Imperfect Competition in Product Markets and Labor Markets, General Equilibrium and Unemployment

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Chapter 1

Introduction

The causes of *unemployment* and possible countermeasures are old topics of economics. One of the most famous works dealing with unemployment was written by J.M. Keynes (Keynes 1936). He saw a major reason for the rising unemployment during the great depression of the nineteenthirties in the difficulty of lowering nominal wages. Keynes argued that employees would not accept lower wages because of long run nominal wage contracts as well as social rules. So with rigid prices, real wages could not adjust to a labor market equilibrium.

The rise of European unemployment since the nineteenseventies again has led many economists to think about the roots of unemployment and consequences for economic policy. Thereby nominal and real wage rigidities are still seen as a major reason for the failing labor market clearings. But other frictions are also made responsible for the high unemployment rates in European countries. Examples worth mentioning are job protection legislation, generous unemployment insurance (in terms of replacement rates and benefit duration), high tax wedges and mismatch.

Several sources are named in the economic literature for the wage rigidities: Minimum wage legislation by *governments* in some countries is seen

as a reason why employers do not create enough jobs for the working age population. But also *employers* are reproached for setting wages above the market clearing level. Roughly speaking, such *efficiency wages* are offered to increase the workers' effort and productivity. *Employees* are also often accused of claiming too high wages. It is argued that they use their insider status to demand high wages in bargaining procedures between employers and (unionized) employees. Thereby they are said to make use of their advantages over the unemployed outsiders due to all types of labor turnover costs. Labor turnover costs can arise from the dismissal of incumbent employees (for instance litigation against dismissal) and with hiring and training of new recruits.

All the above mentioned deviations from a competitive labor market have been made responsible for the bad performance of European labor markets in several studies (see e.g. the OECD jobs study 1995). The recommended policy implications often point out that a better performance, i.e. a decrease of unemployment can only be achieved by making European labor markets more flexible similar to the US labor market. On the other hand, many economists advocate the European social protection system and often refer to the large income inequalities in the US associated with labor market flexibility.

In order to complement labor market reforms, some authors have recently suggested that product market reforms could be helpful to reduce unemployment (see McKinsey Global Institute 1995, 1997). This thesis investigates that possibility: Several European product markets experienced strong deregulations recently. Major examples are the telecommunication industry and the market for energy (electricity and gas), where monopolies are given up in favor of competitive markets. Other markets still hold further potential

to increase competition (see Gersbach and Sheldon 1996). The central question that arises is how (un)employment is affected by these deregulations. Do deregulations that lead to more competition in product markets affect employment positively or negatively? This thesis tries to answer this question using general equilibrium models with simultanous rigidities in labor and product markets. The major conclusion of the thesis is that the answer to the central question is positive, i.e. product market reforms affect employment postitively, but there are important exceptions. By trying to solve the central problem we encounter a number of conceptual issues that demand a microfoundation of frictions in markets. Further investigations of the thesis therefore concern the microfoundation of non-competitive product markets and labor markets. In this context, the thesis tries to shed light on the often asserted statement that insufficient recognition of general equilibrium effects by economic agents is another reason for bad macroeconomic performance. In particular, the consequences of insufficient consideration of general equilibrium effects in product markets and labor markets for aggregate unemployment are investigated.

The thesis is organized as follows: Chapter 2 develops the general equilibrium model used for the comparative static analysis. Then the impacts of product market deregulations on unemployment are analyzed for an exogenously given minimum real wage. Product market reforms are assumed to have two major consequences for competition in the corresponding industry: First, due to entrances of new firms mark-ups in the industry are supposed to decline (see the prices for telecommunication in Germany since the opening of the market). Second, we assume that increasing competition in an industry leads to a rise in total factor productivity. The second chapter analyzes how these two features of product market competition affect unemployment

for an exogenously given minimum real wage under different degrees of labor force mobility.

In chapter 3 the results of chapter 2 are examined with regard to robustness under different parameters and model specifications.

While we use aggregate production functions for our analysis in chapter 2, we provide a *micro*foundation of occurring mark-ups in chapter 4. We analyze an economy similar to that presented in chapter 2 and investigate the employment outcomes when the non-competitive industry sector is characterized by several firms competing à la Cournot. The modeling of such imperfect product market competition in a general equilibrium framework leads to the question of which general equilibrium effects the firms take into account when they choose their quantities to maximize profits. We distinguish between two cases: the first possibility is that firms take only account of the price reaction associated with a certain quantity choice. This is the main feature of the industrial organization literature when modeling Cournot competition in partial models. We show that the behavior of firms can be modeled as a learning process which leads to a steady state where the myopic maximizing behavior of firms is consistent with their (general equilibrium) environment. The other possibility we analyze is that firms incorporate all general equilibrium effects at once when they choose quantities. We then compare the different outcomes of the two views in terms of employment, depending on the mobility of the labor force.

As an application of the microfoundation of mark-ups in chapter 4, we analyze the implication of a merger of two firms in the Cournot competing industry for unemployment in chapter 5.

In chapter 6 we investigate the conditions under which non competitive wages can occur. We analyze the case where wages are negotiated between

an employers' association and a union. Again, this modeling of imperfect competition (this time in labor markets) leads to the question of which general equilibrium effects are incorporated by the agents when bargaining over wages. We analyze three cases: First, we assume that employers and employees consider only the employment effect of a certain wage contract, taking all other variables as given. The second possibility under consideration is the case where firms and unions take account of all the *direct* effects of a negotiated wage for their industry, i.e. the employment effect, the impact on other production factors and the price effect. We show that these two possibilities of modeling imperfect labor market competition can be understood as a learning process leading to a consistent equilibrium in analogy to chapter 4. The third possibility we analyze is again that agents consider *all* occurring general equilibrium effects when negotiating a certain wage. We compare the (employment) outcomes of the different scenarios for different degrees of labor mobility.

In chapter 7 we investigate the impact of such wage responses due to bargaining procedures on the employment effects of product market reforms. Do the results obtained in chapter 2 change if (real) wages are not set exogenously but are negotiated in a wage bargaining procedure?

The last chapter gives a summary of the results and discusses the implications for economic policy. Furthermore, the significance of the results for future economic research is dicussed.

Chapter 2

Product Market Reforms and Unemployment

2.1   Introduction

In this chapter, we examine how product market reforms aimed at increasing competition in product markets affect unemployment. We also examine why political forces may be against the deregulation of product markets. The model we use for the analysis in this chapter allows for different types of labor and assumes an exogenously given minimum real wage for low-skilled workers. The main result of the chapter is that product market reforms will help to reduce aggregate unemployment under many circumstances even though sectoral unemployment may increase. We also highlight that the mobility of high-skilled workers and the distribution of unemployment across sectors determine whether productivity improvements in one sector affect aggregate unemployment positively or negatively.

We examine a simple general equilibrium model with two types of labor, low and high-skilled, and two sectors. The novelty of our analysis are explicit considerations of a number of general equilibrium effects when product mar-

ket reforms occur in the presence of labor market rigidities. To mirror the situation in mature sectors, we will focus in the whole chapter on a low elasticity of substitution between the commodities of different sectors.[1]. Then we examine the following general equilibirum effects. First, a decline of mark-ups in one sector affects employment positively through income effects in all sectors. Aggregate employment effects are always positive. Second, labor productivity improvements in one sector reduces aggregate unemployment if workers are mobile across sectors. The same holds also if low-skilled workers are immobile, provided that there is unemployment in sufficiently many sectors. Third, even if low-skilled and high-skilled workers are immobile across sectors, labor productivity improvements may reduce aggregate unemployment although it raises sectorial unemployment. Fourth, only if unemployment is concentrated in the sector, where the productivity improvements occur, aggregate unemployment may increase.

To develop the results, the chapter is organized as follows: In the next section we relate the chapter to the literature of the European unemployment problem. In section 3 we outline the model without any frictions in labor or product markets and derive the equilibrium conditions. In section 4 we introduce a real reservation wage of low-skilled people as the main institution in the labor market, either arising from minimum wages legislation, negotiated wages in a sector, or from unemployment benefits which put a floor on wages people are willing to accept when searching for jobs. In the product market we allow for more or less intensive competition captured by different degrees of mark-ups and by different degrees of total factor productivity. We show that promoting product market competition through the reduction of

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1 The impact of changes in mark-ups on unemployment and income distribution for a
   high elasticity of substitution has been examined in Gersbach 1996.

mark-ups or through the increase of productivity does lower unemployment under most circumstances. Moreover, low-skilled and high-skilled workers alike benefit from increasing competition. If mark-ups decline wages for high-skilled people rise and overcompensate declining profit income.

In section 5 we allow additionally for different degrees of mobility among low-skilled workers. High-mobility is associated with the ability of workers to achieve similar marginal productivity in both industries. Low-mobility or immobility adds the restriction that low-skilled workers can earn the real reservation wage only in one sector, but not in the other. We show that decreasing mark-ups lead to higher employment for all low-skilled employees. It also leads to higher real income for all households because of higher employment for low-skilled in all sectors and higher wages (overcompensating the decline in profits) for the high skilled. Productivity improvements in one sector raise employment in *all* sectors until full employment in the remaining sectors is achieved. When we have full employment in the remaining industries, employment in the industry where the productivity improvement takes place may decrease for small elasicities of substitution in the utility function.

In section 6 we allow for different degrees of mobility among low-skilled *and* high-skilled workers. We show that decreasing mark-ups again have positive effects on employment as well as on welfare for all households. Improving productivity, however, may have negative consequences for employment and welfare in the sector where the productivity improvement takes place when all workers are immobile and when the elasticity of substitution between the produced goods is small. Employment and welfare in the other sectors will always be positively affected. Moreover, the simulation shows that aggregate employment increases until we have full employment in the sectors where no product market reforms take place.

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In section 7 and 8 we provide some intuitions for the results, disscuss the robustness of the findings and finish with a short conclusion.

2.2 Relation to the Literature

There is a vast literature discussing the impact of labor market institutions on unemployment that we will not try to summarize here. Surveys and detailed accounts of labor market factors as root causes of the unemployment in Europe can be found in Blanchard and Summers (1986), Layard, Jackman, and Nickell (1991), Snower (1993), Bean (1994), Krugman (1994), Franz (1995), Minford (1995), OECD (1995), Paque (1995), Alogoskoufis, Bean, Bertola, Cohen, Doaldo and Saint-Paul (1996), Giersch (1996), Gersbach and Sheldon (1996), Lindbeck (1996), Siebert (1997), Nickell (1997). In general, unemployment has been associated with labor market factors affecting supply and demand for labor, including unemployment benefits systems, institutional settings for wage determination, and minimum wages.

Although European labor markets are quite fluid (see Burda and Wyplosz 1994), the current evidence also suggests that reallocation difficulties for low-skilled workers play a role in Europe. It is, however, not clear which sources of structural rigidities inhibit the rapid transfer of workers from declining firms to growing firms.[2] We show that the low mobility of low-skilled workers may reduce the benefits of product market reforms for unemployment, especially if high-skilled workers are less mobile as well.

While the labor market rigidities are well documented there is less broad evidence for differences in mark-ups across countries. Some studies have iden-

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2 For instance, low real wages in job-creating industries combined with generous unemployment benefits create incentives for wait unemployment [Burda 1988]. At the other extreme [Oswald 1996] conjectures that the raise of home-ownership has reduced workers' mobility and may thereby raise the equilibrium rate of unemployment.

tified market power with aggregte data [e.g. Hall 1990]. There is large literature which identifies market power at the industry level [see e.g. Gerowski 1996 et al. for a recent survey]. On average, most studies conclude that product market imperfections are widespread and mark-ups persist for longer time periods. Moreover, recent studies suggest that mark-ups are slightly higher in Europe than in the U.S. [see e.g. Martins, Scarpetta, and Pilat 1996]. The sources of market power can be quite different, although it usually arises from barriers to entry or exit in conjunction with product demand and the particular way firms compete in the market. Hence, promoting competition in product markets through competition policy or removing trade restrictions is basically concerned with relaxing entry and exit barriers - as far as possible - through regulation or deregulation. Extreme cases such as the privatization and deregulation of telecommunication affects mark-ups negatively [see Gerowski 1996]. Obviously, as the industrial organization literature indicates, mark-ups cannot and should not be removed by policy in many cases. In industries with large fixed costs and research and development investments or advertising intensities, mark-ups are essential to cover theses costs.

Alternatively, imperfect competition can result in low total factor productivity. As discussed e.g. in Baily and Gersbach [1995], Gersbach and Sheldon [1996], OECD 1997 product market reforms in Europe have the potential to foster productivity gains in a variety of industries. Detailed accounts of productivity differences across industries in different countries indicate that it is the nature of companies facing competition that significantly influences the productivity of the production process in an industry. The major share of productivity differences can be attributed to the way functions and tasks are organised and to the fact that some companies have designed their products and services so that they require less labor and material for manufacturing

or delivering.[3] Thus, increasing competition can not only result in lower mark-ups, but can also cause productivity improvements by inducing organizational and design changes. An overview of the potential impact at the industry and aggregate level of regulatory reform in product markets in Europe can be found in OECD [1997]. However, as it is well known, the presence of market power or productivity gaps alone does itself not lead to unemployment, unless some frictions elsewhere exist. Market power can shift labor demand; however, as long as wages are flexible full employment is still possible. Thus, the impact of market power on unemployment arises only if labor market frictions are present simultaneously.[4] As a more subtle point, however, we show that the presence of market power or lagging in technology can be the reason that real reservation wages are binding.

The chapter focusses on short-term effects of product market reforms on unemployment. The aspects of sectoral productivity improvements due to product market reforms are related to recent work in the new growth theory.[5] Recently, Blanchard [1998] and Cohen and Saint-Paul [1997] have pointed out, that uneven technical progress may lead to higher unemployment, when technical progress widens the productivity differential between different sectors.

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3 The ongoing changes in production technologies can be interpreted as a third paradigm-sometimes called agile production- which replaces to some extent craft or mass production [see Baily and Gersbach 1995]. The transition towards a new production paradigm has potentially large effects on wage and employment, raising the wage and job opportunities of some workers relative to others [see e.g. Lindbeck and Snower 1995, Lindbeck and Snower 1996].

4 The interaction between product market and labor market frictions plays a considerable role in the New Keynesian Economics [see Mankiw and Romer 1991, Dixon and Rankin 1995] that focuses on nominal or real wage and price rigidities as well as deviations from perfect competition as causes or amplifiers of economic fluctuations and points out the potential role of macroeconomic policies.

5 The question of how productivity improvements in one sector affect employment in the economy is an old question. The modern answers date back at least to Baumol (1967).

The chapter highlights that the mobility of high-skilled people and the distrubution of unemployment across sectors are crucial for whether aggregate unemployment increases or decreases when sectoral productivity rises.

Finally, this chapter is related to the political implementation and reform design issues. First, Saint-Paul [1994, 1995], has argued that the redistributive goals that motivate labor market institutions in Europe may be achieved at a much lower cost using more traditional tax and transfer instruments. However, the current level of regulation can be explained by a political equilibrium since there is a bias towards maintaining the status quo. We will examine the political resistance to product market reforms. Second, as argued in Coe and Snower [1997] for the labor market and in Gersbach and Sheldon [1996] for the combination of product and labor market reforms, many policies appear to be complementary. The unemployment effect of each policy is greater when it is implemented in conjunction with the other policies than in isolation. Broad packages of product and labor market reforms can internalise complementarities across reform steps. However, such programs remain unstable against the formation of coalitions, lobbying for specific exemptions.

2.3 The Basic Model without Frictions

In this section we develop a simple model to analyze the effects of product market reforms on unemployment.

There are two types of labor in our model: skilled and unskilled. These are the only inputs into production. In the long run, there is no loss of generality associated with neglecting capital provided that capacity constraints are not binding and that the long-run capital stock is determined by equating the marginal product of capital with the real world interest.

There are two sectors. In both sectors low-skilled and high-skilled workers can be employed. The production functions are given by:

$$q_1 = A_1 L_1^{\ell^{\beta_1^\ell}} L_1^{h^{\beta_1^h}} \tag{2.1}$$

$$q_2 = A_2 L_2^{\ell^{\beta_2^\ell}} L_2^{h^{\beta_2^h}} \tag{2.2}$$

where subscripts 1 and 2 denote the first and second sector, respectively. h and ℓ denote the skill levels of workers. Total labor input of low-skilled workers is $L_1^\ell + L_2^\ell$. $L_1^h + L_2^h$ is the labor input of high-skilled workers. Labor supply of both types of labor is given by $\overline{L}^\ell$ and $\overline{L}^h$ and overall labor supply amounts to $\overline{L} = \overline{L}^\ell + \overline{L}^h$. We assume that labor is supplied inelasticly.[6]

We assume that both types of workers have the same CES-utility function:

$$u = \left(\alpha_1 \cdot c_1^{\frac{\sigma-1}{\sigma}} + \alpha_2 \cdot c_2^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}} \tag{2.3}$$

c denotes the corresponding consumption levels whereas σ denotes the elasticity of substitution between consumption good 1 and 2. We assume

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6 Our model could be complemented by a labor/leisure tradeoff. Since we focus on unemployment rather than on aggregate output, adding a labor/leisure tradeoff would not affect our basic results.

that all profits accrue to the high-skilled workers, i.e. they own all firms. Each high-skilled worker owns the same share of ownership.[7] The feedback from profits to wages will be an essential ingredient of our analysis.

2.3.1 The System of Equations

As a benchmark we solve for the equilibrium with no imperfections. Throughout the chapter we normalize the price of the first good to 1, i.e.

$$p_1 = 1 \tag{2.4}$$

By utility maximization we receive the following demand equations for consumption:

$$c_1 = \frac{b}{p_1 + p_2(\frac{p_1 \alpha_2}{p_2 \alpha_1})^{\sigma}} \tag{2.5}$$

$$c_2 = \frac{b}{p_2 + p_1(\frac{p_2 \alpha_1}{p_1 \alpha_2})^{\sigma}} \tag{2.6}$$

b denotes the budgets of the households. The budgets b are given by:

$$b^{\ell} = w^{\ell} \ \Rightarrow c_1^{\ell}, c_2^{\ell} \tag{2.7}$$

$$b^h = w^h + (\pi_1 + \pi_2)/(L_1^h + L_2^h) \ \Rightarrow c_1^h, c_2^h \tag{2.8}$$

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7 If shares of firms are traded, each high-skilled worker would hold the market portfolio. Allowing for differences in the ownership pattern of high-skilled workers would yield further distributional effects of product market reforms among high-skilled workers.

The low-skilled worker's budget consists entirely of wages. The high-skilled worker's budget also contains firms' profits, equally distributed among owners. The profit functions of the firms are given by:

$$\pi_1 = p_1 q_1 - w^\ell L_1^\ell - w^h L_1^h \tag{2.9}$$

$$\pi_2 = p_2 q_2 - w^\ell L_2^\ell - w^h L_2^h \tag{2.10}$$

From the profit functions we receive the first order conditions for profit maximisation:

$$w^\ell = A_1 L_1^{h^{\beta_1^h}} \beta_1^\ell L_1^{\ell^{\beta_1^\ell - 1}} \tag{2.11}$$

$$w^h = A_1 L_1^{\ell^{\beta_1^\ell}} \beta_1^h L_1^{h^{\beta_1^h - 1}} \tag{2.12}$$

$$w^\ell = p_2 A_2 L_2^{h^{\beta_2^h}} \beta_2^\ell L_2^{\ell^{\beta_2^\ell - 1}} \tag{2.13}$$

$$w^h = p_2 A_2 L_2^{\ell^{\beta_2^\ell}} \beta_2^h L_2^{h^{\beta_2^h - 1}} \tag{2.14}$$

Market clearing for good 1 implies:

$$(L_1^\ell + L_2^\ell)c_1^\ell + (L_1^h + L_2^h)c_1^h = q_1 \tag{2.15}$$

Labor market clearing is defined by

$$\overline{L}^\ell = L_1^\ell + L_2^\ell \tag{2.16}$$

$$\overline{L}^h = L_1^h + L_2^h \tag{2.17}$$

The system for determining the equilibrium consists of the equations: 2.4, 2.7, 2.8, 2.11, 2.12, 2.13, 2.14, 2.15, 2.16, 2.17. The unknown variables are: w^ℓ, w^h, L_1^ℓ, L_2^ℓ, L_1^h, L_2^h, p_1, p_2, c_1^ℓ, c_2^ℓ, c_1^h, c_2^h.

2.4 Equilibrium with Frictions in Labor and Product Markets

2.4.1 Real Wage Rigidity and Unemployment Insurance

In this section we introduce the frictions in the labor and product market. The institution in the labor market we focus upon is a real reservation wage for low-skilled workers that is above the market clearing level. The real reservation wage, denoted by $\overline{rw}$, is defined as a percentage of the market clearing real wage $\frac{w^\ell}{p}$ if no frictions are present. If $\overline{rw}$ exceeds $\frac{w^\ell}{p}$, it becomes binding and unemployment occurs. w^ℓ is then $p \cdot \overline{rw}$. A variety of regulations can cause a real wage floor: explicit minimum wages, an unemployment benefit system or institutional wage settings. Labor is taxed at flat rate, denoted by τ, to finance benefits for the unemployed workers.[8]

We assume that the unemployed obtain a fixed percentage of the wage earned by their counterparts who work, denoted by ub. Let us denote the number of unemployed workers by Δ, given by:

$$\Delta = \overline{L}^\ell - L_1^\ell - L_2^\ell \tag{2.18}$$

The government's budget constraint implies that

$$(w^\ell(L_1^\ell + L_2^\ell) + w^h(L_1^h + L_2^h)) \cdot \tau = ub \cdot \Delta \tag{2.19}$$

There are two ways how consumption levels of low-skilled workers are determined. At one extreme, one can assume that the employed earn wages

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8 If taxation were not distortionary, full employment and any distributional goal could be achieved by an appropriate tax scheme. Hence, the impossibility to eliminate real wage rigidities can either be explained by tax distortions or by political factors.

w^ℓ and that the unemployed receive ub. However, if labor market turnover is very high the low-skilled workers may receive the weighted average income of the employed and unemployed low-skilled workers.

2.4.2 Market Power and Productivity Improvements

In the product market, we allow for market power in one sector, i.e. prices can exceed marginal costs. This allows us to isolate the differential impact of market power on unemployment by varying the degree of market power from zero (no imperfect competition) to higher levels. We first introduce the corresponding framework and then compare the scenarios in terms of unemployment and income distribution.

Moreover, we allow for increasing competition that can lead to cost reduction and hence to a rise of total factor productivity. While the latter effect of competition can simply be performed as a comparative static exercise with respect to changes in A_1 or A_2, the former indication of incomplete competition needs more subtle considerations.

We allow that some firms can exert market power and are able to set prices above marginal costs. Specifically, we assume that this is the case in sector 2. We denote by m the mark-up, firms in the second sector achieve. Mark-ups can occur for a large variety of reasons [see e.g. Tirole 1988]. For instance, suppose that n $(n > 1)$ firms are operating in sector 2 and suppose they are playing a standard Cournot game. Then, the size of the mark-up m is decreasing in the number of firms. Another possibility may be a monopoly or a state owned enterprise which faces an upper limit on mark-ups enforced by competition policy or by regulation. While a concrete microfoundation for a particular level of mark-ups can be given by assuming Cournot Competition (see Gersbach [1996]), its pure existence is sufficient for our purpose (see also

Ginsburgh and Keyzer [1997]). Thus, the behavior of the firms in the second sector can be summarized by the following equilibrium condition:

$$p_2 = (1 + m) \cdot \text{marginal costs} \tag{2.20}$$

Obviously, prices and marginal costs must be determined in equilibrium. We will treat m as a parameter that indicates the competitive intensity in sector 2. Competitive intensity in sector 2 can increase for a variety of reasons. In the Cournot case entry of firms may be facilitated by competition policy or by a reduction of protectionist measures against foreign firms. Or state owned companies, such as telecommunication or airline companies, may be privatized and markets are opened up for other competitors. The remaining problem for the firms in sector 2 is to choose cost-minimizing input combinations.[9]

2.4.3 The System of Equations

The equilibrium with real wage rigidities and market power is determined by the following system of equations. The demand functions for consumption are again

$$c_1 = \frac{b}{p_1 + p_2 \left(\frac{p_1}{p_2} \frac{\alpha_2}{\alpha_1} \right)^\sigma} \tag{2.21}$$

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[9] Choosing cost-minimizing inputs is always optimal for an individual firm in the Cournot example. If only one firm is present in sector 2 and faces an upper limit on mark-ups, choosing cost-minimizing input combination is still optimal, but there are circumstances where firms have an incentive to raise marginal costs by paying higher wages, depending on the elasticity of product demand. We consider such cases as implausible in our context, since they would imply even larger real wages than the real reservation wage.

$$c_2 = \frac{b}{p_2 + p_1(\frac{p_2\alpha_1}{p_1\alpha_2})^\sigma} \tag{2.22}$$

Now we have three different budgets. The low-skilled worker's budget consists of their wages. The budget of the high-skilled again include their wages and the profits. The unemployed obtain benefits ub. Hence we get six demand functions for consumption.

$$b^\ell = w^\ell \Rightarrow c_1^\ell, c_2^\ell \tag{2.23}$$

$$b^h = w^h + (\pi_1 + \pi_2)/(L_1^h + L_2^h) \Rightarrow c_1^h, c_2^h \tag{2.24}$$

$$b^u = ub \Rightarrow c_1^u, c_2^u \tag{2.25}$$

The profit functions of the firms are as before, augmented by a tax wedge. Total labor costs for a firm consist of the wage bill and the tax expenditures.

$$\pi_1 = p_1 q_1 - w^\ell(1+\tau)L_1^\ell - w^h(1+\tau)L_1^h \tag{2.26}$$

$$\pi_2 = p_2 q_2 - w^\ell(1+\tau)L_2^\ell - w^h(1+\tau)L_2^h \tag{2.27}$$

Accordingly, we obtain the first order conditions for profit maximization of firms in sector 1 with perfect competition

$$w^\ell(1 + \tau) = p_1 A_1 L_1^{h\beta_1^\ell} \beta_1^\ell L_1^{\ell\beta_1^\ell - 1} \tag{2.28}$$

$$w^h(1 + \tau) = p_1 A_1 L_1^{\ell\beta_1^\ell} \beta_1^h L_1^{h\beta_1^h - 1} \tag{2.29}$$

Firms in sector 2 have mark-ups and minimize costs. The first-order conditions for cost-minimizing yield:

$$\frac{L_2^\ell}{L_2^h} = \frac{\beta_2^\ell w^h}{\beta_2^h w^\ell} \tag{2.30}$$

The cost function of firm 2 or the expenditures for inputs, denoted by E_2, is then given by

$$E_2 = A_2^{-\frac{1}{\beta_2^\ell + \beta_2^h}} \left[\left(\frac{\beta_2^\ell}{\beta_2^h} \right)^{\frac{\beta_2^h}{\beta_2^\ell + \beta_2^h}} + \left(\frac{\beta_2^\ell}{\beta_2^h} \right)^{-\frac{\beta_2^\ell}{\beta_2^\ell + \beta_2^h}} \right]$$
$$\left(w^\ell(1 + \tau) \right)^{\frac{\beta_2^\ell}{\beta_2^\ell + \beta_2^h}} \left(w^h(1 + \tau) \right)^{\frac{\beta_2^h}{\beta_2^\ell + \beta_2^h}} q_2^{\frac{1}{\beta_2^\ell + \beta_2^h}} \tag{2.31}$$

Firm 2 will use the space to increase prices above marginal costs. Hence, price setting of firm 2 implies

$$p_2 = (1 + m) \cdot \frac{\partial E_2}{\partial q_2} \tag{2.32}$$

$\frac{\partial E_2}{\partial q_2}$ are the marginal costs of firm 2. Note that marginal costs depend on wages and are therefore determined in equilibrium.

Market clearing for good 1 implies:

$$(L_1^\ell + L_2^\ell)c_1^\ell + (L_1^h + L_2^h)c_1^h + \Delta c_1^u = q_1 \qquad (2.33)$$

We will choose our parameters so that the real reservation wage will be binding and thus the labor market for low-skilled workers will not clear. Labor market clearing for high skilled workers is given by:

$$\overline{L}^h = L_1^h + L_2^h \qquad (2.34)$$

The true price index is defined by [see e.g. Dixon 1995]

$$p = \left[\left(\frac{\alpha_1^\sigma}{\alpha_1^\sigma + \alpha_2^\sigma} \right) \cdot p_1^{(1-\sigma)} + \left(\frac{\alpha_2^\sigma}{\alpha_1^\sigma + \alpha_2^\sigma} \right) p_2^{(1-\sigma)} \right]^{\left(\frac{1}{1-\sigma} \right)} \qquad (2.35)$$

This price index guarantees that changes in prices do not affect utility of households as long as real wages are kept constant. Nominal wages for low-skilled workers are given by:

$$w^\ell = \overline{rw} \cdot p \qquad (2.36)$$

The unemployment benefits ub are defined as a fraction s of the minimum wages for the low-skilled, $0 < s \leq 1$.

$$ub = s \cdot \overline{rw} \cdot p \qquad (2.37)$$

Unemployment is given by:

$$\Delta = \overline{L}^\ell - L_1^\ell - L_2^\ell \tag{2.38}$$

Labor is taxed at a flat rate in order to finance a transfer to the unemployed. The tax rate is determined by the condition that the government budget must be balanced:

$$((w^\ell(L_1^\ell + L_2^\ell) + w^h(L_1^h + L_2^h)) \cdot \tau = ub \cdot \Delta \tag{2.39}$$

The equilibrium is determined by the system of equations 2.4, 4.3, 4.4, 4.5, 2.28, 2.29, 2.30, 2.32, 2.33, 2.34, 2.35, 2.36, 2.37, 2.38, 2.39. The unknown variables are w^ℓ, w^h, ub, L_1^ℓ, L_2^ℓ, L_1^h, L_2^h, $p1, p2, p$, c_1^u, c_2^u, c_1^ℓ, c_2^ℓ, c_1^h, c_2^h, Δ, τ.

In the preceding model, low and high-skilled labor is fully flexible to work in either of the sectors. This model is denoted by Mob. In the $Imlow$-model discussed in section 5, we will add mobility barriers for low-skilled workers. Mobility barriers add the restriction that low-skilled workers are able to earn the real reservation wage in only one sector. Finally, in the $Imall$-model in section 6, we will add mobility barriers for high-skilled workers as well.

In the simulation results we will compute how utility levels for low and high-skilled workers react to changes in product market constraints. The utility or welfare for low-skilled workers is defined as follows:

$$u(low) = \frac{1}{\overline{L}^\ell} \cdot ((L_1^\ell + L_2^\ell)u^\ell + \Delta u^u) \tag{2.40}$$

Hence we consider the weighted arithmetic mean of the utility of employed low-skilled workers and unemployed low-skilled workers. The simulation results show the change in utility (in percent) relative to the baseline

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(mark-up=0 and productivity A2 = 1).

The utility of high-skilled workers is simply their original utility u^h. In the simulation we again compute the relative change in utility compared to the baseline.

2.4.4 Simulation Results for *Mob*

The preceding section outlined the general equilibrium relationships between taxes, mark-ups, unemployment and wages. In this section we calibrate the model and examine how different product market reforms affect unemployment. Given the model's simplicity, it is not easy to estimate what parameter values should be. However, as we will discuss in the last section, the results are very robust across a wide range of variations of the parameters. We consider the following parameter constellation (see table 1):

Table 2.1:

Parameters	Values
α_1	0.5
α_2	0.5
σ	0.1
A_1	1
β_1^ℓ	$\frac{2}{9}$
β_1^h	$\frac{4}{9}$
A_2	1
β_2^ℓ	$\frac{2}{9}$
β_2^h	$\frac{4}{9}$
$\overline{L}^\ell$	60
$\overline{L}^h$	40
$rwfactor$	1.1
s	0.8

rwfactor denotes the factor, the low skilled real wage in the model without frictions is multiplied with, for the model with rigidities. In this benchmark solution, the proportion of skilled to unskilled workers is 2 to 3. Although there is no clear-cut way to calibrate skill proportions in a two skill level economy, an estimate around 1/2 is an average of wage or education considerations [see Saint-Paul 1994]. The production function parameters were calibrated so as to imply $\frac{w^\ell}{w^h}$ to be around 1/2 (1/3 if no frictions are present in the economy). Note that the overall income differences are larger since the high-skill people are owners of the firms. The overall income of the high-skilled people is 3 to 4 times higher than that of the low-skilled people. Moreover, we focus on a low elasticity of substitution in the utility function between the two goods. As discussed in Gersbach [1996], a high elasticity of substitution will in general increase the beneficial impact of product market reforms since a relative price decline will shore up demand in the sector where frictions are reduced. A low elasticity of substitution mirrors the situation of many declining industries in manufacturing and mature services where price declines do no lead to large output gains and hence overall employment must decline [see e.g. Gersbach and Sheldon 1996].

All our simulation exercises are comparative static experiments. We will vary mark-ups leaving productivity at its initial value. Then we will increase productivity leaving mark-ups at zero. Since the effects of mark-up and productivity changes are almost additive, we will discuss them seperately.[10]

In figures 1 and 2 the mark-ups in percent and productivity improvements as a percentage change of A_2 (baseline $A_2 =1$) are plotted against the resulting unemployment. Three different levels of real wages of low-skilled people

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10 Lowering mark-ups and increasing productivity at the same time exhibit weak complementarities. That is the change in unemployment is slightly larger than the sum of the changes by varying mark-ups and productivity in isolation.

were chosen. The simulation clearly indicates the monotonical relationship between unemployment and mark-ups or productivity improvements. In the case $rwfactor = 1.0$, the real wage is not binding with zero mark-ups and unemployment becomes zero, while increasing mark-ups make the real reservation wage binding.

Since the relationships in the simulation are very similar for different levels of real reservation wages, we select $rwfactor = 1.1$ as real wage rigidity for all future simulation exercises. That is, real wages are 10% above the market clearing wages when there is perfect competition. In figure 3 we observe that the reduction of unemployment by increasing competition is achieved by higher employment of low-skilled people in both sectors. The high-skilled workers always remain fully employed. However, declining mark-ups increase the share of high-skilled workers in sector 2 at the expense of sector 1. In figure 4 the relative welfare changes in percent for low and high-skilled workers are plotted against the size of the mark-ups. The utility, i.e. the real income for low-skilled workers is decreasing with the level of mark-ups, because a larger share of low-skilled workers receives the unemployment benefits instead of real reservation wages. More surprising, the real income of high-skilled people raises with lower mark-ups. Declining mark-ups lower the profit income for high-skilled workers, but rising wages overcompensate declining profits. Wages rise because marginal productivity of high-skilled workers increases and taxes to finance the unemployed decline. Marginal productivity of the high skilled increases with higher employment (of low skilled) as long as high skilled and low skilled labor exhibit complementarities as in case of the Cobb-Douglas-function.

In figures 5 and 6 the same pattern can be observed when productivity changes are compared to employment and utility changes. Due to the

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low elasticity of substitution in the utility function, the level of employment composed of low and high-skilled workers decreases in sector 2. However, more low-skilled workers are employed in both sectors. Again welfare increases for both types of labor. High-skilled workers benefit relatively more from productivity improvements since wages and profits raise, whereas taxes decline.

In summary, in the $Mob-case$, promoting product market competition through the reduction of mark-ups or through the increase of productivity lowers unemployment under all circumstances. Moreover, low-skilled and high-skilled workers alike benefit from increasing competition. If mark-ups decline, wages for high-skilled people rise and overcompensate declining profit income.

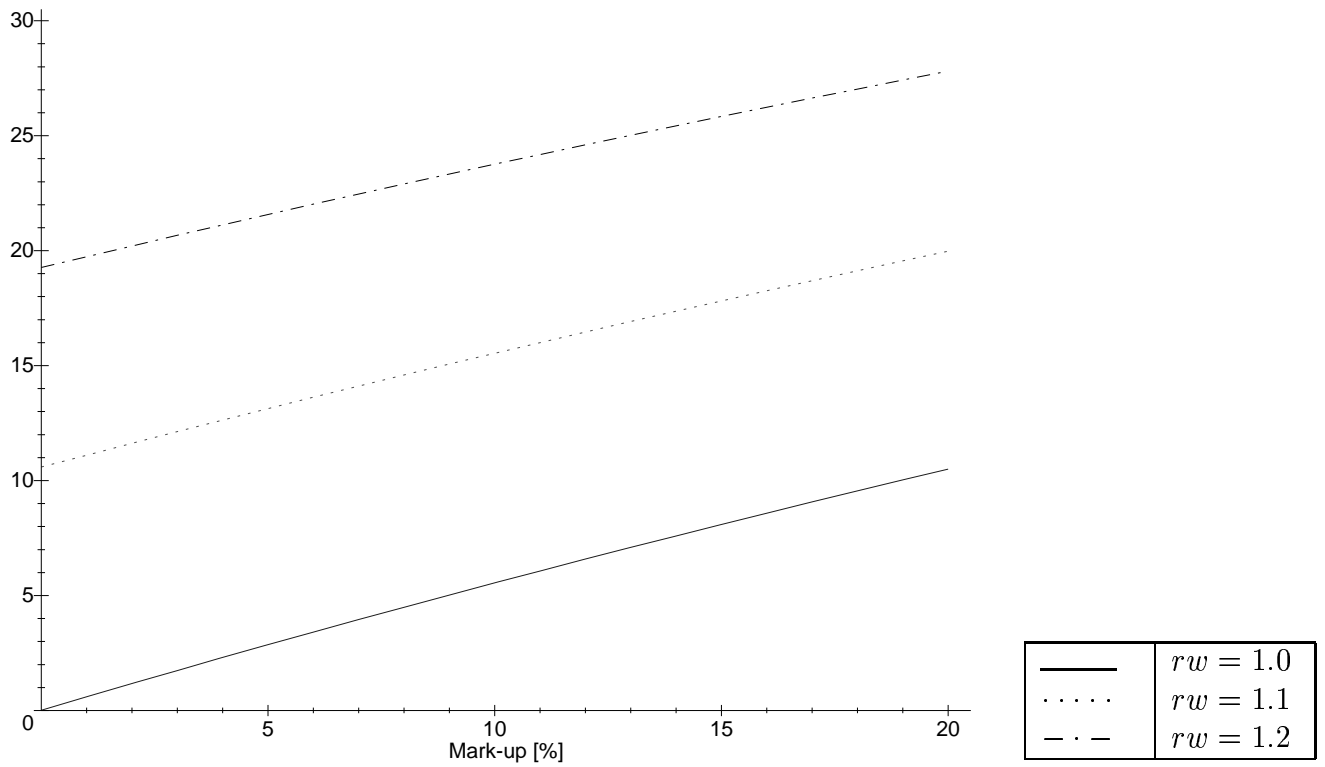Figure 1: Unemployment and Markups (Mob)

——	$rw = 1.0$
· · · · ·	$rw = 1.1$
— · —	$rw = 1.2$

Figure 2: Unemployment and Productivity Improvement (Mob)

· · · · ·	$rw = 1.1$
— · —	$rw = 1.2$
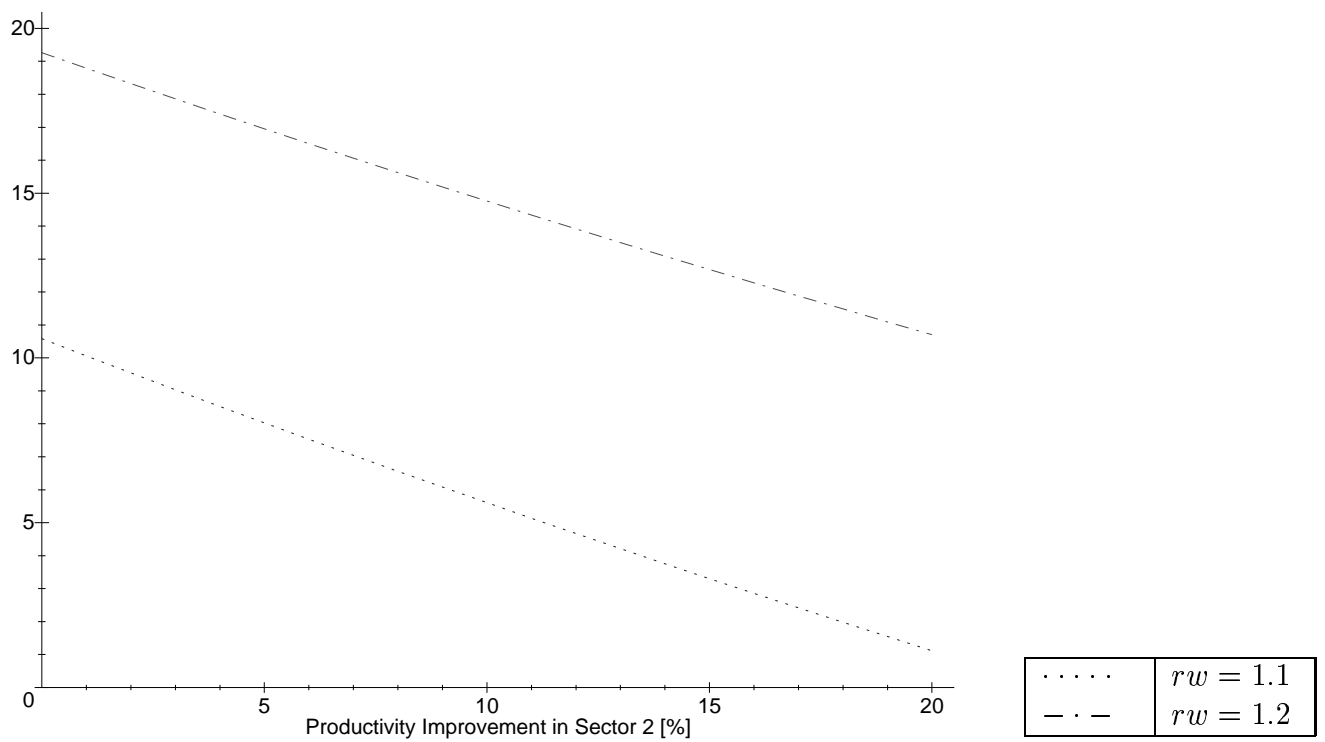
Figure 3: Employment and Mark-ups (Mob)

——	L_1^ℓ
· · · · ·	L_2^ℓ
◇ ◇ ◇	L_1^h
∘ ∘ ∘ ∘ ∘	L_2^h
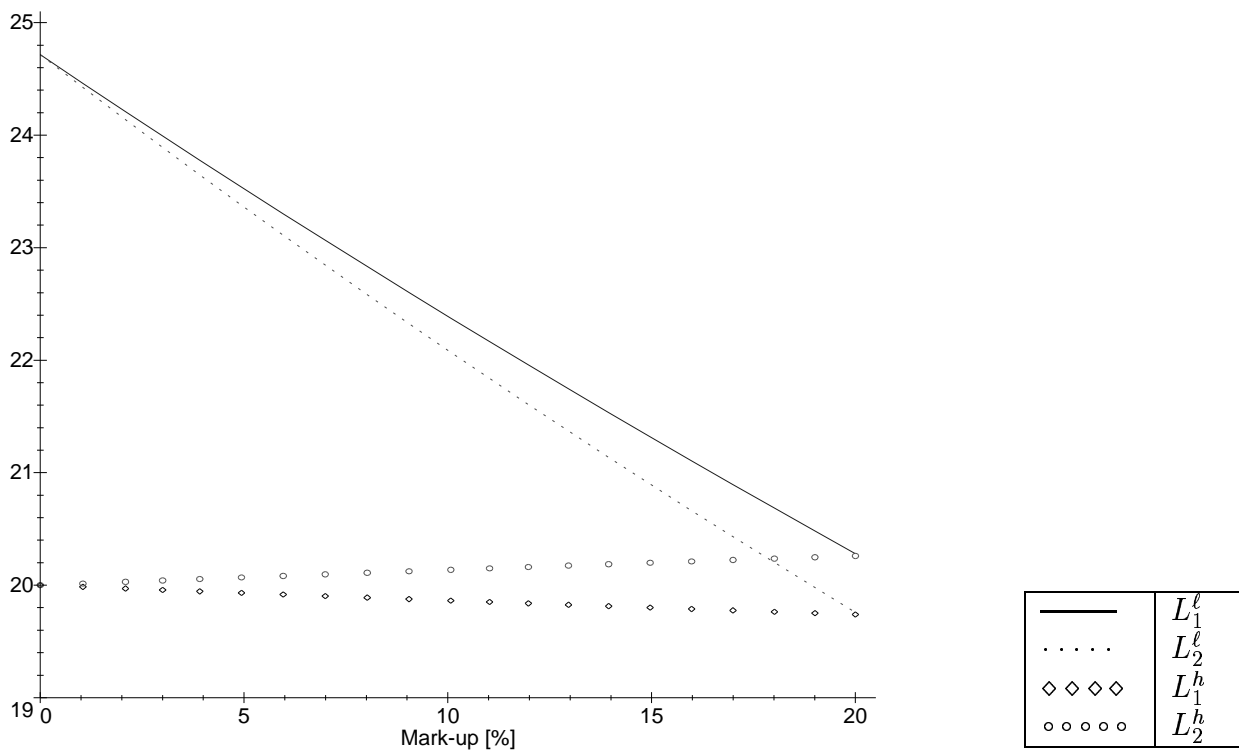
Figure 4: Utility Change and Mark-ups (Mob)

— · —	u^ℓ
+ + + +	u^h

Figure 5: Employment and Productivity Improvement (Mob)

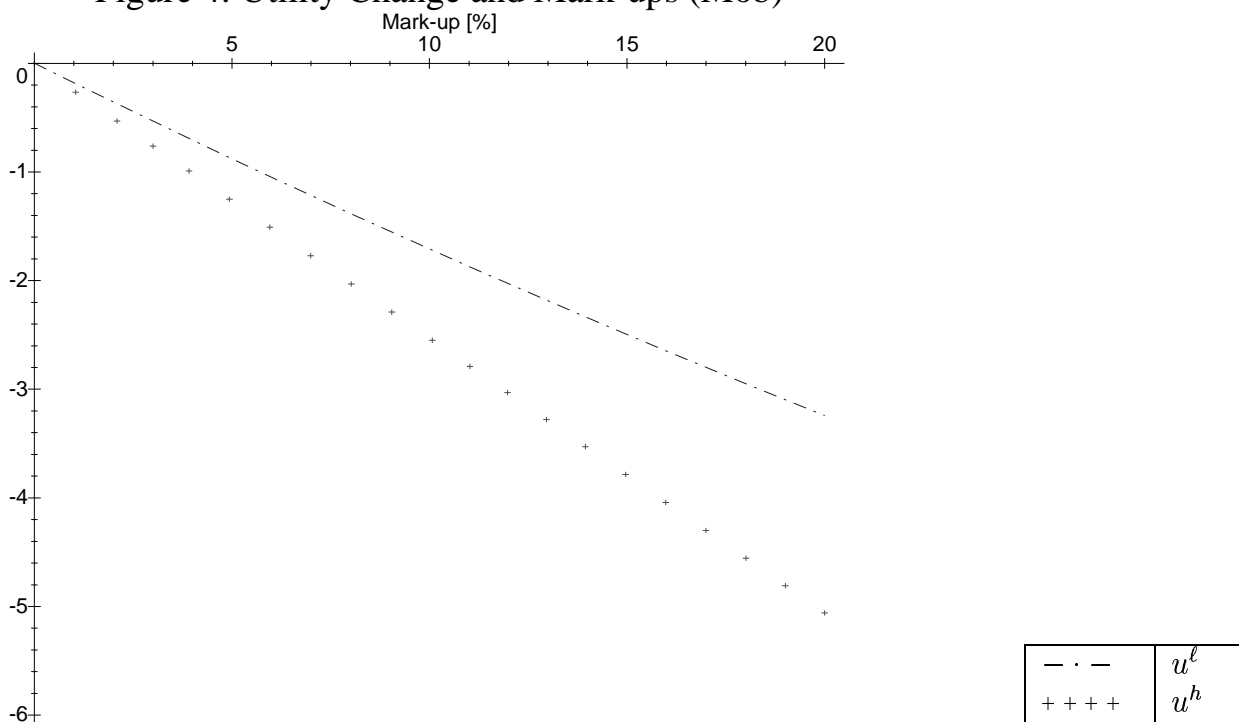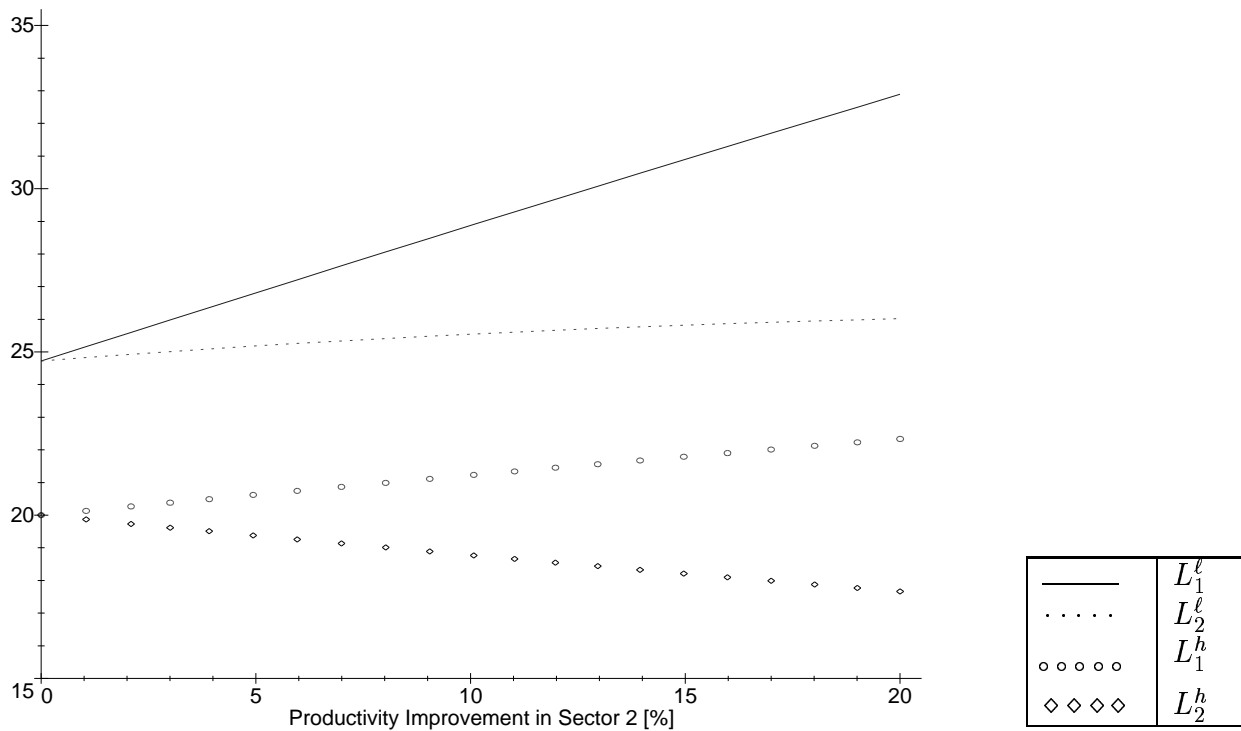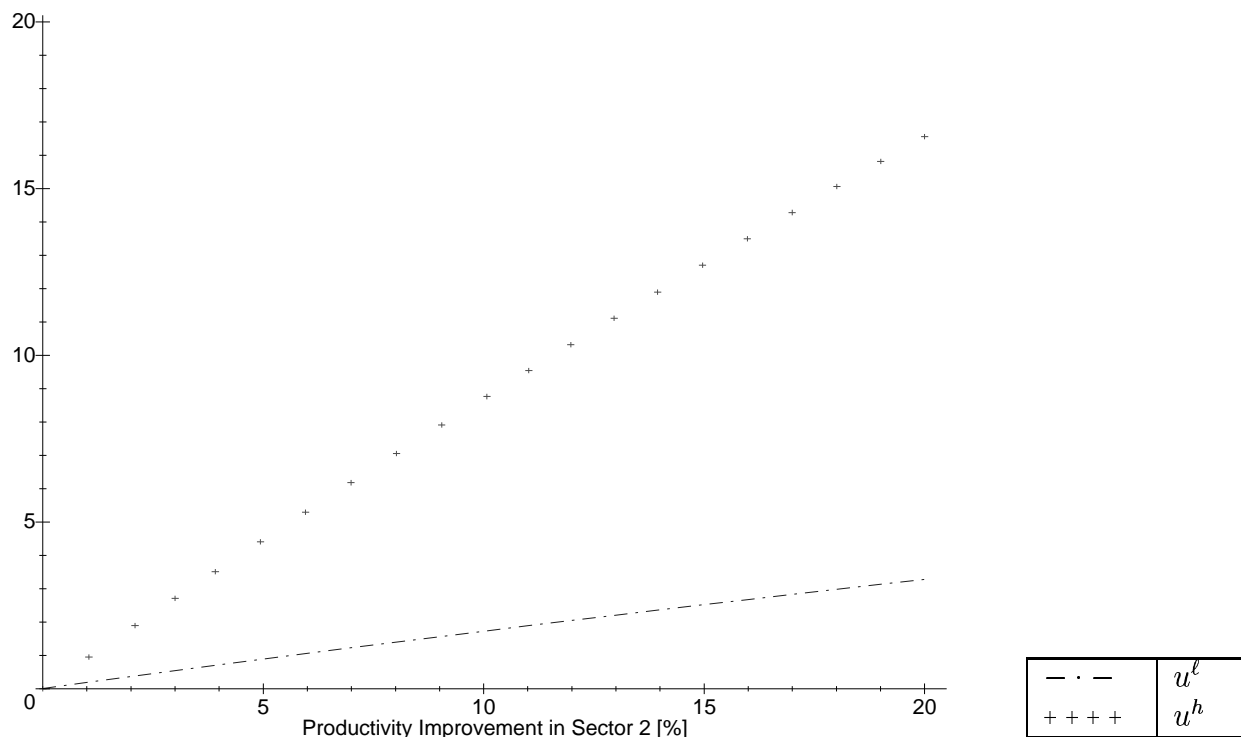Figure 6: Utility Change and Productivity Improvement (Mob)

2.5 Immobility of Low-Skilled Labor Force

In this section we consider immobility of low-skilled labor force. Low-skilled workers are now divided into two groups $\overline{L}_1^\ell$ and $\overline{L}_2^\ell$. Labor force $\overline{L}_1^\ell$ is only able to work in sector 1, whereas labor force $\overline{L}_2^\ell$ can only work in sector 2. Total low-skilled labor supply is $\overline{L}^\ell = \overline{L}_1^\ell + \overline{L}_2^\ell$.

2.5.1 The Model

The equilibrium model remains the same as before for the most part. In the case without frictions, low-skilled labor market clearings now become

$$\overline{L}_1^\ell = L_1^\ell \tag{2.41}$$

$$\overline{L}_2^\ell = L_2^\ell \tag{2.42}$$

High skilled labor market clearing is still defined as

$$\overline{L}^h = L_1^h + L_2^h \tag{2.43}$$

In the model with labor market and product market frictions, the real reservation wage $\overline{rw}$ is now defined as a percentage of the minimum of the market clearing real wages $\frac{w_1^\ell}{p}$ and $\frac{w_2^\ell}{p}$ when no frictions are present.

$$w_1^\ell = \overline{rw}\, p \tag{2.44}$$

$$w_2^\ell = \overline{rw}\, p \tag{2.45}$$

If the real wage $\overline{rw}$ exceeds the market clearing level, unemployment occurs (at least in one of the two sectors) and is defined as

$$\Delta = \overline{L}_1^\ell - L_1^\ell + \overline{L}_2^\ell - L_2^\ell \qquad (2.46)$$

2.5.2 Simulation Results for *Imlow*

The parameters for the following simulations are the same as in the mobility case. Low-skilled workers are divided symmetrically into two groups: 30 can work in sector 1 and 30 can work in sector 2.

In figure 7 we examine the development of the employment allocation with decreasing mark-ups. Figure 7 is equal to figure 3. Hence we see that immobility of low-skilled labor force causes no difference in the employment allocation as long as there exists unemployment in all sectors. Immobility only affects employment when there is an excess labor demand in one sector and workers cannot change from another sector to the sector with the excess demand.

In figure 8 utility change in percent is plotted against mark-ups. There are three curves: one for the high-skilled, one for the low-skilled of sector 1 (where utility is the weighted arithmetic mean of the low-skilled who work in sector 1 and the low-skilled who are qualified for sector 1 but are not employed) and one for the low-skilled in sector 2 (weighted arithmetic mean). We see that a decrease in the mark-ups leads to an increase in utility for all households. The biggest utility change is observed for the high-skilled. Again their loss in profits is overcompensated by their rise in wages due to the increase in marginal productivity and the decrease in taxes. At high mark-ups the low-skilled in sector 2 suffer more than their counterparts in sector 1 because of the higher unemployment in sector 2. When mark-ups decrease to zero,

utility and employment for both groups of low-skilled workers are the same because of the symmetrical parameters for the simulations.

In figure 9 employment is plotted against productivity improvement in sector 2 (as a percentage of the baseline A2=1). We see that high-skilled workers change from industry 2 to industry 1. Because of the low elasticity of substitution in the symmetrical utility function ($\sigma = 0.1$) it must be ensured that production of good 1 and 2 is approximately the same. So productivity improvement in sector 2 causes some high skilled workers to change in sector 1. Employment of low-skilled workers increases in both sectors. For the same reason mentioned before employment of low-skilled workers in sector 1 raises more than in sector 2. But when the low-skilled of the first industry are full employed, employment in the second industry decreases. The explanation for that phenomena is as follows: Because of the increasing productivity and therefore production of sector 2, the price for good 2 decreases relative to the price for good 1. So despite the increasing marginal productivity of low-skilled workers in sector 2, the real wages would normally (without reservation wage) fall. But because of the real wage rigidity, the real wages remain constant and employment decreases.

Figure 10 shows the corresponding utility changes. Utility of high-skilled workers is monotonically increasing. Utility of the low-skilled in the first sector also increases and the slope gets even steeper when full employment is achieved. The reason for that is, that from the point, when all workers are employed, the wages increase. The incomes of the low-skilled of sector 2 first increase because of the increasing employment and then decrease because of the occuring unemployment.

It is obvious that the decrease of employment in sector 2, when sector 1 is full employed, only holds for small elasticities of substitution. For higher

elasticities of substitution demand for products in sector 2 increases more when productivity raises and hence it is possible to employ more people. If, for instance, the elasticity of substitution is 1, when the CES utility function equals the Cobb Douglas utility function, employment increases until full employment in both sectors is achieved. Real incomes increase over the full range.

In summary, the simulation exercise yields that in the $Imlow-case$, decreasing mark-ups always have positive effects on employment and welfare for all households. Productivity improvements in one sector raise employment and welfare in *all* sectors until full employment in the remaining sectors is achieved. When we have full employment in the remaining industries, employment in the industry where the productivity improvement takes place may decrease for small elasticities of substitution.

Figure 7: Employment and Mark-ups (Imlow)

Mark-up [%]

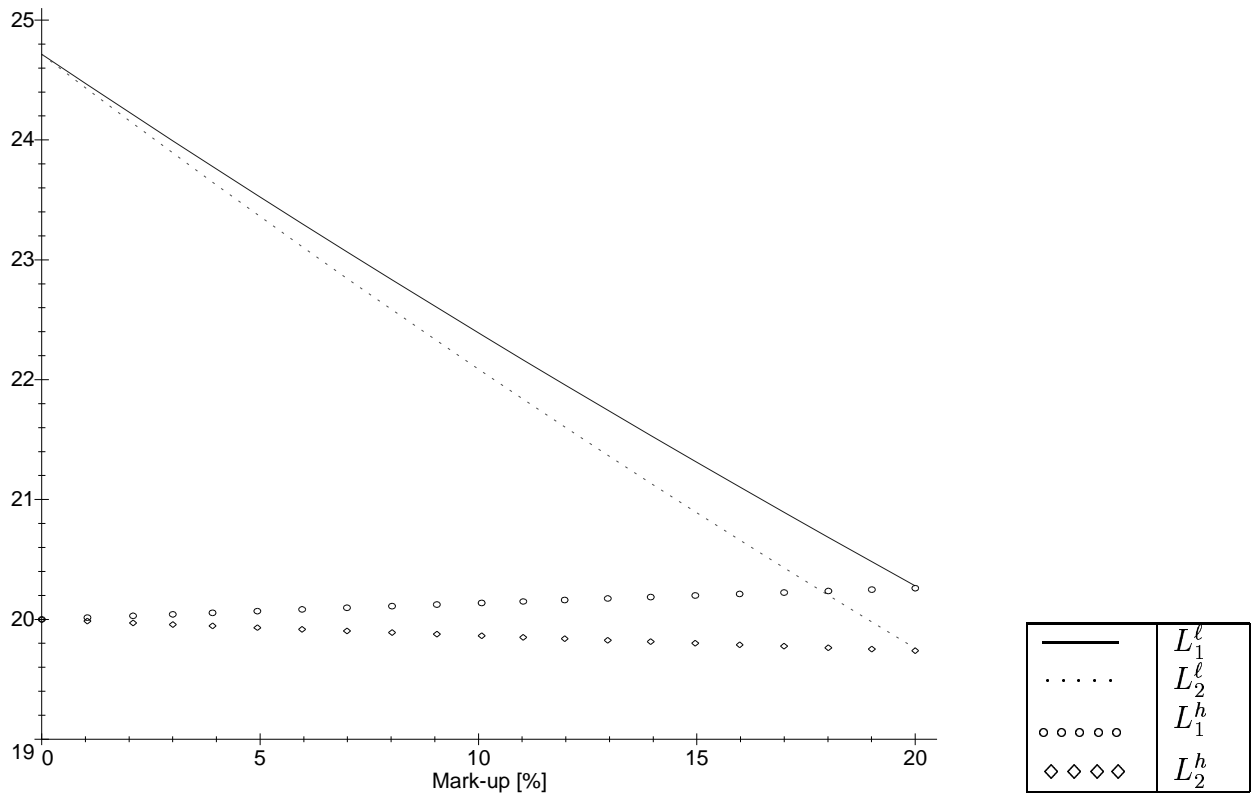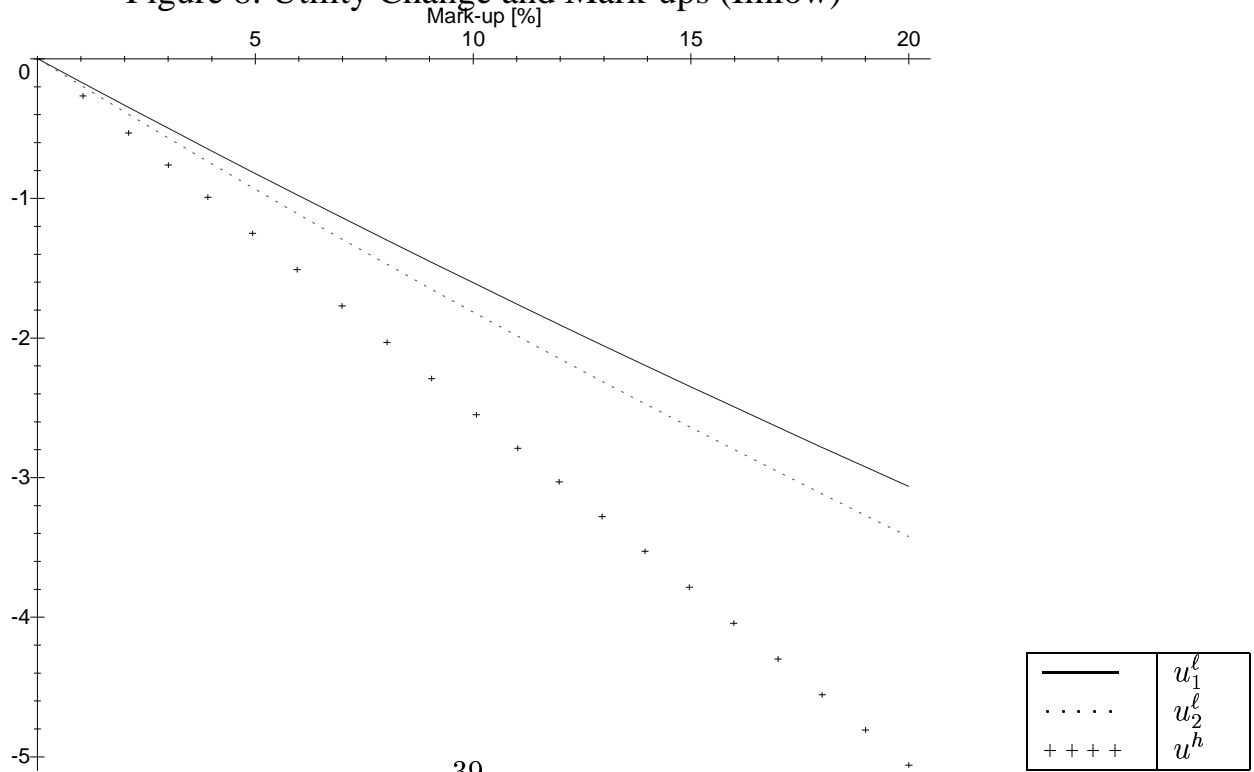|	
——	L_1^ℓ
· · · · ·	L_2^ℓ
∘ ∘ ∘ ∘ ∘	L_1^h
◇ ◇ ◇ ◇	L_2^h

Figure 8: Utility Change and Mark-ups (Imlow)

Mark-up [%]

——	u_1^ℓ
· · · · ·	u_2^ℓ
+ + +	u^h

Figure 9: Employment and Productivity Improvement (Imlow)

	L_1^ℓ
.....	L_2^ℓ
o o o o o	L_1^h
◇ ◇ ◇ ◇	L_2^h

Productivity Improvement in Sector 2 [%]
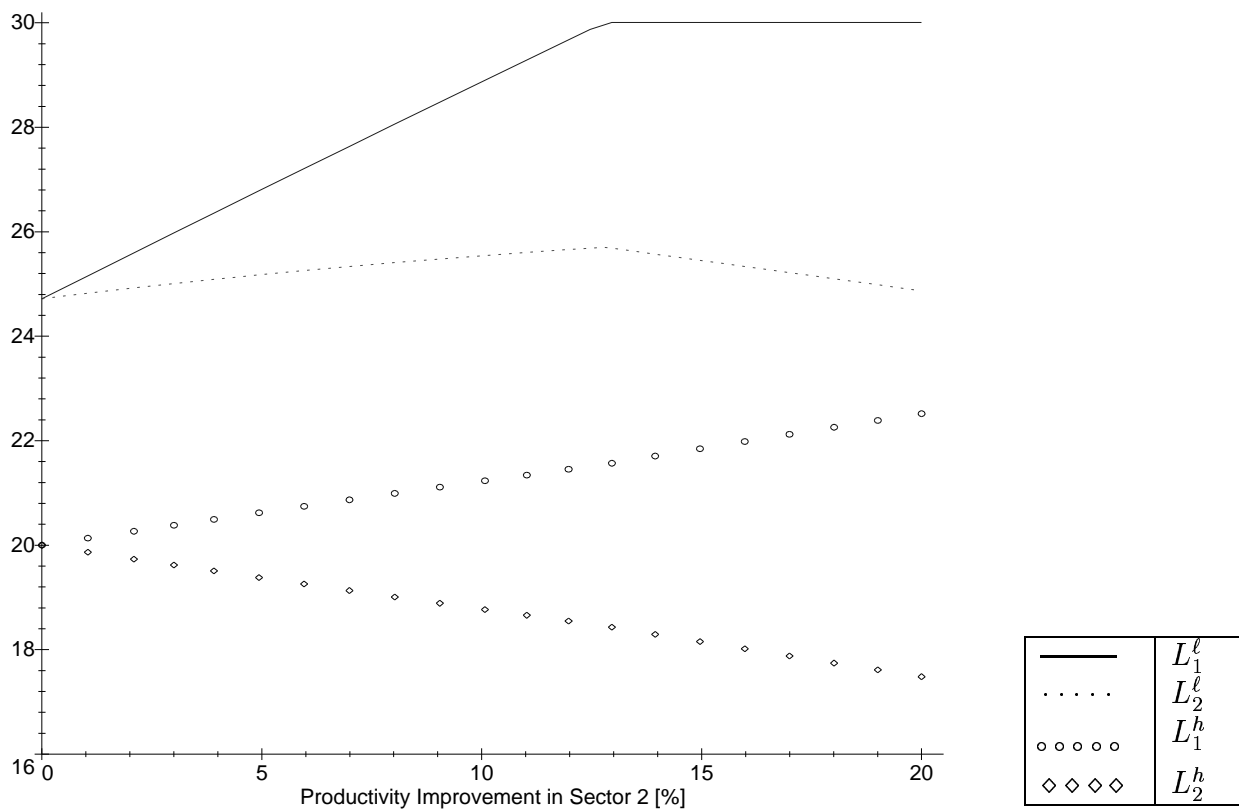
Figure 10: Utility Change and Productivity Improvement (Imlow)

40

	u_1^ℓ
.....	u_2^ℓ
+ + + +	u^h

Productivity Improvement in Sector 2 [%]
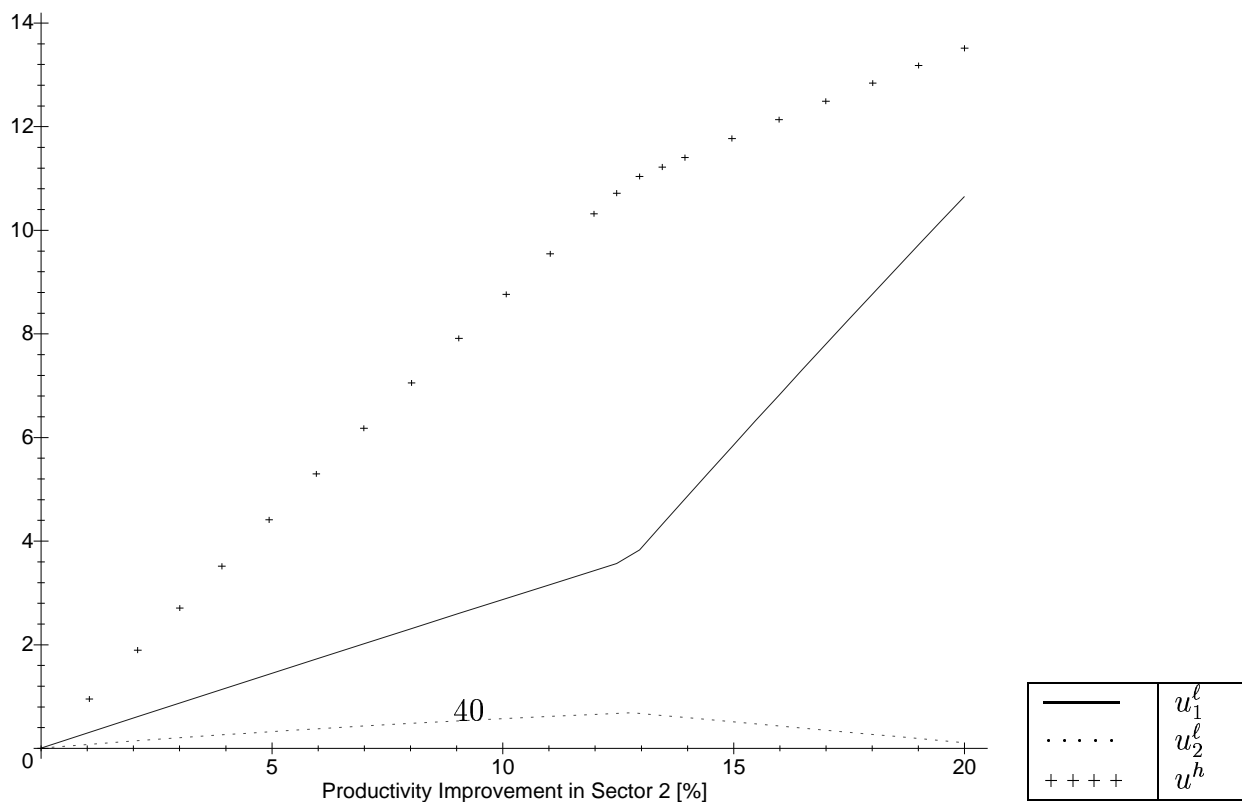
2.6 Immobility of Low-Skilled *and* High-Skilled Labor Force

Now we study the case, where not only low-skilled but also high-skilled labor force is immobile. High-skilled labor force is now also divided into two groups $\overline{L}_1^h$, which can only be employed in sector 1 and $\overline{L}_2^h$, which can only work in sector 2. Total high skilled labor supply amounts to $\overline{L}^h = \overline{L}_1^h + \overline{L}_2^h$.

2.6.1 The Model

Again the model generally remains the same as before. High skilled labor market clearings are now

$$\overline{L}_1^h = L_1^h \tag{2.47}$$

$$\overline{L}_2^h = L_2^h \tag{2.48}$$

Without frictions also low-skilled labor market clearings hold:

$$\overline{L}_1^\ell = L_1^\ell \tag{2.49}$$

$$\overline{L}_2^\ell = L_2^\ell \tag{2.50}$$

2.6.2 Simulation Results for *Imall*

The parameters for the the case when all labor force is immobile across industries (*Imall*) are the same as before. High-skilled labor force is now also symmetrically divided into two groups of 20 workers each.

Figure 11 shows the development of employment when product market competition increases, i.e. mark-ups decrease. Again we can see that employment is positively affected. Job offers for low-skilled workers of both types of households increase. With high mark-ups, unemployment in both sectors gets big, especially in the industry with market power. Due to the symmetry of the system, employment in both sectors is the same with no mark-ups. High-skilled workers now always stay in their sectors without changing because they are now also immobile across industries. Hence 20 high-skilled workers are employed in both industries.

We also see in Figure 12 that decreasing mark-ups cause an increase in real incomes of all households. At high mark-ups in sector 2, especially the utilities of the people in this sector are negatively affected. Total incomes of high skilled households again increase because the fall in profits is overcompensated by the rise in wages.

When productivity improvement in sector 2 takes place (Figure 13), low-skilled employment in sector 1 rises to full employment so that production in both sectors is similar because of the low elasticity of substitution in the symmetrical utility function. Productivity improvement in the second industry is now not weakened by changing of high skilled workers into the first industry because of their immobility. This is the reason why employment of low-skilled workers in sector 2 now decreases from the beginning. This decrease even gets stronger when full employment in the first sector is achieved. The reason is again that outputs in both sectors must roughly be the same due to the utility functions.

In figure 14 we can see the corresponding utilities. High-skilled workers in industry 1 profit from the productivity increase in industry 2: The price of the first good clearly rises relative to the price of good 2. This causes

an increase of real wages for high skilled-people in the first sector. When full employment is achieved in sector 1, also the real wage for low-skilled labor in this sector increases, which causes an even steeper positive slope in the corresponding utilities. Low-skilled labor in industry 2 suffers from the decrease in employment - especially from the point when the first sector is fully employed. But at this moment, also high-skilled households suffer because of the decreasing wages in the second sector.

The above results again only hold for small elasticities of substitution. Again, if the elasticity of substitution is 1, employment increases until full employment in both sectors is achieved. Real incomes increase over the full range.

In summary, in the $Imall - case$, reducing mark-ups has only positive effects on employment and welfare for all households. Improving productivity, however, can have negative consequences for employment and welfare in the industry where improvements take place if the elasticity of substitution between the goods is small. This can cause large political resistance against product market reforms. Employment and welfare in the remaining industries are always positively affected. Moreover, the simulation shows that aggregate employment increases until we have full employment in the sectors where no product market reforms take place.

Figure 11: Employment and Mark-ups (Imall)

Mark-up [%]

Legend:
- L_1^{ℓ} (solid line)
- L_2^{ℓ} (dotted line)
- $L_{1/2}^{h}$ (circles)
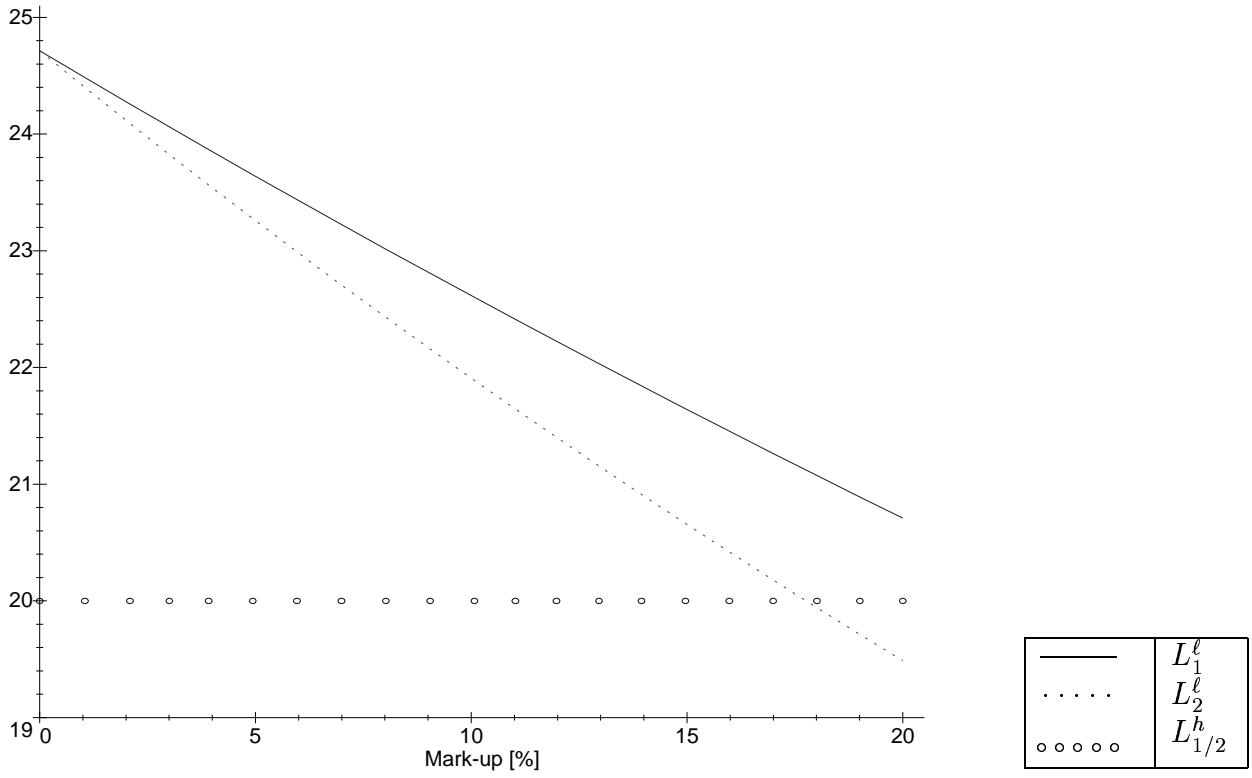
Figure 12: Utility Change and Mark-ups (Imall)

Mark-up [%]

Legend:
- u_1^{ℓ} (solid line)
- u_2^{ℓ} (dotted line)
- u_1^{h} (circles)
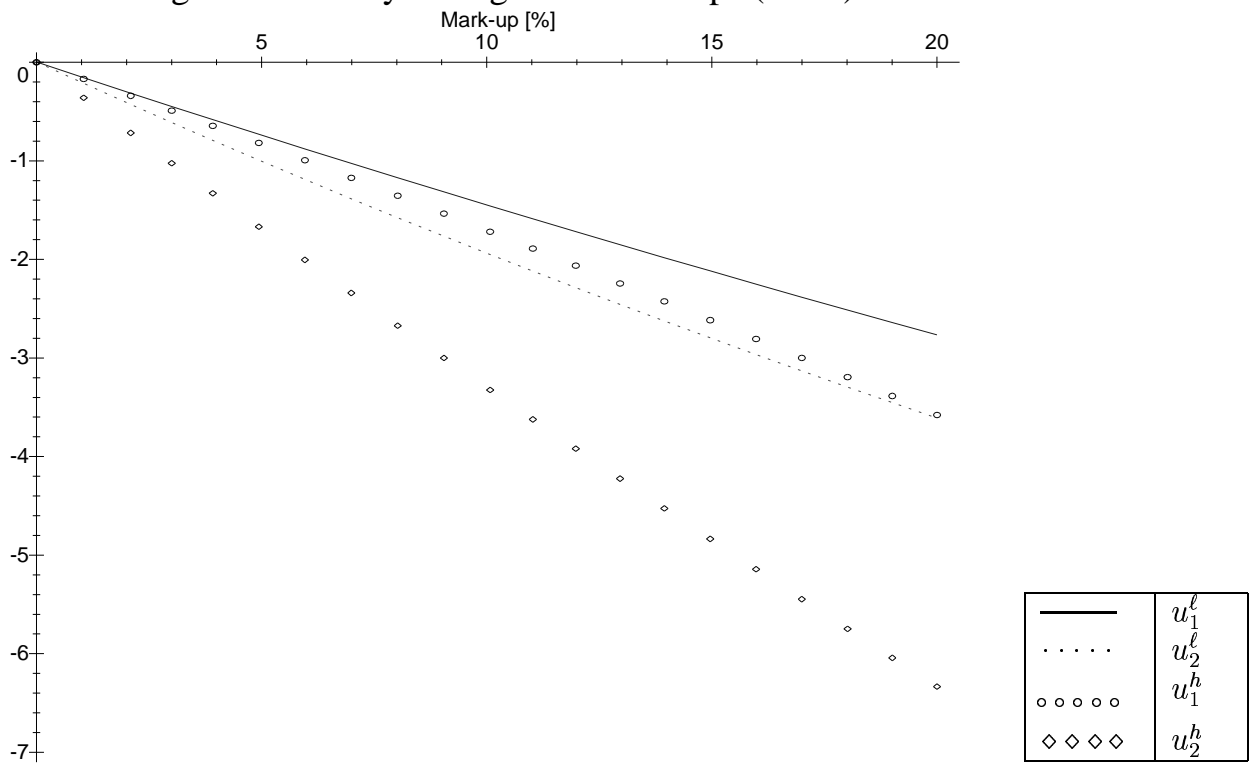- u_2^{h} (diamonds)

44

Figure 13: Employment and Productivity Improvement (Imall)
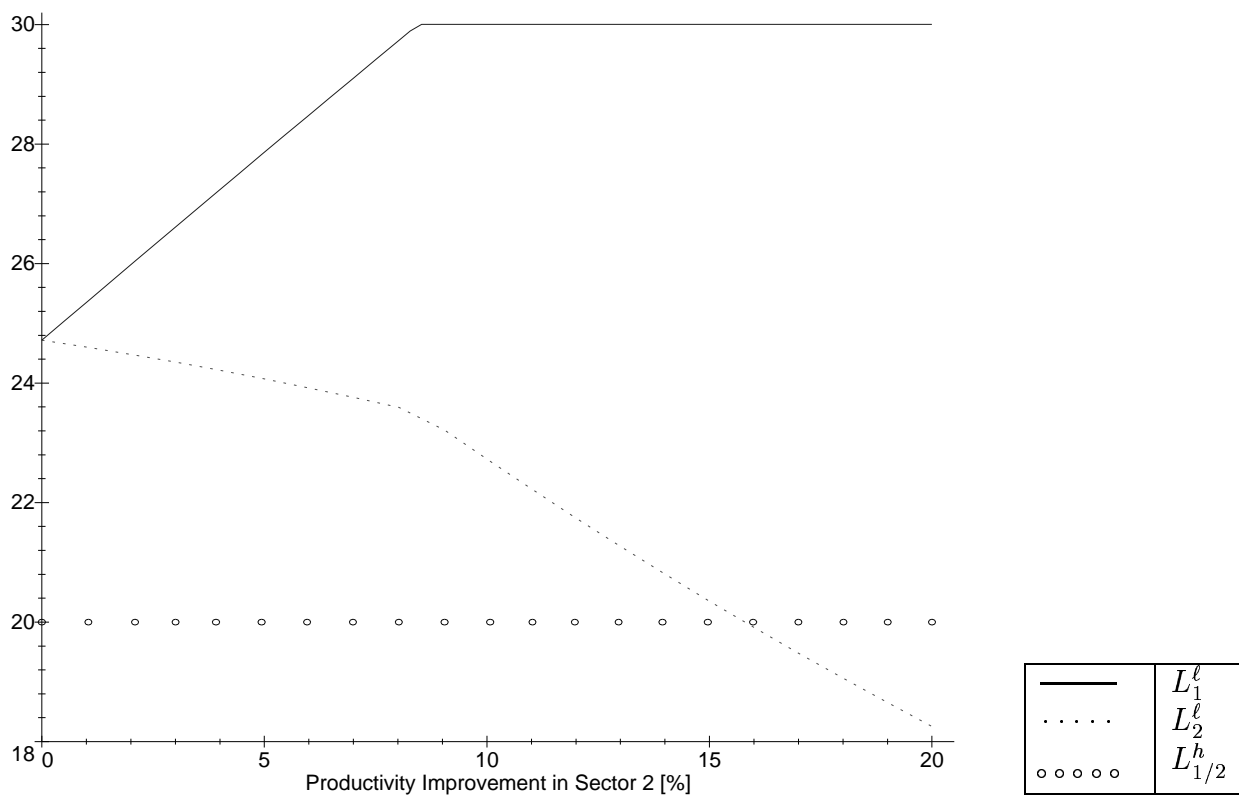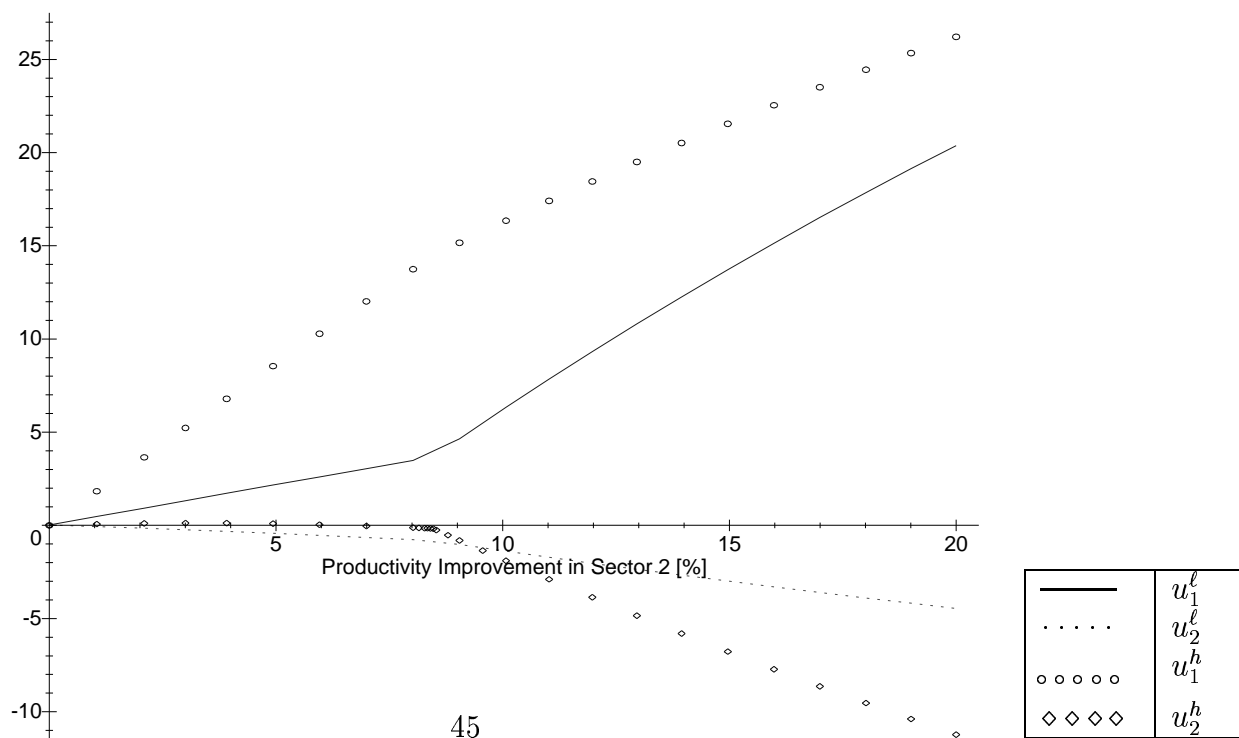

Figure 14: Utility Change and Productivity Improvement (Imall)

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2.7 Intuitions and Robustness of the Results

We get two main results from our simulations. The first result is that declining mark-ups *always* lead to a rise in employment. The second result is that improving productivity in one sector *always* increases aggregate employment until there is full employment in the remaining sector.

The intuition for the first phenomenon is the following: Declining mark-ups in sector 2 lead to a declining price of good 2, implying a higher demand for good 2 and therefore more employment of low skilled workers in sector 2. This in turn provides a higher real income of households, more demand for good 1 and good 2, more employment in both sectors, more income of households, more demand for both goods, more employment and so on until the new equilibrium is reached.

The explanation for the second phenomenon is more subtle: When total factor productivity in the second industry (A_2) rises, marginal productivity of low-skilled workers in this sector increases as well. If the price p_2 increases, the valued marginal productivity of low skilled workers would rise, so that employment would increase. The more realistic case (also resulting in the simulations) is a fall in p_2. Of course this can only happen when q_2 rises. This in turn means that aggregate real income of the economy rises. We have the same fixed (gross) income distribution in both industries with respect to the shares of low- and high-skilled workers since $\beta_1^\ell = \beta_2^\ell$ and $\beta_1^h = \beta_2^h$ in the Cobb Douglas production functions. Therefore, when aggregate real income rises, the real gross income of employed low-skilled, namely $\frac{w^\ell}{p} \cdot (1 + \tau) \cdot L^\ell$, rises as well (with $L^\ell = L_1^\ell + L_2^\ell$). With a fixed real wage $\frac{w^\ell}{p}$ (unemployment in both sectors) $(1+\tau) \cdot L^\ell$ must increase. In the final step we argue that it is not possible that only τ increases whereas L^ℓ does not: Total real income of

low-skilled (including the unemployed) consists of $\frac{w^\ell}{p} \cdot (1 + \tau) \cdot L^\ell$ and of the tax expenditures of the high-skilled to finance unemployed low-skilled. Total gross labor real income of high-skilled is $\frac{w^h_1}{p} \cdot (1 + \tau) \cdot L^h_1 + \frac{w^h_2}{p} \cdot (1 + \tau) \cdot L^h_2$. Because of the rise in aggregate real income and the fixed income distribution of the economy, total gross wage income of high-skilled rises as well. Now if τ did increase, total real income of low-skilled (including unemployed) would rise. A fixed real wage floor and fixed unemployment benefits in turn imply that more people must receive the real wage floor which is higher than the unemployment benefits. But this implies that more low-skilled people must be employed in the economy as soon as productivity in one sector is improved.

The robustness of the preceeding arguments is supported by a variety of different calibrations of our model. The obtained results are stable across a broad range of parameters. All reasonable values for the parameters in the model lead to the same qualitative conclusions. As already discussed, the only parameter that can cause differences in the results is the elasticity of substitution between the two consumption goods in the utility function. Only low elasticities of substitution can lead to negative effects of increasing productivity in the case of immobile workers. For high elasticities of substitution all households benefit from product market reforms, independent of their mobility.

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2.8   Concluding Remarks

We have developed a simple general equilibrium model to study how promoting product market competition through the reduction of mark-ups or through the increase of productivity lowers unemployment and affects real incomes of low and high-skilled workers. The general message is that there is little justification to remain timid with respect to product market reforms. Promoting product market competition by lowering mark-ups has always positive impacts on employment and utility. Improving productivity in an industry has positive effects on aggregate employment until full employment in the remaining industries is achieved. Real incomes in the sector where the productivity improvements take place may decrease for the worst case scenario, where all workers are immobile across sectors and the elasticity of substitution between the goods is small.

The model in this chapter could be extended in various directions. For instance, we could allow that real wages for low-skilled workers can be adjusted when product market reforms are introduced. Suppose, for instance, that real wages for low-skilled workers are determined by wage bargaining between a labor union and an industry association. Then, the wage bargaining process can tend to push for higher wages if product market reforms, yielding higher productivity, have been introduced. While such wage adjustment effects can lower the positive impact of product market reforms on employment, our simulation exercises for such an extended model suggest that aggregate employment effects remain positive.

We could allow a broader perspective on product market reforms. Incorporating fixed costs, and hence fixed labor input, while allowing firms to merge would capture another element of the potential impact of product

market reforms. A further interesting aspect of the deregulation exercise in the U.S. is the evolution of product variety. The expansion of product mix and variety in deregulated industries is more pronounced than in many European industries [Gersbach and Sheldon 1996]. While we think, that it is useful to incorporate such elements in our framework, we are convinced that the general message of our results will hold in a more complete picture of the impact of product market reforms.

Chapter 3

Robustness of the Results

In the last chapter we have seen that product market reforms through the reduction of mark-ups or increase of productivity affect aggregate employment positively under many circumstances. In this chapter we examine in more details the robustness of our findings. What are the conditions for aggregate employment to increase or decrease when product market reforms take place?

The positive employment effects of a reduction of mark-ups hold in general. On the other hand the employment consequences of productivity improvements need some further considerations.

Let us recapitulate the argumentation for the positive impact of productivity improvements on aggregate employment. It consists basically of 3 steps. First, an increasing productivity leads to an increasing production of q_2, which in turn implies a higher real income for the economy. Second, the Cobb-Douglas production functions with the same elasticities in both sectors ($\beta_1^\ell = \beta_2^\ell, \beta_1^h = \beta_2^h$) imply that the income distribution in the economy remains the same. Therefore the low-skilled people must receive more (real) income when A_2 rises. Third, as long as there is unemployment in all sectors, the low-skilled workers earn a fixed minimum real wage, and the unemployed receive a fixed percentage of this minimum real wage. Therefore a higher real

income for low-skilled people means that more of them must be employed.

Now we analyze how the 3 steps of the argumentation depend on the parameters and model specifications. The first step in the argumentation is surely independent of the modeling and can be stated without reservations. The second step is more delicate. The argument relies on the fact that the income distribution in the economy always remains the same. This of course is true for similar Cobb-Douglas functions in both sectors. But it can be different for other types of production functions, such as CES-functions for instance. As an example, take the *Imall*-case of our model: When A_2 rises, more low-skilled workers are employed in sector 1 (until full employment) due to the Cobb-Douglas functions, overcompensating the decline of low-skilled people in sector 2, so that the net employment effect is positive. But if we think of a CES production function in sector 1 with an elasticity of substitution much lower than 1 (consider the most extreme, i.e. the Leontieff case), then marginal productivity of low-skilled workers will approach zero, as soon as more than a certain amount of them are employed. Combined with a real wage rigidity, this implies that the decline of employment in sector 2 cannot be compensated by a rise of employment in sector 1, so that the net employment effect would be negative. Additionally, the argument of step 2 does not hold for the case that the elasticities of the Cobb-Douglas production functions are not the same in all sectors. Consider for example the *Imall*-case with $\beta_1^\ell \ll \beta_2^\ell$. When A_2 rises and the elasticity of substitution in the utility function is sufficiently low, employment in sector 2 decreases because of the strong price decline in sector 2 (see figure 13). Real income generated in sector 1 increases. However, low-skilled workers in sector 1 do not participate very much because of their low income share (β_1^ℓ small). This means that only a few more of them get employed, not overcompensating the

decline of low-skilled employment in sector 1. So aggregate employment can decrease despite the higher real income of the economy, which is absorbed by the high-skilled and the profits. The third step in the argumentation relies on the fact that there is unemployment in all sectors. If this is not true, then aggregate employment can decline despite the productivity improvement in one sector, as already observed in the simulations (see figures 9 and 13).

The above arguments remain the same in a model with more than 2 sectors and different magnitudes of the sectors. In such a model one could also construct examples for income distributions in the sectors, where an increase of productivity in one sector does not lead to an increase of aggregate employment. Furthermore one can imagine that full employment in sufficiently many sectors of large magnitude leads to higher unemployment when productivity in one sector improves. In such a model, a simple condition for aggregate employment to increase with an increase of productivity in one sector is that real income of low-skilled workers (employed and unemployed) in sectors without full employment must increase. With a fixed minimum real wage, a higher real income for low-skilled workers necessarily implies more employment.

In summary, one can argue that the aggregate employment effects of uneven productivity improvements can be positive or negative. But the parameter constellations that lead to negative employment effects appear to be rather extreme, so that the employment effects of uneven productivity improvements will likely be positive under most cicumstances.

Chapter 4

Microfoundation of Mark-ups

4.1 Introduction

In the second chapter we have performed comparative statics excercises with respect to mark-ups and productivity changes given some exogenously fixed minimum real wage for low-skilled people. We have left unspecified how mark-ups of a particular level can occur. In this chapter we provide a microfoundation of the mark-ups by embedding imperfect competition in the sense of Cournot into our general equilibrium model introduced in the second chapter. In order to integrate imperfect competition in a general equilibrium model we encounter a basic conceptual problem. Which assumptions about their own and other sectors do agents have when they compete in the market?

We introduce in this chapter a canonical formulation of imperfect competition that leads to a learning process by the agents until their maximization under a partial equilibrium view is consistent with their (general equilibrium) environment. We then apply our methodology to a hypothesis brought forward by Saint-Paul [1993] and Gersbach and Sheldon [1996], namely that neglecting general equilibrium effects by agents and particularly firms leads to high unemployment. Our major conclusion is that the hypothesis is wrong

if labor is immobile across industries and true if labor is mobile.

We examine a two sector model with imperfect competition in one sector and a real wage rigidity which creates unemployment. We compare two scenarios of Cournot Competition in the imperfectly competitive sector: In the first scenario, we analyze what happens when the firms incorporate all general equilibrium feedback effects of their quantity choice at once, so that the choice remains the best response to their competitors' best response when markets clear. We call this procedure General Equilibrium Cournot Competition, denoted by GEC and the resulting equilibrium shall be the GEC outcome.

In the second scenario, we assume that firms do not take general equilibrium feedbacks of their quantity choice into account. Firms select best responses against their competitors' best responses under the assumption that the rest of the economy stays the same. Then they encounter general equilibrium feedbacks and their profit estimation generally differs from realized profits. Firms revise their production plans until they are best responses against the plans of the competitors *and* no unexpected general equilibrium effects surprise the firms. As we will show, this learning procedure will converge to a steady state, where no further unexpected general equilibrium feedbacks will occur anymore. We call this process Partial Equilibrium Cournot Competition, denoted by PEC and the steady state we call PEC steady state.

We obtain the following results: First, the resulting equilibria under PEC and GEC generally differ. Second, unemployment in the PEC steady state is not always higher than in the GEC outcome. In particular, we show that the degree of labor mobility across sectors determines relative unemployment of GEC and PEC. High labor mobility favors GEC, whereas labor immobility

favors PEC. To understand this result we will identify four effects that account for the difference between PEC and GEC. The major effect leading to create low output and low employment under PEC relative to GEC is the overestimation of the price reaction when the quantity is changed downwards by an individual firm, which has a negative impact on output choices and employment under PEC relative to GEC. The counteracting effect in our model is the underestimation of the change of high-skilled workers' wages, that are assumed to stay constant by firms. Since firms underestimate their wage costs when choosing a higher quantity, quantity choices and employment tend to be higher for PEC relative to GEC. The latter effect is large if labor is immobile and dominates all other effects. But when labor is mobile, the wage effect is rather small, so that the net effect of the PEC view relative to GEC in terms of output and employment is negative.

We proceed as follows in this chapter: In section 2 we relate the chapter to the literature of imperfect competition in a general equilibrium context. Section 3 develops the model. The simulation results are presented in section 4. Section 5 deals with the implications of an immobile labor force and section 6 concludes.

4.2 Relation to the Literature

In this chapter we combine three strands of literature. Our starting point is the claim often brought forward in the discussion about remedies to the European unemployment problem, that insufficient recognition of general equilibrium effects by firms or unions contribute to the persistence of unemployment. Hence, we examine in this chapter whether and how it makes a difference for unemployment (or output), if firms in oligopolistic industries

act under a general or partial equilibrium view. To answer the question we need to address two conceptual problems. First, we have to incorporate imperfect (Cournot) competition in a general equilibrium framework, which raises some delicate conceptual issues. Comprehensive surveys of the state of the art in embedding imperfect competition in a general equilibrium are given by Ginsburgh and Keyzer [1997], Gabszewicz [1999] and d'Aspremont et al. [1999]. Dynamic macroeconomic models with imperfect competition are analyzed by Kaas [1999].

Second, while the general equilibrium view of firms can be formulated as a static problem, the partial equilibrium view is more challenging. Since the firms recognize at the market clearing stage, that realized prices, profits and other variables differ from those anticipated, it is natural to assume, that firms will react. This essentially leads to a learning process, where firms change their best responses under a partial equilibrium view, until they are not surprised anymore by general equilibrium effects at the market clearing stage. To formulate such a learning process, we draw on the recent work on learning in game theoretic situations (for recent surveys see Young [1997], Fudenberg and Levine [1998]). The learning process we employ for firms is similar to the best reply dynamics in game theoretic situations with one major difference: Given the partial equilibrium view of firms, the Nash equilibrium of firms competing in quantities is derived in the standard way and therefore firms do not learn about each other, but about effects resulting from other markets. In particular, they take realizations of output in other sectors and factor prices as given and adjust their best responses against the best responses of other firms to changes in other sectors and factor prices.

The approach we suggest in this chapter to model imperfect competition in a general equilibrium framework can also be applied to cooperative games (Gersbach and Schniewind [1999]).

4.3 Model

In this section, we develop a model to analyze the different Cournot competition processes associated with different degrees of sophistication about general equilibrium feedback effects.

The model is similar to the model used in chapter 2. The first sector is represented by an aggregate production function, whereas we assume sector 2 to consist of n identical firms competing in quantities. Aggregate production of sector 1 is given by

$$q_1 = A_1 L_1^{\ell^{\beta_1^\ell}} L_1^{h^{\beta_1^h}} \tag{4.1}$$

Production of a firm i in sector 2 is determined as follows:

$$q_{2i} = A_2 L_{2i}^{\ell^{\beta_2^\ell}} L_{2i}^{h^{\beta_2^h}} \tag{4.2}$$

We assume that low-skilled workers and high-skilled workers are mobile across industries, i.e. they can work in either sector. Later on we will analyze what happens when the labor force is immobile. Total labor input of low-skilled workers is $L_1^\ell + n \cdot L_{2i}^\ell$. $L_1^h + n \cdot L_{2i}^h$ is the labor input of high-skilled workers. Labor supply of both types of labor is given by $\overline{L}^\ell$ and $\overline{L}^h$. Labor is supplied inelasticly again. Households' preferences are represented by a CES-utility function. In the labor market there exists again a real wage rigidity and the unemployed obtain a fixed percentage of the wage earned by their working counterparts.

We assume Sector 1 to be perfectly competitive, i.e. firms are price takers and maximize profits. Firms in sector 2 minimize costs and then choose quantities. How they choose quantities under Cournot competition will be the focus of our examinations and is discussed in the next section.

4.3.1 Cournot Competition in Sector 2

We assume that firms in sector 2 compete in quantities. The objective of the firms is to maximize profits which are given by

$$\pi_{2i} = p_2(q_2) \cdot q_{2i} - E_{2i}(w^\ell, \tau, w^h, q_{2i}) \tag{4.3}$$

where $q_2 = \sum_{i=1}^{n} q_{2i}$ [1].

The key issue is which feedback loops firms will take into account when they choose quantities. We consider two different levels of sophistication of the firms.

Partial Equilibrium Cournot Competition (PEC)

In the first case firms only consider partial equilibrium effects when they choose their quantities. This is the main feature of the industrial organization literature. This means that with a change in quantities, only the price reaction along the demand schedule with constant household income is considered. All other variables are assumed to stay constant. But after the firms have realized their quantities, in equilibrium not only the price adjusts

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1 While we will assume profit maximization, it is questionable whether such an assumption is reasonable when imperfectly competitive sectors are embedded in a general equilibrium framework (see Gabszewicz and Vial [1972] and the discussion in Ginsburgh and Keyzer [1997]). In our model, since only high-skilled workers benefit from firm profits, profit maximization will also maximize shareholder's utility as long as the share of high-skilled workers is not too large.

to the (new) quantities, but also all other variables in the system, and so do the budgets of the households and the factor prices, which in turn enter the underlying demand and cost functions. This means that the cost and the demand functions change, which implies that firms adjust their best response quantity to the new situation, again leading to a change in the price but also to a change in the budget and the costs, implying a new quantity adjustment and so on. This means that we obtain no static solution but a dynamic adjustment process with a starting point and an endpoint. We call this dynamic process Partial Equilibrium Cournot competition (PEC) process. An endpoint is a constellation of quantities, prices, output, employment etc., such that firms do not want to adjust quantities anymore and goods markets are in equilibrium. If the system converges to such a steady state in the dynamic process we call it PEC steady state equilibrium. The following figure illustrates the dynamic adjustment process, under which the firms take all variables of the preceding equilibrium as given except p_2.
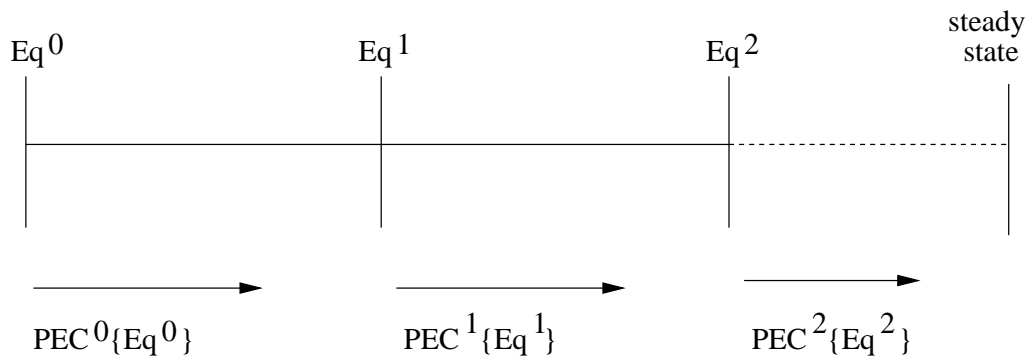
We examine now in more detail the demand function of a household for good 2 as expressed in equation (4.4):

$$c_2 = q_2 = \frac{b}{p_2 + p_1(\frac{p_2\alpha_1}{p_1\alpha_2})^\sigma} \tag{4.4}$$

The demand functions are the same for all households. We have three different types of households which differ in their income b. If we aggregate the demand functions, we have to replace the budget b by the aggregate income of the whole economy (the CES demand functions are unit elastic to income). The starting point of the PEC process is an arbitrary feasible level of quantities produced by the firms in sector 2. Then the first order condition of the profit equation (4.3) and the demand equation (4.4) are to be solved simultaneously for the q_{2i} (and p_2), that maximize profits.

General Equilibrium Cournot Competition (GEC)

The second case is that *all* general equilibrium effects are taken into account by the agents at once when choosing quantities. Hence, changes in output, prices in all sectors, changes in taxes etc. are calculated and enter the profit function. Given the standard assumptions about demand and cost functions, the solution of this problem must be symmetric because all firms in sector 2 are identical. Mathematically we have to calculate the market equilibria for different quantities q_{2i} chosen by all firms. Then we calculate the market equilibrium, including the profits, when one firm j changes its quantity whereas all other firms still choose q_{2i}. The q_{2i}, where it is not profitable *in equilibrium* for a certain firm j to deviate, given that all other firms $i \neq j$ choose q_{2i}, is the Cournot Nash solution. Note that the resulting equilibrium is the one that *really* maximizes π_{2i}, given that all other firms in sector 2 choose the same quantity, since these equilibrium values will actually be

realized. Under this Cournot competition procedure agents take all general equilibrium effects into account that occur when a quantity is changed. We call this static Cournot competition process General Equilibrium Cournot competition (GEC) process.

4.4   Simulation Results

4.4.1   Calibration

The preceding section outlined the general equilibrium relationships between quantities and other variables for both PEC and GEC. In this section we calibrate the model and examine how the PEC and the GEC results differ in terms of aggregate employment. We consider the following parameter constellation (see table (4.1)):

Table 4.1:

Parameters	Values
σ	0.5
A_1	1
β_1^{ℓ}	$\frac{1}{3}$
β_1^{h}	$\frac{2}{3}$
A_2	1
β_2^{ℓ}	$\frac{1}{3}$
β_2^{h}	$\frac{2}{3}$
$\overline{L}^{\ell}$	60
$\overline{L}^{h}$	40
$rwfactor$	1.1
s	0.8

The parameters α_1 and α_2 in the utility function are chosen to imply that sector 2 has a percentage of 10 % of the economy. This means that a

household spends 10 % of his budget for good 2 when the prices of good 1 and good 2 are equal. Later on we will analyze what happens when sector 2 has a percentage of 20 % of the economy. Moreover, we focus on an elasticity of substitution of 1/2 between the two goods in the utility function. We will also analyze what happens, when the elasticity of substitution between the consumption goods decreases to 1/4.

4.4.2 Calculations for PEC and GEC

We first analyze PEC. Because we have to calculate a fix point in this case, we need a starting point for PEC, that is we need a market equilibrium of initial values of quantities in sector 2. The dynamics runs as follows: The economy starts with the market equilibrium for an arbitrary feasible initial value of quantities q_{2i}. Feasibility means that the aggregate quantity q_2 can be produced by using the available labor. Building on that equilibrium, the firms in sector 2 choose quantities à la Cournot by considering all variables as constant except the price of good 2. The chosen quantities are produced and based on the resulting new Cournot Nash equilibrium, general equilibrium feedbacks take place, and a new market equilibrium is determined. In the next step, PEC based on this new market equilibrium takes place, leading to new quantities, followed by a new market equilibrium and so on.

The question arises, if this procedure converges and if so, where does it converge to? To answer this question, look at figure 15: On the horizontal and vertical axes quantity levels q_{2i} are shown. For this and the next figures the number of firms in sector 2 shall be 5. The two curves in figure 15 represent the following relationships: The first line takes a specific quantity of a firm in the non-competitive sector 2 on the abscissa, calculates the market equilibrium (prices, output, employment ...), and then derives the

PEC quantity for a firm i (which is the same for all firms in sector 2) building on the calculated equilibrium values as starting point. The curve represents all combinations of quantities generating equilibrium values as starting points and PEC quantities. The other curve is the identity (Id). Since the identity has a steeper slope than the other curve, the point of intersection is a stable fix point. This means that repeated PEC, i.e. the PEC process, approaches the quantity q_{2i} belonging to the intersection of the two curves. The fix point is the PEC steady state equilibrium quantity q_{2i}. Note that all firms in sector 2 choose the same quantity q_{2i} because being identical.

As already mentioned, the (static) GEC solution is symmetrical as well because all firms are identical. So if we take the GEC solution q_{2i} for all firms $i \neq j$, vary the quantity of firm j, calculate the market equilibrium (including profits), the q_{2j} that maximizes profits of firm j, must exactly be equal to q_{2i} (see figure 16).

4.4.3 Results

If we compare figure 15 and figure 16, we see that the profit maximizing quantity in figure 16 (GEC) lies above the PEC steady state equilibrium quantity. Correspondingly, unemployment associated with PEC will be higher than under GEC. Why do firms tend to choose fewer quantities than optimal and thereby create less employment when they fail to consider all general equilibrium effects at once?

To find out the reason for the behavior under PEC compared with GEC, we first illustrate quantity choices under PEC if firms take the GEC equilibrium values as starting point. In figure 17 we have plotted the profit functions against the quantities. One curve is the profit function of a firm j under GEC as in the figure before (all firms $i \neq j$ staying at their GEC

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solution quantities). The other curve is the profit function of a firm j under PEC based on the equilibrium that corresponds to the GEC solution (this means we take the values of this equilibrium as the starting point for PEC and then vary only q_{2j} of firm j). As we see, firm j tends to choose a smaller quantity under PEC starting from the optimal point of GEC. Note that the curves intersect at the true optimal point (the maximum of the GEC profit function of firm j). This happens because at this point all the variables considered to be constant under PEC have the values also realized under GEC. So when these variables are inserted into the profit function, the value of the profit function is of course the same as under GEC, where these values occur just in the equilibrium corresponding to the profit maximizing quantity of firm j.

To explain the wrong profit estimation by firms that lead to a lower quantity choice under PEC than under GEC, we identify four effects. The profit function faced by the firms (see equation (4.5)) depends on 5 arguments. Table (4.2) shows which arguments in the profit function are overestimated by a firm j and which are underestimated, when the firm deviates *downwards* from the GEC solution quantity with the other firms staying at their GEC quantity.

$$\pi_{2j} = p_2(q_2) \cdot q_{2j} - E_{2j}(w^\ell, \tau, w^h, q_{2j}) \qquad (4.5)$$

To understand table (4.2), we have plotted in figure 18 one of the important variables, namely the price p_2 of good 2. In the figure, one of the curves shows the price that will actually be realized associated with a certain quantity q_{2j} in market equilibrium. This is what a firm j would see under GEC, where it has the whole picture of the economy in mind (the other firms

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Table 4.2:

Revenue	Estimation under PEC relative to GEC	Impact on output and employment under PEC relative to GEC
p_2	overestimated	negative
q_{2j}	-	-
Costs		
w^ℓ	underestimated	negative
τ	underestimated	negative
w^h	overestimated	positive

always choosing the GEC-optimal q_{2i}). The other curve is the price expected by a firm j deviating from the GEC solution as starting point (with the other firms staying at their GEC quantities) with its PEC view, considering only the interactions between q_{2i} and p_2. If we compare the two curves, we observe that with a decreasing quantity q_{2j}, the price p_2 rises less in market equilibrium than firm j *thinks* with its PEC view. The reason for this phenomenon is as follows: Under PEC, a firm j recognizes the first increase of p_2 associated with a lower quantity. But what it does not realize is that with a lower quantity real income of the economy decreases. This in turn implies a decline in demand for good 2 *and* good 1. Because of the real wage rigidity employment decreases not only in sector 2 but also in sector 1. This implies a declining production of good 1, which tends to raise the price p_1 relative to p_2. So the rise of p_2 (relative to p_1) is not as big as expected under PEC. The overestimation of the price effect (and therefore the revenue) leads to a lower quantity choice and has therefore a negative impact on employment.

Regarding the cost effects, w^ℓ is assumed to be constant by firm j, but in reality it increases, i.e. it is underestimated. This happens because when q_2

decreases due to the downward deviation of firm j, the price p_2 increases (but overestimated), leading to a higher price index p ($p_1 \equiv 1$). For a constant minimum real wage the nominal wage w^ℓ must increase therefore. Actually this negative cost effect would be an argument for the firm to produce more, but it is not seen, and this leads to a lower production than optimal and therefore more unemployment. For a similar reason the tax rate τ does not stay constant, but increases: With q_2 declining, less people are employed, which means more unemployment, calling for a higher tax rate to finance it. The above effects all lead to an overestimation of the profits, and therefore to a low quantity choice and low employment. The only variable, that can be counteracting is w^h. When firm j reduces its output, less low skilled workers are employed, implying a lower marginal productivity of the high-skilled, leading to a declining wage. On the other hand, the high-skilled wage can increase because of the increasing p_2. Of course the high-skilled wage differential between sector 1 and sector 2 diminishes because high-skilled workers can move between sectors. In our simulations the net effect is a bit negative, i.e. w^h decreases a little, when q_{2j} decreases. The overestimated high-skilled wage when deviating downwards would lead to a *higher* production than optimal, but this counteracting effect is overcompensated by the other effects.

4.4.4 Robustness

In this section we examine the impact of three parameters on the employment outcomes under GEC and PEC: the number of firms in the non-competitive sector 2, the elasticity of substitution between the consumption goods 1 and 2, and the size of the sector 2, where PEC or GEC take place.

To illustrate the effect of the myopic PEC view compared with the case, where all general equilibrium effects are incorporated by the the firms (GEC

view), we have plotted aggregate employment against the number of firms in sector 2. Since in this section we analyze the case, where all labor force is mobile across industries, the figures are labeled with *Mob*. One curve in figure 19 is the PEC equilibrium employment outcome, i.e. aggregate employment in the steady state of the dynamic PEC process. The other curve (marked in figure 19) is aggregate employment resulting in the GEC equilibrium. The third curve is employment resulting under perfect competition, which we take as a benchmark. The fact, that employment under GEC is always higher than under PEC is the consequence of the lower quantity choice under PEC than under GEC. The less firms there are in the market, the stronger the price effect of choosing a low quantity is, but also the overestimation of this effect, so that PEC performs particularly bad relative to GEC for a small number of firms. When the number of firms increases, the price effect becomes smaller and smaller, so that the outcomes converge to the result under perfect competition. The distance between the PEC curve and the GEC curve decreases as well, because not only the price effect per se, but also the bias under PEC looses importance.

Figure 20 shows the same curves as figure 19, but now with a (lower) elasticity of substitution of 1/4. The pattern of the curves remains the same except for the distance between the curves. With a lower elasticity of substitution the (positive) price effect of producing low quantities becomes stronger, so that the distance of the PEC and GEC curve to the benchmark curve (perfect competition) increases. But with the lower elasticity of substitution the bias of the price effect increases as well, so that the distance between the PEC and the GEC curve increases too.

In Figure 21 the curves are plotted again for an elasticity of substitution of 1/2, but now we consider a sector size of 20 % instead of 10 %. This means

that α_1 and α_2 in the utility function are chosen to imply that households spend 20 % of their budgets for good 2 and 80 % for good 1 when prices of good 1 and good 2 are equal. Obviously, the employment difference between GEC and PEC increases. The consequence of the overestimation of the price effect becomes more important when the sector size increases. The distances to the perfect competition employment outcome increase as well.
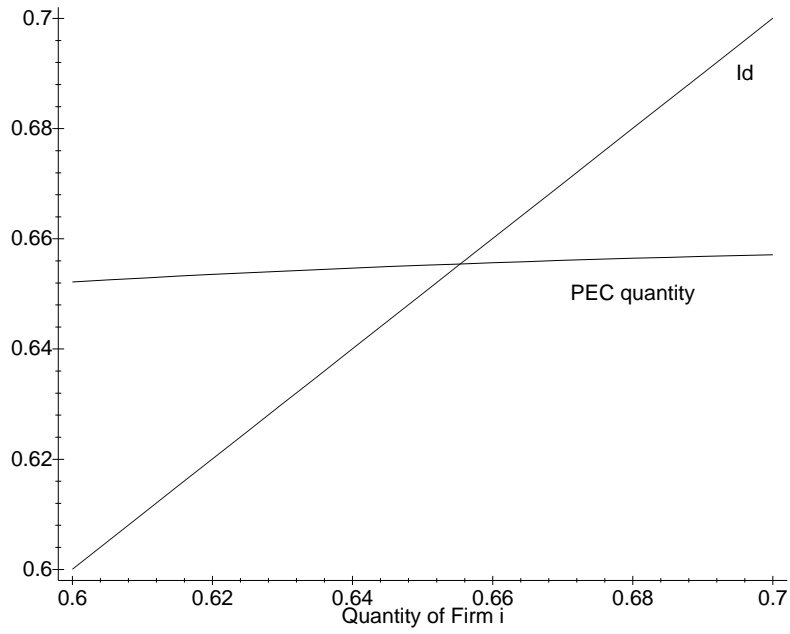
Figure 15: Convergence of Cournot Quantities

Id

PEC quantity

Quantity of Firm i
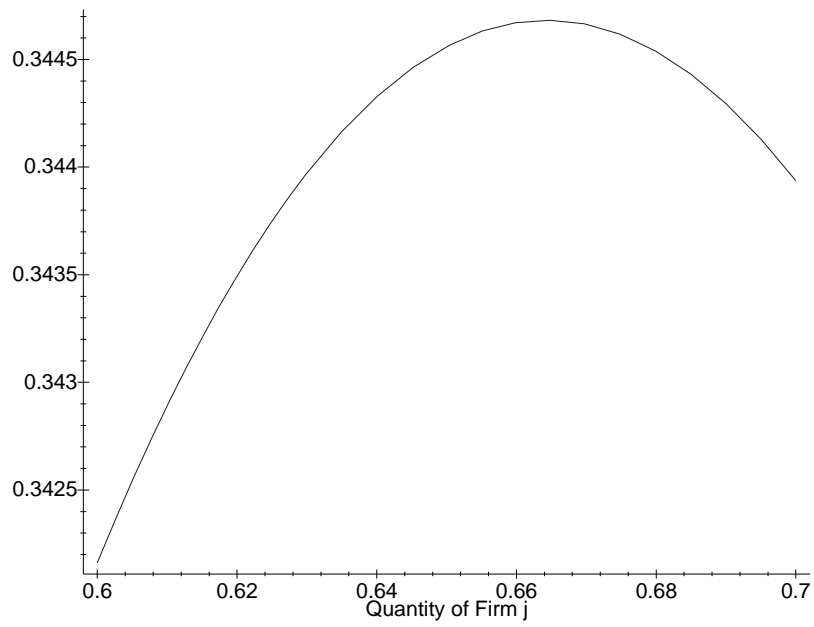
Figure 16: Profits of Firm j (GEC)

Quantity of Firm j

Figure 17: Profits Firm j (PEC/ GEC)

0.3445

0.344

0.3435

0.343

0.3425

PEC

GEC

0.6   0.62   0.64   0.66   0.68   0.7

Quantity of Firm j

Figure 18: Price 2 (PEC/ GEC)

1.57

1.56

1.55

1.54

1.53

1.52

1.51

1.5

1.49

PEC

GEC

0.6   0.62   0.64   0.66   0.68   0.7

Quantity of Firm j
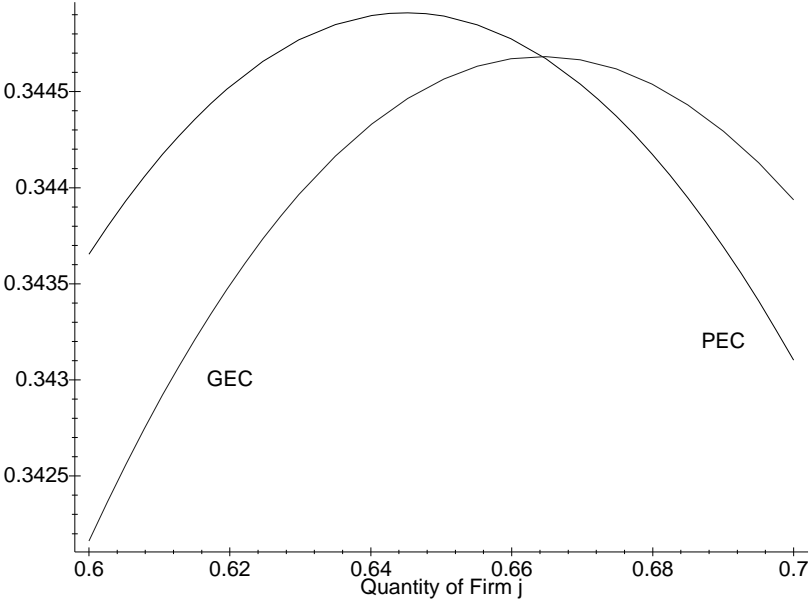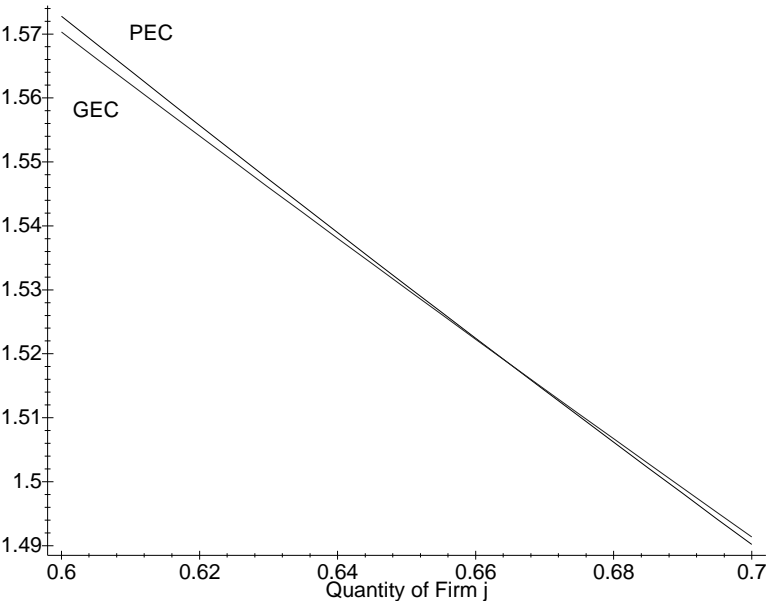
Figure 19: Competition and Employment (Mob)

Perfect Competition

GEC

PEC

Number of Firms in Sector 2
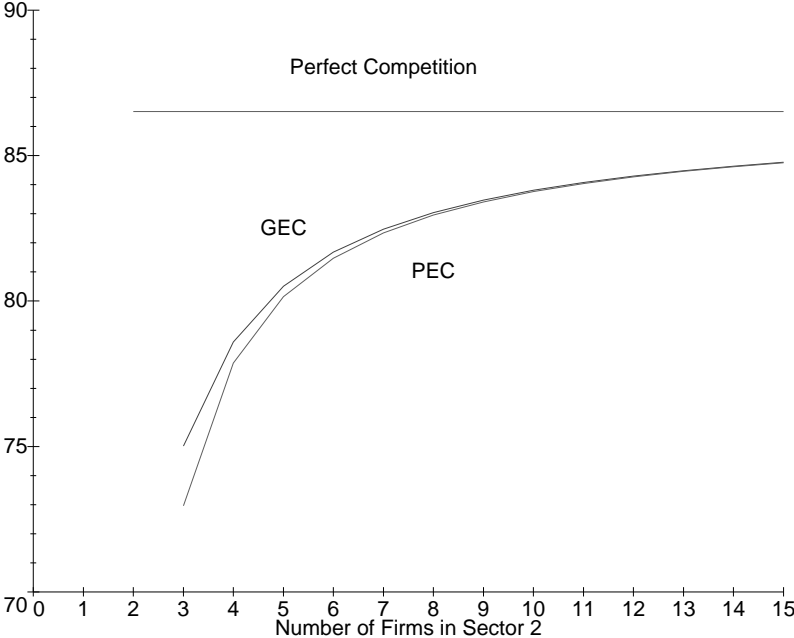
Figure 20: Competition and Employment (Mob)

Perfect Competition

GEC

PEC

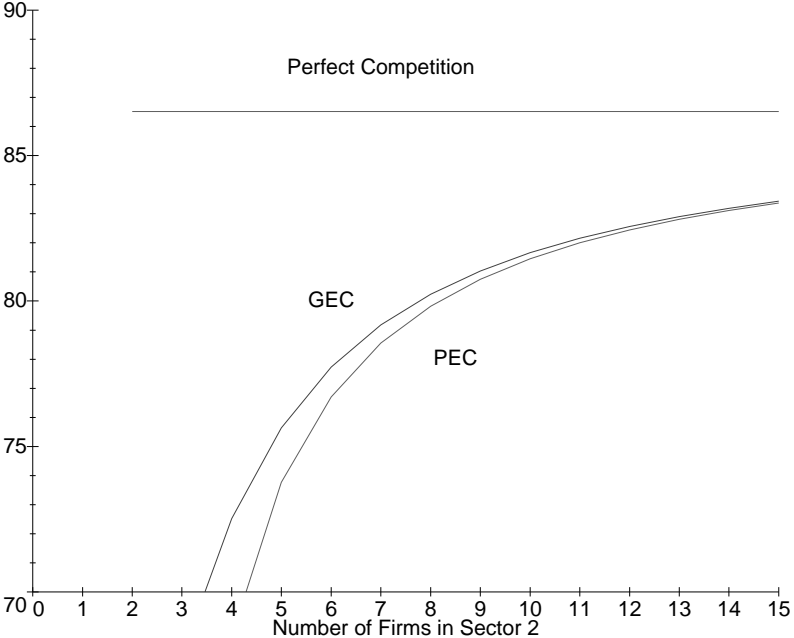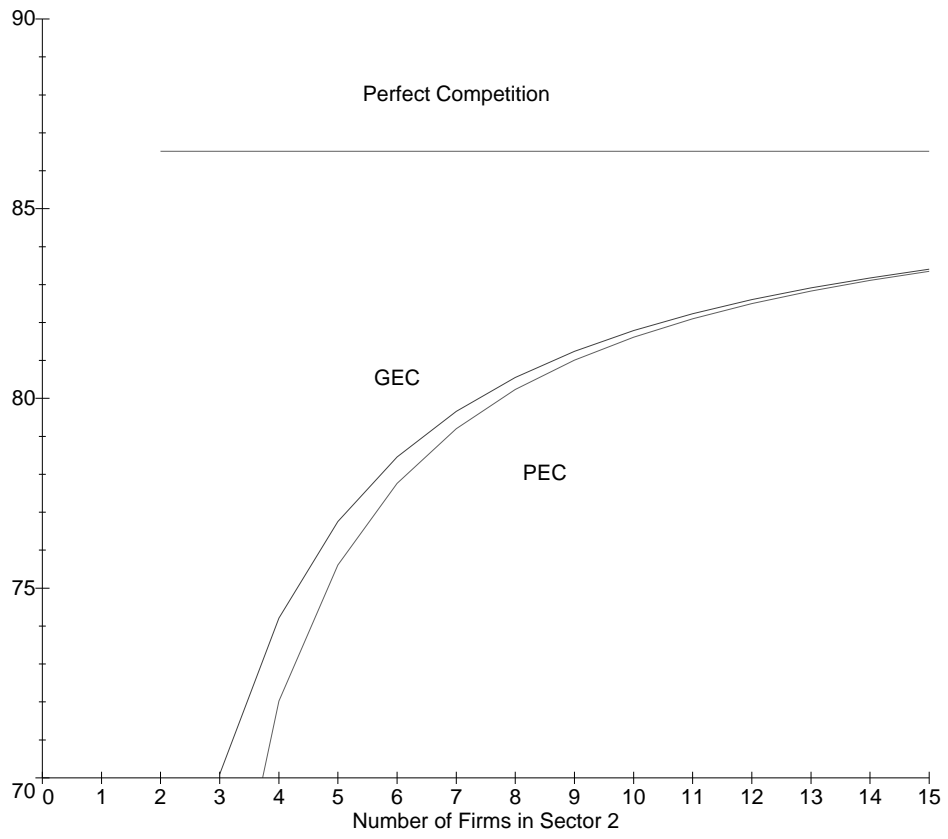Number of Firms in Sector 2

Figure 21: Competition and Employment (Mob)

4.5 Immobility of the Labor Force

In this section we extend our analysis to the case, where the whole labor is immobile.

4.5.1 The Model

The model remains the same as before for the most part. Labor market clearings for low-skilled workers will still not hold because of the real wage rigidity, whereas high-skilled labor markets clear.

Again we analyze the effects of PEC and GEC in sector 2.

4.5.2 Simulation Results

The parameters for the following simulations are the same as in the mobility case. Low-skilled workers are now divided into two groups: 54 can work in sector 1 and 6 can work in sector 2. High-skilled labor force is also divided into two groups of 36 working in sector 1 and 4 in sector 2, so that production of good 2 makes 10 % of total production (we have constant returns to scale).

The calculations for PEC and GEC are similar to the mobile labor force case. Figure 22 shows the PEC steady state equilibrium and figure 23 demonstrates the GEC solution.

4.5.3 Results

If we compare figure 22 and figure 23, we see that the profit maximizing quantity in figure 23 (GEC) lies *below* the PEC equilibrium quantity now. Correspondingly, unemployment associated with PEC will be lower than under GEC. Why do firms tend to choose higher quantities than optimal and

thereby create more employment when they fail to consider all general equilibrium effects at once?

The major difference is now that wages of high-skilled people react much stronger to quantity changes in the immobility case. Its neglect under PEC overcompensates all other effects. To illustrate this point, we examine again quantity choices under GEC and PEC with the GEC equilibrium values as starting point. Figure 24 is analogous to figure 17. As we see, firm j now tends to choose a higher quantity under PEC starting from the optimal point of GEC.

Table (4.3) shows again, which arguments in the profit function are overestimated by a firm j and which are underestimated, when the firm deviates *upwards* from the GEC solution quantity with the other firms staying at their GEC quantity. Note that we now examine an *upward* deviation of a firm's quantity choice since we want to understand why PEC yields output choices bigger than GEC (starting from the GEC solution).

Table 4.3:

Revenue	Estimation under PEC relative to GEC	Impact on output and employment under PEC relative to GEC
p_2	underestimated	negative
q_{2j}	-	-
Costs		
w_2^ℓ	overestimated	negative
τ	overestimated	negative
w_2^h	underestimated	positive

Note that the second column in table (4.3) is the mirror image of the second column of table (4.2) because we consider an *upward* deviation in

quantities. To review table (4.3) we have plotted in figure 25 one of the important variables, namely the wage w_2^h of high-skilled people working in sector 2. In the figure one of the curves shows the wage that will actually be realized associated with a certain quantity q_{2j} in market equilibrium (GEC). The other curve is the wage expected by a firm j deviating from the GEC solution (with the other firms staying at their GEC quantities) with its PEC view, considering only the interactions between q_{2i} and p_2. Comparing the two curves, we observe that with an increasing quantity q_{2j} the wage w_2^h rises more in market equilibrium than firm j *thinks* under its PEC view. The reason for this phenomenon is as follows: Under PEC, a firm j takes the factor costs as given and does not expect a change of factor costs when changing the quantity (only interactions between quantity and price are considered by the firms). But with a higher quantity, more low-skilled are employed in the sector, raising the marginal product of high-skilled. This in turn implies a rise of the high-skilled wage. The underestimation of the wage (and therefore the costs) leads to a higher quantity choice and has therefore a positive impact on employment. This effect is very strong and overcompensates all other (counteracting) effects.

Regarding the price effect, p_2 is underestimated. The argumentation is analogous to the mobile case: With an increasing production of q_2, p_2 falls. But the higher generated income leads to higher demand and production of good 1 as well, leading to a fall in the price of good 1, or to a less strong fall of p_2 relative to p_1. Because of the underestimated price p_2, the firms tend to chose fewer quantities than optimal, which creates less employment. The wage of low-skilled workers is still assumed to be constant by firm j, but in reality it decreases, i.e. it is overestimated. This happens because when q_2 increases owing to the upward deviation of firm j, the price p_2 falls

(but is underestimated), leading to a lower price index p ($p_1 \equiv 1$). For a constant minimum real wage the nominal wage w^ℓ must therefore decrease. The tax rate τ does not stay constant either, but decreases for a similar reason: With q_2 increasing, more people are employed, allowing for a lower tax rate to finance unemployment. But all these effects are overcompensated by the high-skilled wage effect, which leads to a higher quantity choice than optimal.

4.5.4 Robustness

In this section we examine again the impact of three parameters on the employment outcomes under GEC and PEC: the number of firms in the sector, the elasticity of substitution between consumption goods 1 and 2, and the size of the sector 2, where PEC or GEC take place.

To illustrate the effects of PEC compared with GEC, we have plotted aggregate employment against the number of firms in sector 2 again. As all the labor force is immobile now, this is denoted by *Imall* in the figures. One curve in figure 26 is the PEC steady state equilibrium employment outcome, the other curve is aggregate employment resulting in the GEC equilibrium. The third curve is employment resulting under perfect competition, i.e. the benchmark. The fact, that employment under PEC is always higher than under GEC, is the result of the higher quantity choice under PEC than under GEC. The less firms are in the market, the stronger the price effect of choosing a low quantity is, but the stronger the overestimation of this effect compared to the wage effect also is, so that the distance of the PEC curve and the GEC curve disappears. When the number of firms increases, the price effect becomes smaller and smaller, so that the outcomes converge to the result under perfect competition. The distance between the PEC curve

and the GEC curve increases at the beginning, because now the wage effect dominates clearly the price effect.

Figure 27 shows the same curves as figure 26, but now again with a lower elasticity of substitution of 1/4. The pattern of the curves changes now. With a low elasticity of substitution in the utility function, the price effect of a certain quantity choice becomes more important and so does the overestimation of this effect. This implies that the distance between the perfect competition curve and the other curves increases. Additionally the price effect (together with the low-skilled wage effect and the tax effect) now overcompensates the high-skilled wage effect for a small number of firms, so that the GEC outcome is better than the PEC outcome. With the number of firms in sector 2 increasing, the wrong estimation of the wage effect becomes more important relative to the wrong estimation of the price effect, so that the curves intersect and the PEC result is getting better for many firms in the sector.

In Figure 28 the curves are plotted again for an elasticity of substitution of 1/2, but now we consider a sector size of 20 %. Again the result is, that the distance between the benchmark curve (perfect competition) and the other curves increases. The reason for this phenomenon is simply, that the negative employment effect of imperfect competition is bigger when the sector with imperfect competition is bigger. In addition, the consequence of the overestimation of the price effect of course becomes more important when the sector size increases. This leads to an intersection of the PEC curve and the GEC curve and a better outcome in the GEC case for a small number of firms, whereas for a large number of firms the PEC outcome is still better.

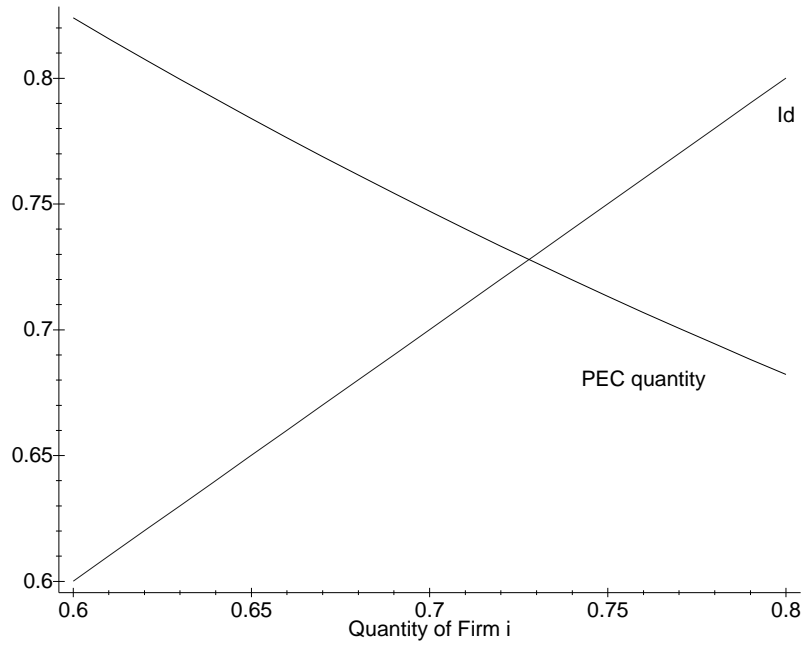Figure 22: Convergence of Cournot Quantities

Id

PEC quantity

Quantity of Firm i

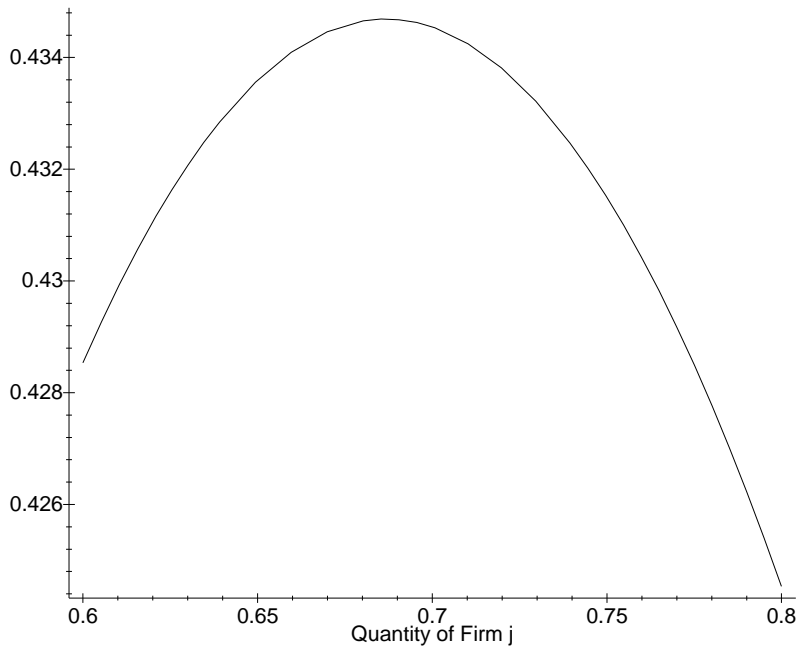Figure 23: Profits of Firm j (GEC)

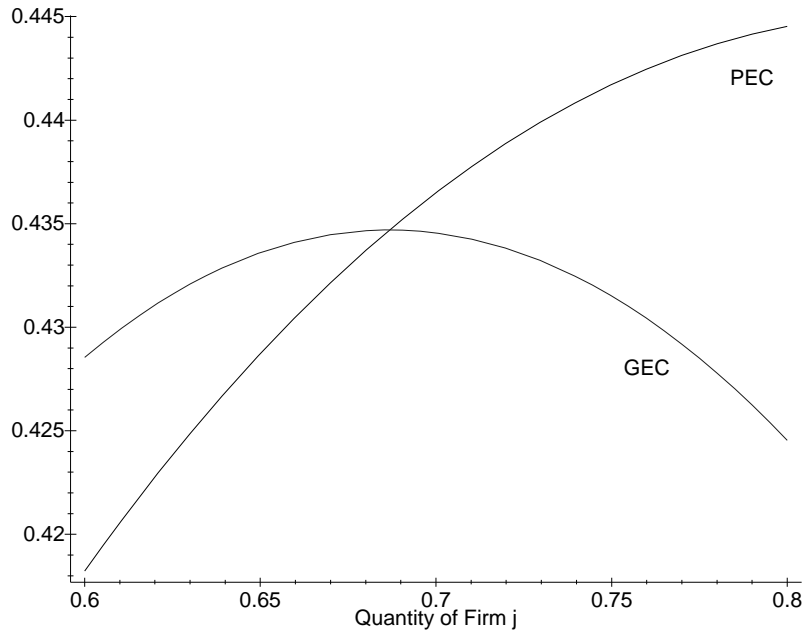Quantity of Firm j

Figure 24: Profits Firm j (PEC/ GEC)
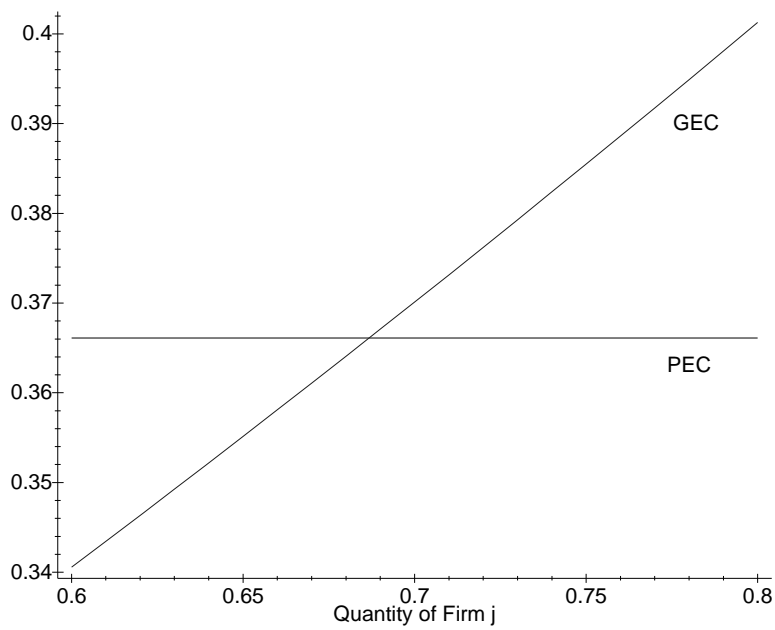

Figure 25: Wage High-Skilled (PEC/ GEC)

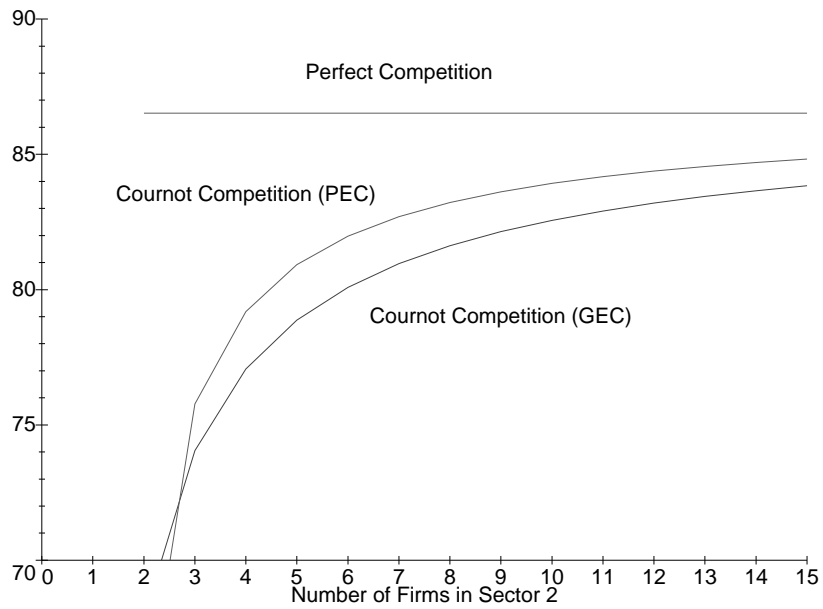Figure 26: Competition and Employment (Imall)
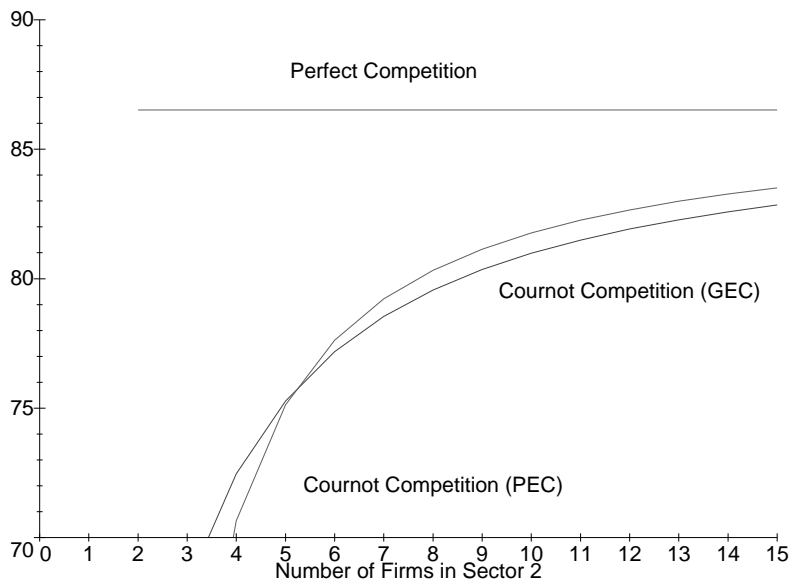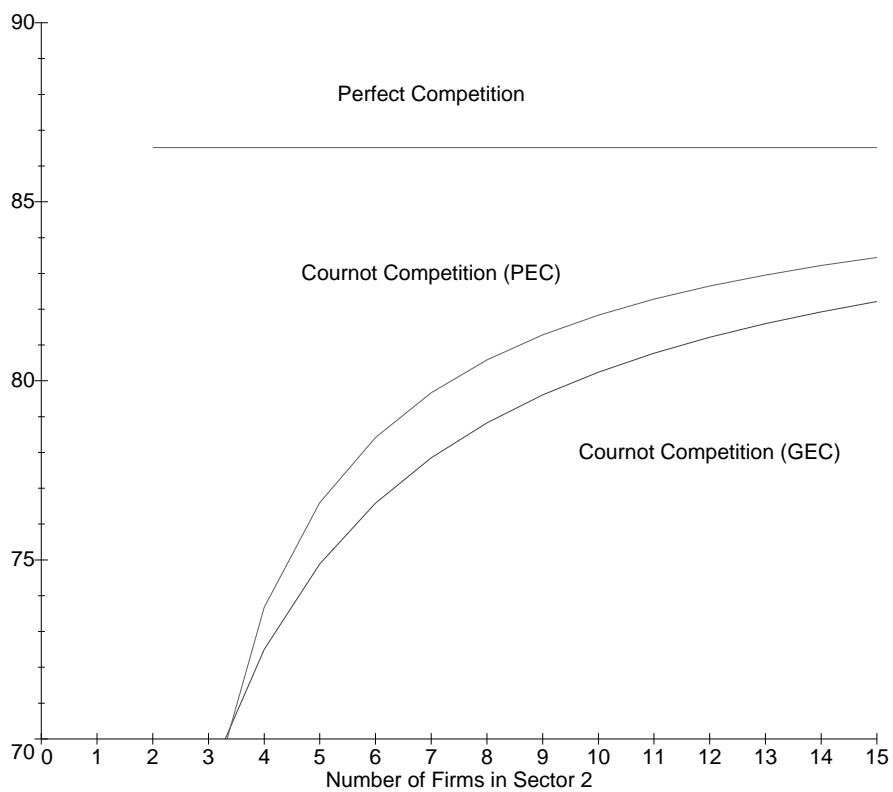

Figure 27: Competition and Employment (Imall)

Figure 28: Competition and Employment (Imall)

4.6 Conclusions and Extensions

We have developed a general equilibrium model with Cournot Competition in one sector and perfect competition in the other sector in order to study how different learning abilities of agents affect economic outcomes, especially unemployment. We have shown that a partial equilibrium view of the economy by competing firms leads to low unemployment compared with a general equilibrium view, when the production factors are immobile. In contrast, if the production factors are mobile, the opposite result holds.

An important feature on the agenda of further research is to examine other types of product market competition in order to improve our understanding in which way imperfect competition in a general equilibrium environment works and affects outcomes. An interesting point in this context is the analysis of firms competing à la Bertand with homogeneous goods (and constant marginal costs) instead of Cournot. The following argument demonstrates that in this case the outcome must be equal to the outcome under perfect competition: If the price setting process, where at every stage prices equal marginal costs, converges to a stable steady state under PEC, which means that the function from p_2 to p_2 contracts (analogous to figure 15 and 22 in this chapter), one can apply the fix point theorem of Banach to this situation. It states the existence and uniqueness of a fix point for contracting functions. Since the general equilibrium with *perfect competition* in all goods markets fulfills the claim that prices equalize marginal costs, the steady state of PEC reduces (like GEC) to *this* outcome. Hence, with Bertrand competition, differences in the recognition of general equilibrium effects can be irrelevant. In which way other types of product market competition affect the relative comparison of PEC and GEC is left for future research.

Chapter 5

An Application: Mergers and Unemployment

5.1 Model

A phenomenon that can often be observed in industrialized countries recently are mergers of firms. In this chapter we want to analyze the impact of mergers on unemployment as an application of the microanalysis of imperfect competition in the previous chapter. The framework for the analysis is the same as in chapter 4. Workers are mobile across industries and n firms compete à la Cournot in sector 2. We then study the impact of a merger of two of the n firms on unemployment. In our framework mergers can be studied by comparative statics with respect to the number of firms. However, in order to capture a frequent phenomenon when mergers occur, we allow for simultanous productivity improvements when two firms merge, expressed by a change of the total factor productivity index A. For our analysis we assume that the firms act under **P**artial **E**quilibrium **C**ournot Competition (PEC), which we consider to be more realistic than **G**eneral **E**quilibrium **C**ournot Competition (GEC).

We proceed as follows: We calculate the PEC steady state equilibrium for a certain number of firms in sector 2. We then pick two of the n identical firms in sector 2 and formulate a condition for them to merge. The condition is straightforward: Two firms want to merge when the (expected) profit after the merger (PEC-view) is more than the sum of their single profits before the merger. We assume that the new firm j gains from the merger in terms of a rise in total factor productivity A_{2j}. To meet the above formulated merger condition, A_{2j} must rise by a certain value. We calculate the minimum level, the total factor productivity A_{2j} must rise to meet the condition under the PEC view of the firms. In the next step we calculate the PEC steady state equilibrium for n-2 identical firms and one firm j with the A_{2j} calculated in the step before. Finally we compare unemployment in the PEC steady states before and after the merger.

5.2 Results

For our simulation analysis we use the following parameters (see table (5.1)):

Table 5.1:

Parameters	Values
σ	1
α_1	0.9
α_2	0.1
A_1	1
β_1^{ℓ}	$\frac{1}{3}$
β_1^h	$\frac{2}{3}$
A_2	1
β_2^{ℓ}	$\frac{1}{3}$
β_2^h	$\frac{2}{3}$
$\overline{L}^{\ell}$	60
$\overline{L}^h$	40
$rwfactor$	1.1
s	0.8

Table (5.2) shows the simulation results. The first three columns contain data of the economic situation before the merger takes place. The number of firms is given in column 1. Column 2 contains the total factor productivity of the n identical firms A_{2i}. The associated unemployment rate is shown in column 3. In the next 4 columns the situation after the merger is characterized. Column 4 reports the number of firms after the merger. The total factor productivity of the new firm A_{2j}^{min}, that is built on the two merged firms, is given in column 5. Remember that the underlying A_{2j}^{min} is the productivity, that is *at least* necessary for the two firms to meet the merger condition, and is calculated under the PEC-view of the firms. All other n-2 firms do not change, i.e. their total factor productivity stays the same as before. The

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third column shows the unemployment rate associated with the new PEC steady state equilibrium. Finally the last column reports the difference in the unemployment rate before and after the merger.

Table 5.2:

n	A_{2i}	Δ_0	n-1	A_{2j}^{min}	Δ	$\Delta - \Delta_0$
4	1	17.29	3	1.047	18.62	1.33
6	1	15.91	5	1.058	16.30	0.39
8	1	15.27	7	1.048	15.45	0.18

We observe that, despite the necessary improvement of total factor productivity of the new emerged firm in sector 2, the unemployment rate increases after the merger. The interpretation of this result runs as follows: In our model, mergers have 2 opposite effects on employment: On the one hand, the necessary rise of total factor productivity of the new firm has a positive impact on employment (see chapter 2). On the other hand the mark-up by which the price of good 2 exceeds the marginal costs of firms in sector 2 becomes higher, the less firms compete in the market. This has a negative impact on employment (see also chapter 2). For the parameters used in the simulation, the negative mark-up effect overcompensates the positive A_{2j}-effect, so that the net effect is negative. However, other simulations show that when the total factor productivity of the new firm grows sufficiently high (higher than the necessary condition), the net effect of mergers on employment will be positive. Next we observe that the negative employment effect of mergers becomes less severe for a larger number of firms, which we can interpret as a magnitude effect resulting from the smaller size of firms (the sector size is always 10 %).

In the final step we analyze the effect of different sizes of the sector, in which PEC and the merger are taking place (see table (5.3)). Again we observe a magnitude effect, i.e. the negative impact of mergers on unemployment becomes more severe, the larger the sector size is.

Table 5.3:

sector size	n	A_{2i}	Δ_0	n-1	A_{2j}^{min}	Δ	$\Delta - \Delta_0$
5%	6	1	14.71	5	1.058	14.91	0.2
10%	6	1	15.91	5	1.058	16.30	0.39
15%	6	1	17.10	5	1.058	17.68	0.58

Another remarkable negative consequence of mergers is that less competition in a market generally leads to a lower productivity growth in the future (see Nickell [1998]). While it might be possible to receive qualitative results with our model that differ from ours by choosing extreme parameter constellations, we are convinced that our results will hold for reasonable parameters.

Chapter 6

Microfoundation of Wage Bargaining

6.1 Introduction

So far we have assumed fixed minimum real wages for low-skilled workers
in all our analysis. This might be the case when the government imposes
minimum wages. However, in many circumstances wages are determined
by bargaining processes between labor unions and employers' associations.
In this chapter we try to isolate a specific factor underlying the high Eu-
ropean unemployment rate. We argue that insufficient learning of general
equilibrium effects by unions and employers' associations may provide an
explanation why European unemployment remains so high.

We consider wage bargaining in a sector between a labor union and an
employers' association. We assume that both bargaining agents take partial
equilibrium effects into account but do not or cannot consider all feedback
effects from other sectors or from the tax system when negotiating wages.
After a wage agreement has been reached and general equilibrium effects
have been realized, the union and the employers' association observe that

unemployment is higher than assumed, because income and demand for *all* sectors have been negatively affected. In addition the employers' association observes that sector profits have been overestimated because prices and output are lower than expected because of general equilibrium effects. But when both parties negotiate wages again, employers' associations are prepared to make further wage concessions because they overestimate price increases again. Also, unions push again for higher wages to increase their members' wage bill because they underestimate negative feedbacks from other sectors. Hence, both bargaining agents react to negative feedback effects by agreeing for higher wages. Such repeated wage adjustments will cease when both parties do not want to change wages any more. In such a steady state, however, unemployment is persistant and much higher compared to the outcome that would occur when both parties incorporate all general equilibrium effects in the wage negotiations at once. Hence, insufficient learning of general equilibrium effects can provide an explanation why high unemployment persists.

The chapter is motivated by the large literature on the European unemployment problem (see chapter 2). Since a substantial part of the unemployment is structural in nature and, in principle, could be eliminated, it has been difficult to explain why high unemployment persists. Saint-Paul (1994, 1995, 1998) has shown that current labor market regulations can be explained by a political equilibrium. Coe and Snower (1997) have suggested that the importance of complementarities among labor market policies have not been suffciently recognized. This chapter suggests that agents' insufficient learning of general equilibrium effects in countries with collective bargaining arrangements or minimum wage laws can provide a complementary explanation why unemployment persists. If unions and employers' associations are not able to

incorporate all feedback effects from other sectors when negotiating wages, they end up in high wages and unemployment because they react to negative output, income and profit realizations by wage adjustments in the wrong direction.

The chapter is organized as follows. In the next section, we relate the chapter to the literature. In section 3 we introduce the model. We again examine a general equilibrium model with two types of labor, low and high-skilled, and two industry sectors. The model is closed by an unemployment insurance financed by taxes on labor, i.e. the governments' budget constraint. In section 4 we first explain a bargaining process called Partial Equilibrium Bargaining (PEB). For PEB we assume that the bargaining parties recognize, and therefore take into account, only the *direct* effects on their sector resulting from wage setting. However, they react to general equilibrium effects in the next wage negotiation. The outcome is compared with the case called General Equilibrium Bargaining (GEB). GEB means that all general equilibrium effects are taken into account when the wage is negotiated. We show that unemployment is always higher under repeated PEB than under GEB. This means that an insufficient recognition of general equilibrium effects will not be learned when unions and employers' associations bargain repeatedly over wages. We also illustrate that the relationship between the degree of feedback effects taken into account and unemployment is not monotonical over the whole set of feedback effects. If bargaining parties were very myopic and took only the direct employment effects of wages into account without recognizing changes in product prices etc., wages and unemployment would be lower compared to PEB. Section 5 concludes.

6.2   Relation to the Literature

In the literature, unemployment has been associated with labor market factors affecting supply and demand for labor, including unemployment benefits systems, institutional settings for wage determination and minimum wages. The main point of this chapter is that insufficient learning of general equilibrium effects can considerably reinforce the negative impact of particular labor market institutions on unemployment. Collective wage agreements yield high unemployment under PEB and moderate unemployment under GEB.

This chapter is again related to the political implementation and reform design issues (see chapter 2). In that context Piketty [1998] has suggested unemployment remains high because a necessary decline of low-skilled people's wages would be associated with a low social status or human value which may not be widely accepted in the public. The results in this chapter suggest that high unemployment may also be the result of insufficient learning of general equilibrium effects.

Finally, the chapter is related to the recent literature on adaptive learning processes in game theoretic situations (for recent comprehensive surveys see Young 1997, Fudenberg and Levine 1998). The learning process we employ for unions and employers' associations is similar to the best reply dynamics. There are two differences to the best reply learning models in game theoretic situations. First, the union and the employers' association bargain cooperatively (Nash bargaining), and hence they maximize a common objective function. Second, in our general equilibrium setting, both agents take the previous realizations of output and income generated in other sectors as given. They do not assume any particular behavior of other agents in the economy, but outcomes of market equilibria.

6.3 Model

The model used for the analysis is similar to the model in chapter 2. We analyze different wage bargaining processes associated with different degrees of sophistication concerning feedback effects. We assume that low-skilled workers as well as high skilled-workers are immobile across industries, i.e. they can only work in one sector.

In sector 1, we still assume that a real reservation wage exists, denoted by $\overline{rw}$ and defined as a percentage of the market clearing real wage of the low-skilled in sector 1 if no frictions are present (all wages competitive). If $\overline{rw}$ exceeds the market clearing real wages, it becomes binding for the low-skilled and unemployment occurs in the first sector. w_1^ℓ is then $p \cdot \overline{rw}$. Wages for the low-skilled in the second sector are determined by the wage bargaining process that will be the focus of our examinations. The high-skilled labor markets we always assume to be competitive in both sectors. Labor is taxed at flat rate, denoted by τ, to finance benefits for the unemployed workers. We assume that the unemployed obtain a fixed percentage s of the wages earned by the low-skilled working in sector 1, denoted by ub. Profit functions of the firms are sales minus costs, augmented by the tax wedge. Total labor costs for a firm consist of the wage bill and the tax expenditures. Therefore profits in sector 2 (sector 1 analogous) amount to

$$\pi_2 = p_2 q_2 - w_2^\ell(1+\tau)L_2^\ell - w_2^h(1+\tau)L_2^h \qquad (6.1)$$

Firms are price takers in both sectors. We obtain the first order conditions for profit maximization of firms in sector 2

$$w_2^\ell(1 + \tau) = p_2 A_2 L_2^{h\beta_2^\ell} \beta_2^\ell L_2^{\ell^{\beta_2^\ell} - 1}$$ (6.2)

$$w_2^h(1 + \tau) = p_2 A_2 L_2^{\ell^{\beta_2^\ell}} \beta_2^h L_2^{h^{\beta_2^h} - 1}$$ (6.3)

Market clearing for good 1 implies:

$$L_1^\ell \cdot c_{11}^\ell + L_2^\ell \cdot c_{21}^\ell + L_1^h \cdot c_{11}^h + L_2^h \cdot c_{21}^h + \Delta \cdot c_1^u = q_1$$ (6.4)

We will choose our parameters so that the real reservation wage will be binding and thus the labor market for low-skilled workers in sector 1 will not clear. This mirrors the fact that there are non competitive wages in many industries. In sector 2 the negotiated wage for low-skilled will not clear the labor market either, whereas labor market clearings for high skilled workers hold.

The variable that is not specified in the model so far is the wage resulting from the bargaining process in the second sector.

6.3.1 The Wage Bargaining Process in Sector 2

We assume that wages in sector 2 are determined by collective bargaining between a union and an employers' association (see Manzini [1998] for a survey). The union has the following objective function

$$\Gamma_u = \frac{w_2^\ell - ub}{p} \cdot L_2^\ell$$ (6.5)

Γ_u results from utility maximization of the labor union for its members (see Manzini [1998]). It is the excess of the union member's utility in case of agreement over the utility in case of disagreement in the negotiation.

The objective of the employers' federation is to maximize real profits:

$$\Gamma_e = \frac{\pi_2}{p} \tag{6.6}$$

We assume that wages are determined by the Nash-bargaining solution. The general objective function is the weighted geometric mean of the two single objective functions.

$$\Gamma = \Gamma_u^\delta \cdot \Gamma_e^{1-\delta} \tag{6.7}$$

δ is the union's bargaining power ($0 \leq \delta \leq 1$). $1 - \delta$ is the bargaining power of the employers' association.

The key issue is which feedback loops labor unions and industry associations will take into account when they agree upon wages. We consider three different levels of sophistication of the bargaining parties. The first possibility is that all general equilibrium effects are taken into account by the bargaining agents. Hence, changes in output, prices in all sectors and changes in taxes are calculated and enter the common objective. Mathematically this implies that we first have to solve the whole system of equations for the unknown variables w_1^ℓ, w_1^h, w_2^h, ub, L_1^ℓ, L_2^ℓ, L_1^h, L_2^h, $p1$, $p2$, p, c_1^u, c_2^u, c_{11}^ℓ, c_{12}^ℓ, c_{21}^ℓ, c_{22}^ℓ, c_{11}^h, c_{12}^h, c_{21}^h, c_{22}^h, Δ, τ as functions of w_2^ℓ. The solved variables must be inserted in the objective function Γ of the bargaining parties. The Nash Bargaining Solution (NBS) w_2^ℓ is then determined as the wage that maximizes Γ. Note that the resulting equilibrium is the one that really maximizes the objective function Γ, since these equilibrium values will actually

be realized. Under this bargaining procedure agents take into account all general equilibrium effects that occur when a wage in one sector is changed. We call this bargaining process General Equilibrium Bargaining (GEB).

We next examine what happens in the probably more realistic case that agents do not or cannot take into account all feedback effects resulting in the general equilibrium. One might think that unions and industry associations only take into account the employment effect $L_2^\ell(w_2^\ell)$, i.e. that only the change in employment L_2^ℓ associated with a change in wages w_2^ℓ is considered, whereas all other variables are assumed to stay constant. The wage bargaining process based on this myopic assessment of the economy is called Myopic Bargaining (MB).

Probably the most plausible case is that agents only take the most direct feedbacks into account. Let's look again at the objective function of the union and the industry association when the profit π_2 is inserted.

$$\Gamma_u = \frac{w_2^\ell - ub}{p(p1, p2)} \cdot L_2^\ell \tag{6.8}$$

$$\Gamma_e = \frac{p_2 q_2 - w_2^\ell(1 + \tau)L_2^\ell - w_2^h(1 + \tau)L_2^h}{p(p1, p2)} \tag{6.9}$$

We consider the case where the union and the employers' association take only the *direct* effects of the negotiated wage into account, i.e. the effects that take place *directly* in their sector. By doing so the bargaining parties take into account not only the employment effect L_2^ℓ of the negotiated wage w_2^ℓ, but also the price effect p_2 (and thereby p) and the high-skilled wage effect w_2^h. The tax rate τ and the unemployment benefits ub as well as all other variables are considered (by the bargaining agents) to stay constant.

Only the interactions between w_2^ℓ, L_2^ℓ, $p2$ (and thereby p) and w_2^h are taken into account by the wage setters. The bargaining process based on this way of assessing the feedbacks from wage setting will be called partial equilibrium bargaining (PEB).

For MB and PEB we assume that not all general equilibrium effects are taken into account, i.e. only a few feedback effects are incorporated whereas some or most of the economic variables are considered to stay *constant*. However, wage setters react to general equilibrium developement by renegotiating wages. This implies that the analogon to the static solution under GEB is a dynamic adjustment process for PEB and MB with a starting point and an endpoint. An endpoint is a constellation of wages, prices, employment, output and consumption such that unions and employers do not want to adjust wages anymore and good markets are in equilibrium. Such a steady state is called a PEB equilibrium or MB equilibrium (depending on the nature of the bargaining process). The following figure illustrates the dynamic adjustment process for PEB, under which the bargaining parties assume that data in sector 1 and the tax rate of the preceding equilibrium stay constant.
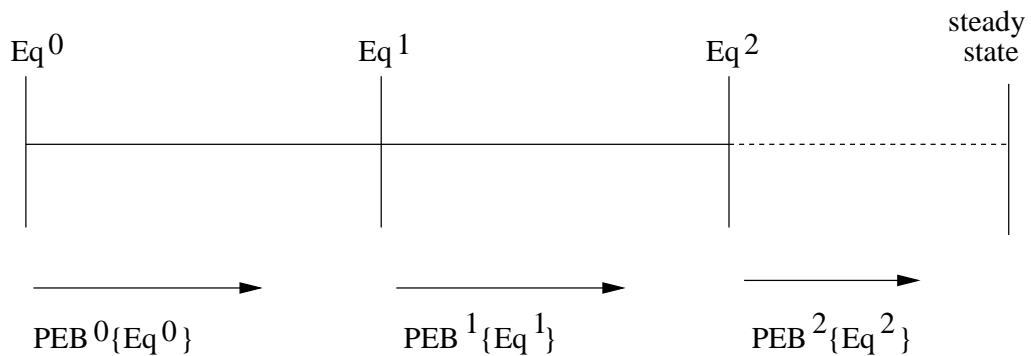
Mathematically this means for the PEB case that the three equations that determine L_2^ℓ, w_2^h and p_2 (equations 6.2,6.3,6.4) are solved simultaneously (each depending on w_2^ℓ) and inserted in the objective function Γ. In the MB case, only $L_2^\ell(w_2^\ell)$ is calculated from equation 6.2 and inserted in Γ. After that, the constants of the starting point equilibrium are inserted in the objective function, and now the wage w_2^ℓ is calculated, which maximizes Γ.

6.4 Results

6.4.1 Simulation Results for PEB and GEB

The preceding section outlined the general equilibrium relationships between wages and unemployment. In this section we calibrate the model and examine how the different circumstances under which wages are negotiated affect unemployment. As we will discuss in the last section, the results are robust across a wide range of variations of the parameters. We consider the following parameter constellation (see table 6.1):

Table 6.1:

Parameters	Values
α_1	0.5
α_2	0.5
σ	2
A_1	1
β_1^ℓ	$\frac{2}{9}$
β_1^h	$\frac{4}{9}$
A_2	1
β_2^ℓ	$\frac{2}{9}$
β_2^h	$\frac{4}{9}$
$\overline{L}_1^\ell$	30
$\overline{L}_2^\ell$	30
$\overline{L}_1^h$	20
$\overline{L}_1^h$	20
$rwfactor$	1.1
s	0.6
δ	1/3

$rwfactor$ denotes the factor, the low-skilled real wage in sector 1 in the benchmark model without frictions (all wages competitive) is multiplied with,

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for the model with rigidities. Moreover, we focus on an elasticity of substitution of 2 in the utility function between the two goods.

As already mentioned, we need starting points for PEB and MB, that is we need a market equilibrium we can start with. We first analyze PEB. In an economy with PEB, the dynamics runs as follows: The economy starts with any market equilibrium and the agents in sector 2 negotiate by considering the variables in other sectors as constant. They only take into account the interactions between wage, employment, price and high-skilled wages in sector 2. Then the wage maximizing the objective function is determined. Based on this new wage in sector 2, a new market equilibrium is determined. In the next step, PEB based on this new market equilibrium takes place, leading to a new wage, followed by a new market equilibrium and so on.

The question arises, if this procedure converges and if so, where does it converge to? To answer this question look at figure 29: On the horizontal and vertical axes wage levels w_2^ℓ are shown. The two curves represent the following relationships. The first line takes a specific wage on the abscissa, calculates the equilibrium (prices, output, ..), and then derives the PEB wage associated with the calculated equilibrium values as starting point. The curve represents all combinations of wages generating equilibrium values as starting points and PEB wages. The other curve is the identity (Id). From the fact that the identity has got a steeper slope than the other curve we can conclude that the point of intersection is a stable fix point. This means that repeated PEB approaches the wage associated with the intersection. The fix point is the PEB equilibrium.

In figure 30 we have first calculated the equilibria based on the wages on the abscissa and have then inserted them in the objective function. The wage corresponding to the maximum of the objective function is the one

the bargaining parties would choose in a world where all general equilibrium effects were taken into account. This is the GEB result, i.e. the wage that maximizes the objective function, when all feedback effects are taken into account. Surprisingly, if we compare figure 1 and figure 2, we see that the wage associated with a PEB equilibrium lies above the wage under GEB.

To find out the reason for the behavior under PEB compared with GEB, we next analyze the objective functions. In figure 31 we have plotted the general objective functions against the wage. One curve is the objective function under GEB as in the figure before. The other curve is the objective function under PEB based on the equilibrium that corresponds to the maximum of the objective function under GEB (this means we take the values of this maximum as the starting point for PEB). As we see, the agents tend to agree on higher wages under PEB starting from the optimal point of GEB. Note that at the true optimal point (the maximum of the GEB objective function) the curves intersect. This happens because at this point all the variables considered to be constant under PEB have the values also realized under GEB. So when these variables are inserted into the objective function, the value of the objective function is of course the same as under GEB, where these values occur just in the equilibrium corresponding to the maximizing wage.

In the next step we further analyze the joint objective function Γ by looking at Γ_u and Γ_e separately. In figure 32, Γ_u under GEB and PEB are plotted against the wage, again using the maximum of Γ under GEB as the starting point for PEB. The result is that for high wages, Γ_u under PEB lies above Γ_u under GEB. This implies that, from the PEB point of view, the unions push for higher wages compared to GEB (recognizing all general equilibrium effects of the economy). For low wages it is just the other way

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round. In figure 33, Γ_e under GEB and PEB (always with the maximum of Γ under GEB as the starting point) are plotted against wages. In this figure we can observe a pattern similar to the figure before: The objective function of the industry association Γ_e under PEB lies above Γ_e under GEB for high wages. This implies that employers do not realize the negative consequences of high wages under PEB as much as they would do under GEB. So they are more easily prepared to make wage concessions under PEB than under GEB. Note that the curves always intersect at the starting point for PEB, namely the wage, that maximizes the joint objective function Γ under GEB.

The question now is: Why do employers and unions tend to agree on higher wages when they fail to consider all general equilibrium effects at once? In figure 34 and 35 we have plotted two of the important variables, namely employment L_2^ℓ and price p_2 in sector 2. In figure 34, one of the curves shows the employment that will actually be realized associated with a certain wage in market equilibrium. This is what unions and employers see under GEB, when they have the whole picture of the economy in mind. The other curve is the employment expected by wage setters with their PEB view considering only the interactions of w_2^ℓ, L_2^ℓ, p_2 and w_2^h (the starting point is again the maximum of the GEB objective function). If we compare the two curves, we observe that with increasing wages employment decreases more in market equilibrium than the negotiating parties *think* under their PEB view. The reason for this phenomenon is as follows: Under PEB, the bargaining parties recognize the first decrease of employment associated with high wages. But what they do not realize is that with lower employment real income in the second sector decreases as well. This in turn implies a decline in demand for good 2 *and* good 1. Because of the high negotiated wage in sector 2 and the real wage rigidity in sector 1, employment in both sectors decreases

even more. This again implies a further decline in income and therefore in demand for both goods, leading to a further decline in employment and so on. Furthermore, because unemployment is increasing, the tax rate to finance the unemployed also increases, leading to higher gross wages, implying a further decline in employment, leading to more unemployment, which in turn implies higher tax rates and so on until the new market equilibrium is reached. As we see, employment in a market equilibrium associated with a high wage is much lower than expected by the bargaining parties under PEB.

In figure 35, the price of good 2 is plotted against the low-skilled wage in sector 2. We can observe that the price is overestimated under PEB. The real price (also expected in the GEB view) is lower for high wages. The argumentation for this effect is the following: Because of the decline of employment in sector 2, production of good 2 also declines, which in turn increases the price p_2 compared to the other price (p_1). This is also recognized under PEB, as well as the fact that an increasing p_2 also increases the profits of the firms. But what is not seen is that with high wages in sector 2 not only employment in sector 2 but also in sector 1 decreases because of the decline in demand for both goods. This in turn implies that also production of good 1 declines, thereby raising the price of good 1 compared to good 2, so that the rise of p_2 relative to $p1$ is not as big as expected under PEB.

The underestimation of the negative employment effect and the overestimation of the positive price effect associated with high wages both lead to the higher values of the objective functions under PEB and thereby to a higher wage agreement, which in turn implies more unemployment.

6.4.2 Simulation Results for MB

In this section we will complete our discussion by studying Myopic Bargaining (MB).

In an economy with MB, the dynamics is similar as under PEB: The economy starts with any market equilibrium and the agents in sector 2 negotiate by considering most of the economic variables in other sectors as constant and by taking into account only the interactions between wage and employment in sector 2. The wage maximizing the objective function as the result of the bargaining is now implemented. Based on this new wage in sector 2 a new market equilibrium is determined. In the next step, MB based on this new equilibrium takes place leading to a new wage followed by a new market equilibrium and so on. The question that arises is again whether this procedure converges and if so where to? To analyze this, consider figure 36 which has wages in sector 2 on both axes: We have again calculated the general equilibria values resulting from the wages on the abscissa. These general equilibrium values have been taken as starting points to calculate the MB outcome, i.e. the negotiated wages, which, together with the starting wages, generate one curve in the figure. The other curve is the identity (Id). From the fact that the identity has a steeper slope than the other curve we can again conclude that the point of intersection is a stable fix point. This means the wage associated with the point of intersection will be the wage the economy converges to in a MB equilibrium. In figure 37 we have first calculated the market equilibria based on the wages on the abscissa and have then inserted the equilibrium values in the objective function. The wage corresponding to the maximum is the one the bargaining parties would choose in a world where all general equilibrium effects would be taken into account. This is the GEB result (see figure 30). Surprisingly, if we compare figure 36

and figure 37, we see that the wage the economy converges to under MB now lies below the wage under GEB. Why does this happen? The answer in this case is very simple: Under MB, the bargaining agents do not take the positive price effect associated with high wages into account. That is, high wages lead to low employment and therefore low output, which in turn results in a high price of good 2. By ignoring this positive effect of high wages, the employers do not realize the positive effects on the profits. So they expect their objectives to go down more strongly with high wages than it is actually the case, implying that they are not ready for high wage concessions. This in turn leads to an agreement on a lower wage than the wage that would maximize the joint objective function.

Figure 29: Convergence of PEB

Id

PEB-wage

low-skilled wage in sector 2
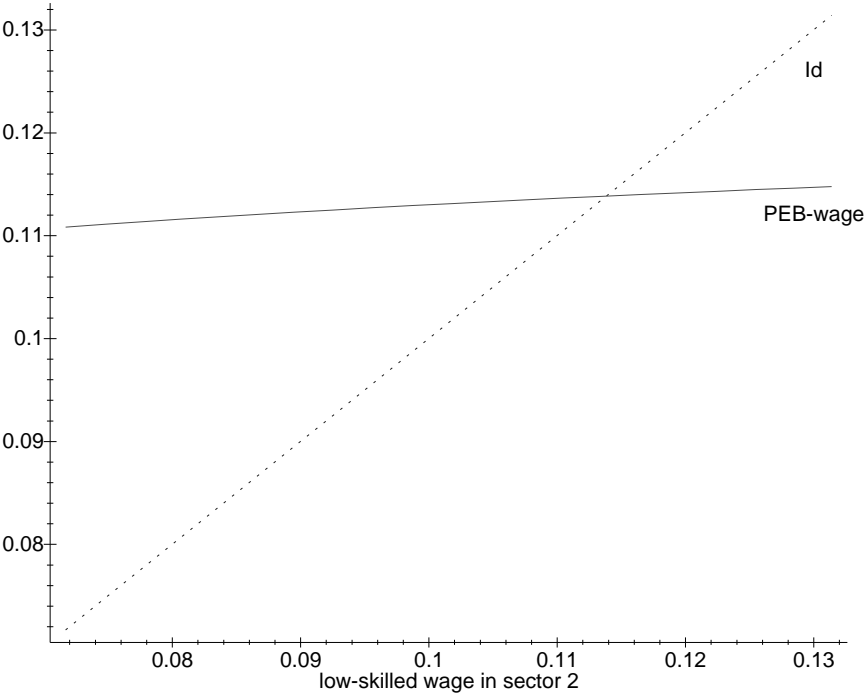
Figure 30: GEB Objective Function

low-skilled wage in sector 2
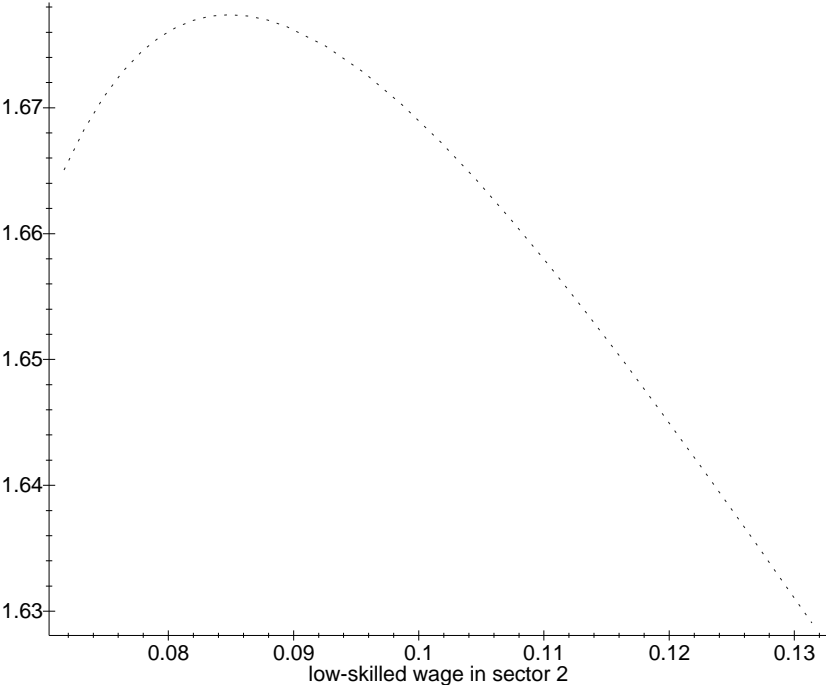
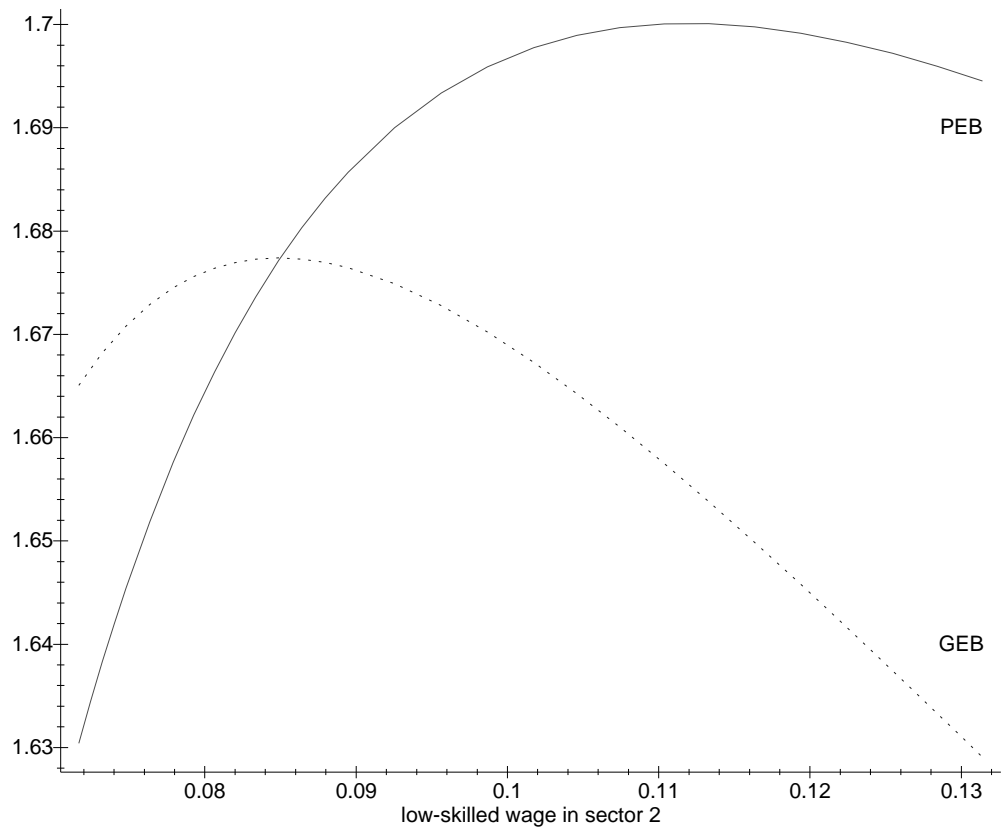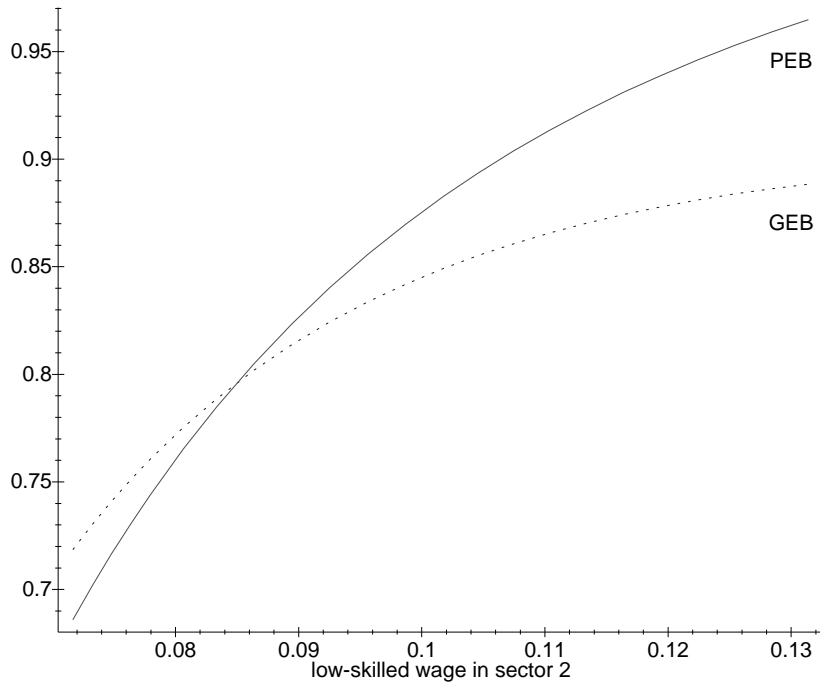Figure 31: Objective Functions GEB / PEB

Figure 32: Union Objective Functions GEB / PEB

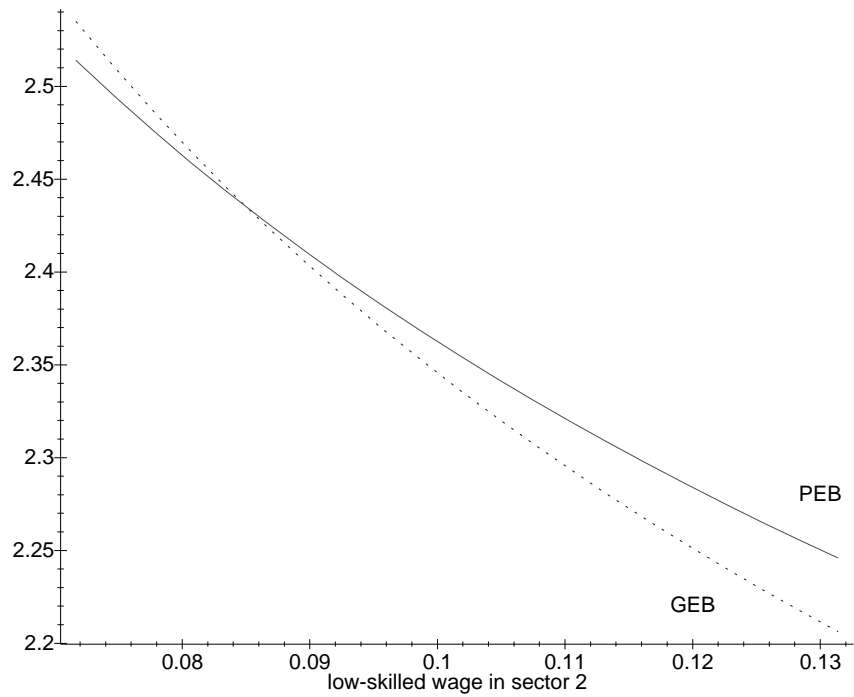Figure 33: Employer Association Objective Functions GEB / PEB

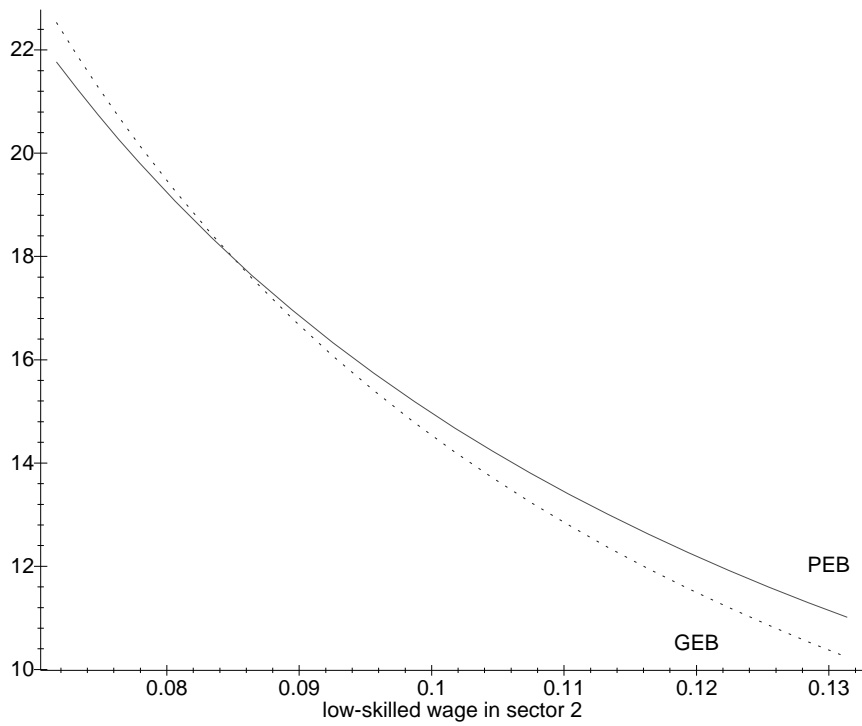## Figure 34: Low-Skilled Employment in Sector 2 GEB / PEB

low-skilled wage in sector 2

Figure 35: Price of Good 2 GEB / PEB
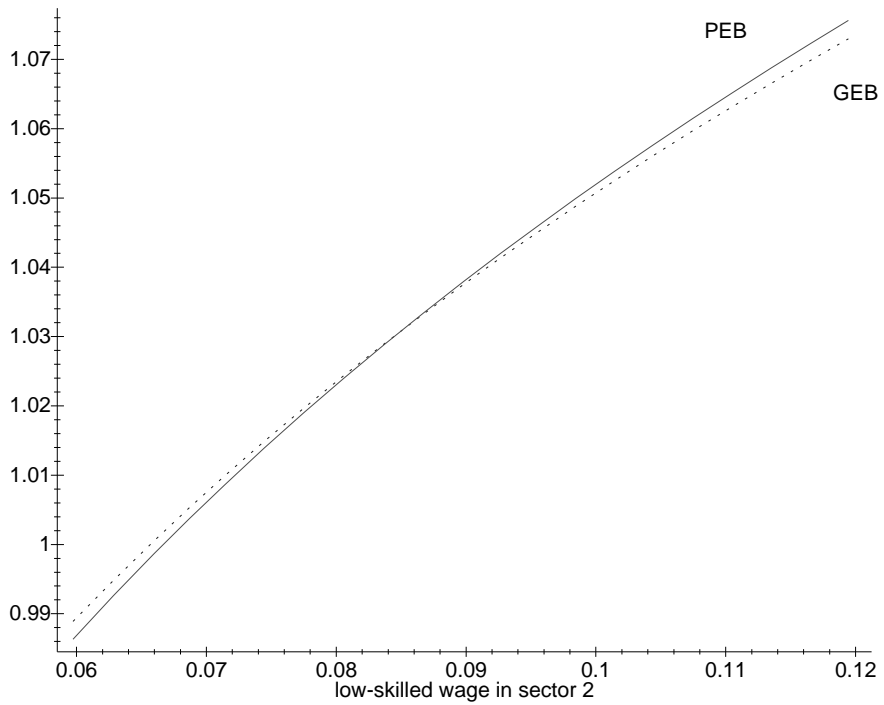

low-skilled wage in sector 2

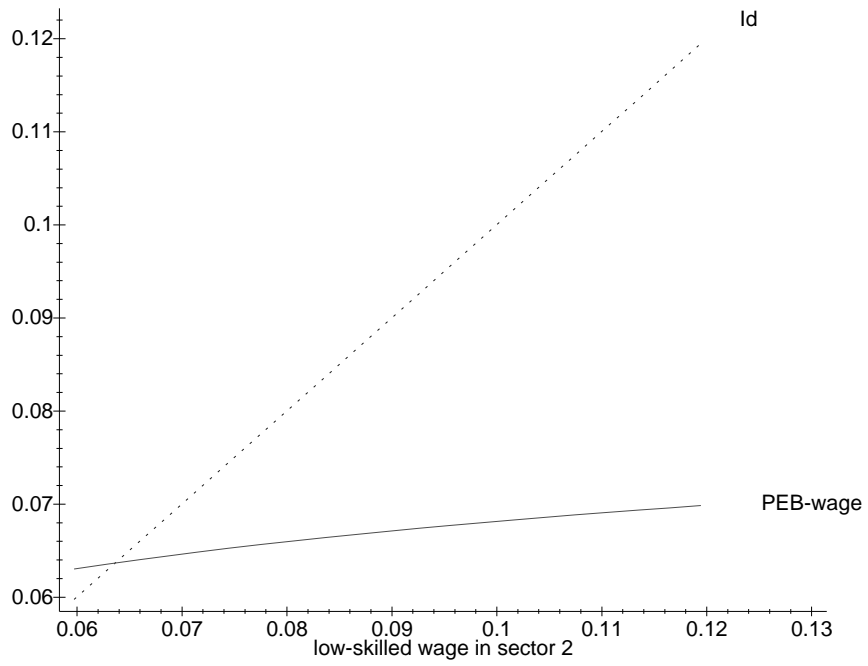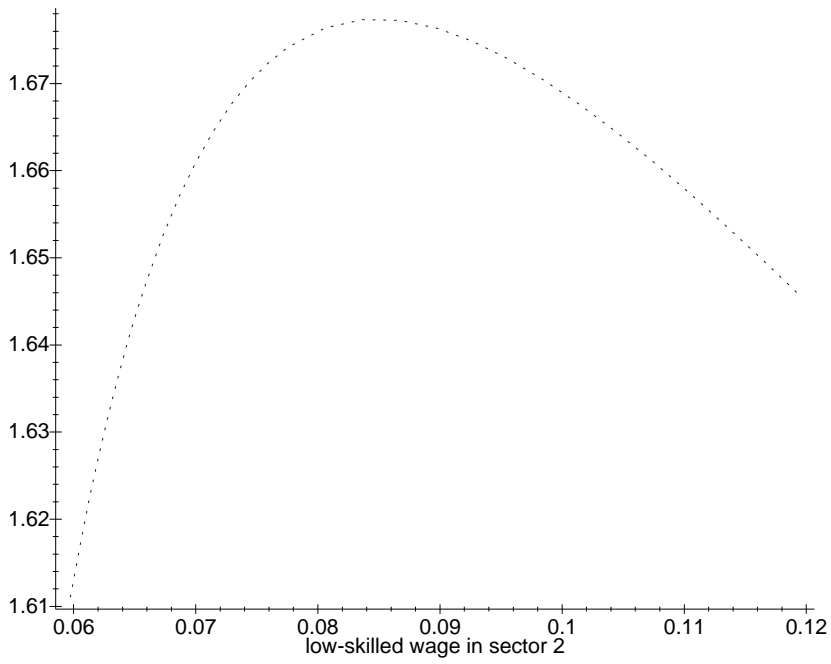## Figure 36: Convergence of MB

Figure 37: GEB Objective Function

6.5 Mobility of the High-Skilled Labor Force

In this section we consider wage bargaining in case, where the high-skilled labor force is mobile. Low-skilled workers are still assumed to be immobile across industries.

6.5.1 The Model

The model remains unchanged for the most part. High-skilled labor market clearing is now defined as

$$\overline{L}^h = L_1^h + L_2^h \tag{6.10}$$

Profits in sector 2 are given as follows

$$\pi_2 = p_2 q_2 - w_2^{\ell}(1+\tau)L_2^{\ell} - w^h(1+\tau)L_2^h \tag{6.11}$$

Firms are price takers in both sectors. We obtain the first order conditions for profit maximization of firms in sector 2

$$w_2^{\ell}(1+\tau) = p_2 A_2 L_2^{h^{\beta_2^h}} \beta_2^{\ell} L_2^{\ell^{\beta_2^{\ell}-1}} \tag{6.12}$$

$$w^h(1+\tau) = p_2 A_2 L_2^{\ell^{\beta_2^{\ell}}} \beta_2^h L_2^{h^{\beta_2^h - 1}} \tag{6.13}$$

Market clearing for good 1 implies:

$$L_1^{\ell} \cdot c_{11}^{\ell} + L_2^{\ell} \cdot c_{21}^{\ell} + (L_1^h + L_2^h) \cdot c_1^h + \Delta \cdot c_1^u = q_1 \tag{6.14}$$

Again we analyze the effects of GEB, PEB and MB in sector 2.

GEB and MB are calculated as before. Under PEB, the bargaining parties take into account the employment effect L_2^ℓ, the price effect p_2 (and thereby p) and the high-skilled employment effect L_2^h. For the high-skilled, the employment effect is now considered instead of the wage effect because of their mobility. The tax rate τ and the unemployment benefits ub as well as all other variables are again considered to stay constant by the bargaining agents. For the PEB case, this implies that the three equations that determine L_2^ℓ, L_2^h and p_2 (equations 6.12, 6.13, 6.14) are solved simultaneously (each depending on w_2^ℓ) and inserted in the objective function Γ. After that, the constants of the starting point equilibrium are inserted in the objective function, and now the wage w_2^ℓ is calculated, which maximizes Γ.

6.5.2 Results

We consider the same parameter constellation as in table (6.1) with $\overline{L}^h = 40$.

Figures 38 and 39 show the simulation results for PEB and GEB. Comparing the two figures, we see again that the wage associated with a PEB equilibrium lies above the wage under GEB. The reasons for this phenomenon are the same as in the high-skilled immobility case: from the GEB solution as starting point, the negative low-skilled employment effect is underestimated when agreeing on higher wages, whereas the positive price effect is overestimated. Due to the mobility of high-skilled workers the bargaining parties now calculate high-skilled employment effects instead of high-skilled wage effects in sector 2. But as we see in figure 40, also the high-skilled wage changes because of general equilibrium effects: When the low-skilled wage in sector 2 rises, less low-skilled workers are employed. This implies a decreasing marginal product of high skilled workers in sector 2. The high-skilled

workers are now mobile across industries and the high-skilled labor market is perfectly competitive. This means that the high-skilled wage in sector 2 cannot fall for the moment, but some high-skilled workers change from sector 2 into sector 1. So far the effects are taken into account by the bargaining parties. But the increasing high-skilled employment in sector 1 leads to a decreasing marginal productivity there. So the wages must fall which in turn implies that some of the high-skilled workers change back into sector 2, where the high-skilled wage declines as well. In equilibrium, the high-skilled wages in sector 2 decline (as well as in sector 1) and so high-skilled employment in sector 2 is higher than expected by the bargaining agents (see figure 41).

The MB case again leads to a wage agreement lower than under GEB. The reason is again that the positive price effect when agreeing on high wages is not considered (high wages lead to low employment, leading to low quantities and therefore a high price p_2).
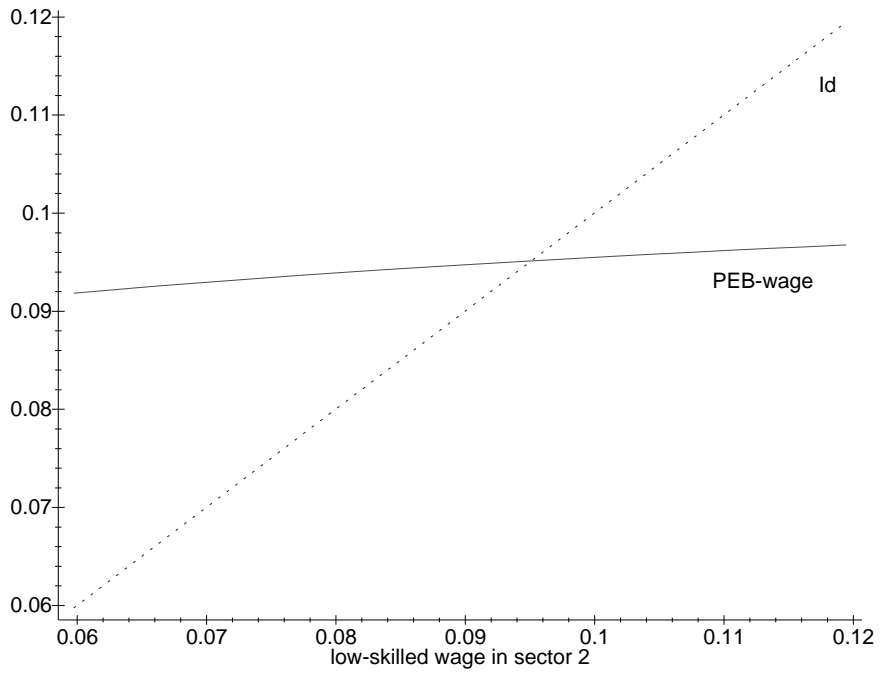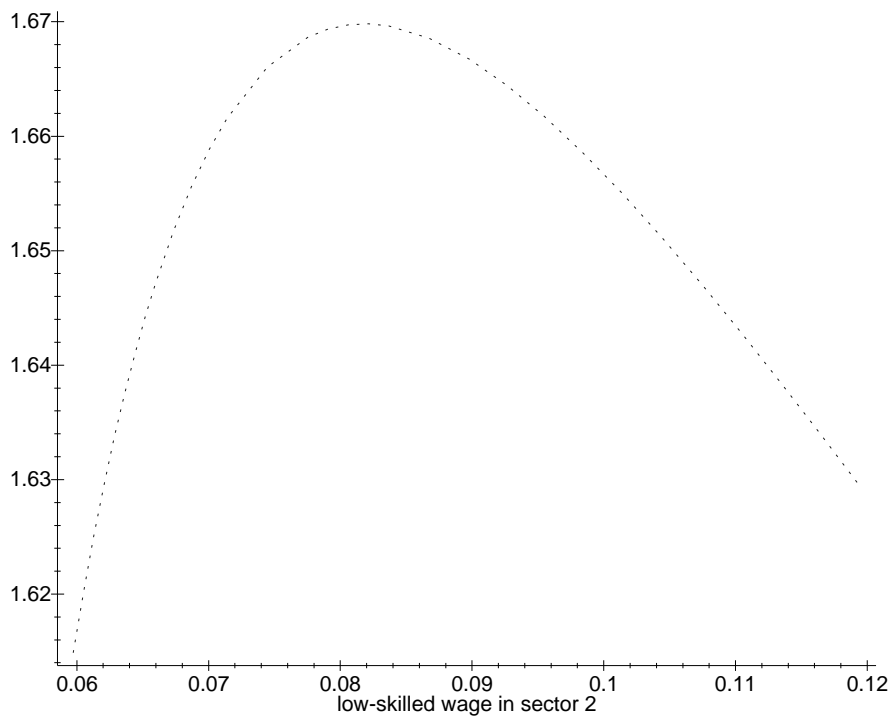
Figure 38: Convergence of PEB

Id

PEB-wage

low-skilled wage in sector 2

Figure 39: GEB Objective Function

low-skilled wage in sector 2

Figure 40: Wage High-Skilled

PEB

GEB

low-skilled wage in sector 2

Figure 41: High-Skilled Employment in Sector 2

GEB

PEB

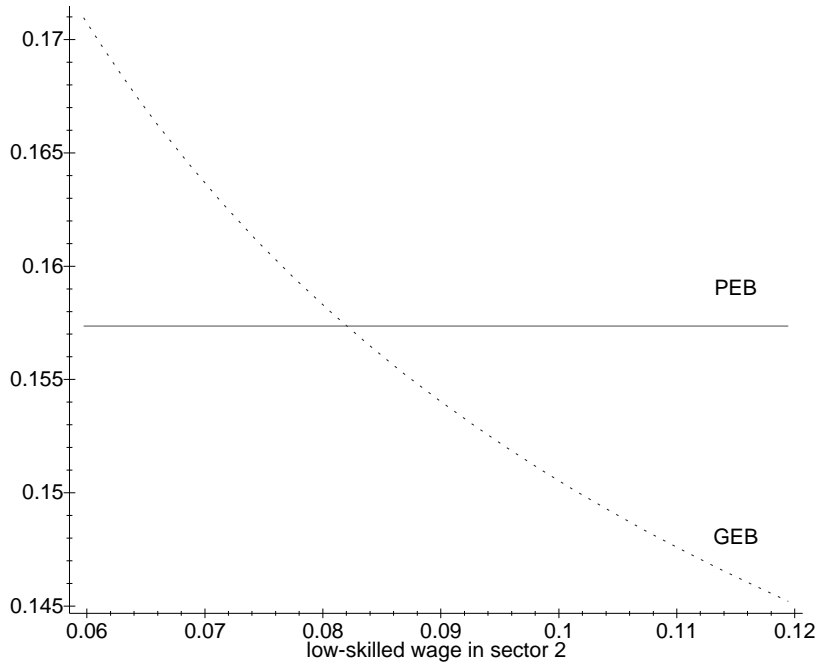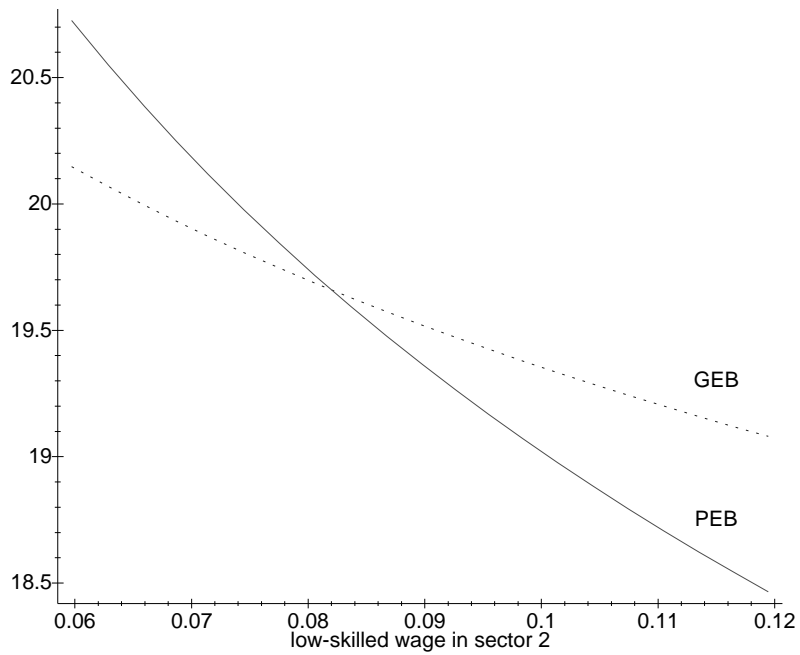low-skilled wage in sector 2

6.6 Extensions and Conclusions

We have amended our general equilibrium model in order to study how different learning abilities of agents affect wage negotiations and unemployment. We have shown that a partial equilibrium view of the economy leads to high wages and unemployment. In contrast, if employers associations and unions take all general equilibrium effects of the economy into account, this results in low wages and unemployment. The conclusions from this chapter provide an additional argument why industry sector specific collective wage agreements can be detremental for unemployment. However, the relationship between the extent to which feedback effects are taken into account and unemployment is not monotonical over the whole set of feedback effects. If bargaining parties were very myopic and would only take the direct employment effects of wages into account without recognizing changes in product prices etc., wages and unemployment would be lower compared to the outcome of the partial equilibrium view.

The results in this chapter have some similarities to a well known result of labor economics, namely the observance that in an economy with very decentralized wage negotitions wages and unemployment are rather low, in an economy with more centralized wage bargaining wages and unemployment are high, and in economies with totally centralized wage settings wages and unemployment are again low (see Calmfors and Driffill [1988]). We have compared different learning procedures for a given size of a sector while Calmfors and Driffill point out the fact that uncoordinated wage bargainings by many unions lead to high wages and unemployment since negative general equilibrium effects for each union are small. Overall, insufficient recognition of general equilibrium effects can explain, why we do not see more forceful move

to reforms in labor and product markets. Even when unions and employers react to general equilibrium effects by adaptive learn behavior they may end up with high wages and unemployment in wage bargaining procedures.

Chapter 7

Product Market Reforms with Wage Adjustments

7.1 Model

We now turn back to our starting point in chapter 2, namely the question if product market reforms can help to reduce unemployment. In chapter 2 we have found out that reducing mark-ups or increasing productivity in one sector reduces aggregate unemployment under most circumstances. Thereby we assumed the existence of a real wage rigidity that was binding for the low-skilled workers. In this chapter we want to analyze the implications of product market reforms for unemployment for endogenously set wages in the sector where the product market reforms take place. Do the employment gains of reducing mark-ups and increasing productivity remain when wages are determined by a wage bargaining procedure as discussed in chapter 6? To answer this question with our common model, it seems most realistic to use the **P**artial **E**quilibrium wage **B**argaining procedure (PEB). We proceed as follows: We calculate the PEB steady state equilibria for different mark-ups and total factor productivities in sector 2 and look at the consequences for

(un)employment. We analyze the two cases of a mobile and an immobile high-skilled labor force. Low-skilled workers are always immobile.

7.2 Results

The parameters for these simulations are the same as in chapter 6. We first analyze the *Imlow* case. In figure 42 we can observe that declining mark-ups are still positive for employment: The rise of low-skilled employment in both sectors when mark-ups are reduced remains. Due to the high negotiated wages in sector 2, the absolute level of unemployment is higher than it would be if sector 2 had the same real wage for low-skilled workers as sector 1. In particular, when mark-ups are 0, low-skilled employment in sector 2 is lower than in sector 1. High-skilled employment in sector 2 is lower than in sector 1 too, because of the marginal productivity effect. When mark-ups in sector 2 rise, low-skilled *and* high-skilled employment in sector 2 decreases. Low-skilled workers are dismissed because of the effects discussed in chapter 2, and some high-skilled workers change from sector 2 into sector 1. The change of high-skilled workers from sector 2 into sector 1 is due to the fact that marginal productivity of high-skilled workers in the second sector tends to fall more than in sector 1. This is caused by more dismissals of low-skilled workers in the non-competitive sector 2 than in sector 1.

We now examine the effects of a total factor productivity improvement in sector 2 on employment. The starting point in figure 43 is the same as in figure 42 (with A_2=1 and mark-ups=0). When total factor productivity in the second sector rises, low-skilled and high-skilled employment in that sector increases in the new steady states of PEB. Low-skilled employment in sector 1 increases as well, whereas high-skilled workers are changing partially

from sector 1 into sector 2.

In the $Imall$ case (figures 44 and 45) things are quite similar. Low-skilled employment in both sectors increases when mark-ups go down or productivity goes up. High-skilled employment does not change in either sector because of the workers' immobility.

In summary, the results suggest that the positive employment effects of product market reforms remain when wages are determined in a wage bargaining procedure.

Figure 42: Employment and Mark-ups (Imlow)

Legend:
- L_1^ℓ (solid line)
- L_2^ℓ (dotted line)
- L_1^h (circles)
- L_2^h (diamonds)

Mark-up in Sector 2 [%]
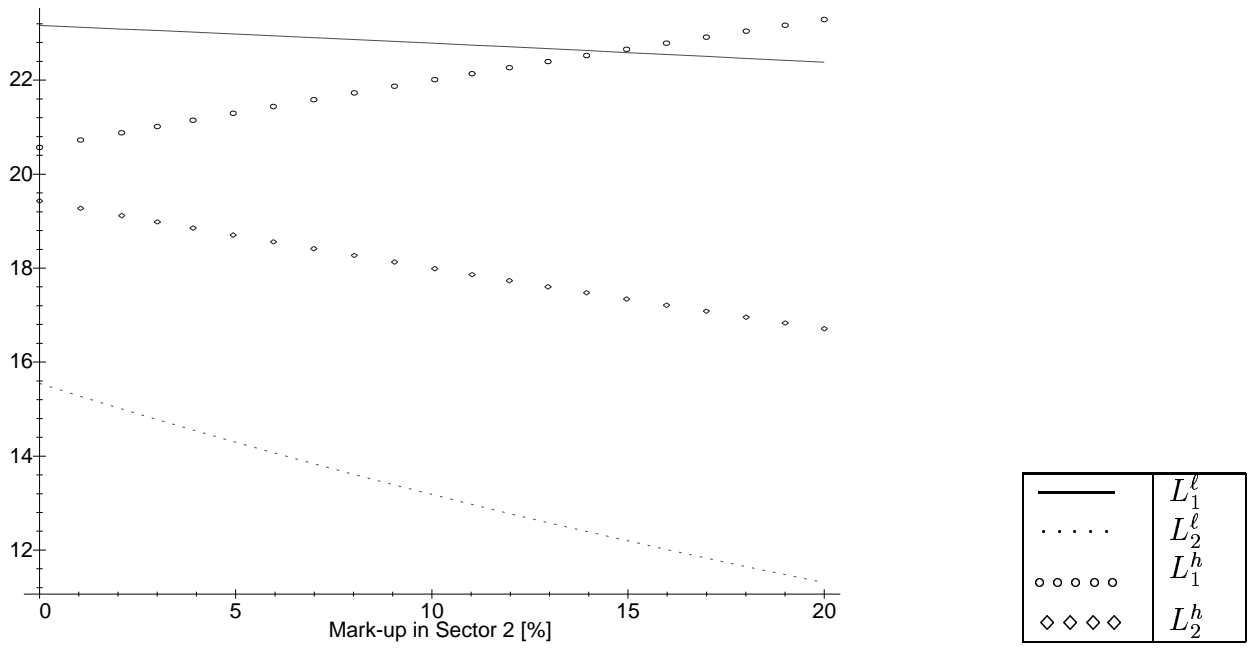
Figure 43: Employment and Productivity Improvement (Imlow)

Legend:
- L_1^ℓ (solid line)
- L_2^ℓ (dotted line)
- L_1^h (circles)
- L_2^h (diamonds)

Productivity Improvement in Sector 2 [%]
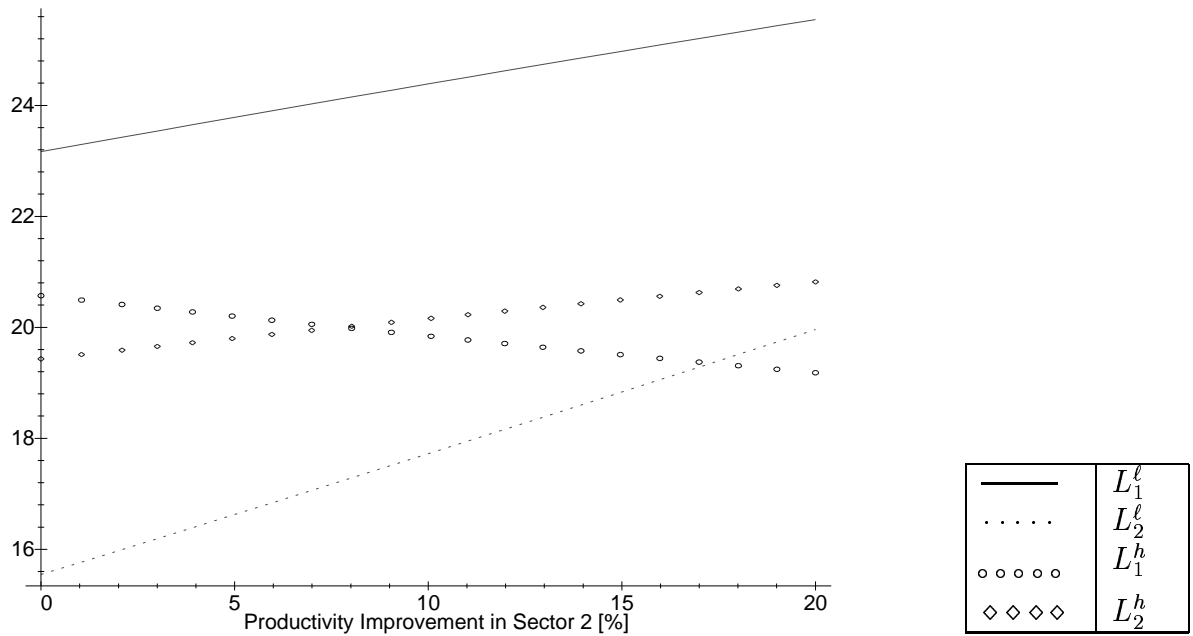
Figure 44: Employment and Mark-ups (Imall)

Mark-up in Sector 2 [%]

	L_1^ℓ
.....	L_2^ℓ
○ ○ ○ ○ ○	$L_{1/2}^h$
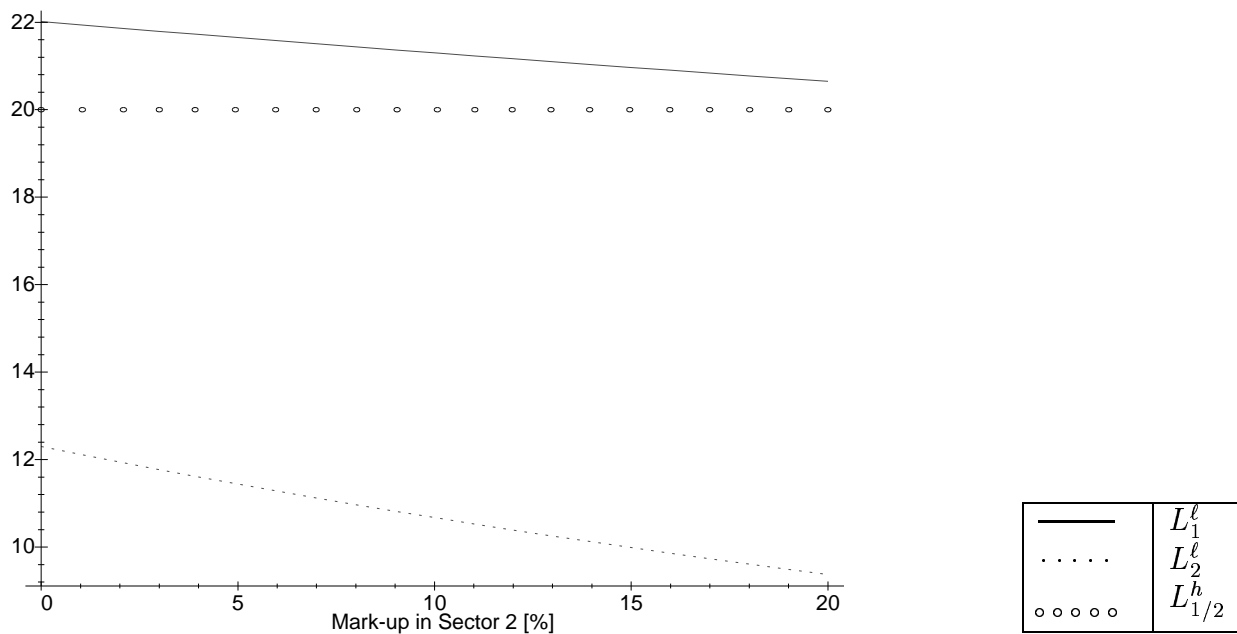
Figure 45: Employment and Productivity Improvement (Imall)

Productivity Improvement in Sector 2 [%]

	L_1^ℓ
.....	L_2^ℓ
○ ○ ○ ○ ○	$L_{1/2}^h$

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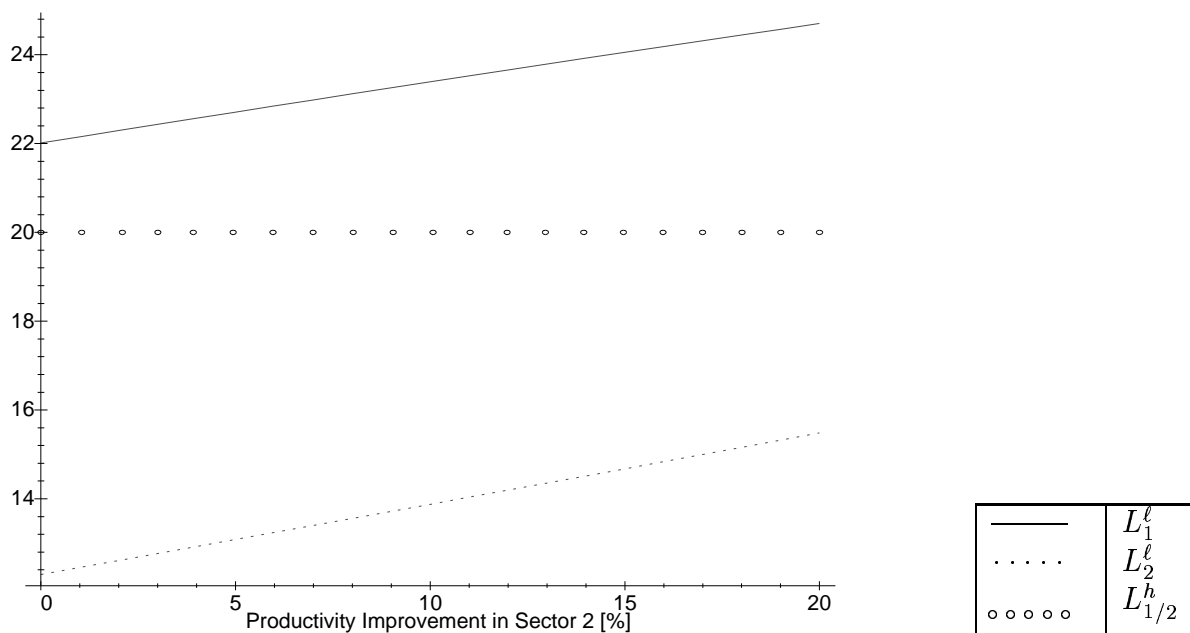
Chapter 8

Conclusion

The starting point of this thesis was the question whether product market reforms could help to reduce unemployment in Europe. Do reforms such as the deregulation of the market for telecommunication or energy in Germany that increase competition affect aggregate employment positively or negatively? This question was analyzed in this thesis using a general equilibrium model with simultaneous rigidities in product markets and labor markets. In particular, we have examined how declining mark-ups and increasing productivity in one sector as consequences of increasing competition affect aggregate unemployment for a given minimum real wage. We have found out that the impact of declining mark-ups on employment is always positive. The impact of productivity improvements on employment is positive under many circumstances, but there are some important exceptions. Particularly, aggregate unemployment can increase when the elasticity of substitution between consumption goods is small and no further workers in the remaining industries can be employed. The latter can happen in the following situations: First, workers are immobile and there is already full employment in other sectors. Second, production factors of the remaining industries (in our model low-skilled and high-skilled labor) are strong complements and high skilled-

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labor is fully employed, so that further employment of low-skilled workers would decrease their marginal productivity such that the real reservation wage becomes immediately binding. However, it seems reasonable that for most European countries such constellations are not the rule and product market reforms would have a positive impact on aggregate employment. A rough estimate by Gersbach (Gersbach 1999) based on data of the McKinsey Global Institute (McKinsey Global Institute 1997) finds a reduction of unemployment in France and Germany by at least 1.5 percentage points for the economic situation in 1995. Thus, deregulations towards more competitive product markets should be of no concern for economic policy with respect to their consequences for unemployment.

For the analysis of our starting point we have used aggregate production functions to examine the impact of decreasing mark-ups and improving productivity in one sector on aggregate unemployment. In the next step of the thesis we have provided a microfoundation of imperfect product market competition. While modeling imperfect competition à la Cournot in a general equilibrium framework, we have encountered some delicate conceptual issues. The most crucial question is, which general equilibrium effects associated with a certain quantity choice the firm takes into account. We have distinguished two cases: First, we have assumed that firms consider only the price effect of a certain quantity choice, taking all other variables as given. This corresponds to the industrial organization literature, where imperfect competition is usually analyzed in partial models. We have shown that this type of imperfect competition can be modeled as a learning process of a myopic firm which leads to a steady state where the optimal quantity choice is consistent with its (general equilibrium) environment. The second possibility is the case where *all* general equilibrium effects are incorporated by a firm,

so that its quantity choice remains optimal when markets clear. We have shown that for a given minimum real wage the (employment) outcomes of the two types of firm behavior generally differ. Labor force immobility between sectors yields higher employment in the steady state under the myopic view than under the general equilibrium view of firms. In contrast, when labor is mobile, the view where all general equilibrium effects are considered by firms leads to higher employment.

As an application of the microfoundation of mark-ups within a general equilibrium environment we have investigated the impact of mergers of firms on unemployment. We have shown that even when mergers have a positive effect on productivity, this may be overcompensated by an increasing mark-up effect so that unemployment will increase. Consensus for rising unemployment in the presence of mergers can therefore be justified.

In the next step of the thesis we have provided a microfoundation of imperfect competition in labor markets. We have analyzed wage bargaining between a union and an employers' association. Again, such a modeling of imperfect competition in a general equilibrium framework leads to the question of which general equilibrium effects are taken into account by the bargaining parties when negotiating wages. We have differentiated between three degrees of sophistication of the bargaining agents: First, we have assumed that only the direct employment consequences of a certain wage contract are considered whereas all other variables are taken as given. Second, we have analyzed the more sophisticated case where not only the employment effect but also changes of all other variables in the sector are incorporated by agents. Finally, we had a look at the case where *all* general equilibrium effects are taken into account by the wage bargaining parties. We have demonstrated that the first two cases can be modeled as a learning

process which leads to a steady state analogous to the modeling of imperfect product market competition. We have shown that the extreme myopic view (the first case) leads to low wages and high employment in the steady state, the intermediate view (second case) leads to high wages and correspondingly low employment, and the far-sighted general equilibrium view leads again to moderate wages and high employment. Thus we have obtained an analogy to the results of Calmfors and Driffill (Calmfors and Driffill 1988) who have received a similar pattern of real wages and aggregate employment depending on the degree of centralization of wage bargaining procedures. Calmfors and Driffill argued that the good labor market performance associated with a high degree of bargaining centralization results from the fact that agents take into account the bad macroeconomic effects of high wages. This corresponds to our case of considering all general equilibrium effects when unions and employers' federations set wages. The other extreme of firm level wage bargaining corresponds to our extreme myopic view, i.e. agents assume a rather competitive kind of labor market, where variables are taken as given. The intermediate case of Calmfors and Driffill, i.e. industry level wage bargaining is comparable to our intermediate case where some general equilibrium effects are considered, but most are not. For Germany it is often recommended that industry level wage bargaining should be replaced by a more decentralized system. Our findings about wage negotiations are in favor of that argument, if we consider the assumption that all general equilibrium effects are taken into account as implausible. However, there are also authors arguing that Insider-Outsider aspects are more pronounced at the firm level than at the industry level, so that the superiority of decentralized bargaining over industry level negotiations is questionable (Fitzenberger and Franz 1999). Correspondingly, further research is necessary in order to find out the

appropriate way in which wage negotiations in European countries should be reformed in order to improve the employment situation.

In the final part of the thesis we have returned again to our starting point. We have investigated the impact of product market reforms on unemployment if (real) wages are not given exogenously but are negotiated in a wage bargaining process as discussed above. For an intermediate wage setting view, which we consider as the most realistic model for wage bargaining in Germany, the positive impact of product market reforms on employment generally remains, apart from the extreme constellations considered at the beginning of the thesis. This result strengthens the policy recommendation that product market reforms towards more competition are positive from an employment perspective.

The thesis offers some avenues for future research. First of all, it seems desirable to find out conceptually the impact of further types of (uneven) productivity improvements like labor saving or capital saving technical progress on unemployment. In parallel, a complete picture about the interaction of uneven productivity improvements and elasticities of substitution as well as income elasticities of demand should be established. This would enhance our understanding of how improvements in one sector (for instance due to deregulations) influence the whole economy. In order to get more certainty about the impact of uneven productivity improvements on unemployment it is necessary to *estimate* elasticities for the industries where product market reforms have the highest potential.

The microfoundation of imperfectly competitive markets where firms compete à la Cournot has demonstrated that economic outcomes can depend strongly on the extent how general equilibrium effects are taken into account by the agents. Under Bertrand competition, however, this is not the case

since the differences between the outcomes of the myopic partial equilibrium view and the far-sighted general equilibrium view will disappear. In order to improve our understanding about how imperfect competition in a general equilibrium environment works and affects outcomes, the study of further types of product market competition is needed. In particular, it would be helpful to understand how other types of competition affect the comparison between the partial equilibrium view and the general equilibrium view. Another interesting aspect could be to model *perfect* competition as a learning process, too. Moreover, by allowing for changes in the economy, e.g. due to technology shocks, the relative performance of the different types of competition in such a *dynamic* framework could be studied.

In our analysis of wage negotiations similar research questions as in the modeling of imperfect product market competition occur. For instance, how do other types of wage setting such as efficiency wages affect the economy in general equilibrium? How do the results depend on which variables of the economy are taken into account by agents? What happens when the learning process of a particular bargaining procedure interacts with exogenous (technological) shocks? Are the two extreme views still better than the intermediate view in terms of employment? We hope that the present thesis has created a conceptual framework and first results to motivate others to follow these avenues of research.

Bibliography

[1] d'Aspremont, C. et al.: "Imperfect Competition, General Equilibrium", in Kirman, Alan and Gèrard-Varet, Louis-Andrè: Economics Beyond The Millenium, *Oxford University Press*, Oxford

[2] Alogoskoufis, G., C. Bean, G. Bertola, D. Cohen, J. Dolado, G. Saint-Paul (1996): "Unemployment: Choices for Europe", *Centre for Economic Policy Research.*

[3] Baily, M. N., Gersbach, H. (1995): "Efficiency in Manufactoring and the Need for Global Competition", *Brooking Papers on Economic Activity: Microeconomics*, 307-358.

[4] Baumol, W.J. (1967): "Macroeconomics of Unbalanced Growth: The Anatomy of Urban Crisis", *The American Economic Review*, 3, pp. 415-426

[5] Bean, Charles R. (1994): "European Unemployment: A Survey", *Journal of Economic Literature*, Vol.XXXII, pp. 573-619.

[6] Blanchard, O. (1998): "The Economics of Post-Communist Transition", *Clarendon Press*, Oxford

[7] Blanchard, O. J., Summers, L. H. (1986): "Hysteresis and the European Unemployment Problem", *NBER, Macroeconomics Annual*, 1, pp. 15-78.

[8] Burda, M. (1988): "Wait Unemployment in Europe", *Economic Policy*, 393-425.

[9] Burda, M., Wyplosz C. (1994): "Gross Job and Worker flows in Europe", *European Economic Review*, 38, 1287-1315.

[10] Calmfors, L., J. Driffill (1988): "Bargaining Structure, Corporatism and Macroeconomic Performance", *Economic Policy*, 6, 14-61.

[11] Coe, D. T. and Snower, D.J.(1997): "Policy Complementaries: The Case for Fundamental Labor Market Reform", *IMF Staff Papers*, Vol.44, No. 1.

[12] Cohen, D. and Saint-Paul, G. (1997): "Uneven Technical Progress and Job Destructions", mimeo

[13] Dixon, H.D., Rankin (1995): "The New Macroeconomics: Imperfect Markets and Policy Effectiveness", *Cambrdige University Press*, Cambridge, UK.

[14] Fitzenberger, B. and Franz, W (1999): "Industry Level Wage Bargaining: A Partial Rehabilitation", *Working Paper*, ZEW Mannheim

[15] Franz W. (eds) (1995): "Theoretische Ansaetze zur Erklaerung der Arbeitslosigkeit: Wo stehen wir 1995?", Working Paper, CILE, Konstanz.

[16] Freeman, R.B. (ed.) (1994): "Working under different Rules", *National Bureau of Economic Research*, Russel Sage Foundation, New York.

[17] Fudenberg, D., Levine, D.K. (1998): "Theory of Learning in Games", *Draft*, September 24, 1998

[18] Gabszewicz, J., Vial, J.-Ph. (1972):"Oligopoly à la Cournot in General Equilibrium Analysis", *Journal of Economic Theory*, 4, 381-400

[19] Gabszewicz, J. (1999): "General Equilibrium Economics: Allowing for Imperfect Competition", in Kirman, Alan and Gèrard-Varet, Louis-Andrè: Economics Beyond The Millenium, *Oxford University Press*, Oxford

[20] Giersch H. (eds) (1996): "Fighting Europe's Unemployment in the 1990s", Springer, Berlin, Heidelberg.

[21] Gerowski, P. (1996): "Market Imperfections and Employment", *OECD Economic Studies*, No. 26, 1996/1.

[22] Gersbach, H. (1996): "Product Market Competition, Unemployment and Income Disparities", Working Paper, University of Heidelberg.

[23] Gersbach, H. and Sheldon, G. (1996): "Structural Reforms and their Implications for Macroeconomic Policies", *OECD Proceedings*, pp.131-167.

[24] Gersbach, H. and Schniewind, A. (1999): "Can Product Market Reforms Help to Reduce Unemployment in Europe?", *Working Papers*, University of Heidelberg

[25] Gersbach, H. and Schniewind, A. (1999): "Learning of General Equilibrium Effects and the Unemployment Trap", *Working Papers*, University of Heidelberg

[26] Gersbach, H. and Schniewind, A. (1999): "Imperfect Competition, General Equilibrium and Unemployment", *Working Papers*, University of Heidelberg

[27] Gersbach, H. (1999): "Promoting Product Market Competition to Reduce Unemployment in Europe: An Alternative Approach?", *mimeo*, University of Heidelberg

[28] Ginsburgh, V. and Keyzer, M. (1997): "The Structure of Applied General Equilibrium Models", *The MIT Press*, Cambridge, Massachusetts, London, England

[29] Hall, R. (1990): "Invariance properties of Solow's residual", in P.Diamond (ed.): *Growth, productivity and employment*, MIT Press.

[30] Kaas, L. (1999): "Dynamic Macroeconomics with Imperfect Competition", *Springer-Verlag*, Berlin, Heidelberg, New York

[31] Keynes, J. M. (1936): "The General Theory of Employment, Interest and Money", *Macmillan*, London

[32] Krugman, P. (1994): "Past and Prospective Causes of High Unemployment", in *Reducing Unemployment: Current Issues and Policy Options, A Symposium Sponsored by the Federal Reserve Bank of Kansas City, Wyoming*, 49-80.

[33] Layard, R., S.Nickell and R.Jackman (1991): "Unemployment", *Oxford University Press*, Oxford.

[34] Leonard, J. S. and Audenrode, M.V. (1993): "Corporatism run amok: job stability and industrial policy in Belgium and the United States", *Economic Policy*.

[35] Lindbeck, A. and Snower, D.J. (1995): "Restructuring Production and Work", *Centre for Economic Policy Research*.

[36] Lindbeck, A. and Snower, D.J. (1996): "Reorganisation of Firms and Labor Market Inequality", *Centre for Economic Policy Research.*

[37] Lindbeck, A. (1996): "The West European Employment", *Weltwirtschaftliches Archiv, 609-637.*

[38] McKinsey Global Institute (1995): "Employment Performance", *Washington.*

[39] McKinsey Global Institute (1997): "Removing Barriers to Growth and Employment in France and Germany", *Frankfurt, Paris, Washington.*

[40] Mankiw, N.G., Romer, D.: "New Keynsian Economics", Vol.1 and 2, MIT Press, Cambridge Massachusetts, 1991.

[41] Manzini, P (1998): "Game Theoretic Models of Wage Bargaining", *Journal of Economic Surveys.*

[42] Martins, J.O., Sarpetta, S. and Pilat, D. (1996): "Mark-ups of Prices over Marginal Costs for 14 OECD Countries", OECD Economics Department, Working Paper *OECD.*

[43] Minford, P. (1995): "Unemployment in the OECD and Its Remedies", in *H. Giersch: Fighting Europe's Unemployment in the 1990s*, Springer-Verlag, Berlin, Heidelberg.

[44] Nickell, S. (1997): "Unemployment and Labor Market Rigidities: Europe versus North America", *Journal of Economic Perspectives*, Vol. 11, 55-75.

[45] Nickell, S. (1998): "Product Markets and Labour Markets", in *Adam Smith Lecture*, European Association of Labor Economists Congress, Blankenberge, Belgium

[46] OECD (1995): "The OECD Jobs Study: Investment, Production and Employment", *OECD*, Paris.

[47] OECD (1997): "The OECD Report on Regulatory Reform, Vol.I and II, *OECD*, Paris.

[48] Oswald, A. (1996): "A Conjecture on the Explanation for High Unemployment in the Industrialised Nations: Part 1", *Warwick Economic Research Papers*, No. 475, University of Warwick.

[49] Paque, K.-H., (1995): "Unemployment and the Crisis of the German Model: A Long-Term Interpretation", in *H. Giersch: Fighting Europe's Unemployment in the 1990s*, Springer-Verlag, Berlin, Heidelberg.

[50] Piketty, T. (1998): "Can Fiscal Redistribution Undo Skill-Biased Technical Change? Evidence from the French Experience", in *"Explaining the Evolution of Income Inequality"* , European Economic Association Congress, Berlin

[51] Siebert, H. (1997): "At the Root of Unemployment in Europe", *Journal of Economic Perspectives*, Vol. 11, 37-55.

[52] Saint-Paul, G. (1994): "Searching for the Virtues of the European Model", *Centre for Economic Policy Research*, Discussion Paper, 950, 1994/5.

[53] Saint-Paul, G. (1995): "Some Political Aspects of Unemployment", *European Economic Review*, 39, 575-582.

[54] Snower, Dennis J. (1993): "Why People Don't Find Work", *Centre for Economic Policy Research*, Discussion Paper, 883, 1993/12.

[55] Sutton, J. (1991): "Sunk Costs and Market Structure", *MIT Press*, Cambridge, Massachusetts.

[56] Tirole, J. (1988): "The Theory of Industrial Organization", *MIT Press*, Boston.

[57] Young, H.P. (1997): "Microstrategy and Macrostructure", *Draft*, May 15, 1997.

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