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## **Product Market Reforms and Unemployment in Europe**

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February 2001

# Product Market Reforms and Unemployment in Europe

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## **ABSTRACT**

### **Product Market Reforms and Unemployment in Europe<sup>\*</sup>**

In this paper we study how promoting product market competition by reducing mark-ups or by increasing productivity are able to complement labor market reforms. We use a simple general equilibrium model with different types of labor. The bottom-line of the paper 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.

JEL Classification: D58, E24, J60, L13

Keywords: Product market competition, unemployment, mobility of labor force, political support for reforms

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# 1 Introduction

Should Europe reform its product markets in order to reduce unemployment? In this paper we will argue that product market reforms through the reduction of mark-ups or the increase of productivity are able to complement labor market reforms in combating unemployment.

Long-term unemployment is associated with acutely low levels of well-being. Explaining and solving the secular rise in unemployment in Europe has proved difficult, however. A lot of proposals for combating European unemployment, including the OECD job study, call for extensive deregulation in the direction of a US-style labor market.<sup>1</sup> It is well known that the employment record in the U.S. was markedly better than that of Western Europe. In particular, the United States have created significantly more market services jobs than any of the European economies in order to employ its growing labor force.

However, the discussion of fundamental labor reforms are overshadowed by the fear that an “American model” of the labor market would achieve full employment only at the cost of large income inequalities and the destruction of social cohesion. Thus, current regulations in the labor market are sometimes justified by socially desirable redistributive goals.

In order to complement labor market reforms, some authors have recently suggested that product market reforms could be helpful to reduce unemployment in Europe [see McKinsey Global Institute 1995, McKinsey Global Institute 1997].<sup>2</sup> As demonstrated in a number of studies, product markets in a variety of Europe’s industries function significantly different than in the U.S. Since labor demand originates from firm behavior in the product market, it is possible that frictions in the product market can inhibit the redeployment of workers and hence contribute to unemployment.

In this paper, we examine how product market reforms aimed at increasing competition in product markets can complement labor market reforms. We also examine why political forces may be against the deregulation of product markets. The bottom line of the paper is that product market reforms will help to reduce unemployment under many circumstances. If, however, the ability of low and high-skilled employees to work in different industries is relatively small, large political resistance can make product market reforms inviable.

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<sup>1</sup> Others are more cautious and only advocate the removal of some specific rigidities while preserving some of the beneficial labor market institutions in Europe [e.g. Freeman 1994]. Incremental reforms are considered to be crucial in the areas of the duration of unemployment benefits, active labor policies and the reduction of real wages for low-skilled people.

<sup>2</sup> See also Gersbach and Sheldon 1996. Moreover, the study by Leonard and Audenrode 1993 additionally suggests that government policies in Europe of subsidizing declining industries by a tax on growing firms are likely to reduce labor demand and, with rigid wages, increase unemployment.

We examine a simple general equilibrium model with two types of labor, low and high-skilled, and two sectors. The novelties of our analysis are explicit considerations of a number of general equilibrium effects when product market reforms occur in the presence of labor market rigidities.<sup>3</sup> 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 reduce aggregate unemployment if workers are mobile across sectors. The same also holds 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 sectoral unemployment. Fourth, aggregate unemployment increases only if unemployment is concentrated in the sector in which the productivity improvements occur.

To develop the results, the paper is organized as follows: In the next section we relate our paper to the literature on 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 the 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 mark-ups or through the increase of productivity lowers 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 additionally allow 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

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<sup>3</sup> The impact of changes in mark-ups on unemployment and income distribution for a high elasticity of substitution has been examined in Gersbach 1996.

industries, employment in the industry in which the productivity improvement takes place may decrease for small elasticities 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 in which 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.

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

## 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, Dolado 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.<sup>4</sup> 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 identified market power with aggregate data [e.g. Hall 1990]. There is large literature which identifies market

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<sup>4</sup> 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 rise of home-ownership has reduced workers' mobility and may thereby raise the equilibrium rate of unemployment.

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 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 these costs.

Alternatively, imperfect competition can result in low total factor productivity. As discussed in a series of papers based on productivity studies at the McKinsey Global Institute (Baily 1993, Baily and Gersbach 1995, Börsch-Supan 1999, Gersbach and Sheldon 1996), product market reforms in Europe have the potential to foster total factor productivity gains in a variety of industries. Also OECD (1997), Caves and associates (1992), Green and Mayes (1991), Hay and Liu (1997) and Nickell (1996 and 1999) provide evidence that productivity levels or growth rates are on average negatively correlated with market power.<sup>5</sup> Thus, increasing competition may not only result in lower markups, but can also cause productivity improvements by inducing organizational and design changes. An overview of the potential impact of regulatory reform in product markets in Europe can be found in OECD (1997).<sup>6</sup>

However, as it is well known, the presence of market power or productivity gaps only leads to unemployment if frictions exist elsewhere. 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 rises only if labor market frictions are present simultaneously. 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

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<sup>5</sup> The ongoing changes in production technologies can be interpreted as a third paradigm, sometimes called agile production, which replaces craft or mass production to some extent (see Baily and Gersbach 1995). The transition towards a new production paradigm has potentially large effects on wage and employment by raising the wage and job opportunities of some workers relative to others (see e.g. Lindbeck and Snower 1995, Lindbeck and Snower 1996).

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wages are binding. The general equilibrium effects explored in this paper complement the important insights explored in Nickell (1999) about how monopoly power in the product market badly impacts on the performance of the labour market. He points to the strong evidence of the sharing of monopoly rents and of higher wages associated with market power.<sup>7</sup>

Our paper focuses 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.<sup>8</sup> 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. Moreover, Anderson [2000] highlights that product market integration in Europe may lead to a more unequal distribution of wages and employment, even though there are aggregate gains in terms of higher real incomes and employment. Gersbach [2000] provides a survey on whether product market reforms could help to reduce unemployment in Europe.

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

Finally, our paper 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 internalize complementarities across reform steps. However, such programs remain unstable against the formation of coalitions lobbying for specific exemptions. Nevertheless, product market reforms may lower the bias towards the status quo in democracies [see Gersbach 1993] with respect to labor market reforms.

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<sup>7</sup> 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.

<sup>8</sup> 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].

### 3 Model and Equilibrium without Frictions

In this section we develop a simple model to analyze the effects of product market reforms on unemployment. It is an applied general equilibrium model that incorporates different types of labor and two sectors. Later on we will focus on the effects of a real wage rigidity, market power and different degrees of mobility of the labor force on unemployment. The model belongs to the large sample of applied general equilibrium models surveyed in Ginsburgh and Keyzer [1997]. However, none of these models addresses the interaction of product market reforms and 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:

$$q_1 = A_1 L_1^{\ell\beta_1^\ell} L_1^{h\beta_1^h} \quad (1)$$

$$q_2 = A_2 L_2^{\ell\beta_2^\ell} L_2^{h\beta_2^h} \quad (2)$$

Subscripts 1 and 2 denote the first and second sector, respectively.  $h$  and  $\ell$  denote the workers' skill level. 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  $\bar{L}^\ell$  and  $\bar{L}^h$  and overall labor supply amounts to  $\bar{L} = \bar{L}^\ell + \bar{L}^h$ . We assume that labor is supplied inelastically.<sup>9</sup>

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

$$u = \left( \alpha_1 \cdot c_1^{\frac{\sigma-1}{\sigma}} + \alpha_2 \cdot c_2^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}} \quad (3)$$

$c$  denotes the corresponding consumption levels, whereas  $\sigma$  denotes the elasticity of substitution between consumption good 1 and 2. We assume 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.<sup>10</sup> The feedback from profits to wages will be an essential ingredient of our analysis.

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<sup>9</sup> 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.

<sup>10</sup> 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.

### 3.1 The System of Equations

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

$$p_1 = 1 \quad (4)$$

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

$$c_1 = \frac{b}{p_1 + p_2 \left( \frac{p_1 \alpha_2}{p_2 \alpha_1} \right)^\sigma} \quad (5)$$

$$c_2 = \frac{b}{p_2 + p_1 \left( \frac{p_2 \alpha_1}{p_1 \alpha_2} \right)^\sigma} \quad (6)$$

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

$$b^\ell = w^\ell \Rightarrow c_1^\ell, c_2^\ell \quad (7)$$

$$b^h = w^h + (\pi_1 + \pi_2)/(L_1^h + L_2^h) \Rightarrow c_1^h, c_2^h \quad (8)$$

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:

$$\pi_1 = p_1 q_1 - w^\ell L_1^\ell - w^h L_1^h \quad (9)$$

$$\pi_2 = p_2 q_2 - w^\ell L_2^\ell - w^h L_2^h \quad (10)$$

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

$$w^\ell = A_1 L_1^{h\beta_1^\ell} \beta_1^\ell L_1^{\ell\beta_1^\ell-1} \quad (11)$$

$$w^h = A_1 L_1^{\ell\beta_1^\ell} \beta_1^h L_1^{h\beta_1^\ell-1} \quad (12)$$

$$w^\ell = p_2 A_2 L_2^{h\beta_2^\ell} \beta_2^\ell L_2^{\ell\beta_2^\ell-1} \quad (13)$$

$$w^h = p_2 A_2 L_2^{\ell\beta_2^h} \beta_2^h L_2^{h\beta_2^h-1} \quad (14)$$

Market clearing for good 1 implies:

$$(L_1^\ell + L_2^\ell)c_1^\ell + (L_1^h + L_2^h)c_1^h = q_1 \quad (15)$$

Labor market clearing is defined by

$$\overline{L}^\ell = L_1^\ell + L_2^\ell \quad (16)$$

$$\overline{L}^h = L_1^h + L_2^h \quad (17)$$

The system for determining the equilibrium consists of the equations:

4, 7, 8, 11, 12, 13, 14, 15, 16, 17. The unknown variables are:

$w^\ell, w^h, L_1^\ell, L_2^\ell, L_1^h, L_2^h, p_1, p_2, c_1^\ell, c_2^\ell, c_1^h, c_2^h$ .

## 4 Equilibrium with Frictions in Labor and Product Markets

### 4.1 Real Wage Rigidity and Unemployment Insurance

In this section we introduce 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  $\frac{w^\ell}{p}$  when no frictions are present. If  $\overline{rw}$  exceeds  $\frac{w^\ell}{p}$ , it becomes binding and unemployment occurs.  $w^\ell$  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 a flat rate, denoted by  $\tau$ , to finance benefits for the unemployed workers.<sup>11</sup>

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  $\Delta$ , given by:

$$\Delta = \overline{L}^\ell - L_1^\ell - L_2^\ell \quad (18)$$

The government's budget constraint implies that

$$(w^\ell(L_1^\ell + L_2^\ell) + w^h(L_1^h + L_2^h)) \cdot \tau = ub \cdot \Delta \quad (19)$$

There are two ways of determining the consumption levels of low-skilled workers. At one extreme, one can assume that the employed earn wages  $w^\ell$  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.

### 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.

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<sup>11</sup> If taxation were not distortionary, full employment and any distributional goal could be achieved by an appropriate tax scheme. Hence, the impossibility of eliminating real wage rigidities can either be explained by tax distortions or by political factors.

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 some firms to exert market power and to set prices above marginal costs. Specifically, we assume that this is the case in sector 2. We denote by  $m$  the mark-up that 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 facing an upper limit on mark-ups enforced by competition policy or by regulation. While a concrete micro-foundation 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:

$$p_2 = (1 + m) \cdot \text{marginal costs} \quad (20)$$

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 opened for other competitors. The remaining problem for the firms in sector 2 is to choose cost-minimizing input combinations.<sup>12</sup>

### 4.3 The System of Equations

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

$$c_1 = \frac{b}{p_1 + p_2 \left( \frac{p_1}{p_2} \frac{\alpha_2}{\alpha_1} \right)^\sigma} \quad (21)$$

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<sup>12</sup> 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. There are, however, 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.

$$c_2 = \frac{b}{p_2 + p_1 \left( \frac{p_2 \alpha_1}{p_1 \alpha_2} \right)^\sigma} \quad (22)$$

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

$$b^\ell = w^\ell \Rightarrow c_1^\ell, c_2^\ell \quad (23)$$

$$b^h = w^h + (\pi_1 + \pi_2)/(L_1^h + L_2^h) \Rightarrow c_1^h, c_2^h \quad (24)$$

$$b^u = ub \Rightarrow c_1^u, c_2^u \quad (25)$$

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.

$$\pi_1 = p_1 q_1 - w^\ell(1 + \tau)L_1^\ell - w^h(1 + \tau)L_1^h \quad (26)$$

$$\pi_2 = p_2 q_2 - w^\ell(1 + \tau)L_2^\ell - w^h(1 + \tau)L_2^h \quad (27)$$

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

$$w^\ell(1 + \tau) = p_1 A_1 L_1^h \beta_1^\ell L_1^{\ell \beta_1^\ell - 1} \quad (28)$$

$$w^h(1 + \tau) = p_1 A_1 L_1^{\ell \beta_1^\ell} \beta_1^h L_1^{h \beta_1^h - 1} \quad (29)$$

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

$$\frac{L_2^\ell}{L_2^h} = \frac{\beta_2^\ell w^h}{\beta_2^h w^\ell} \quad (30)$$

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

$$E_2 = A_2^{-\frac{1}{\beta_2^\ell + \beta_2^h}} \left[ \left( \frac{\beta_2^\ell}{\beta_2^h} \right)^{\frac{\beta_2^h}{\beta_2^\ell + \beta_2^h}} + \left( \frac{\beta_2^h}{\beta_2^\ell} \right)^{-\frac{\beta_2^\ell}{\beta_2^\ell + \beta_2^h}} \right] \quad (31)$$

$$\left( w^\ell (1 + \tau) \right)^{\frac{\beta_2^\ell}{\beta_2^\ell + \beta_2^h}} \left( w^h (1 + \tau) \right)^{\frac{\beta_2^h}{\beta_2^\ell + \beta_2^h}} q_2^{\frac{1}{\beta_2^\ell + \beta_2^h}}$$

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

$$p_2 = (1 + m) \cdot \frac{\partial E_2}{\partial q_2} \quad (32)$$

$\frac{\partial E_2}{\partial q_2}$  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:

$$(L_1^\ell + L_2^\ell) c_1^\ell + (L_1^h + L_2^h) c_1^h + \Delta c_1^u = q_1 \quad (33)$$

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:

$$\overline{L}^h = L_1^h + L_2^h \quad (34)$$

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

$$p = \left[ \left( \frac{\alpha_1^\sigma}{\alpha_1^\sigma + \alpha_2^\sigma} \right) \cdot p_1^{(1-\sigma)} + \left( \frac{\alpha_2^\sigma}{\alpha_1^\sigma + \alpha_2^\sigma} \right) p_2^{(1-\sigma)} \right]^{\left( \frac{1}{1-\sigma} \right)} \quad (35)$$

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:

$$w^\ell = \overline{r} \overline{w} \cdot p \quad (36)$$



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

$$ub = s \cdot \overline{rw} \cdot p \quad (37)$$

Unemployment is given by:

$$\Delta = \overline{L}^\ell - L_1^\ell - L_2^\ell \quad (38)$$

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:

$$((w^\ell(L_1^\ell + L_2^\ell) + w^h(L_1^h + L_2^h)) \cdot \tau = ub \cdot \Delta \quad (39)$$

The equilibrium is determined by the system of equations 4, 23, 24, 25, 28, 29, 30, 32, 33, 34, 35, 36, 37, 38, 39. The unknown variables are  $w^\ell$ ,  $w^h$ ,  $ub$ ,  $L_1^\ell$ ,  $L_2^\ell$ ,  $L_1^h$ ,  $L_2^h$ ,  $p1$ ,  $p2$ ,  $p$ ,  $c_1^u$ ,  $c_2^u$ ,  $c_1^\ell$ ,  $c_2^\ell$ ,  $c_1^h$ ,  $c_2^h$ ,  $\Delta$ ,  $\tau$ .

In the preceding model, low and high-skilled labor is fully flexible and able 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:

$$u(low) = \frac{1}{\overline{L}^\ell} \cdot ((L_1^\ell + L_2^\ell)u^\ell + \Delta u^u) \quad (40)$$

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

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

## 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 1:

Parameters	Values
$\alpha_1$	0.5
$\alpha_2$	0.5
$\sigma$	0.1
$A_1$	1
$\beta_1^\ell$	$\frac{2}{9}$
$\beta_1^h$	$\frac{4}{9}$
$A_2$	1
$\beta_2^\ell$	$\frac{2}{9}$
$\beta_2^h$	$\frac{4}{9}$
$\bar{L}^\ell$	60
$\bar{L}^h$	40
<i>rw factor</i>	1.1
<i>s</i>	0.8

*rw factor* 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 of 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 if there are no frictions in the economy. Note that the overall income differences are larger since the high-skill people are the 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 not 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 while leaving mark-ups constant at zero. Since the effects of mark-up and productivity changes are almost additive, we will discuss them separately.<sup>13</sup>

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 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 under perfect competition. In figure 3 we observe that the reduction of unemployment by increasing competition is achieved by a 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 surprisingly, the real income of high-skilled people rises 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 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

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<sup>13</sup> Lowering mark-ups and increasing productivity at the same time exhibit weak complementarities. The change in unemployment is slightly larger than the sum of the changes by varying mark-ups and productivity in isolation.

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.

## 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  $\bar{L}_1^\ell$  and  $\bar{L}_2^\ell$ . Labor force  $\bar{L}_1^\ell$  is only able to work in sector 1, whereas labor force  $\bar{L}_2^\ell$  can only work in sector 2. Total low-skilled labor supply is  $\bar{L}^\ell = \bar{L}_1^\ell + \bar{L}_2^\ell$ .

### 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

$$\bar{L}_1^\ell = L_1^\ell \quad (41)$$

$$\bar{L}_2^\ell = L_2^\ell \quad (42)$$

High skilled labor market clearing is still defined as

$$\bar{L}^h = L_1^h + L_2^h \quad (43)$$

In the model with labor market and product market frictions, the real reservation wage  $\bar{r}\bar{w}$  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.

$$w_1^\ell = \bar{r}\bar{w} p \quad (44)$$

$$w_2^\ell = \bar{r}\bar{w} p \quad (45)$$

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

$$\Delta = \overline{L}_1^\ell - L_1^\ell + \overline{L}_2^\ell - L_2^\ell \quad (46)$$

## 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 the immobility of the low-skilled labor force causes no difference in the employment allocation as long as there is unemployment in all sectors. Immobility only affects employment when there is an excess labor demand in one sector and workers cannot move to that sector.

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 the 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  $A_2=1$ ). 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 to 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 rises more than in sector 2. But when the low-skilled of the first industry are fully 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 becomes even steeper when full employment is achieved. This is caused by the wage increase from the point on when all workers are employed. The incomes of the low-skilled of sector 2 first increase because of the increasing employment and then decrease because of the occurring unemployment.

It is obvious that the decrease of employment in sector 2, when sector 1 is fully employed, only holds for small elasticities of substitution. For higher elasticities of substitution demand for products in sector 2 increases more when productivity rises and it is hence 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 in which the productivity improvement takes place may decrease for small elasticities of substitution.

## 6 Immobility of Low-Skilled *and* High-Skilled Labor Force

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

### 6.1 The Model

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

$$\bar{L}_1^h = L_1^h \tag{47}$$

$$\overline{L}_2^h = L_2^h \quad (48)$$

Without frictions, low-skilled labor market clearings hold:

$$\overline{L}_1^\ell = L_1^\ell \quad (49)$$

$$\overline{L}_2^\ell = L_2^\ell \quad (50)$$

## 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. The 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 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 no longer 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 is achieved in the first sector. 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 without product market reforms.

## 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 rises, so that employment increases. 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 for  $\tau$  to increase while  $L^\ell$  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  $\frac{w^h}{p} \cdot (1 + \tau) \cdot L_1^h + \frac{w_s^h}{p} \cdot (1 + \tau) \cdot L_2^h$ . Because of the rise in aggregate real income and the fixed income distribution of the economy, total gross wage income of the high-skilled rises as well. Now if  $\tau$  were to 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 preceding 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.

## 8 Concluding Remarks

We have developed a simple general equilibrium model to study how promoting product market competition by reducing mark-ups or by increasing 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 always has 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, in which all workers are immobile across sectors and the elasticity of substitution between the goods is small.

The model in this paper could be extended in various directions. For instance, we could allow for the real wages for low-skilled workers to 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 still hold in a more complete picture of the impact of product market reforms.

Figure 1: Unemployment and Markups (Mob)

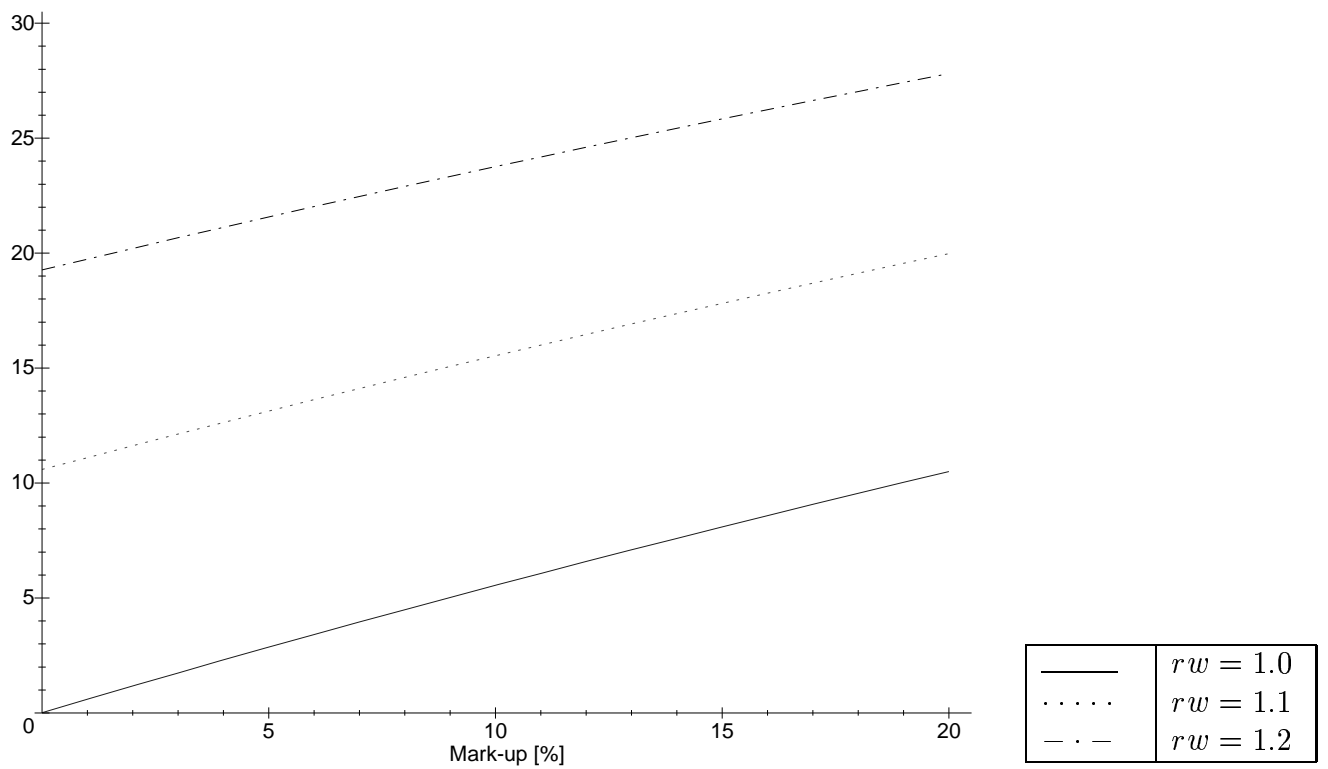


Figure 2: Unemployment and Productivity Improvement (Mob)

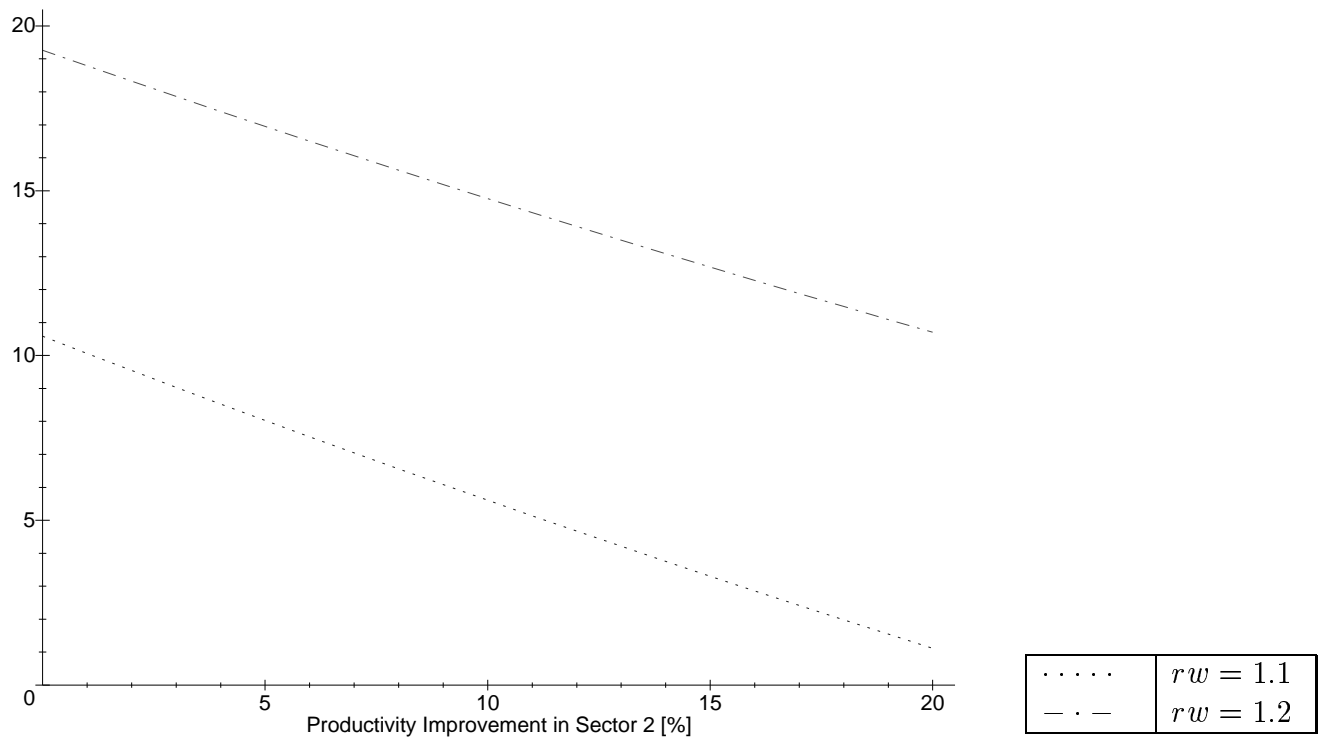


Figure 3: Employment and Mark-ups (Mob)

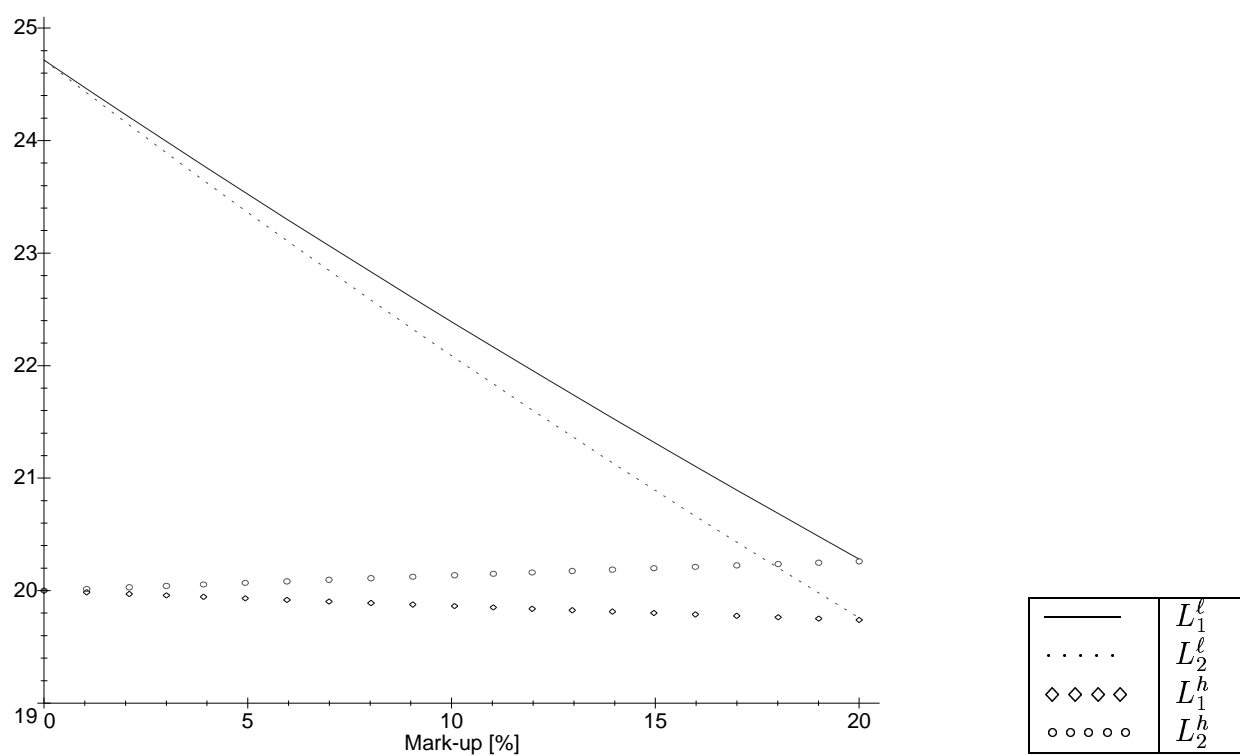


Figure 4: Utility Change and Mark-ups (Mob)

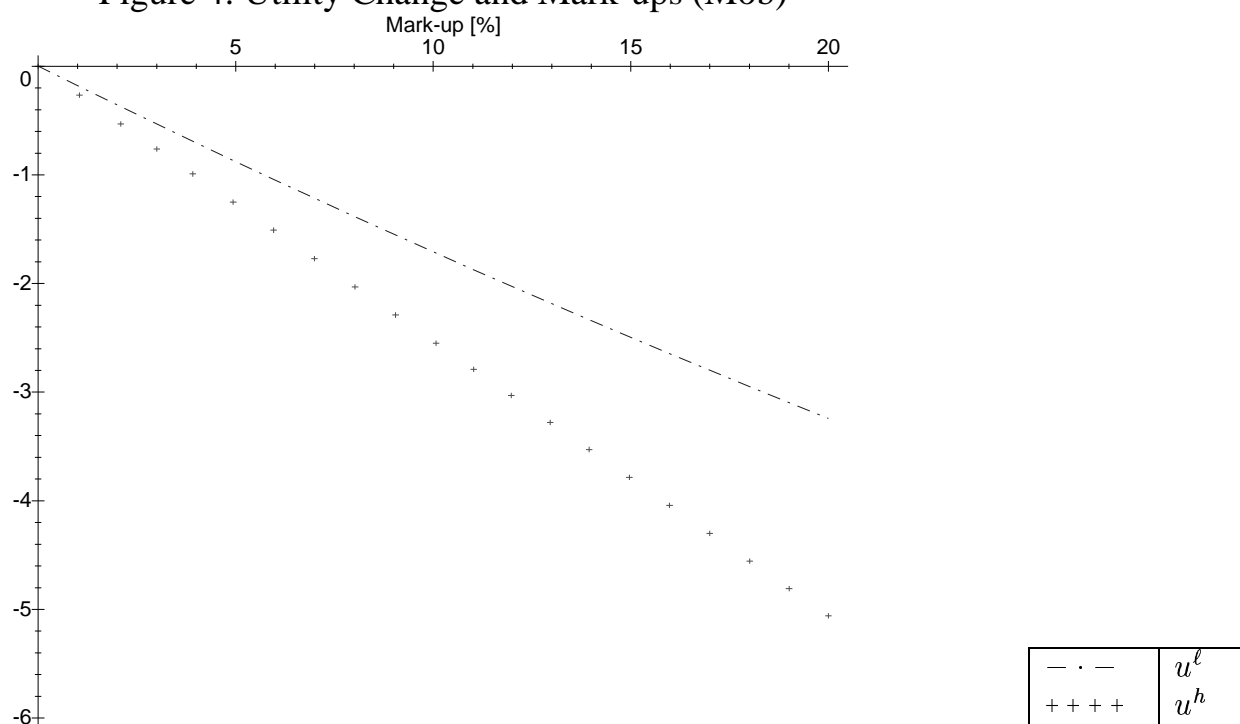


Figure 5: Employment and Productivity Improvement (Mob)

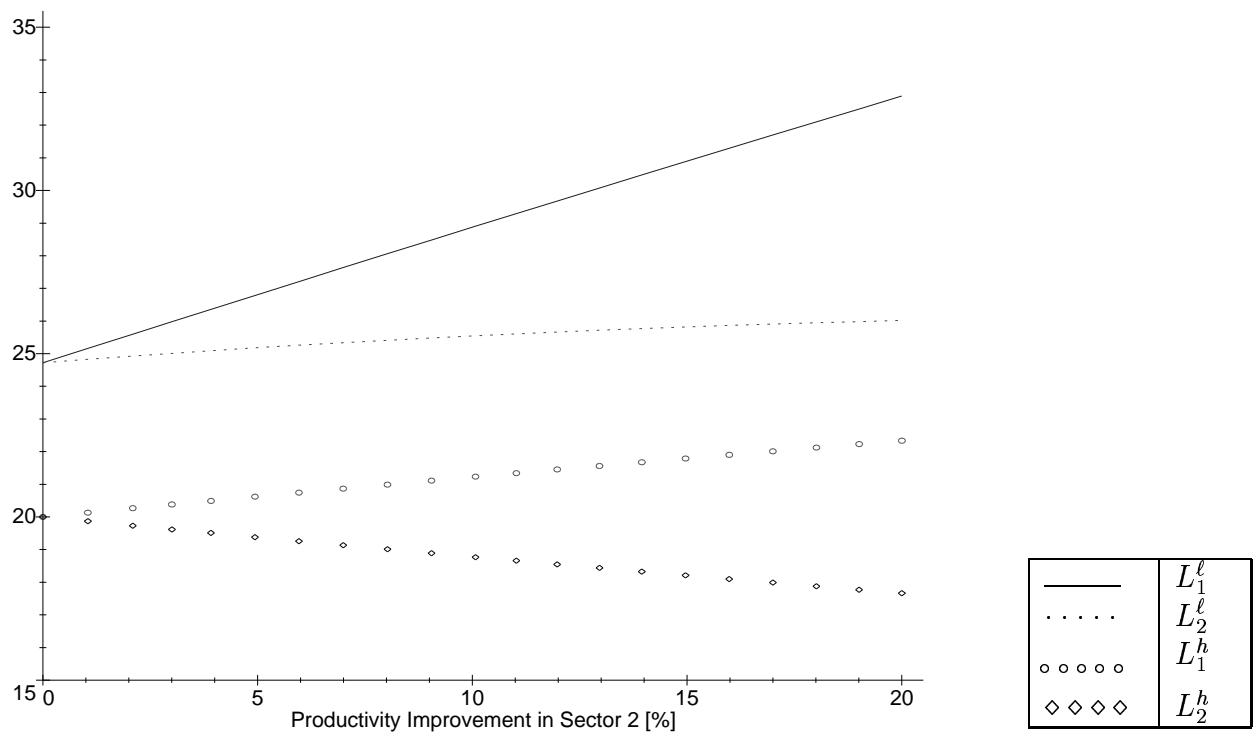


Figure 6: Utility Change and Productivity Improvement (Mob)

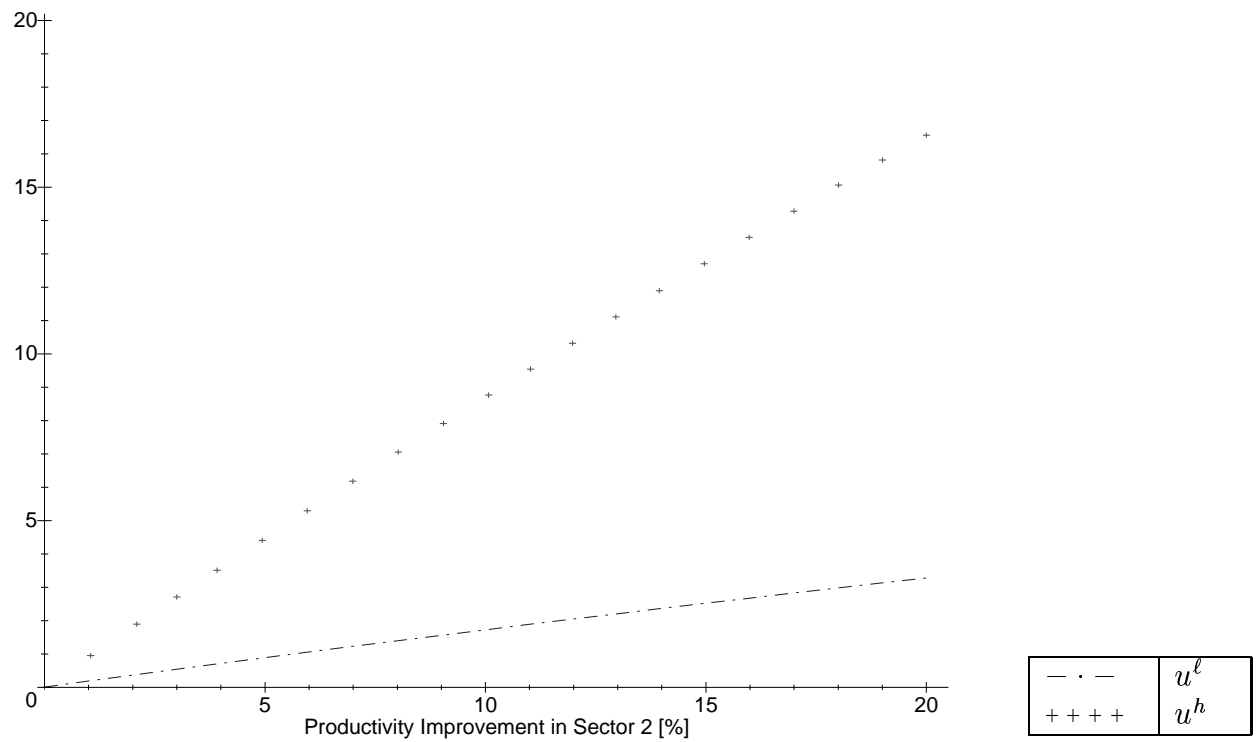


Figure 7: Employment and Mark-ups (Imlow)

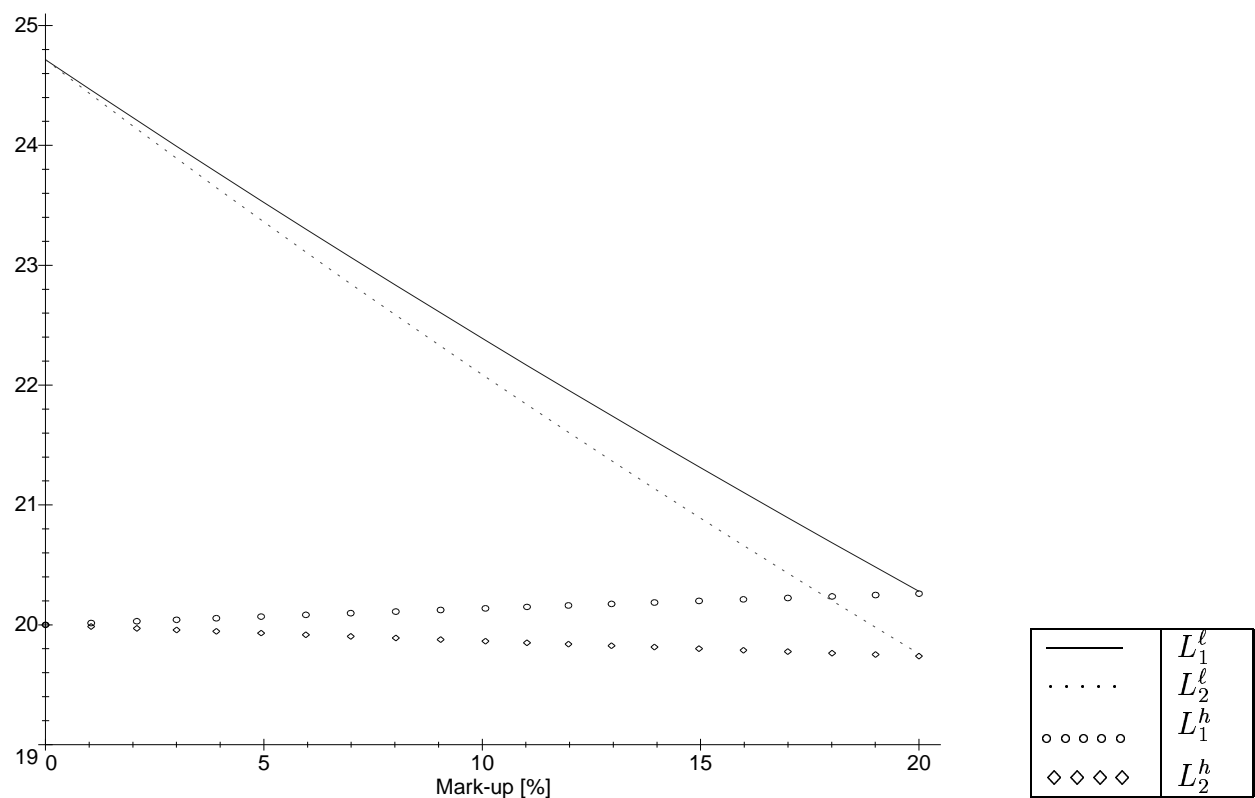


Figure 8: Utility Change and Mark-ups (Imlow)

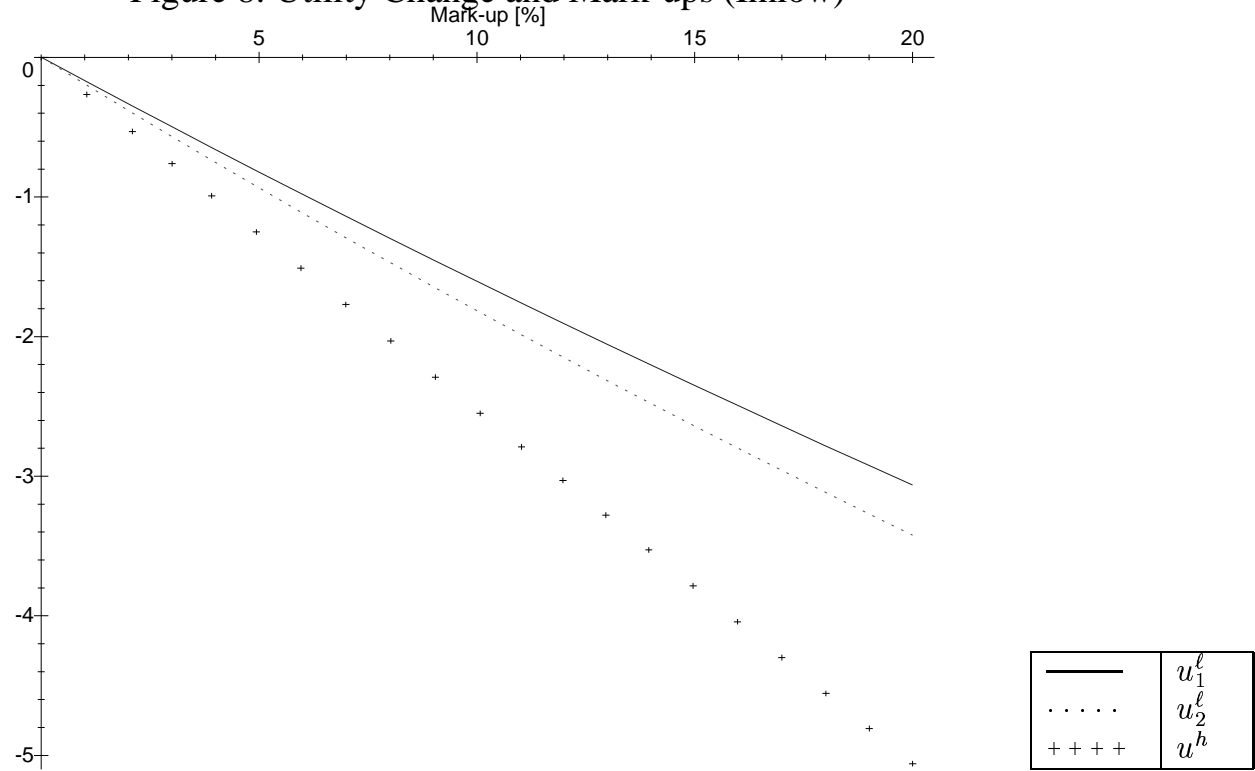


Figure 9: Employment and Productivity Improvement (Imlow)

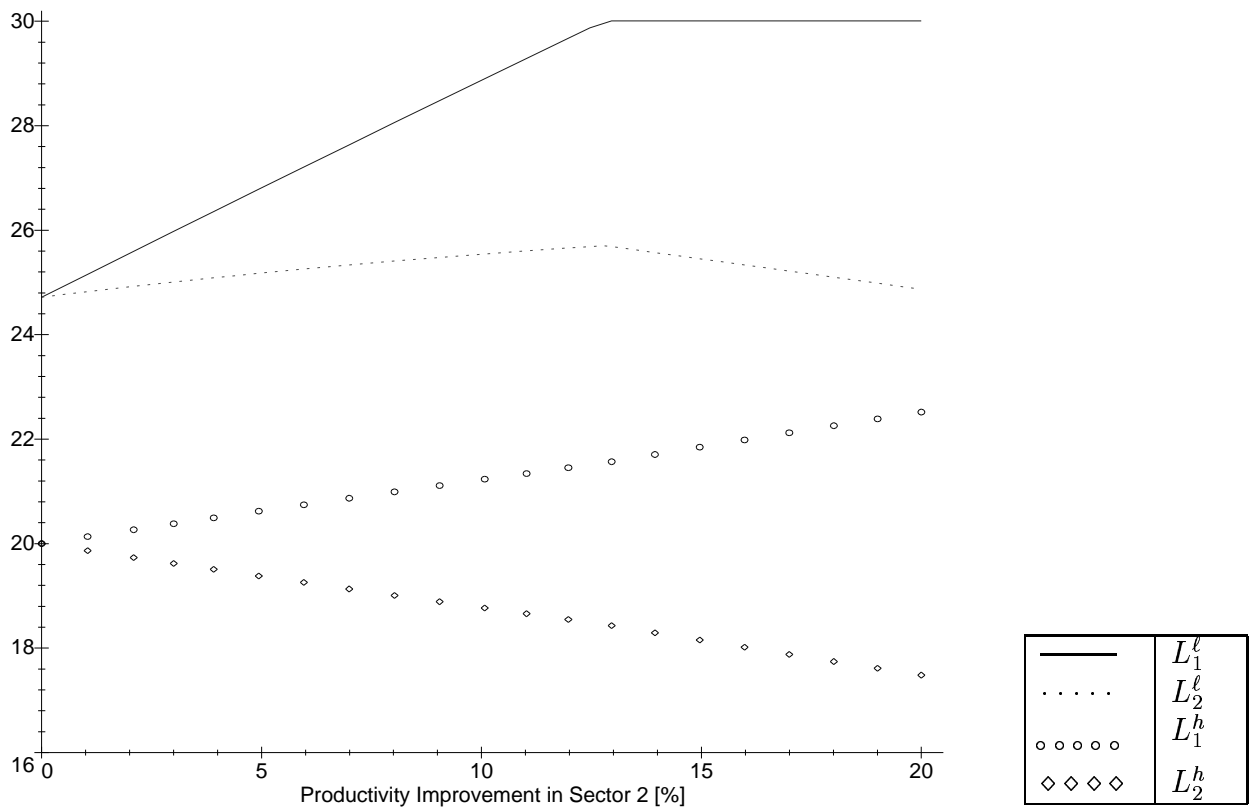


Figure 10: Utility Change and Productivity Improvement (Imlow)

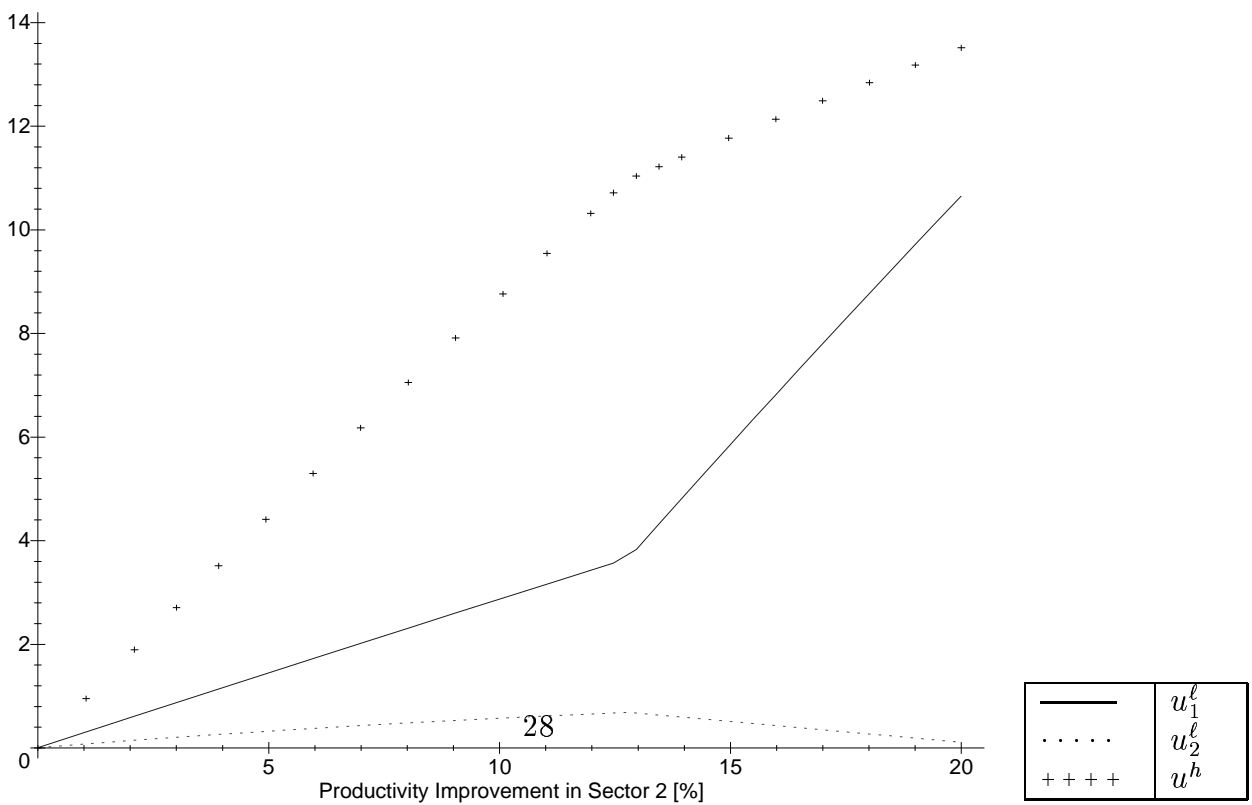


Figure 11: Employment and Mark-ups (Imall)

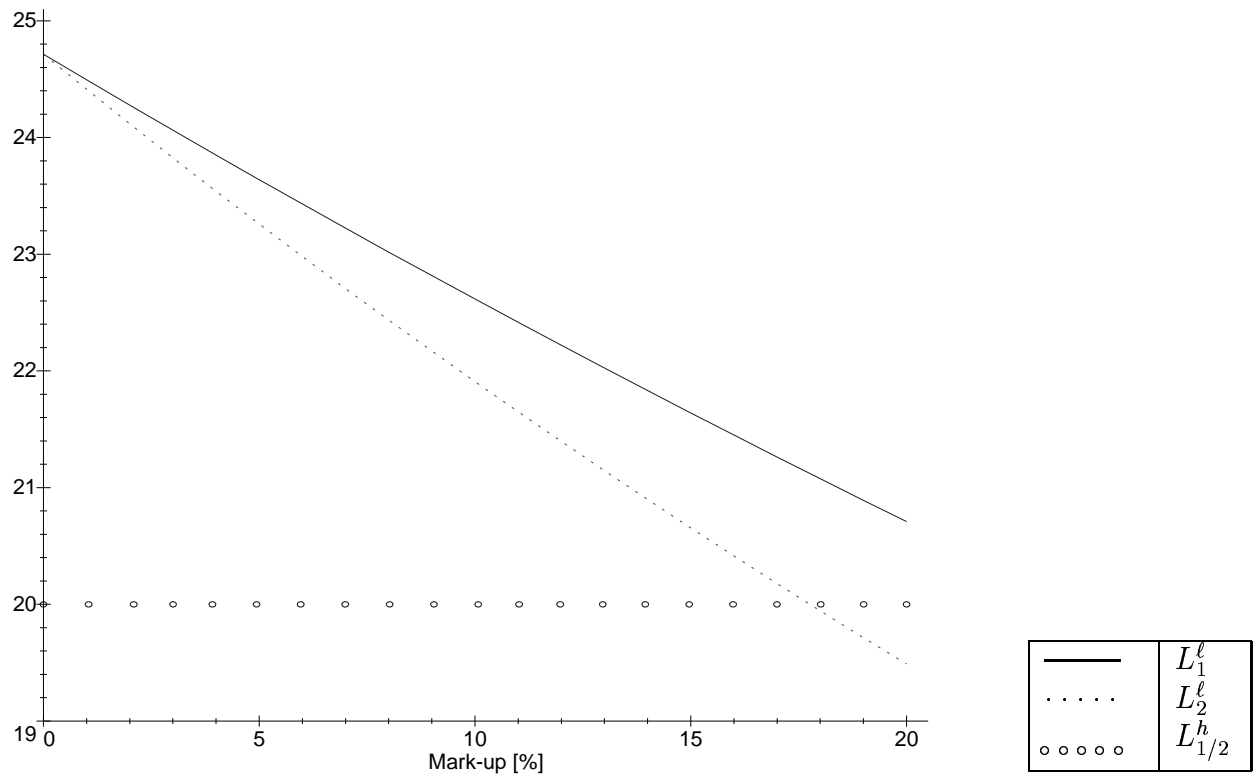


Figure 12: Utility Change and Mark-ups (Imall)

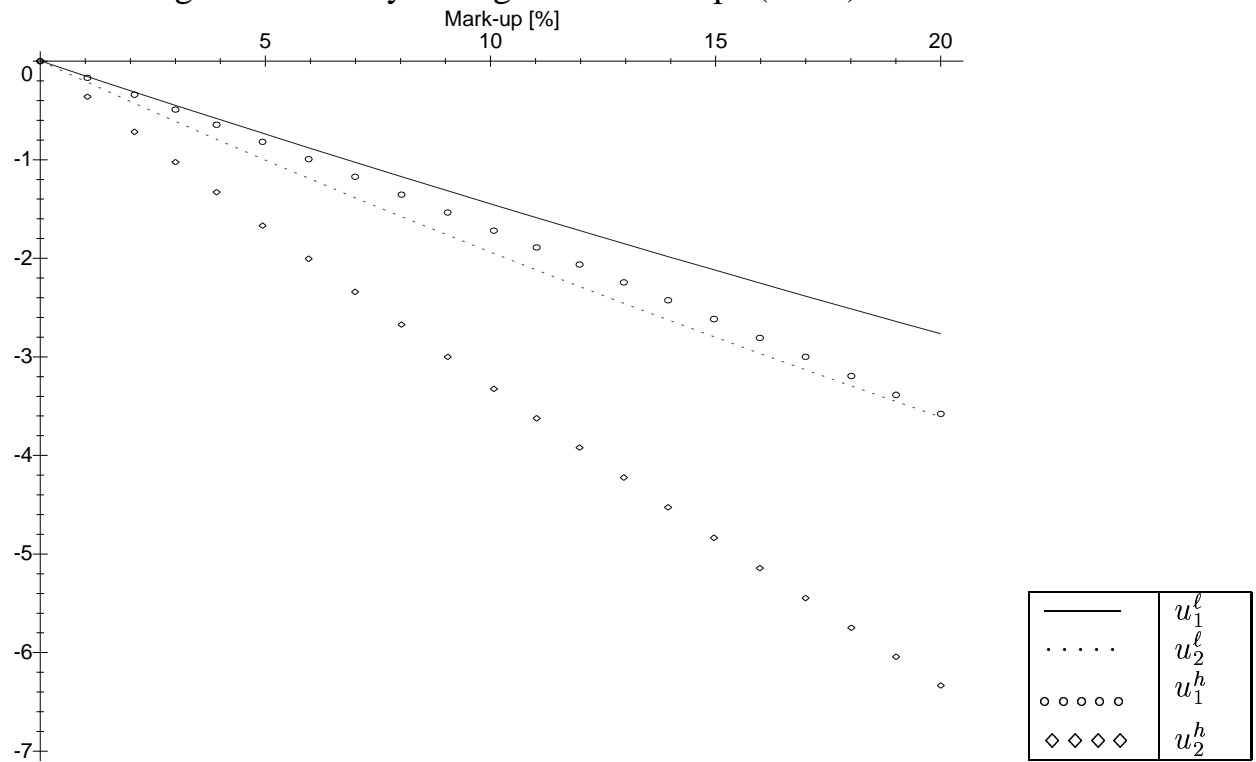




Figure 13: Employment and Productivity Improvement (Imall)

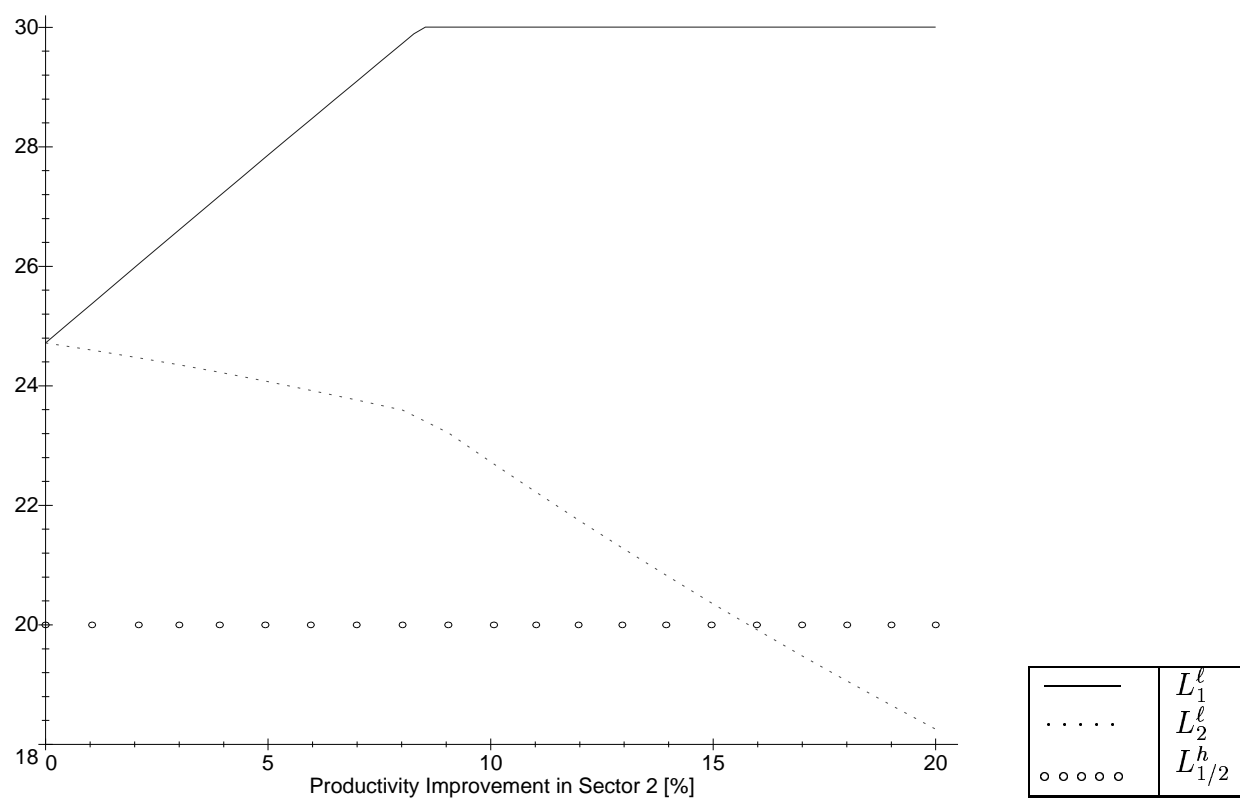
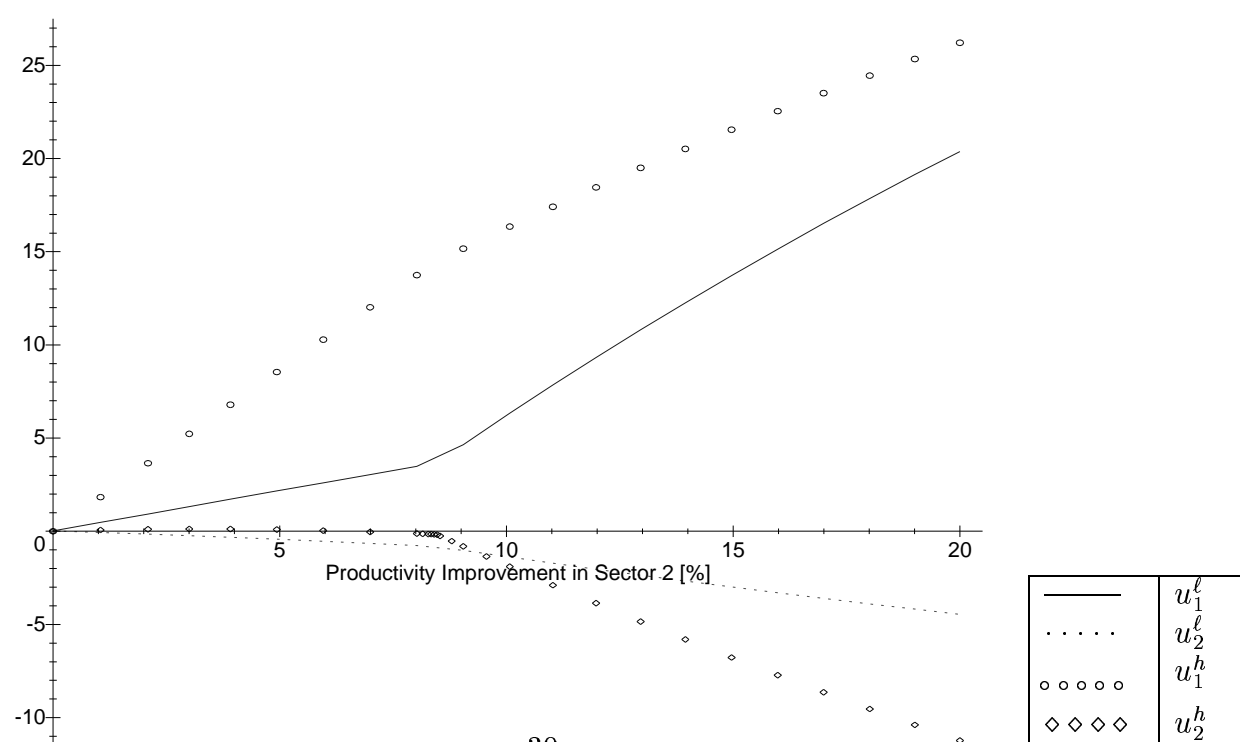


Figure 14: Utility Change and Productivity Improvement (Imall)



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