816**	0.016	.809**	.607**	.386*	0.288	.399*	.636**	.792**	.817**
	0		0.037	0.039	0.204	0.097	0.969	0.615	0.007	0.004	0.007	0	0	0.923	0	0	0.015	0.076	0.012	0	0	0
Tobacco	.762**	.335*	1	.333*	0.31	.412**	-0.047	.366*	0.417	0.157	0.294	.550**	.501**	.684**	0.337	.789**	.716**	.737**	.717**	0.187	0.293	0.356
	0	0.037		0.044	0.054	0.009	0.783	0.024	0.138	0.593	0.069	0	0.001	0	0.158	0	0	0	0	0.261	0.165	0.147
CottonSUDAN	.578**	.340*	.333*	1	.809**	.774**	.690**	.668**	.729**	0.23	.356*	0.295	.354*	0.324	0.171	.355*	0.287	0.226	0.159	.555**	0.281	.519*
	0	0.039	0.044		0	0	0	0	0.007	0.473	0.031	0.077	0.031	0.051	0.512	0.031	0.085	0.179	0.346	0	0.205	0.04
CottonUSEST	.500**	0.208	0.31	.809**	1	.974**	.971**	.620**	0.157	0.012	0.249	0.252	0.302	0.276	-0.148	0.263	.322*	0.312	0.162	.388*	0.144	0.225
	0.001	0.204	0.054	0		0	0	0	0.592	0.967	0.126	0.122	0.062	0.089	0.545	0.106	0.045	0.053	0.323	0.016	0.501	0.369
CottonUSTx	.598**	0.27	.412**	.774**	.974**	1	.942**	.609**	0.23	0.086	0.292	.318*	.363*	.358*	-0.06	.385*	.444**	.437**	0.299	.396*	0.245	0.309
	0	0.097	0.009	0	0		0	0	0.428	0.77	0.071	0.048	0.023	0.025	0.806	0.016	0.005	0.005	0.065	0.014	0.249	0.211
CottonFAREASTERN	0.285	0.007	-0.047	.690**	.971**	.942**	1	.465**	0.33	0.154	0.165	-0.158	-0.035	-0.001	-0.078	-0.002	0.026	0.062	-0.101	0.316	0.197	0.308
	0.092	0.969	0.783	0	0	0		0.005	0.249	0.598	0.335	0.357	0.84	0.997	0.752	0.993	0.882	0.721	0.558	0.065	0.356	0.214
CottonEGY	0.294	0.084	.366*	.668**	.620**	.609**	.465**	1	-0.006	-0.111	0.262	0.126	0.172	.422**	-0.419	0.208	0.118	0.093	-0.002	0.131	-0.221	0.072
	0.073	0.615	0.024	0	0	0	0.005		0.983	0.705	0.112	0.45	0.301	0.008	0.084	0.21	0.482	0.579	0.992	0.44	0.312	0.785
FineWool	.819**	.684**	0.417	.729**	0.157	0.23	0.33	-0.006	1	.732**	0.403	0.47	.593*	-0.346	.790**	.790**	0.37	0.266	.842**	.769**	.816**	.810**
	0	0.007	0.138	0.007	0.592	0.428	0.249	0.983		0.003	0.153	0.09	0.025	0.226	0.001	0.001	0.193	0.357	0	0.002	0	0
Wool	.716**	.713**	0.157	0.23	0.012	0.086	0.154	-0.111	.732**	1	0.348	0.372	.575*	-0.506	.780**	.712**	0.448	0.156	.669**	.806**	.794**	.783**
	0.004	0.004	0.593	0.473	0.967	0.77	0.598	0.705	0.003		0.222	0.191	0.031	0.065	0.001	0.004	0.108	0.595	0.009	0.001	0.001	0.001
Jute	.378*	.427**	0.294	.356*	0.249	0.292	0.165	0.262	0.403	0.348	1	0.224	0.268	-0.034	.668**	0.244	0.024	0.09	0.094	.334*	.631**	.709**
	0.018	0.007	0.069	0.031	0.126	0.071	0.335	0.112	0.153	0.222		0.171	0.1	0.835	0.002	0.135	0.883	0.586	0.568	0.04	0.001	0.001
SisalKENIA2_3	.677**	.749**	.550**	0.295	0.252	.318*	-0.158	0.126	0.47	0.372	0.224	1	.977**	.418**	.658**	.633**	.705**	.606**	.650**	.461**	.619**	.599**
	0	0	0	0.077	0.122	0.048	0.357	0.45	0.09	0.191	0.171		0	0.008	0.002	0	0	0	0	0.004	0.001	0.009
SisalKENIA3	.711**	.816**	.501**	.354*	0.302	.363*	-0.035	0.172	.593*	.575*	0.268	.977**	1	.340*	.735**	.651**	.670**	.554**	.613**	.550**	.739**	.775**
	0	0	0.001	0.031	0.062	0.023	0.84	0.301	0.025	0.031	0.1	0		0.034	0	0	0	0	0	0	0	0
CattleUS	.535**	0.016	.684**	0.324	0.276	.358*	-0.001	.422**	-0.346	-0.506	-0.034	.418**	.340*	1	-.675**	.607**	.733**	.780**	.710**	0.04	-.465*	-.494*
	0	0.923	0	0.051	0.089	0.025	0.997	0.008	0.226	0.065	0.835	0.008	0.034		0.002	0	0	0	0	0.809	0.022	0.037
NonconiferousWoods	.754**	.809**	0.337	0.171	-0.148	-0.06	-0.078	-0.419	.790**	.780**	.668**	.658**	.735**	-.675**	1	.694**	0.323	0.046	.613**	.880**	.862**	.876**
	0	0	0.158	0.512	0.545	0.806	0.752	0.084	0.001	0.001	0.002	0.002	0	0.002		0.001	0.178	0.851	0.005	0	0	0
TropLogUKIMPORT	.924**	.607**	.789**	.355*	0.263	.385*	-0.002	0.208	.790**	.712**	0.244	.633**	.651**	.607**	.694**	1	.814**	.769**	.867**	.502**	.814**	.849**
	0	0	0	0.031	0.106	0.016	0.993	0.21	0.001	0.004	0.135	0	0	0	0.001		0	0	0	0.001	0	0
TropLogGabun	.798**	.386*	.716**	0.287	.322*	.444**	0.026	0.118	0.37	0.448	0.024	.705**	.670**	.733**	0.323	.814**	1	.920**	.914**	.382*	.608**	.579*
	0	0.015	0	0.085	0.045	0.005	0.882	0.482	0.193	0.108	0.883	0	0	0	0.178	0		0	0	0.018	0.002	0.012
TropSawnwoodMAL	.717**	0.288	.737**	0.226	0.312	.437**	0.062	0.093	0.266	0.156	0.09	.606**	.554**	.780**	0.046	.769**	.920**	1	.900**	0.163	0.322	0.205
	0	0.076	0	0.179	0.053	0.005	0.721	0.579	0.357	0.595	0.586	0	0	0	0.851	0	0		0	0.327	0.125	0.415
Plywood	.797**	.399*	.717**	0.159	0.162	0.299	-0.101	-0.002	.842**	.669**	0.094	.650**	.613**	.710**	.613**	.867**	.914**	.900**	1	.340*	.722**	.741**
	0	0.012	0	0.346	0.323	0.065	0.558	0.992	0	0.009	0.568	0	0	0	0.005	0	0	0		0.037	0	0
RubberNo1SPORE	.726**	.636**	0.187	.555**	.388*	.396*	0.316	0.131	.769**	.806**	.334*	.461**	.550**	0.04	.880**	.502**	.382*	0.163	.340*	1	.953**	.984**
	0	0	0.261	0	0.016	0.014	0.065	0.44	0.002	0.001	0.04	0.004	0	0.809	0	0.001	0.018	0.327	0.037		0	0
RubberNY	.936**	.792**	0.293	0.281	0.144	0.245	0.197	-0.221	.816**	.794**	.631**	.619**	.739**	-.465*	.862**	.814**	.608**	0.322	.722**	.953**	1	.998**
	0	0	0.165	0.205	0.501	0.249	0.356	0.312	0	0.001	0.001	0.001	0	0.022	0	0	0.002	0.125	0	0		0
RubberSPORE	.959**	.817**	0.356	.519*	0.225	0.309	0.308	0.072	.810**	.783**	.709**	.599**	.775**	-.494*	.876**	.849**	.579*	0.205	.741**	.984**	.998**	1
	0	0	0.147	0.04	0.369	0.211	0.214	0.785	0	0.001	0.001	0.009	0	0.037	0	0	0.012	0.415	0	0	0	

Appendix 3.7h: Pearson Correlations of Commodity Price Index Constituents 1971-2009 — Vegetables Oils Seeds

	VEGOILSEEDSI	SoybeansUS	SoybeansNL	SunflowerUS	Groundnut	CopraPH_IN	coconutPH	PalmMAY	PalmOilIND	CottonseedU
VEGOILSEEDSIX	1	.890**	.976**	.937**	.855**	.909**	.899**	.896**	.974**	.895**
		0	0	0	0	0	0	0	0	0
SoybeansUS	.890**	1	.866**	.808**	.806**	.741**	.708**	.687**	.786**	.815**
	0		0	0	0	0	0	0	0	0
SoybeansNL	.976**	.866**	1	.974**	.895**	.850**	.842**	.834**	.928**	.936**
	0	0		0	0	0	0	0	0	0
SunflowerUS	.937**	.808**	.974**	1	.879**	.801**	.796**	.791**	.891**	.928**
	0	0	0		0	0	0	0	0	0
Groundnut	.855**	.806**	.895**	.879**	1	.697**	.687**	.672**	.783**	.906**
	0	0	0	0		0	0	0	0	0
CopraPH_IN	.909**	.741**	.850**	.801**	.697**	1	.994**	.989**	.900**	.778**
	0	0	0	0	0		0	0	0	0
coconutPH	.899**	.708**	.842**	.796**	.687**	.994**	1	.986**	.899**	.768**
	0	0	0	0	0	0		0	0	0
PalmMAY	.896**	.687**	.834**	.791**	.672**	.989**	.986**	1	.909**	.747**
	0	0	0	0	0	0	0		0	0
PalmOilIND	.974**	.786**	.928**	.891**	.783**	.900**	.899**	.909**	1	.825**
	0	0	0	0	0	0	0	0		0
CottonseedUS	.895**	.815**	.936**	.928**	.906**	.778**	.768**	.747**	.825**	1
	0	0	0	0	0	0	0	0	0	

Appendix 3.7i: Pearson Correlations of Commodity Price Index Constituents 1971-2009 — Food

	FOODIX	WheatARG	WheatUS	MaizeARG	MaizeUS	RiseThai	Sugar	BeefAUS	BananasCent	PepperEU	SoybeanHH	FishMealB
FOODIX	1	.879**	.881**	.930**	.928**	.932**	.704**	.443**	.594**	0.175	.819**	.697**
		0	0	0	0	0	0	0.005	0	0.286	0	0
WheatARG	.879**	1	.949**	.946**	.959**	.772**	.500**	.414**	.587**	0.203	.779**	.690**
	0		0	0	0	0	0.001	0.009	0	0.216	0	0
WheatUS	.881**	.949**	1	.950**	.966**	.767**	.400*	.475**	.697**	0.236	.824**	.776**
	0	0		0	0	0	0.012	0.002	0	0.147	0	0
MaizeARG	.930**	.946**	.950**	1	.992**	.876**	.659**	0.283	.749**	0.104	.885**	.742**
	0	0	0		0	0	0	0.18	0	0.629	0	0
MaizeUS	.928**	.959**	.966**	.992**	1	.869**	.619**	0.282	.768**	0.094	.897**	.757**
	0	0	0	0		0	0.001	0.182	0	0.664	0	0
RiseThai	.932**	.772**	.767**	.876**	.869**	1	.677**	0.311	.387*	0.104	.727**	.503**
	0	0	0	0	0		0	0.054	0.015	0.527	0	0.001
Sugar	.704**	.500**	.400*	.659**	.619**	.677**	1	0.061	0.037	-0.156	0.255	0.182
	0	0.001	0.012	0	0.001	0		0.713	0.824	0.344	0.118	0.268
BeefAUS	.443**	.414**	.475**	0.283	0.282	0.311	0.061	1	.614**	0.016	.526**	.434**
	0.005	0.009	0.002	0.18	0.182	0.054	0.713		0	0.922	0.001	0.006
BananasCentrAm	.594**	.587**	.697**	.749**	.768**	.387*	0.037	.614**	1	.417**	.666**	.812**
	0	0	0	0	0	0.015	0.824	0		0.008	0	0
PepperEU	0.175	0.203	0.236	0.104	0.094	0.104	-0.156	0.016	.417**	1	0.264	.345*
	0.286	0.216	0.147	0.629	0.664	0.527	0.344	0.922	0.008		0.104	0.031
SoybeanHH	.819**	.779**	.824**	.885**	.897**	.727**	0.255	.526**	.666**	0.264	1	.769**
	0	0	0	0	0	0	0.118	0.001	0	0.104		0
FishMealB	.697**	.690**	.776**	.742**	.757**	.503**	0.182	.434**	.812**	.345*	.769**	1
	0	0	0	0	0	0.001	0.268	0.006	0	0.031	0	

Appendix 3.7j: Pearson Correlations of Commodity Price Index Constituents 1971-2009 — Tropical Beverages

	TROPBEVIX	CoffeeCOL	CoffeeBRL	CoffeeOtherE	CoffeEXNY	CoffeeCOMP	CoffeeGER	CoffeeFR	CoffeeCOMP	CocoaNY	CocoaSDR	Tea
TROPBEVIX	1	.957**	.954**	.962**	.949**	.981**	.944**	.930**	.975**	.885**	.879**	.552*
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
CoffeeCOL	.957**	1	.935**	.985**	.877**	.956**	.968**	.818**	.930**	.770**	.745**	.544*
	0		0	0	0	0	0	0	0	0	0	0
CoffeeBRL	.954**	.935**	1	.941**	.935**	.964**	.916**	.890**	.933**	.748**	.778**	0.309
	0	0		0	0	0	0	0	0	0	0	0
CoffeeOtherEXNY	.962**	.985**	.941**	1	.896**	.974**	.991**	.851**	.957**	.760**	.740**	0.433
	0	0	0		0	0	0	0	0	0	0	0
CoffeEXNY	.949**	.877**	.935**	.896**	1	.974**	.869**	.998**	.961**	.797**	.840**	0.192
	0	0	0	0		0	0	0	0	0	0	0
CoffeeCOMP	.981**	.956**	.964**	.974**	.974**	1	.962**	.960**	.994**	.799**	.811**	0.34
	0	0	0	0	0		0	0	0	0	0	0
CoffeeGER	.944**	.968**	.916**	.991**	.869**	.962**	1	.866**	.969**	.641**	.627**	0.443
	0	0	0	0	0	0		0	0	0	0	0
CoffeeFR	.930**	.818**	.890**	.851**	.998**	.960**	.866**	1	.960**	.685**	.750**	0.179
	0	0	0	0	0	0	0		0	0	0	0
CoffeeCOMP97	.975**	.930**	.933**	.957**	.961**	.994**	.969**	.960**	1	.702**	.719**	0.367
	0	0	0	0	0	0	0	0		0	0	0
CocoaNY	.885**	.770**	.748**	.760**	.797**	.799**	.641**	.685**	.702**	1	.955**	.576*
	0	0	0	0	0	0	0	0	0		0	0
CocoaSDR	.879**	.745**	.778**	.740**	.840**	.811**	.627**	.750**	.719**	.955**	1	.548*
	0	0	0	0	0	0	0	0	0	0	0	0
Tea	.552*	.544*	0.309	0.433	0.192	0.34	0.443	0.179	0.367	.576*	.548*	1
	0.022	0.024	0.227	0.082	0.459	0.182	0.075	0.491	0.148	0.015	0.023	0

Appendix 3.8: Pearson Correlations — Commodity Price Index vs. Constituents

1971-2009 & 1996-2008

MinMetalsIx	**’71-‘09**	**’96-‘08**
Phosphate	.678**	.657*
Manganese	.738**	.702**
IronOre BRL	.924**	.931**
IronOre AUS JP	.896**	.906**
Alum LME	.836**	.947**
CopperGradeALME	.975**	.984**
Copper LME	.990**	.995**
Copper US	.991**	.993**
Nickel LME	.920**	.898**
Nickel NA	.929**	.905**
Lead GBP	.930**	.929**
Lead US$	.920**	.945**
Lead NA	.940**	.964**
ZincHiGrade	.875**	.852**
Zinc US	.875**	.840**
Tin LME	.471**	.919**
Tin MAY	.757**	.917**
Tin	.482**	.922**
Tungsten	.554**	.960**
GLD	.831**	.878**
Silv	.634**	.951**

AgriRawIx	**’71-‘09**	**’96-‘08**
Linseed	.654**	.856**
Tobacco	.762**	.577*
Cotton SUDAN	.578**	.744**
Cotton US EST	.500**	0.328
Cotton US Tx	.598**	0.452
Cotton FAREASTERN	0.285	0.457
Cotton EGY	0.294	0.217
Fine Wool	.819**	.819**
Wool	.716**	.716**
Jute	.378*	.744**
SisalKENIA2_3	.677**	.708**
SisalKENIA3	.711**	.845**
Cattle US	.535**	-.557*
NonconiferousWoodsUK	.754**	.899**
TropLog UK IMPORT	.924**	.939**
TropLog Gabun	.798**	0.527
TropSawnwood MAL	.717**	0.315
Plywood	.797**	.926**
RubberNo1SPORE	.726**	.926**
Rubber NY	.936**	.971**
Rubber SPORE	.959**	.973**

VegOilSeedsIx	**’71-‘09**	**’96-08**
Soybeans US	.890**	.954**
Soybeans NL	.976**	.990**
Sunflower US	.937**	.958**
Groundnut	.855**	.907**
Copra PH IN	.909**	.925**
coconut PH	.899**	.921**
Palm MAY	.896**	.920**
PalmOil IND	.974**	.976**
Cottonseed US	.895**	.910**

TropBevIx	**’71-‘09**	**’96-08**
Coffee COL	.957**	.941**
Coffee BRL	.954**	.895**
CoffeeOtherEXNY	.962**	.941**
Coffee EX NY	.949**	.904**
Coffee COMP	.981**	.965**
Coffee GER	.944**	.942**
Coffee FR	.930**	.892**
CoffeeCOMP97	.975**	.974**
Cocoa NY	.885**	.683**
Cocoa SDR	.879**	.624*
Tea	.552*	.700**

FoodIx	**’71-‘09**	**’96-08**
Wheat ARG	.879**	.896**
Wheat US	.881**	.912**
Maize ARG	.930**	.928**
Maize US	.928**	.926**
Rise Thai	.932**	.964**
Sugar	.704**	.822**
Beef AUS	.443**	.617*
Bananas CentrAm	.594**	.894**
Pepper EU	0.175	0.189
Soybean HH	.819**	.952**
FishMeal B	.697**	.850**

Data Source: Calculated and arranged by the author.

Appendix 3.9: Worldwide Governance Index Definition

Source: World Bank (2010c), Documentation Page. Tables created and arranged by the author.

Appendix 3.9a: Worldwide Governance Index — Voice and Accountability, Political Stability, Government Effectiveness

INDICATORS	DEFINITION / COMMENTS	ABBREVIATION
Indicator Name	**Voice and Accountability**	**WGIVA**
Definition	The extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media.	
Source	World Bank.	
Topic	Country Governance Index.	
Periodicity	Annual.	
Aggregation method	Composite of weighted averages.	
Indicator Name	**Political Stability and Absence of Violence**	**WGIPS**
Definition	The likelihood that the government will be destabilized by unconstitutional or violent means, including terrorism.	
Source	World Bank.	
Topic	Country Governance Index.	
Periodicity	Annual.	
Aggregation method	Composite of weighted averages.	
Indicator Name	**Government Effectiveness**	**WGIGE**
Definition	The quality of public services, the capacity of the civil service and its independence from political pressures, and the quality of policy formulation.	
Source	World Bank.	
Topic	Country Governance Index.	
Periodicity	Annual.	
Aggregation method	Composite of weighted averages.	

Source: World Bank (2010c), Documentation Page. Table created and arranged by the author.

Appendix 3.9b: Worldwide Governance Index — Regulatory Quality, Rule of Law, Corruption

INDICATORS	DEFINITION / COMMENTS	ABBREVIATION
Indicator Name	**Regulatory Quality**	**WGIRQ**
Definition	The ability of the government to provide sound policies and regulations that enables and promotes private sector development.	
Source	World Bank.	
Topic	Country Governance Index.	
Periodicity	Annual.	
Aggregation method	Composite of weighted averages.	
Indicator Name	**Rule of Law**	**WGIRL**
Definition	Trust in and abide by the rules of society, including the quality of contract enforcement and property rights, the police, and the courts, as well as the likelihood of crime and violence.	
Source	World Bank.	
Topic	Country Governance Index.	
Periodicity	Annual.	
Aggregation method	Composite of weighted averages.	
Indicator Name	**Control of Corruption**	**WGICC**
Definition	The extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as “capture” of the state by elites and private interests.	
Source	World Bank.	
Topic	Country Governance Index.	
Periodicity	Annual.	
Aggregation method	Composite of weighted averages.	

Source: World Bank (2010c), Documentation Page. Table created and arranged by the author.

Appendix 3.10: Worldwide Governance Indexes — Individual Data Sources

Governance Indicator Source *(Annual Coverage)*	**Type**	**Public**	**2009**	**2008**	**2007**	**2006**	**2005**	**2004**	**2003**	**2002**	**2000**	**1998**	**1996**
1 African Development Bank Country Policy and Institutional Assessments (ADB)	Expert (GOV)	Partial	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*na*
2 Afrobarometer (AFR)	Survey	Yes	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*na*	*na*
3 Asian Development Bank Country Policy and Institutional Assessments (ASD)	Expert (GOV)	Partial	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*na*	*na*
4 Business Environment and Enterprise Performance Survey (BPS)	Survey	Yes	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*na*	*na*
5 Bertelsmann Transformation Index (BTI)	Expert (NGO)	Yes	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*na*	*na*	*na*
6 Global Insight Global Risk Service (DRI)	Expert (NGO)	Yes	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
7 European Bank for Reconstruction and Development Transition Report (EBR)	Expert (GOV)	Yes	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
8 Economist Intelligence Unit (EIU)	Expert (CBIP)	Yes	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
9 Global Integrity Index (GII)	Expert (NGO)	Yes	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*na*	*na*	*na*	*na*
10 Gallup World Poll (GWP)	Survey	Yes	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
11 Transparency International Global Corruption Barometer (GCB)	Survey	Yes	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
12 World Economic Forum Global Competitiveness Survey (GCS)	Survey	Yes	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
13 Freedom House (FRH, CCR)	Expert (NGO)	Yes	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*na*	*na*	*na*	*na*	*na*
14 Heritage Foundation Index of Economic Freedom (HER)	Expert (NGO)	Yes	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
15 Cingranelli Richards Human Rights Database & Political Terror Scale (HUM)	Expert (GOV)	Yes	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
16 IFAD Rural Sector Performance Assessments (IFD)	Expert (GOV)	Yes	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*na*	*na*	*na*	*na*	*na*
17 International Research and Exchanges Board Media Sustainability Index (MSI)	Expert (NGO)	Yes	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*na*	*na*	*na*
18 iJET Country Security Risk Ratings (IJT)	Expert (CBIP)	Yes	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
19 Institutional Profiles Database (IPD)	Expert (GOV)	Yes	*Yes*	*Yes*	*Yes*	*Yes*	*na*	*na*	*na*	*na*	*na*	*na*	*na*
20 African Electoral Index (IRP)	Expert (NGO)	Yes	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*na*	*na*
21 Latinobarometro (LBO)	Survey	Yes	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
22 International Research and Exchanges Board Media Sustainability Index (MSI)	Expert (NGO)	Yes	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
23 International Budget Project Open Budget Index (OBI)	Expert (NGO)	Yes	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*na*	*na*	*na*	*na*	*na*	*na*
24 World Bank Country Policy and Institutional Assessments (PIA)	Expert (GOV)	Partial	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
25 Political and Economic Risk Consultancy Corruption in Asia Survey (PRC)	Survey	Yes	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*na*
26 Political Risk Services International Country Risk Guide (PRS)	Expert (CBIP)	Yes	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
27 Reporters Without Borders Press Freedom Index (RSF)	Expert (NGO)	Yes	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
28 U.S. Department of State Trafficking in People Report (TPR)	Expert (GOV)	Yes	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*na*	*na*
29 Vanderbilt University's Americas Barometer (VAB)	Survey	Yes	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
30 Institute for Management Development World Competitiveness Yearbook (WCY)	Survey	Yes	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*na*	*na*	*na*	*na*	*na*
31 Global Insight Business Risk and Conditions (WMO)	Expert (CBIP)	Yes	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*na*

Source: World Bank (2010 a). Table created and arranged by the author.

Appendix 3.11: Economic Freedom Index Definition

Source for Appendix 3.11: Heritage Foundation (2011b). Tables created and arranged by the author.

Appendix 3.11a: Economic Freedom Index — Business, Trade

INDICATORS	DEFINITION / COMMENTS	ABBREVIATION
Indicator Name	**Business Freedom**	**EFIBiz**
Definition	Business freedom is a quantitative measure of the ability to start, operate, and close a business that represents the overall burden of regulation, as well as the efficiency of government in the regulatory process. The business freedom score for each country is a number between 0 and 100, with 100 equaling the freest business environment. The score is based on 10 factors, all weighted equally, using data from the World Bank's Doing Business study.	
Source	The Heritage Foundation.	
Topic	Country Economic Freedom Indexes.	
Periodicity	Annual.	
Aggregation method	Composite of weighted averages.	
Indicator Name	**Trade Freedom**	**EFITrade**
Definition	Trade freedom is a composite measure of the absence of tariff and non-tariff barriers that affect imports and exports of goods and services. The trade freedom score is based on two inputs: The trade-weighted average tariff rate and Non-tariff barriers (NTBs). Different imports entering a country can, and often do, face different tariffs. Weighted average tariff uses weights for each tariff based on share of imports for each good.	
Source	The Heritage Foundation.	
Topic	Country Economic Freedom Indexes.	
Periodicity	Annual.	
Aggregation method	Composite of weighted averages.	

Source for Appendix 3.11: Heritage Foundation (2011b). Tables created and arranged by the author.

Appendix 3.11b: Economic Freedom Index — Fiscal, Government Size

INDICATORS	DEFINITION / COMMENTS	ABBREVIATION
Indicator Name	**Fiscal Freedom**	**EFIFisc**
Definition	Fiscal freedom is a measure of the burden of government from the revenue side. It includes both the tax burden in terms of the top tax rate on incomes (individual and corporate separately) and the overall amount of tax revenue as a percentage of GDP. Thus, the fiscal freedom component is composed of three quantitative factors: The top tax rate on individual income, The top tax rate on corporate income, and Total tax revenue as a percentage of GDP. In scoring the fiscal freedom component, each of these numerical variables is weighted equally as one-third of the factor. This equal weighting allows a country to achieve a score as high as 67 based on two of the factors even if it receives a score of 0 on the third.	
Source	The Heritage Foundation.	
Topic	Country Economic Freedom Indexes.	
Periodicity	Annual.	
Aggregation method	Composite of weighted averages.	
Indicator Name	**Government Size**	**EFIGovtS**
Definition	This component considers the level of government expenditures as a percentage of GDP. Government expenditures—including consumption and transfers—account for the entire score. Some level of government expenditures represents true public goods, implying an ideal level greater than zero. However, identifying that ideal level seems too arbitrary, static, and difficult to apply universally. For these reasons, the methodology treats zero government spending as the benchmark. Moreover, governments that have no public goods will be penalized by lower scores in the other factors (such as property rights and financial freedom)	
Source	The Heritage Foundation.	
Topic	Country Economic Freedom Indexes.	
Periodicity	Annual.	
Aggregation method	Composite of weighted averages.	

Appendix 3.11c: Economic Freedom Index — Monetary

INDICATORS	DEFINITION / COMMENTS	ABBREVIATION
Indicator Name	**Monetary Freedom**	**EFIMon**
Definition	Monetary freedom combines a measure of price stability with an assessment of price controls. Both inflation and price controls distort market activity. Price stability without microeconomic intervention is the ideal state for the free market. The score for the monetary freedom factor is based on two factors: The weighted average inflation rate for the most recent three years and Price controls. The weighted average inflation rate for the most recent three years serves as the primary input into an equation that generates the base score for monetary freedom. The extent of price controls is then assessed as a penalty of up to 20 points subtracted from the base score.	
Source	The Heritage Foundation.	
Topic	Country Economic Freedom Indexes.	
Periodicity	Annual.	
Aggregation method	Composite of weighted averages.	

Appendix 3.11d: Economic Freedom Index — Investment, Financial

INDICATORS	DEFINITION / COMMENTS	ABBREVIATION
Indicator Name	**Investment Freedom**	**EFIInvest**
Definition	This component scrutinizes each country’s policies toward the free flow of investment capital (foreign investment as well as internal capital flows) in order to determine its overall investment climate. The authors assess all countries using the same rubric. Questions examined include whether there is a foreign investment code that defines the country’s investment laws and procedures; whether the government encourages foreign investment through fair and equitable treatment of investors; whether there are restrictions on access to foreign exchange; whether foreign firms are treated the same as domestic firms under the law; whether the government imposes restrictions on payments, transfers, and capital transactions; and whether specific industries are closed to foreign investment.	
Source	The Heritage Foundation.	
Topic	Country Economic Freedom Indexes.	
Periodicity	Annual.	
Aggregation method	Composite of weighted averages.	

Indicator Name	**Financial Freedom**	**EFIFin**
Definition	Financial freedom is a measure of banking security as well as a measure of independence from government control. State ownership of banks and other financial institutions such as insurers and capital markets is an inefficient burden that reduces competition and generally lowers the level of available services. The authors score this component by determining the extent of government regulation of financial services; the extent of state intervention in banks and other financial services; the difficulty of opening and operating financial services firms (for both domestic and foreign individuals); and government influence on the allocation of credit. The authors use this analysis to develop a description of the country’s financial climate and assign it an overall score on a scale of 0 to 100.	
Source	The Heritage Foundation.	
Topic	Country Economic Freedom Indexes.	
Periodicity	Annual.	
Aggregation method	Composite of weighted averages.	

Appendix 3.11e: Economic Freedom Index — Property Rights, Corruption

INDICATORS	DEFINITION / COMMENTS	ABBREVIATION
Indicator Name	**Property Rights**	**EFIPropRi**
Definition	The property rights component is an assessment of the ability of individuals to accumulate private property, secured by clear laws that are fully enforced by the state. It measures the degree to which a country's laws protect private property rights and the degree to which its government enforces those laws. It also assesses the likelihood that private property will be expropriated and analyzes the independence of the judiciary, the existence of corruption within the judiciary, and the ability of individuals and businesses to enforce contracts. The more certain the legal protection of property, the higher a country's score; similarly, the greater the chances of government expropriation of property, the lower a country's score.	
Source	The Heritage Foundation.	
Topic	Country Economic Freedom Indexes.	
Periodicity	Annual.	
Aggregation method	Composite of weighted averages.	
Indicator Name	**Freedom from Corruption**	**EFICorrup**
Definition	Corruption erodes economic freedom by introducing insecurity and uncertainty into economic relationships. The score for this component is derived primarily from Transparency International's Corruption Perceptions Index (CPI) for 2007, which measures the level of corruption in 179 countries. The CPI is based on a 10-point scale in which a score of 10 indicates very little corruption and a score of 0 indicates a very corrupt government. In scoring freedom from corruption, the authors convert the raw CPI data to a scale of 0 to 100 by multiplying the CPI score by 10. For example, if a country's raw CPI data score is 5.5, its overall freedom from corruption score is 55. For countries that are not covered in the CPI, the freedom from corruption score is determined by using the qualitative information from internationally recognized and reliable sources.4 This procedure considers the extent to which corruption prevails in a country. The higher the level of corruption, the lower the level of overall economic freedom.	
Source	The Heritage Foundation.	
Topic	Country Economic Freedom Indexes.	
Periodicity	Annual.	
Aggregation method	Composite of weighted averages.	

Appendix 3.12: Data Series Brazil

Data Source for Appendixes 3.12a-d: World Bank (2009, 2010), World Bank (2010a), Heritage Foundation (2011b). Tables created and arranged by the author.

Appendix 3.12a: Data Series Brazil (Governance Data)

WGI GOVERNANCE	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
WGIVA	0.18	0.19	0.19	0.18	0.17	0.25	0.33	0.48	0.35	0.44	0.47	0.48	0.48	0.51
WGIPS	-0.48	-0.43	-0.38	-0.08	0.21	0.03	-0.16	0.07	-0.12	-0.08	-0.11	-0.20	-0.11	0.29
WGIGE	-0.24	-0.17	-0.10	-0.01	0.08	0.02	-0.04	0.21	0.14	0.01	-0.05	-0.07	0.06	0.08
WGIRQ	0.36	0.33	0.30	0.33	0.35	0.29	0.23	0.35	0.10	0.07	-0.02	-0.04	0.07	0.18
WGIRL	-0.18	-0.24	-0.30	-0.29	-0.27	-0.31	-0.34	-0.32	-0.33	-0.45	-0.41	-0.42	-0.34	-0.18
WGICC	-0.25	-0.10	0.05	0.08	0.11	-0.01	-0.13	0.21	0.11	-0.18	-0.15	-0.15	-0.05	-0.07

EFI GOVERNANCE	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
EFIBiz	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	53.45	54.19	54.04	54.38	54.50
EFITrade	57.00	57.40	57.40	51.00	57.00	58.00	62.80	62.80	65.20	69.00	69.80	70.80	71.60	69.20
EFIFisc	88.30	88.71	88.71	87.23	87.02	86.35	90.19	90.19	86.19	83.82	68.63	68.63	65.82	68.40
EFIGovtS	80.80	74.40	79.25	71.17	71.17	71.17	82.70	68.12	69.85	71.73	55.53	55.53	50.31	50.30
EFIMon	70.00	70.00	70.98	80.51	81.33	79.31	78.60	77.23	72.67	76.28	72.63	75.74	77.23	75.80
EFIInvest	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	45.00
EFIFin	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	40.00	40.00	50.00	50.00
EFIPropRi	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
EFICorrup	27.00	30.00	35.60	40.00	41.00	39.00	40.00	40.00	39.00	39.00	37.00	33.00	35.00	35.00

Data Source for Appendixes 3.12a-d: World Bank (2009, 2010), World Bank (2010a), Heritage Foundation (2011b). Tables created and arranged by the author.

Appendix 3.12b: Data Series Brazil (Variables 1-34)

Dependent Variables (Nr.)	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
GDPDefl (1)	77.38	83.29	86.82	94.18	100.00	108.97	120.47	137.00	148.02	158.69	168.45	178.33	191.52	200.69
GDP_gr (2)	2.15	3.37	0.04	0.25	4.31	1.31	2.66	1.15	5.71	3.16	3.96	6.09	5.14	-0.19
GDPpCap_gr (3)	0.62	1.83	-1.45	-1.22	2.81	-0.11	1.25	-0.20	4.37	1.93	2.81	5.00	4.12	-1.09
Agri_GDP (4)	5.51	5.40	5.52	5.47	5.60	5.97	6.62	7.39	6.91	5.71	5.47	5.82	6.40	6.61
Agri_gr (5)	2.96	0.81	3.41	6.53	2.72	6.06	6.58	5.81	2.32	0.30	4.52	5.86	5.78	3.65
IndustValAd_GDP (6)	25.98	26.13	25.66	25.95	27.73	26.92	27.05	27.85	30.11	29.27	28.78	27.27	26.70	27.19
IndustValAd_gr (7)	1.13	4.16	-2.50	-1.94	4.93	-0.61	2.13	1.31	7.85	2.08	2.28	4.76	4.30	-36.91
ManuValAdd_GDP (8)	16.80	16.67	15.72	16.12	17.22	17.13	16.85	18.02	19.22	18.10	17.40	16.93	15.28	15.54
ManFactValAdd_gr (9)	0.08	2.49	-4.84	-1.86	5.69	0.70	2.44	1.85	8.47	1.25	1.14	4.69	3.18	1.96
GrossSav_GDP (10)	14.08	13.58	13.03	12.06	13.94	13.81	15.16	17.99	20.36	18.79	18.68	17.66	16.86	14.78
GrossSav_GNI (11)	14.29	13.84	13.32	12.46	14.34	14.27	15.63	18.21	20.59	19.06	18.94	17.92	17.16	15.02
GrossDomSav_GDP (12)	15.24	15.23	15.03	14.97	16.49	16.71	17.71	18.68	20.99	19.81	19.67	18.81	18.37	16.15
GrossNatExp_GDP (13)	101.80	102.20	102.00	101.40	101.76	101.32	98.49	97.09	96.12	96.39	97.10	98.50	99.84	100.45
GovFinConExp_GDP (14)	20.10	19.90	20.64	20.30	19.17	19.82	20.57	19.39	19.23	19.91	20.04	19.44	19.45	19.52
GovFinConExp_gr (15)	-1.83	1.25	3.22	1.69	-0.15	2.74	4.75	1.15	4.09	2.30	2.58	4.73	5.64	1.09
FinConExp_GDP (16)	84.76	84.77	84.97	85.03	83.51	83.29	82.29	81.32	79.01	80.19	80.33	81.19	81.63	83.85
FinConExp_gr (17)	2.02	2.62	0.18	0.68	3.04	3.74	1.61	1.75	0.36	3.45	4.02	7.87	6.62	2.25
HHFinConExp_gr (18)	3.24	3.03	-0.72	0.38	4.03	4.03	0.68	1.93	-0.78	3.82	4.47	8.83	6.92	2.59
HHFinConExp_GDP (19)	64.66	64.88	64.33	64.73	64.35	63.47	61.72	61.93	59.78	60.27	60.29	61.75	62.18	64.33
HHFinConExpPCap_gr (20)	1.69	1.49	-2.20	-1.09	2.54	2.57	-0.70	0.57	-2.03	2.58	3.31	7.41	6.74	2.50
GroCapF_GDP (21)	17.04	17.43	17.03	16.38	18.25	18.03	16.20	15.77	17.12	16.21	16.77	17.31	18.21	16.60
GroCapF_gr (22)	1.50	8.73	-0.34	-8.20	14.10	-7.55	-5.23	-4.59	9.12	3.63	9.77	13.50	13.77	-10.18
GrossFixCapForm_GDP(23)	16.87	17.37	16.97	15.66	16.80	17.03	16.39	15.28	16.10	15.94	16.43	17.10	18.26	16.22
GrossFixCapForm_gr (24)	1.50	8.73	-0.34	-8.20	5.03	0.44	-5.23	-4.59	9.12	3.63	9.77	13.50	13.77	-10.18
Trade_GDP (25)	14.93	15.84	15.87	20.23	21.72	25.68	26.68	27.06	28.97	26.65	25.83	25.20	27.41	26.12
MrchTrade_GDP (26)	12.45	13.35	13.31	17.03	17.70	21.11	21.83	22.43	24.57	22.24	21.46	21.03	23.21	18.23
ExpGS_GDP (27)	6.57	6.82	6.93	9.41	9.98	12.18	14.10	14.99	16.43	15.13	14.37	13.35	13.79	12.83
ExpGS_gr (28)	-0.42	11.02	4.91	5.71	12.86	10.05	7.42	10.40	15.29	9.33	5.04	6.72	-0.60	11.37
ExtBalGS_GDP (29)	-1.80	-2.20	-2.00	-1.40	-1.76	-1.32	1.51	2.91	3.88	3.61	2.90	1.50	0.16	-0.45
CurrACC_GDP (30)	-2.77	-3.50	-4.01	-4.33	-3.76	-4.19	-1.51	0.76	1.77	1.59	1.25	0.11	-1.72	-1.55
ImpGS_GDP (31)	8.37	9.02	8.93	10.82	11.74	13.50	12.58	12.08	12.55	11.52	11.47	11.85	13.63	13.29
ImpGS_gr (32)	5.60	14.59	-0.06	-15.09	10.80	1.52	-11.82	-1.62	13.30	8.48	18.45	20.79	18.49	8.12
AgRawImp_MrchImp (33)	3.00	2.57	2.10	2.02	1.97	1.35	1.50	1.75	1.75	1.54	1.52	1.42	1.22	1.16
ManfImp_MrchImp (34)	69.95	73.85	76.30	75.72	73.29	75.96	74.05	72.35	71.16	71.81	70.09	63.82	70.22	75.88

Data Sources: World Bank (2009, 2010). All variables in Appendix 3.12b/c/d are in % except for index variables and/or otherwise stated. Table created and arranged by the author.

Appendix 3.12c: Data Series Brazil (Variables 35-71)

Dependent Variables (Nr.)	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
FuelImp_MerchImp (35)	13.17	11.68	9.30	11.37	14.93	13.97	14.87	15.55	18.31	18.37	18.83	18.55	19.82	14.80
ExpValX (36)	86.62	96.15	92.78	87.11	100.00	105.75	109.65	132.81	175.40	215.04	250.02	291.46	359.12	277.57
ImpValIx (37)	97.17	109.55	103.42	88.27	100.00	99.55	84.79	86.76	113.28	132.37	163.42	215.82	310.97	227.74
ExpVolX (38)	74.08	80.84	82.89	88.94	100.00	109.63	119.08	137.86	164.03	178.76	184.72	194.86	190.05	169.62
ImpVolIx (39)	89.93	106.60	105.56	92.93	100.00	102.85	90.59	87.34	103.67	109.14	126.07	153.82	181.67	150.00
UnitValIxExp (40)	117.00	119.00	112.00	98.00	100.00	96.45	92.08	96.34	106.93	120.30	135.35	149.58	188.96	163.64
UnitValIxImp (41)	108.00	104.00	98.00	95.00	100.00	96.80	93.60	99.34	109.27	121.29	129.63	140.31	171.17	151.83
ToT (42)	108.33	114.42	114.29	103.16	100.00	99.64	98.38	96.98	97.86	99.18	104.42	106.61	110.39	107.78
PPIxExp (43)	80.26	92.50	94.73	91.75	100.00	109.24	117.15	133.69	160.52	177.29	192.88	207.73	209.80	182.82
TariffAllweight (44)	13.80	14.00	15.94	12.31	12.65	10.42	9.98	9.40	7.55	7.09	6.71	6.83	6.74	NA
HiTekExp_ManuExp (45)	6.09	7.32	9.17	12.97	18.56	19.11	16.92	11.96	11.59	12.84	12.09	11.95	11.97	NA
ICTExp_TTExp (46)	2.22	2.22	2.33	3.08	4.56	4.53	4.00	3.19	2.37	3.41	3.19	1.97	1.82	NA
ICTImp_TTImp (47)	13.05	13.05	12.63	14.02	16.35	15.65	12.74	12.77	13.71	14.45	14.51	6.96	10.91	NA
AgrRwExp_MerchExp (48)	3.70	3.56	3.72	4.51	4.76	4.10	3.92	4.49	3.98	3.83	3.70	3.78	3.53	3.77
FoodExp_MrchExp (49)	30.27	31.26	29.84	28.94	23.39	27.63	27.92	28.66	28.00	25.77	25.04	26.35	27.58	34.20
ManufExp_MrchExp (50)	53.76	53.66	54.67	54.07	58.43	54.30	52.62	51.82	53.35	52.96	50.83	47.85	44.85	39.47
FDInet_GDP (51)	1.33	2.26	3.78	4.87	5.08	4.06	3.29	1.84	2.74	1.71	1.72	2.53	2.75	1.65
StoxVal_GDP (52)	13.35	23.24	17.38	14.87	15.71	11.76	9.56	10.94	14.10	17.48	23.37	42.82	44.42	41.30
FuelExp_MerchExp (53)	0.89	0.61	0.72	0.84	1.64	3.58	4.88	5.19	4.57	5.98	7.71	8.29	9.46	9.00
MrktCapList_GDP (54)	25.84	29.32	19.07	38.84	35.08	33.64	24.55	42.46	49.77	53.80	65.30	100.32	35.97	74.26
FoodPrdIx (55)	84.00	88.00	89.00	96.00	98.00	104.00	111.00	121.00	125.00	129.00	125.00	131.00	131.67	133.98
CropProdIX (56)	82.00	88.00	89.00	96.00	98.00	105.00	111.00	122.00	127.00	125.00	131.00	143.00	149.56	NA
LivStockProdIX (57)	87.00	87.00	88.00	95.00	100.00	103.00	110.00	115.00	124.00	132.00	118.00	119.00	120.01	NA
CPIx (58)	53.32	57.01	58.84	61.70	66.04	70.56	76.52	87.78	93.57	100.00	104.18	107.97	114.09	119.66
Infltn (59)	15.76	6.93	3.20	4.86	7.04	6.84	8.45	14.72	6.60	6.87	4.18	3.64	5.66	4.89
M2_GDP (60)	31.36	34.72	38.10	40.37	43.37	45.27	44.02	44.40	46.38	49.62	53.58	56.63	59.12	NA
M2_gr (61)	31.03	17.24	12.02	18.12	19.70	11.52	9.32	22.13	16.98	19.48	18.86	18.59	17.28	NA
IRSSpread (62)	53.84	53.84	58.36	54.42	39.63	39.76	43.73	45.11	39.51	37.75	36.88	33.14	35.59	NA
RealIR (63)	65.54	65.54	78.79	66.34	47.71	44.64	47.33	46.92	43.40	44.93	42.07	35.75	37.11	38.04
ExtDebtST_ExpGSInc (64)	303.55	301.40	373.54	404.65	348.48	318.07	308.22	264.17	191.34	133.85	116.16	119.39	104.84	NA
ExtDebtST_GNI (65)	21.91	23.21	29.25	42.97	38.54	42.74	47.22	43.70	33.92	21.78	18.15	18.14	16.21	NA
STD_ExpGSInc (66)	60.16	52.93	46.24	48.45	44.68	39.27	31.23	27.67	22.03	17.13	12.20	19.73	15.03	NA
STD_TTExtDbt (67)	19.82	17.56	12.38	11.97	12.82	12.35	10.13	10.47	11.51	12.80	10.50	16.53	14.34	NA
STD_TTResv (68)	60.19	67.41	68.09	80.43	93.81	78.83	61.84	49.89	47.73	44.60	23.68	21.76	18.91	NA
TTRes_TTExtDbt (69)	32.92	26.05	18.18	14.89	13.67	15.66	16.38	20.99	24.12	28.70	44.36	75.94	75.81	NA
M2_TTReserv (70)	5.00	6.31	7.74	7.06	9.23	7.38	6.15	5.47	6.27	8.86	7.38	4.66	5.40	NA
MultiDebt_TTExtD (71)	5.19	5.07	6.76	7.60	7.55	8.46	9.08	8.74	8.85	10.27	11.23	9.70	7.27	NA

Appendix 3.12d: Data Series Brazil (Variables 72-79, Others)

Dependent Variables (Nr.)	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
EnrgyImp_Euse (72)	30.05	29.13	26.85	24.24	21.57	19.95	14.39	10.29	12.81	9.44	7.22	8.48	8.18	NA
GDP_UEnUKPPPOilE (73)	7.56	7.41	7.24	7.07	7.29	7.34	7.33	7.30	7.31	7.34	7.38	7.41	7.43	NA
GDP_UEnUPPPOilE (74)	6.17	6.15	6.08	6.02	6.35	6.54	6.64	6.76	7.07	7.34	7.62	7.87	8.06	NA
RuPp_ToTPp (75)	21.52	20.84	20.16	19.48	18.80	18.20	17.60	17.00	16.40	15.80	15.34	14.88	14.42	13.96
Internet_100 (76)	0.45	0.79	1.48	2.04	2.87	4.53	9.15	13.21	19.07	21.02	28.18	30.88	37.52	NA
Phonelines_100 (77)	9.20	10.22	11.82	14.55	17.76	21.19	21.67	21.60	21.53	21.42	20.62	20.72	21.43	NA
Unempl_Lforce (78)	6.80	7.70	8.90	9.60	9.45	9.30	9.10	9.70	8.90	9.30	8.40	9.30	7.90	NA
MobileSubs_100 (79)	1.52	2.73	4.36	8.76	13.31	16.27	19.47	25.54	35.68	46.33	53.10	63.63	78.47	NA
MCA Independents[105]	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
BMca1MetOil	129.19	127.20	96.89	108.38	141.43	124.40	123.89	141.41	191.69	256.20	357.40	399.69	478.16	NA
BMca2FdAg	196.44	183.11	159.60	138.52	141.42	140.41	139.11	151.84	172.50	181.43	210.64	232.16	305.34	NA
BMca3BevAg	190.70	211.64	182.06	152.79	141.41	123.88	129.51	144.76	159.47	180.38	198.47	220.77	265.80	NA
BMca4EFscGvt	119.57	115.34	118.77	112.01	111.86	111.38	122.25	111.94	110.34	109.98	87.79	87.79	82.12	NA
BgrMcaFoodAg	NA	-9.68	-18.09	-18.45	2.96	-1.00	-1.33	13.36	19.25	7.39	22.819	14.48	44.59	NA
Other Variables	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Export% of Total World	0.88	0.95	0.93	0.84	0.85	0.94	0.93	0.97	1.05	1.13	1.14	1.15	1.23	1.23
REAL/USD FX Rate (avg.)	1.01	1.08	1.16	1.81	1.83	2.35	2.92	3.08	2.93	2.43	2.18	1.95	1.83	2.0
Non-Performing Loans (%) to Total Loans	NA	NA	NA	NA	8.3	5.6	4.5	4.1	2.9	3.5	3.5	3.0	3.1	NA
Bank Capital to Assets (%)	NA	NA	NA	NA	12.1	8.9	9.2	9.6	10.1	9.8	9.9	9.8	9.1	NA
GDP (const. billion USD)[106]	596	616	617	618	645	653	671	678	717	740	769	816	858	856
GDP (curr. billion USD)[107]	840	871	844	587	645	554	504	552	664	882	1,089	1,366	1,653	1,594
GDP PerCapita (const.USD)[108]	3,632	3,698	3,645	3,600	3,701	3,697	3,743	3,736	3,899	3,975	4,086	4,290	4,469	4,399
GDP Per Capita (curr. USD)[109]	5,115	5,228	4,988	3,418	3,701	3,134	2,815	3,043	3,610	4,741	5,787	7,185	8,609	8,230

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[105] Results of Principal Component Analises, calculated and arranged by the author.

[106] Year 2000 constant (const.) USD.

[107] Current (curr.) USD.

[108] Year 2000 constant USD, Purchase Price Parity.

[109] Current USD, Purchase Price Parity.

Appendix 3.13: Data Series China

Data Source for Appendixes 3.13a-d: World Bank (2009, 2010), World Bank (2010a), Heritage Foundation (2011b). Table created and arranged by the author.

Appendix 3.13a: Data Series China (Governance Data)

WGI GOVERNANCE	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
WGIVA	-1.66	-1.52	-1.38	-1.34	-1.29	-1.44	-1.58	-1.53	-1.46	-1.52	-1.68	-1.72	-1.68	-1.65
WGIPS	-0.35	-0.26	-0.16	-0.19	-0.22	-0.20	-0.18	-0.38	-0.21	-0.36	-0.46	-0.39	-0.39	-0.44
WGIGE	0.04	-0.14	-0.33	-0.23	-0.13	-0.09	-0.05	-0.10	-0.05	-0.21	0.03	0.21	0.15	0.12
WGIRQ	0.195	-0.033	-0.260	-0.270	-0.280	-0.385	-0.490	-0.350	-0.240	-0.200	-0.280	-0.180	-0.150	-0.20
WGIRL	-0.202	-0.286	-0.370	-0.405	-0.440	-0.390	-0.340	-0.430	-0.350	-0.410	-0.520	-0.450	-0.330	-0.35
WGICC	-0.202	-0.234	-0.265	-0.247	-0.229	-0.351	-0.473	-0.376	-0.616	-0.736	-0.522	-0.599	-0.458	-0.53
EFI GOVERNANCE	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
EFIBiz	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	43.11	46.93	50.25	51.55	49.70
EFITrade	30.00	34.00	38.20	42.60	46.00	48.60	50.60	51.40	54.40	68.00	68.00	70.20	71.40	72.20
EFIFisc	70.43	70.48	70.51	70.44	70.39	70.30	66.87	66.40	67.93	70.03	66.58	66.36	70.61	70.20
EFIGovtS	95.39	95.89	95.08	90.28	94.12	92.32	90.17	88.36	86.00	86.00	87.02	89.73	88.94	88.10
EFIMon	62.70	68.19	75.24	83.99	84.08	87.56	85.81	86.39	84.84	79.38	75.48	76.53	72.85	70.60
EFIInvest	50.00	50.00	50.00	50.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	20.00
EFIFin	50.00	50.00	50.00	50.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
EFIPropRi	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	20.00	20.00	20.00	20.00
EFICorrup	21.60	24.30	28.80	35.00	34.00	31.00	35.00	35.00	34.00	34.00	32.00	33.00	35.00	36.00

Data Source for Appendixes 3.13a-d: World Bank (2009, 2010), World Bank (2010a), Heritage Foundation (2011b). Table created and arranged by the author.

Appendix 3.13b: Data Series China (Variables 1-35)

Dependent Variables (Nr.)	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
GDPDefl (1)	98.59	100.08	99.22	97.98	100.00	102.05	102.65	105.33	112.61	117.04	121.47	130.70	140.89	140.02
GDP_gr (2)	10.00	9.30	7.80	7.60	8.40	8.30	9.10	10.00	10.10	11.30	12.70	14.20	9.60	9.10
GDPpCap_gr (3)	8.85	8.19	6.77	6.67	7.55	7.52	8.37	9.32	9.45	10.65	12.07	13.61	9.04	8.54
Agri_GDP (4)	19.69	18.29	17.56	16.47	15.06	14.39	13.74	12.80	13.39	12.12	11.11	10.77	10.73	10.35
Agri_gr (5)	5.10	3.50	3.50	2.80	2.40	2.80	2.90	2.50	6.30	5.20	5.00	3.70	5.40	4.20
IndustValAd_GDP (6)	47.54	47.54	46.21	45.76	45.92	45.15	44.79	45.97	46.23	47.37	47.95	47.34	47.45	46.30
IndustValAd_gr (7)	12.10	10.50	8.90	8.10	9.40	8.40	9.80	12.70	11.10	12.10	13.40	15.10	9.90	9.90
ManuValAdd_GDP (8)	33.51	33.18	31.84	31.59	32.12	31.64	31.42	32.85	32.37	32.51	32.92	32.90	32.92	33.92
ManFactValAdd_gr (9)	11.33	9.85	8.06	8.67	10.77	8.62	10.07	14.90	8.97	9.47	13.10	16.62	20.06	NA
GrossSav_GDP (10)	41.29	41.83	40.19	38.37	36.83	37.58	40.30	44.00	46.82	50.73	52.96	52.34	51.95	NA
GrossSav_GNI (11)	41.90	42.32	40.86	39.02	37.29	38.13	40.72	44.21	46.90	50.49	52.67	51.96	51.59	NA
GrossDomSav_GDP (12)	42.49	42.44	41.40	39.57	37.53	38.39	40.44	43.40	45.81	49.14	51.33	50.50	50.24	54.17
GrossNatExp_GDP (13)	97.95	95.50	95.70	97.17	97.59	97.88	97.43	97.80	97.45	94.47	92.31	91.23	92.30	90.66
GovFinConExp_GDP (14)	14.00	14.21	14.64	15.30	15.79	16.11	15.89	15.18	14.51	14.39	13.92	13.24	12.97	11.50
GovFinConExp_gr (15)	10.15	8.19	10.19	11.97	10.51	10.55	7.77	5.48	7.06	9.53	8.57	10.48	8.13	11.50
FinConExp_GDP (16)	57.51	57.56	58.60	60.43	62.47	61.61	59.56	56.60	54.19	50.86	48.67	49.50	49.76	45.83
FinConExp_gr (17)	11.67	9.86	8.74	11.48	8.99	7.07	5.44	4.00	3.40	5.97	8.52	14.41	12.47	8.75
HHFinConExp_gr (18)	12.19	10.41	8.27	11.32	8.49	5.89	4.61	3.46	2.04	4.58	8.50	16.02	14.16	7.60
HHFinConExp_GDP (19)	43.51	43.35	43.96	45.13	46.69	45.50	43.67	41.42	39.67	36.48	34.75	36.26	36.79	34.03
HHFinConExpPCap_gr (20)	9.62	3.52	4.99	6.86	5.08	4.50	5.42	5.36	6.13	5.93	7.77	9.41	7.66	7.31
GroCapF_GDP (21)	40.44	37.95	37.10	36.74	35.12	36.27	37.87	41.20	43.26	43.61	43.64	41.73	42.55	44.84
GroCapF_gr (22)	8.47	3.86	4.66	4.17	3.69	11.96	12.13	16.90	13.59	9.01	11.13	11.45	9.51	15.80
GrossFixCapForm_GDP(23)	33.79	32.88	33.85	34.04	34.11	34.43	36.26	39.38	40.73	41.80	41.68	39.67	40.19	42.43
GrossFixCapForm_gr (24)	10.45	7.72	10.22	5.77	8.70	9.38	13.20	16.64	11.88	11.00	10.72	10.93	8.82	16.00
Trade_GDP (25)	38.06	39.01	36.39	37.97	44.24	43.08	47.70	56.91	65.35	68.63	70.47	67.81	62.09	47.10
MrchTrade_GDP (26)	33.86	34.13	31.78	33.29	39.57	38.47	42.70	51.86	59.77	63.00	64.80	62.08	56.55	44.96
ExpGS_GDP (27)	20.05	21.75	20.35	20.40	23.33	22.60	25.13	29.56	33.95	37.08	39.08	38.29	34.89	26.18
ExpGS_gr (28)	-0.71	22.93	7.16	15.16	30.57	10.04	28.88	26.78	28.41	21.18	16.98	8.69	-9.49	-12.09
ExtBalGS_GDP (29)	2.05	4.50	4.30	2.83	2.41	2.12	2.57	2.20	2.55	5.53	7.69	8.77	7.70	5.25
CurrACC_GDP (30)	0.85	3.88	3.09	1.95	1.71	1.31	2.44	2.80	3.55	7.13	9.32	10.61	9.40	NA
ImpGS_GDP (31)	18.00	17.26	16.05	17.57	20.92	20.48	22.56	27.36	31.40	31.55	31.39	29.52	27.20	20.93
ImpGS_gr (32)	1.14	11.12	3.11	22.59	24.50	12.71	25.30	24.76	22.49	11.17	9.57	3.34	-13.35	-5.73
AgRawImp_MrchImp (33)	5.12	5.23	4.25	4.30	4.81	4.57	4.25	3.99	4.03	3.88	3.98	3.76	3.56	3.37
ManfImp_MrchImp (34)	79.10	77.14	81.26	80.29	75.12	77.56	79.62	78.89	75.26	73.07	71.18	68.47	61.93	64.38
FuelImp_MerchImp (35)	4.97	7.25	4.87	5.40	9.47	7.45	6.89	7.50	9.12	10.56	12.36	11.99	16.25	13.44

Data Sources: World Bank (2009, 2010). All variables in Appendix 3.13b/c/d are in % except for index variables and/or otherwise stated. Table created and arranged by the author.

Appendix 3.13c: Data Series China (Variables 36-71)

Dependent Variables (Nr.)	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
ExpValX (36)	60.61	73.35	73.72	78.22	100.00	106.78	130.65	175.85	238.09	305.76	388.99	488.67	573.29	482.25
ImpValIx (37)	61.68	63.25	62.30	73.61	100.00	108.20	131.13	183.37	249.33	293.19	351.68	424.82	502.73	446.11
ExpVolX (38)	56.65	67.92	70.88	77.45	100.00	108.78	134.80	179.80	236.78	300.54	376.93	459.18	507.27	438.06
ImpVolIx (39)	61.07	64.54	66.28	75.89	100.00	112.64	138.31	183.77	229.10	248.38	281.47	321.19	328.62	323.19
UnitValIxExp (40)	107.00	108.00	104.00	101.00	100.00	98.16	96.92	97.80	100.55	101.73	103.20	106.42	113.01	110.09
UnitValIxImp (41)	101.00	98.00	94.00	97.00	100.00	96.05	94.81	99.78	108.83	118.04	124.94	132.27	152.98	138.03
ToT (42)	105.94	110.20	110.64	104.12	100.00	102.19	102.23	98.02	92.39	86.19	82.60	80.46	73.87	79.75
PPIxExp (43)	60.01	74.85	78.43	80.64	100.00	111.17	137.81	176.24	218.77	259.03	311.33	369.46	374.74	349.37
TariffAllweight (44)	19.76	15.82	15.58	14.46	14.62	14.10	10.30	6.49	6.00	4.83	4.29	4.30	3.92	NA
HiTekExp_ManuExp (45)	12.00	12.68	15.08	16.76	18.58	20.57	23.31	27.10	29.81	30.60	30.30	29.68	28.66	NA
ICTExp_TTExp (46)	12.30	12.69	14.92	16.76	18.86	20.78	24.38	28.14	30.41	30.86	30.86	29.20	27.46	NA
ICTImp_TTImp (47)	12.14	13.76	18.19	20.98	22.48	23.51	25.90	26.78	26.49	27.73	28.62	26.70	23.19	NA
AgrRwExp_MerchExp (48)	1.56	1.38	1.09	1.21	1.09	0.86	0.78	0.64	0.54	0.52	0.48	0.46	0.43	0.45
FoodExp_MrchExp (49)	8.21	7.13	6.62	6.01	5.44	5.34	4.96	4.39	3.50	3.23	2.87	2.71	2.51	2.94
ManufExp_MrchExp (50)	84.36	85.36	87.29	88.28	88.22	88.60	89.84	90.57	91.38	91.88	92.38	93.08	92.99	93.57
FDInet_GDP (51)	4.69	4.64	4.29	3.58	3.20	3.34	3.39	2.87	2.84	3.51	2.87	3.95	3.26	1.57
StoxVal_GDP (52)	29.90	38.79	27.93	34.81	60.20	33.89	22.93	29.06	38.74	25.98	60.18	222.27	120.69	179.67
FuelExp_MerchExp (53)	3.91	3.81	2.80	2.38	3.14	3.16	2.59	2.54	2.43	2.30	1.81	1.69	2.21	1.70
MrktCapList_GDP (54)	13.29	21.66	22.69	30.53	48.48	39.55	31.85	41.51	33.12	34.59	89.31	177.61	61.63	100.46
FoodPrdIx (55)	84.00	89.00	93.00	97.00	100.00	102.00	107.00	109.00	116.00	120.00	123.00	125.00	126.71	NA
CropProdIx (56)	89.00	91.00	93.00	96.00	100.00	102.00	108.00	107.00	115.00	118.00	120.00	123.00	124.71	NA
LivStockProdIx (57)	79.00	87.00	94.00	97.00	100.00	102.00	105.00	109.00	113.00	119.00	122.00	122.00	123.02	NA
CPIx (58)	92.80	95.40	94.60	93.27	93.50	94.18	93.46	94.54	98.21	100.00	101.46	106.28	112.52	111.72
Infltn (59)	8.32	2.81	-0.84	-1.41	0.26	0.72	-0.77	1.16	3.88	1.82	1.46	4.75	5.86	-0.70
M2_GDP (60)	90.65	101.80	112.82	121.44	124.06	127.54	135.70	142.83	141.81	142.06	145.30	140.90	139.89	159.38
M2_gr (61)	26.53	23.09	14.66	14.11	12.07	15.01	18.28	19.24	14.89	16.74	22.12	16.74	17.78	28.42
IRSSpread (62)	2.61	2.97	2.61	3.60	3.60	3.60	3.33	3.33	3.33	3.33	3.60	3.33	3.06	NA
RealIR (63)	3.42	7.02	7.31	7.20	3.71	3.72	4.70	2.63	-1.25	1.59	2.25	-0.12	-2.31	4.19
ExtDebtST_ExpGSInc (64)	71.30	67.49	67.52	66.21	49.79	59.67	49.58	41.32	36.37	32.22	28.96	26.03	22.42	NA
ExtDebtST_GNI (65)	15.27	15.58	14.36	14.23	12.31	14.15	12.93	12.76	12.85	12.64	12.17	10.97	8.65	NA
STD_ExpGSInc (66)	14.06	14.47	8.13	6.61	4.47	18.18	17.50	17.46	17.00	16.82	15.44	14.19	11.10	NA
STD_TTExtDbt (67)	19.72	21.45	12.04	9.98	8.98	30.46	35.29	42.26	46.74	52.21	53.30	54.50	49.49	NA
STD_TTResv (68)	22.74	21.48	11.34	9.40	7.62	25.58	22.06	21.17	18.58	17.83	16.04	13.17	9.52	NA
TTRes_TTExtDbt (69)	86.73	99.83	106.15	106.15	117.88	119.08	159.98	199.68	251.51	292.76	332.27	413.72	519.78	NA
M2_TTReserv (70)	7.76	7.31	8.04	8.69	9.15	8.21	7.18	6.13	4.70	4.15	4.01	3.43	3.48	3.64
MultiDebt_TTExtD (71)	13.74	12.93	15.48	15.69	17.71	14.53	14.73	12.59	10.71	9.30	8.53	7.83	8.10	NA

Appendix 3.13d: Data Series China (Variables 72-79, Others)

Dependent Variables (Nr.)	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
EnrgyImp_Euse (72)	-1.03	-0.74	0.03	2.23	2.85	-0.20	0.88	2.10	4.60	4.39	6.88	7.25	8.57	NA
GDP_UEnUKPPPOilE (73)	2.26	2.47	2.66	2.87	3.08	3.35	3.38	3.27	3.09	3.17	3.28	3.53	3.66	NA
GDP_UEnUPPPOilE (74)	1.85	2.05	2.24	2.44	2.68	2.99	3.07	3.03	2.99	3.17	3.38	3.75	3.96	NA
RuPp_ToTPp (75)	67.72	66.84	65.96	65.08	64.20	63.28	62.36	61.44	60.52	59.60	58.70	57.80	56.90	56.00
Internet_100 (76)	0.01	0.03	0.17	0.71	1.78	2.65	4.62	6.17	7.25	8.58	10.60	16.13	22.50	NA
Phonelines_100 (77)	4.51	5.72	7.04	8.68	11.47	14.18	16.73	20.39	24.05	26.88	28.05	27.74	25.73	NA
Unempl_Lforce (78)	3.00	3.10	3.10	3.10	3.10	3.60	4.00	4.30	4.20	4.20	4.10	4.00	4.20	NA
MobileSubs_100 (79)	0.56	1.08	1.92	3.46	6.75	11.39	16.09	20.95	25.83	30.18	35.17	41.53	48.41	NA
MCA INDEPENDENTS[110]	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
CMca1MetOil	129.19	127.20	96.89	108.38	141.43	124.40	123.89	141.41	191.69	256.20	357.40	399.69	478.16	NA
CMca2FdAg	196.44	183.11	159.60	138.52	141.42	140.41	139.11	151.84	172.50	181.43	210.64	232.16	305.34	NA
CMca3FdVegAg	252.01	240.60	228.05	185.33	173.20	168.71	180.93	202.98	230.30	229.22	257.24	319.46	420.75	NA
CMca4WVaPs	-1.42	-1.26	-1.09	-1.08	-1.07	-1.16	-1.24	-1.35	-1.18	-1.33	-1.51	-1.49	-1.464	NA
CMca5EInvFin	70.71	70.71	70.71	70.71	42.43	42.43	42.43	42.43	42.43	42.43	42.43	42.43	42.426	NA
OTHER VARIABLES	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Export% of Total World	2.79	3.27	3.34	3.41	3.86	4.30	5.02	5.81	6.46	7.25	7.99	8.71	8.87	9.68
RMB/USD FX Rate (avg.)	8.31	8.29	8.28	8.28	8.28	8.28	8.28	8.28	8.28	8.19	7.97	7.61	6.95	6.83
Non-Performing Loans (%) to Total Loans	NA	NA	NA	NA	22.4	29.8	26	20.4	13.2	8.6	7.1	6.2	2.4	NA
Bank Capital to Assets (%)	NA	NA	NA	NA	NA	4.1	NA	3.8	4.0	4.4	5.1	5.8	6.1	NA
GDP (const. billion USD)[111]	872	953	1,028	1,106	1,198	1,298	1,416	1,558	1,715	1,909	2,151	2,457	2,693	2,938
GDP (curr. billion USD)[112]	856	953	1,019	1,083	1,198	1,325	1,454	1,641	1,932	2,257	2,713	3,494	4,522	4,985
GDP Per Capita (const. USD)[113]	716	775	827	883	949	1,021	1,106	1,209	1,323	1,464	1,641	1,864	2,033	2,206
GDP Per Capita (curr. USD)[114]	703	774	821	865	949	1,042	1,135	1,274	1,490	1,731	2,069	2,651	3,414	3,744

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[110] Results of Principal Component Analises, calculated and arranged by the author.

[111] Year 2000 constant (const.) USD.

[112] Current (curr.) USD.

[113] Year 2000 constant USD, Purchase Price Parity.

[114] Current USD, Purchase Price Parity.

Appendix 3.14: Commodity Price Indexes and World GDP / World GDP per Capita / Trade to GDP ratios

Year	Food		Tropical Beverages		Vegetables, Oilseeds, Oils		Agricultural Raw Materials		Minerals, Ores, and Metals		Crude		World GDP 2000 const.USD		World GDP Per Capita		World Trade % of W.GDP
	Index	Change	Index	Change	Index	Change	Index	Change	Index	Change	Index	Change	Trio	Change	USD	Change	Share
1971	53.7	-0.1%	57.5	-11.5%	77.7	3.3%	39.8	-0.3%	46.9	-12.9%	9.1	21.7%	12.64	4.1%	3,358	1.88%	27.1%
1972	66.7	24.1%	64.1	11.4%	68.2	-12.1%	43.6	9.5%	47	0.2%	9.9	8.7%	13.37	5.7%	3,478	3.59%	27.2%
1973	122.7	84.1%	82.5	28.7%	125.9	84.4%	76	74.5%	68.4	45.7%	11.1	12.0%	14.24	6.5%	3,633	4.45%	30.0%
1974	178.7	45.7%	98	18.8%	197	56.5%	78.6	3.4%	88.3	29.1%	39.7	257.8%	14.46	1.6%	3,619	-0.40%	35.4%
1975	133.7	-25.2%	95.1	-2.9%	129.7	-34.2%	70.9	-9.8%	67.9	-23.1%	37.5	-5.6%	14.59	0.9%	3,584	-0.94%	33.0%
1976	108.3	-18.9%	172.2	81.0%	120.5	-7.1%	92.2	29.9%	73	7.5%	41.9	11.7%	15.31	4.9%	3,695	3.09%	34.2%
1977	103.3	-4.7%	307.3	78.5%	153.7	27.6%	94.1	2.1%	74.8	2.6%	45.5	8.5%	15.94	4.1%	3,779	2.28%	34.3%
1978	114.9	11.2%	219.5	-28.6%	165.3	7.5%	101.4	7.7%	77.2	3.1%	45.9	0.9%	16.64	4.4%	3,877	2.58%	33.7%
1979	125.8	9.6%	227.9	3.8%	186.4	12.8%	118.2	16.6%	105.3	36.4%	103.6	125.6%	17.33	4.1%	3,966	2.32%	36.1%
1980	183.1	45.5%	211.7	-7.1%	165.6	-11.2%	131.1	11.0%	115.8	10.0%	125.7	21.4%	17.65	1.9%	3,971	0.10%	38.4%
1981	160.4	-12.4%	172.5	-18.5%	156.2	-5.7%	112.5	-14.2%	97.8	-15.6%	120.9	-3.8%	18.03	2.2%	3,986	0.40%	38.8%
1982	113.9	-29.0%	162.8	-5.6%	127.4	-18.4%	96	-14.7%	85.8	-12.2%	111.2	-8.0%	18.1	0.4%	3,933	-1.33%	37.4%
1983	119.6	5.0%	173.4	6.5%	150	17.7%	104.6	9.0%	92.6	7.9%	100.5	-9.6%	18.61	2.8%	3,973	1.02%	36.7%
1984	103.3	-13.6%	198	14.1%	198	32.0%	104.9	0.2%	85.1	-8.1%	100.1	-0.4%	19.51	4.8%	4,095	3.07%	38.4%
1985	89.6	-13.3%	179.1	-9.5%	141.2	-28.7%	94	-10.4%	81.2	-4.6%	95.6	-4.5%	20.27	3.9%	4,184	2.17%	37.8%
1986	94.4	5.3%	219.1	22.3%	89.2	-36.8%	95.4	1.5%	77.9	-4.1%	49	-48.8%	20.95	3.4%	4,250	1.58%	34.9%
1987	99.5	5.4%	145.1	-33.8%	103	15.4%	111.8	17.2%	93.1	19.6%	63.1	28.8%	21.7	3.6%	4,326	1.78%	35.4%
1988	129	29.7%	145.4	0.2%	137.4	33.4%	117.6	5.2%	137.5	47.7%	50.1	-20.5%	22.72	4.7%	4,453	2.93%	36.4%
1989	135.1	4.7%	122.9	-15.5%	120.8	-12.1%	118.3	0.6%	139.4	1.4%	60.9	21.4%	23.58	3.8%	4,543	2.02%	37.7%
1990	125.4	-7.2%	107.6	-12.4%	107	-11.4%	128.2	8.3%	127	-8.9%	78.1	28.3%	24.28	3.0%	4,599	1.25%	38.0%
1991	120.8	-3.6%	99.3	-7.8%	113.8	6.3%	123.4	-3.8%	111.5	-12.2%	64.8	-17.1%	24.66	1.6%	4,597	-0.04%	37.8%
1992	117.6	-2.6%	85.6	-13.7%	121	6.4%	119.1	-3.5%	108.5	-2.7%	64.5	-0.3%	25.18	2.1%	4,625	0.60%	38.7%
1993	116.6	-0.9%	92.6	8.2%	122.8	1.5%	110.7	-7.0%	91.5	-15.7%	57.2	-11.4%	25.63	1.8%	4,637	0.27%	38.5%
1994	129.1	10.7%	161.4	74.3%	152.1	23.8%	131.4	18.7%	105.7	15.5%	54.8	-4.1%	26.47	3.3%	4,721	1.81%	39.7%
1995	132.3	2.5%	163.3	1.2%	167.1	9.9%	150.4	14.4%	128.1	21.2%	59.9	9.3%	27.24	2.9%	4,788	1.41%	41.8%
1996	144.2	9.0%	136.1	-16.6%	158.9	-4.9%	133.6	-11.2%	110.4	-13.8%	72.3	20.7%	28.16	3.4%	4,881	1.95%	42.4%
1997	136.4	-5.4%	176.7	29.8%	158.1	-0.5%	122.6	-8.2%	111.9	1.4%	68	-6.0%	29.2	3.7%	4,993	2.28%	44.1%
1998	117.8	-13.6%	149.6	-15.4%	169.9	7.5%	107.9	-12.0%	90.7	-19.0%	46.3	-31.8%	29.9	2.4%	5,043	1.00%	44.4%
1999	98	-16.8%	118.2	-21.0%	125.4	-26.2%	97.9	-9.3%	89	-1.8%	64.3	38.7%	30.89	3.3%	5,142	1.96%	44.7%
2000	100	2.1%	100	-15.4%	100	-20.3%	100	2.1%	100	12.4%	100	55.6%	32.21	4.3%	5,293	2.95%	48.8%
2001	102.8	2.8%	79.4	-20.6%	93.6	-6.4%	95.8	-4.2%	89.2	-10.8%	86.7	-13.3%	32.73	1.6%	5,311	0.33%	48.4%
2002	102.2	-0.5%	88.7	11.7%	116.9	24.9%	94.5	-1.4%	86.8	-2.7%	88.4	2.0%	33.37	2.0%	5,348	0.70%	47.8%
2003	104.1	1.9%	94.1	6.2%	137.2	17.4%	110.6	17.0%	97.6	12.4%	102.4	15.8%	34.26	2.7%	5,425	1.43%	48.3%
2004	118.6	13.9%	100.2	6.4%	155.3	13.2%	125.4	13.4%	137.3	40.7%	133.8	30.7%	35.66	4.1%	5,579	2.84%	51.5%
2005	127.2	7.2%	125.7	25.5%	140.6	-9.5%	129.4	3.2%	173.2	26.2%	189.1	41.3%	36.93	3.6%	5,710	2.36%	53.7%
2006	151.3	19.0%	134.1	6.7%	147.7	5.0%	146.6	13.3%	277.7	60.3%	227.8	20.4%	38.41	4.0%	5,870	2.80%	56.5%
2007	164.1	8.5%	148	10.4%	225.7	52.9%	164.2	12.0%	313.2	12.8%	252.1	10.7%	39.92	3.9%	6,030	2.73%	57.3%
2008	233.9	42.5%	178	20.2%	297.8	31.9%	197.9	20.5%	332.5	6.2%	343.8	36.4%	40.54	1.6%	6,053	0.38%	59.0%
2009	219.9	-6.0%	181.5	1.9%	213.3	-28.4%	163.3	-17.5%	232	-30.2%	219	-36.3%	39.75	-1.9%	5,867	-3.07%	46.7%

Data Source: World Bank (2009, 2010), Data and Table calculated and arranged by the author.

Appendix 3.15: Data Series Standard Deviations 1996–2008

Variable	Brazil SD	China SD
FoodIx	37.69	37.69
TropBevIx	32.23	32.23
VegOilSeedsIx	54.26	54.26
AgriRawIx	30.35	30.35
MinMetalsIx	91.21	91.21
CrudeIx	89.85	89.85
WGIVA	0.13	0.14
WGIPS	0.20	0.10
WGIGE	0.12	0.15
WGIRQ	0.15	0.17
WGIRL	0.07	0.08
WGICC	0.14	0.17
EFIBiz	7.68	3.87
EFITrade	6.62	14.03
EFIFisc	8.95	1.85
EFIGovtS	9.98	3.54
EFIMon	3.95	7.70
EFIInvest	-	9.61
EFIFin	3.76	9.61
EFIPropRi	-	4.39
EFICorrup	4.32	4.35
GDPDefl	38.97	13.84
GDP_gr	1.99	1.91
GDPpCap_gr	2.10	2.03
Agri_GDP	0.64	2.95
Agri_gr	2.18	1.30
IndustValAd_GDP	1.37	1.03
IndustValAd_gr	2.93	2.10
ManuValAdd_GDP	1.04	0.67
ManFactValAdd_gr	3.33	3.62
GrossSav_GDP	2.66	5.99
GrossSav_GNI	2.61	5.60
GrossDomSav_GDP	2.05	4.85
GrossNatExp_GDP	2.34	2.42
GovFinConExp_GDP	0.49	0.99
GovFinConExp_gr	2.10	1.77
FinConExp_GDP	2.05	4.85
FinConExp_gr	2.30	3.36
HHFinConExp_gr	2.83	4.26
HHFinConExp_GDP	1.86	4.06
HHFinConExpPCap_gr	2.98	1.85
GroCapF_GDP	0.79	3.07
GroCapF_gr	8.34	4.17
GrossFixCapForm_GDP	0.79	3.45
GrossFixCapForm_gr	7.14	2.66
Trade_GDP	4.95	13.33
MrchTrade_GDP	4.13	12.85
ExpGS_GDP	3.49	7.49
ExpGS_gr	4.70	12.32
ExtBalGS_GDP	2.34	2.42
CurrACC_GDP	2.38	3.41
ImpGS_GDP	1.69	5.97
ImpGS_gr	11.41	11.69
AgRawImp_MrchImp	0.51	0.51
ManfImp_MrchImp	3.36	5.49
FuelImp_MerchImp	3.33	3.33
ExpValX	90.08	172.84
ImpValIx	65.31	150.70
ExpVolX	45.89	157.21
ImpVolIx	27.52	100.86
UnitValIxExp	27.12	4.67
UnitValIxImp	22.62	18.03
ToT	6.18	11.90
PPIxExp	47.58	114.52
TariffAllweight	3.21	5.58
HiTekExp_ManuExp	3.89	7.10
ICTExp_TTExp	0.94	7.14
ICTImp_TTImp	2.33	5.27
AgrRwExp_MerchExp	0.39	0.38
FoodExp_MrchExp	2.19	1.83
ManufExp_MrchExp	3.33	2.83
FDInet_GDP	1.22	0.64
StoxVal_GDP	11.31	55.95
FuelExp_MerchExp	3.10	0.68
MrktCapList_GDP	21.52	43.08
FoodPrdIx	17.84	14.28
CropProdIX	21.84	12.56
LivStockProdIX	15.24	14.12
CPIx	21.38	5.98
Infltn	3.85	2.88
M2_GDP	8.14	17.43
M2_gr	5.39	4.08
IRSSpread	8.39	0.35
RealIR	13.26	3.10
ExtDebtST_ExpGSInc	106.25	17.57
ExtDebtST_GNI	11.36	1.85
STD_ExpGSInc	15.96	4.53
STD_TTExtDbt	2.96	17.45
STD_TTResv	23.62	5.92
TTRes_TTExtDbt	21.52	138.09
M2_TTReserv	1.42	2.10
MultiDebt_TTExtD	1.82	3.26
EnrgyImp_Euse	8.51	3.21
GDP_UEnUKPPPOilE	0.11	0.41
GDP_UEnUPPPOilE	0.71	0.63
RuPp_ToTPp	2.33	3.53
Internet_100	12.91	6.88
Phonelines_100	4.79	8.96
Unempl_Lforce	0.86	0.53
MobileSubs_100	25.07	16.38

Source: Data and Table calculated and arranged by the author based on Data Series introduced in Chapter 3. SD = Standard Deviation.

Appendix 5.1: CPIx, M2 to GDP — US, Brazil, China

Year	**US**		**Brazil**		**China**	
	CPIx	**M2_GDP (%)**	**CPIx**	**M2_GDP (%)**	**CPIx**	**M2_GDP (%)**
1971	20.73	67.46	Na	Na	Na	Na
1972	21.41	69.74	Na	Na	Na	Na
1973	22.75	69.73	Na	Na	Na	Na
1974	25.26	70.02	Na	Na	Na	Na
1975	27.56	69.89	Na	Na	Na	Na
1976	29.14	69.11	Na	Na	Na	Na
1977	31.03	69.03	Na	Na	Na	Na
1978	33.41	68.17	Na	Na	Na	Na
1979	37.17	67.40	Na	Na	Na	Na
1980	42.19	68.30	Na	Na	Na	Na
1981	46.55	67.85	Na	Na	Na	Na
1982	49.41	72.41	Na	Na	Na	Na
1983	51.00	72.72	Na	Na	Na	Na
1984	53.20	72.24	Na	Na	Na	Na
1985	55.10	74.26	Na	Na	Na	Na
1986	56.12	76.44	Na	Na	Na	Na
1987	58.22	76.74	Na	11.866	32.288	59.319
1988	60.55	75.14	Na	38.708	38.338	58.365
1989	63.48	74.12	Na	58.439	45.367	61.779
1990	66.90	72.84	0.001	17.249	46.754	69.840
1991	69.74	72.00	0.006	20.426	48.411	76.397
1992	71.85	68.47	0.063	32.114	51.480	79.719
1993	73.97	65.27	1.275	48.215	58.988	81.876
1994	75.90	61.71	27.748	24.621	73.285	80.431
1995	78.03	61.10	46.063	27.481	85.668	83.039
1996	80.32	62.04	53.322	31.356	92.799	90.651
1997	82.19	62.96	57.014	34.719	95.404	101.804
1998	83.47	64.90	58.838	38.099	94.598	112.818
1999	85.30	66.81	61.696	40.371	93.266	121.438
2000	88.18	68.29	66.043	43.370	93.504	124.059
2001	90.67	71.19	70.559	45.880	94.180	127.538
2002	92.11	72.84	76.521	45.260	93.459	135.698
2003	94.20	72.64	87.781	45.408	94.539	142.825
2004	96.72	71.68	93.574	47.056	98.211	141.808
2005	100.00	72.00	100.000	50.197	100.000	142.058
2006	103.23	73.76	104.184	54.071	101.463	145.301
2007	106.17	77.26	107.973	57.042	106.283	140.899
2008	110.25	83.07	114.087	59.175	112.516	139.886
2009	109.85	87.58	119.662	65.807	111.725	159.379

Data Source: World Bank (2009, 2010). Table created and arranged by the author.

ATTACHMENTS

ATTACHMENT

CD-ROM[115]

1. Location of CD-ROM:

In the envelope inside the back cover page of this thesis document.

2. Explanatory comments:

CD-ROM contains PDF files showing the syntax of the unit root tests, Granger causality tests, and multiple regression tests which have been performed with SAS. The correlation calculations have been carried out with PASW.

3. CD-ROM Structure:

1. The Folder structure of the CD-ROM mirrors the relevant folder structure of the thesis. Each respective sectional folder has subfolders, which contain the relevant PDF files. Each subfolder is labeled respectively. The titles of the respective sectional folders and/or subfolders are held in abbreviated form.
2. Files: The header of a PDF or any other document is labeled on basis of the respective name of the section, table and/or figure of reference. For each respective SAS computation step please see the PDF document which contains the SAS program, log, and output syntax.
3. Sets: Due to the large scale of the data series and other operational reasons I have separated the data series in two sets: Set 1 and Set 2. The cut-off variable for Set 1 is usually Variable 39 (ImpVolIx). The continuing variable in Set 2 is usually Variable 40 (UnitValIxExp).
4. File denotation example (for SAS): ‘China09 Granger Set1 Program’. Denotation: ‘09’ is an archive-related label. ‘Granger’ indicates the statistical diagnosis test type. ‘Set 1’ indicates the data cut-off set type. ‘Program/Output/Log’ indicates the SAS processing type. The files containing the data for Brazil and China are marked with the label add-on ‘BRL’ and/or ‘CHN’, respectively.

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[115] Sources: The CD-ROM file content has been analysed, computed, calculated, and arranged by the author. The CD-ROM file content has been created on September 10, 2011.

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CD-ROM

4. CD-ROM Content:

Folder	File Name	Comment
Chapter 2 / Section 2.5.1 Dualism		
	2.5.1_FDI 00-2009 gr BRL and CHN Output	Correlation PASW
	2.5.1_FDI 00-2009 gr BRL and CHN	Correlation PASW
	2.5.1_FDI 91-2009 gr BRL and CHN Output	Correlation PASW
	2.5.1_FDI 91-2009 gr BRL and CHN	Correlation PASW
Chapter 2 / Section 2.5.2 Cooperation		
	2.5.2_PMI Apr2007 - May2011 BRL and CHN Output	Correlation PASW
	2.5.2_PMI Apr2007 - May2011 BRL and CHN	Correlation PASW
	Figure 2.1_PMI Index Brazil China Data	PMI Data
	Figure 2.1_PMI Index Brazil China	PMI Figure
Chapter 3 / Section 3.3.3 Commodity Price Indexes		
	Table 3.7_Granger Causality SAS	Granger Causality
	Table 3.10_Granger Causality SAS	Granger Causality
Chapter 4 / Section 4.2.1.2 Unit Root Test Results		
	4.2.1.2_Unit Root Test BRL SAS Editor	Unit Root Brazil
	4.2.1.2_Unit Root Test BRL SAS LOG Output	Unit Root Brazil
	4.2.1.2_Unit Root Test BRL change rates SAS Editor	Unit Root Brazil
	4.2.1.2_Unit Root Test BRL change rates SAS Log Output	Unit Root Brazil
	4.2.1.2_Unit Root Test China SAS Editor	Unit Root China
	4.2.1.2_Unit Root Test China SAS Log Output	Unit Root China
	4.2.1.2_Unit Root Test China change rates SAS Editor	Unit Root China
	4.2.1.2_Unit Root Test China change rates SAS LOG Output	Unit Root China
Chapter 4 / Section 4.2.3.2 Causality Analysis Brazil		
	4.2.3.2_Brazil09 Granger Set1 SAS Output	Granger Brazil
	4.2.3.2_Brazil09 Granger Set1 SAS Program	Granger Brazil
	4.2.3.2_Brazil09 Granger Set2 SAS Output	Granger Brazil
	4.2.3.2_Brazil09 Granger Set2 SAS Program	Granger Brazil
	4.2.3.2_Brazil Granger change r Output Selected	Granger Brazil
	4.2.3.2_Brazil Granger change r Output	Granger Brazil
	4.2.3.2_Brazil Granger change r Program	Granger Brazil
Chapter 4 / Section 4.2.3.3 Causality Analysis China		
	4.2.3.3_China09 Granger All Set 1&Set 2 SAS	Granger China
	4.2.3.3_China09 Granger Set1 SAS Output	Granger China
	4.2.3.3_China09 Granger Set1 SAS Program	Granger China
	4.2.3.3_China09 Granger Set2 SAS Output	Granger China
	4.2.3.3_China09 Granger Set2 SAS Program	Granger China
	4.2.3.3_China Granger change rates SAS Output Selected	Granger China
	4.2.3.3_China Granger change rates SAS Output	Granger China
	4.2.3.3_China Granger change rates SAS Program	Granger China

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CD-ROM

Folder	File Name	Comment
Chapter 4 / Section 4.2.4.2.1 PCA of Commodity Price Ix		
	4.2.4.2.1_BMca1MetOil	PCA Commodities Brazil
	4.2.4.2.1_BMca2FdAg	PCA Commodities Brazil
	4.2.4.2.1_BMca3BevAG	PCA Commodities Brazil
	4.2.4.2.1_Brazil09PCA SAS Program Log Output	PCA Commodities Brazil
	4.2.4.2.1_China09PCA SAS Program Log Output	PCA Commodities China
	4.2.4.2.1_CMca1MetOil	PCA Commodities China
	4.2.4.2.1_CMca2FdAg	PCA Commodities China
	4.2.4.2.1_CMca3FdVegAg	PCA Commodities China
Chapter 4 / Section 4.2.4.2.2 PCA of Changes in Commodity Price Ix		
	Table 4.16_Brazil PCA change rates Program and Result	PCA Commodities Brazil
Chapter 4 / Section 4.2.4.3.1 PCA of WGI Indexes		
	4.2.4.3.1_China09 EG Governance	PCA WGI China
	4.2.4.3.1_Cmca4wvaps	PCA WGI China
	Table 4.19 CMca4WVaPs	PCA WGI China
Chapter 4 / Section 4.2.4.4.1 PCA of EFI Indexes		
	4.2.4.4.1_Bmca4efscgvt	EFI HTM Table Brazil
	4.2.4.4.1_Brazil09 PCA EFI SAS Program Output	EFI Brazil
	Table 4.23_BMca4EfscGvt	EFI Brazil
	Table 4.25_CMca5EInvFin	EFI China
Chapter 4 / Section 4.3.2 Multiple Regression Analysis Brazil		
	4.3.2_Brazil09REG SAS Program&Output	Regression Brazil
	4.3.2_Brazil09REGSet1	Data Series Brazil
	4.3.2_Brazil09REGSet2	Data Series Brazil
	4.3.2_Brazil09REG change rates SAS Program&Output	Regression Brazil
Chapter 4 / Section 4.3.3 Multiple Regression Analysis China		
	4.3.3_China09REG SAS Program&Output	Regression China
	4.3.3_China09REGSet1#LN00017	Data Series China
	4.3.3_China09REGSet2#LN00017	Data Series China
	4.3.3_China09REG change rates SAS Program&Output	Regression China
Chapter 5 / Section 5.2.12 CPIx and M2 to GDP		
	5.2.12_Granger Corr CPIx US 71-09 96-08 SAS Output	Granger and Correlation Analysis: CPIx and M2 to GDP 1971-2009, 1996-2008.
	5.2.12_Granger Corr CPIx US 71-09 96-08 SAS Program	
	5.2.12_Granger Corr M2_GDP US 71-09 96-08 SAS Output	
	5.2.12_Granger Corr M2_GDP US 71-09 96-08 SAS Program	

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