Fiscal Decentralization and Fiscal Policy: An Economic Analysis

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Part I

Introduction and literature review

Chapter 1

Introduction

Public sector decentralization has become an important policy goal of major international organizations. The World Bank, for instance, argues that fiscal decentralization, when carefully implemented, can decrease political instability, increase government efficiency, and contribute to the overall level of welfare (World Bank, 2000). By most accounts, the proponents of decentralized government have been remarkably successful. Dillinger (1994), for example, reports that about 60 out of the 75 developing countries with a population greater than 5 million claim to have embarked on some form of fiscal decentralization. Simultaneously, many developed countries have also initiated moves to reduce the level of centralization in their public sectors (Moreno, 2002; Arachi and Isesao, 2002).

Despite this apparent world-wide trend toward less centralized government, it is uncertain whether fiscal decentralization will indeed lead to more preferable political and economic outcomes. In the field of economics, the presumption that fiscal decentralization has primarily beneficial consequences stems mainly from two lines of thought: Firstly, from Oates' famous decentralization theorem, which states that a decentralized provision of public goods is capable of addressing varying preferences between inhabitants of geographically and culturally disparate regions (Oates, 1972); and secondly from the Public Choice tradition, where it is argued that the division of the state into several tiers and the existence of competing jurisdictions restricts the ability of leviathan governments to over-tax citizens (Brennan and Buchanan, 1980).

This sympathetic outlook on fiscal decentralization has not remained without criticism, and several potential drawbacks have been identified in the literature. For example, it is well known that fiscal decentralization might decrease the ability of governments to conduct stabilization policies and to redistribute income (Musgrave, 1959). However, the primary reason for a growing disenchantment in recent years seems to be the possibility that fiscal decentralization can distort the incentives of subnational and federal politicians if it is ill-designed. This drawback, it is often argued, causes decentralized states to be more prone to macroeconomic instability, higher deficits, and unsustainable levels of debt (Goodspeed, 2002; Wildasin, 1997).

In this dissertation, we contribute to the wider literature on the merits and drawbacks of fiscal decentralization by exploring the validity of this particular claim. That is, we investigate the consequences of fiscal decentralization for fiscal outcomes.

We begin this investigation with a short literature review (chapter 2). We first provide an introduction to the general "concept" of decentralization, and then distinguish *fiscal* decentralization, which will be the main subject of our discussion, from other variants. Subsequently, we review the literature on the consequences of fiscal decentralization for allocative efficiency. We then move on to discuss the literature on the determinants of the government's fiscal policy. Within this section, we will examine the specific literature dealing with the impact of fiscal decentralization on the size of government and public borrowing, but also alternative explanations of the government's fiscal policy.

In the first original part of this dissertation, we explore whether fiscal decentralization constrains or enables public expenditures. We initially develop a model in which we argue that the consequences of fiscal decentralization for public spending depend on the ideological disposition of the ruling party at the federal level (chapter 3), and then test the main theoretical proposition with data on OECD countries (chapter 4).

In the second original part, we switch our attention to the question of fiscal stability, and inquire whether decentralized government leads to over-borrowing. We again start out by developing a simple theoretical model that is inspired by the system of fiscal federalism in Germany, and derive several hypotheses with respect to the impact of federal transfers and bailout expectations (chapter 5). We then "test" these with descriptive statistics from German States (chapter 6).

The research focus is expanded subsequently to OECD countries. While this limits the ability of the theoretical model to generate useful predictions, it enables us to study the consequences of fiscal decentralization on fiscal stability in a general framework. In these two chapters of the dissertation, we explore whether fiscal decentralization leads to higher primary deficits (chapter 7) and to higher levels of debt (chapter 8). Finally, we offer a brief summary and outlook in chapter 9.

Chapter 2

Literature review

2.1 Unraveling the concept of decentralization

Public sector decentralization is a complex concept, and a generally accepted definition does not exist. Most definitions are either to narrow to encompass all of its characteristics, or too broad to provide any meaningful empirical content. Furthermore, its normative and positive implications tend to be confused: Sometimes decentralization is considered to be a goal in itself, and sometimes it is described as a means to a higher end. Sometimes political considerations are used in its favor, and sometimes economic.

Therefore, in order to arrive at a useful definition, we shall first discuss and clarify our understanding of the term "decentralization" in this dissertation. We start with a general definition, and then narrow it down until it has a very specific meaning. Along the way, we try to motivate our classifications.

The most general characteristic of a decentralized system of government is that sub-central units of the state have the ability to make autonomous decisions. Considering this broad definition, decentralization seems to be nothing extraordinary. It is safe to assume that even the most autocratic states allow for some degree of self-rule at lower levels.

Implicit in this definition is the understanding that decentralization is not a dichotomous variable, but rather a continuum. The appropriate question to ask is therefore not whether a state is or is not decentralized, but rather to what extent. This definition is somewhat contradictory to most theoretical models in the field of economics which usually differentiate strictly between the two types of state organization: Countries are either centralized *or* decentralized. The usefulness of understanding public sector decentralization as a continuous variable lies in the empirical sphere, where intermediate systems are the norm. Since complete centralization and decentralization can be incorporated into this framework as extreme cases, we work with this convention in the following.

There are different units to which power can be devolved. The best known are multi-purpose geographical units, usually named states, regions, or communities. These tend to possess similar institutions as the national tier, such as their own courts or executive departments, and are responsible for multiple policy areas. The boundaries of these units tend to be clearly demarcated

and membership is exclusive, which implies that a citizen can only be associated with one unit at any given time.

The boundaries and political institutions of these units are as much a product of historical (meaning coincidental) developments as of rational design. Therefore, they sometimes possess "irrational" characteristics such as being too small to benefit from scale economies in the production of public goods, or to large to take account of preference heterogeneity.

An alternative to geographical multi-purpose regions are ad-hoc jurisdictions which are created either by the central government or through the initiative of the affected citizens in order to deal with one specific objective. Hooghe and Marks (2003), for example, report that in Switzerland, about 5000 communes or *Zweckverbände* exist in addition to the 26 cantons and the approximately 3000 municipalities. These "functional" jurisdictions are responsible for a number of policy areas such as electricity or education, and their territorial "borders" regularly surpass that of territorial jurisdictions, i.e. municipalities or cantons. In the United States a similar situation can be observed. The number of so called special districts, inter alia responsible for various utilities, is larger than 35.000, and over ninety percent of them are single-purpose jurisdictions (Hooghe and Marks, 2003).

If functional decentralization takes place, different policy spheres are organized into different jurisdictions which might or might not overlap. That is, any citizen might belong at the same time to various functional jurisdictions which have incongruent territorial borders. For example, a community which is situated on a river might form a jurisdiction with other communities also situated on the same river to ensure flood protection, but might be associated with different communities when it comes to the disposal of garbage.

Various other units of decentralization have been (and continue to be) used in political systems. Kaberry (1957) reports that in so called "primitive" states authority was sometimes vested in permanent unilineal decent groups, with each lineage having its own state-like hierarchy and functioning independently from the central authority and other lineages. In more modern societies, guilds and professional associations have often been alternative units of decentralization. The professional associations in particular are vested with a considerable amount of autonomy and, albeit regularly organized along territorial borders, function independently of regional governments (Freidson, 1984).

Nevertheless in economics it is usually assumed that territorial multi-purpose jurisdictions are the units of decentralization. We shall carry on with this assumption in this dissertation. Therefore, all our statements in the following will refer to this brand of decentralization (which, of course, does not preclude their validity for other brands).

However, while this convention clarifies our understanding of decentralization, it does not eliminate all ambiguities. The description of the devolvement of authority to any kind of lower level territorial unit as decentralization masks the fact that these lower-level jurisdictions can possess different characteristics. First, most states do not only have two but rather multiple tiers of government. France, for example, has four, the United States has three, as do Germany and Switzerland. It is difficult to compare countries where authority has been devolved to different tiers. We might, for instance, ask whether a country that devolves authority to the lowest jurisdictions is more decentralized than a country where the unit of devolution is at the intermediate level. In the first case, the subnational tiers individually might remain quite weak in relation to

the central government, and in the latter case government bodies might still be "too far away" from the people in order to reap the benefits of "real" decentralization.[1] Another problem with this broad generalization is that individual jurisdictions, even if they belong to the same tier, can be quite heterogeneous. Consequently, we should expect that the devolution of power to a jurisdiction which is numerically large and/or has a large tax base will have different consequences than the imposition of responsibilities to poor or otherwise weak ones. Fesler (1965), for example, points to the fallacies of homogenizing "the agricultural village" and "the industrialized city" into the abstraction "locality".[2]

Apart from whether power is decentralized to functional or territorial units, we have to inquire whether decentralization encompasses administrative and/or political authority. While political decentralization is generally accompanied by administrative– to decide on policies at the local level usually leads to their implementation at this level– the reverse does not generally hold. Preferably, we would like to differentiate between administrative and political decentralization in order to identify their individual effects. Even though this might be possible in theoretical models, the complexity of reality makes such a distinction infeasible when embarking on empirical investigations. This is due to the fact that the power to implement has also a political dimension. That is, by delaying the execution of orders, subnational tiers can effectively retard the political program of the center. Second, there is no clear distinction between administrative and political spheres. For example, it is not clear at the outset whether the decision to build a small bridge over some creek is administrative or political. Out of practicability, therefore, we shall not make a distinction between these types of decentralization in this dissertation.

A discussion of the types of authority devolved leads naturally to a discussion of the causes for decentralization. The degree of autonomy has varied throughout history, both due to technological and political constraints. For instance, in ancient and medieval times there were technological constraints which posed an upper bound for uniformity. Even though centralization with respect to political matters might have been sometimes complete, with all important decisions and guidelines formulated at the center, it is hard to imagine that, say, a particular way to provide certain utilities could be imposed upon all cities in any given empire and *enforced* due to the costs of acquiring accurate information and exercising administrative control. Hence, a certain degree of self-administration was simply a practical necessity (Eulau, 1941).

In contrast, modern states sometimes allow their constituent jurisdictions to decide autonomously in certain policy areas whilst imposing and *enforcing* uniformity in others. The decision to allow subnational jurisdictions to manage their affairs as they please is therefore a political one. Even though technological constraints might sometimes reveal themselves in high costs of enforcing uniformity, they are rarely prohibitive.

Having established the formation of a decentralized system of government in modern times is a conscious decision by policy makers, we need to discuss why policy makers would choose to decentralize. We recognize several fundamental rationales for decentralization. First, it might be a means to hold together differing populations within one state. Particularly in cases of "coming together federations", a devolved type of government might be a prerequisite for the formation

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[1]For example, several states in the United States are larger than some "centralized" European countries.

[2]This observation implies that we have to take systematic differences between countries into account when embarking on empirical investigations, for example by using multivariate econometric techniques and/or fixed effects estimations.

of the union. Conversely, if a state is already multi-ethnic or encompasses different cultures, religions, and languages, it might be necessary to allow its constituent parts some autonomy to ensure the continued existence of the state in its current form- the alternative being some kind of autocratic or dictatorial rule. In these contexts, therefore, decentralization is more a necessity than a voluntary political decision.

A comparable connection between democracy and decentralization exists in more homogeneous states, too. Here, decentralization has had a distinct political connotation as a way of increasing democracy by empowering citizens to have more control in political decisions which affect their day to day lives.

A more subtle link between democracy and decentralization has been identified by political thinkers in the late 18th century. For the constitutional fathers of the United States of America, decentralization was one representation of the principle of checks and balances and as such a means to ensure that no single institution or party becomes so powerful to impose its will on the public. Decentralization (or a variant of it, called federalization) was thought to supplement the horizontal separation of powers with a vertical dimension. This vertical separation of power was intended to work in both ways, to protect individual jurisdictions against a potentially tyrannical central government, but also to protect the national demos or electorate against the usurpation of the government by powerful minorities (Cameron and Falleti, 2005).

Whereas the theoretical arguments are persuasive, there is little evidence that the link between decentralization and democracy really exists. Fesler (1965) notes that decentralization might in fact diminish democracy by relinquishing citizens to the power of local elites. In addition to this, if voter turnout is any indication, there is also some evidence that voters tend to be more interested in national than in local issues– a fact which defies orthodox theories of democratic participation. There is also little evidence that national regulations are less important to the day to day lives than local ones, considering, for example, redistributional policies, which tend to be formulated at the central level.[3]

We may conclude from the above discussion that the link between democracy and decentralization is not straightforward. Decentralized government is not *sui generis* more democratic and efficient than centralized government. Even though it is tempting to explore the exact conditions under which decentralization might increase democratic governance further, it is outside the scope of this dissertation, and we neglect these issues in the following.

Beneath the rationales for decentralization which originate from explicit political considera- tion, and are either im- or explicitly linked to democracy, there is also a third explanation for why states are either found on decentralized principles or start to decentralize in the course of their existence: in order to increase economic efficiency. We will emphasize this explanation for decentralization in this dissertation. Further below, we will provide a review of the economic literature on decentralization and its impact on public welfare. Here we simply state that the rationales for decentralization may vary, and that we expect that different rationales will lead to different institutional setups and finally to different economic outcomes. That is, decentralization should generate more positive economic results if it has explicitly taken place in order to increase economic efficiency than in a situation where it is "forced" upon policy makers by political con-

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[3]There are some important exceptions to this statement, however, such as the United States and Switzerland. In these countries, welfare programs are formulated and administered by the state or the cantonal governments, respectively.

siderations. The shape of territorial units and the institutional arrangements in the latter case will not necessarily be "optimal" in an economic sense.

In order to arrive at a useful definition of decentralization, we should therefore differentiate government decentralization according to its determinants. In view of the research agenda put forward in the introduction, decentralization due to economic considerations will be emphasized in this dissertation.

Decentralization to lower level territorial units for economic reasons has taken place under different headings. We treat decentralization as the most general concept of empowering sub-central jurisdictions. In the literature, this broad concept is differentiated in sub-concepts such as devolution, federalization, deconcentration, and delegation.[4] There is no consistent usage of the terms, however. Furthermore, the differences in meaning seem to be minor (Bankauskaite and Saltman, 2006). Two exceptions are perhaps the concepts of devolution and federalization which are often used to differentiate between two *political* spheres. The first is associated with unitary states where subnational tiers are assumed to have no sovereignty. The second is associated with federations or confederations, where the constituent parts possess a political life separate from that of the union.

However, the fact that constituent states are in theory sovereign in federations does not necessarily imply that they are in reality more autonomous than comparable administrative units in an unitary states, making any formal distinction somewhat meaningless. This can be seen by considering concrete examples. Comparing the Union of India and the United Kingdom, for example, we have a classical federation in the former and a unitary state in the latter case. The political reality in these two countries, however, does not suggest that Indian States are more autonomous than British Provinces. There is a considerable amount of anecdotal evidence which indicates that the constituent parts of the United Kingdom, in particular Scotland and Wales, possess significantly more autonomy than Indian States. In India, there are many instances where elected chief ministers of states were dismissed by the union government, and the states placed under so called presidential rule. It seems difficult to conceive similar developments in the United Kingdom even though the central government has the legal authority for such actions (Leeke et al., 2003). Researchers have dubbed the Union of India therefore a unitary or prefectorial federation (Rajashekara, 1997).

That the formal distinction between unitary and federal systems is only superficial is also corroborated by the observation that otherwise similar states end up with different institutional arrangements at the time of their founding. Ziblatt (2004), for example, discuss the cases of the German and Italian unifications. Both states shared several political similarities, but ended up with different institutional arrangements: the German Empire became a federation dominated by Prussia whereas Italy became a unitary state dominated by Piedmont. While Ziblatt (2004) proposes various explanations in order to solve this puzzle, one reasonable explanation is that these different formal institutional setups do not indicate distinct political realities.

For these reasons, we will not emphasize the distinction between formally federal and unitary countries in this dissertation. We rather take a practical view on decentralization, and therefore try to focus on the distribution of power between territorial units as it can be observed empirically.

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[4]Attempts for a classification and different definitions may be, for example, found in OECD (2003) and Bird and Vaillancourt (1998).

The causes and consequences of decentralization are analyzed by at least three sciences: law, political science, and economics. Naturally, each of these sciences focuses on different aspects. The constitutional problems of federalism and decentralization are emphasized by the legal sciences. This approach is predominantly deductive insofar as it takes the constitutional reality prevailing in a state as a datum, and derives implications with regard to the formal division of authority between tiers of government. Political scientists seem to be more interested in the degree of the political autonomy of subnational governments, and in the ability of decentralized government to accommodate populations that are of disparate ethnicities or have distinct religions. The majority of contributions in this field therefore discuss the link between decentralization and democratic governance.

Economists, on the other hand, are primarily interested in the *fiscal* autonomy of subnational governments, that is in the devolvement of spending and revenue raising autonomy to lower level territorial jurisdictions, and intergovernmental financing schemes. This focus is primarily due to the fact that changes in subnational fiscal autonomy are often explicitly undertaken in order to increase economic efficiency and fiscal stability. Therefore, this brand of decentralization exhibits the closest and most straightforward connection to economic and fiscal outcomes. We shall therefore concentrate on the consequences of this variant of decentralization in this dissertation.

In view of the discussion in this section, we can summarize our understanding of the general concept of decentralization in this dissertation as follows. We understand decentralization as a *continuous* "variable" which is related to the *de facto* political and administrative *autonomy* of subnational governments to determine *taxes and spending*, and the prevailing intergovernmental transfer scheme. We call this particular version of decentralized government *fiscal decentralization*.

2.2   Fiscal decentralization and allocative efficiency

Within the field of economics, the initial contributions tend to provide a positive picture of fiscal decentralization by stressing its allocative superiority. Tiebout (1956), for example, argues that if citizens are perfectly mobile and an infinite number of jurisdictions exist, then each individual citizen can sort himself into the jurisdictions with the most preferred tax and public goods bundle. Oates (1972) develops the closely related decentralization theorem. This famous theorem states that decentralized countries can match the preferences of heterogeneous citizens better that centralized regimes.

The second generation of contributions, originating in particular from the Public Choice school, focuses on the ability of decentralization to constrain inefficient government intervention. Hence, the "power" of decentralization is a negative one– to deter governments from intervening in private markets. This argument has been made particularly forceful by Brennan and Buchanan (1980), and has been taken up and extended by, inter alia, Qian and Weingast (1997) under the heading "market-preserving" federalism.

The ability to constrain governments originates from the competition of jurisdictions for mobile tax bases. However, a major problem with this line of reasoning is that if the state is not a leviathan, then horizontal tax competition might lead to an erosion public finances, and hence to suboptimal outcomes (Wilson, 1986; Zodrow and Mieszkowski, 1986). On the other hand, tax

competition might also offset the higher tax burden originating from the vertical tax competition between benevolent subnational and federal governments (Keen and Kotsogiannis, 2002).

Over times, additional arguments in favor of decentralization have been developed. For example, several authors have argued that individual jurisdictions can be thought of as laboratories where decision makers can experiment with policy innovations. Those which turn out to be efficient might then be adopted by other jurisdictions (see for example Oates (1999)). These theories of "laboratory federalism" are connected to approaches that try to extend the idea of benchmarking to the public sector. The existence of similar jurisdictions enables comparisons, and citizens can use the quality and the tax price of public goods in other jurisdictions as a yardstick in evaluating local governments. This tends to reduce informational asymmetries between voters and politicians, thereby enhancing efficiency and presumably growth (Salmon, 1987; Besley and Case, 1995).

There are certain prerequisites for the effective functioning of this "laboratory federalism". First, risk averse policy makers might choose to act as free-riders with regard to policy innovations. As a consequence, decentralization might lead to a diminished supply of innovations. Hence, the institutional structure under which inter-jurisdictional competition and experimentation takes place must ensure that the impact of decentralization leads to positive outcomes with regard to policy innovations (Vanberg and Kerber, 1994). Secondly, it is questionable whether yardstick competition is indeed beneficial. Since only those incumbents who provide an efficient combination of tax prices and public goods tend to be re-elected, risk averse subnational politicians have an incentive to free-ride on the innovations of other jurisdictions (Strumpf, 2002).

Another potential advantage of decentralization is that the incentives of subnational politicians and tax administrators to collect taxes are improved. Since the pool to which tax collections flow becomes smaller if fiscal authority is devolved, the benefit principle of taxation is strengthened. As a result, resistance to taxation, either formally through political and legal channels or informally through tax evasion, will be lower. Due to the increased transparency of public budgets, decentralization might also increase the accountability of politicians, forcing them to spend and tax efficiently (Bahl, 1999). Again, there are certain prerequisites for this mechanism to work. Most important, the budgets of the various tiers of government should be separated from each other. Hence, tax sharing arrangements, intergovernmental transfers, and horizontal equalization schemes might distort the incentives of policy makers, and lead to a worse outcome than centralization.

There are also several contributions which emphasize the negative features of fiscal decentralization. The potential drawbacks range from the inability of subnational tiers to redistribute incomes to the difficulties in conducting macroeconomic stabilization policies. Redistribution of income might be difficult in decentralized states if tax bases are indeed capable to move freely between jurisdictions. Stabilization policies might be difficult to conduct because each jurisdiction has an incentive to act as a free rider (Musgrave, 1959). Finally, if public goods exhibit increasing returns to scale, decentralization is inefficient since a centralized provision (which is associated with a higher activity level) can exploit these more effectively (Buiter and Kletzer, 1992).

Apart from several contributions which link decentralization (or federalization, respectively) to the stability of democratic government (see for example Myerson (2006)), the above arguments encompass the bulk of the normative discussion on decentralization. However, there is also a positive literature on the economic determinants of decentralization. Alesina and Spolaore (1997),

for example, attempt to explain the size of nations by the amount of integration of the world economy (i. e. globalization). They note that in every state preference heterogeneity works as a centrifugal and economies of scale (which increase with the size of the nation) as centripetal forces. Their basic argument is that if individual countries have to operate under a regime of closed borders, smaller states would not be able to reap the fruits of specialization. Under such a regime, political integration would be the only means to increase productivity. The price to be paid, however, is uniformity. But if the importance of borders is reduced by the deepening of globalization, jurisdictions might be less inclined to pay the price. Within this framework, then, separation can be understood as the most extreme type of decentralization

2.3 Fiscal decentralization and fiscal policy

In this section, we survey the literature on fiscal decentralization and fiscal outcomes. We first discuss how fiscal decentralization might influence the size of government, and then discuss the issue of public borrowing and fiscal stability. Obviously, both issues are interconnected because an expansion in public debt is usually caused by the fact that expenditures do not match available revenues.

2.3.1 Fiscal decentralization and government size

A substantial fraction of the empirical research in the field of fiscal federalism is concerned with the question of whether decentralization leads to a reduction in the size of government. The theoretical starting point of this literature is the previously mentioned conjecture by Brennan and Buchanan (1980) which states that government intrusion into the economy will be smaller when the public sector is decentralized. Several authors have attempted to test this "Leviathan Hypothesis", partly because Brennan and Buchanen explicitly invited researchers to do so[5], and partly because the validity of the hypothesis is based on a rather controversial view of government.[6]

Indeed, the opposite relationship between fiscal decentralization and government size is also conceivable. For example, Persson and Tabellini (1994) argue on the basis of a political economy model that centralization leads to a reduction in public spending for general expenditures such as interpersonal redistribution through social security transfers.[7] Additional arguments are offered by Oates (1985). One argument, which he credits to the economic historian John Wallis, is that citizens' willingness to delegate responsibility to the government might increase when the public sector is decentralized. Another argument is based on the insight that decentralization might lead to losses in economies of scale, thereby increasing the budgetary costs of public good provision.

Facing two competing theories, Oates (1985) explores the issue empirically. He runs two sets of cross-section regressions, first with data on US States and then with international data, using

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[5] "There are, then, clear empirical implications here that could be tested to determine the extent to which this explanation of revenue sharing and the structure of grants is an appropriate one" (Brennan and Buchanan, 1980, p.182).

[6] Note, however, that the same basic relationship between fiscal decentralization and government size can also be derived with the opposite normative connotation. See in particular Wilson (1986) and Zodrow and Mieszkowski (1986) who show, by assuming benevolent governments, that horizontal tax competition leads to inefficiently low government expenditures.

[7] However, for "targeted expenditures" such as local infrastructure projects, they find that centralization leads to rent-seeking and thus to higher expenditures.

three different measures of (de)centralization[8], and a number of specifications which he himself considers to be somewhat ad hoc. However, his regressions suggest neither a robust nor a significant relationship between fiscal decentralization and government size.

The articles which build upon his seminal research try to consider additional facets of how decentralization might be related to government size. The overarching aim seems to be to discount the disappointing finding of no significant relationship by using better data, an improved specification, considering alternative sets of countries, or other measures of decentralization. For example, one issue that is ignored in Oates's study is whether the federal and subnational governments are able to circumvent the competitive pressure of decentralization by colluding with each other. Grossman and West (1994) address this possibility in a study on the Canadian Provinces with time series data. They indeed find that "collusion" between tiers of government increases the size of government.[9]

Other studies explicitly emphasize the importance of the fiscal constitution for how decentralization impacts government size. In these it is argued that granting certain types of intergovernmental transfers to subnational governments might increase the size of the public sector when the federation is characterized by soft budget constraints and horizontal equalization schemes. For example, Grossman (1989) finds that even though decentralization has led to a smaller public sector in the US, intergovernmental grants have contributed to the growth of government. Nelson (1986), on the other hand, finds for US States that revenue decentralization, measured by the state share of total state and local taxes, has either an insignificant or a significantly negative effect on taxes. He therefore rejects the Leviathan hypothesis when a "fiscal" measure of decentralization is used. However, he finds that the number of local units in a state, which he uses as an alternative proxy for the intensity of horizontal competition, is negatively and significantly related to state taxes. This latter finding is confirmed by Nelson (1987).

Marlow (1988) explores the link between decentralization and government size for the United States at the national level by using time-series data. He measures the aggregate (federal and subnational) size of government with the ratio of total government expenditures to GNP, and regresses this variable on a measure of decentralization and two other controls. The results indicate that decentralization is negatively related to government size.

In a study with panel data on 32 industrial and developing countries, Jin and Zou (2002) reach more differentiated conclusions by disaggregating the general concept of fiscal decentralization into different "representations". That is, they recognize that fiscal decentralization could either pertain to the expenditure or the revenue side of the budget, and that the effects might vary according to the side of the budget that is considered. Indeed, they discover the existence of conflicting effects. According to their results, expenditure decentralization leads to smaller national and to larger subnational governments, and it seems to increase aggregate government size. Revenue decentralization displays similar effects on national and subnational government size as expenditure

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[8]Which are: the share of state/central government revenues to local/state government revenues, the share of state/central government expenditures to local/state government expenditures, and the number of local governments within a state in the state-level regressions.

[9]Even though their study is concerned with "federalism" and not with decentralization, the argument they make points to an important problem for empirical research on fiscal federalism: that the terminology is sometimes confusing. In their terminology, collusion means the sharing of revenues from harmonized and federally collected taxes. Thus, collusion is clearly something different than fiscal decentralization which in essence is defined as the ability of subnational governments to independently set tax rates or to define bases.

decentralization (i. e. it leads to larger subnational and smaller national governments), but an increase in this variant of decentralization seems to lead to smaller aggregate governments. With regard to vertical fiscal imbalances, Jin and Zou (2002) find that they lead to both larger national and subnational governments, and thus to larger aggregate governments.

Overall, their empirical results confirm that it is important to perceive fiscal decentralization as a general concept which encompasses several different aspects. That is, expenditure and revenue decentralization, and vertical fiscal balances should be treated as (to some extent) independent representations of fiscal decentralization, and analyzed as such.

Stein (1998) rejects the Leviathan hypothesis in a study on South American countries by concluding that decentralization, when financed through central transfers, leads to an expansion of the public sector. In contrast, Feld et al. (2003) find in an analysis with panel data on Swiss Cantons that revenue decentralization leads to smaller governments because of more intense tax competition. However, cantons are capable to avoid the competitive pressures of tax decentralization to some extent by relying more on user fees to finance government activity.

A different and somewhat more fundamental perspective on the problem is taken in Anderson and Van Den Berg (1998). They argue that the variables which are traditionally used to measure government size, i. e. both tax revenue and total government expenditures as a ratio of GDP, might be inaccurate and therefore lead to biased estimates. Their simple argument is that GDP is an inaccurate measure of the size of the economy because it does not take non-market activities into account. However, they too fail to find a significant relationship even though they correct for this problem.

Compared to these studies, the scope of analysis is somewhat broadened in Rodden (2003). While his main concern continues to be the impact of the intergovernmental transfer scheme on the relationship between decentralization and size of government, he also considers a number of political and institutional variables. He finds that fiscal decentralization tends to decrease the size of government, but that governments grow faster when subnational expenditures are financed with intergovernmental grants. However, his key insight is that the overall impact of decentralization might be determined by how different tax bases are allocated to the various tiers of government. The argument is that fiscal decentralization will lead to smaller sizes of government particularly in such regimes where the fiscal constitution allocates those bases which are mobile to the subnational tier. He thus points to the possibility that the suppliers of different factors which are distinguished by the ability to move between jurisdictions might be locked in a battle to pass the financial burden of national and regional public goods onto each other by structuring the fiscal constitution accordingly.

2.3.2 Fiscal decentralization and public borrowing

Apart from its impact on government size, the effect of fiscal decentralization on the fiscal stability of the public sector has evoked a considerable amount of attention in recent years.

The most important concept in this context is that of the "soft budget constraint syndrome" (Kornai et al., 2003). This concept was introduced when reforms of the socialist Hungarian economy during the seventies were studied (Kornai, 1979, 1980). These reforms consisted, inter alia, of providing managers with incentives to exert effort. They were offered bonuses in case of

profits and threatened with sanctions in case of losses. However, the results of these reforms have been described as rather disappointing, and soft budget constraints were identified as a major cause for this failure.

Soft budget constraints were created by these reforms because the threat of sanctions by the planning board, particularly the ultimate threat that the firm would be liquidated if it permanently incurred losses, was not credible because the planning board was unable to afford the social costs of layoffs (i. e. unemployment) given the ideological environment it had to operate in. Hence, the incentives of managers to perform efficiently were diminished.[10]

Starting from this seminal literature on the socialist firm, the use of the concept has been steadily expanding. The first major extension was made when it was found that soft budget constraints were not only confined to the socialist system, but that they could also be found within capitalist firms (Kornai, 1980). From thereon, the concept was further expanded from the narrow analysis of firms to such diverse topics as foreign aid (Svensson, 2000), non-profit organizations (Duggan, 2000), and intergovernmental relations in decentralized states.

A significant share of the literature on the soft budget constraints syndrome in the context of intergovernmental relations consists of case studies on individual countries. In Brazil, for example, the fiscal autonomy of states was significantly expanded with democratization, partly as a counter motion against military rule where the country experienced significant revenue centralization. Unfortunately, this process of decentralization resulted in severe fiscal difficulties. Since intense political competition ensued in the states, subnational governments were confronted with various demands for increases in spending. These were primarily financed by borrowing, predominantly from state-owned banks. Because the political horizon of governors was rather short, and the federal government relied on their agreement to pass legislation in congress, they would either postpone or even completely refuse repayment, effectively throwing these banks into financial crises and prompting the central government to intervene with bailouts. This pattern was observed until the so called "Plano Real", which was implemented in 1995, led to a hardening of budget constraints (Armijo and Jha, 1999; Samuels, 2003).[11]

Whereas Brazilian States relied primarily on state-owned banks to exploit their soft budget constraints, Indian States used the elaborated intergovernmental transfer system.[12] There are four mechanisms for vertical and horizontal transfers in India, all of which come in some way under the purview of so called Finance Commissions. The determination of appropriate transfers by these commissions has been described as "gap filling": Planned expenditures were contrasted with available revenues and any gap between both was closed by grants. This approach provided state governments, inter alia, with incentives to run deficits, knowing that these would be offset by higher transfers. Indeed, the imbalance of own revenue to current expenditures of states increased between 1955 and 2002 from 52% to 69% (Singh, 2004).

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[10]Another closely related culprit that was identified was the so called *ratchet effect*. This term is used to describe the phenomenon that managers were given a target output by the central planning board for a given period. To provide them with the right incentives, they were offered bonuses if they exceeded their targets. However, at the same time the target output for the next period would be adjusted upwards by the board. Thus, managers who were performing above-average in the current period would face more demanding production plans in the next period, which would obviously diminish their incentives in incur effort in the first place.

[11]Note, however, that state governments also borrowed from private banks. This debt, too, was also repeatedly assumed by the federal government.

[12]A detailed study is provided by McCarten (2003).

Another interesting case is Mexico. Trillo et al. (2002) name loans from the Development Bank to subnational governments as a source of *hidden* bailouts. In China, even though subnational governments are largely prevented from borrowing and are required to run balanced budgets, "indirect" borrowing has taken place (Ahmad et al., 2004). In Russia, unfunded federal mandates and a large vertical fiscal imbalance led to soft budget constraints for regional governors in the early phase of transition (Wallich, 1994). Also, some discretionary transfers are known to be determined according to political consideration. Treisman (1999b), for example, shows that regions with separatist tendencies received favorable treatment. Furthermore, regional governments were also known to shield enterprises from federal tax collectors (Treisman, 1999a), even though the regions have a partial claim on revenues in case of shared taxes. They also accumulated wage arrears that resulted in federal bailouts (Earle and Sabirianova, 2002). In Italy, soft budget constraints were created through the peculiar organization of the health sector. Due to the political sensitivity of health care, regions were able to divert funds that were intended for this sector into other uses, forcing the central government to increase transfers (Bordignon and Turati, 2003).

On the other hand, the American and Swiss Federations have been described as less susceptible to soft budget constraints. This has been rationalized on the grounds that the federal governments in both countries have always maintained a *credible* no-bailout policy and have relied on market forces to discipline subnational units. Indeed, the credit-market ratings of subnational units vary according to their fiscal position in these countries.

The theoretical literature on soft budget constraints is largely positive insofar as it attempts to explain under what conditions soft budget constraints emerge. With regard to the normative connotation, authors usually assume more often implicitly than explicitly, that soft budget constraints are socially harmful.

Wildasin (1997), for example, develops a model in which subnational governments provide a local public good which generates positive externalities in neighboring jurisdictions. In order to correct for inefficiencies due to the presence of these externalities, the federal government may institute an appropriate matching grant system. However, if some subnational government believes that the federal government will offer additional grants once it ceases to provide the externality-generating local public good, it has an incentive to deviate from the first-best solution in order to attract those federal transfers.

Note that while it is shown in the model that national welfare is diminished by soft budget constraints, the emergence of deficits is not explicitly addressed (the budget is by assumption always in balance). However, the model can be easily extended to this effect by applying a fiscal illusion argument (Oates, 1991). That is, when citizens suffer from fiscal illusion, the federal government can raise the resources for grants more easily through borrowing than by increasing taxes.

Another model is developed by Goodspeed (2002). The model covers two periods. In the first period, subnational governments provide a local public good by either taxing citizens or by borrowing. In the second period, they have to repay the principle and interest. The objective of the federal government is to maximize its re-election probability. This probability is modeled as a function of net-consumption levels in each individual jurisdiction. Therefore, since net-consumption in the second period is diminished by first-period debt, the federal government can in general increase the probability of re-election by granting appropriate bailout transfers. These

incentives of the federal government are taken into account by subnational governments in the first stage, i. e. when they decide on the level of borrowing; which will generally lead to inefficiently high levels of debt.

Note that it is not necessary to assume that subnational politicians are leviathans to derive that fiscal decentralization might lead to more fiscal instability than centralization. If voters understand that the federal government, and thereby the federation as a whole, will eventually pay the bill for local expenditures, they might demand that subnational politicians over-spend or under-tax. It could therefore be precisely a high degree of electoral accountability that forces subnational politicians to accumulate debt, while strong hierarchical control of subnational party branches by national leaders, or concerns of subnational politicians about a future career at the federal level could actually alleviate the inefficiencies resulting from soft budget constraints (Blanchard and Schleifer, 2001).

The models that were discussed so far assume implicitly that soft budget constraints are socially harmful. In recent times, several authors have criticized this assumption. For example, Besfamille and Lockwood (2004) develop a model where they show that under certain assumptions, hard budget constraints might also be socially harmful by inducing agents to incur "too much" effort. Lindahl and Westermark (2006) make a similar point by perceiving soft budget constraints as an implicit risk sharing arrangement.

A different perspective on the relationship between decentralization and soft budget constraints is taken by Qian and Roland (1998). They develop a model with three layers, i. e. a federal government, many subnational governments and several state enterprises owned by the subnational governments. They show that decentralization can be a means to avoid soft budget constraints at the state owned firm level. They reach this result by assuming that subnational governments must compete with each other to attract mobile non-state capital through infrastructure investments. This leads to an (inefficient) overspending in investments and underspending in local public goods. This, in turn, increases the marginal utility of a unit increase in local public goods. Hence, the opportunity costs of bailouts rise. If the efficiency gains from a no-bailout policy outweigh the efficiency losses due to infrastructure overspending, the commitment of the government is credible. Interestingly, their results hold even if decentralization is not complete, i. e. if the central government transfers resources to subnational units through grants.

Apart from the soft budget constraint concept, there are alternative (but related) arguments as to why fiscal decentralization could contribute to fiscal imbalances. One strand of the literature is concerned with the impact of intergovernmental transfer schemes. The basic idea behind these approaches is that vertical transfers might contribute to common pool problems. If the federal governments allocates grants to subnational jurisdictions at its discretion, the latter have an incentive to appear as if they are needy: They might then run high deficits in order to "prove" that they are under-financed. Since the marginal cost of federal funds are distributed over the whole federation while the benefits are concentrated within each individual jurisdiction, such a behavior is reasonable from the perspective of individual subnational governments (Weingast et al., 1981).

Another strand of the literature is concerned with the "technical" problems of coordinating the policies of different tiers of government. If there are several independent governments which may spend and tax at their own discretion, a concerted fiscal policy could be impossible to maintain,

and might manifest itself in a deficit-bias at all tiers of government (De Mello, 1999). It was for this reason that those EMU member states which exhibit a significant degree of fiscal decentralization complemented the European Stability Pact with comparable national regulations (Joumard and Kongsrud, 2003).

While a number of theoretical contributions address the possibility that decentralized states could exhibit a deficit bias, only few theoretical studies try to argue that fiscal decentralization might induce subnational and federal politicians to reduce the level of indebtedness. Thus, more indirect arguments which essentially address different issues must be drawn upon.

The most relevant originate probably from the Public Choice tradition. In this literature, the government is perceived as a revenue-maximizing leviathan, and fiscal decentralization is believed to force governments to refrain from expropriatory taxation because citizens can simply leave jurisdictions where the government behaves as a leviathan (Hayek, 1939; Brennan and Buchanan, 1980).[13] Also, contrary to the traditional view that tax sharing arrangements and vertical fiscal imbalances lead to inefficiencies by enabling governments to "collude" and thereby avoid the competitive pressures generated by fiscal decentralization, there are some arguments in this literature which suggest that they can be welfare-enhancing. For example, Köthenbürger (2005) shows that equalization schemes can complement tax competition in achieving more efficiency by indirectly "taxing" the tax revenue extracted by leviathan governments.

These Public Choice arguments can be adapted straightforwardly to explain public indebtedness by arguing that levels of debt should be lower when citizens take future tax burdens into account in their mobility decisions, or if these are internalized in property prices.

Secondly, it is also possible to informally relate the reasoning that pertains to the ability of decentralized systems to achieve allocative efficiency (see the discussion further above) to fiscal outcomes. The obvious, albeit not unconditionally convincing, argument is that more efficient polities should display lower levels of indebtedness.[14]

The question of how fiscal decentralization is related to debt accumulation is, somewhat surprisingly, not very well explored in the empirical literature. Rather, the impact of fiscal decentralization on the size of government seems to have evoked more interest among applied econometricians.[15] There are only a few empirical studies which *primarily* consider the impact of fiscal decentralization on fiscal balances.[16]

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[13]Note that the idea that competition between public institutions can improve the functioning of government must not only apply to horizontal tax competition between subnational governments. For example, Eichenberger and Schelker (2007) show for Swiss cantons that the existence of so called Finance Commissions, which are elected separately from the government as an independent review body of budget decisions, leads to smaller tax burdens and lower public expenditures. However, it should also me mentioned that there are some contributions arguing that competition by public institutions alone is not sufficient to generate efficient outcomes, e. g. Apolte (2001).

[14]We are assuming here that debt is "bad" from a normative perspective. Obviously, this assumption is not necessarily correct since a number of theoretical contributions show that government borrowing can be beneficial (Barro, 1979). In reality, however, most authors seem to believe that levels of debt are generally too high to be justified by the need for macroeconomic stabilization or consumption-smoothing. One indication for the validity of this believe are the widely differing levels of indebtedness between otherwise similar countries (Alesina and Perotti, 1995b). Clearly, political and institutional factors do play a role.

[15]There are also a number of studies that investigate the impact of fiscal decentralization on non-fiscal variables empirically. For example, Fisman and Gatti (2002) show for US states that vertical federal transfers are associated with higher rates of conviction for abuse of public office. They conclude on the basis of this finding that vertical fiscal imbalances and soft budget constraints might lead to higher rates of corruption.

[16]There are some studies who control for the impact of fiscal decentralization while being ultimately interested in different issues. For example, Singh and Plekhanov (2005) also include a decentralization measure (subnational expenditure to GDP) as a control in their models. They indeed find in some models that decentralization tends to significantly increase subnational deficits. But given that this issue is not the main focus of their analysis, they do

De Mello (2000) focuses on the effect of fiscal decentralization on the deficit of the federal and subnational governments separately. He finds that subnational tax autonomy (his proxy for decentralization) generally leads to an increase of subnational deficits, which implies that decentralization might aggravate soft budget constraints and coordination failures.

Fornasari et al. (2000) find in their study on 32 developing and industrial countries that expenditure decentralization generally contributes to a larger government sector, but that subnational deficits are unrelated to the fiscal balance of the central government. However, once a revenue measure of decentralization is used, decentralization turns out to be negatively related to central government budget deficits. They also differentiate between a "long-run" analysis using cross-section averages and a "short-run" analysis using the within-panel variation, and find that expenditure decentralization increases central government deficits when the within-variation is used.

Freitag and Vatter (2008) find in a study with panel data from Swiss Cantons that more decentralized cantons tend to have lower deficits in times of economic crisis. However, they fail to observe significant differences between centralized and decentralized cantons when the economy is doing well.

Further studies on this and related questions are Stein (1998), who finds that greater decentralization increases the public sector size but not the deficit of the total government sector in Latin America; Rodden (2002) who controls in some models for the degree of revenue and expenditure decentralization, and finds that both tend to increase total government deficits; Schaltegger and Feld (2009) who explore with data from Switzerland whether fiscal adjustments are more successful in decentralized cantons, and find that cantons which are less centralized are more likely to conduct fiscal adjustments; and Baldacci et al. (2006) who fail to observe a robust relationship between fiscal decentralization and fiscal consolidations in a study with data on 25 emerging market countries.

2.4 Other determinants of fiscal policy

The literature on the determinants of public debt and public expenditures is vast, and no survey can be comprehensive. Nonetheless, recognizing the contributions of this literature, even if they are not specifically related to fiscal decentralization, is important for the correct specification of the empirical models which are estimated in subsequent sections. We will first review the literature on the determinants of government size, and then the literature on public borrowing.

2.4.1 Determinants of government size

The literature on the size of government has a long tradition. Early contributions were based on "empirical regularities". Wagner (1911), for example, argues that the degree of economic development is positively related to the size of government because the demands on the governments for "cultural" or "economic" organization increase disproportionately. Brecht (1932) notes that

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not structure their estimation procedure in such a way that would be appropriate to analyze this particular question, so that any conclusions in their study with regard to this variable should be considered as preliminary. Feld and Kirchgässner (2007) use a measure for fiscal decentralization as a control variable in a study that is primarily concerned with debt limitations at the cantonal level in Switzerland. They find that fiscal decentralization is negatively related to cantonal debt, even though it seems to be unrelated to public deficits.

urbanization and the associated increase in population density leads to congestion costs in the consumption of public goods. Since the government therefore has to provide additional public goods, the size of the government would increase with continued urbanization and increasing population density.

Modern contributions extend these early arguments in various directions. Rodrik (1998) speculates that more open countries have to provide more redistributive transfers due to the higher incidence of economic shocks, and are thus also more likely to exhibit a large government size. He also provides empirical evidence to this effect. However, Alesina and Wacziarg (1998) argue that the true relationship is between government size and country size, and that the positive relationship between openness and government size found by Rodrik (1998) is primarily due to the fact that smaller countries tend to be more open.

Persson (2002) finds that presidential regimes and majoritarian elections are associated with smaller governments. Hibbs (1977) maintains that there are significant ideological differences in how governments view the relative (and, at least in the short run, mutually exclusive) benefits of high employment and price stability. He argues that left-wing parties prefer high employment over price stability whereas right-wing governments prefer price stability over high employment. This argument implies that left-wing governments will spend more than right-wing governments. However, empirical studies do not generally confirm this conjecture. De Haan and Sturm (1997) find no significant relationship, whereas Katsimi (1998) finds that left-wing governments are associated with smaller governments.

A large fraction of the literature on this issue can also be traced back to "common pool theories" of government expenditures (Weingast et al., 1981). A line of research focuses on the "stability" of the government. Roubini and Sachs (1989), for example, argue that coalition (i.e. more fragmented) governments tend to spend more because a larger number of interests have to be satisfied. Secondly, explanations based on interest group influence have also been developed. The more the free rider problem in the context of collective action can be solved by interest groups, the larger government size is likely to become since more groups attempt to pressurize the government to conduct targeted spending (Olson, 1965).

Meltzer and Richard (1981) state that the size of government can be explained by the demand of the median voter for redistributive programs. They explain the marked increase in welfare spending in the last century with the continued expansion of suffrage to lower-income individuals. This process supposedly made the median voter poorer, and thus more in favor of income redistribution.

Finally, the impact of fiscal institutions on government spending has also been studied. Feld and Matsusaka (2003), for example, explore the impact of fiscal referendums on government spending, and find that they tend to reduce public expenditures significantly if they are mandatory.

2.4.2 Determinants of public borrowing

The literature on the determinants of government expenditures and public borrowing are naturally related. Therefore, several arguments mentioned in the preceding section can be adapted to explain public borrowing.

Classifying the literature on public borrowing is not easy, but a fundamental distinction lies in the goals that the government is assumed to pursue. Contributions in the welfare-economic

tradition model governments as benevolent, implying that they acquire debt to the extent that is beneficial to their constituency. Notable articles in this tradition are Barro (1979) and Lucas and Stokey (1983), who show that benevolent governments should set a fixed tax rate and smooth unexpected shocks through debt in order to minimize the excess burden of taxation.[17]

However, the inability of these "normative" models to explain the large variation in the degree of indebtedness between countries, and in particular between subnational units within federations has led to the development of alternative theories. A considerable amount of effort has been devoted to the political economy of public debt. In the relevant contributions, governments are assumed to be primarily interested in political benefits, and to relegate citizen's utility to a secondary position. Based on the basic argument in Hibbs (1977), the idea of political business cycles is often extended to cover public debt by arguing that present governments can "commit" future administrations by means of over-borrowing. Alesina and Tabellini (1990), for example, develop a model in which they show that incumbents will over-borrow if their preferences differ significantly from those of the opposition.

As with respect to the size of government, a strand of the literature emphasizes the ideology of political parties. Alesina and Sachs (1988) note that left-wing administrations might be less averse to increases in spending by means of deficit-finance[18] and more prone to engage in Keynesian-style stabilization policies. The empirical support for this conjecture is mixed, however. Roubini and Sachs (1989) indeed find for OECD countries that left-wing parties lean more toward deficit-finance, but alternative contributions such as Alesina and Perotti (1995a) show that centrist parties tend to borrow more, while De Haan and Sturm (1997) and Borrelli and Royed (1995)[19] fail to confirm any relationship between ideology and public borrowing. Models developed by Aghion and Bolton (1990) and Milesi-Ferretti and Spolaore (1994) might provide an explanation for this rather ambiguous result. In their models, right-wing governments are more likely to finance expenditures through debt. They argue that if the electorate consists of many creditors who own government bonds, a large share of voters will favor price stability. This in turn will diminish electoral support for left-wing parties which are assumed to be less averse to inflation.

Neck and Getzner (2001) conduct a case study on the politico-economic determinants of public debt growth in Austria. While there seems to be some evidence that debt accumulation is influenced by political variables, they conclude that the unemployment rate is the most important determinant of the fiscal policy of Austrian federal governments. A similar conclusion is reached by Seitz (2000) in an analysis of the determinants of subnational deficits in Germany. He finds that subnational deficits can be largely explained by inter-regional differences in economic conditions whereas ideological factors seem to be irrelevant.

Another line of research on the political determinants of public debt explores whether government fragmentation (in parliamentary systems) or, respectively, divided government (in presidential systems) has an effect on fiscal outcomes. The theoretical expectation is, as in the literature on the impact of fragmentation on government size, that the common pool problem is more severe when governments consist of many coalition partners (parliamentary systems) or when the

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[17]In a related contribution, Barro (1974) argues that taxes and debt are equivalent. The famous Ricardian equivalence argument suggests that it is only a matter of taste whether public revenues accrue through borrowing or taxes, without any real consequences.

[18]They actually discuss monetary expansion, but the basic thrust of the argument can be easily applied to fiscal balances.

[19]For Borrelli and Royed (1995), this statement is only true when they exclude outliers, however.

presidency and the legislature are controlled by different parties (presidential systems). Volkerink and de Haan (2001) indeed find that more fragmented governments exhibit larger deficits. However, Elgie and McMenamin (2008) show that these results cannot be generally replicated when a different sample is used.[20]

It is also possible to extend the findings by Persson (2002) (i. e. that presidential regimes and majoritarian elections are associated with smaller governments) to public borrowing. That is, even though large governments as such must not necessarily be correlated with high levels of debt, making the reasonable assumption that citizens suffer from fiscal illusion (i. e. do not understand the inter-temporal budget constraint) and reward high expenditures while punishing tax increases indeed provides a link between the size of government and fiscal imbalances (Buchanan and Wagner, 1977).

While the literature on political institutions is relatively scarce, a fairly large literature studies the impact of budget procedures on debt accumulation. Both numerical as well as procedural rules have been analyzed. Examples of numerical rules are the budget balance requirements in US states or the Maastricht criteria which stipulate, inter alia, upper limits for public debt and/or deficits. Procedural rules relate to the stringency of the procedures that govern the various stages at which the budget is formulated.

Poterba (1995a) provides a comprehensive summary of the literature on balanced budget rules, and concludes that such formal institutions may have real effects.[21] Singh and Plekhanov (2005) analyze subnational borrowing restrictions and find that they have a measurable impact on subnational policies. Von Hagen and Eichengreen (1996) show that borrowing restrictions tend to increase levels of consolidated debt in countries where subnational jurisdictions have no tax autonomy, suggesting that subnational deficits are shifted to the federal government.[22] Cabasés et al. (2007) explore the effectiveness of borrowing restrictions with data on Spanish municipalities, and find that they impose some amount of discipline on the borrowing policies of local governments. Lagona and Padovano (2007) criticize the methodology with which the impact of budget rules is usually analyzed. They argue that the application of indices to measure the stringency of rules implies the need for arbitrary classifications. Instead, they propose a nonlinear principal component analysis approach. However, their results also seem to indicate that more stringent rules lead to larger fiscal balances and a smaller budget size. Using data on US states, Bohn and Inman (1996) also confirm the finding that fiscal outcomes are significantly related to budget rules.

Feld and Kirchgässner (2001) argue that budget referenda might prevent inefficient and selfish actions by politicians who operate within the general framework of a representative democracy.[23] In their empirical analysis with panel data on Swiss municipalities, they indeed find that such direct democratic institutions lead to lower public indebtedness. For the United States, Kiewiet and Szakaly (1996) reach the same conclusion.

The discussion in this chapter indicates that apart from fiscal decentralization, there are various other determinants of both the size of government and the level of public indebtedness. We will therefore take these alternative determinants into account in the following chapters.

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[20] For a more comprehensive survey on the political economy of debt see van Velthoven et al. (1993).

[21] He motivates this conclusion by referring, inter alia, to Alt and Lowry (1994) and Poterba (1994, 1995b).

[22] See also Inman (2003) for an empirical analysis of deficit shifting in the US.

[23] Kroegstrup and Wälti (2008) find that budget institutions continue to have a significant effect even when they control for the fiscal preferences of the inhabitants of Swiss cantons.

Part II

Fiscal decentralization and the size of government

Chapter 3

A theoretical model on the political economy of decentralized spending

3.1   Introduction

In this chapter, we develop a political economy model in order to study the relationship between fiscal decentralization, the ideology of the ruling party at the federal level, and the size of government. We first introduce the general framework upon which the model is built, and then analyze fiscal outcomes under centralization and decentralization when benevolent governments are assumed. Thereafter, we analyze the size of government under these two regimes when governments are perceived as "political".

3.2   General framework

Assume a federation consisting of a continuum of jurisdictions whose measure is normalized to 1. The population in each jurisdiction is also normalized to have a measure of 1. Then, the number of inhabitants in the federation is unity.

In each jurisdiction, there are two types of inhabitants who are distinguished by the factor of production they supply. There are (i) "capitalists" who each supply inelastically 1 unit of capital and zero labor, and (ii) "laborers" who each supply inelastically 1 unit of labor and zero capital. We assume that capital is mobile between subnational jurisdictions, but that it cannot leave the country. While the latter assumption is primarily made for simplicity, it conforms to the empirical observation that capital is generally more mobile within than between nations. We assume, as is customary, that inhabitants and therefore labor is immobile between jurisdictions.

In order to ensure consistency with later sections, we will in the following denominate these two groups of factor suppliers as right-wing (capitalists) and left-wing (laborers) inhabitants or, alternatively, voters. We refer to right-wing inhabitants with a r subscript and to left-wing inhabitants with a l subscript. The share of right-wing inhabitants in jurisdiction j is denoted with

$a_r(j)$, and the share of left-wing inhabitants in j with $a_l(j) = 1 - a_r(j)$. The share of right-wing inhabitants in the federation is given by $R = \int_0^1 a_r(j)dj$ and the share of left-wing inhabitants by $L = \int_0^1 a_l(j)dj$. Note that $0 < R, L < 1$ and $L = 1 - R$.

In each jurisdiction j, an industry produces an output good by using capital and labor according to the general production function $y(j) = F(k(j), l(j))$. Note that capital and labor demand by the industry in jurisdiction j are denoted with $k(j)$ and $l(j)$, respectively. We assume that the price of output is normalized to 1. One implication of this assumption is that the price is not determined endogenously in the "home" market, and it is appropriate if output can be traded globally, in which case supply and demand is completely price-elastic. The objective of the industry is to maximize profits, taking the subnational and federal tax rates and available capital and labor supply as given.

There is a federal government which is responsible for the whole federation, and in each subnational jurisdiction a local government. It is assumed that the fiscal constitution allocates the authority to tax returns on capital to the federal government whereas subnational governments are allowed to tax wages which are paid within their jurisdiction. Such neatly disjoint tax bases ensure that vertical tax competition due to shared bases cannot emerge. One argument for this assumption is that a rational constitutional assembly should allocate tax bases between tiers of government precisely in this fashion.[1] The primary reason for making this assumption is, however, that we are interested in the inefficiencies generated by the "political economy" of decentralization. Since inefficiencies due to vertical tax competition and tax sharing arrangements are already well understood (e. g. Keen and Kotsogiannis (2002), Weingast et al. (1981)), we want to construct a public sector which operates under an "economically efficient" fiscal constitution. We show further below that there is indeed no difference between centralization and decentralization in terms of efficiency if governments are welfare-maximizers. Thus, the model is deliberately structured in such a way that any inefficiencies in the federation can only be caused by the political process.

The federal tax rate is given by t_K while the labor tax rate in jurisdiction j is $t_l(j)$. Taxes are assumed to be per item. The federal government is constrained to be "uniform" in its tax rate whereas regional tax rates may vary. Given these assumptions, the gross return to capital is given by $r = \rho(j) + t_K$, where $\rho(j)$ denotes the net-of-taxes return to capital in jurisdiction j. Since we assume that capital is perfectly mobile throughout the federation, the net return of capital must be the same in all jurisdictions, that is $\rho(j) = \rho$.

The gross wage in jurisdiction j is given by $w(j) = \omega(j) + t_l(j)$. In contrast to the net-of-taxes return to capital, the net-of-taxes wage rate $\omega(j)$ may vary between jurisdictions since labor is immobile.[2]

Capital and labor demand in jurisdiction j are implicitly determined according to

$$F_k(j) = \rho(j) + t_K \text{ and } F_l(j) = \omega(j) + t_l(j), \tag{3.1}$$

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[1] Admittedly, another approach to construct an efficient fiscal constitution under the assumptions of this model is to apply the residence principle and then to decentralize capital taxation. However, under such a fiscal constitution, the federal government has no meaningful role to play, and the model would become uninteresting. We therefore continue to assume that capital is taxed at the source.

[2] Note that if we would assume a constant return to scale production technology, wages would also be the same in all jurisdictions. This is so because under constant returns, there is an optimal combination of labor and capital at all activity levels. Since capital is mobile, it will adjust such that the optimal combination of capital and labor is always achieved. Because the marginal product of labor is the same in all jurisdictions at this optimal combination irrespective of differing activity levels, equilibrium wages will also be the same.

where $F_k(j)$ and $F_l(j)$ denote the marginal product of capital and labor in jurisdiction j, respectively. Capital and labor demand in region j are therefore a function of federal and regional taxes on capital and labor.

The gross return to capital is given by the following equilibrium condition[3]:

$$\int_0^1 a_r(j)dj = \int_0^1 k(j)dj. \tag{3.2}$$

That is, total capital supply in the federation must equal total capital demand in equilibrium. Note that since capital is mobile throughout the federation, the market for it is national.

By totally differentiating and using the assumption that capital is supplied inelastically, it is easy to show that the incidence of the federal tax is completely on capital, i.e.

$$\frac{d\rho}{dt_K} = -1. \tag{3.3}$$

Using the assumption that labor is supplied inelastically, the equilibrium condition for the labor market in jurisdiction j is given by

$$a_l(j) = l(j). \tag{3.4}$$

That is, labor supply in jurisdiction j must equal demand in that jurisdiction. In contrast to capital, therefore, the market for labor is local because this factor is immobile.

Again, it is easy to show that the incidence of the regional tax on labor is completely on labor.

$$\frac{d\omega(j)}{dt_l(j)} = -1. \tag{3.5}$$

Given that taxes are always borne by the respective factor suppliers, an increase in tax rate by one unit always decreases available income by one unit, i.e. there are no adjustments in the gross returns for capital and labor and the incidence of the taxes is completely on the factor suppliers (see the budget constraints for both factor suppliers further below).

On the consumption side of the economy, both right-wing and left-wing voters have identical preferences irrespective of the jurisdiction in which they live. These preferences are defined over private consumption, and two different public goods. There is a national public good G which is provided by the federal government, and financed with federal revenues from taxes on capital. Secondly, each subnational government provides a local public good $g(j)$ which is financed with regional revenue from wage taxes.

We model the utility of inhabitants as quasilinear in private and public consumption. An inhabitant in jurisdiction j has the following utility

$$U_i(j) = c_i(j) + v(g(j)) + W(G) \quad i = r, l. \tag{3.6}$$

with $g(j)$ denoting the level of the local public good, G the national public good and $c_i(j)$ private consumption by group $i = r, l$ in jurisdiction j. Inhabitants in each jurisdiction are distinguished by their budget constraints. That is, a right-wing inhabitant in j has as budget constraint

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[3]Each capitalist in the federation supplies one unit of capital, and there are $R = \int_0^1 a_r(j)dj$ inhabitants. Thus, the gross supply of capital is also $R = \int_0^1 a_r(j)dj$.

$$c_r(j) = \rho = (r - t_K),$$
(3.7)

whereas a left-wing supporter has

$$c_l(j) = \omega(j) = w(j) - t_l(j).$$
(3.8)

The budget constraint of the federal government is

$$G = t_K \int_0^1 a_r(j)dj,$$
(3.9)

and that of regional government j is

$$g(j) = t_l(j)a_l(j).$$
(3.10)

3.3 Centralized public sector and benevolent governments

As a benchmark, we derive the conditions which describe the level of public goods when the public sector is centralized *and* the government is a welfare-maximizer. Under centralization, the level of both the subnational and the national public goods is set by the federal government. We define social efficiency as a situation where the sum of the individual utilities is maximized. The objective function of the federal government is

$$U^s = \int_0^1 \sum_i a_i(j)\left(c_i(j) + v(g(j)) + W(G)\right)dj, \quad i = r, l$$
(3.11)

The budget constraint of the government at the federal tier and in each subnational jurisdiction j is given by equation 3.9 and 3.10.[4] Obviously, the national good is "pure" in the sense that every inhabitant in the country is able to consume it without reducing the consumption of other inhabitants, whereas the local public good $g(j)$ is "local" in the sense that it does not generate any spillovers in other jurisdictions.

By differentiating equation 3.11 with regard to $g(j)$ and G and taking the various budget constraints into account, we obtain the following first order conditions for the optimal provision of the two public goods

$$1 - \frac{dv}{dg(j)} = 0, \text{ and}$$
(3.12)

$$1 - \frac{dW}{dG} = 0.$$
(3.13)

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[4]Obviously, we assume that each subnational jurisdiction has its own budget constraint even in centralized public sectors. It might be more realistic to assume for centralized regimes that the federal government treats the subnational sector as one homogeneous unit for taxation purposes, and then reallocates revenues between jurisdictions by means of horizontal transfers. However, when quasi-linear utility functions are used, the optimality conditions will not differ between both approaches because the federal government has no incentives to redistribute private consumption between the inhabitants of different jurisdictions.

These conditions determine the optimal levels of the regional and federal public goods. We denote the solutions to these equations with $g^*(j)$ and G^*. For $g^*(j)$ to be viable, however, it must hold that the gross income of labor in jurisdiction j is sufficient to pay the taxes associated with $g^*(j)$. It must therefore hold that

$$a_l(j)w(j) \geq g^*(j). \tag{3.14}$$

We assume throughout this chapter that this condition holds.[5] Similarly, for G^* to be viable, it must hold that

$$r \int_0^1 a_k(j)dj \geq G^*. \tag{3.15}$$

We assume throughout this chapter that this condition, too, holds.

Note also that taxes are indirectly determined by the provision of the national and subnational public goods. In particular, whereas the capital tax is the same throughout the federation, the wage tax varies between jurisdictions. The optimal tax burden on the laborers in jurisdiction j is given by $t_l(j) = \frac{g(j)}{a_l(j)}$, and depends on the number of laborers living in the jurisdiction.

3.4 Decentralized public sector and benevolent governments

We now derive the equilibrium under a decentralized public sector. We understand decentralization as a situation where each tier of government maximizes the utility of its constituency independently. Due to the assumptions that regional public goods do not generate any spillovers and that federal and subnational tax bases do not overlap, strategic interactions are irrelevant.

The objective function of a welfare-maximizing subnational government in jurisdiction j is therefore

$$U^s(j) = \sum_i a_i(j) \left(c_i(j) + v(g(j)) + W(G) \right), \tag{3.16}$$

where $c_i(j), i = r, l$ is given by equations 3.7 and 3.8, and the budget constraint of the regional government by equation 3.10. The first order condition pertaining to the equilibrium level of the local public good is

$$1 - \frac{dv}{dg(j)} = 0. \tag{3.17}$$

Thus, regional provision is determined according to a condition that is identical to equation 3.12. Therefore, the first best level is provided by all jurisdictions. The fact that a decentralized public sector is generally efficient when governments are welfare maximizers is not surprising given that vertical and horizontal interactions are assumed to be non-existent.

Similarly, it can be shown that the level of national public good provided by the federal government is determined according to

$$1 - \frac{dW}{dG} = 0. \tag{3.18}$$

Thus the same condition as in equation 3.13 is obtained, implying that the federal government provides the efficient level of the national public good.

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[5]A corollary of this condition is that there is at least one laborer in every subnational jurisdiction.

Overall, we obtain that (i) if the allocation of taxing powers is such that the federal government may tax mobile and subnational governments immobile factors and (ii) federal and subnational governments are welfare-maximizers, then the first best equilibrium can be achieved under a decentralized public sector. This follows firstly from the fact that the burden of the regional wage tax is completely borne by labor suppliers, implying that regional labor demand is not reduced by wage taxes, and secondly because the federal capital tax is borne completely by capital suppliers, implying that capital demand in region j is not reduced by an increase in the federation wide capital tax.

3.5 The political economy of (de)centralization

In the last section, we assumed that the level of the public goods is determined by welfare-maximizing governments. This might be an unrealistic assumption, and is therefore abandoned is this section. Instead, we model the regional and federal governments as being elected by their respective electorates. The electorate of the federal government is the total population in the federation, the electorate of the regional government j are all inhabitants of this jurisdiction.

Once elected, each party implements the "favored policy" of the voters it represents. A right-wing party is elected into office in jurisdiction j when $a_r(j) \geq 1/2$. Otherwise, the left-wing party is elected into office. Similarly, a right-wing party controls the federal executive if $R = \int_0^1 a_r(j)dj \geq 1/2$. Since $L = 1 - R = \int_0^1 a_l(j)dj$, a left-wing party controls the federal executive when $L > 1/2$. Note that we assume that the right-wing party wins the election in both the subnational jurisdictions and in the federation in cases where the share of right-wing voters is exactly 50% (and therefore equal to the share of left-wing voters).[6]

By "favored policy", we mean that each party implements the level of the regional and federal public goods preferred by its voters. Qualitatively, this assumption implies that if a jurisdiction j is ruled by a right-wing government, the level of the regional public good will be set as high as possible because the associated tax burden is completely borne by left-wing voters (labor suppliers). On the other hand, if the federal government is controlled by the right, it will provide a sub-optimally low level of the national public good because its constituency has to bear the full costs of provision but disregards the benefits that accrue to left-wing voters.

Conversely, if the left controls the government in jurisdiction j, it will set the level of the regional public good too low because it ignores the benefits that accrue to the right-wing supporters living in that jurisdiction. On the other hand, if the federal executive is in the hands of a left-wing party, the national public good will be over-provided.[7]

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[6]This assumption is only made for convenience but does not qualitatively affect any of the results because the population share function $a_l(j) = 1 - a_r(j)$ is continuous.

[7]The explanation that the constitutional assembly establishes a socially optimal fiscal constitution may seem contradictory to the assumption that political governments are only interested in the welfare of their constituencies and attempt to "exploit" the other constituency as much as possible. One (in our view reasonable) response to such objections is that constitutions usually have to be approved by a qualified majority, while governments are elected by 50% (or less) of the electorate. Since a larger majority has to be attained before a constitution is established, it is more difficult to codify the preferential treatment of one of the two constituencies in the constitution. Rather, the necessity to obtain a qualified majority should ensure that the constitution is indeed socially optimal. There are no such considerations to obtain qualified majorities in the post-constitutional stage, and –except for constitutional limitations– governments are free to exploit certain groups once they are elected by a simple majority.

We will assume in the following that there is some upper limit to the level of public goods, for example because of a constitutional provision which has been established to prevent expropriatory taxation or because public expenditures which generate only small social benefits might become politically unfeasible from a certain point onwards.[8]

To obtain quantitative results, we will consecutively impose more structure on the problem. We start by assuming that the utility functions in equation 3.11 are given by the customary logarithmic function, i.e. $v = \ln(g)$ and $W = \ln(G)$. Then, we obtain for the optimal level of each regional public good $g^*(j) = 1$, and for the national public good $G^* = 1$. The optimal government size is given by $S^* = \int_0^1 g^*(j)dj + G^* = 2$.[9]

Because we assume that governments only consider the utility of their voters, a left-wing government in jurisdiction j strives to maximize

$$U_l(j) = a_l(j) \left(c_l(j) + \ln(g(j)) + \ln(G) \right), \tag{3.19}$$

i.e. the sum of the utilities of all its voters. Thus, the level of the local public good is determined by the following condition

$$\frac{1}{a_l(j)} - \frac{1}{g(j)} = 0. \tag{3.20}$$

The solution to this equation, i.e. the level of the regional public good under a left-wing subnational government, is $g_l(j) = a_l(j) \leq 1$.

On the other hand, if the right controls the local government it will set the level of the regional public good as high as possible. We assume that the highest possible level of the regional public good $g_r(j)$ is the socially efficient level $g^*(j)$, that is $g_r(j) = g^*(j) = 1$.

We make this restrictive assumption in order to avoid that the following argument is blurred by technical details. We show in the appendix to this chapter that the main results continue to hold in more general cases. However, note that the imposition of this particular spending limit can be justified on grounds of plausibility. While left-wing supporters have to pay more taxes than they would like to when the maximum possible public good level is equal to the efficient level, right-wing local governments can "justify" the tax burden from a "moral" perspective on the grounds that it maximizes aggregate welfare.

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[8]It might seem strange that one seeks to prevent exploitation of one particular group through an upper limit on the level of public goods rather than through a limit on tax rates. However, expenditures and taxes are clearly related, and formulating the constitutional restrictions in this way facilitates the derivation of quantitative results. Assuming tax instead of spending limits would make the spending undertaken in a subnational jurisdiction that is controlled by a right-wing party dependent on the wage rate and the number of labor suppliers in that jurisdiction. Thus, without assuming that the production technology exhibits constant returns to scale (and therefore leads to the same wage rate in all jurisdictions), it would be impossible to derive explicit expressions for the government size. Apart from this technical argument, the assumption can be further rationalized by the fact that over-provision of a public good is a particularly visible sign of government inefficiency. This is especially true in rich societies (i.e. as the OECD countries which we use to test the theory) where marginal increases in tax rates result in high amounts of revenue, thus causing expenditures to be a more obvious signal for government inefficiency than the associated tax rates.

[9]Note that not only the volume but also the *distribution* of spending between the two tiers of government is relevant for efficiency. For example, an equilibrium where the federal government would spend $G = 2$ and subnational governments $g(j) = 0$ is not optimal even though the *aggregate* government size is equal to the efficient government size.

At the federal level, the amount of the regional public good provided by a government controlled by the right is determined according to

$$\frac{1}{R} - \frac{1}{G} = 0, \tag{3.21}$$

with $R = \int_0^1 a_k(j)dj$ denoting the total number of right-wing voters in the federation. We obtain for the level of the public good when the right is in control of the federal government $G_r = R < 1 = G^*$.

When the left controls the federal government, it will strive to provide the highest possible level of the federal public good. We again impose that the maximum level cannot be higher than the socially optimal level, that is $G_l = G^* = 1$ (a more general case is analyzed in appendix A).

In the following subsections, we will analyze the size of government under various policy regimes and administrations. We start by discussing the case of a centralized executive, which is fairly easy and move on to discuss the impact of decentralization. The aim of these subsections is to derive empirical predictions which simultaneously address the institutional regime of a country (centralization vs. decentralization), and the prevailing political environment (that is, which of the two groups has the federation-wide majority). In the next chapter of this dissertation, we will test the implications with appropriate data.

3.6   Government size under centralization

We first derive the size of government under a centralized regime. Under centralization, the federal government chooses both the level of the national and that of each subnational public good. Thus, we need to discuss two separate cases: the case where the left has a majority in the whole federation and the case where the federal government is controlled by the right. Keeping in mind that the number of right-wing voters is given by $R = \int_0^1 a_r(j)dj$, the federal executive is controlled by the right when $R \geq 1/2$. Under the assumption that the utility function $W(.)$ is logarithmic, the size of the federal government is then given in equilibrium by R.[10] The aggregate size of all subnational governments is given by $\int_0^1 1dj = 1$ because the highest possible level of the local public good will be chosen in all jurisdictions (which is 1). Thus the aggregate government size when the right is in control and the country is centralized is given by

$$S_r^c = 1 + R < 2. \tag{3.22}$$

On the other hand, when $L > 1/2$, the left-wing party controls the government. It will choose the maximum level of the national public good, and in each jurisdiction the level of the subnational public good that is preferred by its constituency. The size of the government is given in this case by

$$S_l^c = 1 + \int_0^1 a_l(j)dj = 1 + L < 2. \tag{3.23}$$

We can reach two conclusions from these expressions. First, the political equilibrium leads to a smaller than efficient aggregate government size, both when the federal government is controlled by the right and when it is controlled by the left. Secondly, there is no systematic difference in

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[10]We use equation 3.21 to obtain this result.

the size of aggregate government chosen by the two parties. However, there are differences in the distribution of spending between tiers of government. If the left is in the majority, the aggregate size of subnational governments will be lower than in the first-best equilibrium. The opposite results are obtained when the right has the majority.

3.7   Government size under decentralization

When the public sector is decentralized, the situation is different. The federal government continues to be controlled by the party which has the federation-wide majority. The determination of the number of jurisdictions controlled by the left- and the right-wing parties is more complicated than in the case of centralization, however. This number depends on both the relative shares of the two groups in the federation, and their spatial distribution between jurisdictions. On the most basic level, the two groups could be "equally" or "unequally" distributed. If both groups are equally distributed, each jurisdiction is populated by $a_r(j) = R$ right-wing and $a_l(j) = L$ left-wing voters. Thus if the right has the federation-wide majority ($R \geq 1/2$), it will not only control the federal executive but also *all* subnational governments and vice versa. Obviously, when the two groups are equally distributed, the number of jurisdictions controlled by either group and in turn the size of government is the same as under centralization. This case therefore does not need further analysis.
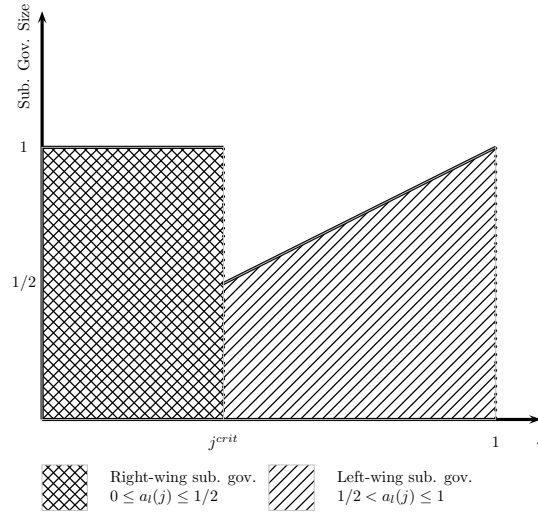
Figure 3.1: Subnational government size under a decentralized public sector

The more interesting case is the one where right- and left-wing voters are unequally distributed between jurisdictions, and it is here where decentralization makes a critical difference. Assume without loss of generality that jurisdictions are ranked in descending order according to the number of right-wing supporters, and that the function $a_r(j) = 1 - a_l(j)$ is continuous. That is, $j = 0$ is the jurisdiction with the highest share of right-wing supporters and $j = 1$ the jurisdiction with the smallest share. Denote with j^{crit} ($0 \leq j^{crit} \leq 1$) the critical jurisdiction where the share of right wing supporters is exactly 50%. Then, all subnational jurisdictions $j \leq j^{crit}$ are

controlled by right-wing administrations and all jurisdictions with $j > j^{crit}$ are controlled by left-wing administrations.[11]

The aggregate size of the subnational sector is given by

$$S^{sub} = \int_0^{j^{crit}} 1 dj + \int_{j^{crit}}^1 a_l(j) dj, \tag{3.24}$$

using the fact that $a_l(j) = (1 - a_r(j))$, this expression simplifies to

$$S^{sub} = 1 - \int_{j^{crit}}^1 a_r(j) dj. \tag{3.25}$$

This formula can be explained with the help of figure 3.1. In this figure, all subnational jurisdictions with $j \leq j^{crit}$ are controlled by right-wing administrations. They will thus choose the highest possible level of the local public good, which is 1. The jurisdictions $j > j^{crit}$ will be controlled by left-wing administrations. In these jurisdictions, the government will choose the level of the public good preferred by the left-wing voters, which equals the share of left-wing voters in the jurisdiction if a logarithmic utility function is assumed. Since we have assumed that jurisdictions are ranked according the share of right-wing voters, the size of government is equal to $1/2$ in the jurisdiction next to the critical jurisdiction, which is the first controlled by the left, and increases thereafter monotonically.

Having derived the aggregate size of subnational governments, the total public sector size can be easily expressed as follows. If the federal government is controlled by the right, the aggregate government size under decentralization is given by

$$S_r^d = R + 1 - \int_{j^{crit}}^1 a_r(j) dj, \tag{3.26}$$

because a right-wing federal government chooses $G_r = R$ for the national public good.

Since left-wing administrations will provide the highest possible and thus the socially efficient amount of the national public good, the aggregate government size under a left-wing federal administration and a decentralized public sector is given by the following expression:

$$S_l^d = 2 - \int_{j^{crit}}^1 a_r(j) dj.$$

By considering these expressions, we can compare the size of government under different public sector regimes and governments. We derive the following result from the model:

Result A: Since $\int_{j^{crit}}^1 a_r(j) < R = (1 - L) < 1$, the relationship

$$S_l^d > S_l^c \text{ and } S_r^d < S_r^c,$$

holds.

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[11]If there is no jurisdiction for which $a_r(j) = a_l(j) = 0.5$, then all subnational governments must be formed by right-wing or left-wing parties, depending on whether $R > L$ or vice versa. In this case, the critical jurisdiction can be defined without any harm as $j = 0$ when $R < L$ or $j = 1$ when $R > L$.

That is, decentralized public sectors exhibit bigger governments than centralized regimes when the federal administration is left-wing. Conversely, decentralized public sectors exhibit smaller governments than centralized regimes when the federal government is right-wing.

3.8 Conclusion

In this chapter, we have analyzed the relationship between fiscal decentralization and the size of government by developing a model which relates the political affiliation of voters and governments to the size of the public sector under different public sector regimes. The model led to a theoretical proposition which states that decentralization will lead to larger governments when the federal government is controlled by a left-wing party, and to smaller governments when it is controlled by a right-wing party. We shall test this proposition in the next chapter of this dissertation.

Appendix

We show in this appendix that the main theoretical result in this chapter (*Result A*) continues to hold under less restrictive assumptions about the spending limits. We therefore relax the assumption that the highest possible level of the national and local public goods is the efficient level and assume instead that the limits are given by the general parameters $\overline{G}$ and $\overline{g}$, respectively.

Since a right-wing government under centralization will provide the level of the national public good that is preferred by its constituency, and the maximum amount of the local public good in each jurisdiction, the aggregate size of the public sector under a right-wing federal government is given by

$$S_r^c = \overline{g} + R. \tag{3.27}$$

Equally, the size of the public sector under a left-wing government is given by

$$S_l^c = \overline{G} + \int_0^1 a_l(j)dj = \overline{G} + L. \tag{3.28}$$

We see from these expressions that when the public sector is centralized, government size under different ideological governments depends on the relative magnitudes of the national and subnational spending limits. If $\overline{G} > \overline{g}$, left-wing governments will exhibit a larger government size in centralized public sectors than right-wing administrations and vice versa. However, note that when $\overline{G} = \overline{g}$, the previous finding of no systematic differences between left- and right-wing governments in centralized public sectors will continue to remain valid.

Under decentralization and a right-wing federal government, the aggregate size of government is given by

$$S_r^d = 1 + R + (\overline{g} - 1)j^{crit} - \int_{j^{crit}}^1 a_r(j)dj. \tag{3.29}$$

Under decentralization and a left-wing federal government, the aggregate size of government is given by

$$S_l^d = 1 + \overline{G} + (\overline{g} - 1)j^{crit} - \int_{j^{crit}}^1 a_r(j)dj. \tag{3.30}$$

These expressions reveal that a left-wing federal government is always associated with a larger public sector than a right wing federal government under decentralization (since $\overline{G} \geq R$ by definition).

With these expressions, we can discuss the conditions under which the main theoretical result in this chapter remains valid in this more general case. Remember that *Result A* states that decentralization decreases the size of government under a right-wing federal government whereas it increases it under a left-wing federal government. In view of this hypothesis, we derive the following proposition.

Proposition 3.1 *i) Right-wing federal governments: centralization will lead to a larger government size than decentralization when*

$$\overline{g} > 1 - \frac{\int_{j^{crit}}^{1} a_r(j)dj}{1 - j^{crit}} \tag{3.31}$$

ii) Left-wing federal governments: decentralization will lead to a larger government size than centralization when

$$\overline{g} > 1 + \frac{L - 1 + \int_{j^{crit}}^{1} a_r(j)dj}{j^{crit}}. \tag{3.32}$$

This proposition reveals that *Result A* remains valid if the spending limit on the local public good is not set too low. In the case of a right-wing federal government, it can be easily seen that the minimum permissible spending limit at which the result continues to hold is always less than the efficient level, which is 1. Similarly, the minimum permissible spending limit in the case of left-wing federal governments is also always less than 1 because the expression $L - 1 + \int_{j^{crit}}^{1} a_r(j)dj$ is always negative. It seems reasonable to assume that in real-world countries, spending limits, if they exist at all, are always (weakly) larger than the efficient level.[12]

We may thus conclude that the theoretical result that decentralization increases the size of government under left-wing administration whereas it decreases it under right-wing administrations is relatively robust to more general assumptions about spending limits.

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[12]If they were not, then jurisdictions that are completely populated by left-wing voters would not be allowed to choose their preferred level of the local public good. It seems not particularly realistic to assume that a rational constitutional assembly would choose such spending limits.

Chapter 4

Empirical evidence on the political economy of decentralized spending

4.1 Introduction

In this chapter, we test the theory developed in the last chapter. We first "translate" the theoretical propositions derived in the last chapter into testable empirical hypotheses, and then introduce the empirical model and explain the data. Thereafter, we present and discuss the results. Finally, we offer a brief conclusion.

4.2 Hypotheses, empirical model and data

The theoretical *Result A* in chapter 3 suggests the following empirical hypothesis.

> *Hypothesis A*: Fiscal decentralization leads to a larger aggregate government size than centralization when a left wing party controls the federal government and to a smaller aggregate government size than centralization when a right-wing party controls the federal government

One major problem that emerges when one attempts to test this hypothesis empirically is that "real-world" countries almost never match the assumptions upon which the theoretical model was built. We have, for example, treated centralization as a regime in which subnational governments have absolutely no role to play. This assumption is inappropriate given that even the most centralized states allow for some amount of local self-rule. Secondly, we have continuously talked about "federal" and "subnational" governments, thus evoking the impression that only federations can be decentralized. In reality, this is not the case. Whether a country is decentralized or not is primarily determined by the prevailing political reality and not by whether the constitution designates the country as a federation or a unitary state.[1] Thirdly, we have assumed that there are only two parties in the country, and that each individual is associated with one of these two,

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[1]Indeed, some federal countries are far less fiscally decentralized than unitary states, see Stegarescu (2005) for empirical evidence to this effect.

and furthermore that this association depends only on the factor of production that the individual supplies.

We therefore have to provide a reasonable "translation" of the concepts used in the theoretical part in order to specify a meaningful empirical model. In this empirical section, we treat decentralization as a continuous concept which is based on the amount of fiscal autonomy of subnational governments. We take a dual approach in measuring fiscal decentralization. There are two types of fiscal decentralization, one that is related to the expenditure and one that is related to the revenue side of the budget, and both might exhibit different effects on the size of government in real-world countries (even though there should be no difference theoretically since taxes and spending are simultaneously determined in the model). Expenditure decentralization (*Exp. dec.*) is defined in this chapter as the share of subnational expenditures to total government expenditures. Revenue decentralization (*Rev. dec.*) is accordingly defined as the share of subnational revenues to total government revenues. Both measures are calculated with the IMF's GFS data, and are available in a dataset provided by the World Bank.

In order to account for multi-party systems, we assume that parties can be divided into two different political camps. We will thus measure the ideological affiliation of the central government with an index that takes the party affiliation of its members into account. The use of a more disaggregated measure also enables us to consider coalition governments and intermediate regimes since the clear distinction of governments into left and right put forward in the theoretical section is seldom observed in reality.

The ideological position of the central government is measured by an index from the CPDS I database provided by Armingeon et al. (2006).[2] This index, denominated *Ideology*, assumes the value 1 when the government is considered to be far-right and 5 when it is considered to be far to the left (see table 4.1).

Finally, government size is measured by total government expenditures divided by GDP. The data is obtained from the OECD's Economic Outlook database.

Initial investigations of *Hypothesis A* are conducted in figure 4.1 and 4.2 for a sample of 18 high-income OECD countries[3] over the 1980-2000 period. In both figures, we split the observations according to whether the central government in a given country-year combination is left-wing (*Ideology* > 3) or right-wing (*Ideology* < 3).[4] We then fit linearly the data on government size and expenditure decentralization for these two subgroups in figure 4.1. In figure 4.2, we plot the data on government size and revenue decentralization linearly.

Both figures seem to confirm our conjecture on the relationship between decentralization and government size. For the subgroup of observations with left-wing administrations, we observe a positive relationship between both expenditure and revenue decentralization and government size. For the subgroup with right-wing administrations, the relationship is negative. However, these simple figures do not control for other confounding factors and can therefore only provide preliminary evidence.

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[2]The original source is the Political Data Yearbook (various issues) published by the European Journal of Political Research.

[3]Which are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, United States. Several high-income OECD countries had to be dropped from the database because of the unavailability of the decentralization data from the IMF / World Bank .

[4]Note that we drop observations for which *Ideology* = 3 ("centrist" governments).
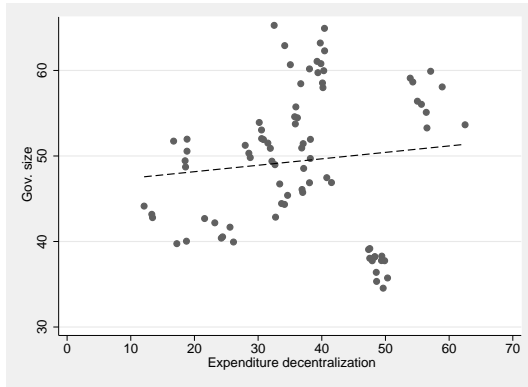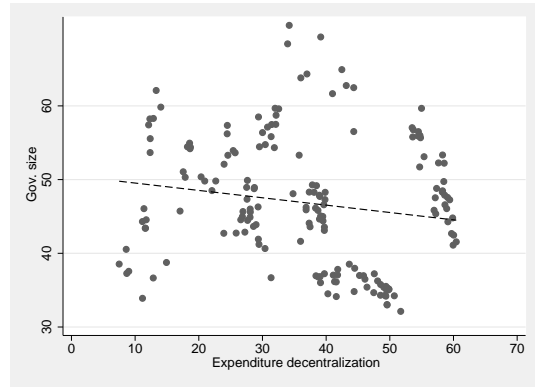
(a) Left-wing administrations   (b) Right-wing administrations

Figure 4.1: Impact of expenditure decentralization on size of government under left- and right-wing administrations, OECD countries, 1980-2000
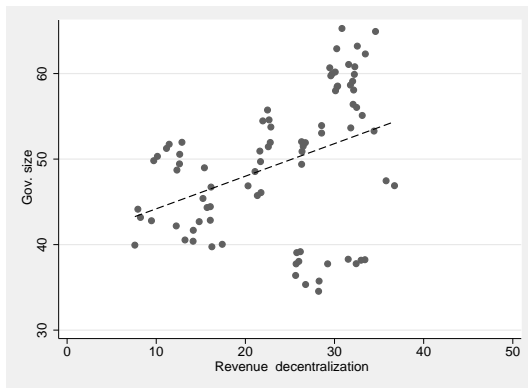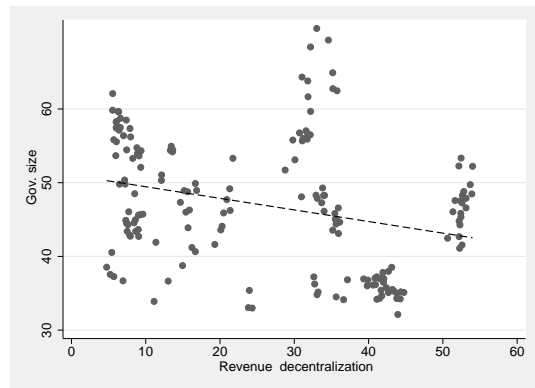
(a) Left-wing administrations   (b) Right-wing administration

Figure 4.2: Impact of revenue decentralization on size of government under left- and right-wing administrations, OECD countries, 1980-2000

Table 4.1: DEFINITION AND SOURCE OF VARIABLES

Label	Description	Source
Dependent variable		
Gov. size	Logistic transformation of public expenditures/GDP	OECD Economic Outlook No. 83
Decentralization variables		
Exp. decentralization	Subnational share of total government expenditures	IMF / World Bank
Rev. decentralization	Subnational share of total government revenues	IMF / World Bank
Ideological variable		
Ideology	Index of the ideology of government, higher values indicate more leftist ideology	CPDS I Dataset 1960-2006 (Armingeon et al., 2008)
Interactions		
Exp. dec.× Ideology	Interaction between ideology-index and expenditure decentralization	Own calculations based on original data
Rev. dec.× Ideology	Interaction between ideology-index and revenue decentralization	Own calculations based on original data
Control variables		
Population	Logarithm of Population	OECD Population and Labour Force Statistics
Working	Share of population between 15-65 years	OECD Population and Labour Force Statistics
Pop. density	Population density	UN
GDP p. c.	GDP per capita	OECD Annual National Accounts
Unemployment	Unemployment rate	OECD Economic Outlook No. 83
Openness	Trade openness ([exports+imports]/GDP)	OECD Macro Trade Indicators
Herf. index	Herfindahl index of government concentration, higher values indicate less fragmented governments	DPI 2006 Dataset (Beck et al., 2001)
Plurality	Index for the voting system, higher values indicate more elements of plurality rule	CPDS I Dataset 1960-2006 (Armingeon et al., 2008) / Own calculations when observations are missing
President	Dummy =1 if presidential system	CPDS I Dataset 1960-2006 (Armingeon et al., 2008) / Own calculation when observations are missing
Federation	Dummy =1 if federation	Own calculations, different constitutions
Excluded instrument		
Urbanity	Share of Population living in urban areas	UN
Constructed instruments		
Prediction of Exp. Dec × Ideology	Non-linear function (of a linear combination) of in- and excluded instruments	Own construction after Wooldridge (2002), see main text for explanation
Prediction of Rev. Dec. × Ideology	Non-linear function (of a linear combination) of in- and excluded instruments	Own construction after Wooldridge (2002), see main text for explanation

In order to investigate whether the findings from the bivariate plots are robust to a more elaborate methodology, we estimate the following general model in various individual specifications.

$$\text{Gov. size} = a_i + \gamma_t + b_1 \text{ Decentralization } + b_2 \text{ Ideology } + b_3 \text{ Decentralization} \times \text{Ideology}$$
$$+ \mathbf{b} \text{ Control variables } + \epsilon. \tag{4.1}$$

In this equation, the a and γ coefficients are cross-section and time-fixed effects, ϵ is the error-term. The remaining variables are listed in table 4.1.

The dependent variable is the size of government (*Gov. size*). It is measured by the ratio of total government expenditures to GDP. We follow Oates (1985) and Marlow (1988) by applying a logistic transformation to this measure in the regressions. This transformation is motivated by the fact that the expenditure to GDP ratio is constrained to lie between 0 and 1, thus contradicting the assumptions for Least Squares to be appropriate.

In order to test *Hypothesis A*, we construct two interaction variables by multiplying the ideology with the decentralization variables. They are denominated as *Exp. dec.* $\times$ *Ideology* and *Rev. dec.* $\times$ *Ideology* in the regression tables. Our theory predicts a positive sign of the estimated coefficients on these interaction variables, i.e. that a marginal increase in decentralization leads to an increase in government size when the central government is formed by left-wing parties and vice versa.

We include a number of additional control variables which might influence the size of government. We consider the (log of) population size (*Population*), the share of the non-dependent population (*Working*), the population density (*Pop. density*), GDP per capita (*GDP p. c.*), the unemployment rate (*Unemployment*), the trade openness of the economy (*Openness*), and the Herfindahl index of government fragmentation (*Herf. index*).

We also include variables which capture the institutional structure of a country. However, these variables cannot be included in fixed effects models because the underlying institutional features are time-invariant. We control for whether a country is a presidential or parliamentary democracy (*President*), and whether the country is federal or unitary (*Federation*) by means of dummy variables. We also include an index which measures to what extent a country has a plurality or proportional electoral system (*Plurality*).[5] Higher values of this index indicate the presence of more elements of plurality rule.

In addition to baseline regressions, we conduct a number of robustness checks where we take potential simultaneity between the size of government and the decentralization measures into account. The instruments used in these models are discussed in more detail in section 4.3.2.[6]

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[5]Technically, there is some within-variation for two of these variables. For the federation dummy, there is within-variation for Belgium which became a federation in 1993. For the plurality rule variable, Italy exhibits within-variation because of a reform in 1994. We nonetheless do not include these variables in the fixed effects models because we do not want to base our conclusions on the variation in one country only.

[6]Note on terminology: "Excluded" instruments are those variables that are not used as exogenous regressors in the baseline regressions in table 4.2 and 4.3, "included" instruments are those variables that are used as control variables in these tables. See for example Baltagi (1998) for further details.

4.3 Results

4.3.1 Baseline results

Baseline results are collected in table 4.2 for models where expenditure decentralization is used as the representation of fiscal decentralization. We estimate and report both random and fixed effects models. In case of significantly different estimates between the two specifications, we rely on the fixed effects models since they are consistent in the presence of unobserved heterogeneity while the random effects models are not. Fixed effects models also implicitly take account of (largely) time-constant country specific features that are difficult to measure explicitly, for example moral hazard problems due to the presence of intergovernmental transfer schemes (Goodspeed, 2002).

The first specification in both sets of models (RE 1 and FE 1) only includes a linear control for decentralization. A variant of this model is traditionally used to explore the Leviathan Hypothesis. We append this basic model consecutively in subsequent specifications. In the second specification (RE 2 and FE 2), we include the interaction variable in order to test the hypothesis that decentralization under a left-wing administration increases the size of government. In the third specification (RE3 and FE 3), we additionally include year-fixed effects in order to control for contemporaneous correlation between countries. In the fourth specification, we take autocorrelation within countries into account by conducting the hypothesis tests on the basis of clustered standard errors. Note that hypothesis tests in all models are conducted with robust standard errors in order to take potential heteroscedasticity into account.

The estimation results for the control variables in table 4.2 generally do not differ qualitatively between the random and fixed effects models. Even though there are some differences in the quantitative estimates and significance levels, the sign on the estimated coefficient stays the same for most variables. For those variables where this is not the case, there are reasonable explanations for the discrepancies. For brevity, we will generally describe the results from fixed effects models, even though we address for some variables differences in the results between the random and fixed effects estimations.

For example, a larger population size significantly increases the size of government according to the fixed effects models, whereas the random effects models suggest that this variable is insignificant. The differing results can be explained as follows. Population size rises *within* countries either because of an increase in the birth rate, a decrease in old age mortality, or through more immigration. It is a reasonable conjecture that all three explanations for population growth might lead to a short-term expansion of government activity, for example in the field of social protection. On the other hand, once population levels have settled on some "long-term" level, there might be no differences in government size *between* countries that exhibit different population sizes.

The share of the non-dependent variable is apparently negatively related to the size of government, even though the significance of the effect vanishes in the fourth model when clustered standard errors are used for hypothesis tests. This result is reasonable since a less dependent population decreases spending needs.

Population density is negatively related to the size of government. This result suggests that scale economies exist in the provision of public goods.

GDP per capita is negatively related to the size of government. This result is expected and can be explained, for example, by the intuitive notion that more prosperous societies depend

less on interpersonal risk sharing through the social security transfers when private resources are sufficient to absorb negative economic shocks. However, the finding could also be statistical artifact produced by the presence of GDP in the denominator of the dependent variable and in the nominator of the *GDP p. c.* variable in equation 4.1. While we are not particularly interested in the effect of GDP per capita on government size in this chapter, this "ratio problem" could lead to biased estimates of our variable of interest– the interaction between decentralization and government ideology.[7] We investigate this possibility in the appendix to this chapter (appendix A) in two robustness checks and find that the conclusions further below with regard to *Hypothesis A* remain valid.[8]

The unemployment rate is positively related to the size of government, presumably because a high level of unemployment leads to increased expenditures for social protection and counter-cyclical fiscal policies.

The coefficient on the openness variable is significantly negative in both the random and fixed effects models. More open countries seem to have smaller governments than closed economies, thus indicating that a higher exposure to international competition limits government intervention. Note that this result contradicts the findings by Rodrik (1998) who argues that more open economies tend to have bigger governments because of the higher need to smooth idiosyncratic shocks. This difference can perhaps be explained by the fact that he uses a different sample in his regressions (not only OECD but also several middle- and low-income countries).

The coefficient on the Herfindahl index is insignificant, suggesting that government fragmentation has no significant effect on government size.

The variables with which we control for the institutional structure of a country can only be included in the random effects models. The results suggest that federations have smaller governments than unitary states. There is also some evidence that presidential democracies have smaller governments than countries with parliamentary systems. However, the coefficient becomes insignificant when clustered standard errors are used. The distinction between plurality rule and proportional systems seems to be irrelevant for government size when it is controlled for year fixed effects, as indicated by the insignificant coefficient in models RE 3 and RE 4.

The political and decentralization variables are our main concern. In particular, the interaction between expenditure decentralization and the ideology variable are used to explore the implications of the theoretical model. When no interaction variables are used (RE 1 and FE 1), the coefficient on the decentralization variable is significantly positive. At face value, this result suggests that more decentralized states have larger governments, in turn indicating that the simple linear Leviathan Hypothesis– that decentralization (always) decreases government size– is not correct.

However, the inclusion of the interaction variable leads to a re-evaluation of this conclusion. In the fixed effects regressions, the coefficient on the interaction variable is consistently positive.[9] It is also always significant at least at the 10% level, even when clustered standard errors are used.

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[7]See Kronmal (1993) for a more detailed discussion.

[8]As an additional robustness check, we also re-estimate the main models in this chapter with the fixed effects vector decomposition approach developed by Pluemper and Troeger (2007) in appendix B. See this appendix for a description of this methodology and an explanation for why we think that it can increase the robustness of our results.

[9]Note that the base variables, that is *Exp. dec* and *Ideology*, have no meaningful interpretation when interaction variables belong in the model. Since the coefficients on the interaction variables are significant, they should be necessarily included.

Thus, these models confirm *Hypothesis A*: (expenditure) decentralization under leftist governments indeed leads to larger governments.

Do we obtain the same results when we use a revenue measure as representation of fiscal decentralization? The results for models where revenue decentralization is used as explanatory variables are collected in table 4.3. The structure of this table is the same as that in table 4.2. In particular, we estimate four random and four fixed effects models. In both sets of regressions, we include from the second model onwards an interaction variable between revenue decentralization and ideology. From the third model onwards, we control for year fixed effects. In the fourth model, clustered standard errors are used for hypothesis tests.

Note that the results with regard to the control variables in this table are the same as in the models in table 4.2. We therefore do not discuss them further.

The results with regard to the interaction variable, on the other hand, are slightly different to those in table 4.2. While the coefficient is consistently positive in the fixed effects models, it is also generally insignificant. Thus, we conclude that there is only relatively weak evidence for *Hypothesis A* when the revenue measure for fiscal decentralization is used.

Table 4.2: IMPACT OF EXPENDITURE DECENTRALIZATION ON SIZE OF GOVERNMENT, 1980-2000

	Random Effects				Fixed Effects			
	RE 1 b/t	RE 2 b/t	RE 3 b/t	RE 4 b/t	FE 1 b/t	FE 2 b/t	FE 3 b/t	FE 4 b/t
Population	-6.872	-7.705*	5.776	5.776	74.360***	73.023***	61.830***	61.830**
	(-1.597)	(-1.890)	(1.278)	(0.442)	(5.509)	(5.516)	(4.407)	(2.336)
Working	-4.382***	-4.340***	0.317	0.317	-2.523***	-2.599***	-1.707*	-1.707
	(-4.921)	(-4.840)	(0.317)	(0.135)	(-2.749)	(-2.797)	(-1.722)	(-0.903)
Pop. density	0.159***	0.161***	-0.048	-0.048	-0.593***	-0.598***	-0.970***	-0.970***
	(3.132)	(3.396)	(-1.151)	(-0.429)	(-3.543)	(-3.546)	(-5.642)	(-3.912)
GDP p. c.	0.001**	0.001**	0.001	0.001	-0.000	-0.000	-0.003***	-0.003**
	(2.144)	(2.221)	(1.584)	(0.558)	(-1.386)	(-1.213)	(-3.385)	(-2.411)
Unemployment	5.162***	5.120***	-0.421	-0.421	4.949***	4.969***	4.059***	4.059***
	(15.172)	(14.610)	(-0.576)	(-0.180)	(14.414)	(14.185)	(7.585)	(3.433)
Openness	-0.603***	-0.596***	0.341*	0.341	-0.762***	-0.767***	-0.962***	-0.962***
	(-6.831)	(-6.701)	(1.933)	(0.782)	(-7.784)	(-7.944)	(-7.534)	(-5.459)
Herf. index	0.946	-0.413	-35.252***	-35.252	-3.086	-5.173	-8.049	-8.049
	(0.130)	(-0.055)	(-2.858)	(-1.384)	(-0.527)	(-0.851)	(-1.375)	(-1.489)
Plurality	-17.201***	-15.879***	-2.345	-2.345				
	(-3.324)	(-3.100)	(-0.764)	(-0.257)				
President	-14.063	-13.861	-22.622***	-22.622				
	(-1.253)	(-1.308)	(-3.602)	(-1.355)				
Federation	-24.521***	-23.827***	-32.939***	-32.939**				
	(-6.654)	(-6.402)	(-7.676)	(-2.078)				
Ideology	-0.010	-1.095	5.803**	5.803	0.574	-1.491	-1.729	-1.729
	(-0.013)	(-0.683)	(1.964)	(1.076)	(0.835)	(-1.117)	(-1.412)	(-1.138)
Exp. dec.	1.118***	1.007***	0.474**	0.474	0.973***	0.826***	0.641***	0.641*
	(4.791)	(3.876)	(2.026)	(0.846)	(4.310)	(3.508)	(2.684)	(1.967)
Exp. dec. × Ideology		0.033	-0.092	-0.092		0.062*	0.073**	0.073*
		(0.807)	(-1.172)	(-0.569)		(1.706)	(2.195)	(2.006)
Year effects	No	No	Yes	Yes	No	No	Yes	Yes
N	322	322	322	322	322	322	322	322
F / χ^2	347.204	324.605	583.917	660.650	45.572	39.285	16.878	29.456
R^2	0.138	0.145	0.465	0.465	0.596	0.600	0.647	0.647
RMS error	10.189	10.350	25.776	25.776	9.328	9.296	9.035	9.035

[1] Hypothesis tests are based on heteroscedasticity robust standard errors
[2] Clustered standard errors are used in models RE 4 and FE 4
[3] Stars indicate significance levels at 10% (*), 5% (**) and 1%(***)
[4] t-statistics in parentheses
[5] Model significance in RE models is evaluated with Wald-χ^2-test, in FE models with F-test

Table 4.3: Impact of revenue decentralization on size of government, 1980–2000

	Random Effects				Fixed Effects			
	RE 1 b/t	RE 2 b/t	RE 3 b/t	RE 4 b/t	FE 1 b/t	FE 2 b/t	FE 3 b/t	FE 4 b/t
Population	-8.652*	-7.852*	9.708***	9.708	71.711***	71.724***	63.673***	63.673**
	(-1.937)	(-1.684)	(2.593)	(0.909)	(5.595)	(5.603)	(4.698)	(2.399)
Working	-3.596***	-3.594***	-1.188	-1.188	-1.836**	-1.834**	-0.828	-0.828
	(-3.974)	(-3.943)	(-1.081)	(-0.442)	(-2.131)	(-2.123)	(-0.924)	(-0.369)
Pop. density	0.165***	0.157**	-0.004	-0.004	-0.796***	-0.794***	-1.114***	-1.114***
	(2.900)	(2.520)	(-0.091)	(-0.034)	(-4.585)	(-4.529)	(-6.633)	(-4.265)
GDP p. c.	0.000*	0.000*	0.000	0.000	-0.000	-0.000	-0.002***	-0.002*
	(1.864)	(1.804)	(0.171)	(0.069)	(-1.172)	(-1.174)	(-3.083)	(-1.895)
Unemployment	4.626***	4.638***	-0.165	-0.165	4.441***	4.442***	3.764***	3.764***
	(13.171)	(13.364)	(-0.278)	(-0.092)	(11.440)	(11.446)	(6.811)	(3.295)
Openness	-0.581***	-0.585***	0.468***	0.468	-0.754***	-0.755***	-0.963***	-0.963***
	(-6.744)	(-6.856)	(3.276)	(1.300)	(-7.844)	(-7.997)	(-7.771)	(-5.668)
Herf. index	-1.728	-0.403	-40.846***	-40.846*	-5.636	-5.822	-8.352	-8.352
	(-0.245)	(-0.056)	(-3.871)	(-1.827)	(-0.960)	(-0.935)	(-1.411)	(-1.281)
Plurality	-16.078***	-17.365***	-1.788	-1.788				
	(-3.188)	(-3.268)	(-0.640)	(-0.207)				
President	-22.470**	-23.021*	-24.433***	-24.433				
	(-1.969)	(-1.892)	(-4.083)	(-1.533)				
Federation	-27.494***	-27.503***	-44.445***	-44.445***				
	(-6.759)	(-6.654)	(-10.005)	(-2.621)				
Ideology	0.633	1.146	-0.662	-0.662	1.170*	1.070	0.856	0.856
	(0.778)	(0.893)	(-0.272)	(-0.158)	(1.697)	(0.962)	(0.750)	(0.475)
Rev. dec.	1.428***	1.494***	0.897***	0.897	1.290***	1.280***	1.062***	1.062
	(5.386)	(4.936)	(2.980)	(1.051)	(4.122)	(3.897)	(3.400)	(1.612)
Rev. dec. × Ideology		-0.027	0.221**	0.221		0.005	0.020	0.020
		(-0.544)	(2.272)	(1.100)		(0.105)	(0.398)	(0.229)
Year effects	No	No	Yes	Yes	No	No	Yes	Yes
N	322	322	322	322	322	322	322	322
F / χ^2	356.071	386.003	801.766	254.894	43.190	40.626	19.348	22.961
R^2	0.215	0.200	0.542	0.542	0.593	0.593	0.641	0.641
RMS error	10.227	10.123	23.848	23.848	9.368	9.383	9.106	9.106

[1] Hypothesis tests are based on heteroscedasticity robust standard errors
[2] Clustered standard errors are used in models RE 4 and FE 4
[3] Stars indicate significance levels at 10% (*), 5% (**) and 1%(***)
[4] t-statistics in parentheses
[5] Model significance in RE models is evaluated with Wald-χ^2-test, in FE models with F-test

4.3.2   Robustness of the results

Since both the expenditure and the revenue decentralization measures are constructed with fiscal variables, it is conceivable that both are simultaneously determined with the size of government since the latter is also a fiscal variable. Hence, the previous results might be biased because both the expenditure and revenue decentralization measures and their interactions with the *Ideology* variable might be endogenous. We therefore re-evaluate the results in this section with an instrumental variable approach.

We use as excluded instruments for the decentralization variables and their interactions with the *Ideology* variable an urbanity index and two additional instrumental variables which are constructed according to a procedure recommended by Wooldridge (2002). In this procedure, the endogenous decentralization variables are linearly projected into the space spanned by the (in- and excluded) instruments.[10] The linear projections are then interacted with the *Ideology* variable, which results in a non-linear transformation of the linear prediction. These non-linear transformations can then be used as additional instruments since they are solely based on exogenous variables.[11] By applying this procedure, we obtain for each model altogether three excluded instruments for two potentially endogenous regressors (i.e. the decentralization variables and their interactions with the *Ideology* variable). Since we have therefore at least on overidentifying restriction for each model, we can calculate diagnostic statistics to confirm the validity of the set of instruments.

The results from the instrumental variable regressions are collected in table 4.4. For the sake of brevity, we only report the results from the fixed effects regressions for both decentralization variables. Note that the instruments generally perform well. The over-identification test (Hansen J) suggests that they are valid. The relevance test generally indicates that the instruments are not weak.

With regard to expenditure decentralization, the conclusions from the baseline models are confirmed. The interaction variable is consistently positive and at least at the 10% level significant in models FE 3 and FE 4. Thus, we conclude that *Hypothesis A* is unambiguously confirmed for expenditure decentralization by this robustness check.

With regard to revenue decentralization, the estimates are similar to those in the baseline models. The interaction variable is consistently positive, albeit insignificant. Note however that the t-statistics on the interaction variable are larger than in the baseline models. Thus, these regressions seem to provide somewhat more support for *Hypothesis A* than the baseline models, even though it remains relatively weak.

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[10]Which also include the cross-section and time fixed effects.

[11]See Wooldridge (2002) for further details.

Table 4.4: Impact of expenditure and revenue decentralization on size of government, 1980-2000, Fixed Effects models with instrumental variables

	Expenditure Decentralization				Revenue Decentralization			
	FE 1 b/t	FE 2 b/t	FE 3 b/t	FE 4 b/t	FE 1 b/t	FE 2 b/t	FE 3 b/t	FE 4 b/t
Population	52.730***	44.883**	18.118	18.118	36.440	33.155	34.694	34.694
	(2.657)	(2.069)	(0.640)	(0.395)	(1.307)	(1.125)	(1.304)	(0.426)
Working	-6.644***	-7.799***	-9.396**	-9.396	-4.030***	-4.213***	-3.368**	-3.368
	(-3.358)	(-3.150)	(-2.415)	(-1.150)	(-3.510)	(-3.609)	(-2.308)	(-0.924)
Pop. density	-0.075	0.041	-0.256	-0.256	-0.967***	-0.952***	-1.182***	-1.182**
	(-0.239)	(0.107)	(-0.554)	(-0.337)	(-3.232)	(-2.983)	(-4.350)	(-2.170)
GDP p. c.	-0.000	-0.000	-0.003***	-0.003*	-0.000	0.000	-0.001	-0.001
	(-1.006)	(-0.677)	(-2.715)	(-1.667)	(-0.069)	(0.061)	(-1.229)	(-0.527)
Unemployment	6.347***	6.727***	5.499***	5.499**	4.138***	4.133***	3.741***	3.741***
	(8.848)	(8.069)	(5.315)	(2.281)	(10.426)	(10.026)	(6.438)	(3.013)
Openness	-0.759***	-0.769***	-0.717***	-0.717**	-0.720***	-0.734***	-0.849***	-0.849***
	(-6.668)	(-6.351)	(-3.580)	(-2.048)	(-6.790)	(-6.630)	(-5.800)	(-4.050)
Herf. index	-4.896	-9.312	-11.661	-11.661	-17.434**	-21.434**	-20.029***	-20.029*
	(-0.680)	(-1.195)	(-1.546)	(-1.099)	(-2.363)	(-2.440)	(-2.717)	(-1.674)
Ideology	-0.564	-4.775	-5.020	-5.020	2.105**	0.675	0.422	0.422
	(-0.512)	(-1.494)	(-1.580)	(-1.603)	(2.353)	(0.410)	(0.301)	(0.216)
Exp. dec.	4.144***	4.641***	4.697**	4.697				
	(3.274)	(3.086)	(2.375)	(1.162)				
Exp. dec. × Ideology		0.118	0.120*	0.120**				
		(1.577)	(1.686)	(2.279)				
Rev. dec.					6.189***	6.525***	5.077***	5.077
					(3.808)	(3.739)	(3.082)	(1.352)
Rev. dec. × Ideology						0.078	0.079	0.079
						(0.943)	(1.161)	(0.803)
Year effects	No	No	Yes	Yes	No	No	Yes	Yes
N	322	322	322	322	322	322	322	322
F	25.879	20.282	13.324	22.835	23.540	19.219	23.609	17.041
RMS error	12.406	13.759	13.333	13.333	12.916	13.538	11.506	11.506
Overid. test	0.083	0.215	0.123	0.333	0.244	0.221	0.066	0.165
I. relevance test	0.000	0.000	0.009	0.384	0.000	0.000	0.000	0.218

[1] Hypothesis tests are based on heteroscedasticity robust standard errors
[2] Clustered standard errors are used in models FE 4
[3] Stars indicate significance levels at 10% (*), 5% (**) and 1%(***)
[4] t-statistics in parentheses

4.4 Conclusion

In this chapter, we have tested the implications of the theoretical model developed in chapter 3. We indeed find some evidence in favor of the theory. We may thus conclude that fiscal decentralization *is* an important determinant of government size, but that its impact is not unambiguous. The simple linear Leviathan Hypothesis by Brennan and Buchanan is found to be too broad to be approved in an empirical test. When the details of the political environment are considered, we find that we can trace some of its implications in the data. That is, decentralization indeed seems to lead to a smaller public sector when a right-wing government rules the center.

However, we should be careful in reaching normative conclusions on the basis of this result. The Leviathan Hypothesis is based on a rather controversial view of government. The underlying assumption of the hypothesis is that government intervention is "bad" and that small government is therefore always desirable. In contrast, both "too large" *and* "too small" governments should be avoided in our framework. That right-wing administrations seem to be associated with smaller government does therefore not imply that they are better. It only implies that they are different.

Appendix A

Since GDP appears as the denominator of the dependent variable and through the *GDP per capita* variable also in the set of explanatory variables, estimates and hypothesis tests could be inaccurate. In this appendix, we investigate whether our results with regard to *Hypothesis A* are affected by this problem with two different strategies. First, we simply estimate equation 4.1 without including the GDP per capita variable in the set of explanatory variable. Secondly, we estimate models where we do not scale expenditures by GDP but instead specify as dependent variable the log of total (nominal) expenditures, and include as additional independent variables the GDP deflator (to take account of the fact that expenditures are given in nominal terms) and the level of GDP. In both cases, we use the instrumental variables approach.

Results for the first strategy are provided in table 4.5, for the second strategy in table 4.6. For brevity, only the results for the variables of interest are reported. With regard to the first strategy, we see from table 4.5 that dropping *GDP. p. c* from the set of regressors does not lead to different conclusions with regard to the interaction variables.

With regard to the second strategy, we see in table 4.6 that using total expenditures as the dependent variable leaves the sign of the estimated coefficients on the interaction variables positive, and thus in accordance with the hypothesis. However, note that expenditure decentralization is generally insignificant while revenue decentralization is only significant in model FE 3. Nonetheless, this does not contradict the main hypothesis.

Overall, we may conclude that these estimates reaffirm the previous findings with regard to *Hypothesis A*.

Table 4.5: IMPACT OF EXPENDITURE AND REVENUE DECENTRALIZATION ON SIZE OF GOVERNMENT, 1980-2000, FIXED EFFECTS MODELS WITH INSTRUMENTAL VARIABLES, WITHOUT GDP P. C. AS CONTROL VARIABLE

	Expenditure Decentralization				Revenue Decentralization			
	FE 1 b/t	FE 2 b/t	FE 3 b/t	FE 4 b/t	FE 1 b/t	FE 2 b/t	FE 3 b/t	FE 4 b/t
Exp. dec. × Ideology		0.121*	0.117*	0.117**				
		(1.692)	(1.855)	(2.296)				
Rev. dec. × Ideology						0.087	0.079	0.079
						(1.024)	(1.173)	(0.790)
Year effects	No	No	Yes	Yes	No	No	Yes	Yes
N	322	322	322	322	322	322	322	322
F	30.973	23.179	18.753	25.244	25.985	20.257	24.859	17.799
RMS error	11.833	13.439	12.242	12.242	13.109	14.028	11.406	11.406
Overid. test	0.050	0.200	0.078	0.266	0.280	0.259	0.048	0.155
I. relevance test	0.000	0.001	0.010	0.417	0.001	0.000	0.001	0.290

[1] Hypothesis tests are based on heteroscedasticity robust standard errors
[2] Clustered standard errors are used in models FE 4
[3] Stars indicate significance levels at 10% (*), 5% (**) and 1%(***)
[4] t-statistics in parentheses

Table 4.6: IMPACT OF EXPENDITURE AND REVENUE DECENTRALIZATION ON SIZE OF GOVERNMENT, 1980-2000, FIXED EFFECTS MODELS WITH INSTRUMENTAL VARIABLES, DEPENDENT VARIABLE: (LOG OF) TOTAL GOVERNMENT EXPENDITURES

	Expenditure Decentralization				Revenue Decentralization			
	FE 1 b/t	FE 2 b/t	FE 3 b/t	FE 4 b/t	FE 1 b/t	FE 2 b/t	FE 3 b/t	FE 4 b/t
Exp. dec. × Ideology		0.040	0.036	0.036				
		(1.264)	(1.172)	(0.899)				
Rev. dec. × Ideology						0.055	0.068*	0.068
						(1.464)	(1.825)	(1.359)
Year effects	No	No	Yes	Yes	No	No	Yes	Yes
N	322	322	322	322	322	322	322	322
F	665.829	510.140	36.944	37.894	627.862	508.632	43.715	12.068
RMS error	5.726	6.392	6.389	6.389	6.041	6.422	6.477	6.477
Overid. test	0.105	0.162	0.042	0.265	0.137	0.220	0.569	0.697
I. relevance test	0.003	0.040	0.001	0.252	0.022	0.008	0.024	0.622

[1] Hypothesis tests are based on heteroscedasticity robust standard errors
[2] Clustered standard errors are used in models FE 4
[3] Stars indicate significance levels at 10% (*), 5% (**) and 1%(***)
[4] t-statistics in parentheses

Appendix B

In this appendix, we reestimate the fixed effects models in table 4.2 and 4.3 (except the one with clustered standard errors) with the fixed effects vector decomposition approach developed by Pluemper and Troeger (2007). The fixed effects vector decomposition method has the advantage that it facilitates the estimation of fixed effects models with time-invariant variables. Pluemper and Troeger (2007) also show in Monte-Carlo simulations that it leads to more reliable estimates for variables that display relatively little time variation, such as the decentralization variables, due to increases in efficiency.

In the regressions, we treat the decentralization variables and their interactions with the ideology variables as rarely changing variables.[12] The results are collected in table 4.7. We find that the interaction variables are positive both for expenditure and revenue decentralization. However, note that the interaction between revenue decentralization and the ideology variable is now also significant. Overall, these estimates reaffirm our previous results, and thus support *Hypothesis A*.

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[12]We do not include the time invariant variables that are routinely included in the random effects models. Since their inclusion increases the likelihood of inconsistent estimates, there is no advantage in including them in these models since we are not particularly interested in them.

Table 4.7: IMPACT OF EXPENDITURE DECENTRALIZATION ON SIZE OF GOVERNMENT, 1980-2000, FIXED EFFECTS VECTOR DECOMPOSITION

	Exp. decentralization			Rev. decentralization		
	FE 1 b/t	FE 2 b/t	FE 3 b/t	FE 1 b/t	FE 2 b/t	FE 3 b/t
Population	74.360***	73.023***	61.830***	71.711***	71.724***	63.673***
	(39.533)	(38.667)	(36.045)	(38.579)	(38.044)	(36.975)
Working	-2.523***	-2.599***	-1.707***	-1.836***	-1.834***	-0.828**
	(-7.265)	(-7.415)	(-4.562)	(-5.001)	(-4.856)	(-2.067)
Pop. density	-0.593***	-0.598***	-0.970***	-0.796***	-0.794***	-1.114***
	(-37.302)	(-36.793)	(-43.406)	(-38.304)	(-38.078)	(-42.568)
GDP p. c.	-0.000***	-0.000**	-0.003***	-0.000**	-0.000**	-0.002***
	(-2.734)	(-2.347)	(-11.006)	(-2.249)	(-2.230)	(-10.594)
Unemployment	4.949***	4.969***	4.059***	4.441***	4.442***	3.764***
	(24.874)	(24.914)	(17.439)	(22.672)	(22.403)	(16.724)
Openness	-0.762***	-0.767***	-0.962***	-0.754***	-0.755***	-0.963***
	(-17.774)	(-17.583)	(-20.859)	(-17.777)	(-16.838)	(-20.306)
Herf. index	-3.086	-5.173*	-8.049***	-5.636**	-5.822**	-8.352***
	(-1.117)	(-1.872)	(-2.882)	(-2.058)	(-2.108)	(-3.045)
Ideology	0.574	-1.491	-1.729	1.170***	1.070	0.856
	(1.403)	(-1.256)	(-1.471)	(2.813)	(1.061)	(0.860)
Exp. dec.	-2.380***	-3.206***	-4.192***			
	(-31.466)	(-28.035)	(-32.226)			
Exp. dec. × Ideology		0.408***	0.213***			
		(12.445)	(6.785)			
Rev. dec.				-4.895***	-5.488***	-6.285***
				(-38.541)	(-35.455)	(-37.690)
Rev. dec. × Ideology					0.427***	0.132***
					(10.345)	(3.255)
Year effects	No	No	Yes	No	No	Yes
N	322	322	322	322	322	322
F	359.457	329.246	124.358	356.161	322.697	122.272
R^2	0.924	0.925	0.934	0.924	0.924	0.933
RMS error	9.182	9.136	8.589	9.221	9.221	8.657

[1] Stars indicate significance levels at 10% (*), 5% (**) and 1%(***)
[2] t-statistics in parentheses
[3] Model significance evaluated with F-test
[4] The estimate for the second stage error term (eta) is not shown

Appendix C

Table 4.8: SUMMARY STATISTICS OF VARIABLES (SAMPLE AVERAGE), BY COUNTRIES

Country	Gov. size	Population	Working Population	Pop. density	GDP p. c.	Unemploy- ment	Openness	Herf. index	Plurality	President	Federation	Ideology	Exp. dec.	Rev. dec.
AUS	36.56	16855	66.37	2.11	21788.02	8.00	34.78	0.88	1	0	1	3.60	48.54	28.79
AUT	53.08	7775	67.02	92.13	23068.53	4.21	71.69	0.65	0	0	1	3.50	31.29	26.75
BEL	55.08	9979	66.59	324.50	21947.14	8.91	132.78	0.28	0	0	0.32	2.32	12.35	5.78
CAN	46.86	27607	68.05	2.71	23293.68	9.35	60.97	1	2	0	1	1.00	58.66	52.52
CHE	34.76	7025	67.76	170.20	29746.53	3.35	72.24	0.26	0	1	1	2.00	49.79	43.66
DNK	56.59	5182	66.74	119.74	23426.63	6.55	72.03	0.54	0	0	0	2.57	55.27	31.60
ESP	41.90	38695	65.88	76.00	15489.19	15.00	38.87	0.99	0	0	0	4.06	25.88	15.12
FIN	50.94	4975	67.43	14.60	19907.19	8.85	57.39	0.35	0	1	0	2.63	42.29	31.24
FRA	51.18	56204	65.38	101.15	20494.75	8.64	44.39	0.67	1	1	0	3.00	19.83	12.03
GBR	44.85	57187	65.02	234.53	19728.29	9.21	52.72	1	2	0	0	1.32	27.94	12.51
GER	46.50	69907	68.72	221.67	20945.98	7.15	48.41	0.55	0	0	1	1.47	39.07	34.72
IRL	48.04	3536	61.37	49.88	14929.96	14.24	115.07	0.74	0	0	0	1.89	27.22	8.16
ITA	50.23	56803	69.04	188.86	21893.83	10.54	42.23	0.71	0.44	0	0	2.67	23.37	8.92
NLD	55.48	14851	68.22	353.63	21911.97	7.30	110.93	0.51	0	0	0	2.06	30.25	7.81
NOR	49.37	4250	64.34	10.93	27404.58	3.79	73.25	0.74	0	0	0	3.40	37.13	21.50
PRT	42.15	9902	67.32	108.78	13636.24	5.84	64.11	1	0	0	0	1.83	10.84	7.14
SWE	62.74	8562	64.18	18.92	22526.84	4.36	65.64	0.73	0	0	0	3.85	38.68	32.05
USA	36.29	252249	65.96	26.14	27783.72	6.40	20.85	1	2	1	1	1.00	42.94	40.62

[1] The plurality rule variable index for Italy is not an integer because of a reform in 1994. This reform moved Italy more in the direction of plurality rule

[2] The federation dummy for Belgium is not binary because Belgium moved from being a unitary country to a federal constitution in 1993

[3] Summary statistics for the *Gov. size* and *Population* variables are calculated for the levels and not the transformed variables for easier interpretability

[4] For Germany before 1991, only data from the western part is used

Part III

Fiscal decentralization and public borrowing

Chapter 5

Explaining government borrowing: Some theoretical considerations

5.1 Introduction

The convergence criteria laid out in the Maastricht Treaty and clarified in the Stability and Growth Pact stipulate, inter alia, that the member states of the European Economic and Monetary Union (EMU) should achieve balanced budgets over the business cycle, and avoid excessively high levels of debt. Compliance with these provisions is undoubtedly a difficult task for all EMU member states, but countries where subnational units possess independent fiscal authority are bound to experience additional difficulties if intergovernmental transfer schemes are ill-designed and central coordination is weak. This problem was quickly recognized by a number of decentralized states, inducing them to supplement the European Stability Pact with national regulations on how different tiers of government may formulate their fiscal policies (Joumard and Kongsrud, 2003; Vallés and Zárate, 2007). It is, however, questionable whether these pacts will be effective.

A large body of literature suggests that prevailing systems of intergovernmental fiscal relations might create "undesirable" incentives on the part of subnational politicians. That is, extensive revenue sharing arrangements and intergovernmental transfer schemes could lead to a wedge between subnational expenditures and "own" revenues (in the following simply referred to as *fiscal imbalances*) and may thus cause unsustainable and inefficient fiscal policies (Rodden, 2003; Blankart and Klaiber, 2006).[1]

The main objective in this chapter is therefore to provide a comprehensive theoretical analysis of the impact of intergovernmental transfer schemes on the fiscal policy of subnational governments. For concreteness, we will use a framework that resembles the system of fiscal federalism in Germany. In the next chapter, we will then "test" some of the propositions derived in the theoretical analysis with subnational data from Germany.

The basic version of the model describes how borrowing is determined when subnational jurisdictions are completely autonomous in their fiscal decisions. This solution will serve as a benchmark

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[1] The recent South American debt crises, for example, have been largely ascribed to subnational borrowing caused by ill-designed equalization and tax sharing systems (Dillinger, 2001).

when two variations of the model are discussed, one pertaining to equalization schemes and the other to federal bailouts.

The first variation investigates the impact of institutionalized horizontal and vertical transfers on subnational borrowing. In Germany, however, both horizontal and vertical transfers and the tax sharing arrangement tend to redistribute resources from fiscally strong to fiscally weak jurisdictions, implying that even though these types of intergovernmental fiscal flows are formally distinct, they have the same effect. It is therefore unnecessary to explicitly distinguish between both. Since the ultimate aim of these transfers is the horizontal equalization of resources, they are subsumed in the model under the general notion of a horizontal equalization scheme.

In a second variation, the possibility of federal bailouts is introduced. The main aim here is to investigate the impact of the idiosyncratic characteristics of subnational jurisdictions on their incentives to exploit *existing* soft budget constraints.

The model takes the tax smoothing argument for public borrowing into account but neglects political economy explanations because they would be a distraction from the primary intention of this model – which is to describe the impact of fiscal institutions such as horizontal equalization schemes and bailout expectations on public borrowing. The model builds in particular upon Homburg (1994) who analyzes theoretically the impact of the intergovernmental transfer scheme in Germany on fiscal outcomes.[2] However, he considers the impact of jurisdictional asymmetries only in passing. He argues, for example, that the possibility of a bailout will increase deficits particularly in small jurisdictions, but does so rather informally. One of our main contributions in this chapter is therefore that such informal arguments are explicitly derived in a comprehensive framework.

5.2 The model

5.2.1 Production

Assume a federation with N jurisdictions (N is large). The time horizon of all agents in the model is two periods. Each jurisdiction $i = \{1, ..., N\}$ is inhabited by $\overline{L}_i > 1$ immobile and identical citizens who each supply *inelastically* one unit of labor. They also supply one unit of capital which is, in contrast to labor, assumed to be mobile.

A regional industry uses both factors to produce some region-specific output good. The production function is identical in all jurisdictions, but the price of the output good is assumed to vary exogenously between regions and periods. This assumption is reasonable when the output of the regional industry is small compared to world supply, making the region a price taker. In the German context, one notable example for such an industry is coal and steel production in Saarland. This industry is (still) highly important for regional employment, and its viability depends on developments on the world market for its products.

The profit function of the industry in jurisdiction i in period t is given by

$$\Pi_t = p_t \Big[a \log(K_t) + b \log(L_t)\Big] - r_t K_t - w_t L_t, \tag{5.1}$$

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[2]Another related paper is Homburg (1993) which analyzes the effects of horizontal transfers on regional factor productivity.

where p_t denotes the price of the output good, $F(K, L) = a \log(K_t) + b \log(L_t)$ a logarithmic production function[3], w_t the wage rate, r_t the interest rate, L_t employed labor and K_t employed capital. The $t = 1, 2$ index denotes the time-period whereas the cross-section index i has been suppressed in order to ease the notation. We assume in the following that employed capital and labor are always larger than unity in equilibrium (that is $K_t > 1$ and $L_t > 1$) in order ensure a positive output.[4]

A number of assumptions are made in order to ensure that the underlying framework of the model mirrors the prevailing economic reality in Germany. Firstly, wages are assumed to be exogenously fixed throughout the federation and between periods, that is $w_t = \overline{w}$. A regionally fixed wage rate is a reasonable assumption for Germany given the fact that real wage differences are almost absent between East and West-German States despite large productivity differentials (Roos, 2006). The assumption of an exogenous wage rate further implies that labor demand cannot be equated with supply by adjustments in equilibrium wages. As a consequence, employed labor L_t may not equal labor supply $\overline{L}$, and unemployment might ensue. Since regionally varying levels of unemployment are an empirical fact in Germany, this modeling strategy seems to be reasonable.

Because capital is completely mobile, an exogenous interest rate which is determined by the world market for capital has to be paid by the industry, i.e. $r_t = \overline{r}$. Obviously, the interest rate is the same in all subnational jurisdictions. We also assume that it does not change between periods.

The price of the output good in both periods is the sum of a deterministic parameter $p_0 > 0$ and an idiosyncratic demand shock ϵ_t, that is

$$p_t = p_0 + \epsilon_t,$$

where $p_0 > |\epsilon_t|$ is imposed in order to ensure a positive price in both periods.

The idiosyncratic shocks in $t = 1, 2$ are assumed to follow a bivariate normal distribution with a correlation coefficient $1 \geq \rho \geq 0$ (the shocks are weakly positively correlated), an unconditional mean of $\mu_1 = \mu_2 = 0$ and standard deviations $\sigma_1 = \sigma_2 = \sigma$.[5]

For convenience, a higher value of ϵ_t is in the following referred to as higher productivity and vice versa.[6] Since this chapter is concerned with subnational borrowing, it is further assumed for concreteness that $\epsilon_1 < 0$. Thus, the jurisdiction under consideration faces a negative price shock in the first period and will therefore have an incentive to smooth consumption by borrowing. Conclusions with respect to $\epsilon_1 \geq 0$ follow by a symmetrical argument.

The properties of the bivariate normal distribution imply that the conditional expectation of the shock in period 2 is a linear function of the shock in period 1. Thus, using the fact that

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[3]This particular production function deserves some explanation as it implicitly assumes that the marginal products of labor and capital do not depend upon each other, which is in contradiction to otherwise widely used parametric production functions such as the Cobb-Douglas or the CES function. The reason for this rather strong assumption is technical. In order to obtain a unique solution for the problem of the industry, it must be assumed that the production function displays decreasing returns to scale (because of an unmodeled third production factor such as land, for example). Secondly, we prefer to obtain an explicit solution for factor demand in order to keep the analysis further below tractable. Both requirements are most easily achieved by using the above production function.

[4]This assumption effectively imposes the following restrictions on the parameters: $p_t a / r_t > 1$ and $p_t b / w_t > 1$.

[5]That is: $(\epsilon_1 \ \epsilon_2) \sim N(\mu, \boldsymbol{\Sigma})$ with $\mu = (0 \ 0)$ and $\boldsymbol{\Sigma} = \begin{pmatrix} \sigma^2 & \rho\sigma^2 \\ \rho\sigma^2 & \sigma^2 \end{pmatrix}$.

[6]A larger shock implies a higher price for one unit of output. One unit of labor and/or capital employed in a jurisdiction with a large value of ϵ_t is therefore "worth" more. In this sense, ϵ_t is a proxy for productivity.

$E(\epsilon_1) = \mu_1 = 0$ and $\sigma_1 = \sigma_2 = \sigma$, the expected price of the output good in $t = 2$ conditional on the price in period 1 is

$$p_2^e \equiv E(p_2|p_1) = p_0 + \rho\epsilon_1.$$

Since ρ is assumed to be weakly positive, there is some degree of continuity in the level of productivity in the jurisdiction.

Maximizing equation 5.1 with regard to L_t gives labor demand in period t. Since a logarithmic production function implies that labor demand is a linear function in the price of the output good, it is given by

$$L_t = (b/\overline{w})p_t = (b/\overline{w})p_0 + (b/\overline{w})\epsilon_t. \tag{5.2}$$

Labor demand in t is therefore a normally distributed random variable with expected value $E(L_t) = (b/\overline{w})p_0$ and variance $V(L_t) = (b/\overline{w})^2\sigma^2$.

For later use, the expected labor demand in period 2 conditional on labor demand in period 1 is also derived, it is given by

$$L_2^e \equiv E(L_2|L_1) = (b/\overline{w})p_0 + \rho(b/\overline{w})\epsilon_1. \tag{5.3}$$

5.2.2 Benchmark consumption

On the consumption side of the economy, citizens consume in both periods a private good x and a publicly provided good g. When there is no ambiguity, however, the publicly provided good will be referred to as public good, or alternatively as public consumption. The marginal rate of transformation between both goods is assumed to be unity, which implies that one unit of the private good has to be forgone in order to acquire one unit of the public good and vice versa.

The *regionally benevolent*[7] and *risk-neutral* subnational government taxes income in order to finance the provision of the public good. Since capital supply is completely elastic while labor supply is inelastic, the incidence of any factor taxes will be on labor. In order to simplify the exposition, therefore, it is assumed without loss of generality that only labor income is taxed.

In order to obtain a benchmark solution, the jurisdiction is initially treated as a completely independent fiscal entity. Under this assumption, it may choose tax rates and levels of debt autonomously, and none of its collected revenues have to be shared or forgone because of intergovernmental equalization schemes.

The problem of such a fiscally independent, benevolent and risk-neutral jurisdiction is captured by the following objective function:

$$\max_{\tau,\Delta} W = x_1 + x_2 + v(\underbrace{G_1/\overline{L}^\alpha}_{g_1}) + v(\underbrace{G_2/\overline{L}^\alpha}_{g_2}), \tag{5.4}$$

---

[7]That is, the subnational government is interested in maximizing the utility of the inhabitants in its jurisdiction but neglects the utility of inhabitants in other jurisdictions.

$$\text{with} \quad G_1 = \tau\overline{w}L_1 + \Delta,$$

$$G_2 = \tau\overline{w}L_2^e - \Delta$$

$$x_t = \overline{r} + \overline{w}(1-\tau)(L_t/\overline{L}), \quad t = 1, 2.$$

In this formulation, utility is modeled as a quasi-linear function of per-capita consumption of private and public goods. The non-linear part of the function, $v(.)$, exhibits the usual neoclassical properties, in particular $v_g > 0$ and $v_{gg} < 0$. That is, it is increasing and concave. The subnational government maximizes the utility of a representative consumer. Because all inhabitants are identical, this is equivalent to maximizing aggregate welfare.

The tax rate is denoted with τ, and is obviously constrained to be the same in both periods. This is a reasonable restriction if the time-periods are relatively close to each other, making major reforms of the tax code impractical.[8]

Being risk-neutral, the government treats its expected labor demand in period 2 as actual labor demand when making its fiscal decisions. Thus $L_2 = L_2^e$ holds from the jurisdiction's perspective. This is a reasonable assumption since real-world parliaments usually adopt the budget for the coming period based on projections about future revenues and expenditures that rely on current economic conditions.

Total resources for private consumption are given by total labor income minus wage taxes $L_t\overline{w}(1-\tau)$[9], and total capital income $r\overline{L}$[10]. Per-capita private consumption in period t, which is denoted with x_t, is then given by dividing total resources for private consumption by $\overline{L}$, the number of inhabitants living in the jurisdiction, i.e. $x_t = \overline{r} + \overline{w}(1-\tau)(L_t/\overline{L})$.

The total amount of the public good in period t is denoted by G_t, but no assumption is made about whether it is a pure public good (per-capita consumption is equal to total consumption) or whether it is a publicly provided *private* good (per-capita consumption is given by the total amount of public goods divided by the number of inhabitants). In order to capture intermediate cases, per-capita public good consumption is modeled by $g_t = G_t/\overline{L}^\alpha$, where the parameter $\alpha \in [0,1]$ describes the nature of the publicly provided good. When $\alpha = 0$, there is no rivalry in consumption and thus the good is a pure public good, when $\alpha = 1$ the good is a publicly provided private good.

The provision of the public good in period 1 is financed either with tax revenues or with debt Δ. Debt acquired in period 1 has to be paid back in period 2.[11] There is no discounting of future consumption and no interest on government bonds. This assumption does not drive our results and is only made in order to reduce the notational complexity.[12] Alternatively, it may be assumed that the time-preference parameter of the representative consumer equals the interest rate. Period

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[8]Furthermore, there is also a technical reason for constraining tax rates to be time-invariant. Assuming time-varying tax rates leaves them indeterminate in optimum when the jurisdiction has also the ability to borrow. Maximizing equation 5.4 involves fulfilling two independent first order conditions, but since time-varying tax rates and the ability to borrow bestow three independent decision variables to the government, at least one would be superfluous.

[9]Since labor is supplied inelastically, there are no disincentive-effects of labor taxation.

[10]Each inhabitant supplies in both periods one unit of capital which pays an interest rate of r, and there are $\overline{L}$ inhabitants.

[11]Alternatively, the jurisdiction may save in period 1 (acquire a negative debt) and thus consume more in period 2. In order to avoid tedious qualifications, however, only the case of positive period 1 debt will be illustrated. For this to be valid, $\epsilon_1 < 0$ must hold, which has been assumed above.

[12]It does, however, imply that the interest rate paid by the regional industry is a compensation for the relative riskiness of the industry's operations compared to government bonds.

1 per-capita public consumption is therefore given by $g_1 = G_1/\overline{L}^\alpha = (\tau\overline{w}L_1 + \Delta)/\overline{L}^\alpha$, and period 2 per-capita public consumption by $g_2 = G_2/\overline{L}^\alpha = (\tau\overline{w}L_2^e - \Delta)/\overline{L}^\alpha$.

Maximizing equation 5.4 involves the choice of the optimal tax rate τ^* and optimal debt Δ^*. Differentiating the objective function in equation 5.4 with regard to Δ gives as one first order condition

$$v_{g_1} = v_{g_2}. \tag{5.5}$$

This first order condition obviously implies that public consumption should be smoothed between period 1 and 2, that is $g_1^* = g_2^* \equiv g^*$ should hold in optimum. Debt should therefore be chosen in order to equalize fiscal resources between both periods, and is given by[13]

$$\Delta^* = \frac{1}{2}\tau^*\overline{w}(L_2^e - L_1). \tag{5.6}$$

Substituting this solution for optimal debt into the expressions for public good consumption in equation 5.4, and maximizing this equation with regard to τ gives as first order condition for determining the optimal tax rate

$$(1/2)v_{g_1} + (1/2)v_{g_2} = (\overline{L}^\alpha/\overline{L}). \tag{5.7}$$

By using equation 5.5, which determines the marginal utilities of period 1 and period 2 public consumption in optimum, this condition can be further simplified to

$$v_g = \frac{\overline{L}^\alpha}{\overline{L}}, \tag{5.8}$$

with $v_g \equiv v_{g_1} = v_{g_2}$. This equation defines the implicit solution for the optimal tax rate τ^*. Obviously, the nature of the public good is important for the solution. For example, if $\alpha = 0$, g is a pure public good, and the first order condition simplifies to $v_g = (1/\overline{L})$. Since the marginal utility of public consumption for the representative consumer should be relatively low, the optimal tax rate should be high. Conversely, if $\alpha = 1$, g is a publicly provided private good. The first order condition simplifies to $v_g = 1 > (1/\overline{L})$. Because there is rivalry in consumption, the marginal utility of public consumption should be relatively high in optimum and thus the tax rate relatively low. Intermediate solutions are obtained for $0 < \alpha < 1$.

Even though discussing the sensitivity of the solution to the characteristics of g is enlightening, the main focus in this chapter are the comparative statics with regard to regional characteristics. The following proposition is therefore derived.

Proposition 5.1 *i) Jurisdictions which are more productive in period 1 choose lower tax rates. ii) More productive jurisdictions choose lower levels of debt as long as shocks are positively but not perfectly correlated between periods.*

Proof See appendix.

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[13]The following equation can be further simplified to $\Delta^* = \frac{1}{2}\tau^*\overline{w}(L_2^e - L_1) = \frac{1}{2}\tau^*(\rho - 1)b\epsilon_1$ by using the expressions for labor demand in equation 5.2 and 5.3. This formulation reinforces the consumption-smoothing rationale for borrowing by revealing that Δ^* will only be positive if $\rho < 1$, that is when there is no perfect correlation between the shocks. Furthermore, the weaker the correlation, the higher is the level of debt.

This proposition is proved in the appendix, but its intuition is straightforward. Since the utility function is quasi-linear, a fixed amount of resources (which is independent of the value of the productivity shock ϵ_1) should be optimally allocated to public consumption. But because more productive jurisdictions have a larger tax base in period 1, they are able to collect the optimal amount of resources with a lower tax rate. Since the tax rate chosen in view of the shock in period 1 is constrained to be time-invariant, expected tax revenues in period 2 tend to be lower as well. This then reduces available resources that can be reallocated from period 2 to 1 through borrowing.

The solution described in equation 5.6 and 5.8 is defined as the benchmark. In the next two subsections, two variations to this basic model are studied, one pertaining to the introduction of a horizontal equalization scheme and a second one dealing with bailout expectations and soft budget constraints. The ultimate goal of these variations is to explore the impact of these institutional features on subnational incentives to acquire debt.

5.2.3 Subnational borrowing and horizontal equalization

Does the introduction of a horizontal equalization scheme change the incentives of subnational governments? In order to answer this question, the essential features of such schemes have to be modeled. Furthermore, any model of the fiscal constitution in Germany should incorporate the absence of subnational tax autonomy. The problem of a subnational government can therefore be formulated in the following way

$$\max_{c, \Delta} W = x_1 + x_2 + v(\underbrace{G_1/\overline{L}^\alpha}_{g_1}) + v(\underbrace{G_2/\overline{L}^\alpha}_{g_2}), \tag{5.9}$$

$$\text{with} \quad G_1 = c(1-\gamma)\overline{\tau}\,\overline{w}L_1 + \phi + \Delta,$$

$$G_2 = c(1-\gamma)\overline{\tau}\,\overline{w}L_2^e + \phi - \Delta$$

$$x_t = \overline{r} + \overline{w}(1 - c\overline{\tau})(L_t/\overline{L}), \quad t = 1, 2.$$

This formulation differs from that in the benchmark case (see equation 5.4) in three ways. Firstly, the tax rate τ is exogenously fixed at $\overline{\tau}$ and therefore ceases to be an independent fiscal instrument. Secondly, a variable $c \geq 0$ is introduced in order to denote the tax collection effort of the subnational government. The introduction of this variable is motivated by the fact that if subnational governments are tasked with the collection of tax revenues – as they indeed are in Germany –, they may decide to conduct only casual tax audits (Wurzel, 1999). Thus, their ability to choose the tax collection effort gives them some degree of indirect leverage on the tax burden within their jurisdiction.

Thirdly, a horizontal equalization scheme is incorporated into the model. The exogenous parameter $0 \leq \gamma \leq 1$ denotes the share of revenues that have to be forgone because of the horizontal equalization scheme, whereas ϕ denotes a lump-sum per-capita transfer that is time-invariant and

the same for all jurisdictions.[14] This combination of a proportional "tax" and a lump-sum transfer is standard way to model equalization schemes (e.g. Meltzer and Richard (1981)).

Before deriving the optimal c and Δ when the values of both variables may be freely chosen by subnational governments, the important special case where the level of tax collection effort is exogenously set at $c = 1$ is investigated. In this case, the de-jure federation-wide tax rate $\bar{\tau}$ is also the de-facto rate. This special case may be an accurate description of reality if the federal government can observe subnational effort in tax collection and discipline diverging jurisdictions, or if the tax administration is centralized.

If c is exogenously fixed, the only decision variable of the government is debt Δ. Differentiating equation 5.9 with respect to Δ gives as first order condition $v_{g_1} = v_{g_2}$. Debt is therefore chosen to equalize public consumption between periods, and is given by

$$\Delta^{|c=1} = \frac{1}{2}(1-\gamma)\bar{\tau}\overline{w}(L_2^e - L_1). \tag{5.10}$$

The level of debt in this case is determined by the interaction between the two exogenous parameters $\bar{\tau}$ and γ. It is therefore not possible to derive generally whether the combination of the absence of subnational tax autonomy and the existence of horizontal equalization will increase or decrease levels of debt when the tax collection effort is exogenously fixed. However, the equation indicates that a high degree of equalization γ tends to reduce levels of indebtedness whereas a high tax rate $\bar{\tau}$ tends to increase it.

It remains to be investigated whether this conclusion remains valid when jurisdictions are allowed to choose the collection effort c. Optimal debt in this case is given by

$$\Delta^{|c=c^*} = \frac{1}{2}c^*(1-\gamma)\bar{\tau}\overline{w}(L_2^e - L_1). \tag{5.11}$$

Substituting this expression in equation 5.9 and differentiating with regard to c gives as first order condition for the optimal collection effort c^*

$$v_g = \frac{1}{(1-\gamma)}\frac{\overline{L}^\alpha}{\overline{L}}, \tag{5.12}$$

with $v_g \equiv v_{g_1} = v_{g_2}$.

The optimal collection effort c^* together with the nominal tax rate $\bar{\tau}$ defines the effective tax rate $\tau^e = c^*\bar{\tau}$. The first order condition pertains to this effective tax rate and states that the collection effort is chosen in such a way that the marginal utility of (effective) taxation in terms of public consumption (which is $v_g(1-\gamma)\overline{L}/\overline{L}^\alpha$) is equal to its costs (which is unity). Comparing equation 5.12 with 5.8 reveals that $\tau^e = c^*\bar{\tau} < \tau^*$ holds irrespective of the value of $\bar{\tau}$.[15] Resubstituting the expression for the effective tax rate into equation 5.11 gives optimal debt when a horizontal

[14]The transfer ϕ is determined residually by total tax receipts in the federation and the tax sharing parameter γ, i.e. $\phi_t = \gamma(\sum_i^N \bar{\tau}c\overline{w}L_{it}/\overline{L}_i)$. Applying the law of large numbers, it is easily shown that $\text{plim}_{N\to\infty} \phi_t \equiv \phi = \gamma\bar{\tau}cbp_0/\left(\sum_i^N \overline{L}_i/N\right) = \gamma\bar{\tau}cbp_0/L$, with L denoting the average number of inhabitants in a jurisdiction, i.e. $L = \sum_i^N \overline{L}_i/N$. The probability limit is constant and does not vary between periods. Therefore, the omission of a time subscript on ϕ in equation 5.9 is justified. The reason for this result is that jurisdictions have identical productivity shocks ex-ante with an expected value of 0 (the density function for ϵ_t is the same for all jurisdictions with $E(\epsilon_t)=0$).

[15]Since according to the first order conditions the marginal utility of public consumption should be higher in optimum when a horizontal equalization scheme is established than in the case of fiscally independent jurisdictions,
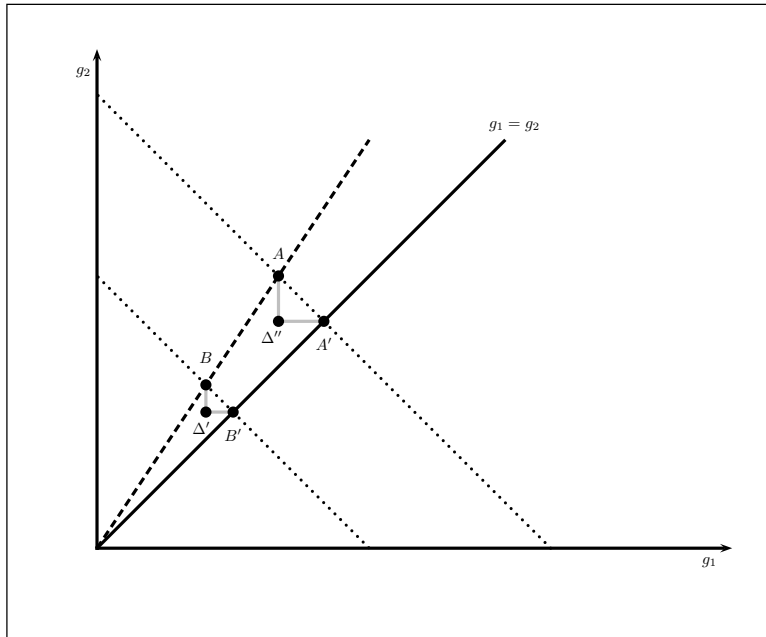
Figure 5.1: The horizontal equalization scheme and borrowing

equalization scheme is established. It is then easily seen by comparing equation 5.11 with 5.6 that debt will be lower under horizontal equalization than in the case of fiscally independent jurisdictions when the jurisdiction is capable to choose the collection effort. This important result is collected in the following proposition.

Proposition 5.2 *The introduction of a horizontal equalization scheme reduces borrowing in all jurisdictions when they may choose the level of collection effort. Therefore, the more intense horizontal equalization is, the lower levels of subnational indebtedness will be.*

This result might be considered counterintuitive, but can be easily explained with the help of figure 5.1. In this figure, one stylized jurisdiction is considered. There are four consumption bundles available to the jurisdiction. The consumption bundles at A and A' are associated with a larger amount of available revenues than the bundles at B and B'. The following discussion focuses only on these four bundles.

Available revenues, that is the sum of resources in period 1 and 2, are captured by dotted "budget-like" lines. The more to the right such a line is, the more revenues are under the control of the jurisdiction. Under a horizontal equalization scheme, the jurisdiction's revenues over which it has complete discretion are reduced because of two reasons. Firstly, because the equalization scheme takes a share of the revenues γ directly away[16], and secondly because of diminished incentives to choose a high level of collection effort. Thus, with a horizontal equalization scheme the left "budget-like" line, which is associated with fewer available revenues, is relevant. With-

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fewer resources should be devoted to public consumption (remember that the utility function in concave). Therefore, the effective tax rate under horizontal equalization τ^e will be smaller than the optimal tax rate τ^*.

[16]Even though these forgone revenues are replaced with the lump sum transfer ϕ, these transfers tend to reduce subnational borrowing even further because they are the same in both periods, i.e. the need for consumption-smoothing through debt is reduced.

out a horizontal equalization scheme, the right "budget-like" line, which is associated with more available revenues, is relevant.

The jurisdiction in question prefers, conditional on the amount of available resources, a bundle which is on the solid line through the origin with a slope of unity (that is, at A' or B'), because such an allocation implies that public consumption is smoothed between periods. Even though the initial allocation will generally not be such that $g_1 = g_2$, the government has the ability to redistribute revenues by means of debt Δ. The initial allocation is given by the bundles on the dashed line (at A or B), which captures a constant relative share of period 1 and 2 revenues at increasing volumes. Debt in this figure is then exhibited by the vertical and horizontal distance (which are of the same length) of the initial resource allocation at A or B to the points Δ'' or Δ', respectively.

According to the figure, the distance from point A to Δ'', which is associated with more revenues, is greater than the distance from point B to Δ', which is associated with a lower level of revenues. That is, since less revenues are available for inter-temporal redistribution under horizontal equalization, less debt will be assumed by the jurisdiction.

With regard to the interaction of the horizontal equalization scheme with idiosyncratic characteristics of jurisdictions, the following proposition is derived.

Proposition 5.3 *i) Jurisdictions which are more productive in period 1 display less effort in revenue collection and thus choose lower effective tax rates. ii) More productive jurisdictions have lower levels of debt as long as shocks are positively but not perfectly correlated between periods. iii) The effect of regional productivity on tax rates and borrowing is smaller in countries where a horizontal equalization is established compared to countries where jurisdictions possess complete fiscal independence.*

Proof See appendix.

The intuition for part i) and ii) of this proposition is similar to the one offered for proposition 5.1 in the last section. The intuition for Part iii) is not simple since this result is technical in nature. It follows from the fact that the strength of the comparative statics depends, inter alia, upon the tax rate at which the marginal effect of an increase in the productivity shock is evaluated (see also equation 5.18). Total tax revenues increase proportionally in productivity when taxes are ad-valorem, whereas optimal allocations for public consumption are independent of regional productivity when the utility function is quasi-linear. Since the horizontal equalization scheme leads to a lower tax rate, the appropriate derivatives will therefore display smaller absolute values.

These results offer three empirically verifiable hypotheses for German States. Firstly, that fiscally weak jurisdictions should display higher deficits and levels of public debt than fiscally strong jurisdictions; secondly, that the level of debt in all jurisdictions should be lower when the intensity of horizontal equalization increases; and thirdly, that there should be a convergence in the level of indebtedness between strong and weak states when the intensity of equalization increases. Some of these hypotheses will be "tested" with descriptive statistics in the next chapter.

What are the welfare implications of the horizontal equalization scheme? Since the tax rate is fixed, the equalization scheme as such has no adverse incentive effects when jurisdictions have no discretion over the collection effort, that is when $c = 1$ is exogenously fixed. However, a fixed tax

rate – which is necessary in order to avoid the likely under-taxation when a horizontal equalization scheme is established – also implies that jurisdictions throughout the federation face a uniform rate. But a uniform rate might not be appropriate for their circumstances, i. e. jurisdictions with a high demand shock would want to set a lower tax rate than some "average" tax rate chosen at the federal level and vice versa.

If jurisdictions may choose their preferred level of collection effort such that $c = c^*$, the effective tax rates may vary between jurisdictions even though the nominal rates are uniform. This effective tax rate, however, will be too low as indicated by equation 5.12 because jurisdictions take into account that they have to forgo a share of the taxes they collect. Whereas some jurisdictions with large negative shocks may benefit from the equalization scheme, the federation as a group experiences a loss in utility.

Therefore, the horizontal equalization scheme generally reduces welfare from a national perspective when collection effort can be chosen by subnational governments. It is emphasized, however, that this is a positive model which is concerned with deriving empirically verifiable hypotheses regarding the effects of fiscal institutions on observable fiscal variables such as the degree of indebtedness. The welfare implications of fiscal institutions are thus neglected in the following.

5.2.4 Subnational borrowing and soft budget constraints

Having analyzed horizontal equalization schemes, the impact of soft budget constraints on subnational borrowing is investigated in this section. In doing so, we take a different perspective on the bailout problem than prior contributions. Whereas existing models explain the likelihood of receiving a bailout by subnational characteristics which make the jurisdiction in some way important to the federal government (e. g. Goodspeed (2002)), we investigate how the characteristics of subnational jurisdictions are related to *their willingness to exploit* an existing soft budget constraint. This implies that the existence of soft budget constraints is effectively postulated. This postulation seems reasonable given the explicit bailout guarantee that the constitutional court has given to German States.

Whereas the horizontal equalization scheme equalizes fiscal revenues through a lump sum transfer ϕ, the bailout guarantee pertains to *actual public consumption*, which is determined as total revenues minus debt repayments. Assuming that the federation guarantees a minimum level ζ of per-capita public consumption, the problem of the representative jurisdiction can be formulated in the following way:

$$\max_{\Delta} W = x_1 + x_2 + v(\underbrace{G_1/\overline{L}^{\alpha}}_{g_1}) + v(\underbrace{G_2/\overline{L}^{\alpha}}_{g_2}), \tag{5.13}$$

with $\quad G_1 = \bar{\tau}wL_1 + \Delta,$

$$G_2 = \begin{cases} \bar{\tau}\overline{w}L_2^e - \Delta & \text{if } (\bar{\tau}\overline{w}L_2^e - \Delta)/\overline{L}^\alpha \geq \zeta \\ \zeta\overline{L}^\alpha & \text{if } (\bar{\tau}\overline{w}L_2^e - \Delta)/\overline{L}^\alpha < \zeta \text{ and } \left(\zeta\overline{L}^\alpha - (\bar{\tau}\overline{w}L_2^e - \Delta)\right) \leq \Omega \\ (\Omega - \Delta) & \text{if } (\bar{\tau}\overline{w}L_2^e - \Delta)/\overline{L}^\alpha < \zeta \text{ and } \left(\zeta\overline{L}^\alpha - (\bar{\tau}\overline{w}L_2^e - \Delta)\right) > \Omega \end{cases}$$

$$x_t = \bar{r} + \overline{w}(1 - c\bar{\tau})(L_t/\overline{L}), \quad t = 1, 2.$$

In this formulation, the horizontal equalization scheme has not been explicitly modeled in order to reduce the notational complexity. It is also assumed for simplicity that the tax rate is exogenously fixed at some level $\bar{\tau}$, and that jurisdictions may not choose tax collection effort (i. e. $c = 1$ is exogenously fixed).

The case-wise function for G_2, the level of total public consumption in the second period, describes the bailout system. This function states that per-capita public consumption in $t = 2$ is given by $g_2 = (\bar{\tau}\overline{w}L_2^e - \Delta)/\overline{L}^\alpha$ when this expression is larger than ζ, the minimum level of per-capita public consumption guaranteed to each jurisdiction. If g_2 falls below ζ, bailout transfers start to flow in order to fill the gap between net-of-debt per-capita revenues and the minimum level ζ.

However, it is assumed that there is some fixed maximum amount of resources, denoted with Ω, that can be paid by the federal government as bailout transfers.[17] Assuming an upper bound for total bailout payments to a jurisdiction is reasonable because federal resources are not infinite, which implies that transfers must cease at some point.[18]

Per-capita consumption in period 2 in case of a bailout will therefore be fixed at ζ only as long as total bailout payments are lower than available federal resources Ω. Once net-of-debt resources are so low that total bailout payments would exceed Ω when the difference between net-per-capita public consumption and ζ was to be bridged completely, the federal governments transfers Ω to the jurisdiction, but refuses to provide any additional resources. In this case, then, per-capita public consumption in period 2 is given by $g_2 = (\Omega - \Delta)/\overline{L}^\alpha$.[19]

Given this fiscal constitution, the jurisdiction has to choose its optimal level of debt. The bailout system, however, introduces a non-continuity into its problem. It has the choice of either borrowing "efficiently" and to ignore the fact that it might get a bailout if debt repayments turn

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[17]The source of these bailout resources are not explicitly modeled. It might be assumed, for example, that the federal government imposes its own tax on wages or interest income in order to finance its expenditures, including potential bailout payments. However, incorporating such a tax into the model would only complicate the exposition without changing any of the results. The federal government's budget is therefore treated as exogenous, and as determined outside of the model.

[18]One might think that there is an alternative way to model the bailout system. Given that there is a guaranteed minimum consumption level ζ, the conditional distribution for public consumption in period 2 might be thought of as being truncated at ζ. This is, however, not the case. Technically, the underlying shock ϵ_t is not truncated and can therefore assume any (negative) value. Therefore, treating public consumption as truncated at some value necessarily implies that bailout resources are in theory infinite, which is clearly unrealistic. Secondly, the above formulation is more in line with the rest of this chapter, and is correct if government treats the expected value for labor demand in period 2 as actual labor demand. This has been assumed so far.

[19]One implicit assumption in this formulation is that $\bar{\tau}\overline{w}L_2^e/\overline{L}^\alpha > \zeta$, i. e. the expected per-capita consumption in period 2 when the jurisdiction does not borrow at all is larger than the minimum level ζ. This assumption is realistic because otherwise every subnational jurisdiction would know ex-ante that federation-wide resources in period 2 would be insufficient to guarantee a per-capita public consumption level of ζ to all jurisdictions. Since this would in turn imply that jurisdictions could not reasonably harbor bailout expectations, they would face hard budget constraints, making the problem uninteresting.

out to be too high, or it might choose to deliberately incur a higher level of debt than optimal in view of the fact that it will get a bailout if the debt load turns out to be unbearable in the second period. In any case, the existence of the bailout system renders the budget of the jurisdiction soft. But whether it actually wants to exploit the soft budget constraint is a different question. The ultimate answer, as it will be shown, depends upon the characteristics of the jurisdiction.

The problem can be solved by "backward induction". Firstly, the optimal levels of debt conditional on whether the jurisdiction chooses to exploit the soft budget constraint or not are obtained. After that, the utility of the representative consumer at the respective levels of debt is evaluated in order to decide whether it is worthwhile to trigger a bailout.

If the subnational government exploits the soft budget constraint, it can increase period 1 consumption through borrowing without reducing period 2 consumption below ζ, as long as available bailout resources Ω are not exhausted. The price it has to pay for this increase in period 1 consumption is that public consumption levels cannot be the same in both periods. The question is whether the extraordinary increase in period 1 consumption compensates the utility losses caused by the imbalance in the inter-temporal consumption bundle. In order to answer this question, the appropriate consumption bundles need to be derived.

When the subnational government decides to *exploit the soft budget constraint*, it will set debt such that total bailout payments are equal to the maximum possible bailout payments, that is $\Delta^b = \overline{\tau}\overline{w}L_2^e + \Omega - \zeta\overline{L}^{\alpha}$. This follows from the fact that period 1 consumption can be increased to the largest extent without reducing period 2 consumption when debt is chosen such that total bailout transfers in period 2 are exactly Ω.[20]

When such a level of debt is chosen, period 1 per-capita public consumption in case of a bailout is given by $g_1^b = \left(\overline{\tau}\overline{w}(L_1 + L_2^e) + \Omega - \zeta\overline{L}^{\alpha}\right)/\overline{L}^{\alpha}$ and expected period 2 consumption by $g_2^b = \zeta$.[21] The expression for g_1^b is obtained by substituting Δ^b for Δ in equation 5.13, whereas $g_2^b = \zeta$ follows from the bailout system.

If the government decides *not to exploit the soft budget constraint*, it will use debt in order to equalize public consumption levels between periods (which is the "efficient" policy), that is $\Delta = \Delta^*$. Per-capita public consumption in period 1 and 2 is then given by $g_1^{nb} = g_2^{nb} = (\overline{\tau}\overline{w}(L_1 + L_2^e))/2\overline{L}^{\alpha}$.

On the basis of these expressions, the strength of the incentives to trigger a bailout can be represented by the following function

$$\chi \equiv v\underbrace{\left(\left(\overline{\tau}\overline{w}(L_1 + L_2^e) + \Omega - \zeta\overline{L}^{\alpha}\right)/\overline{L}^{\alpha}\right)}_{g_1^b} + v(\underbrace{\zeta}_{g_2^b})$$
$$- v\underbrace{\left(\overline{\tau}\overline{w}(L_1 + L_2^e)/2\overline{L}^{\alpha}\right)}_{g_1^{nb}} - v\underbrace{\left(\overline{\tau}\overline{w}(L_1 + L_2^e)/2\overline{L}^{\alpha}\right)}_{g_2^{nb}}. \tag{5.14}$$

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[20]The expression for Δ^b originates from the equation for G_2 in equation 5.13, which states that per-capita public consumption in period 2 is $g_2^b = G_2^b/\overline{L}^{\alpha} = \zeta$ as long as $(\zeta\overline{L}^{\alpha} - (\overline{\tau}\overline{w}L_2^e - \Delta)) \leq \Omega$. Replacing the weak inequality sign in the last condition with an equality sign and solving for debt gives the largest possible debt consistent with a per-capita public consumption of $g_2^b = \zeta$. This level of debt is denoted with Δ^b.

[21]Technically, by choosing an even higher level of debt, period 1 public consumption can be further increased, but from that point on, for each unit of increase the same amount of period 2 consumption has to be forgone. As long as $g_1 = (\overline{\tau}\overline{w}(L_1 + L_2^e) + \Omega - \zeta\overline{L}^{\alpha})/\overline{L}^{\alpha} > \zeta = g_2$, this will not be optimal for the government. The last condition will most likely fail when ζ is excessively high. But since this is a rather unlikely and uninteresting case, it will not be investigated further.

The $\chi(.)$ function thus captures to what extent it is beneficial for the jurisdiction to exploit the soft budget constraint. A bailout will be triggered if $\chi > 0$, that is when the utility from triggering a bailout is larger than from borrowing efficiently. Since private consumption is the same in the bailout and the no-bailout case, differences in utility levels can only originate from the nonlinear part $v(.)$ of the utility function which is concerned with public consumption.

Obviously, per-capita public consumption in case of a bailout in period 2 is given by the minimum level ζ and is independent of the idiosyncratic characteristics of the jurisdiction. Period 1 public consumption, however, varies with the characteristics of the jurisdiction. In particular, its size and labor demand, which is determined by the productivity shock, enter into this function. The following proposition is therefore derived.

Proposition 5.4 *i) Jurisdictions that are more productive have fewer incentives to trigger a bailout by means of excessive borrowing. ii) Smaller jurisdictions have larger incentives to trigger a bailout by means of excessive borrowing as long as $\alpha \neq 0$.*

Proof See appendix

This proposition holds under general conditions.[22] It can be intuitively explained with the help of figures 5.2 and 5.3. Figure 5.2 pertains to part (i) of the proposition. In this figure, the "transformation-curves" between period 1 and 2 per-capita public consumption of two stylized jurisdictions are depicted. The jurisdictions face different productivity shocks in the first period, but are otherwise equal. They have in particular identical population sizes.

The indifference curves of the high-productivity jurisdiction have been drawn with dashed and that of the low-productivity jurisdiction with solid lines. Accordingly, the transformation curve of the high-productivity jurisdiction is also drawn with a dashed and that of the low-productivity jurisdiction with a solid line. Both transformation curves have a slope of unity because resources can be costlessly transferred between period 1 and 2 through borrowing. The transformation curve of the high-productivity jurisdiction is obviously shifted to the right since it can afford more public consumption in both periods. Both transformation curves have a discontinuity at ζ. From this point on, period 1 consumption can be increased without reducing period 2 consumption since the bailout system takes effect. Thus, the transformation curves are horizontal once bailout transfers start to flow. When total bailout resources are exhausted, period 1 consumption can be further increased, but since no additional transfers will be granted, period 2 consumption has to be forgone. That is, at the end of the horizontal section, the original transformation curve with a slope of unity is again relevant. Because the two stylized jurisdictions differ only in their period 1 productivity shock but are otherwise identical, the length of the horizontal section of the transformation curve is the same for both jurisdictions.

When a jurisdiction exploits the soft budget constraint, it can consume a bundle which involves $g_1 > g_2$; if it chooses to borrow efficiently, it can consume a bundle which involves $g_1 = g_2$. The jurisdiction therefore confronts a trade-off when it wants to exploit the soft budget constraint: It can consume a high level of g_1, but must at the same time consume an unbalanced bundle with a relatively low level of g_2. It is obvious from the figure that the high productivity jurisdiction

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[22]The cases under which the proposition does not hold are quite unrealistic and do not undermine its generality in any significant manner, therefore no qualifications with regard to its generality are made in the proposition itself. This issue is discussed more fully in the appendix, however.
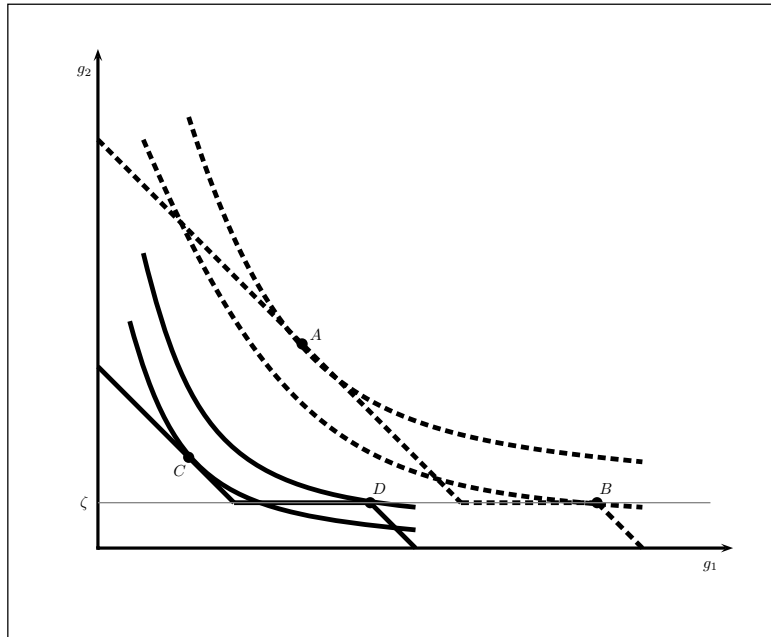
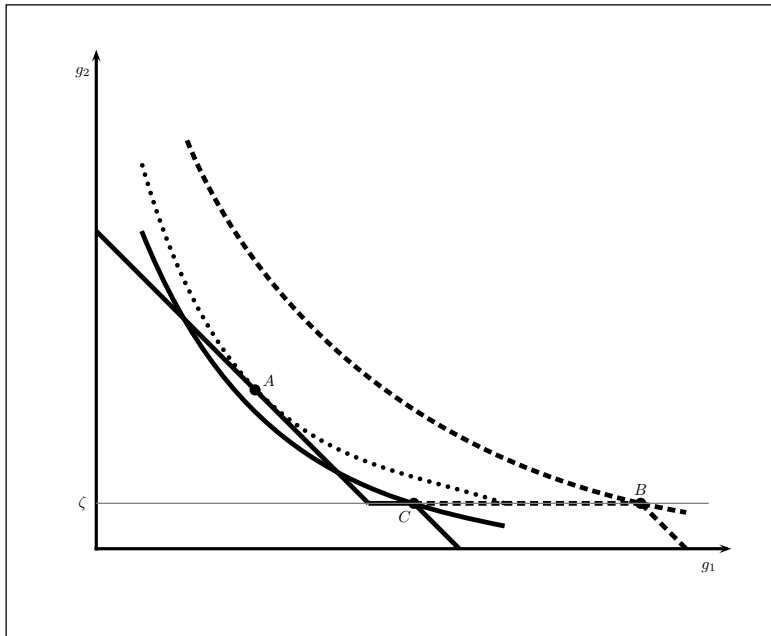Figure 5.2: Productivity and incentives to trigger a bailout

Figure 5.3: Size and incentives to trigger a bailout

can reach a higher indifference curve by choosing debt such that it consumes the public good bundle at point A where $g_1 = g_2$ holds (i.e. by borrowing efficiently). When the low-productivity jurisdiction exploits the soft budget constraint, it can consume the bundle at D. Since this bundle is associated with a higher indifference curve then the bundle at C where the jurisdiction borrows efficiently, it will exploit the soft budget constraint. The reason for the contradictory results for high- and low-productivity jurisdictions is that the high-productivity jurisdiction consumes a *relatively* more unbalanced bundle than the low-productivity jurisdiction when it chooses to exploit the soft budget constraint, and therefore gains less by doing so.

A similar argument can be made with regard to part (ii) of the proposition. The relationship between population size and incentives to exploit the soft budget constraint is explained on the basis of figure 5.3. Here, the transformation curves of a small and a large jurisdiction are depicted with dashed and solid lines, respectively. Obviously, the horizontal section where period 1 public consumption can be increased without reducing period 2 consumption is longer for a smaller jurisdiction. This is due to the fact that as long as $\alpha > 0$, the total bailout resources Ω are exhausted more quickly for the large jurisdiction. The amount of additional period 1 consumption that can be achieved by exploiting the soft budget constraint is therefore greater for a small jurisdiction, which can reach the dashed indifference curve that is tangent to the bundle B.

This indifference curve is above the dotted indifference curve that is tangent to bundle A. The bundle A involves $g_1 = g_2$ and is the best choice for both jurisdictions when they decide to ignore the bailout system and borrow efficiently. Therefore, the small jurisdiction has an incentive to exploit the soft budget constraint by means of over-borrowing. In contrast to the small jurisdiction, a large jurisdiction can consume the bundle C when it decides to trigger a bailout. The indifference curve which it could achieve by such a policy, however, is below the indifference curve that is tangent to A. Therefore, the large jurisdiction prefers to borrow efficiently.

5.3   Conclusion

Our aim in this chapter was to conduct a theoretical analysis of an intergovernmental transfer scheme that resembles the system of fiscal federalism in Germany, and to derive a number of testable empirical implications with regard to subnational borrowing. The model indicates that the impact of horizontal equalization and bailout transfers varies with the idiosyncratic characteristics of jurisdictions. The analysis leads in particular to the following theoretical results:

- Horizontal transfers tend to reduce levels of indebtedness in all jurisdictions. However, even with a horizontal equalization scheme, a negative relationship between productivity and indebtedness could still be derived.

- When soft budget constraints were analyzed, population size and regional productivity were found to be negatively related to the incentives of subnational governments to exploit them by means of over-borrowing.

We shall test these theoretical propositions in the next chapter with data from the German States.

Appendix

Proof of proposition 5.1

i) Implicitly differentiating equation 5.7 with respect to ϵ_1 gives

$$(1/4)v_{g_1,g_1}\left(\tau\overline{w}\left(\frac{dL_1}{d\epsilon_1} + \frac{dL_2^e}{d\epsilon_1}\right) + \frac{d\tau}{d\epsilon_1}\overline{w}\left(L_1 + L_2^e\right)\right)$$
$$+ (1/4)v_{g_2,g_2}\left(\tau\overline{w}\left(\frac{dL_1}{d\epsilon_1} + \frac{dL_2^e}{d\epsilon_1}\right) + \frac{d\tau}{d\epsilon_1}\overline{w}\left(L_1 + L_2^e\right)\right) = 0. \tag{5.15}$$

It holds that $v_{g_1,g_1} = v_{g_2,g_2} \equiv v_{g,g}$ at $g_1 = g_2$ because consumption in period 1 and 2 are evaluated with the same utility function $v(.)$. The above expression therefore simplifies to

$$v_{g,g}\left(\tau^*\overline{w}\left(\frac{dL_1}{d\epsilon_1} + \frac{dL_2^e}{d\epsilon_1}\right) + \frac{d\tau^*}{d\epsilon_1}\overline{w}\left(L_1 + L_2^e\right)\right) = 0, \tag{5.16}$$

Collecting terms gives

$$\frac{d\tau^*}{d\epsilon_1} = -\frac{\tau^*\left(\frac{dL_1}{d\epsilon_1} + \frac{dL_2^e}{d\epsilon_1}\right)}{L_1 + L_2^e} \tag{5.17}$$

Using equation 5.3 in order to calculate $\frac{dL_1}{d\epsilon_1}$ and $\frac{dL_2^e}{d\epsilon_1}$ gives

$$\frac{d\tau^*}{d\epsilon_1} = -\frac{\tau^*(1+\rho)}{2p_0 + (1+\rho)\epsilon_1} < 0. \tag{5.18}$$

Since $p_0 > |\epsilon_1|$ and $\rho \geq 0$ by assumption, the expression is negative, which proves part i) of the proposition.

ii) Differentiating equation 5.6 with regard to ϵ_1 gives after substitution for L_t

$$\frac{d\Delta^*}{d\epsilon_1} = \frac{1}{2}\frac{d\tau^*}{d\epsilon_1}\overline{w}(\rho - 1)b. \tag{5.19}$$

Substituting from part (i) of this proposition for $\frac{d\tau^*}{d\epsilon_1}$ and rearranging gives

$$\frac{d\Delta^*}{d\epsilon_1} = \frac{1}{2}\tau^*(\rho - 1)b\left(-\frac{(1+\rho)\epsilon_1}{2p_0 + (1+\rho)\epsilon_1} + 1\right) < 0. \tag{5.20}$$

Since $p_0 > |\epsilon_1|$ and $\rho \geq 0$ by assumption, the expression for $\frac{d\Delta^*}{d\epsilon_1}$ is negative as long as $\rho < 1$, that is as long the shocks are not perfectly correlated. ■

Proof of proposition 5.3

The proof is similar to the proof of proposition 5.1. i) Equation 5.12 states that

$$v_g = \frac{1}{(1-\gamma)}\frac{\overline{L}^\alpha}{\overline{L}}.$$

Implicitly differentiating this equation with regard to ϵ_1 and rearranging gives

$$\frac{dc^*}{d\epsilon_1} = -\frac{c^*\left(\frac{dL_1}{d\epsilon_1} + \frac{dL_2^e}{d\epsilon_1}\right)}{L_1 + L_2^e}.$$

Using equation 5.3 to calculate $\frac{dL_t}{d\epsilon_1}$, this expression further simplifies to

$$\frac{dc^*}{d\epsilon_1} = -\frac{c^*\left(1 + \rho\right)}{2p_0 + (1 + \rho)\epsilon_1} < 0.$$

This expression is negative because it holds by assumption that $p_0 > |\epsilon_1|$ and $\rho \geq 0$. Since the effective tax rate is given by $\tau^e = c^*\bar{\tau}$, it follows

$$\frac{d\tau^e}{d\epsilon_1} = \bar{\tau}\frac{dc^*}{d\epsilon_1} = -\frac{c^*\bar{\tau}\left(1 + \rho\right)}{2p_0 + (1 + \rho)\epsilon_1} < 0, \tag{5.21}$$

which proves part i) of the proposition.

ii) Differentiating equation 5.11 with regard to ϵ_1 gives after using the above expression for $\frac{dc^*}{d\epsilon_1}$ and rearranging

$$\frac{d\Delta^*}{d\epsilon_1} = \frac{1}{2}(1 - \gamma)c^*\bar{\tau}(\rho - 1)b\left(-\frac{(1 + \rho)\epsilon_1}{2p_0 + (1 + \rho)\epsilon_1} + 1\right) < 0. \tag{5.22}$$

The derivative is negative as long as $1 > \rho \geq 0$, that is as long the shocks are positively but not perfectly correlated. This proofs part (ii) of the proposition.

iii) Part (iii) of the proposition can be easily proved on the basis of the above equations. Comparing equation 5.21 with 5.18 reveals that both are identical except for the expression for the tax rate which appears in the numerator. For a fiscal constitution with completely autonomous jurisdictions, this tax rate is τ^*. This rate has been shown to be larger than the effective tax rate $\tau^e = c^*\bar{\tau}$ when jurisdictions may freely choose the collection effort. The absolute strength of the effect of a change in the productivity in period 1 is thus smaller when a horizontal equalization scheme is established. A similar argument can be made for subnational borrowing by comparing equation 5.22 with 5.20. ∎

Proof of proposition 5.4

i) Differentiating equation 5.14 with regard to ϵ_1 and recognizing that $v_{g_1} = v_{g_2} \equiv v_g$ when the jurisdiction does not choose to trigger a bailout gives

$$\frac{d\chi}{d\epsilon_1} = \left(v_{g_1}[g_1^b] - v_g[g^{nb}]\right)\left(\frac{\bar{\tau}\bar{w}(\frac{L_1}{d\epsilon_1} + \frac{L_2^e}{d\epsilon_1})}{\bar{L}^\alpha}\right), \tag{5.23}$$

where the expressions in the squared brackets indicate the consumption levels at which the derivatives are evaluated. These consumption levels are given by

$$g_1^b = \left(\bar{\tau}\bar{w}(L_1 + L_2^e) + \Omega - \zeta\bar{L}^\alpha\right)/\bar{L}^\alpha \text{ and}$$

$$g^{nb} = \left(\bar{\tau}\bar{w}(L_1 + L_2^e)\right)/2\bar{L}^\alpha.$$

Since the $v(.)$ function is concave, it follows that $v_{g_1}[g^b] < v_{g_1}[g^{nb}]$ because $g_1^b > g^{nb}$ as long as ζ is not excessively large. A very large ζ is clearly unrealistic. The expression in equation 5.23 is therefore in all likelihood negative, proving part (i) of the proposition.

ii) Differentiating equation 5.14 with regard to $\overline{L}$ gives (after using the fact that $v_{g_1} = v_{g_2} \equiv v_g$ when the jurisdiction does not choose to trigger a bailout)

$$\frac{d\chi}{d\overline{L}} = \alpha \overline{L}^{-\alpha-1} \left(-v_{g_1}[g_1^b] \left(\bar{\tau}\bar{w}(L_1 + L_2^e) + \Omega \right) + v_g[g^{nb}] \left(\bar{\tau}\bar{w}(L_1 + L_2^e) \right) \right), \qquad (5.24)$$

with g_1^b and g^{nb} defined as above. The sign of expression 5.24 depends upon whether the term $v_{g_1}[g_1^b] \left(\bar{\tau}\bar{w}(L_1 + L_2^e) + \Omega \right)$ is larger or smaller than $v_g[g^{nb}] \left(\bar{\tau}\bar{w}(L_1 + L_2^e) \right)$. If it were larger, expression 5.24 would be negative and it may be concluded that larger jurisdictions have less incentives to trigger a bailout. Now evaluating the derivative for $v_{g_1}[g_1^b]$ at $\zeta = \left(\bar{\tau}\bar{w}(L_1 + L_2^e) - \nu \right)/2\overline{L}^{\alpha}$ and $\Omega = \nu$ with ν arbitrarily close to 0 means that $v_{g_1}[g_1^b] = v_g[g^{nb}]$. Evaluating equation 5.24 at this particular values of ζ and Ω implies that the bailout is "marginally small". This is so because period 1 public consumption in the "marginal bailout" case is given by $g_1^b = (1/2)\bar{\tau}\bar{w}(L_1 + L_2^e) + (3/2)\nu$ and is therefore, since ν is close to zero, arbitrarily close to period 1 consumption in the no-bailout case.[23] Equation 5.24 simplifies at this point of evaluation to

$$\frac{d\chi}{d\overline{L}} = -\alpha \overline{L}^{-\alpha-1} v_{g_1}[g_1^b]\Omega < 0, \qquad (5.25)$$

for arbitrarily small Ω.

Thus, larger jurisdictions have smaller incentives to trigger a bailout as long as $\alpha \neq 0$. On the other hand, if the publicly provided good is a pure public good ($\alpha = 0$), population size is irrelevant for the incentives to trigger a bailout. ∎

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[23]Part (ii) of the proposition holds not in general for "non-marginal" bailouts. However, the expression should reasonably be negative even for larger bailouts. Firstly, it always holds that $\left(\bar{\tau}\bar{w}(L_1 + L_2^e) + \Omega \right) > \left(\bar{\tau}\bar{w}(L_1 + L_2^e) \right)$. On the other hand, it also holds always that $v_{g_1}[g_1^b] < v_g[g^{nb}]$ since $g_1^b > g_1^{nb}$. Whether expression 5.24 is positive or negative therefore depends on the difference between $v_{g_1}[g_1^b]$ and $v_g[g^{nb}]$. This difference will be the smaller, the lower the level of period 1 public consumption in the bailout case (g_1^b) is, because the derivative $v_{g_1}[g_1^b]$ is evaluated at this value (the $v(.)$ function is concave, therefore the derivative is decreasing in period 1 public consumption). The relative gain in period 1 public consumption through a bailout (all else held fixed) is given by the expression $\Omega/\overline{L}^{\alpha}$, which reveals that the relative gain will be small as long as a) the total amount of federal resources Ω is not excessively large and b) the jurisdiction is not very small. Put differently, at given levels of Ω, the expression in equation 5.24 is more likely to be positive for small jurisdictions. This implies further that *if* a marginal increase in its size makes a bailout a more attractive choice for some jurisdictions, this jurisdiction should be relatively small. But according to equation 5.14, a small jurisdiction has already larger incentives to trigger a bailout because it profits more through it in terms of per-capita consumption. That is, it is mostly those jurisdictions which, due to their smallness, already have large incentives to exploit the soft budget constraint which will see them become even larger by a marginal increase in their size. Therefore, part ii) of the proposition is likely to hold.

The reason for this surprising ambiguity is that not only the utility in period 1 in the bailout case but also period 1 and 2 utility in the no-bailout case depend upon the number of inhabitants. Thus, an increase in the population size reduces per-capita public consumption not only in the bailout but also in the no-bailout case. Which of the two cases will then be more desirable at the margin depends upon the consumption levels at which the derivatives are evaluated. In the extreme case, for example, where consumption in case of a bailout is very high, the marginal utility of additional public consumption in period 1, $v_{g_1}[g_1^b]$, will be 0, implying that a decrease in per-capita consumption due to an increase in population size has no consequences on the utility in the bailout case. However, because it decreases utility in the no-bailout case (since marginal utility of additional public consumption is not 0), the bailout becomes even more attractive. But it is again emphasized that since per-capita public consumption levels in case of a bailout are larger for small than for large jurisdictions, part ii) of the proposition will hold in all likelihood even when bailouts are non-marginal.

Chapter 6

Subnational borrowing in Germany: Empirical evidence

6.1 Introduction

In this chapter, we test some of the propositions derived in the previous chapter with data from German States. That is, we will explore whether there are systematic differences in the incentives of subnational politicians in Germany to exploit soft budget constraints, and thus to over-borrow.

The evolution of subnational debt in Germany in the last twenty years has been remarkable but by no means uniform. According to figures 6.1 and 6.2, states have displayed large variations in their borrowing patterns. At the same time, they have also faced vastly different economic environments. Indeed, there are obvious differences between the newly formed East-German States which were in need of substantial infrastructure investments (Sinn, 2002; Vesper, 2004), Saarland and Bremen which faced severe economic downturns, and Bavaria which transformed from being a fiscally weak state to a fiscally strong one in the early nineties. Even though all states faced the same intergovernmental transfer system, it stands to reason that its impact on borrowing has varied with their idiosyncratic environments and characteristics, making it worthwhile to study these interactions in more detail.

6.2 Determinants of subnational borrowing in Germany

The variables used in this section and their sources are collected in table 6.1. The state-codes, which are used in the following figures instead of the full names of states, are defined in the appendix to this chapter.

Consistent with the theoretical model, horizontal and vertical transfers are not separately treated. That is, horizontal transfers/payments in the original sense ("Länderfinanzausgleich (LFA)") and vertical transfers from the federal government ("Bundesergänzungszuweisungen (BEZ)") are added together and simply referred to as horizontal transfers. Such an approach is justified for two reasons. Firstly, because only those states which are net-recipients during horizontal equalization in the original sense receive vertical transfers; and secondly, because both types of transfers

(a) Fiscally weak states (1970-2007)

(b) Fiscally strong states (1970-2007)

(c) East-German states (1991-2007)

(d) City-states (1970-2007)
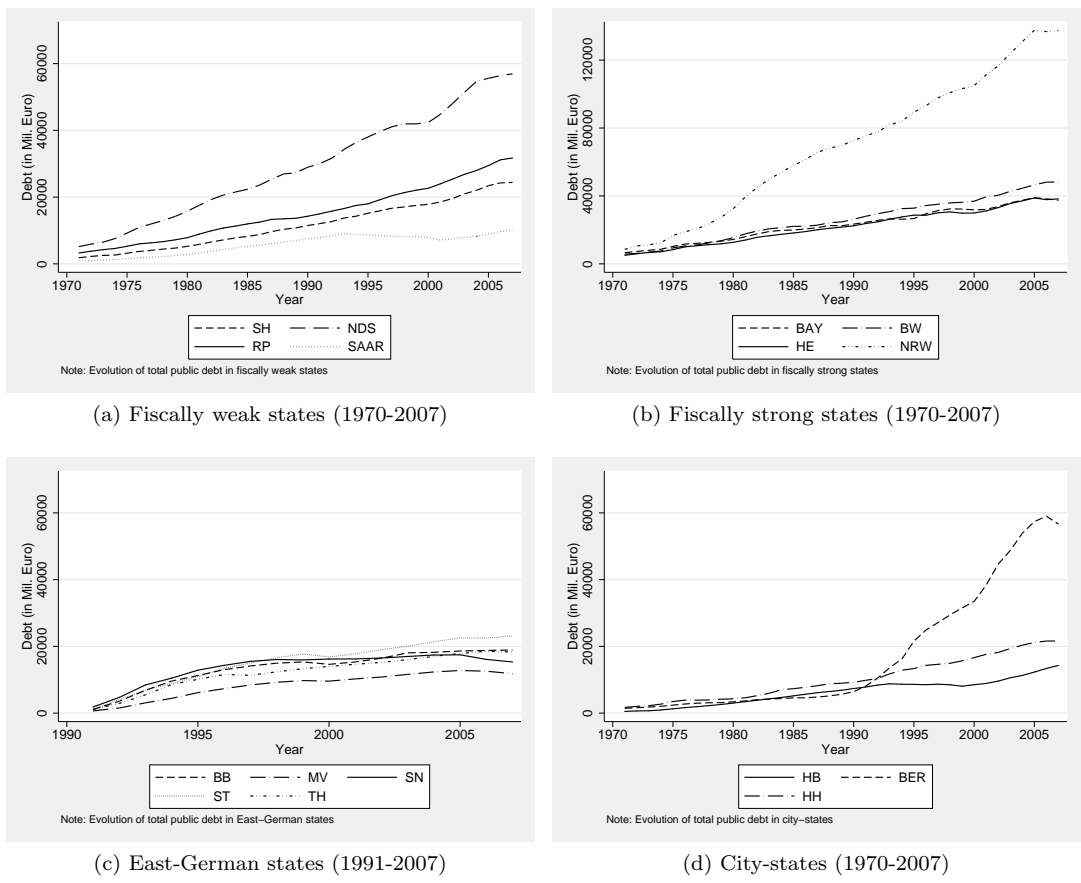
Figure 6.1: Evolution of total debt in German States

(a) Fiscally weak states (1970-2007)

(b) Fiscally strong states (1970-2007)

(c) East-German states (1991-2007)
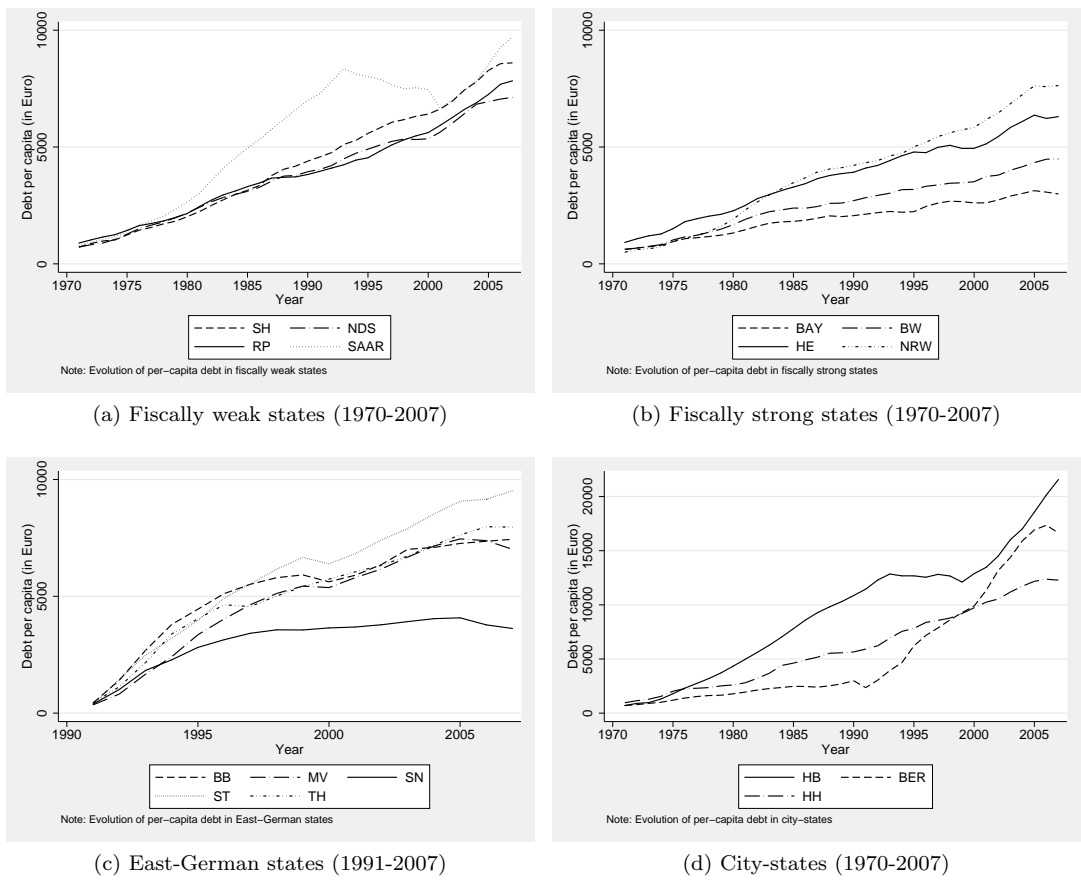
(d) City-states (1970-2007)

Figure 6.2: Evolution of debt per capita in German States

Variable	Source
Unemployment rate	Federal Statistical Office, Federal Employment Office
Population Size	Federal Statistical Office
Consumer Price Index	German Council of Economic Advisors
Horizontal/Vertical Transfers	Federal Statistical Office, Federal Ministry of Finance

Table 6.1: SOURCE OF DATA

lead to an imbalance between "own revenues" and expenditures, which implies that both have the same effect.[1]

In figure 6.3, we collect two bivariate plots on the relationship between the horizontal equalization scheme and the incentives for subnational borrowing. In subfigure (a), jurisdiction's average receipts or payments from/into the various equalization schemes from 1970 to 2007 (West-German States) or between 1995 and 2007 (East-German States and Berlin) are plotted against the average debt per capita ratio. For East-German States and Berlin, the calculation of the average is only possible for a shorter time period since they were admitted into the traditional West-German equalization schemes only in 1995.

The x-axis in this figure represents a ranking where states with larger average receipts (payments are negative receipts) during the sample period receive higher ranks. Hesse has been on average the largest net-contributor whereas Berlin has been the largest recipient. Unsurprisingly, East-German States are more to the right of the figure whereas fiscally strong West-German States like Bavaria and Baden-Wuerttemberg are to be found at the left portion of the figure.

The bivariate plot between the ranking of states and the debt per capita ratio indicates a strong positive relationship. It may therefore be concluded that states which receive more resources through the various equalization schemes tend to have higher levels of public debt, indicating, somewhat paradoxically, that receiving more transfers deteriorates the fiscal stance. However, this observation might be rationalized by arguing that transfers are endogenous to past deficits. If they are nonetheless insufficient to bridge the gap between expenditure requirements[2] and available revenues, a positive correlation between debt and transfers may be observed.

Another explanation might be, of course, that the reliance on transfers diminishes the incentives for fiscal frugality. However, the theoretical model tends to favor the first explanation. Since the model suggests that net-recipient states are relatively unproductive and have thus higher levels of debt (see proposition 5.3), it is possible that the increases in productivity decreases both the debt per capita ratio and horizontal receipts, leading to a positive correlation between both variables. Without a more elaborate empirical analysis, however, the underlying causality and the relative merits of these competing explanations cannot be fully determined. This, therefore, is an obvious task for future research.

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[1]It might be questioned, however, whether the vertical bailout transfers which are provided by the federal government to Saarland and Bremen ("Sanierungs-BEZ") should be treated in this way. Since one of the main aims of the last chapter was to distinguish between the effect of a horizontal equalization scheme and that of soft budget constraints created by bailout expectations, such an approach might be considered counterproductive. However, the fact that the total volume of bailout payments to these two states have been guaranteed by contract implies that they were in effect analogous to the usual vertical transfers. That is, the important cause for the emergence of soft budget constraints is the *expectation* of a bailout in the future, not the *volume* of past bailout transfers.

[2]Due to constitutional requirements or federal regulations, for example.

Subfigure (b) pertains to proposition 5.2 which states that the intensity of equalization is negatively related to debt. Accordingly, the debt per capita ratio in Germany as a whole is plotted against the per-capita amount of resources transferred through the equalization schemes in each year. Both variables have been adjusted for inflation by considering the CPI during the sample period of 1995-2007. The subfigure indicates that there is no significant relationship between the intensity of equalization and borrowing. While this result does not confirm proposition 5.2, it does also not outrightly reject it.[3] In any case, a more elaborate empirical analysis is called for.

Figure 6.4 consists of two bivariate plots on the relationship between idiosyncratic characteristics of states and incentives for subnational borrowing.

Subfigure (a) pertains to the effect of regional productivity, proxied by the average unemployment rate over the sample period. States are ranked according to their average unemployment rate on the x-axis, and those which had on average higher unemployment rates are more to the right on this axis. The sample period is 1970-2007 for West-German States and 1995-2007 for East-German States and Berlin. Apparently, Baden-Wuerttemberg has had on average the lowest unemployment rate whereas Berlin and Saxony-Anhalt had the highest. As predicted by the theory, the figure suggests that there is a negative relationship between subnational debt and regional unemployment rates.

Finally, subfigure (b) pertains to the bivariate relationship between a jurisdiction's population size and subnational debt per capita. The sample period is again 1970-2007 for West-German and 1995-2007 for Berlin and East-German States. Obviously, this figure seems to confirm the theory by depicting a negative relationship between size and indebtedness. That is, large jurisdictions tend to have low levels of debt, as predicted by part (ii) of proposition 5.4.

6.3   Conclusion

Overall, the empirical evidence provided in the figures tend to give credence to the propositions derived in chapter 5. However, the deficiencies of such simple descriptive analyses are well known. Firstly, omitted variable biases might invalidate the bivariate relationships, and make causal conclusions elusive. Secondly, reversed causality is most certainly an issue as the likelihood of receiving federal transfers increases with the level of indebtedness. With a descriptive approach, it is also not possible to provide quantitative estimates on the extent to which debt can be explained by the consumption smoothing argument, by horizontal equalization schemes, and bailout expectations.

The obvious solution to these deficiencies is to conduct a multivariate analysis using regression techniques. Indeed, we will use such techniques in the next two chapters to study the relationship between fiscal decentralization and debt accumulation in more detail. However, we will explore this relationship for OECD countries in general, rather than only for German States.

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[3]It should be mentioned that plotting both variables against each other over the 1970-2007 period leads to a different conclusion. In the full sample, the intensity of equalization and debt per capita are positively related. This graph is not reported but available upon request. It is, however, questionable whether this observation should lead to a discounting of proposition 5.2. Plotting the variables over the full sample indicates a significant break in the equalization series in 1995, as horizontal and vertical transfers increase instantly almost threefold. Before 1995, the degree of equalization has been relatively negligible. It is thus reasonable to argue that the inclusion of the East-German States and Berlin has changed the nature of horizontal equalization scheme permanently, and that this "new" scheme with its characteristics is the relevant one for the years to come.
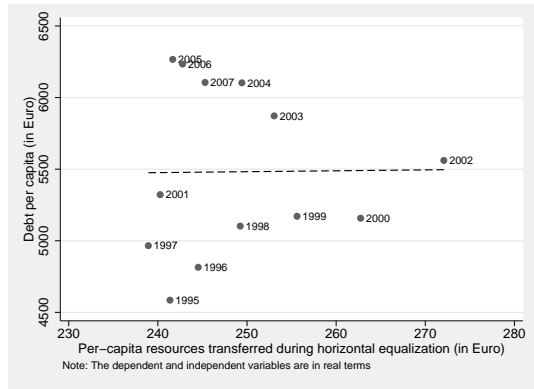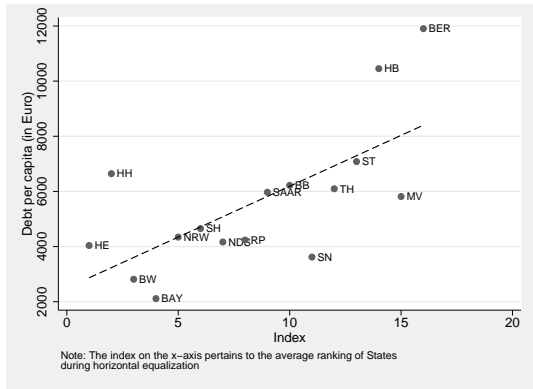
(a) Receipts/Payments into the equalization system and debt

(b) Intensity of equalization and debt

Figure 6.3: Horizontal equalization and subnational borrowing
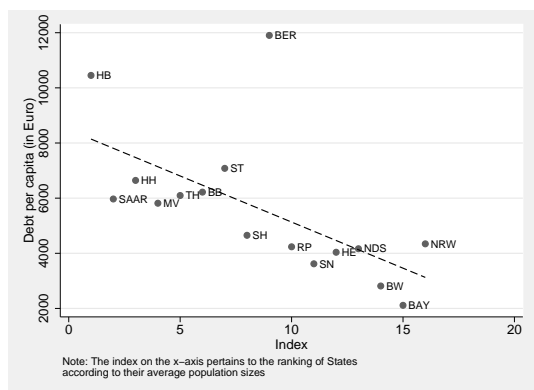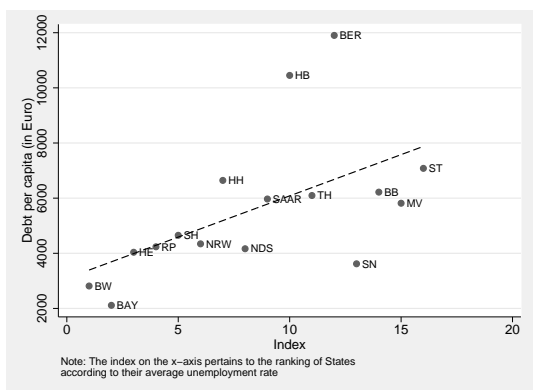
(a) Unemployment rate and debt

(b) Population size and debt

Figure 6.4: Regional characteristics and subnational borrowing

Appendix

The State codes are defined as follows: BA (Bavaria), BB (Brandenburg), BER (Berlin), BW (Baden-Wuerttemberg) HB (Bremen), HE (Hesse), HH (Hamburg), MV (Mecklenburg-Western Pomerania), NDS (Lower-Saxony), NRW (North Rhine-Westphalia), RP (Rhineland-Palatinate), SAAR (Saarland) SH (Schleswig-Holstein), SN (Saxony), ST (Saxony-Anhalt), TH (Thuringia).

Chapter 7

Fiscal decentralization and primary deficits: Empirical evidence for OECD countries

7.1 Introduction

In this chapter, we examine empirically whether fiscal decentralization improves or endangers public finances with data on 21 OECD countries over the 1975-2001 period. The innovative features of our investigation are i) the focus on consolidated primary deficits, ii) the consideration of non-linearities in the relationship between fiscal decentralization and fiscal outcomes, and iii) the simultaneous analysis of three different variants of fiscal decentralization. Even though other studies are characterized by some of these features separately (see the literature review), this is to our knowledge the first to consider them jointly.

The three variants of fiscal decentralization are operationalized with three different measures. Specifically, we use one measure of expenditure decentralization and two revenue decentralization measures, one pertaining to subnational tax autonomy and the other to tax sharing arrangements.

This chapter is organized as follows. Some methodological issues are discussed in section 7.2. The data used in the estimations in this chapter is described in section 7.3. The econometric model is introduced in section 7.4. In section 7.5, we present the results. A short discussion of the results and some concluding remarks are offered in section 7.6.

7.2 Methodological issues

The aim of this section is to clarify some methodological issues with regard to the specification of the econometric model. Firstly, note that fiscal decentralization may come in different guises; it might pertain to the expenditure, the revenue, or both sides of the budget. Different variants of decentralization might therefore have countervailing effects, i.e. allocating autonomy over expenditures to subnational governments might increase deficits while allocating authority over revenues might decrease them – or vice versa (see also the literature review in chapter 2). This

argument points to the importance of testing the impact of different types of decentralization separately. We therefore consider in this chapter several measures of fiscal decentralization that are either based on subnational expenditures, shared taxes which accrue to subnational governments, or on own source tax revenues. See section 7.3 for a more detailed discussion of these measures.

Secondly, several authors argue that the relative degrees of expenditure and tax revenue decentralization are important for how subnational fiscal autonomy affects fiscal outcomes. Blankart and Klaiber (2006), for example, state that especially those countries where the fiscal constitution stipulates high subnational expenditure but low revenue autonomy are characterized by soft budget constraints. The idea is that subnational politicians, having the ability to spend at their own discretion, might use resources acquired through borrowing for "inefficient" purposes (e. g. electoral advantages). Once the debt matures, however, they may argue that they cannot repay it due to the absence of taxing powers, thus forcing the federal government to grant them a bailout. Empirical evidence suggesting that such arguments might be relevant is provided by Rodden (2002) and von Hagen and Eichengreen (1996).

We thus conclude that it is important to control in some way for the relative degrees of expenditure and revenue decentralization, and thereby for vertical fiscal imbalances. We discuss in section 7.4 how we deal with this issue.

Thirdly, it seems to be a reasonable conjecture that both expenditure and revenue decentralization have a non-linear impact on fiscal outcomes. On the one hand, it is possible that neither complete centralization nor complete decentralization is an efficient way to structure the government. At low levels of either expenditure or revenue autonomy, the marginal effect of an increase in these variants of decentralization might be positive, but may turn negative as the degree of autonomy increases. That is, there might be an optimal level for both variants of decentralization somewhere in the middle. On the other hand, intermediate levels of expenditure and revenue autonomy might lead to a blurring of responsibilities and make it more difficult to coordinate fiscal policies, suggesting that intermediate systems could be worse than either complete subnational autonomy or complete central control.

We thus conclude that potential non-linearities should be considered in the regressions, and that the marginal impact of an increase in the various forms of fiscal decentralization should be evaluated at some "average level".

Fourthly, several contributions (see the literature review) suggest that fiscal profligacy at the subnational level must not necessarily lead to increases in *subnational deficits*. For if the federal government borrows in place of subnational governments and passes these additional revenues quietly to the latter by means of intergovernmental transfers, the federal government might exhibit a deficit while subnational budgets remain balanced.

We thus conclude that it is necessary to consider the fiscal stance of all tiers of government simultaneously when discussing the effects of fiscal decentralization.

7.3 Data

7.3.1 Measures of fiscal decentralization

Measuring the degree of fiscal decentralization has been one of the most awkward problems in the empirical literature on fiscal federalism. The majority of studies use expenditure and revenue decentralization measures based on data from the IMF's GFS yearbook. However, many authors have argued that these measures do not provide an accurate approximation of the "real" amount of subnational revenue and expenditure autonomy (Ebel and Yilmaz, 2002; Rodden, 2004). On the expenditure side, they do not differentiate whether subnational governments are simply "spending agencies" whose expenditures are largely determined by federal regulations, or whether they are autonomous in formulating their expenditure policy; on the revenue side, they do not differentiate whether subnational governments obtain their revenue through vertical grants or whether they have autonomous taxing powers.

In order to address this problem, the OECD (1999) provides a set of measures which supposedly mirror the real extent of subnational tax autonomy more accurately than the GFS variables from the IMF. These measures stratify subnational tax revenues according to the degree of subnational autonomy over the underlying tax sources. Taxes are classified into several distinct categories, of which the most important are: i) taxes that accrue completely to subnational governments and for which they have the authority to determine rates and bases, and ii) shared taxes for which the revenue split is determined by subnational governments. The ratios of the revenue from each of these two sets of taxes with respect to consolidated total government tax revenue are then treated as measures of two variants of tax decentralization.[1] We refer in the following to the first measure as "own taxes decentralization", and to the second measure as "shared taxes decentralization".[2]

A drawback of these two measures is that they are only available in a cross-section dataset for 1995. Even though Blöchlinger and King (2007) provide data for additional years, Stegarescu (2005) is the first to extend these into a real panel dataset for the 1975-2001 period. We therefore use his data to measure tax decentralization in the following analysis.

Unfortunately, a similar measure for the expenditure side is unavailable, forcing us to use the traditional GFS measures from the IMF in order to control for expenditure decentralization.

As indicated in the theoretical discussion, it is important to control for the degree of the vertical fiscal imbalance. This can be done either explicitly by including a variable which measures the amount of vertical grants that flow to lower-level governments, or in an indirect way by jointly controlling for the degree of expenditure and tax decentralization. The idea behind the second strategy is that a marginal increase in expenditure decentralization also implicitly captures an increase in the vertical fiscal imbalance when it is controlled for the prevailing degree of tax decentralization; and that a marginal increase in the tax decentralization measures implicitly captures a reduction in the vertical fiscal imbalance when it is controlled for the prevailing degree of expenditure decentralization. While this indirect approach is preferred in this chapter, we use a more direct approach in the next one.

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[1]These measures are by now widely used in empirical research on fiscal federalism. For example, Thornton (2007) explores with them the impact of fiscal decentralization on economic growth.

[2]Note that these two measures may indicate an increase in the degree of decentralization for two reasons: First, because the number of taxes over which subnational governments have authority increases at a constant volume of revenue, and second because the revenue from an existing set of taxes increases.

Table 7.1: DEFINITION AND SOURCE OF VARIABLES

Label	Description	Source
	Decentralization Measures	
Expenditure dec.	Subnational share of total government expenditures	World Bank
Own taxes dec.	Subnational revenue from taxes for which subnational governments determine rates *and/or* define bases as share of general government tax revenue	Stegarescu (2005)
Shared taxes dec.	Subnational revenue from taxes for which subnational governments determine the revenue split as share of general government revenue	Stegarescu (2005)

Table 7.2: SUMMARY STATISTICS ON DECENTRALIZATION MEASURES

Variable	**Variance**	**Obs.**	**Mean**	**Std. Dev.**	**Min.**	**Max.**
Expenditure dec.	overall	421	34.817	14.390	3.291	65.670
	between	21		15.195	3.957	59.758
	within	20.048		3.358	19.208	47.799
Own taxes dec.	overall	421	20.356	15.935	0.180	58.670
	between	21		16.681	0.418	55.367
	within	20.048		3.080	9.096	32.286
Shared taxes dec.	overall	421	4.705	11.385	0.000	42.730
	between	21		10.474	0.000	41.347
	within	20.048		2.493	-5.104	16.126

[1] Summary statistics are always calculated using the number of observations in the largest available sample in the various sets of regressions.
[2] The number of within observations is uneven because of the unbalanced nature of the panel.

Table 7.3: CROSS-CORRELATION BETWEEN DECENTRALIZATION MEASURES

Variables	Exp. dec.	Own taxes dec.	Shared taxes dec.
Expenditure dec.	1		
Own taxes dec.	0.698	1	
Shared taxes dec.	-0.028	-0.305	1
(Obs=421)			

[1] All Observations which were used in the regressions and were jointly defined were used in calculating the coefficients.

Summary statistics on the three measures of fiscal decentralization are provided in table 7.2.[3] All summary statistics are calculated with those observations which are used in at least one regression model. They indicate that expenditures are on average almost twice as much decentralized than own tax revenues. We further observe that even though much of the variation in the decentralization variables is due to differences between countries, they also possess some amount of within-variation. This variation is helpful for the regressions as it facilitates a meaningful estimation of fixed effects models.

In table 7.3, we present the bivariate correlation coefficients of the decentralization variables. These coefficients indicate that there is a relatively high positive correlation between expenditure and own taxes decentralization, suggesting that in OECD countries increased subnational expenditure responsibilities tend to be matched with higher revenue autonomy. On the other hand, expenditure decentralization is almost uncorrelated with the shared taxes decentralization variable. The own taxes decentralization variable is negatively correlated with the shared taxes variable, indicating that both are to some extent substitutes.

In figure 7.1, the average value of the three decentralization variables across countries is depicted. This figure confirms the conclusions derived from the summary statistics. OECD countries continuously display a higher level of expenditure than tax decentralization, and "own taxes decentralization" is far more important than the variant based on shared taxes. The degree of expenditure decentralization has on average not increased significantly during the time frame of our analysis, and there seems to be little year-to-year variation in this variable. A similar pattern can be observed for the averages of the own and shared taxes decentralization variables, which have also remained more or less constant during the sample period.[4]

However, as indicated by figures 7.2, 7.3, and 7.4, individual countries display a high amount of innovation in the decentralization variables, thus reinforcing the notion that there is sufficient within-variation to estimate fixed effects models. In order to obtain a continuous plot, these figures are calculated with all available observations (not only those that are actually used in the regressions).

How are these decentralization variables related to fiscal outcomes? We provide a preliminary graphical investigation in figures 7.5 to 7.7. In these figures, the average level of the three decentralization measures is plotted against the average primary deficit (a positive slope therefore indicates a positive correlation between decentralization and primary deficits) of the general government in the sample period. Data on primary deficits is obtained from the OECD Economic Outlook Database (see table 7.4).

In figure 7.5, the solid line is the bivariate plot between primary deficits and expenditure decentralization and suggests a negative correlation between both. Canada, which is a federation, and

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[3]Note: Stegarescu (2005) uses a slightly different definition of shared taxes decentralization. He defines this variable as the sum of subnational revenue from taxes for which subnational governments determine rates or define bases *and* subnational revenue from taxes for which subnational governments determine the revenue split. A drawback of this definition is the increased likelihood of multicollinearity in the regressions. Since the difference between the two tax decentralization measures is simply the subnational revenue from taxes for which subnational governments determine the revenue split, we redefine shared taxes decentralization to this difference.

[4]Note that the year-averages for the decentralization variables are only shown up to 1998 because after this year, observations are missing for a significant number of countries. For example, in 2001 Canada is the only country for which an observation of the expenditure decentralization variable is available. This implies that averages of the variables are unreliable after 1998 because they are easily dominated by individual countries.
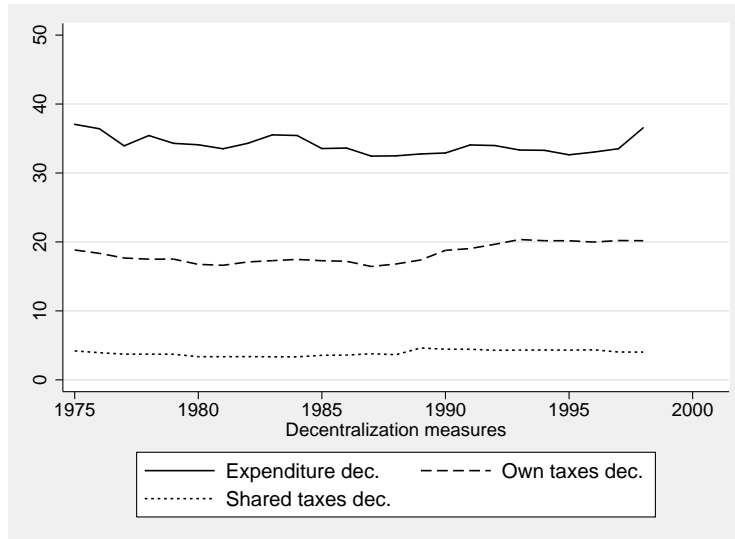
Figure 7.1: Development of expenditure and tax decentralization variables, Mean across Countries.

Denmark, which is a unitary country, display the highest levels of expenditure decentralization whereas Greece and Portugal are at the other end of the spectrum.

The bivariate plot between own taxes decentralization and primary deficits in figure 7.6 is positive and suggests that this variant of decentralization increases public deficits. According to this decentralization measure, Canada and Switzerland are the most decentralized countries.

The plot of the shared taxes decentralization variable against primary deficits in figure 7.7 indicates a weak positive relationship between primary deficits and this particular type of decentralization. Significant values for this variable are only observed in Austria, Belgium, Germany, Spain, and Switzerland. In most countries, subnational governments have no or only marginal control over shared taxes, which explains the accumulation of observations at 0.

Even though these bivariate relationships are informative, they ignore that there might be other important determinants of fiscal balances. We therefore explore in section 7.4 and 7.5 whether the observed correlations are robust to the inclusion of additional covariates.

Figure 7.2: DEVELOPMENT OF EXPENDITURE DECENTRALIZATION IN INDIVIDUAL COUNTRIES
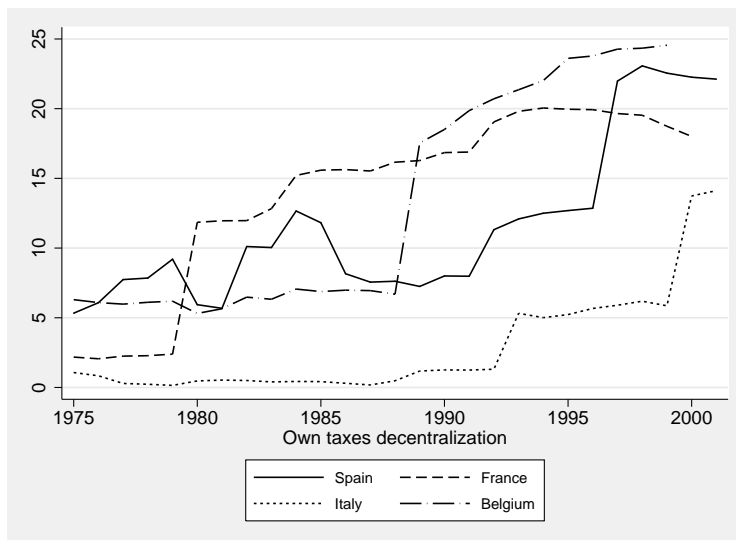
Figure 7.3: DEVELOPMENT OF OWN TAXES DECENTRALIZATION IN INDIVIDUAL COUNTRIES
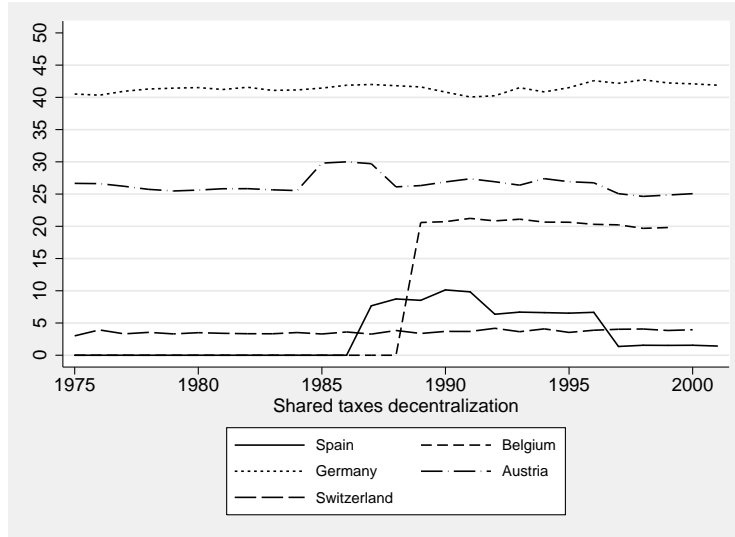
Figure 7.4: DEVELOPMENT OF SHARED TAXES DECENTRALIZATION IN INDIVIDUAL COUNTRIES
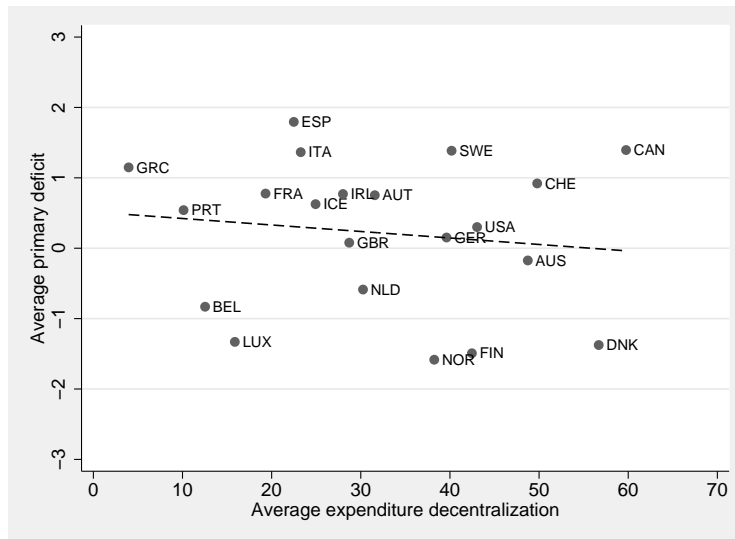
Figure 7.5: BIVARIATE CORRELATIONS BETWEEN AVERAGE EXPENDITURE DECENTRALIZATION AND AVERAGE PRIMARY DEFICIT
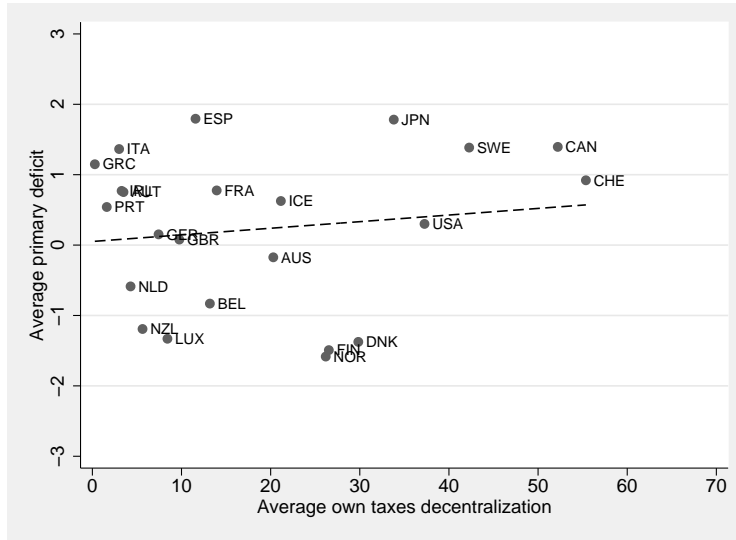
Figure 7.6: BIVARIATE CORRELATIONS BETWEEN AVERAGE OWN TAXES DECENTRALIZATION AND AVERAGE PRIMARY DEFICIT
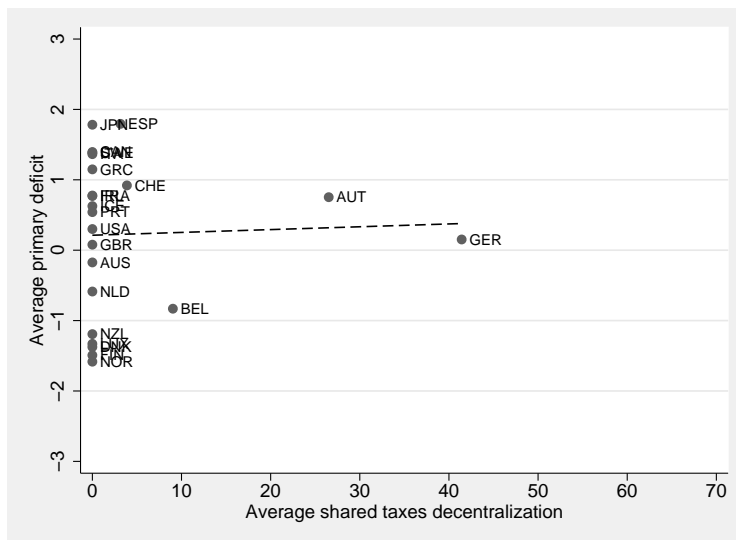
Figure 7.7: BIVARIATE CORRELATIONS BETWEEN AVERAGE SHARED TAXES DECENTRALIZATION AND AVERAGE PRIMARY DEFICIT

7.3.2 Dependent and control variables

In this subsection, we discuss the dependent and economic control variables used in the econometric models. Their definition and sources are described in table 7.4. Summary statistics are provided in table 7.5.

With regard to the dependent variable, we have argued during the methodological discussion that the fiscal stance of the federal and subnational governments should be considered simultaneously. Some studies approach this problem by extrapolating the effect of subnational deficits on the fiscal stance of the federal government (e.g. Fornasari et al. (2000)). Another possibility is to use a consolidated measure of the fiscal stance of the public sector. As this approach is arguably more straightforward, it is preferred in this study. We thus use the general government primary deficit as the dependent variable in our regressions.

Table 7.4: DEFINITION AND SOURCE OF VARIABLES

Label	Description	Source
Dependent variable		
Primary deficit	Primary deficit of government in % GDP	OECD Economic Outlook No. 83
Controls		
Population	Population	OECD Population and Labor Force Dataset
GDP Growth	GDP growth per capita	OECD Economic Outlook No. 83
Unemployment	Unemployment rate	OECD Economic Outlook No. 83
Inflation	Growth in the CPI Index	OECD Key Economic Indicators
Urbanity	Percentage of people living in urban areas	World Urbanization Prospects: The 2007 Revision (UN)
Working Age	Share of people between 15 and 65 years	OECD Population and Labor Force Dataset
Left	Index of government's ideology, higher values indicate more leftist ideology	CPDS I Dataset 1960-2006
Plurality Rule	Index of electoral rules, higher values indicate "more" plurality rule	Mostly CPDS I Dataset 1960-2006, different other sources (see main text)
Presidential Sys.	Dummy = 1 if country has a presidential system	Mostly CPDS I Dataset 1960-2006, different other sources (see main text)
Government revenue	Government receipts in % of GDP	OECD Economic Outlook No. 83
Openness	Trade-to-GDP ratio	OECD Macro Trade Indicators
Interest rate	Long-term interest rate on government bonds	OECD Economic Outlook No. 83
Federalism	Dummy =1 if country is a federation	Own calculation, different constitutions

[1] All OECD data have been downloaded with the OECD.Stat interface which provides access to different OECD databases

With regard to the control variables, we estimate two different specifications: a "baseline" model with a restricted set of controls, and a "full" specification where a number of additional control variables are considered.

In the baseline regressions, we include the population size, GDP growth, the unemployment rate, inflation, the share of the population living in urban areas, the share of people aged between 15 and 65, a measure of the ideology of the current central government, and some measures of a country's constitutional structure.

The population size and urbanization variables are included in order to control for both scale economies and congestion effects in the provision of public goods. Because scale economies tend

Table 7.5: SUMMARY STATISTICS ON DEPENDENT AND INDEPENDENT VARIABLES

Variable	Variance Component	Obs.	Mean	Std. Dev.	Min.	Max.
Population	overall	421	34.843	58.427	0.228	282.217
	between	21		53.771	0.252	246.120
	within	20.048		5.474	4.696	70.940
GDP Growth	overall	421	2.103	2.165	-7.008	9.803
	between	21		0.724	0.471	3.862
	within	20.048		2.068	-6.899	8.044
Unemployment	overall	421	6.944	3.804	0.811	19.108
	between	21		3.328	1.894	13.648
	within	20		2.264	-2.553	16.773
Inflation	overall	421	6.551	7.545	-0.691	83.950
	between	21		4.948	1.956	22.817
	within	20.048		6.207	-14.713	67.684
Urbanity	overall	421	74.827	11.334	45.300	96.800
	between	21		12.181	48.317	95.938
	within	20.048		1.352	70.215	79.911
Working Age	overall	421	65.808	2.182	58.302	70.157
	between	21		1.963	60.849	68.960
	within	20.048		1.180	61.553	70.516
Left	overall	421	2.489	1.506	1.000	5.000
	between	21		0.818	1.000	3.720
	within	20.048		1.242	-0.231	5.864
Plurality Rule	overall	421	0.489	0.786	0.000	2.000
	between	21		0.735	0.000	2.000
	within	20.048		0.069	-0.011	0.989
Presidential Sys.	overall	421	0.197	0.398	0.000	1.000
	between	21		0.402	0.000	1.000
	within	20.048		0.000	0.197	0.197
Federal dummy	overall	421	0.363	0.482	0.000	1.000
	between	21		0.454	0.000	1.000
	within	20.048		0.151	-0.113	1.078
Government revenue	overall	397	44.447	8.018	27.717	63.185
	between	20		7.406	32.589	59.176
	within	19.85		2.684	35.611	51.173
Openness	overall	397	65.154	31.699	16.100	224.500
	between	20		40.989	20.155	201.470
	within	19.85		7.099	38.719	98.015
Interest rate	overall	397	9.761	3.325	3.039	21.283
	between	20		2.237	4.403	14.531
	within	19.85		2.753	0.107	19.229

[1] Summary statistics are always calculated with the observations used in at least one regression model.
[2] The number of within observations is uneven for some variables because of the unbalanced nature of the panel.
[3] The number of between observations varies between variables because Greece falls out of the "full" models due to missing observations on the interest rate

to reduce the costs of government activity whereas congestion effects tend to increase them, the direction of these variables' effect on primary deficits is ex-ante ambiguous. GDP per capita growth and the unemployment rate are included in order to control for those business cycle effects that are not already captured by time-fixed effects (for example, country-specific economic shocks). GDP growth is expected to reduce deficits, firstly because of an increase in taxes and secondly because of the diminished need to engage in expansionary policies. For opposite reasons, the unemployment rate is expected to have a positive effect on public deficits. The inflation rate is included in order to control for the extent to which governments finance expenditures by means of an increase in the money supply. Since deficit-finance and an expansion of the money supply are alternative ways to raise revenues, it is expected that the estimated coefficient on this variable will have a negative sign. The share of the population which is between 15 and 65 is included in order to control for the number of people who either explicitly or implicitly receive redistributive transfers. Since expenditure needs are higher in countries where a larger share of the population is "dependent", this variable is expected to have a positive sign.

The Left variable, which measures the ideological position of the ruling party or coalition at the center, is included in order to control for systematic partisan differences in the disposition toward deficits. The ideology of the government is measured by an index that runs from 1 (right-wing hegemony) to 5 (left-wing hegemony). The data is obtained from the Comparative Political Data Set I, 1960-2006 (CPDS I) constructed by Armingeon et al. (2008). While the literature suggests that this variable might be an important determinant of deficits, the expected sign of the coefficient is ambiguous ex ante. More traditional contributions (e. g. Hibbs (1977)) seem to suggest a positive coefficient, that is that left-wing governments run higher deficits, but this conjecture has been questioned recently. While stating that left parties might indeed favor higher expenditures, Borrelli and Royed (1995) argue that they are also more likely to raise taxes, with no obvious effect on public deficits. Alesina and Perotti (1995a) indeed show that in OECD countries during the mid-seventies and eighties, left governments were more likely to implement successful budget consolidations than center and right-wing governments.

We also consider some institutional variables since a number of contributions have established their relevance for fiscal outcomes (e. g. Persson and Tabellini (2004b) and Feld and Schnellenbach (2008)). We control for whether the executive is based on a presidential or parliamentary system, and for whether the electoral system is based on a plurality rule or a proportional allocation of seats. The type of executive is measured by a dummy variable which assumes the value of 1 if the country is a presidential system. The electoral system is measured by an index that runs from 0 (proportional) to 2 (plurality), with a 1 indicating intermediate systems. Both variables are derived from the CPDS I database, which in turn has obtained them from Huber et al. (2004). Since observations for these variables are only available up to the year 2000 while our remaining variables also cover 2001, we extrapolate the values for these variables from 2000 to 2001 for all countries since we are (after consulting different sources) unaware of any major constitutional reforms in this particular year that should result in a change of the values for these variables. A second caveat is that observations for certain countries[5] are unavailable in this database. We construct these missing observations by consulting different sources, and in particular the database used in Persson and Tabellini (2003).

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[5]That is, Greece, Iceland, Luxembourg, Portugal, and Spain.

Since a number of contributions (e. g. Persson and Tabellini (2004a)) have provided both theoretical arguments and empirical evidence suggesting that elections based on plurality rule lead to more accountability, less spending and lower deficits than a proportional allocation of votes, the expected sign on the plurality variable is negative.[6] On the other hand, the expected coefficient on the presidential-parliamentary dummy is ambiguous. While presidential regimes tend to have a longer time-horizon (because the executive usually does not have to face votes of no-confidence), they are also more likely to suffer from political deadlock when the executive is controlled by one party and the legislature by another (Persson and Tabellini, 2004b).

We include in some of the baseline and full models a dummy variable which indicates whether the country is a federation. This federal dummy is included because it seems a reasonable conjecture that the constitutional standing of subnational governments is related to both the degree of fiscal decentralization and the fiscal deficit of the public sector. The values of this variable in our dataset mirror the federalism dummies in the CPDS I and Persson and Tabellini (2003) databases for all countries with the exception of Spain and Belgium. While the last two databases code these two countries as unitary states throughout the sample periods, Spain and Belgium are widely recognized to be federal states in all but name at least since the mid-nineties and the late eighties[7], respectively (see Agranoff (1996) for a discussion of the Spanish case and Beaufays (1988) for Belgium). We thus code Belgium until 1989 and Spain until 1992 as unitary states, and then as federations because important constitutional reforms were made around these years in the two countries (we rely on the time-line in Stegarescu (2005) for choosing these particular years). While recognizing that there is a degree of arbitrariness in this coding, we believe that it is reasonable. In any case, the results below are also robust to different codings.

Note that there is within-variation in the federalism dummy and in the electoral rule variable, which enables us to include these in fixed effects models. This variation over time, however, is based on a small number of countries; therefore conclusions with regard to these two variables should only be made with caution. The presidential-parliamentary dummy has no time-variation and is therefore discarded in the fixed effects models.

In the full specifications, we additionally include the ratio of government receipts to GDP, a measure of trade openness, and the interest rate on government bonds. The inclusion of the government receipt variable is perhaps problematic because revenues might be directly influenced by the level of fiscal decentralization, i. e. the inclusion of this variable might mask the independent effect of decentralization. However, including this variable has one advantage. Since the measures of tax decentralization are constructed as a ratio with respect to total government revenues, the decentralization measure might indicate an increase in decentralization when the federal government receives fewer revenues and everything else is held constant (and vice versa). But such a decrease in federal revenues would also imply that the size of government shrinks, and not controlling for this effect might lead to an omitted variable bias. We therefore try to deal with this problem by including government revenue as an additional control in the fully specified models while omitting this variable in the baseline specifications.

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[6]Some qualifications must be made, however. There are some arguments as to why plurality rule might lead to less favorable outcomes, see Persson and Tabellini (2004b) for a comprehensive discussion. In general, therefore, observing a positive sign on the variable is not considered to be impossible.

[7]Belgium has even become a federal state with the constitutional reform of 1994.

The inclusion of the openness variable is motivated by the fact that globalization might constrain the government's ability to tax mobile production factors, and at the same time lead to a process of decentralization as argued by the recent literature on "glocalization" (Sharma, 2005). On the other hand, it might also improve the fiscal stance of the government if sound fiscal policies are perceived by investors as a commitment to lower tax rates in the future. The expected direction of the effect is therefore ambiguous.

The interest rate on government bonds is included in order to control for the cost of borrowing. It is likely to be relevant in determining the fiscal policies of all tiers of governments, even though its theoretical sign is ambiguous. On the one hand, governments should borrow less if the interest rate increases. On the other hand, expenditures to pay interest on the existing stock of debt will increase, leaving the overall effect on deficits indeterminate.

7.4 The empirical model

We test two well-established hypotheses: (i) that decentralization increases public sector deficits because of coordination failures and soft budget constraints ("welfare-economic view"); or (ii) that decentralization decreases deficits by forcing leviathanic governments to reduce inefficient spending ("Public Choice view").

Since these hypotheses contradict each other, we have no priors with regard to the sign of the coefficients of the decentralization variables in the following empirical model

$$Y_{it} = \alpha_i + \omega_t + \beta DEC_{it} + \delta Z_{it} + \epsilon_{it}. \tag{7.1}$$

In this model, Y_{it} denotes the consolidated primary deficit to GDP ratio, ω_t represent the time and α_i the cross-country effects. The error term is denoted with ϵ_{it}. Cross-section dummies are included in the fixed-effects models in order to control for unobserved heterogeneity. Time fixed effects are included in all models in order to control for common shocks.

The DEC_{it} vector consists of decentralization measures and their squares. By including quadratic transformations of the decentralization variables, we explicitly consider nonlinearities in the impact of fiscal decentralization (see also the discussion in section 7.2).

The $Z_{it} \in$ {Population, GDP Growth, Unemployment, Inflation, Urbanity, Working Age, Left, Plurality Rule, Presidential Sys., Government revenue, Openness, Interest rate, Federal dummy} vector consists of economic controls. For the individual specifications of the models, see the regression tables. All variables and the theoretical rationale for including them are described in the last section.

The final dataset consists of an unbalanced panel of 21 OECD[8] countries for which annual observations are available between 1975 and 2001. The unbalanced nature is mostly due to missing observations of the expenditure decentralization variable from the IMF's GFS dataset. To ensure comparability between the various models in each regression table, we drop all observations for which at least one of the decentralization variables is missing. All hypothesis tests are based on heteroscedasticity-robust standard errors. In some models (see the regression tables), stan-

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[8] See appendix A for a full list of countries.

dard errors are also clustered in order to control for cross-section specific autocorrelation in the idiosyncratic errors.

Given the panel structure of the dataset, the random effects model is in all likelihood superior to a simple pooled OLS specification. This conjecture is partially confirmed by Breusch-Pagan Lagrange Multiplier tests (not reported but available upon request) which tend to reject the hypothesis of no cross-section specific effects for a number of representative models. One implicit assumption that must be true for the random effects model to be correct is that the unobserved country-specific effect is not correlated with the control variables. As this is deemed unlikely in macro-economic datasets, the Hausman test is conducted for a number of representative models (not reported but available upon request). Since the test generally rejects the null of no systematic differences between the random and fixed effects specifications, the fixed effects specification is in all likelihood the appropriate one.

An additional reason for including country dummies is that while we explicitly control for some institutional features (e.g. presidential vs. parliamentary) of a country, it is certainly impractical to control for all of them. Given that these are extremely "sticky" and rarely vary within a country over time, they are most easily captured by country-specific dummies. For example, we can implicitly capture different subnational borrowing regimes between countries by such an approach. One unfortunate implication of this approach is that we cannot estimate the independent effect of these omitted institutional features on fiscal balances. But since we are primarily interested in the impact of decentralization, this is only a minor shortcoming.

However, even though fixed effects models have these advantages, they rely exclusively on the within-country variation and completely discard the information present in the between variation. Therefore, we first report the results from random effects models, and then contrast these against the results from fixed effects regression. When there are significant differences between these two specifications, we rely on the fixed effects models. Finally, we report the results from a number of robustness checks.

7.5 Results

7.5.1 Random effects models

In table 7.6, the baseline random effects regressions with a restricted set of economic controls are reported. In models RE 1 to RE 3, each of the decentralization variables is included separately. In these models, the own taxes decentralization variable is the only one to display a non-linear effect as evidenced by the significant coefficient on the square of this variable. The sign on the square (*Own taxes Sq.*) is positive whereas the base effect (*Own taxes*) is negative. This points to a U-shaped relationship between own taxes decentralization and public deficits: OECD countries with either a very high or a very low level of own taxes decentralization have apparently faced disproportionately higher primary deficits during the time frame of our analysis than countries with intermediate levels. The significantly negative marginal effect of the variable at the sample average suggests furthermore that a marginal increase in the decentralization variable in the "average" OECD country would have led to a reduction in primary deficits. However, we also see from the estimates in model RE 2 that the level of own tax decentralization associated with the minimum

primary deficit is about 23%.[9] Since the average level of own tax decentralization in our sample is about 20% (see table 7.2), OECD countries were– according to these estimates- already very close to the optimal level of own taxes decentralization.

In model RE 4, all decentralization variables are jointly included. Model RE 5 augments the fourth model by the inclusion of a federation dummy. In model RE-CL, significance tests are based on clustered standard errors.

In models RE 4 and RE 5, the square on the shared taxes decentralization variable (*Shared taxes Sq.*) displays a significantly positive coefficient whereas the coefficient on the base effect (*Shared taxes*) is negative. According to these estimates, therefore, the shared taxes decentralization variable also displays U-shaped relationship. The optimal level of shared tax decentralization is about 20%. Since the average OECD country has only a level of shared taxes decentralization of about 4.7% (see table 7.2), it is not surprising that our estimates suggest that an increase in this variant of decentralization would have led to a reduction in primary deficits in the average OECD country (the coefficient at the sample average is negative).

The signs of the *Own taxes* and *Own taxes Sq.* variables reaffirm the finding of an U-shaped relationship between own taxes decentralization and primary deficits. According to the numerical values of the estimates, the optimal level of own taxes decentralization is about 22%. That is, we find again that in OECD countries with either a very high or a very low level of own taxes decentralization, a reform which would have brought the level of own taxes decentralization to some intermediate level would have reduced primary deficits. However, given that the marginal effect at the sample average is insignificant in these models, there is some doubt that a change in own taxes decentralization would have led to a reduction in primary deficits in the average OECD country.

The expenditure decentralization variable continues to display an effect that is similar to that in model RE 1. Both the square of this variable and its marginal effect at the sample average are insignificant, except in model RE 5 where both are barely significant at the 10% level.

The remaining economic control variables perform reasonably in all six models. Firstly, the GDP per capita growth variable is significantly negative in all models, indicating that an one percentage point increase in GDP per capita growth has reduced the deficit to GDP ratio by about 0.24 percentage points. The coefficient on the unemployment variable is significant and positive, suggesting that an one percentage point increase in the unemployment rate has increased the deficit to GDP ratio by about 0.20 percentage points. These results provide evidence in favor of the intuitive conjecture that periods of recession with low levels of growth and high levels of unemployment tend to increase the financial pressures on all branches of government, thereby leading to higher deficits.

The urbanity variable is consistently positive in those models where the decentralization variables are jointly included, indicating the presence of congestion effects. The share of "non-dependent" people is negatively related to deficits, thus confirming expectations. The Left variable is consistently positive, and significant in a number of models, suggesting that left-wing governments have higher deficits on average. As expected, the plurality rule index is negative and

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[9]This "optimal" level is determined as the value of DEC which solves the equation $\beta_1 + 2\beta_2 DEC = 0$, where the left-hand side is the marginal effect $\frac{\partial Y_{it}}{\partial DEC_{it}}$ of the decentralization variables on primary deficits (β_1 is the coefficient on the base effect, and β_2 the one on the squared term).

Table 7.6: REGRESSIONS OF DEFICIT TO GDP RATIO ON DECENTRALIZATION MEASURES; 1975 TO 2001, RANDOM EFFECTS, BASELINE SPECIFICATION

	RE 1 b/se	RE 2 b/se	RE 3 b/se	RE 4 b/se	RE 5 b/se	RE-CL b/se
Population	0.002	0.007***	0.001	0.005**	0.005	0.005
	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
GDP Growth	-0.295***	-0.241***	-0.291***	-0.240***	-0.240***	-0.240**
	(0.076)	(0.076)	(0.076)	(0.075)	(0.075)	(0.098)
Unemployment	0.165***	0.198***	0.168***	0.206***	0.204***	0.204**
	(0.042)	(0.041)	(0.043)	(0.041)	(0.042)	(0.086)
Inflation	-0.013	0.007	-0.010	0.004	0.002	0.002
	(0.017)	(0.017)	(0.018)	(0.017)	(0.017)	(0.014)
Urbanity	-0.008	0.039**	-0.007	0.039**	0.039**	0.039**
	(0.014)	(0.016)	(0.014)	(0.015)	(0.015)	(0.018)
Working Age	-0.234***	-0.309***	-0.249***	-0.251***	-0.259***	-0.259**
	(0.089)	(0.077)	(0.089)	(0.088)	(0.089)	(0.106)
Left	0.021	0.186**	0.023	0.234**	0.238**	0.238
	(0.096)	(0.091)	(0.095)	(0.097)	(0.097)	(0.200)
Plurality Rule	0.073	-0.539***	0.092	-0.454**	-0.519**	-0.519
	(0.228)	(0.203)	(0.238)	(0.226)	(0.223)	(0.303)
Presidential Sys.	-0.403	0.259	-0.332	0.084	0.103	0.103
	(0.374)	(0.371)	(0.407)	(0.416)	(0.418)	(0.420)
Federal dummy					0.441	0.441
					(0.382)	(0.442)
Exp. decent.	-0.022			0.044	0.046	0.046
	(0.040)			(0.039)	(0.040)	(0.076)
Exp. decent. Sq.	0.000			-0.001	-0.001*	-0.001
	(0.001)			(0.001)	(0.001)	(0.001)
Own taxes		-0.230***		-0.220***	-0.218***	-0.218**
		(0.036)		(0.047)	(0.047)	(0.095)
Own taxes Sq.		0.005***		0.005***	0.005***	0.005***
		(0.001)		(0.001)	(0.001)	(0.001)
Shared taxes			-0.036	-0.128***	-0.163***	-0.163
			(0.049)	(0.047)	(0.055)	(0.151)
Shared taxes Sq.			0.001	0.003***	0.004***	0.004
			(0.001)	(0.001)	(0.001)	(0.003)
$\frac{\partial S}{\partial ED}(\overline{ED})$	-0.006			-0.027	-0.032*	-0.032
$\frac{\partial S}{\partial OD}(\overline{OD})$		-0.035***		-0.018	-0.019	-0.019
$\frac{\partial S}{\partial SD}(\overline{SD})$			-0.025	-0.095***	-0.124***	-0.124
N	421	421	421	421	421	421
χ^2	1746.017	2421.584	1844.562	2473.784	2561.122	
$\bar{R}^2$	0.331	0.431	0.331	0.447	0.448	
RMS error	2.640	2.434	2.639	2.414	2.414	2.414

[1] The expression $\frac{\partial S}{\partial ED}$ denotes the marginal effect of expenditure decentralization evaluated at the sample average, $\frac{\partial S}{\partial OD}$ the marginal effect of own taxes decentralization, $\frac{\partial S}{\partial SD}$ the marginal effect of shared taxes decentralization

[2] Model 1-6 have been estimated with time fixed effects, coefficients are suppressed in the tables

[3] Stars indicate significance levels at 10% (*), 5% (**) and 1%(***)

[4] Significance tests are based on robust standard errors; model 6 (CL) uses additionally clustered standard errors

significant in a number of models whereas the presidential dummy is insignificant. The size of the population, the inflation rate, and the dummy indicating whether the country is formally a federation are not significantly different from zero.

In table 7.7, the random effects regressions with the full set of economic controls are reported. The number of available observations is slightly smaller in these models than in the baseline regressions because some observations on the interest rate variable are missing for Greece, Iceland, and Luxembourg (Greece even drops out of the sample).

In models RE 1 to RE 3 where the decentralization variables are separately included, only the square of the own tax decentralization variable is significant, i. e. only own taxes decentralization displays a non-linear effect. The coefficient is positive whereas the base effect is negative. The marginal effect at the sample average, however, is significantly negative. Overall, these results are similar to models RE 1 to RE 3 in the baseline regressions.

In the models where all decentralization variables are jointly included, we find that the squares of all decentralization variables are consistently significant, with the exception of the shared taxes decentralization variable which is insignificant in the model with clustered standard errors. The marginal effect of the own taxes decentralization variable at the sample average is negative but insignificant. On the other hand, the marginal effect of the expenditure decentralization variable is significantly negative. Shared taxes decentralization displays a significantly negative effect in models RE 4 and RE 5, but is insignificant in model RE-CL.

In general, the models RE 4 to CL confirm most of the findings from the analogous baseline models. An exception is the effect of expenditure decentralization: In these more complete speci- fications, this variant of decentralization also displays a non-linear effect. However, it is the base effect that is positive and the squared term that is negative for this variable. This suggest that this variable has a *inversely* U-shaped relationship with primary deficits. Both very high and very low levels of expenditure decentralization seem to have led to lower primary deficits than intermediate levels during the time-frame of our analysis. However, before we explore explanations for why the results for this and the other two variants of decentralization differ, we investigate in the next section if they are robust to the inclusion of country-fixed effects.

The economic control variables in this set of regressions also confirm most of the findings of the baseline models. GDP per capita growth is negatively and significantly related to primary deficits, whereas the unemployment rate displays a significantly positive effect. The inflation rate variable is now significantly and negatively related to deficits. That is, once we control for a number of additional variables, we find that increases in the inflation rate have led to decreasing deficits. This observation confirms the theoretical prediction that monetary expansion and deficit-finance are policy substitutes. The openness variable is apparently significantly and negatively related to deficits, suggesting that globalization and increased economic integration have forced governments to be more conscious about their fiscal policies. The interest rate variable is positive, indicating that expenditure pressures due to higher interest payments for the existing stock of debt have dominated the disincentive effects on deficit-finance due to the higher costs of borrowing. The government revenue variable is insignificant, suggesting that higher revenues were matched by increases in expenditures, with no apparent effects on deficits. Last, the plurality rule index is significantly negative and the presidential dummy insignificant, thus confirming the baseline regressions. The Left variable, on the other hand, is now insignificant.

Table 7.7: REGRESSIONS OF DEFICIT TO GDP RATIO ON DECENTRALIZATION MEASURES; 1975 TO 2001, RANDOM EFFECTS, FULL SPECIFICATION

	RE 1 b/se	RE 2 b/se	RE 3 b/se	RE 4 b/se	RE 5 b/se	RE-CL b/se
Population	-0.002	0.005**	-0.002	0.002	0.002	0.002
	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)
Growth	-0.352***	-0.248***	-0.354***	-0.260***	-0.253***	-0.253***
	(0.081)	(0.077)	(0.080)	(0.075)	(0.077)	(0.087)
Unemployment	0.181***	0.220***	0.185***	0.222***	0.221***	0.221***
	(0.044)	(0.043)	(0.044)	(0.043)	(0.043)	(0.073)
Inflation	-0.207***	-0.156***	-0.200***	-0.204***	-0.201***	-0.201*
	(0.068)	(0.058)	(0.068)	(0.065)	(0.065)	(0.112)
Urbanity	-0.013	0.048***	-0.013	0.046***	0.047***	0.047**
	(0.015)	(0.017)	(0.015)	(0.017)	(0.017)	(0.023)
Working Age	-0.286***	-0.350***	-0.297***	-0.235**	-0.240***	-0.240***
	(0.098)	(0.080)	(0.092)	(0.092)	(0.092)	(0.090)
Left	-0.014	0.121	-0.005	0.127	0.127	0.127
	(0.110)	(0.098)	(0.115)	(0.102)	(0.102)	(0.208)
Plurality Rule	-0.056	-0.788***	-0.107	-0.708***	-0.746***	-0.746**
	(0.227)	(0.209)	(0.256)	(0.237)	(0.242)	(0.311)
Presidential Sys.	-0.510	0.355	-0.497	0.018	0.056	0.056
	(0.379)	(0.383)	(0.433)	(0.459)	(0.466)	(0.550)
Government revenue	-0.029	0.015	-0.031	-0.003	0.007	0.007
	(0.023)	(0.020)	(0.023)	(0.019)	(0.026)	(0.045)
Openness	-0.017***	-0.025***	-0.016**	-0.023***	-0.024***	-0.024**
	(0.006)	(0.006)	(0.006)	(0.007)	(0.007)	(0.009)
Interest rate	0.098	0.182**	0.093	0.260***	0.264***	0.264
	(0.088)	(0.073)	(0.080)	(0.092)	(0.093)	(0.165)
Federal dummy					0.337	0.337
					(0.489)	(0.734)
Exp. decent.	-0.006			0.108**	0.105**	0.105
	(0.052)			(0.049)	(0.049)	(0.065)
Exp. decent. Sq.	-0.000			-0.002***	-0.002***	-0.002**
	(0.001)			(0.001)	(0.001)	(0.001)
Own taxes		-0.286***		-0.259***	-0.264***	-0.264***
		(0.039)		(0.044)	(0.046)	(0.088)
Own taxes Sq.		0.006***		0.006***	0.006***	0.006***
		(0.001)		(0.001)	(0.001)	(0.001)
Shared taxes			-0.010	-0.080*	-0.105**	-0.105
			(0.045)	(0.042)	(0.052)	(0.113)
Shared taxes Sq.			0.000	0.002*	0.002**	0.002
			(0.001)	(0.001)	(0.001)	(0.003)
$\frac{\partial S}{\partial ED}(\overline{ED})$	-0.008			-0.039**	-0.041**	-0.041***
$\frac{\partial S}{\partial OD}(\overline{OD})$		-0.045***		-0.018	-0.021	-0.021
$\frac{\partial S}{\partial SD}(\overline{SD})$			-0.007	-0.060*	-0.080*	-0.080
N	397	397	397	397	397	397
χ^2	1875.443	2417.112	1944.801	2556.903	2552.447	879.319
$\bar{R}^2$	0.381	0.504	0.380	0.521	0.522	0.522
RMS error	2.598	2.325	2.600	2.298	2.301	2.301

[1] The expression $\frac{\partial S}{\partial ED}$ denotes the marginal effect of expenditure decentralization evaluated at the sample average, $\frac{\partial S}{\partial OD}$ the marginal effect of own taxes decentralization, $\frac{\partial S}{\partial SD}$ the marginal effect of shared taxes decentralization
[2] Model 1-6 have been estimated with time fixed effects, coefficients are suppressed in the tables
[3] Stars indicate significance levels at 10% (*), 5% (**) and 1%(***)
[4] Significance tests are based on robust standard errors; model 6 (CL) uses additionally clustered standard errors

7.5.2 Fixed effects models

Even though the random effects models reveal a number of interesting relationships between the three types of fiscal decentralization and primary deficits, they might lead to inconsistent estimates if the error term is correlated with some of the control variables due to unobserved country-specific heterogeneity. Therefore, we report in table 7.8 the results from a re-estimation of the baseline models with country dummies.

In models FE 1 to FE-CL only the own taxes decentralization variables displays a significant non-linear effect. The sign of the base and square variables again suggest a U-shaped relationship between this variant of decentralization and primary deficits. However, note that in contrast to the random effects models, the marginal effect at the sample average is significantly positive in models FE 4 to FE-CL. This indicates that an increase in own taxes decentralization would have led to an increase in primary decentralization in the average OECD country. According to these estimates, the optimal level of own taxes decentralization is about 10%, and thus significantly smaller than the optimal level according to the random effects models.

Secondly, we find that the marginal effect of shared taxes decentralization at the sample average is significantly negative. This suggests that an increase in this variant of decentralization would have led to lower primary deficits in the average OECD country.

Thirdly, note that expenditure decentralization neither displays a non-linear nor a significant effect at the sample average.

The economic control variables continue to perform reasonably, even though small changes to the results from the random effects models can also be observed. The size of the population, GDP per capita growth, the unemployment rate, inflation, and the working age variable perform as in the random effects regressions. On the other hand, the urbanity variable is now insignificant, which is not unexpected given that there is only little variation over time is this variable. One interesting change to the baseline regressions with a random effects specification is that the coefficient on the federation dummy is now significantly negative, indicating that moving from a unitary to a federal state structure has reduced primary deficits on average by about two percentage points in the two countries, Spain and Belgium, that display within-variation in this variable.

Also, the effect of the plurality rule index is now much larger, even though it still is negative. However, it must be again emphasized that only Italy displays within variation in this variable. Overall, therefore, the results from the fixed effects models regarding the effect of the plurality rule variable should be interpreted with caution.

We report the models where we include both fixed effects and the complete set of regressors in table 7.9. We find that the results from the fixed effects models with the restricted set of controls are reaffirmed with regard to the decentralization variables.

Expenditure decentralization does not display a non-linear effect, and is insignificant at the sample average in table 7.8 and 7.9. Thus, we might conjecture on the basis of these results that the finding of an inversely U-shaped relationship between expenditure decentralization and primary deficits in the random effects models with the full set of controls is not robust to the inclusion of country-fixed effects.

The economic controls are largely similar to the baseline regressions. One exception is the GDP growth variable which is now insignificant. The additionally included variables– i.e., government

Table 7.8: Regressions of Deficit to GDP ratio on decentralization measures; 1975 to 2001, Fixed Effects, baseline specification

	FE 1 b/se	FE 2 b/se	FE 3 b/se	FE 4 b/se	FE 5 b/se	FE-CL b/se
Population	0.010	0.007	-0.014	-0.017	-0.019	-0.019
	(0.022)	(0.016)	(0.017)	(0.020)	(0.020)	(0.038)
GDP Growth	-0.189**	-0.214***	-0.171**	-0.178**	-0.185**	-0.185**
	(0.074)	(0.073)	(0.072)	(0.071)	(0.072)	(0.069)
Unemployment	0.515***	0.503***	0.481***	0.447***	0.453***	0.453**
	(0.074)	(0.070)	(0.068)	(0.072)	(0.072)	(0.169)
Inflation	-0.033	-0.032	-0.027	-0.019	-0.018	-0.018
	(0.021)	(0.020)	(0.020)	(0.018)	(0.018)	(0.021)
Urbanity	-0.034	-0.019	-0.015	0.067	0.070	0.070
	(0.095)	(0.092)	(0.091)	(0.093)	(0.092)	(0.245)
Working Age	-0.699***	-0.628***	-0.787***	-0.720***	-0.698***	-0.698*
	(0.181)	(0.136)	(0.139)	(0.168)	(0.168)	(0.355)
Left	0.101	0.150	0.155	0.178*	0.160	0.160
	(0.112)	(0.096)	(0.102)	(0.103)	(0.103)	(0.199)
Plurality Rule	-9.163***	-7.610***	-9.535***	-8.462***	-8.730***	-8.730***
	(0.790)	(0.780)	(0.749)	(0.826)	(0.842)	(1.587)
Federal dummy					-2.082***	-2.082**
					(0.687)	(0.853)
Exp. decent.	-0.015			-0.026	-0.009	-0.009
	(0.107)			(0.105)	(0.104)	(0.258)
Exp. decent. Sq.	-0.000			0.001	0.001	0.001
	(0.002)			(0.001)	(0.001)	(0.003)
Own taxes		-0.326***		-0.167**	-0.137**	-0.137
		(0.079)		(0.067)	(0.065)	(0.156)
Own taxes Sq.		0.009***		0.007***	0.007***	0.007
		(0.002)		(0.002)	(0.002)	(0.004)
Shared taxes			-0.356***	-0.374***	-0.273***	-0.273*
			(0.106)	(0.110)	(0.102)	(0.146)
Shared taxes Sq.			0.005	0.005	0.004	0.004
			(0.005)	(0.005)	(0.005)	(0.007)
$\frac{\partial S}{\partial ED}(\overline{ED})$	-0.037			0.032	0.046	0.046
$\frac{\partial S}{\partial OD}(\overline{OD})$		0.022		0.122***	0.137***	0.137
$\frac{\partial S}{\partial SD}(\overline{SD})$			-0.310***	-0.326***	-0.235***	-0.235**
N	421	421	421	421	421	421
F	24.144	25.972	24.091	23.125	22.803	107.578
$\bar{R}^2$	0.409	0.449	0.456	0.482	0.485	0.485
RMS error	2.212	2.136	2.122	2.071	2.066	2.066

[1] The expression $\frac{\partial S}{\partial ED}$ denotes the marginal effect of expenditure decentralization evaluated at the sample average, $\frac{\partial S}{\partial OD}$ the marginal effect of own taxes decentralization, $\frac{\partial S}{\partial SD}$ the marginal effect of shared taxes decentralization
[2] Model 1-6 have been estimated with cross-country and time fixed effects, coefficients are suppressed in the tables
[3] Stars indicate significance levels at 10% (*), 5% (**) and 1%(***)
[4] Significance tests are based on robust standard errors; model 6 (FE-CL) uses additionally clustered standard errors

Table 7.9: REGRESSIONS OF DEFICIT TO GDP RATIO ON DECENTRALIZATION MEASURES; 1975 TO 2001, FIXED EFFECTS, FULL SPECIFICATION

	FE 1 b/se	FE 2 b/se	FE 3 b/se	FE 4 b/se	FE 5 b/se	FE-CL b/se
Population	0.000	-0.001	-0.020	-0.025	-0.029	-0.029
	(0.022)	(0.016)	(0.017)	(0.020)	(0.021)	(0.032)
GDP Growth	-0.076	-0.039	-0.056	-0.047	-0.065	-0.065
	(0.088)	(0.082)	(0.085)	(0.082)	(0.083)	(0.068)
Unemployment	0.640***	0.605***	0.598***	0.543***	0.553***	0.553***
	(0.084)	(0.083)	(0.084)	(0.080)	(0.080)	(0.168)
Inflation	0.014	0.021	0.005	0.012	0.016	0.016
	(0.078)	(0.069)	(0.074)	(0.071)	(0.071)	(0.071)
Urbanity	-0.230**	-0.132	-0.160	-0.078	-0.076	-0.076
	(0.104)	(0.099)	(0.102)	(0.105)	(0.106)	(0.254)
Working Age	-0.562**	-0.266*	-0.524***	-0.480**	-0.477**	-0.477
	(0.217)	(0.151)	(0.156)	(0.199)	(0.198)	(0.344)
Left	0.094	0.175*	0.176*	0.165	0.139	0.139
	(0.112)	(0.100)	(0.105)	(0.103)	(0.101)	(0.178)
Plurality Rule	-8.468***	-6.729***	-8.776***	-7.676***	-8.032***	-8.032***
	(0.811)	(0.849)	(0.835)	(0.859)	(0.866)	(1.255)
Government revenue	-0.208***	-0.083	-0.131*	-0.151**	-0.167**	-0.167
	(0.072)	(0.062)	(0.066)	(0.071)	(0.071)	(0.099)
Openness	-0.153***	-0.167***	-0.138***	-0.157***	-0.154***	-0.154***
	(0.026)	(0.025)	(0.025)	(0.025)	(0.025)	(0.053)
Interest rate	0.159	0.211**	0.158	0.233**	0.231**	0.231
	(0.104)	(0.100)	(0.099)	(0.106)	(0.106)	(0.180)
Federal dummy					-2.588***	-2.588***
					(0.614)	(0.793)
Exp. decent.	0.254**			0.200*	0.241**	0.241
	(0.112)			(0.111)	(0.111)	(0.204)
Exp. decent. Sq.	-0.004**			-0.002	-0.002	-0.002
	(0.002)			(0.002)	(0.002)	(0.003)
Own taxes		-0.339***		-0.170***	-0.128**	-0.128
		(0.076)		(0.061)	(0.059)	(0.107)
Own taxes Sq.		0.010***		0.008***	0.008***	0.008**
		(0.002)		(0.002)	(0.002)	(0.003)
Shared taxes			-0.281**	-0.391***	-0.268**	-0.268*
			(0.118)	(0.113)	(0.104)	(0.132)
Shared taxes Sq.			0.003	0.007	0.005	0.005
			(0.006)	(0.005)	(0.005)	(0.007)
$\frac{\partial S}{\partial ED}(\overline{ED})$	-0.009			0.048	0.072	0.072
$\frac{\partial S}{\partial OD}(\overline{OD})$		0.084*		0.172***	0.189***	0.189*
$\frac{\partial S}{\partial SD}(\overline{SD})$			-0.256***	-0.325***	-0.215***	-0.215***
N	397	397	397	397	397	397
F	27.923	26.310	26.388	23.974	23.666	266.950
$\bar{R}^2$	0.499	0.545	0.531	0.578	0.583	0.583
RMS error	2.071	1.974	2.004	1.902	1.889	1.889

[1] The expression $\frac{\partial S}{\partial ED}$ denotes the marginal effect of expenditure decentralization evaluated at the sample average, $\frac{\partial S}{\partial OD}$ the marginal effect of own taxes decentralization, $\frac{\partial S}{\partial SD}$ the marginal effect of shared taxes decentralization

[2] Model 1-6 have been estimated with cross-country and time fixed effects, coefficients are suppressed in the tables

[3] Stars indicate significance levels at 10% (*), 5% (**) and 1%(***)

[4] Significance tests are based on robust standard errors; model 6 (CL) uses additionally clustered standard errors

revenue, openness, and the interest rate– perform reasonably. Furthermore, the only remarkable difference to the results from the fully specified random effects models in table 7.7 is that the government revenue variable is now significant and negative, indicating that increases in tax receipts have on average improved the fiscal balance. This change in significance is probably due to the fact that the fixed effects models discard the between variation. Within countries, there are various reasons as to why an increase in revenues should lead to improvements in the fiscal balance. For example, a positive exogenous shock might lead to higher tax revenues whereas spending, at least in the short run, might remain constant. Between countries, however, differences in the tax to GDP ratio primarily indicate differing preferences with regard to the size of government. That is, higher tax revenues might be accompanied by higher expenditures, and therefore not lead to an improvement in the fiscal balance in the long run.

In any case, the fiscal effect of an increase in tax revenues is rather small. An increase of the tax revenue to GDP growth ratio by one percentage point has decreased the deficit only by about 0.15 percentage points. This result might be understood as further evidence for the presence of the so called flypaper effect, which is an expression for the empirical phenomenon that an exogenous increase in subnational revenues is often found to lead to an increase in spending rather than to a reduction in tax rates or to a pay-off of the existing stock of debt (Hines and Thaler, 1995).

Overall, the results of the fully specified, consistent and robust model (model FE-CL in table 7.9) are reaffirmed in a number of alternative specifications, and indicate that during the 1975-2001 period

- Expenditure decentralization was unrelated to primary deficits[10]

- Own taxes decentralization had a U-shaped effect on primary deficits

- A reduction in own taxes decentralization would have led to a reduction in primary deficits in the average OECD country

- Shared taxes decentralization did not display a non-linear effect

- An increase in shared taxes decentralization would have decreased primary deficits in the average OECD country.

7.5.3   Robustness checks

In this section, we re-evaluate the results from the above models by conducting a number of robustness checks. We first attempt to increase the efficiency of the fixed effects models by using the fixed effects vector decomposition approach developed by Pluemper and Troeger (2007), and then consider potential outliers.

Fixed effects vector decomposition

In this section, we re-estimate the fully specified fixed effects models in table 7.9 (except FE-CL, i. e. the one with clustered standard errors) with the fixed effects vector decomposition approach.

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[10]This result also suggests that vertical fiscal imbalances have not endangered the fiscal stance of the government in OECD countries, since an increase in expenditure decentralization while holding own and shared taxes decentralization constant has had apparently no significant effect on primary deficits.

As stated in appendix B of chapter 4, this approach can lead to more precise estimates. In the estimations, we again perceive the decentralization measures and their squares as rarely changing variables. The results are collected in table 7.10.

First, note that the decentralization measures, their squares, and the marginal effects at the sample average are usually more significant than in table 7.9 (an obvious indication of the increases in efficiency due to the fixed effects vector decomposition approach). Nonetheless, the main conclusions from the fully specified fixed effects models are confirmed by these regressions. Expenditure decentralization does not seem to display a non-linear effect whereas own tax decentralization has, as in table 7.9, an U-shaped relationship with primary deficits. The coefficients on the shared taxes decentralization variable and its square have the same signs as in table 7.9, but in addition they are now also significant.

The marginal effects at the sample average are always significant and suggest according to models FE 4 and FE 5 (the most reliable ones) that an increase in expenditure decentralization and shared taxes decentralization would have led to a reduction in primary deficits in OECD countries, whereas an increase in own taxes decentralization would have caused an increase. Overall, these estimates seem to reaffirm the main findings in the previous section. One noteworthy difference is, however, that the effect of expenditure decentralization at the sample average is significantly negative. That is, once the efficiency of the estimation approach is increased by the application of the fixed effects vector decomposition method, we find that an increase in expenditure decentralization would have decreased primary deficits in the average OECD country.

Outliers

In this subsection, we test for the presence of outliers. The tests are based on the fixed effects models with the full set of controls. First, we test for the normality of residuals[11], and find that the null of normal residuals generally cannot be rejected.

We nonetheless re-estimate the models in table 7.9 after excluding certain countries which might be outliers. For brevity, we only present in the tables below the results for the marginal effects at the sample average and not the full set of estimates. They are, however, available upon request.

We first replicate all models after dropping the United States because this country might be an outlier due to the large deficits during the Cold War. In table 7.11, we report the marginal effect of the decentralization variables at the sample average, and explore whether an increase or a decrease in the three variants of decentralization would have influenced primary deficits in the average OECD country during the time-frame of our analysis.

As evidenced by table 7.11, dropping the United States from the dataset does not change the conclusions with respect to the "average" OECD country that were obtained from table 7.9. Expenditure decentralization has an insignificant, own taxes decentralization a positive, and shared taxes decentralization a negative effect at the sample average. Even though they are not reported, the economic control variables are similar to the results in the fixed effects models.

Secondly, we re-estimate all models after dropping Spain and Belgium from the dataset, because the peculiar political environments in these countries might simultaneously influence the pace of decentralization and fiscal policies in an unexpected way. The results are collected in table 7.12.

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[11] With the iqr command implemented in Stata 9.2.

Table 7.10: Regressions of Deficit to GDP ratio on decentralization measures; 1975 to 2001, Fixed Effects Vector Decomposition, full specification

| | FE 1 | FE 2 | FE 3 | FE 4 | FE 5 |
	b/se	b/se	b/se	b/se	b/se
Population	0.000	-0.001	-0.020***	-0.025***	-0.029***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
GDP Growth	-0.076	-0.039	-0.056	-0.047	-0.065
	(0.069)	(0.066)	(0.067)	(0.064)	(0.064)
Unemployment	0.640***	0.605***	0.598***	0.543***	0.553***
	(0.048)	(0.048)	(0.043)	(0.042)	(0.042)
Inflation	0.014	0.021	0.005	0.012	0.016
	(0.059)	(0.056)	(0.057)	(0.056)	(0.056)
Urbanity	-0.230***	-0.132***	-0.160***	-0.078***	-0.076***
	(0.020)	(0.019)	(0.015)	(0.016)	(0.015)
Working Age	-0.562***	-0.266***	-0.524***	-0.480***	-0.477***
	(0.071)	(0.060)	(0.063)	(0.068)	(0.068)
Left	0.094	0.175**	0.176**	0.165**	0.139*
	(0.083)	(0.078)	(0.082)	(0.080)	(0.079)
Plurality Rule	-8.468***	-6.729***	-8.776***	-7.676***	-8.032***
	(0.638)	(0.558)	(0.610)	(0.604)	(0.619)
Government revenue	-0.208***	-0.083***	-0.131***	-0.151***	-0.167***
	(0.022)	(0.019)	(0.018)	(0.021)	(0.027)
Openness	-0.153***	-0.167***	-0.138***	-0.157***	-0.154***
	(0.011)	(0.013)	(0.009)	(0.012)	(0.011)
Interest rate	0.159**	0.211***	0.158**	0.233***	0.231***
	(0.070)	(0.060)	(0.062)	(0.068)	(0.068)
Federal dummy					5.677***
					(0.700)
Exp. decent.	-0.459***			-0.129***	-0.099**
	(0.058)			(0.050)	(0.049)
Exp. decent. Sq.	0.008***			0.001	-0.001
	(0.001)			(0.001)	(0.001)
Own taxes		-0.248***		-0.185***	-0.145***
		(0.029)		(0.033)	(0.034)
Own taxes Sq.		0.007***		0.007***	0.005***
		(0.001)		(0.001)	(0.001)
Shared taxes			-0.201***	-0.169***	-0.569***
			(0.043)	(0.041)	(0.068)
Shared taxes Sq.			0.002**	0.004***	0.011***
			(0.001)	(0.001)	(0.001)
$\frac{\partial S}{\partial \mathrm{ED}}(\overline{\mathrm{ED}})$	0.088***			-0.084***	-0.144***
$\frac{\partial S}{\partial \mathrm{OD}}(\overline{\mathrm{OD}})$		0.039***		0.103***	0.084***
$\frac{\partial S}{\partial \mathrm{SD}}(\overline{\mathrm{SD}})$			-0.179***	-0.133***	-0.464***
N	397	397	397	397	397
F	12.974	15.142	14.433	15.501	15.466
$\bar{R}^2$	0.538	0.580	0.567	0.610	0.615
RMS error	1.964	1.872	1.900	1.793	1.779

[1] The expression $\frac{\partial S}{\partial \mathrm{ED}}$ denotes the marginal effect of expenditure decentralization evaluated at the sample average, $\frac{\partial S}{\partial \mathrm{OD}}$ the marginal effect of own taxes decentralization, $\frac{\partial S}{\partial \mathrm{SD}}$ the marginal effect of shared taxes decentralization

[2] Model 1-5 have been estimated with time fixed effects, coefficients are suppressed in the tables

[3] Stars indicate significance levels at 10% (*), 5% (**) and 1%(***)

[4] The estimate for the second stage error term (eta) is not shown

Table 7.11: MARGINAL EFFECTS AT THE SAMPLE AVERAGE; 1975 TO 2001, FIXED EFFECTS, FULL SPECIFICATION, WITHOUT USA

	FE 1	FE 2	FE 3	FE 4	FE 5	FE-CL
$\frac{\partial S}{\partial ED}(\overline{ED})$	-0.023			0.047	0.076	0.076
$\frac{\partial S}{\partial OD}(\overline{OD})$		0.044		0.134***	0.155***	0.155
$\frac{\partial S}{\partial SD}(\overline{SD})$			-0.261***	-0.322***	-0.199***	-0.199

[1] The expression $\frac{\partial D}{\partial ED}$ denotes the marginal effect of expenditure decentralization evaluated at the sample average, $\frac{\partial D}{\partial OD}$ the marginal effect of own taxes decentralization, $\frac{\partial D}{\partial SD}$ the marginal effect of shared taxes decentralization
[2] Model 1-6 have been estimated with cross-country and time fixed effects, coefficients are suppressed in the tables
[3] Stars indicate significance levels at 10% (*), 5% (**) and 1%(***)
[4] Significance tests are based on robust standard errors
[5] All models are estimated without the USA

Only five models are estimated because the difference between model FE 4 and FE 5 in table 7.9 is the federation dummy, which is included in FE 5 but not in FE 4. Since there is no within-variation in the federation dummy without Spain and Belgium, model FE 5 in this table is superfluous and therefore omitted.

We find that the effect at the sample average for the expenditure and own taxes decentralization variable remains the same both in significance and magnitude. However, the coefficient on the shared taxes decentralization variable is different. It is now positive and significant at the sample average. Thus, once Belgium and Spain are dropped, the estimates seem to suggest that an increase in subnational autonomy over shared taxes would have caused higher public deficits in the average OECD country.

The fact that Spain and Belgium have such a large influence on the marginal effect of this variable at the sample average can be explained by recognizing that these countries belong to a set of five countries only that possesses a significant degree of subnational autonomy over shared taxes, the other three being Austria, Germany, and Switzerland. However, shared taxes play a different role in Spain and Belgium than in Austria, Germany and Switzerland. In the first two countries, they are used to facilitate a process of fiscal and political devolution. They are an integral part of major institutional reforms which are intended to reduce political tensions within the nation. Therefore, it is not too surprising that they are correlated with improvements in the fiscal balance of the government. In the last three countries, on the other hand, tax sharing systems are a well-established feature of the fiscal constitution, and are often associated with common pool problems and inefficient distortions in the fiscal policies of subnational governments (Homburg, 1994). An increase in shared taxes that accrue to subnational governments might therefore exacerbate common pool problems in these countries and thereby lead to larger deficits. Since the within-variation of the shared taxes decentralization variable is much larger in Spain and Belgium than in Austria, Germany and Switzerland as evidenced by figure 7.4, it is only to be expected that potential reductions in the deficit to GDP ratio in Spain and Belgium due to an expansion of tax sharing would dominate an increase of fiscal profligacy at the subnational level in the last three countries.

Overall, these robustness checks confirm the results of the fixed effects regressions for the own taxes decentralization variable, whereas more differentiated conclusions are obtained for the expenditure and shared taxes decentralization variables. We discuss the implications of these findings in the conclusion.

Table 7.12: Marginal effects at the sample average; 1975 to 2001, Fixed Effects, full specification, without Spain and Belgium

	FE 1	FE 2	FE 3	FE 4	FE-CL
$\frac{\partial S}{\partial ED}(\overline{ED})$	0.093			0.088	0.088
$\frac{\partial S}{\partial OD}(\overline{OD})$		0.253***		0.233***	0.233**
$\frac{\partial S}{\partial SD}(\overline{SD})$			2.465***	2.708***	2.708***

[1] The expression $\frac{\partial D}{\partial ED}$ denotes the marginal effect of expenditure decentralization evaluated at the sample average, $\frac{\partial D}{\partial OD}$ the marginal effect of own taxes decentralization, $\frac{\partial D}{\partial SD}$ the marginal effect of shared taxes decentralization
[2] Model 1-5 have been estimated with cross-country and time fixed effects, coefficients are suppressed in the tables
[3] Stars indicate significance levels at 10% (*), 5% (**) and 1%(***)
[4] Significance tests are based on robust standard errors
[5] All models are estimated without Spain and Belgium

7.6   Conclusion

Our aim in this chapter was to explore empirically the validity of the widespread claim that fiscal decentralization endangers the fiscal stance of the public sector. Our results confirm this hypothesis to some extent. They indicate that an increase in subnational autonomy over "own taxes" would have indeed endangered public finances in the average OECD country during the time frame of our analysis. However, we also find a U-shaped relationship between this variant of decentralization and primary deficits, which suggests that there is some intermediate level of own taxes decentralization which minimizes public deficits, and that both a very high and a very low level of this variant of decentralization should be avoided.

Why does own taxes decentralization display a U-shaped relationship? We speculate that this effect can be explained by the incentives that subnational tax autonomy generates on part of local politicians. That is, if the level of tax autonomy is very low, incentives of subnational officials to put effort into revenue collection could be lower in countries where the tax administration is also decentralized (e.g. Germany). Alternatively, low levels of tax autonomy could also reduce efficiency gains due to yardstick competition or Tiebout sorting.

On the other hand, very high levels of tax autonomy might lead to less tax revenues because of intense horizontal tax competition. Thus, an intermediate level of subnational tax autonomy could indeed be optimal.

The impact of expenditure decentralization, on the other hand, is more difficult to pin down. The fixed effects models suggest that expenditure decentralization has been insignificant, but this conclusion is contradicted by the fixed effects vector decomposition regressions where it is found that expenditure decentralization has had a negative effect on deficits in the average OECD country. We therefore tentatively conclude on the basis of these models that an increase in expenditure decentralization would have reduced primary deficits in the average OECD country.

The effect of an increase in the amount of shared taxes that accrue to subnational governments is found to have been ambiguous during the time frame of our analysis. In Austria, Germany and Switzerland, shared taxes decentralization seems to have increased public deficits, in Spain and Belgium, on the other hand, this particular variant of decentralization has apparently led to an improvement in fiscal balances.

In both Belgium and Spain, the readjustments of intergovernmental fiscal relations have probably been a conditio sine qua non for those political and constitutional reforms which were imple-

mented during the eighties. The fears of "poor" subnational jurisdictions had to be addressed, and tax sharing systems and implicit horizontal equalization schemes seem to have been a prerequisite for advances toward the eventual objective of these reforms: a federal structure of government. See Moreno (2002) for a discussion of the Spanish and O'Neill (1998) for the Belgian version of fiscal federalism.[12]

That both the federal dummy and shared taxes decentralization display a significantly negative effect of primary deficits in Spain and Belgium may provide an interesting lesson for countries which are currently considering a restructuring of their public sector, and wondering which course of action they should pursue. According to our results, the choice of a federal structure as the objective, and tax sharing arrangements as the means through which this objective is to be achieved, apparently has a beneficial effect on fiscal balances.

However, the fact that in established federations such as Austria, Germany and Switzerland, shared taxes decentralization seems to lead to a worsening of public finances should also be taken into account. While shared taxes decentralization might initially improve fiscal balances when it is accompanied by fundamental reforms of the state, common pool problems could begin to dominate the positive effects once the new structure of governance is established, and policymakers and interest groups have become accustomed to the reformed set of institutions.[13]

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[12]Leaving aside certain technical issues, the personal income tax is shared between the central and subnational governments in both countries. Even though this tax was/is also the potential avenue for horizontal tax competition because the Autonomous Communities in the case of Spain and the regions in the case of Belgium can levy surcharges on tax rates, subnational governments in both countries have been rather reluctant to use their tax autonomy during most of the time-frame of our analysis (see Agranoff and Gallarín (1997) for Spain and Gérard (2001) for Belgium, see also López-Laborda et al. (2006) for further elaborations on Spain.)

[13]To some extent, this result might be perceived as contradicting the proposition in chapter 5 (proposition 5.3 (iii)) which addressed the impact of horizontal equalization schemes of public borrowing, and also the empirical evidence presented in chapter 6. However, note that the theoretical model was specifically structured to resemble the specific German situation. It is conceivable that horizontal equalization transfers have a different impact in other countries like Austria and Switzerland which possess different systems of fiscal federalism. Secondly, shared taxes encompass not only horizontal equalization transfers but also more general taxes. Thus, the theoretical proposition must not necessarily apply to shared taxes.

Appendix: Summary statistics

Table 7.13: Included countries and averages (over time) of variables

Code	Country	Population	GDP Growth	Unemployment	Inflation	Urbanity	Working Age	Left	Plurality Rule	Presidential Sys.
AUS	Australia	16.324	1.918	7.506	6.681	85.740	65.969	3.200	1	0
AUT	Austria	7.733	2.200	3.667	3.640	65.580	66.149	3.600	0	0
BEL	Belgium	9.967	1.889	8.657	3.727	95.938	66.448	2.381	0	0
CAN	Canada	27.009	1.761	8.949	5.060	76.630	67.769	1.000	2	0
CHE	Switzerland	7.025	0.471	3.351	1.956	73.410	67.761	2.000	0	1
DNK	Denmark	5.164	2.031	6.149	5.479	84.042	66.239	2.923	0	0
ESP	Spain	38.444	1.896	13.648	9.548	73.738	65.370	3.619	0	0
FIN	Finland	4.926	1.995	8.045	6.322	60.088	67.437	2.667	0	1
FRA	France	55.539	1.641	7.685	6.179	73.683	64.859	2.739	1	1
GBR	United Kingdom	56.981	1.982	8.389	7.539	87.313	64.637	2.000	2	0
GER	Germany	68.153	2.107	6.434	3.109	72.883	67.899	2.000	0	0
GRC	Greece	9.458	1.882	1.894	17.608	56.200	64.025	1.625	0	0
ICE	Iceland	0.252	1.591	2.667	22.817	89.995	63.999	2.105	0	0
IRL	Ireland	3.492	3.862	13.313	7.490	55.936	60.849	1.818	0	0
ITA	Italy	56.831	2.355	10.616	4.367	66.850	68.960	2.750	0.5	0
LUX	Luxembourg	0.403	2.620	2.369	2.466	81.650	68.001	3.000	0	0
NLD	Netherlands	14.851	1.861	7.300	2.720	67.717	68.218	2.056	0	0
NOR	Norway	4.208	2.950	3.402	6.028	71.160	64.008	3.720	0	0
PRT	Portugal	9.902	3.680	5.842	7.454	48.317	67.318	1.833	0	0
SWE	Sweden	8.499	1.529	3.864	6.439	83.160	64.146	3.560	0	0
USA	United States	246.120	2.099	6.517	4.970	75.062	65.815	1.000	2	1

[1] All summary statistics are calculated on the basis of the observations used in the baseline models.

Table 7.14: Included countries and averages (over time) of variables

Code	Country	Deficit/GDP	Federal dummy	Expenditure Dec.	Own taxes dec.	Shared taxes dec.	Government revenue	Openness	Interest rate
AUS	Australia	-0.020	1	48.737	20.422	0	33.008	33.750	10.744
AUT	Austria	0.951	1	31.572	3.514	26.572	48.812	70.050	7.713
BEL	Belgium	-0.591	0.476	12.535	13.649	9.809	47.138	130.545	9.183
CAN	Canada	1.395	1	59.758	52.210	0	41.121	59.452	9.221
CHE	Switzerland	1.210	1	49.788	55.367	3.893	32.753	72.235	4.403
DNK	Denmark	-1.314	0	56.692	29.834	0	52.916	70.138	11.780
ESP	Spain	2.530	0.286	23.560	10.050	3.767	35.719	37.349	12.619
FIN	Finland	-0.987	0	42.465	26.818	0	50.341	56.540	9.817
FRA	France	1.058	0	19.317	13.320	0	46.848	43.329	10.280
GBR	United Kingdom	0.624	0	28.703	10.354	0	41.614	53.361	10.577
GER	Germany	0.379	1	39.617	7.453	41.347	44.169	46.718	7.374
GRC	Greece	1.991	0	3.957	0.418	0	.	.	.
ICE	Iceland	1.210	0	25.523	20.482	0	40.114	67.836	9.815
IRL	Ireland	1.603	0	27.999	3.478	0	41.481	112.649	11.532
ITA	Italy	-0.357	0	23.750	3.235	0	42.609	42.796	9.239
LUX	Luxembourg	-0.189	0	15.870	8.584	0	42.570	201.470	6.569
NLD	Netherlands	0.066	0	30.248	4.146	0	51.329	110.928	7.783
NOR	Norway	-1.266	0	38.241	26.648	0	52.092	74.079	9.545
PRT	Portugal	-1.055	0	10.842	2.380	0	37.045	64.113	14.531
SWE	Sweden	1.780	0	40.183	42.165	0	59.176	63.811	10.341
USA	United States	0.386	1	43.046	37.314	0	32.589	20.155	8.442

[1] Summary statistics for the Deficit/GDP, Federal dummy, Expenditure dec., Own taxes dec., and Shared taxes dec. variables are calculated on the basis of the observations used in the baseline models. Summary statistics for the Government revenue, Openness, and Interest rate variables are calculated on the basis of the observations used in the full specifications. As Greece disappears from the sample in these models due to missing observations on the interest rate, no summary statistics are reported for Greece on the additional variables included in the fully specified models.

Chapter 8

Fiscal decentralization and public debt: Empirical evidence for OECD countries

8.1   Introduction

In this chapter, we complement and extend the empirical investigation in the last chapter. Firstly, we treat the "level of debt" instead of primary balances as our variable of interest. This is a significant change of focus insofar as that the conclusions with respect to the impact of fiscal decentralization based on primary deficits must not necessarily mirror those reached with public debt due to stock-flow adjustments and interest payments.

Secondly, we operationalize the notion of "level of debt" with the amount of net financial liabilities, and thus take both sides of the government's balance sheet into account.

Thirdly, rather than focusing on non-linearities in the relationship between fiscal decentralization and public borrowing, we revert back to a simple linear specification, but conduct a large number of robustness checks, and take potential non-stationarity into account. Fourthly, instead of measuring "fiscal collusion" between tiers of government with a variable that is based on shared taxes, we take vertical fiscal imbalances in this chapter explicitly into account by considering top-down grants from the central governments. Finally, we also use a slightly different set of control variables. By changing the setup in this chapter in this way, we hope to increase the robustness of our results.

As in the chapter on the impact of fiscal decentralization on primary balances, we will explain the data used by us in the estimations. Even though the dataset in this chapter is similar to that used in the last chapter, there are some notable differences that deserve to be explicitly mentioned. We will also motivate the inclusion of several variables that were already considered in the last chapter even though the argumentation will be to some extent redundant. The advantage of accepting such redundancies is that this chapter can be read "as is", and therefore does not necessarily require knowledge of the previous chapter.

8.2 Data

8.2.1 Decentralization measures

As in the previous chapter, we use data derived from the IMF's GFS yearbook and made available in a World Bank dataset to measure the degree of expenditure decentralization. We also use data from this source to measure the vertical fiscal imbalance. The measure for expenditure decentralization is constructed as usual by simply dividing all expenditures made by subnational governments by total government expenditures, while the measure for the vertical fiscal imbalance is constructed by dividing subnational revenues from federal grants by total subnational revenues.

We call the first measure (as in the last chapter) *expenditure decentralization*, and the second measure, since it relies of the share of grants received by subnational governments, *grant share*.

With respect to revenue autonomy, we primarily use the measure from Stegarescu (2005) that is based on the taxes for which subnational governments determine both rates and bases ("own taxes"). Since we use only one measure (except in a robustness check[1]), there is no need to distinguish between different version of tax decentralization. Thus, we call our measure of revenue autonomy in this chapter simply *tax decentralization*.

We confine ourselves in this chapter to the measure of tax decentralization based on own taxes for two reasons. Firstly, since in our sample subnational governments have control over the revenue split for shared taxes only in four countries (Austria, Belgium, Germany, and Spain), the measure based on shared taxes provides little additional information to the first. Furthermore, two out of these four countries (Austria and Germany) display almost no variation over time in this variable (as evidenced in the last chapter where the results with respect to this variable were highly dependent on the variation in Belgium and Spain). The third measure from the Stegarescu dataset, on the other hand, is discarded because it lumps all types of taxes together. It is therefore not much different to the revenue decentralization measure from the IMF's GFS yearbook.

A more concise description of the measures of fiscal decentralization that are used in this study and their sources is provided in table 8.1. A cross-correlation matrix between them can be found in table 8.3. In figure 8.1, we show the evolution of their average value for the countries in our sample over time. Summary statistics are provided in table 8.2.

The correlation matrix shows that expenditure and tax decentralization are fairly strongly and positively correlated. Expectedly, the grant share and tax decentralization variables are negatively correlated. The correlation of the expenditure decentralization and the grant share variable is also negative, but somewhat weaker. These findings suggest that (i) in OECD countries additional subnational expenditures tend to be financed with "own taxes", and (ii) that "own tax" revenues and grant receipts are substitutes in financing subnational jurisdictions.

Both the summary statistics and figure 8.1 suggest that expenditures are more decentralized than taxes. This seems to be true for the whole period of our analysis. According to figure 8.1, a small convergence between average expenditure and tax decentralization seems to have taken place until the mid-nineties because the gap between both measures has lowered slightly. Correspondingly,

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[1]We conduct a robustness check in which *tax decentralization* is measured by a second variable which also considers shared taxes. However, we find in this robustness check that none of our results change.

the grant share variable is obviously lower in the mid-nineties than in the mid-seventies.[2] While the evolution of the averages suggests that there has not been much within-variation, a number of individual countries have experienced significant changes in the degree of fiscal decentralization.[3]

Table 8.1: DEFINITION AND SOURCE OF DECENTRALIZATION MEASURES

Label	Description	Source
Exp. decentralization	Subnational share of total government expenditures	World Bank/ IMF GFS
Tax decentralization	Subnational revenue from taxes for which subnational governments determine rates *and/or* define bases as share of general government tax revenue	Stegarescu (2005)
Grant share	Subnational revenue from federal grants as share of total subnational revenues	World Bank/ IMF GFS

Table 8.2: SUMMARY STATISTICS ON DECENTRALIZATION MEASURES

Variable	Mean	Std. Dev.	Min.	Max.	Obs.
Exp. decent.	35.232	(14.167)	1.455	65.67	390
Tax. decent.	19.166	(15.039)	0	55.36	446
Grant share	40.239	(18.071)	5.215	86.908	384

[1] Summary statistics are generally calculated with all available observations. Note that the number of observations reported in this table is larger than the number reported in the regression tables because (i) of the use of first-differences to estimate the econometric models and (ii) missing values for some variables

Table 8.3: CROSS-CORRELATION BETWEEN DECENTRALIZATION MEASURES

Variable	Exp. decent.	Tax. decent.	Grant share
Exp. decent.	1.000		
Tax. decent.	0.677	1.000	
Grant share	-0.222	-0.445	1.000

[1] Correlation coefficients are calculated with all available observations

8.2.2 Dependent and independent variables

In this section, we briefly discuss the dependent and independent variable (apart from the decentralization measures which were discussed in the last section) that we use in our econometric models. The variables, their definitions and their sources are listed in table 8.4. We report summary statistics on the variables used in the baseline models in table 8.5. Summary statistics on the variables used in the robustness checks and the instrumental variables regressions can be found in table 8.6.

We use as our primary measure of debt the net financial liabilities of the general government. This measure is preferred to gross financial liabilities because it takes both public assets and

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[2]These variables are only shown up to 1998 instead of up to 2001 because after 1998, both the expenditure and grant share variables exhibit missing observations for many countries. Furthermore, only the observations used in the regressions below have been used to construct this and subsequent figures.

[3]The variation in individual countries is illustrated in the previous chapter.
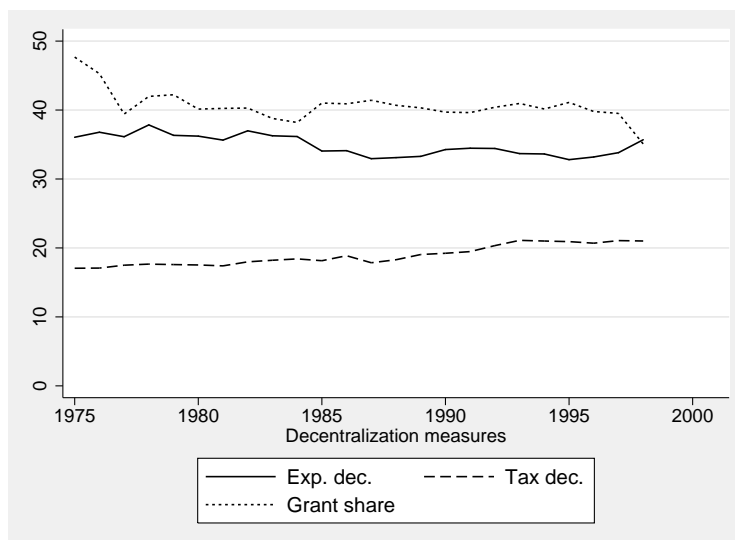
Figure 8.1: Development of decentralization measures, Mean across Countries.

liabilities into account. Obviously, if the government uses debt to acquire some financial or physical asset, the fact that its net financial position remains unchanged should be mirrored by the data. This variable is available for the 1975-2001 time period for a large number of countries from the OECD, but the time series for some countries (e.g. Spain) are rather short and exhibit several missing values.

While net financial liabilities are our preferred measure of government debt, we also conduct further below robustness checks with alternative measures. In particular, we consider gross financial liabilities and government debt calculated according to the requirements of the Maastricht treaty.[4]

We use several economic, demographic and political control variables that might be important determinants of fiscal outcomes, and at the same time correlated with fiscal decentralization. We discuss in this section the variables included in the baseline models. The variables used in the robustness checks are discussed in subsequent sections.

The population variable is included in order to control for scale and/or congestion effects in the production of public goods. If the production function exhibits decreasing returns to scale because of the scarcity of some factor (e.g. land), increased expenditure requirements might lead to an expansion of debt. Even though we scale the debt burden for the size of the economy by dividing it by GDP, a country's population size could still have an additional independent effect, and omitting it might lead to biased estimates because more populous states might be also more decentralized (Treisman, 2002).[5]

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[4]Government debt calculated according to the requirements of the Maastricht treaty is particularly useful for cross-country comparisons since it is based on internationally consistent definitions. However, we do not use this particular variable as the primary measure of debt since archetypical federal countries such as the USA or Australia would have to be discarded (only data for EMU member states are available), and because they do not cover the historical post-oil price crisis period (only data from 1990 onwards are available) where the degree of fiscal decentralization might have had an important effect on the growth of debt.

[5]While other studies have found that geographical area is a more significant predictor of fiscal decentralization than population size (Treisman, 2006), we do not use this variable in our analysis because it is time-invariant and cannot be included in fixed effects models.

Table 8.4: DEFINITION AND SOURCE OF VARIABLES

Label	Description	Source
Baseline models		
Net financial liabilities	Net financial liabilities in % of GDP	OECD Economic Outlook No. 83
Population	Population	OECD Population and Labor Force Dataset
GDP Growth	GDP per capita growth, calculated as log differences of GDP per capita (measured in US$, constant prices & PPP)	OECD Economic Outlook No. 83
Unemployment	Unemployment rate	OECD Economic Outlook No. 83
Inflation	Growth in the CPI Index	OECD Key Economic Indicators
Working Age	Share of people between 15 and 65 years	OECD Population and Labor Force Dataset
Openness	Trade-to-GDP ratio	OECD Macro Trade Indicators
Interest rate	Long-term interest rate on government bonds	OECD Economic Outlook No. 83
Ideology	Index of the ideology of government, higher values indicate more leftist ideology	CPDS I Dataset 1960-2006
Fragmentation	Herfindahl index of government concentration, higher values indicate less fragmented governments	DPI 2006 Dataset
Germany dummy	Pre-unification dummy for Germany	Own calculation
Robustness checks		
Gross-financial liabilities	Gross-financial liabilities in % of GDP	OECD Economic Outlook No. 83
Maastricht debt	Debt according to Maastricht criteria in % of GDP	OECD Economic Outlook No. 83
Shared taxes decent.	Tax decent. + subnational revenue from taxes for which subnational governments are involved in determining revenue split as share of general government tax revenue	Stegarescu (2005)
Instruments		
EMU	Dummy=1 if EMU member state *and* Year > 1992	Own calculation
Election	Years left in current term of government until next election	DPI 2006 Dataset (Beck et al., 2001)
Industrial production	Index of industrial production, base year=2005	OECD Main Economic Indicators
Labor cost	% Change of average cost of labour per unit of output in industry	OECD Main Economic Indicators

[1] OECD data have been generally downloaded with the OECD.Stat interface which provides access to different OECD databases

Table 8.5: SUMMARY STATISTICS ON DEPENDENT AND INDEPENDENT VARIABLES (BASELINE MODELS)

Variable	Mean	Std. Dev.	Min.	Max.	Obs.
Net financial liabilities	26.611	(34.705)	-86.634	115.229	392
Population (in Mil.)	37.324	(57.305)	0.218	285.226	459
Inflation	7.036	(8.178)	-0.691	83.95	458
Working Age	66.03	(1.869)	60.78	70.157	452
Openness	62.181	(27.208)	16.1	166.35	459
GDP Growth	2.065	(2.053)	-8.244	7.69	459
Unemployment	6.771	(3.363)	1.064	19.108	459
Interest rate	9.859	(3.942)	4.5	29.742	442
Ideology	2.554	(1.534)	1	5	455
Fragmentation	0.703	(0.269)	0.181	1	445
Germany	0.035	(0.184)	0	1	459

[1] Summary statistics are generally calculated with all available observations. Note that the number of observations reported in this table is larger than the number reported in the regression tables because (i) of the use of first-differences to estimate the econometric models and (ii) missing values for some variables

Table 8.6: SUMMARY STATISTICS ON VARIABLES USED IN ROBUST AND TSLS MODELS

Variable	Mean	Std. Dev.	Min.	Max.	Obs.
Gross financial liabilities	59.289	(27.065)	7.939	140.693	401
Maastricht debt	66.726	(25.541)	13.965	134.018	143
Shared taxes decent.	23.917	(15.895)	0	55.36	446
EMU	0.222	(0.416)	0	1	459
Election	1.618	(1.27)	0	4	453
Industrial production	71.709	(16.596)	32.9	104.5	436
Labor cost	3.934	(5.629)	-6.600	35.9	423

[1] Summary statistics are generally calculated with all available observations. Note that the number of observations reported in this table is larger than the number reported in the regression tables because (i) of the use of first-differences to estimate the econometric models and (ii) missing values for some variables

GDP growth and the unemployment rate are included in order to control for business cycle effects. The inflation rate is included in order to control for the fact that deficit-finance and an expansion of the money supply are alternative ways to fund expenditures. The working age variable, which measures the share of the population between 15 and 65, is included in order to control for the extent to which income-earners can shoulder the current and future tax burden due to the existing stock of debt.

We control for the ideology of the ruling party at the federal level by including an index that runs from 0 (far-right) to 5 (far-left). This variable is taken from the CPDS I database constructed by Armingeon et al. (2008). Several contributions have argued that there might be significant differences in the fiscal behavior of ideologically opposed parties. For example, the case that left-wing governments are more likely to conduct expansionary policies and to increase inflation is often made (Hibbs, 1977). The effect of ideology on public debt is less obvious, however. While expansionary fiscal policies might on the one hand lead to more spending, some authors argue that left-wing parties are also more likely to increase taxes, with no obvious effect on the level of indebtedness (Borrelli and Royed, 1995). We therefore have no strong priors with regard to the sign of the estimated coefficient.

We also include a Herfindahl index which measures the extent of government fragmentation since several empirical studies suggest (see the literature review) that more fragmented governments tend to be more susceptible to common pool problems. This index assumes higher values when the government is less fragmented. It is taken from the DPI 2006 dataset provided by Beck et al. (2001).

The openness variable is included in order to control for the effect of globalization on fiscal outcomes. Omitting this variable might result in biased estimates since globalization could be correlated with the degree of fiscal decentralization and at the same time with public debt (Sharma, 2005). However, the expected sign of the coefficient is ambiguous. On the one hand, more open countries might be forced to implement more prudent fiscal policies because investors and firms can more easily leave "inefficient" countries (De Mello, 2005). On the other hand, globalization might constrain the ability of governments to raise taxes, forcing them, at least temporarily, to use debt as a substitute for tax revenues (Razin and Sadka, 1991).

The interest rate variable is included in order to control for the costs of borrowing. The expected sign of the coefficient is ambiguous. On the one hand, an increase in the interest rate should make borrowing a less appealing source of finance. On the other hand, short-term debt is often refinanced by acquiring new debt. Since the point in time at which some fraction of the debt is due is fairly exogenous, higher interest rates might simply inflate the repayment costs of the existing stock of debt, thereby leading to an increase in levels of debt.

Finally, we include a dummy variable for Germany before 1990 in order to control for the fact that this country became unified in 1990 and therefore transformed, to some extent, into a different country with a greater population, larger GDP, and various other changes. We expect that this variable is negatively related with government debt since it is a well-known fact that a significant share of infrastructure investments in Eastern Germany after unification was financed by the government through borrowing.

The careful reader will recognize that one potentially important determinant of public debt is missing from the set of control variables: A measure of how subnational borrowing is regulated,

i. e. whether subnational governments are allowed to borrow, and whether special restrictions are imposed upon them by the federal government. This omission needs further explanation since earlier studies, such as Rodden (2002), point to the importance of subnational borrowing restrictions for fiscal outcomes. We do not explicitly control for the subnational borrowing regime because available data on borrowing restrictions for the countries in the sample does not exhibit time-wise variation and therefore cannot be included in fixed effects models, which we determine further below as the appropriate specification (see section 8.3.2). Furthermore, subnational governments are allowed to borrow in all countries in our sample[6], implying that there is also no between variation on this particular issue.

Note that we also do not explicitly control for the constitutional structure of the country since constitutional features rarely vary over time and are thus multi-collinear with country-fixed effects. That is, we do not control for whether a country is a presidential or parliamentary democracy, whether it exhibits a proportional or plurality electoral rule, and whether it has direct democratic institutions. Note in particular that we do not control for the constitutional standing of subnational governments as well, that is, whether a country is unitary or a federation.[7]

Obviously, only those observations for which all variables had non-missing values can be used in the empirical models. Unfortunately, this requirement reduces the number of available observations considerably, primarily because data on net financial liabilities and the decentralization measures are unavailable for a number of OECD countries. The final dataset consists of 17 countries[8], and therefore considers just above half of the OECD member states.

8.2.3 Bivariate relationships

For a preliminary evaluation of the relationship between fiscal decentralization and public debt, bivariate plots between the average net financial liabilities, which is our primary measure of government debt, and the average of each of the three decentralization measures in the countries in our sample are provided in figures 8.2, 8.3 and 8.4.

These figures indicate that net financial liabilities are on average negatively related to both expenditure and tax decentralization, and positively related to the grant share variable. Thus, these simple bivariate plots vindicate the theoretical models of decentralization which emphasize its beneficial features. Both expenditure and tax decentralization seem to lead to more sound fiscal policies whereas vertical fiscal imbalances that are created by top-down grants seem to increase the level of indebtedness in OECD countries.

However, the perils of basing conclusions on simple correlations are well known. Therefore, more sophisticated econometric methods are employed in the following sections to analyze the causal impact of fiscal decentralization on public debt.

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[6] However, there is between variation in the strictness of borrowing controls.

[7] Note that Belgium ceased to be a unitary country and became officially a federation in 1994. It is also sometimes argued that Spain is effectively a federation even though it still is formally unitary. Based on the variation in Belgium (and perhaps in Spain) a federation dummy could be theoretically included in models with country fixed effects. However, we would have to base the conclusions with regard to this variable on the within variation in at most two countries. Since this does not seem to be reasonable, we do not pursue this approach any further.

[8] Australia, Austria, Belgium, Canada, Denmark, Spain, Finland, France, Great Britain, Germany, Iceland, Italy, Netherlands, Norway, Portugal, Sweden, United States.
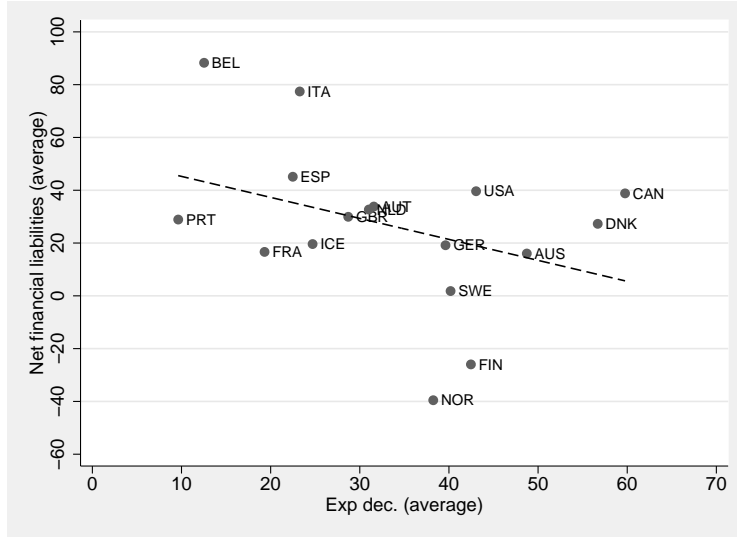
Figure 8.2: NET FINANCIAL LIABILITIES AND EXP. DECENTRALIZATION
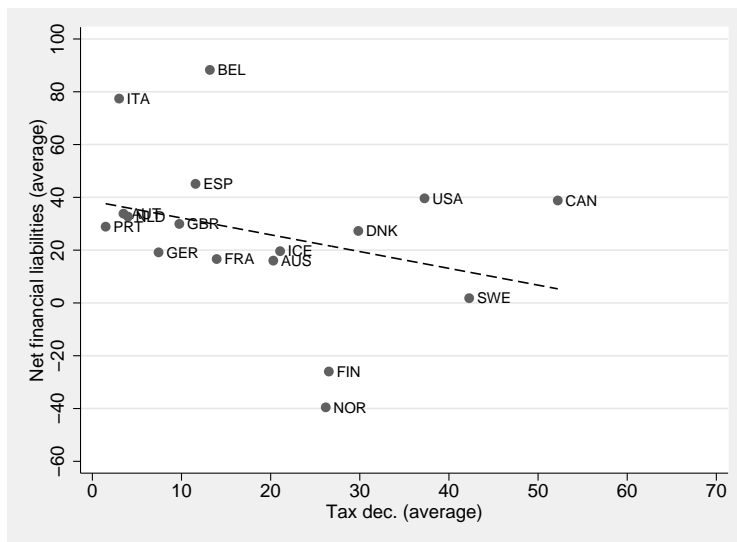

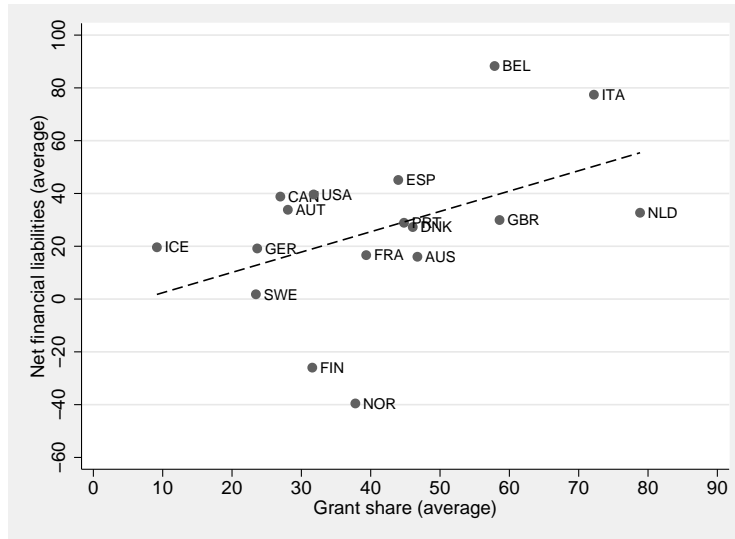Figure 8.3: NET FINANCIAL LIABILITIES AND TAX DECENTRALIZATION

Figure 8.4: NET FINANCIAL LIABILITIES AND GRANT SHARE

8.3 Specification

In this section, we describe our econometric approach. We first investigate whether our main variables of interest are stationary. We then discuss the econometric specification.

8.3.1 Stationarity

The dependent variable, net financial liabilities, and the three decentralization variables exhibit a significant degree of inertia. When simple autoregressive models are estimated with OLS, we find for each of the variables of interest that the coefficient on the autoregressive term is close to unity. The first-differences, on the other hand, display much less inertia. When the same autoregressive model is estimated with the first differences, the coefficient on the autoregressive term is always well below unity.[9]

Next, we investigate the degree of persistence in the variables of interest by using the Levin-Lin-Chu panel unit root test. The results are collected in table 8.7. The tests are calculated for both the levels and the first differences of the variables of interest.[10] With respect to the specification, we include a linear trend and individual intercepts in the tests for the levels, but only individual

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[9]Note that we neither control for autocorrelation in the error process (which could lead to inconsistent estimates in models with lagged dependent variables) nor take the panel characteristics of the data into account in these regressions. They are purely explorative.

[10]Note that the panel unit root tests are calculated with Eviews while the econometric models further below are estimated with Stata. The Stata package is considered to possess superior panel data facilities. However, it lacks, as far as we know, the ability to calculate panel unit root tests with *unbalanced* panel data, forcing us to use the Eviews package instead.

Table 8.7: Panel unit root tests

	Net financial liabilities	Exp. decent.	Tax decent.	Grant share
Levels				
Levin-Lin-Chu	1.826 (0.966)	0.936 (0.825)	0.280 (0.610)	-0.454 (0.325)
Obs.	354	349	403	342
First-Differences				
Levin-Lin-Chu	-4.981 (0.000)	-7.944 (0.000)	-9.843 (0.000)	-8.739 (0.000)
Obs.	342	346	395	330

[1] Panel unit root tests are calculated with all available observations
[2] p-values in parentheses

intercepts for the tests with the first differences.[11] The lag length for the tests is automatically determined using the Schwarz Information Criterion.

According to the results reported in table 8.7, the levels of the variables of interest possess a unit root whereas the first differences are stationary.[12] Based on this evidence, we conclude that the econometric model should be specified in first-differences. We thus transform all dependent and independent variables listed in table 8.4[13] into first-differences in the models estimated further below.

8.3.2 Econometric model

We use the following general linear specification as the starting point of our analysis:

$$\Delta y_{it} = \alpha_i + \omega_t + \beta Z_{it} + DEC_{it} + \epsilon_{it}, \tag{8.1}$$

with y_{it} denoting the net financial-liabilities to GDP ratio in country i at period t, α_i country-fixed effects, and ω_t time-fixed effects (year dummies), and ϵ_{it} the error-term. Δ is the first-difference operator. The Z and DEC vectors are defined as follows:

- $Z =\{\Delta$ Population, Δ Inflation, Δ Working Age, Δ Openness , Δ GDP Growth, Δ Unemployment, Δ Interest rate, Δ Ideology, Δ Fragmentation, Germany $\}$

- $DEC =\{ \Delta$ Exp. decent., Δ Tax. decent., Δ Grant share$\}$

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[11] The reason for considering a trend for the level of the variables but not for the first differences is that the unit root tests would be biased towards finding an unit root (and thus to conclude that the process is difference stationary) if we do not formulate the correct alternative hypothesis. The appropriate alternative for the level variables is, in our case, that they are trend-stationary (and therefore do not poses an unit root). For example, the net financial liabilities to GDP ratio has trended upwards in almost all countries in our sample. When a trend variable is not included in the test equation, such a trending behavior can only be captured by the estimated model by finding an unit root with drift *even if* the series is in reality trend stationary. On the other hand, it is unreasonable to presume that the first differences are trending. Therefore, trends are not considered for the unit root tests on the first differences. See in particular Elder and Kennedy (2001) for a more detailed discussion of this issue.

[12] Eviews also displays by default in addition to the Levin-Lin-Chu test the Breitung, Im-Pesaran-Shin, ADF and Phillips-Perron tests. For brevity, we do not report the results from these tests in this paper. They are, however, available upon request. These tests lead all to the same conclusion with respect to the first-differences, and unambiguously indicate that the first differences are stationary. With respect to the levels, there is some disagreement, e. g. sometimes the unit root hypothesis is rejected. However, in order to avoid the danger of spurious correlations, we choose to work with the hypothesis that the levels of the variables of interest are I(1), as indicated by the Levin-Lin-Chu test.

[13] Except the dummy variables and the election variable (which is a count variable).

We check for the validity of hypothesis tests (and thus implicitly for the validity of the functional form) by investigating whether the residuals from estimating the fully specified model in equation 8.1 (that is, when cross-section and time fixed effects are included) are normally distributed. Graphical inspection indicates that the residuals are indeed normally distributed.[14] We also check explicitly the validity of the linear specification by investigating whether the dependent variable needs to be transformed to be normally distributed, but find that no transformations are needed.[15]

Next, we explore whether the efficiency of the estimates can be increased by imposing restrictions on the fully specified model. That is, we investigate whether the random or the fixed effects model is the correct specification. Both the Hausman-test and the F-test on the cross-section fixed effects indicate that the fixed effects model is the more appropriate specification (results are not shown but available upon request). We therefore estimate and report fixed effects models only.

We then conduct a modified Wald-test for group-wise heteroscedasticity (Baum, 2000) on the fixed effects model, and find that the null is usually rejected. In order to make inferences that are robust to this as well as to other types of heteroscedasticity, we always use robust standard errors for hypothesis tests.

Finally, a test for autocorrelation in the idiosyncratic error ϵ_{it} (Wooldridge, 2002) does not reject the null hypothesis of no autocorrelation.[16] We therefore make no adjustments in our specifications to take account of autocorrelation.

8.4   Results

We first describe the results from estimating the baseline models according to equation 8.1. We then investigate whether these results are robust to alternative definitions of government debt and tax decentralization, and to other changes of the baseline model. Thereafter, we explore whether outliers influence the results unduly. Finally, we check whether potential endogeneity in some of the control variables constitute a problem.

8.4.1   Baseline results

The results for the baseline models are collected in table 8.8. In the first model, none of the decentralization variables are included. In subsequent models, each of the decentralization variables

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[14]More formal tests (with the *sktest* and *iqr* test facilities implemented in Stata) suggest the presence of two outliers: Belgium in 1981 and the Netherlands in 1987. Without these two observations, the hypothesis of normally distributed residuals is never rejected. Even though these two observations seem to be outliers, we leave them in the sample since there is no apparent reason that would justify their exclusion. Given that our sample size is around 300, these two observations should not have an undue effect on the estimated coefficients. In order to be sure, we nonetheless check further below whether our results are robust to these two and other potential outliers. We indeed find that the results do not change when potential outliers are excluded. In any case, the presence of a few outliers does not indicate that the linear functional form chosen by us is wrong. That is, there is no systematic evidence that an alternative functional form, e. g. log-log, is more appropriate.

The first outlier is apparently generated by the fact that net financial liabilities to GDP ratio in Belgium has risen by staggering 16.4 percentage point from 1980 to 1981, presumably because of the deep economic crisis in this country in the wake of the oil-price shock. The second outlier is generated by the fact that the net financial liabilities to GDP ratio in the Netherlands has fallen by 14.8 percentage points from 1986 to 1987. Unlike for the case of Belgium, we have no convincing economic explanation for this large reduction. We speculate that it came about by a change in the definition of net financial liabilities in that particular year.

[15]We use the *ladder* and *gladder* diagnostic commands implemented in Stata to investigate whether transformations are necessary.

[16]Which is an expected result since (i) the model is specified in first differences and (ii) fixed effects are additionally included.

is separately included. More precisely, in model 2 only the expenditure decentralization variable is included. Only the tax decentralization variable is included in model 3. In the fourth model, just the grant share variable is included.

Finally, we include in model 5 all three decentralization variables simultaneously. Since the last model has the most complete specification, we consider this as our preferred model.

Despite the different specifications, it is reassuring that there are no contradictory findings between the estimates collected in table 8.8. This is particularly true for the decentralization variables. That is, the coefficient on the expenditure decentralization variable is significantly negative in both model 2 and 5. Equally, the coefficient on the tax decentralization and the grant share variable is not significantly different from 0 in any of the models where these variables are included.

Table 8.8: Regressions of Change of Debt to GDP ratio on decentralization measures; 1975 to 2001

	FE 1	FE 2	FE 3	FE 4	FE 5
Δ Population	-1.038***	-1.050***	-1.040***	-1.039***	-1.053***
	(-11.118)	(-11.323)	(-11.084)	(-11.075)	(-11.214)
Δ Inflation	-0.095	-0.092	-0.101	-0.094	-0.096
	(-0.587)	(-0.555)	(-0.620)	(-0.580)	(-0.581)
Δ Working Age	-1.822	-1.636	-1.833	-1.829	-1.655
	(-1.644)	(-1.439)	(-1.646)	(-1.643)	(-1.447)
Δ Openness	0.183**	0.171**	0.185**	0.184**	0.174**
	(2.176)	(2.076)	(2.186)	(2.181)	(2.075)
Δ GDP Growth	0.123	0.121	0.118	0.122	0.117
	(0.996)	(0.987)	(0.958)	(0.984)	(0.941)
Δ Unemployment	0.262	0.158	0.270	0.264	0.169
	(1.098)	(0.633)	(1.141)	(1.108)	(0.685)
Δ Interest rate	-0.543***	-0.556***	-0.540***	-0.541***	-0.552***
	(-2.717)	(-2.789)	(-2.699)	(-2.715)	(-2.773)
Δ Ideology	0.438	0.473*	0.433	0.440	0.468*
	(1.541)	(1.689)	(1.521)	(1.547)	(1.667)
Δ Fragmentation	-0.683	-0.733	-0.681	-0.675	-0.725
	(-0.389)	(-0.423)	(-0.384)	(-0.382)	(-0.413)
Germany	-1.651	-1.571	-1.655	-1.661	-1.583
	(-1.308)	(-1.274)	(-1.307)	(-1.307)	(-1.270)
Δ Exp. decent.		-0.235**			-0.229**
		(-2.108)			(-2.047)
Δ Tax decent.			-0.051		-0.047
			(-0.412)		(-0.335)
Δ Grant share				-0.025	-0.015
				(-0.372)	(-0.207)
N	293	293	293	293	293
F	34.257	30.427	33.404	32.692	28.625
$\bar{R}^2$	0.439	0.444	0.437	0.437	0.440
RMS error	2.916	2.903	2.921	2.921	2.914

[1] t-statistics are shown in parentheses
[2] Hypothesis tests are based on robust standard errors
[3] Estimates for cross-section and time-fixed effects are not shown

In addition to expenditure decentralization, four of the remaining control variables are significant. One of these is the population variable, which is consistently negative. This suggests that an increase in population leads to lower government indebtedness, presumably because scale economies in the production of public goods reduce fiscal pressures in larger countries. The openness variable is consistently positive, which suggests that open economies have to cope with more fiscal instability than relatively closed economies. Thirdly, the estimated coefficient on the interest rate variable is consistently negative, which indicates that governments borrow less when the costs of borrowing increase. Finally, the coefficient on the ideology variable is consistently positive and significant in two models (one of the two is the preferred model), which indicates that left-wing governments used to borrow more during the time-frame of our analysis.

Note also that the Germany dummy is consistently negative and, while being insignificant, displays relatively large t-statistics (in absolute terms). This result reaffirms that Germany has borrowed significantly more after unification. Another variable with relatively high but insignificant t-statistics is the working age variable. The coefficient is consistently negative, thus suggesting that a "less dependent" population is associated with more stable fiscal outcomes. The unemployment rate has a positive, albeit insignificant, coefficient in all models. There is thus some evidence that a higher unemployment rate increases fiscal pressures. Finally, note that the fragmentation variable is consistently negative. Even though the coefficient is insignificant, this suggests that common pool problems are indeed more severe when governments are fragmented. Overall, we find that the control variables perform rather reasonably, thereby strengthening our confidence in the estimates.

We may thus reach as a preliminary conclusion that fiscal decentralization is not harmful for fiscal outcomes. That is, neither expenditure or tax decentralization nor vertical fiscal imbalances seem to increase government indebtedness. We rather find evidence that points in the opposite direction: The consistently negative coefficient on the expenditure decentralization variable suggests that this representation of fiscal decentralization leads to improvements in the fiscal stance of the public sector.

In fact, the debt reducing effect of expenditure decentralization is remarkably large. The numerical value of the coefficients imply that an increase of one percentage point in the subnational to total government expenditures ratio reduces the debt to GDP ratio by about 0.23 percentage points. This result suggests, for example, that about 10.8 percentage points of the 49 percentage point difference in (average) net financial liabilities between Belgium and Canada can be explained by the 47 percentage point difference in (average) expenditure decentralization between these two countries. Compare this figure to the differences in net financial liabilities that can be explained by different population sizes in these two countries. According to our estimates, an increase of the population by one million reduces the net financial liabilities to GDP ratio by one percentage point. Since the difference in population sizes between Belgium and Canada is about 17 million, 17 percentage points of the difference in the net financial liabilities to GDP ratios can be explained by population size differences. That is, differences in the level of expenditure decentralization are almost as important as differences in population size for explaining cross-country differences in indebtedness.

Apparently, the beneficial features of fiscal decentralization dominate the potentially harmful features that are emphasized by the theoretical literature on soft budget constraints and common

pool problems. However, we recognize that our estimates could suffer from a number of problems. Therefore, we must investigate whether these findings are robust before we reach any definite conclusion.

8.4.2 Robustness checks

In this section, we explore the robustness of the results from the baseline regressions. These robustness checks are always conducted on the basis of our preferred model (model 5 in table 8.8).

General robustness checks

We begin by reporting results from six different types of robustness checks in table 8.9. Firstly, we use panel corrected standard errors to conduct hypothesis tests (Beck and Katz, 1995). While time fixed effects control for shocks that are common to all countries in the panel, the error term in individual countries could also exhibit idiosyncratic correlations, and not taking these into account might lead to wrong estimates for the standard errors. According to the results reported in the first column (entitled *PCSE*) of the table, using panel corrected standard errors does not change the results with regard to the decentralization variables. That is, expenditure decentralization remains significantly negative whereas tax decentralization and the grant share variable continue to be insignificant.

The results from the baseline models with regard to the remaining control variables also are largely confirmed. Note, however, that the Germany dummy becomes significant once panel corrected standard errors are used.

In the second column, (entitled *P-T*), we present the results when we use the fixed effects vector decomposition approach by Pluemper and Troeger (2007). We again treat the decentralization variables as almost time-invariant. This is less reasonable in this chapter than in the previous because we use first differences instead of the levels of the decentralization variables. Nonetheless, observe that the coefficient on the expenditure decentralization variable remains negative. While it is insignificant, it also displays a relatively high t-statistic. The tax decentralization and the grant share variables remain insignificant.

In the third column (entitled *Gross debt*), we present results which are obtained by estimating a model where gross financial instead of net financial liabilities are used as the measure of government debt. We find that expenditure decentralization still displays a negative coefficient. However, it ceases to be significant. On the other hand, the grant share variable, while displaying as in the baseline models a negative coefficient, turns out to be significant. It is not particularly surprising that the results for this model differ to some extent from those for the baseline model given that the correlation coefficient between the first differences of gross and net financial liabilities in our sample is only about 0.77. We discuss this issue further below in more detail.

In the fourth column (entitled *Shared taxes*), we collect the results from estimating a model where an alternative measure of tax decentralization is used. Whereas tax decentralization in the baseline models is defined as the share of subnational revenues from taxes for which they can set rates and define bases autonomously ("own taxes") to total government tax revenue, this new measure is defined as the share of subnational revenues from "own taxes" and those "shared taxes" for which they have a say in determining the revenue split. Such shared taxes are particularly

relevant for subnational governments in evolving federations like Spain and Belgium, but also in traditionally federal countries like Germany and Austria.

Even though a different measure of tax decentralization is used, we find that none of the results in the third column of table 8.9 differ from the baseline model. Expenditure decentralization is negatively and significantly related to government borrowing whereas the two remaining decentralization variables are insignificant.

In the fifth column (entitled *Maastricht*), we present the results from estimating a model where we use as dependent variable a measure of public debt that is calculated according to the requirements of the Maastricht treaty. Obviously, the sample size is smaller for this model since only data for EMU countries after 1990 are available. We find that while expenditure decentralization continues to have a negative effect, it loses its significance. One explanation for this result might be that the period in the aftermath of the oil price shock has to be excluded when this measure of government indebtedness is used. It is conceivable that expenditure decentralization could have played a particularly important role in arresting the growth of public debt precisely in this period. Note also that the two remaining decentralization variables continue to be insignificant.

In the final column (entitled *5 y. Averages*), we report the results from estimating our preferred model in five-year averages.[17] We find that our main conclusions are confirmed. That is, expenditure decentralization is negatively and significantly related to government borrowing whereas the two remaining decentralization variables are insignificant.

Overall, we find in this set of robustness checks that the results with regard to the decentralization variables from the baseline regressions are confirmed. Expenditure decentralization is apparently negatively related to public indebtedness, whereas tax decentralization and the share of grants in subnational revenues seem to be unrelated to government borrowing. The only exceptions to this general result are those where alternative definitions of public debt are used.[18]

While we can explain the insignificance of the expenditure decentralization variable when the "Maastricht debt" variable is used with the fact that only data from 1990 onwards are available for this measure of public debt, the insignificance of expenditure decentralization in the model with gross financial liabilities as dependent variable is more difficult to explain. Presumably, gross and net financial liabilities measure different aspects of the fiscal stance of the government. This is particularly evident when a country like Norway is considered. This country exhibits on average negative net financial liabilities of about -40% of GDP (and thus possesses more assets than it has liabilities), whereas its gross financial liabilities are on average at a positive 36% of GDP. Considering the fact that gross financial liabilities only measure one side of the government's balance sheet, we believe that we should not base our conclusions on this measure of indebtedness. It is reassuring, however, that even when gross financial liabilities are used as dependent variable, the sign of the expenditure decentralization coefficient remains negative and the two remaining decentralization variables continue to be insignificant, thereby confirming that the effects of these variables in these models point in the same direction as in the baseline models.

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[17]Since our dataset covers the year 2001, the last period lasts from 1996-2001 and is thus technically a six year average.

[18]And perhaps the model where we use the fixed effects vector decomposition approach.

Table 8.9: Regressions of Change of Debt to GDP ratio on decentralization measures; 1975 to 2001; Robustness checks

	Robust 1 (PCSE)	Robust 2 (P-T)	Robust 3 (Gross debt)	Robust 4 (Shared taxes)	Robust 5 (Maastricht)	Robust 6 (5 y. Averages)
Δ Population	-1.053***	-1.053***	-0.431***	-1.060***	-6.821	-0.325
	(-19.467)	(-6.149)	(-4.319)	(-11.185)	(-1.343)	(-0.615)
Δ Inflation	-0.096	-0.096	-0.081	-0.099	-0.947***	0.120
	(-0.459)	(-0.671)	(-0.365)	(-0.595)	(-2.781)	(0.193)
Δ Working Age	-1.655*	-1.655	0.712	-1.645	0.765	-1.746
	(-1.751)	(-1.529)	(0.571)	(-1.431)	(0.281)	(-0.951)
Δ Openness	0.174*	0.174**	0.218***	0.179**	-0.098	0.575
	(1.872)	(2.486)	(2.889)	(2.116)	(-0.467)	(1.664)
Δ GDP Growth	0.117	0.117	-0.012	0.112	0.330	-0.118
	(0.893)	(0.984)	(-0.082)	(0.900)	(0.820)	(-0.167)
Δ Unemployment	0.169	0.169	0.740**	0.162	1.393***	-0.178
	(0.693)	(0.666)	(1.991)	(0.660)	(3.038)	(-0.247)
Δ Interest rate	-0.552***	-0.552**	-0.354	-0.548***	0.627	-0.935
	(-3.105)	(-2.501)	(-1.353)	(-2.742)	(0.951)	(-1.274)
Δ Ideology	0.468*	0.468*	0.160	0.477*	-0.634	0.990
	(1.692)	(1.786)	(0.409)	(1.693)	(-0.706)	(0.914)
Δ Fragmentation	-0.725	-0.725	-3.753	-0.759	0.067	1.968
	(-0.631)	(-0.466)	(-1.468)	(-0.430)	(0.019)	(0.242)
Germany	-1.583***	-1.583	-2.311*	-1.631		0.604
	(-4.495)	(-1.625)	(-1.740)	(-1.297)		(0.320)
Δ Exp. decent.	-0.229**	-0.164	-0.067	-0.229**	-0.090	-1.055**
	(-2.128)	(-1.229)	(-0.514)	(-2.065)	(-0.280)	(-2.040)
Δ Tax decent.	-0.047	0.025	-0.030	-0.062	0.158	0.411
	(-0.338)	(0.186)	(-0.188)	(-0.832)	(0.609)	(0.674)
Δ Grant share	-0.015	-0.049	-0.137*	-0.019	-0.060	0.023
	(-0.149)	(-0.607)	(-1.911)	(-0.281)	(-0.630)	(0.093)
N	293	293	293	293	85	68
F / χ^2	5910.903	7.569	10.867	28.556	10.260	22.298
$\bar{R}^2$		0.452	0.424	0.441	0.701	0.724
RMS error	3.010	2.713	3.248	2.912	2.336	1.526

[1] t-statistics are shown in parentheses
[2] Hypothesis tests are based on robust standard errors (except in PCSE and Pluemper-Troeger model)
[3] Estimates for cross-section and time-fixed effects are not shown
[4] Model significance is evaluated either with a F (in FE models) - or a χ^2 (in PCSE model) statistic
[5] The estimate for the second stage error term (eta) in the Pluemper-Troeger model is not shown

Outliers

We report in this section the results from robustness checks obtained by estimating our preferred model after the exclusion of potential outliers. We use both "model-based" and heuristic techniques to determine potential outliers. In the first column of table 8.10 (entitled *Studentized r*), we exclude all observations where the (absolute) studentized residual is larger than 2. Eleven observations are excluded when this definition of what constitutes an outlier is applied.[19] Apparently, the main results do not change. That is, expenditure decentralization continues to display a significantly negative effect on public debt whereas tax decentralization and the grant share variable are insignificant.

For the models for which the results are reported in the remaining columns, we use more heuristic methods to determine potential outliers. In the second column (entitled *Negative debt*), we exclude all observations for which net financial liabilities are negative. This procedure mainly affects Norway and Finland, and reduces the sample size by 57 observations compared to the baseline regressions. We find that the results remain relatively stable despite the rather large reduction in the sample size. That is, even though expenditure decentralization loses its significance, it still displays a negative coefficient and exhibits a relatively large t-statistic. The remaining decentralization variables continue to be insignificant.

In the third column (entitled *Without USA*), we collect the results from estimating our preferred models without the United States. We conjecture that the USA might be an outlier due to the rather large deficits incurred during the armament race with the Soviet Union in the late eighties, and the relatively decentralized public sector. However, we find that the results remain essentially the same.

In the fourth column, we present the results when Belgium is excluded. Belgium might unduly influence the results because of the rapid process of decentralization that was initiated in this country in the late eighties. However, we find that the results do not differ from the baseline model.

Since Spain is the second country in our sample that has experienced a remarkable increase in public sector decentralization in recent years, this country, too, might be an outlier. Therefore, we present in the last column of table 8.10 the results from estimating the baseline model after excluding Spain. We find once again that the results do not change significantly.

Thus, we may conclude that our baseline results are robust to outliers.

Endogeneity issues

In this section, we present the last set of robustness checks where we attempt to control for potential endogeneity of the interest, inflation and unemployment rate variables. These variables could be simultaneously determined with government borrowing because of the following reasons.

Firstly, it is a reasonable conjecture that governments which exhibit high levels of debt might face higher risk premiums, which would then result in higher interest rates. Secondly, inflation might exhibit reversed causality with government borrowing. That is, countries with a high stock of debt might have an interest to increase the inflation rate in order to reduce the real debt burden. Thirdly, there might also be a reversed relationship between unemployment and government bor-

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[19]As mentioned above, Belgium in 1981 and the Netherlands in 1987 belong to the set of excluded observations.

Table 8.10: Regressions of Change of Debt to GDP ratio on decentralization measures; 1975 to 2001; Outliers

	Outlier 1 (Studentized r)	Outlier 2 (Negative debt)	Outlier 3 (Without USA)	Outlier 4 (Without BEL)	Outlier 5 (Without ESP)
Δ Population	-1.009***	-1.043***	-1.056***	-1.091***	-1.049***
	(-11.752)	(-9.967)	(-10.708)	(-11.648)	(-10.971)
Δ Inflation	-0.202	-0.035	-0.128	-0.092	-0.070
	(-1.474)	(-0.178)	(-0.699)	(-0.573)	(-0.422)
Δ Working Age	-1.821*	-1.978	-1.923	-2.433**	-1.439
	(-1.737)	(-1.471)	(-1.519)	(-2.075)	(-1.255)
Δ Openness	0.094	0.194**	0.167*	0.176**	0.173**
	(1.468)	(2.064)	(1.854)	(2.037)	(2.067)
Δ GDP Growth	0.142	0.101	0.130	0.159	0.119
	(1.549)	(0.627)	(0.954)	(1.487)	(0.948)
Δ Unemployment	0.285	0.196	0.155	0.126	0.208
	(1.298)	(0.678)	(0.596)	(0.505)	(0.793)
Δ Interest rate	-0.648***	-0.342	-0.542**	-0.537***	-0.536***
	(-3.401)	(-1.623)	(-2.556)	(-2.784)	(-2.647)
Δ Ideology	0.401*	0.455	0.483*	0.533*	0.527*
	(1.711)	(1.234)	(1.717)	(1.877)	(1.855)
Δ Fragmentation	-0.784	-1.488	-0.764	-1.352	-0.891
	(-0.512)	(-0.635)	(-0.441)	(-0.785)	(-0.502)
Germany	-1.453	-1.590	-1.494	-0.763	-1.655
	(-1.251)	(-1.212)	(-1.200)	(-0.620)	(-1.307)
Δ Exp. decent.	-0.216**	-0.199	-0.241**	-0.240**	-0.223**
	(-2.158)	(-1.455)	(-2.114)	(-2.157)	(-1.983)
Δ Tax decent.	0.030	-0.064	-0.064	0.087	-0.039
	(0.233)	(-0.342)	(-0.451)	(0.539)	(-0.242)
Δ Grant share	-0.062	-0.000	-0.029	-0.019	-0.010
	(-0.977)	(-0.000)	(-0.384)	(-0.245)	(-0.137)
N	283	236	270	273	286
F	36.039	20.310	40.680	33.198	29.191
$\bar{R}^2$	0.543	0.429	0.435	0.487	0.440
RMS error	2.381	2.955	2.991	2.733	2.930

[1] t-statistics are shown in parentheses
[2] Hypothesis tests are based on robust standard errors
[3] Estimates for cross-section and time-fixed effects are not shown

rowing. That is, governments might engage in deficit finance to combat unemployment. For these reasons, the estimates might be biased when the potential endogeneity of these three variables is not taken into account.

Unfortunately, it is rather difficult to find *time-varying* variables that could be used as instruments for these potentially endogenous covariates. As shown further below, the variables chosen by us "work" in the sense that over-identification tests indicate that they are not directly related to government borrowing. The reader should be aware, however, that they are not completely satisfactory from a theoretical perspective, and seem to be somewhat weak predictors of the interest rate.

We use four variables as instruments. Firstly, a dummy variable (entitled *EMU* in table 8.4) that is 1 for all EMU countries that signed the Maastricht treaty (EU 15) from 1993 onwards and else 0 (for Austria, Finland and Sweden (the former EFTA countries), this variable is 1 from 1995 onwards since they joined the EU not until this year). The Maastricht treaty imposed significant restrictions on the autonomy of the monetary policy of member states and could therefore be correlated with inflation, unemployment and interest rates. While it also imposed some restrictions for fiscal policy, we find that it was not significantly related to the growth of net financial liabilities when we estimate our preferred model with this variable included.[20] Also, the over-identification test reported in table 8.11 do not suggest that this is an invalid instrument.

Secondly, we use an index that measures the industrial production in a country i in year t. This index is constructed by the OECD and considers the goods produced by establishments engaged in mining, manufacturing and the production of gas, electricity, and water. We presume that this variable might be a reasonable instrument since changes in inflation, unemployment and interest rates are likely to be correlated with changes in industrial output.

We use the growth rate of unit labor costs in industry production as the third instrument. As the change in industrial output, this variable might be related to the potentially endogenous variables. The level of the labor unit cost variable is defined as the average cost of labor per unit of output. This variable is also obtained from the OECD.

The fourth instrument is a variable which measures the number of years until the next election. We presume that governments try harder to influence unemployment and inflation rates in a more favorable direction when an election year approaches.

The results from the regressions with instrumental variables regressions are collected in table 8.11. In the first column, we present results when we only instrument the unemployment rate. The results in the second column were obtained by instrumenting only the inflation rate. The third column presents results for a model where only the interest rate is instrumented. Note that we use all available instruments in most models, instead of choosing heuristically the instrument set for each individual model. The only exception is the model where the unemployment rate is instrumented. In this model, the over-identification test is rejected at the 10% level when the industrial production index is included. We therefore do not use this instrument in this particular model.

In the fourth column, we show the results when all potentially endogenous variables are instrumented simultaneously. Finally, we present in the fifth column the results when a GMM instead of the simple TSLS estimator is used to estimate the model where all potentially endogenous vari-

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[20]Results are not shown but available upon request.

ables are simultaneously instrumented. GMM is more efficient than the simple TSLS estimator because it assigns weights to the moment conditions according to their variance. Since the moment conditions which exhibit more variability receive smaller weights when the coefficient vector is calculated in the GMM procedure, it should produce more precise estimates.

Note firstly that according to the over-identification tests (Hansen J) in table 8.11, the instrumental variables are apparently valid in a statistical sense in all models. It is therefore reassuring that the results in the first two models confirm the main results from the baseline models. That is, expenditure decentralization is negatively and significantly related to government borrowing, and the two remaining decentralization variables are insignificant in these models.

However, once we attempt to instrument the interest rate, we find that the set of instruments are very weak predictors, as evidenced by the large p-value reported for the under-identification test in the third model. We obtain similar results when all three potentially endogenous variables are instrumented simultaneously, as evidenced by the results reported in the fourth column.

This is not particularly surprising considering the fact that even though the instrumental variable technique ensures consistency, it also leads to large standard errors when one of the instruments is incapable of predicting one of the potentially endogenous variables sufficiently. This inefficiency problem seems indeed to be particularly severe in the third and fourth model. The RMS error is noticeably higher in these than in the previous models, and the F statistic is relatively low. Note however that even in these models, the expenditure decentralization variable displays a negative coefficient.

We attempt to improve efficiency by using a GMM approach. The results are collected in the fifth column. In view of the fact that the RMS error is smaller in the GMM than in the TSLS 3 and TSLS 4 models, we may conclude that the GMM approach indeed increases efficiency. However, the apparent increase seems to be quite small since most control variables remain insignificant. While this is also true for the expenditure decentralization variable, note that the coefficient remains negative and displays a slightly higher (absolute) t-statistic than in the previous two models.

Given these results, we believe that the conclusions we obtained from the baseline models are robust to endogeneity problems. That is, there seems to be indeed no evidence that fiscal decentralization endangers public finances. We rather find for the expenditure decentralization variable once again evidence that points in the opposite direction. This variant of fiscal decentralization generally displays a negative coefficient, which suggests that expenditure decentralization improves fiscal outcomes.

Table 8.11: Regressions of Change of Debt to GDP ratio on decentralization measures; 1975 to 2001; Instrumental variables

	IV 1 (Unemployment)	IV 2 (Inflation)	IV 3 (Interest rate)	IV 4 (All)	GMM (All)
Δ Population	-1.343***	-1.093***	-1.164***	-1.224**	-1.082*
	(-6.511)	(-11.123)	(-5.806)	(-2.073)	(-1.881)
Δ Inflation	-0.454*	0.673	-0.891	-0.859	0.644
	(-1.658)	(1.255)	(-1.048)	(-0.140)	(0.108)
Δ Working Age	0.183	-1.717	0.457	0.791	-1.686
	(0.122)	(-1.516)	(0.162)	(0.090)	(-0.198)
Δ Openness	0.314***	0.136	0.269*	0.286	0.110
	(2.785)	(1.593)	(1.877)	(0.426)	(0.169)
Δ GDP Growth	-0.156	0.291	-0.112	-0.128	0.315
	(-0.722)	(1.598)	(-0.363)	(-0.069)	(0.175)
Δ Unemployment	-2.701	0.416	0.831	0.465	1.325
	(-1.613)	(1.421)	(0.966)	(0.104)	(0.300)
Δ Interest rate	-1.073***	-1.064***	5.582	5.765	1.102
	(-2.881)	(-3.423)	(0.835)	(0.336)	(0.066)
Δ Ideology	0.279	0.427	0.124	0.067	0.321
	(0.940)	(1.522)	(0.207)	(0.060)	(0.292)
Δ Fragmentation	-0.450	-0.235	-5.807	-5.987	-2.377
	(-0.249)	(-0.137)	(-0.912)	(-0.405)	(-0.165)
Germany	-2.973**	-1.668	-2.313	-2.576	-1.630
	(-2.124)	(-1.387)	(-1.196)	(-0.644)	(-0.418)
Δ Exp. decent.	-0.659**	-0.276**	-0.099	-0.156	-0.194
	(-2.456)	(-2.333)	(-0.393)	(-0.445)	(-0.557)
Δ Tax decent.	0.071	-0.002	-0.134	-0.101	0.016
	(0.289)	(-0.012)	(-0.431)	(-0.249)	(0.042)
Δ Grant share	0.083	-0.003	-0.134	-0.124	-0.063
	(0.702)	(-0.036)	(-0.678)	(-0.473)	(-0.248)
N	287	287	287	287	287
F	12.957	26.805	6.625	6.026	6.065
RMS error	3.398	2.955	5.163	5.278	3.338
Overid. test	0.454	0.189	0.705	0.286	0.286
Underid. test	0.060	0.049	0.880	0.915	0.915

[1] t-statistics are shown in parentheses
[2] Hypothesis tests are based on robust standard errors
[3] Estimates for cross-section and time-fixed effects are not shown

8.5 Conclusion

Our aim in this chapter was to explore the relationship between fiscal decentralization and public finances. In the analysis, which used both decentralization variables derived from the IMF's GFS yearbook (and obtained from World Bank database) and measures provided by Stegarescu (2005), we generally found that a high degree of expenditure decentralization tends to significantly reduce public indebtedness. On the other hand, tax decentralization and vertical fiscal imbalances were found to be insignificant. Thus, our results confirm some results from the last chapter, but they are also to some extent contradictory to others. We will discuss this issue in more detail in the final chapter of this dissertation.

Part IV

Summary and outlook

Chapter 9

Summary and outlook

The aim of this dissertation was to investigate whether a decentralized public sector causes unsustainable fiscal policies, or whether it constrains the ability of governments to over-spend and accumulate debt.

In the literature review, we initially explained our understanding of the general concept of "decentralization", and argued that we are particularly interested in the consequences of *fiscal* autonomy of lower-level governments. We then described both the theoretical and empirical literature on fiscal decentralization. In this part of the review, we first discussed the literature on the impact of fiscal decentralization on allocative efficiency and welfare. Thereafter, we described extensively the literature on the consequences of fiscal decentralization for fiscal outcomes.

The majority of contributions on the relationship between fiscal decentralization and the size of government use as the starting point of their analysis the "Leviathan hypothesis". That is, by restricting inefficient government intervention, a decentralized public sector is believed to lead to smaller governments. Accordingly, the beneficial effects of fiscal decentralization on fiscal outcomes tend to be emphasized by this strand of the literature.

On the other hand, the contributions addressing the impact of fiscal decentralization on public borrowing tend to rely on the soft budget constraint syndrome, and thus emphasize the potentially negative consequences of fiscal decentralization.

However, both lines of research do not offer a clear-cut answer. Therefore, we found it worthwhile to study the impact of fiscal decentralization on both the size of government and public borrowing in more detail.

We first focused the impact of fiscal decentralization on the size of government, and argued that existing theoretical models neglect the "political environment" with which both a centralized and a decentralized public sector have to interact. In order to formalize our argument, we developed a theoretical model in chapter 3 in which we studied the fiscal policy of "ideological" governments under different public sector regimes. We found that fiscal decentralization leads to an expansion of the public sector when the center is ruled by a left-wing party, whereas it causes a reduction when the center is ruled by a right-wing party.

In the next chapter, we investigated whether our theory "stands up to the data" on the basis of the experiences in a number of OECD countries, and found some evidence confirming the theoretical model.

We then moved on to the issue of public borrowing. We developed a model in which the impact of certain features of an intergovernmental transfer scheme on public borrowing were studied in chapter 5. We explored in particular how horizontal equalization schemes and soft budget constraints were related to subnational borrowing within an institutional framework that resembled the prevailing system of fiscal federalism in Germany. The model suggested that idiosyncratic characteristics of subnational governments interacted with the stylized intergovernmental transfer system in determining levels of public debt.

Since the model in chapter 5 was deliberately structured to mirror the situation in Germany, we used in chapter 6 economic and fiscal data from the German States to "test" the propositions derived in the theoretical model. We found that the implications of the model were largely confirmed by the data: Unproductive and small jurisdictions were more likely to exploit soft budget constraints by means of over-borrowing than productive and large ones. There was, however, less empirical evidence in support of the hypothesis that a horizontal equalization scheme reduces levels of debt.

One criticism that could be raised against the empirical investigation in chapter 6 is that it had some methodological shortcomings. Since we recognized the limitations of the methodology, we used more sophisticated econometric techniques in subsequent chapters to explore the relationship between fiscal decentralization and public borrowing further. We also expanded the focus of interest from German States to OECD countries.

We studied in chapter 7 the relationship between fiscal decentralization and primary deficits with data on OECD countries. In this chapter, the notion of fiscal decentralization was operationalized with three different measures, each of which had distinct effects on fiscal outcomes.

Firstly, we found that expenditure decentralization was negatively related to primary deficits in "average" OECD country.

Secondly, and in contrast to expenditure decentralization, we found a non-linear relationship between "own tax" decentralization and primary deficits. The sign of the estimated coefficients indicated that an intermediate degree of subnational tax autonomy leads to smaller public deficits than both a disproportionately high and a disproportionately low level. We also concluded that the "average" OECD country exhibited too much tax decentralization during the time frame of our analysis. That is, a reduction would have led to an improvement in fiscal balances.

With respect to the measure of tax decentralization that was based on shared taxes, we found conflictive effects. With Belgium and Spain included in the sample, we obtained that an increase in shared taxes decentralization would have decreased primary deficits in the "average" OECD country, whereas we found the opposite result when these two countries were excluded from the regressions.

In chapter 8, we analyzed the impact of fiscal decentralization on public debt. We found that the results were to some extent contradicting those obtained by analyzing primary deficits. While expenditure decentralization apparently reduced levels of debt in the "average" OECD country (as in the primary deficit models), tax decentralization was found to be irrelevant.

The contradictory findings with respect to tax decentralization in the two chapters need to be explained. We can think of several explanations. Firstly, we may argue that the results are not necessarily contradictory. Since we specify a non-linear model when primary deficits are analyzed, the finding that tax decentralization increases primary deficits is only true for a hypothetical

"average" country. However, due to data availability constraints, the number of countries in the primary deficit models (i. e. in chapter 7) is different than in the public debt models (i. e. in chapter 8). Since we have 21 countries in the former chapter but only 17 in the latter, the hypothetical "average" country has different characteristics in these two sets of estimations. Thus, we might explain the apparently contradictory findings in the primary deficit and public debt models by different levels of expenditure and tax decentralization in the "average" OECD country.

Secondly, we estimate different specifications in these two chapters. That is, the insignificance of the own tax decentralization variable in the public debt models could be due to the fact that using a linear model to describe a genuinely non-linear relationship is bound to result in insignificant estimates. Since it is impossible to know ex ante the true model, experimenting with different specifications is presumably a more robust approach than to choose some ad hoc specification which is to be used throughout the dissertation. Also, those results that are confirmed by the investigations in both chapter 7 and chapter 8 are more likely to be valid.

What, then, are the conclusions that can be drawn from the investigations in these two chapters? Firstly, we may conclude that high levels of expenditure decentralization are beneficial for fiscal outcomes since both the estimates in the primary deficits and the public debt models suggests that increasing expenditure decentralization improves fiscal outcomes.

Secondly, the results in chapter 7 suggests that *some* amount of tax decentralization is optimal in terms of fiscal stability, while the result in chapter 8 indicate that tax decentralization is not harmful. We thus conclude that intermediate levels of subnational tax autonomy lead presumably to the most preferable outcomes.

Thirdly, we find that vertical fiscal imbalances are not particularly harmful, even though the effect of the shared taxes variable in chapter 7 is to some extent ambiguous.

Overall, this dissertation confirms that fiscal decentralization is an important determinant of fiscal policy. Both the theoretical models and empirical investigations suggest that tax and spending autonomy, as well as certain fiscal institutions like horizontal transfer schemes and federal grants, influence the incentives of subnational politicians and citizens. However, we fail to reach a clear-cut result. We rather find that fiscal decentralization might have both beneficial and harmful consequences, and that the conclusions depend on which features of fiscal decentralization are emphasized.

Considering the findings in this dissertation, we see two important avenues for future research. Firstly, the interaction of fiscal decentralization with other political and economic variables should be studied more extensively. Secondly, it should be differentiated in even more detail than in this dissertation between different representations of fiscal decentralization. As this dissertation shows, different elements of a decentralized public sector have distinct and possibly conflictive effects. Therefore, more evidence needs to be accumulated before it can be conclusively determined whether fiscal decentralization is a boon or a bane for economic efficiency and fiscal stability. We hope that this dissertation is a stepping stone for such studies in the future.

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