SUBSIDIZING EXTRA JOBS

THE ECONOMICS OF MARGINAL EMPLOYMENT SUBSIDIES

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Magdeburg, October 4th, 2007
Andreas Knabe

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Chapter 1

Subsidizing Employment – An Introduction[1]

1. Introduction

Unemployment is one of the most pressing economic problems of our times. Large European countries, in particular, suffer from mass unemployment and have not found an appropriate cure yet. Although total unemployment is high, large differences exist between different qualification levels. While unemployment of college graduates is relatively low, the market for low-skilled labor is in a deep crisis. OECD unemployment rates of low-skilled persons are on average more than twice as high as those of high-skilled persons.

On a global level, the literature identifies two reasons for this development. First, skill-biased technological progress raises the complementarity between capital and high-skilled labor and the substitutability between capital and low-skilled labor. Hence, capital accumulation widens the productivity gap between the different qualification levels and worsens the relative position of the low-skilled (Falk and Koebel 2002). Second, economic integration and international trade threaten either the income position or the jobs of the low-skilled in the developed world.[2] As a consequence, low-skilled individuals have to accept lower wages – which drives them into the "working poor" – or they are forced out of the labor market. The latter happens in countries with generous welfare systems that provide wage-replacement benefits that implicitly result in too high minimum wages: wages at which firms are willing to hire workers become too low to induce the low-skilled to work, and wages at which the low-skilled are willing to work are not affordable by firms. This wedge is widened by taxes and social security contributions.

[1] Parts of this chapter were written in collaboration with Ronnie Schöb and Joachim Weimann and have been published in *Kyklos* (Knabe, Schöb and Weimann 2006b).

[2] For evidence for the impact of technological progress and international integration on low-skill employment and wages, see Acemoglu (2002), Johnson and Stafford (1999), Hijzen et al. (2005), and the references cited therein.

Wage subsidies may be a possible remedy to this problem. If reservation wages exceed the productivity levels of the low-skilled, the government could pay the difference to close the gap and thereby restore the low-wage segment. Kaldor (1936) was the first to propose a general wage subsidy. The main drawback of such a general wage subsidy, however, is its fiscal cost. Wage subsidies have to be paid for all employees, although the labor demand stimulus works only at the margin. This creates large windfall gains for already existing employment. Firms receive the subsidy even if they do not create a single new job.

An efficient way to reduce the fiscal burden is to restrict the subsidy to the extra jobs created by a firm in addition to some reference employment level. Such so-called *marginal employment subsidies* could lower marginal labor costs by a much larger amount than an equal-cost general subsidy and thus create more employment, or, alternatively, create the same marginal stimulus at lower costs.

Even though the fiscal advantage seems obvious, marginal employment subsidies have received rather little attention in the economic literature and do not play a major role in the current policy debate. The main goal of this dissertation is thus to revive the interest in this type of employment subsidization, but also to critically analyze its main drawbacks.

In this chapter, we set the stage by discussing why subsidizing wages appears to be a reasonable policy for revitalizing the low-skilled labor market, especially in Continental Europe. We present some stylized facts on the extent and causes of low-skill unemployment, review the existing literature, and discuss the requirements for an efficient wage subsidy scheme for the low-skilled in Continental European type of welfare states. At the end of this chapter, we summarize the main results of this dissertation.

In Chapter 2, we will present a recent proposal for a marginal employment subsidy for Germany. The so-called *Magdeburg Alternative* suggests a permanent rebate of the social security contributions of additional employees to their employers. This reduces labor costs at the margin without affecting net wages. The problem with such a scheme is, however, that firms can replace regular paid workers by outsourcing employment to newly established firms. To avoid this effect, the *Magdeburg Alternative* features *double marginal subsidization* of incumbent firms. If an incumbent firm hires a formerly unemployed worker in excess of its reference employment level, it receives the subsidy not only for the new employee, but also for one incumbent employee. This reduces the incentive to crowd out regular employment and results in even larger employment effects. If

it functioned perfectly, the *Magdeburg Alternative* could then eliminate the German unemployment problem without imposing an additional fiscal burden.

According to their critics, however, it is highly unlikely that marginal employment subsidies function so perfectly. Instead, marginal subsidization could trigger large-scale displacement between firms. Some firms would expand their employment levels and receive a subsidy for the additionally created jobs. This gives them a cost advantage, which they could use to undercut their competitors. Other firms, who do not increase their employment levels fast enough to gain a similar cost advantage, have to cut jobs or are completely driven out of the market. In the end, marginal employment subsidization might have created a large number of new jobs in some firms, but most of these jobs will have displaced jobs in other firms. Hence, almost all workers in the economy will have to be subsidized, and a marginal subsidy has no advantages over a general subsidy anymore.

Chapters 3 to 5 are devoted to the analysis of between-firm displacement effects of marginal employment subsidies. We want to find out whether displacement necessarily leads to complete equivalence of marginal and general subsidies, or whether marginal employment subsidies can be advantageous in terms of their employment and fiscal effects even if one takes between-firm displacement effects into account. In Chapters 3 and 4, we develop a partial-equilibrium model with perfect competition on the goods market. Unemployment occurs because the wage is too high and rigid. In this setup, we show that marginal employment subsidies create more employment at lower cost than general subsidies despite their displacement effect. The stronger marginal stimulus for employment expansion forces firms into fiercer competition, which results in lower prices, more output demand, and more employment.

In Chapter 5, we present a general-equilibrium model with endogenous wage setting. Firms interact on imperfectly competitive goods markets, while wages are determined by firm-level labor unions. Even in this setup, marginal wage subsidies maintain their advantageousness over general subsidies. The reason lies in the asymmetry of marginal wage subsidies: while they subsidize the hiring of new workers, they do not punish firms that lay off part of their workforce. This tames the labor unions. If unions tried to shift the full subsidy into higher wages, it would be profitable for the firms to lay off workers. Unions can prevent this only by exerting wage restraint, which increases equilibrium employment.

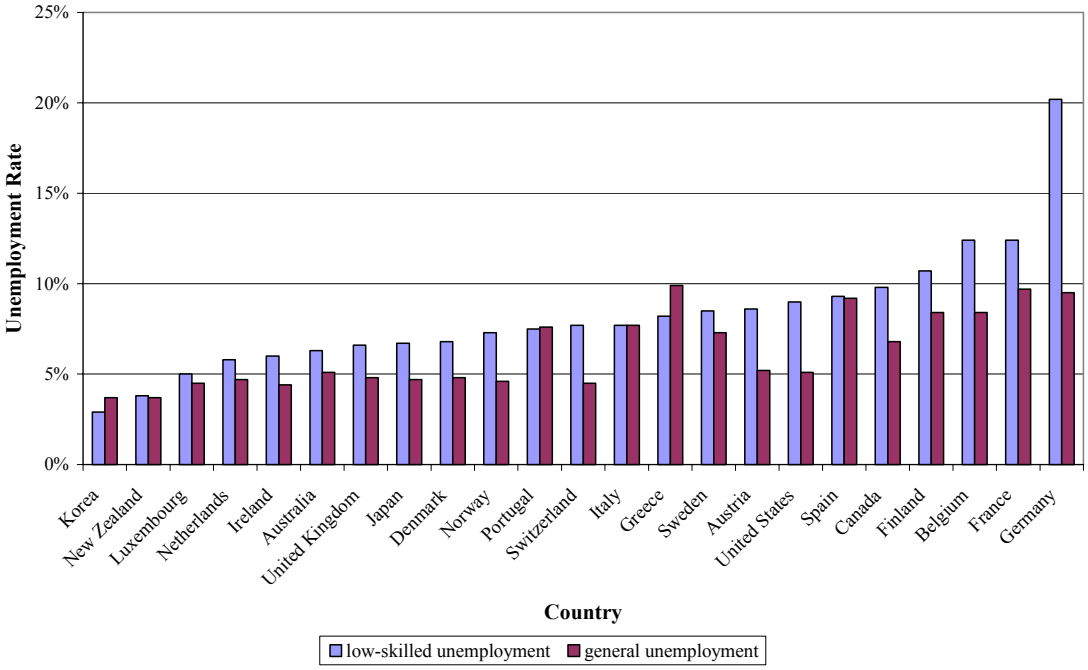
This dissertation argues that employment subsidies are a promising instrument for restoring the employment prospects of low-skilled workers. It contributes to the economic literature by providing a comprehensive theoretical comparison between general and marginal employment subsidies. All models presented in this dissertation show that marginal subsidies are a better policy measure because they can create more employment at less fiscal cost. Even when taking their displacement effects into account, the favorability of marginal employment subsidies persists. Despite their drawbacks, marginal employment subsidies are thus a more efficient policy for employment creation than general wage subsidies.

2. The three types of welfare states: Some stylized facts

In this section, we will examine how different types of welfare states cope with the difficulty of preserving job opportunities for the low skilled. Figure 1.1 compares the unemployment rates of low-skilled persons in 23 OECD-countries with the general unemployment rate. Two observations are noticeable. First, unemployment is generally more prevalent among the low-skilled than among higher qualified groups. In most countries, the unemployment rate of the low-skilled exceeds the general unemployment rate, the exceptions being the Southern European countries Greece, Portugal, and Italy, as well as Korea. This highlights the fact that the low-skilled form a distinct subgroup of the labor force whose unemployment experience differs from that of the rest of the population and therefore requires special attention.

Second, low-skilled unemployment rates vary much more across countries than general unemployment rates, even though both are positively related.[3] While general unemployment rates range from 3.7 percent (Korea) to 9.9 percent (Greece), low-skilled unemployment rates lie between 2.9 percent in Korea and 20.2 percent in Germany. Among the countries with the highest unemployment rates of low-skilled persons, we find the large Continental European countries France, Spain, Italy, and, with an extraordinarily high rate, Germany. Strikingly, the North Americans also score less well than most other countries in the OECD.

[3] The (unweighted) coefficient of variation is 0.33 for the total unemployment rate and 0.43 for the low-skilled unemployment rate. The correlation coefficient is 0.732.



Source: OECD (2007c).

Note: The total unemployment rate refers to the standardized unemployment rates. Low-skilled persons are considered to have completed less than an upper secondary education.

Figure 1.1: Low-skill unemployment in the OECD (2005)

At first sight, it seems impossible to explain the variation in low-skilled unemployment by making the standard distinction between flexible, Anglo-American style labor markets and rigid European labor markets, because both types of economies appear on both ends of the spectrum. To shed some light on the determinants of low-skill unemployment rates, we distinguish three different types of welfare states: the Anglo-Saxon type (e.g. US, UK, Ireland, Australia), the Continental type (e.g. Germany, France, Italy) and the Scandinavian type (e.g. Norway, Sweden, Denmark). Following Scharpf (2000), Anglo-Saxon welfare states are characterized by systems of limited formal welfare that is sufficient to prevent poverty, but cannot maintain living standards of higher paid workers. They have a political commitment to full employment on a private sector basis, provide little employment protection, and exhibit low levels of active labor market policies. On the other hand, Scandinavian welfare states provide mainly tax-

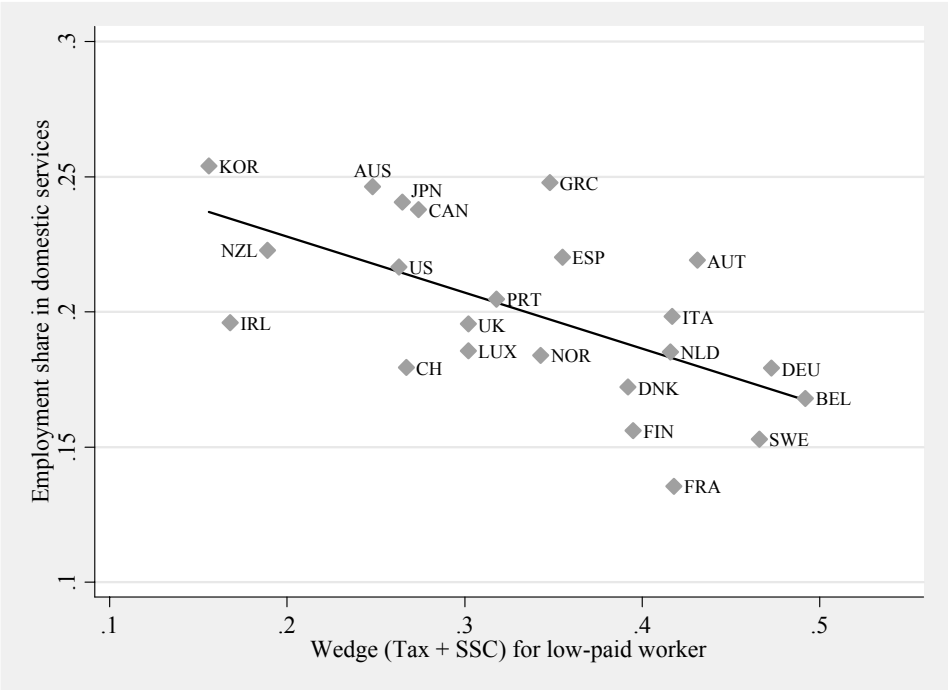
financed earnings-related benefits, show a high level of active labor market policies, and a large share of public employment. The Continental European welfare states also provide earnings-related benefits which are, however, mainly financed by wage-based contributions. Active labor market policies and public employment are more important than in the Anglo-Saxon countries, but do not reach the levels of the Scandinavian welfare states. Common economic shocks are absorbed differently by each type, which might help to explain some of the variation in unemployment rates.

Employment of low-skilled labor is faced with similar obstacles in all OECD economies. Economic integration and biased technological progress have caused relative demand for low-skilled labor to decline. Since both phenomena mainly affect those sectors that produce internationally tradable goods, the released low-skilled workers could be absorbed by the domestic service sector. Domestic services, however, typically provide low-productivity, low-paid jobs. Even if the productivity of these jobs was slightly above the level of welfare benefits, which define the lowest reservation wage, taxes and social security contributions (SSC) have a destructive effect on low-skilled employment. They destroy many additional job opportunities in the domestic service sector. There is clear empirical evidence in favor of this hypothesis. Figure 1.2 shows how the employment share in domestic services relates to the tax and SSC wedge of a low-paid worker.[4] There is a strong negative relation between the two variables ($R^2 = 0.38$): the low-wedge countries have employment shares of between 18 and 26 percent, while most high-wedge countries employ only about 15 to 20 percent of their labor force in domestic services.

If low-skilled workers are driven out of the sectors exposed to international trade in all countries, but high-tax countries are not capable of creating new employment opportunities in domestic services, one should observe a strong positive relation between the wedge on low-paid workers and low-skilled unemployment. As Figure 1.3 shows, there is indeed a positive, and very strong, relation between the two variables ($R^2 = 0.42$). While the low-wedge countries consistently show low unemployment rates among the low-skilled, there appear to be systematic differences among the high-wedge countries attributable to the distinction between Scandinavian and Continental European countries. For example, Sweden and Germany have about the same wedge (46.6 and 47.3

[4] Following Scharpf (2000), we use the employment in ISIC G and H (wholesale and retail trade, restaurants, and hotels) as a proxy for domestic low-skill service employment.

percent, respectively), but the low-skilled unemployment rate in Sweden is only 8.5 percent, compared to Germany with an appalling 20.2 percent. Almost all Scandinavian countries lie clearly below the line fitted into Figure 1.3, while most Continental European countries lie at or above it.



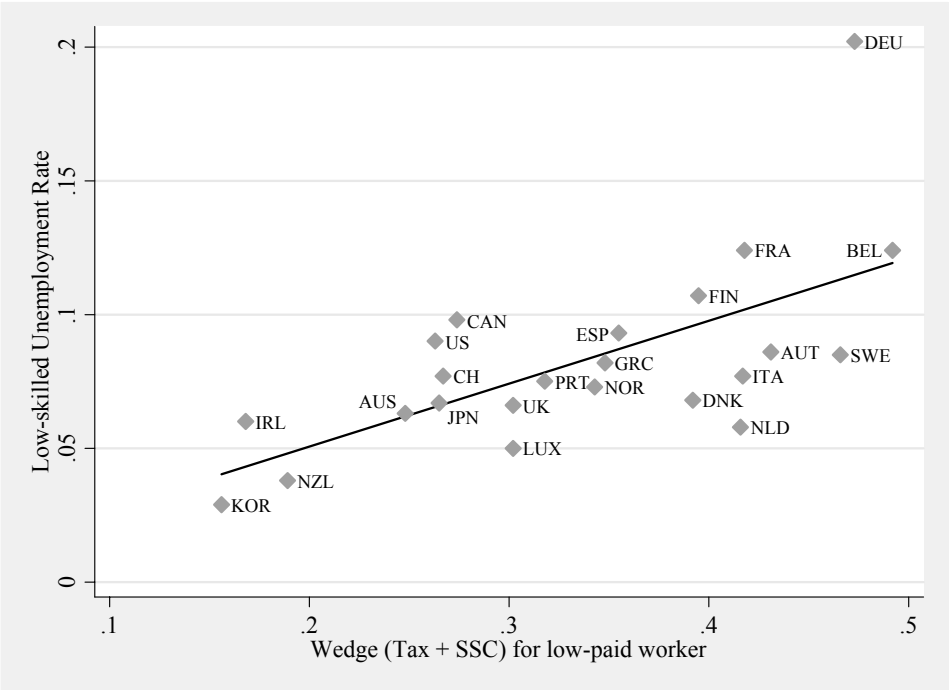
Source: OECD (2007a), ILO (2007).

Note: The wedge for a low-paid worker refers to income tax plus employee and employer social security contributions less cash benefits as a percentage of gross earnings for a single person without children at 67 percent of average earnings. The employment share in domestic services is approximated by ISIC G/H (wholesale and retail trade, hotels and restaurants).

Figure 1.2: The impact of the tax wedge on employment in domestic services (2005)

The two types of high-wedge welfare states seem to deal with low-skilled (un)employment in quite different ways. One possible explanation is the extent to which the state takes an active role in creating employment opportunities for its unemployed. If the high wedge prohibits low-skilled unemployed from being absorbed by the private service sector, the state could step in. In fact, public sector employment differs immensely between the Continental European and the

Scandinavian countries (Figure 1.4). For example, Germany, Italy, and Spain employ around 15 percent of their labor force in the public sector, which is in the same range as for most low-wedge countries. In contrast, Norway, Denmark, and Sweden have public sector employment shares around 35 percent.



Source: OECD (2007a, 2007c).

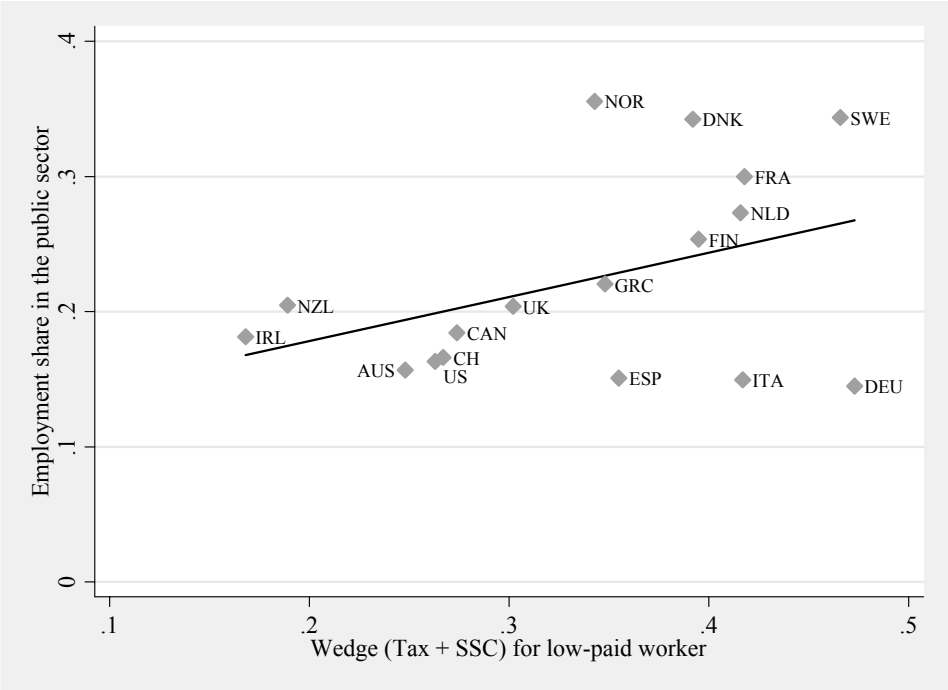
Note: The wedge for a low-paid worker refers to income tax plus employee and employer social security contributions less cash benefits as a percentage of labor costs for a single person without children at 67 percent of average earnings. Low-skilled persons are considered to have completed less than upper secondary education.

Figure 1.3: The impact of the tax wedge on low-skill unemployment (2005)

To test whether public sector employment has explanatory power for the wide variation of unemployment rates among the high wedge countries, we conduct a simple regression to illuminate the distinct impact of the wedge and public employment on the low-skilled unemployment rate. We find the following relation:

$$\underset{\text{unemployment rate}}{\text{low - skilled}} = \underset{(0.028)}{0.037} + \underset{(0.081)}{0.296} * \text{Wedge} - \underset{(0.101)}{0.230} * \text{Public Employment Share}.^{5}$$

Both the wedge and the public employment share have a strong, significant impact on the low-skilled unemployment rate. Including public employment in the regression increases its explanatory power noticeably ($R^2 = 0.50$).



Source: OECD (2007a), ILO (2007).

Note: The wedge for a low-paid worker refers to income tax plus employee and employer social security contributions less cash benefits as a percentage of labor costs for a single person without children at 67 percent of average earnings. Public sector employment covers all employment of the general government sector plus employment of publicly owned enterprises and companies.

Figure 1.4: The tax wedge and public sector employment (2005)

Our quick glance at the data suggests that there are three approaches to dealing with low-skilled unemployment. The Anglo-Saxon countries have relatively low tax and SSC rates on low-pay workers, which enable them to channel their low-skilled workforce into private services. Both the Continental European and the Scandinavian countries have high tax and SSC rates on low-paid workers,

[5] Standard errors are written in parentheses.

resulting in a smaller share of low-skilled employment in the domestic private service sector. The Scandinavian countries use public sector employment as a substitute and thereby keep low-skill unemployment at relatively low levels. The Continental European countries, by contrast, combine high tax and SSC rates with low public employment, and thus experience high unemployment among their low-skilled labor force.

The data suggest two policy options to fight low-skill unemployment: reducing the wedge and/or increasing public employment. The latter option is not advisable for Continental European countries.[6] First, public budgets are already under considerable strain, so that further public spending programs cannot be implemented. Second, public employment as a labor market instrument is most efficient if it emulates the first-best, private sector employment that would exist in a perfectly functioning labor market. This, however, can best be achieved if the government sets the right incentives to create employment directly in the private sector. Therefore, the best policy advice to give is to fight low-skill unemployment by reducing the burden imposed on low-paid workers through reductions in taxes and, especially, social security contributions without placing additional burden on the public budget.

3. Which way to go?

In generous welfare states the labor market for low-skilled workers is typically characterized by a two-sided problem. The high level of taxes and social security contributions in combination with implicit minimum wages and unionized wage negotiations lead to too high wages at the bottom end of the wage scale and reduce labor demand substantially. At the same time, the welfare state cushions the low-skilled unemployed with benefit payments that are conditioned on not being in employment and discourages them from searching for employment with high transfer reduction rates. A successful employment policy measure thus has to tackle both sides simultaneously to solve the unemployment problem. Lowering labor costs without creating incentives for the unemployed to accept job offers will fail as will improving incentives to accept jobs when labor costs remain high.

The question arises how to design wage subsidies. The "prototype" of an employee-oriented subsidy is the Earned Income Tax Credit (EITC) in the United

[6] For example, Sinn (2006b) offers a harsh critique of the Scandinavian model. He labels its employment and output effects "Scandinavia's accounting trick" because public employment enters GDP at cost levels, but not by the actual value created.

States, which was introduced in 1975 as a modest program to offset social security payroll taxes for low income families with children and subsequently became one of the largest welfare programs in the US (see IRS 2006). The EITC grants a tax credit to low-income earners: instead of paying wage-replacing benefits that are decreased if a person starts working, the state pays wage-supplementing benefits that increase a person's income if he decides to leave welfare and accepts a low-paid job. Such employment-conditional benefits serve two purposes: they lower the wedge on low wages, thereby stimulating employment, and at the same time serve as a redistributive measure that raises low wages to socially acceptable levels. Similar programs have been introduced in European countries as well, even though on a much smaller scale than in the United States (see OECD 2003, p. 159).[7]

How can supplementing workers' incomes give firms incentives to employ more workers? At given wages, (potential) workers are more willing to work, or decide to participate in the labor market at all, when they receive an additional subsidy. This increases labor supply, which in turn leads to a fall in wages and increased labor demand. Although the subsidy is paid to workers initially, it will have positive employment effects only if it is shifted to firms in the form of lower wages.

Standard tax incidence analysis indicates that in flexible markets it does not matter to which side a subsidy is given. Instead of paying the subsidy to workers, who then accept lower wages, the subsidy could be given directly to firms as well. Market forces will lead to identical equilibrium outcomes in both cases (see e.g. Borjas 2000, p. 170). If market forces are impaired, however, for example by minimum wage legislation or union wage setting, tax incidence becomes different. First, the timing is different. While subsidies given to employers lower labor cost immediately, wage subsidies given to employees only work after they are transformed into lower gross wages which can take a considerable amount of time.[8] Second, the long-run incidence differs in the presence of minimum wages

[7] For Germany, the Munich-based Ifo institute proposes a similar scheme called *Activating Social Welfare* (Sinn et al. 2003, 2006) and the European Economic Advisory Group at CESifo is propagating the same idea as a "Proposal for Europe" (Corsetti et al. 2002, Ch. 6). For details, see Chapter 2.

[8] These timing differences are often disregarded in economists' policy advice on labor market issues. As Blinder (1988, p. 12) puts it: "The difference between the long-run equilibrium results that we know and love (and teach to our young) and the short-run disequilibrium results that people actually experience are no mere quibbles. They may be fundamental." Hamermesh (1980), using an empirically founded simulation for the United States, shows that the half-life of the

and when unions act as insider organizations. Employer and employee taxes do not have equivalent effects on negotiated wages and employment if employee taxes are subject to exemptions (e.g. Koskela and Schöb 1999) or when unemployment benefits are subject to taxation or are indexed to net wages. They also differ if gross wages are regulated by minimum wage legislation (Picard and Toulemonde 2001) or when trade unions behave as pure insider representatives (e.g. Lindbeck and Snower, 1988 and 2001).[9] With rigid gross wages only employer-oriented wage subsidies will promote employment, while employee-oriented wage subsidies such as the EITC will only raise the net income of incumbent workers and thus only stimulate labor supply.

Table 1.1 compares those institutional labor market factors that contribute to wage rigidity and reduced work incentives between Continental European countries and the United States. On the labor demand side, the main factors reducing demand for low-skilled workers are high tax wedges on low-wages, high minimum wages, strong employment protection legislation, and extensive bargaining coverage. The table shows that the Continental European countries are clearly distinct from the United States with respect to all these factors. The US has a wedge of 26.3 percent, while the European countries' wedges are between 35.5 percent (Spain) and 49.2 percent (Belgium). The relative minimum wage is much lower in the US than in those Continental European countries that enacted statutory minimum wages. The Continental European countries all have strong employment protection laws and extensive collective bargaining, whereas they are practically non-existent in the US. On the labor supply side, high replacement rates and lax work availability conditions weaken the incentives for low-skilled unemployed to take up low-paid work. As Table 1.1 shows, the Continental European countries provide more generous welfare benefits and are less strict on work availability than the US.

adjustment process after a change in the payroll tax is about five years. We expect the half-life to be even longer in unionized labor markets with insider power.

[9] Knoppik and Beissinger (2003) show that German unions pushed through excessive wage increases in booms but ensured downward nominal wage rigidity in busts. Furthermore, firms normally do not accept jobseekers offers to work for wages less than what the firms' incumbent workers receive because they consider such offers as unfair and they fear adverse effects on workers' morale, see Bewley (1999).

	Wedge for Low-Paid Worker[a] (in %)	Net Minimum Wage[b] (in % of APW)	Employment Protection Index[c] (0-6)	Bargaining Coverage[d] (in %)	Net Replacement Rate[e] (in %)	Strictness of Work Availability Conditions[f]
Belgium	49.2	56	2.5	>90	66	3.1
France	41.8	55	2.9	>90	71	2.7
Germany	47.3	-	2.5	68[g]	75	2.6
Italy	41.7	-	2.4	>80	-[h]	-
Spain	35.5	42	3.1	>80	52	-
United States	26.3	37	0.7	14	29	3.3

Sources: a) OECD(2007a, 65), b)OECD(2007a, 28), c) OECD(2004, 117), d) OECD(2004, 145), e) OECD(2007b), f) Nickell et al. (2005, p. 5)

Note: a) income tax plus employee and employer social security contributions less cash benefits as a percentage of labor costs for a single person without children at 67 percent of average earnings, 2005. b) after-tax minimum wage relative to the net income of a full-time average productive worker (APW), 2006. "-" denotes the absence of a statutory minimum wage. c) summary index comprising regulations on regular employment, temporary employment and collective dismissals, 2003. e) average of net replacement rates over 60 months of unemployment for four family types and two earnings levels (67% and 100% of APW), with social assistance, 2004. f) index of the strictness of the conditions governing the availability of unemployment benefits, mid-1990s. g) In Germany, many firms that are not legally covered by collective bargaining nevertheless orientate their wages at collective contracts. Taking these firms into account, bargaining coverage amounts to 84 percent (WSI 2005). h) Unemployment insurance benefits run out after six months. A local social assistance scheme (Minimo Vitale) exists, but benefits are available in some municipalities only and on a case-by-case basis in the absence of national guidelines.

Table 1.1: Labor Market Institutions

The comparison in Table 1.1 suggests that labor market institutions both on the demand and the supply side differ substantially between Continental Europe and the United States. Hence, what may have been a success story in the United States might become a failure in Continental European countries without complementary policy measures. Deregulation that moves the labor market towards a more flexible structure is one option. Such attempts, however, are strongly opposed in Continental European countries. Collective bargaining is the established main institution where rent-sharing rules are set and distributional conflicts between

labor and capital are settled. Thereby, the wage is the main distribution key for the domestic product. Restricting or eliminating such a institution will not be possible without risking social unrest and increasing conflicts between workers and employers (see Schöb 2002).

There are thus good reasons for employer-oriented wage subsidies in an institutional setting with downward rigid wages in the low-wage segment. Lowering the social security contributions in the low-skilled sector is a good candidate for such a scheme. The welfare system is basically a redistributive means to which one should contribute according to one's ability-to-pay. Unlike the tax system, which normally exempts income below the minimum subsistence level from taxation, many European social security system consider all persons as able-to-pay when they are employed. All workers have to contribute from the very first Euro onwards to the social security system. This way of identifying ability-to-pay implicitly assumes that every worker is productive enough to both contribute to the welfare system and still have a net income above the minimum level of subsistence. We have seen that this is no longer true for an increasing number of low-skilled workers. Their gross reservation wage lies above their value-added, and thus their labor is not demanded by firms anymore. Since the unemployed are already covered by the social security system, the social security contributions are, from an economic point of view, a prohibitive tax on labor. Wage subsidies can thus be interpreted as an instrument to eliminate this distortion inherent in the low-skilled sector.

4. Marginal employment subsidies

Wage subsidies may generally be a possible remedy to narrow the wedge described in the last section. Kaldor (1936) was the first to propose a general wage subsidy to restore full employment. More recently, support for his idea came from Phelps (1997) who proposes a graduated tax subsidy scheme to firms for every low-wage worker they employ.

For governments, general wage subsidies are a very expensive policy instrument. Even though new jobs would create some savings because less unemployment and welfare benefits have to be paid and additional taxes are collected, all workers already in employment would have to be subsidized immediately. This makes a general employment subsidy very expensive in the short-run, and even in the long-run, it seems dubious whether such a subsidy can be self-financing.

To overcome these fiscal drawbacks, marginal employment subsidies (MES) propose to restrict the subsidy to the extra jobs created by firms in addition to some reference employment level. Compared to general subsidies, however, MES have received rather little attention in the economic literature. Among the few contributions, the most prominent analysis of MES is presented by Layard and Nickell (1980). They implement a MES in both a Keynesian-type and a monetarist macroeconomic model. In their model, the reduction in marginal production costs mainly benefits the international competitiveness in the export sector, which, through its feedback effects on the domestic economy, increases overall output and employment. They conclude that a MES can generate more jobs than a general subsidy costing the same amount. Since this result holds both in the Keynesian and the monetarist version of their model, their analysis strengthens the confidence in the general advantageousness of MES. Whitley and Wilson (1983) develop a dynamic macrosimulation of the Layard/Nickell-model and calibrate it on the British economy. They also find positive employment effects, even though the advantage of MES over general subsidies is less pronounced than proclaimed by Layard and Nickell (1980).

The macroeconomic desirability of MES is emphasized by Rehn (1982). He proposes MES as a complementary measure to expansionary demand policies to avoid the stagflation trap. Expansionary policies, after a short-run positive effect on output and employment, typically cause prices to rise, which counteracts the expansionary effect. With a MES, the expansion of output and employment could instead be connected with falling prices and could therefore reinforce the positive employment effects.

In a conventional neoclassical macroeconomic model, Chiarella and Steinherr (1982) allow for marginal subsidies that are paid for an unlimited duration although the firms expect the program to be abandoned in the future with some positive probability. Their results show that MES can have a significant effect on employment both in the closed and the open economy, without worsening the government deficit. Oswald (1984) points out the formal similarities between an inflation tax (a tax on price increases) and a marginal employment subsidy. By making use of a dynamic optimization model of profit maximization, he shows that MES, modeled as a continuous function that subsidizes additional employment and taxes layoffs, increase a firm's profit-maximizing employment level. Hart (1989) models a firm's simultaneous decision over its number of employees and the hours worked per employee. MES have a positive employment

effect because they induce the firm to hire more workers and reduce the hours of work. With general subsidies, the substitution effect is reversed if there are quasi-fixed costs per employee (hiring costs, training, etc.), and the employment effects could be negative.

The latest theoretical work on marginal employment subsidization seems to be contained in the influential book on "Unemployment" by Layard et al. (1991). By using a general-equilibrium model with imperfect competition on goods and labor markets, they show that marginal subsidization can increase aggregate employment even if unions succeed in shifting part of the subsidy into higher wages.

There are only a few real-life active labor market policies that have featured MES. The first such program was started in Germany in 1932. The government paid a tax rebate for a firm's additional employment, measured by the increase compared to a pre-determined reference date. Until December 1932, 62,500 jobs were subsidized (see Marcon 1974 and James 1988). In the 1970s, MES-programs were implemented in many countries. Examples are the New Jobs Tax Credit in the United States (1977/78), the French *Prime d'incitation à la création d'emploi* (1975), the Small Firms Employment Subsidy in Great Britain (1977), and the *Lohnkostenzuschüsse* in Germany (1974/75). Even though some of these programs had positive employment effects, their general impact was rather limited. The main reasons were the limited duration for which subsidies were paid, the small magnitude of the subsidies, little knowledge of employers about the programs, bad timing of the reference date, and the possibility to circumvent the reference date by outsourcing to newly established firms.[10]

5. Displacement between firms: the Achilles' heel of marginal subsidization

The main argument in favor of a marginal subsidy is that, since a firm's incentive to hire an additional worker is affected only by the comparison of his marginal value product and his marginal cost, general and marginal employment subsidies at the same rate should have the same employment effect. And since MES only subsidizes additional employment, this employment effect can be created at much lower costs than with a general subsidy.

[10] For detailed descriptions of the institutional details and evaluations of the programs, see Perloff and Wachter (1979) and Bishop and Haveman (1979) for the US, Layard (1979) for Great Britain, Kopits (1978) for France, and Schmidt (1979) for Germany.

This very optimistic view of marginal wage subsidies has been challenged. Critics argue that one must not transfer the firm-level effects of a marginal subsidy to more aggregate levels of the economy. In particular, if the marginal subsidy is applied to all firms in the same industry, competition will cause between-firm displacement not accounted for in firm-level studies. Although themselves proponents of marginal subsidization, Layard and Nickell remark very pointedly:

> "A naive microeconomic analysis might conclude that since a profit-maximising firm is solely concerned with the marginal wage in determining its output and employment levels, a large subsidy on the wages of marginal employees would have a dramatic effect on the firm's level of employment at very little cost. This argument is, however, grossly misleading at a more aggregate level at least in a closed economy. Suppose all firms in a competitive industry in equilibrium are offered a marginal wage subsidy and there is a consequent dramatic expansion in industry output. This will immediately lead to an equally dramatic fall in the price in this industry and since average costs will have fallen but a little, the firms will be making losses. The industry will then contract, and in the new equilibrium the price of output will be equal to the average cost in the marginal firm. Aggregate employment in the industry will have risen only to the extent that average cost has fallen as a result of the marginal subsidy; that is, not very much." (Layard and Nickell 1980, p. 55; italics in original)

Between-firm displacement is also one of the main obstacles to marginal subsidization in the political discussion. When asked about the prospects of MES proposals, the then-Economics Minister of the German state of Saxony-Anhalt commented:

> "The effects of this process are foreseeable: Who quickly doubles his number of low-wage workers belongs to the winners, who comes too late will probably go bankrupt. After one or two years, the state will have to pay 35 percent of the costs of all low-wage workers, without any sizable increase in employment."[11] (Rehberger 2004 -- author's translation)

Sinn (2006a) argues similarily:

> “New firms, founded after the base year, would enjoy the full support, whereas old firms that have reached maturity would get nothing. Therefore, old firms would be driven into bankruptcy and give way to new firms. In view of the

[11] The comment refers to the *Magdeburg Alternative*. This specific proposal for Germany suggests to pay a subsidy rate of 35 percent, but to restrict the subsidy to low-wage workers (cf. Chapter 2).

> foreseeable mass protests of the established firms, I pity the political party that promoted such an approach."

Intra-industry displacement effects are the Achilles' heel of marginal wage subsidies. Even though a thorough analysis of these effects is crucial for definite economic policy advice, the literature on this topic is rather sparse. Oswald (1984) shows that a marginal wage subsidy, while increasing the employment level in each individual firm, affects the number of firms in equilibrium in an ambiguous way. The net effect on employment in the entire industry is generally ambiguous. The subsidy scheme used in his study, however, combines a marginal wage subsidy for employment above the reference employment level with a marginal tax on layoffs below this level. Hence, his results do not carry over directly to evaluating pure marginal wage subsidy proposals which only subsidize hirings, and do not tax layoffs.

Luskin (1986) analyzes the industry effects of a marginal wage subsidy and derives sufficient conditions for the fiscal efficiency (in terms of fiscal expenditure per new job) of marginal over general subsidies. His results are generally ambiguous but show that marginal subsidies will be fiscally more efficient if industry product demand is sufficiently inelastic. This result hinges upon the assumption that, with marginal subsidies, new entrants will receive the subsidy only if they expand their employment above the same reference level as incumbent firms. Hence, minimum average costs with marginal subsidies will always exceed those obtained with equal-rate general subsidies. Since minimum average costs determine the equilibrium price, an elastic industry product demand will cause output and employment to expand much more under general subsidization, thereby decreasing the fiscal efficiency of marginal subsidies. In our view, the assumption that there could be one reference employment level for all firms – incumbents as well as new entrants – is clearly at odds with all actual marginal wage subsidy programs. All these programs have individualized reference levels for incumbent firms, while firms founded after the reference date typically receive the subsidy for all their workers (cf. Schmidt 1979, p. 342).

In this dissertation, we will analyze how damaging between-firm displacement effects are for the effectiveness of marginal employment subsidies. We will study this question in various frameworks. For example, we will use models with perfect competition and with imperfect competition in product markets. Also, we will employ fixed-wage models as well as allow for endogenous wage setting. In

all models concerned with between-firm displacement, however, we will pay close attention to modeling marginal employment subsidies as realistically as possible. Hence, we apply firm-specific reference employment levels (thereby differing from Luskin 1986), and we will not tax layoffs below the reference level (which differs from Oswald 1984).

6. Summaries of following chapters

This dissertation is made up of four chapters, each of which is written in the style of a self-contained article.

Chapter 2
The Magdeburg Alternative: A policy proposal for Germany

In this chapter, we first show that the main problem in the German labor market is unemployment of the low-skilled. While unemployment among college graduates is relatively low, people without a formal education are faced with unemployment rates of 22 percent in Western Germany and above 50 percent in Eastern Germany. This unemployment problem is caused by distortions on both sides of the labor market. On the labor supply side, low-skilled unemployed have few incentives to take up work. Even a full-time job would not give them considerably more income than the welfare benefits they can receive without working at all. On the demand side, high labor costs destroy the job opportunities for those willing to work.

Wage subsidies are a potential remedy to this problem because they close the gap between the workers' reservation wages and the firms' willingness to pay. Such subsidies could either be given to workers to supplement net wages, or they could be paid to firms to lower their labor costs. Employee-oriented wage subsides, as exemplified by the American Earned Income Tax Credit and the proposal made for Germany by the ifo institute under the title *Activating Social Welfare*, subsidize low wages by giving workers a wage supplement. This will create new jobs if workers are then willing to accept lower wages, thereby passing the subsidy to their firms. We argue, however, that this transmission mechanism is impeded in Germany. Collective wage bargaining and insider power prevent the necessary drop in wages. Hence, wage subsidies have to be given to firms directly in order to be effective for employment creation.

In this chapter, we will discuss a recent policy proposal for Germany that takes account of the institutional peculiarities of the German labor market. The so-called *Magdeburg Alternative*, developed by Schöb and Weimann (2003, 2005), proposes a marginal employment subsidy for low-skilled jobs. This proposal is distinct from other wage subsidy schemes by its means to eliminate "revolving-door" effects and displacement effects. The direct exchange of incumbent workers with subsidized workers ("revolving doors") can easily be prevented by linking the subsidy to a requirement that the number of employees in a firm should increase above some reference level. By using *double subsidization*, i.e. the payment of a subsidy not only for the new employee but also for an incumbent employee, the *Magdeburg Alternative* also makes it unattractive to circumvent this additionality requirement by outsourcing employment to new firms. In this chapter, we argue that this is the decisive trick of the *Magdeburg Alternative*. By doing so, not only is outsourcing prevented, but also massive incentives for the creation of further jobs are generated and the funding of the reform is secured.
We conduct numerical simulations to estimate the employment and fiscal effects of the *Magdeburg Alternative*. In a medium scenario, the *Magdeburg Alternative* not only creates 1.6 million new jobs, but also helps to consolidate the budget by saving between 3 and 6 billion Euro per year. Even under very pessimistic assumptions, the expected employment effects of the *Magdeburg Alternative* would still be substantial, and the public budget would be relieved in most cases.

Chapter 3
Marginal versus general wage subsidies in competitive industry equilibrium

The favorable view of marginal employment subsidies presented in Chapter 2 relies on the notion that, since a firm's incentive to hire a worker is affected only by the comparison of its marginal value product with its marginal cost, general and marginal employment subsidies at the same rate should have the same employment effect. The argument in favor of a marginal subsidy compared to a general subsidy is then obvious: if only additional employment is subsidized, the same employment effect could be created at much lower costs.
This argument neglects the repercussions of displacement between firms. As has been pointed out by Layard and Nickell (1980), even though some firms expand their production, hire new workers and obtain the subsidy, they do so mainly at the expense of other firms which have to reduce employment or are driven out of

the market. In an extreme case, all surviving firms would be (almost) completely subsidized and marginal and general subsidies would be equivalent.

In this chapter, we develop a novel approach to modeling the industry-level effects of marginal wage subsidies. We construct a model that allows us to identify the differential impact of general and double marginal wage subsidies in the presence of between-firm displacement. In line with the existing literature (Oswald 1984, Luskin 1986), we restrict our analysis to the partial equilibrium effects of a permanent marginal subsidy which is targeted at a single competitive industry, but relate it to the *Magdeburg Alternative* by incorporating double marginal subsidization. Our aim is to determine the conditions under which a double marginal wage subsidy yields better output and employment effects than a general subsidy, and to clarify which of the subsidy schemes is fiscally more efficient.

Our results show that a double marginal subsidy generally leads to lower equilibrium prices, and hence to a higher equilibrium output level, than an equal-rate general subsidy. Double marginal subsidies trigger strong displacement competition between incumbent firms, because all incumbent firms attempt to expand at the expense of other incumbent firms. This competition reduces the rents of incumbent firms and drives down prices more strongly than with general subsidies. Hence, double marginal subsidies generally result in lower prices as well as larger output and employment effects than general subsidies.

The fiscal effect, measured as the subsidy expenditures per new job, always favors the marginal subsidy if its employment effect exceeds that of the general subsidy. However, even if their employment effect is smaller, the fiscal effect of marginal subsidies can still be favorable since their displacement of non-subsidized workers is generally less than complete.

By making more specific assumptions about the functional form of the production technology, we resolve the remaining ambiguities. We show that homogeneity of the production function is sufficient to ensure favorable output, employment and fiscal effects of double marginal subsidization. Hence, by using a partial-equilibrium model that focuses on the displacement competition between firms in the same industry, we show that double marginal wage subsidies are generally preferable to general subsidies despite their between-firm displacement effects.

Chapter 4

Marginal wage subsidies: a rent-extracting instrument for employment creation

In this chapter, we resume the discussion of displacement between perfectly competitive firms under marginal subsidization. We extend the model developed in Chapter 3 in three respects. First, we embed the industry-level analysis into an economy-wide model of a small open economy. Second, besides comparing the employment and fiscal effects of a double marginal subsidy compared to a general subsidy, we examine the distributive effects of the two subsidy schemes. In particular, we analyze the differential impact of double marginal and general subsidies on incumbent firms' rents, incumbent workers' wages, the public budget, and the functional distribution of income. Third, we use this model to conduct a numerical simulation of the employment and fiscal effects of double marginal subsidies for Germany. This simulation's results, which we compare to previously derived results that did not explicitly account for intra-industry displacement (cf. Chapter 2), allows us a first estimate of the magnitude of the employment and fiscal effects and the size of the rent extraction.

It is indeed the case that between-firm displacement of considerable magnitude takes place in equilibrium under double marginal subsidies. We are, however, able to show that negative employment effects of this displacement are not sufficient to counterbalance the otherwise positive effects of the subsidy. The essential difference between the effects of double marginal and general subsidies is MES' stronger marginal stimulus to employment creation because it leads to a lower output price than would occur under general subsidization. This increases output demand and promotes employment. Since it creates more employment without necessarily subsidizing all employees, double marginal subsidization is always cheaper for the government than general subsidization.

This chapter's analysis clearly reveals why marginal subsidization is fiscally advantageous to general subsidization. Its advantage arises because marginal subsidization reduces the ability of incumbent firms to capture the rents associated with their cost of market entry and thus functions like a tax on pure economic rents. The government has to pay less for the subsidy scheme because it can indirectly make use of incumbent firms' rents to finance it.

The numerical illustration of our model yields more cautious results about the quantitative effects of recent double marginal subsidy-proposals than those predicted by methods that neglect displacement. The employment effects are still

substantial, albeit smaller than without displacement. Moreover, we find that policymakers are offered a "double dividend" at modest subsidy rates because employment gains and fiscal savings can be realized at the same time. At larger subsidy rates, however, policymakers face a trade-off between employment expansion and fiscal austerity.

This chapter shows that if politicians want to devise a self-financing subsidy scheme, but are precluded from applying taxes on pure economic rents, double marginal wage subsidies are a superior policy instrument for employment creation to general wage subsidies.

Chapter 5

Subsidizing extra jobs: boosting employment by taming the unions

In Chapters 3 and 4, we assumed that wages are rigid and do not react to the subsidy. This assumption can be justified by a policy provision mentioned in Chapter 2: since the subsidy is restricted to the low-wage sector, the government can set a wage ceiling, up to which the subsidy is paid, and raise this ceiling proportionally with average wages over all skill groups. This hinders the unions in their attempt to shift the subsidy into higher gross wages for low-wage workers.

A general analysis of marginal employment subsidies, however, has to allow for endogenously determined wages. In this chapter, we will provide an analysis of the incidence of marginal employment subsidies when unions are not directly restricted by the government and can freely set any wage they prefer.

For this purpose, we develop a general-equilibrium model with imperfect labor and output markets. We can identify a benchmark scenario in which wage taxes and general subsidies do not affect employment at all. We then turn to the formal analysis of marginal employment subsidies. The theoretical literature has focused on symmetric marginal wage subsidies where firms are rewarded when they increase employment but are punished when they reduce their workforce. Real-life marginal wage subsidy programs, however, are asymmetric. They subsidize employment expansions but do not punish shrinking firms. This small difference has severe consequences for the incidence of marginal employment subsidies. One might expect that the additional punishment of layoffs under symmetric subsidization may be good for employment, but the opposite is true. The punishment threat of a symmetric marginal employment subsidy makes it more costly for firms to lay off workers when trade unions aggressively raise wages.

Trade unions can thus shift a large share of the wage subsidy towards higher net wages. In our benchmark case, this effect is so strong that symmetric marginal subsidies do not affect employment at all. In the asymmetric case without punishment, by contrast, the firm may be more willing to shrink and lay off a substantial fraction of its workforce when wages become too high. This tames the trade unions. Rather than shifting the whole wage subsidy into higher gross wages, trade unions can raise the wage at most to the level at which the firm becomes indifferent whether to hire more workers or to shrink and lay off workers. This wage restraint leads to positive employment effects of asymmetric marginal employment subsidies.

While the introduction of an asymmetric marginal subsidy at small subsidy rates always increases employment and welfare, higher subsidy rates might raise aggregate employment enough to make the threat of shrinking less frightening for the trade union. This may induce some trade unions to let their firm shrink while other firms continue to expand. The general equilibrium thus exhibits displacement between incumbent firms. Although this displacement may lower employment, we show that the government can promote employment further if it sets the wage subsidy sufficiently high. However, these additional employment gains come at a huge welfare loss. Employment will be concentrated in very few firms which sell their goods at low prices while the majority of firms shrink and sell their goods at higher prices. This distorts the optimal consumption pattern: the variety of goods is diminished substantially. Our numerical simulations illustrate that employment and welfare move in the same direction for moderate subsidy levels, but that the trade-off becomes severe for larger subsidy rates.

In how far these results carry over to the long run with free entry crucially depends on the way in which new firms are treated (Section 6). When they are eligible for the subsidy, their whole workforce has to be subsidized. Any incumbent firms could take advantage of this by setting up a new firm to which it relocates all its business activities. A marginal employment subsidy would then become equivalent to a general wage subsidy in the long run. Alternatively, the government could grant the subsidy to incumbent firms only. In this case, the marginal employment subsidy will continue to tame the trade unions even in the long run. As marginal subsidies normally reduce profits, new firms will not enter and our short-run analysis carries over to the long run. Only if the desire for variety is very high, profits rise and new firms will enter. This may lead to lower,

though still positive employment effects compared to the short run, but the larger variety of goods will increase welfare even further.

Chapter 2

The Magdeburg Alternative: A policy proposal for Germany[1]

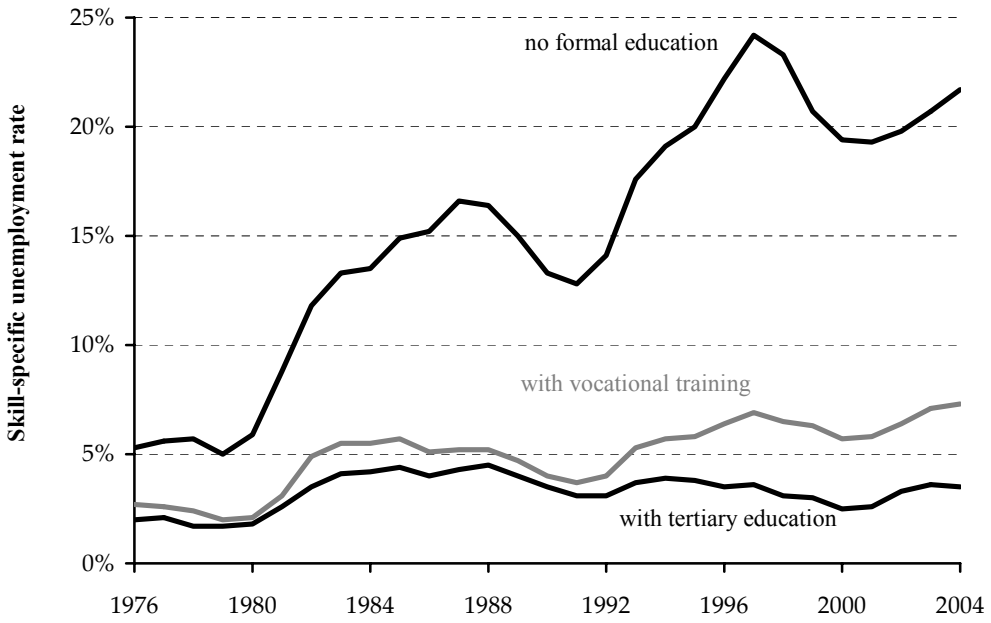
1. Introduction

The fight against mass unemployment is, or at least should be, at the top of the agenda of economic policymakers in Germany. To find an effective cure for the unemployment problem, one first needs the right diagnosis. A specific examination of the German unemployment problem shows that, although unemployment is very high in general, large differences exist between different qualification strata (Figure 2.1). While unemployment of college graduates is relatively low, the market for unskilled labor is in a deep crisis. In Western Germany, the unemployment rate of people without a completed formal education was 21.7 percent in 2004, almost eight times as high as that of college graduates. In Eastern Germany, these figure are even worse, indicating that more than half of all people without formal qualification are not able to find a job. The productive capabilities of these workers are wasted instead of allowing them to contribute to the wealth and well-being of society. Large amounts of public transfers have to be expended to alleviate the resulting poverty and social exclusion that comes with being unemployed.

The reasons for this social grievance lie on both sides of the labor market. On the supply side, low-skilled unemployed have few incentives to take up work. Even a full-time job would not give them considerably more income than the welfare

[1] Parts of this chapter were written in collaboration with Ronnie Schöb and Joachim Weimann and have been published in the CESifo Working Paper Series (Knabe, Schöb and Weimann 2006a).

benefits they can receive without working at all. On the demand side, high labor costs destroy the jobs opportunities even for those willing to work.



Source: Reinberg and Hummel (2005, Appendix)

Figure 2.1: Skill-specific unemployment rate (1976-2004, former West Germany)

Demand for low-skilled labor has decreased in all developed countries. On a global level, this decrease in labor demand is mainly caused by two phenomena: First, skill-biased technological progress makes skilled labor more valuable compared to unskilled labor. Second, globalization leads to stronger interconnections between industrialized and developing economies which threatens the income position of the low-skilled in the developed world.[2] Nevertheless, unemployment is not an inevitable effect of the decrease in demand for low-skilled labor. In economies with flexible labor markets, such as the United States, the labor market adjusts by increasing wage dispersion. With lower relative wages, the employment of low-skilled workers remains profitable for

[2] Acemoglu (2002), Johnson and Stafford (1999), and Hijzen et al. (2005) present empirical evidence for the impact of globalization and technical progress on the employment opportunities of the low-skilled.

firms. Of course, the drawback of this reaction is increased inequality – creating a stratum of "working poor."

The German labor markets lacks this wage flexibility. The German social security system provides wage-replacement benefits; they are only paid out to replace wages, not to supplement low wages. The resulting very high benefit reduction rates make it undesirable for social assistance recipients to seek work. For example, if a social assistance recipient earns 1,200 Euro per month, by taking the job he can increase his monthly net income by merely 280 Euro. For many, this is not sufficient to make it worthwhile to take low-paid jobs. Wages need to be high enough to clearly lift people out of the welfare range; otherwise there is no incentive to take the job. This system creates an implicit minimum wage below which no worker will be willing to accept a job. Wages of low-skilled workers cannot fall below this minimum wage. Since the productivity of many people is below this mark, however, they are excluded from the labor market.

Wage subsidies are a potential remedy to this problem. If gross wages are too high, or net wages too low, the government could grant an employment subsidy that closes the gap between the workers' reservation wages and the firms' willingness to pay. As easy as it sounds, there are certain cliffs to sail around when designing a successful wage subsidy program. For example, policymakers have to decide whether the wage subsidy should be paid to employees or employers. Giving the subsidy to employees would raise their net wage. This would lead to increased incentives to take low-paid jobs that they would not have taken without the subsidy. Because people will work for lower wages than before, firms have an incentives to hire more workers – unemployment decreases. On the other hand, employer-oriented subsidies focus on giving the money to firms if they hire unemployed people. This makes it profitable for firms to hire workers even at wages above the respective workers' productivity, which would not have been done before – unemployment decreases as well. Ultimately, it does not seem to matter who receives the subsidy. A flexible labor market will find the right price that equilibrates supply and demand. So why is there such a quarrel about who should receive the subsidy? Simply put: Germany does not have a flexible labor market. The implicit minimum wage and collective wage bargaining inhibit

the appropriate movement of wages and a market-based distribution of subsidy payments. Under these circumstances, the equivalence of employer- and employee-oriented subsidies does not hold anymore. Labor demand can only be stimulated if the subsidy is given to employers directly.

The largest political obstacle to the implementation of a wage subsidy program is its fiscal cost. Ideally, a wage subsidy would be self-financing by creating as much savings in welfare expenditures as to be expanded for the subsidy. A *general* wage subsidy, however, will never be self-financing when it is implemented because it subsidizes all existing jobs before a single new job is created. *Marginal* wage subsidies can alleviate this problem. Such subsidies are restricted to the extra jobs a firm creates in addition to its incumbent workforce. The marginal stimulus to employment creation stays the same, but the subsidy's fiscal costs are tremendously reduced.

In this chapter, we will discuss a recent policy proposal for Germany. The so-called *Magdeburg Alternative*, developed by Schöb and Weimann (2003, 2005), proposes a marginal employment subsidy for low-skilled jobs. Under this proposal, firms receive a permanent rebate of the social security contributions for all workers they hire in excess of their employment level at a pre-determined reference date. Firms could try to exploit the subsidy by "outsourcing" all their employees: they could set up a new firm and transfer all their workers to this new firm. Since all workers are additional in the new firm, they would all be subsidized, even though aggregate employment would not have changed. To prevent such outsourcing, the *Magdeburg Alternative* introduces *double marginal subsidization.* If a firm hires an additional worker, it receives a subsidy not only for this workers, but also for one of its incumbent workers. This doubles the marginal incentive to employment creation, makes outsourcing less attractive, and leads to even larger employment effects.

We proceed as follows. In Section 2, we lay out the two-sided character of Germany's labor market problem. In Section 3, we discuss the requirements for an efficient wage subsidy scheme for the low-skilled. Section 4 briefly reviews employee-oriented wage subsidy programs and discusses their limitations in rigid labor markets. Against this background, we then present the *Magdeburg*

Alternative and conduct simulations to estimate its employment and fiscal effects. Section 6 concludes.

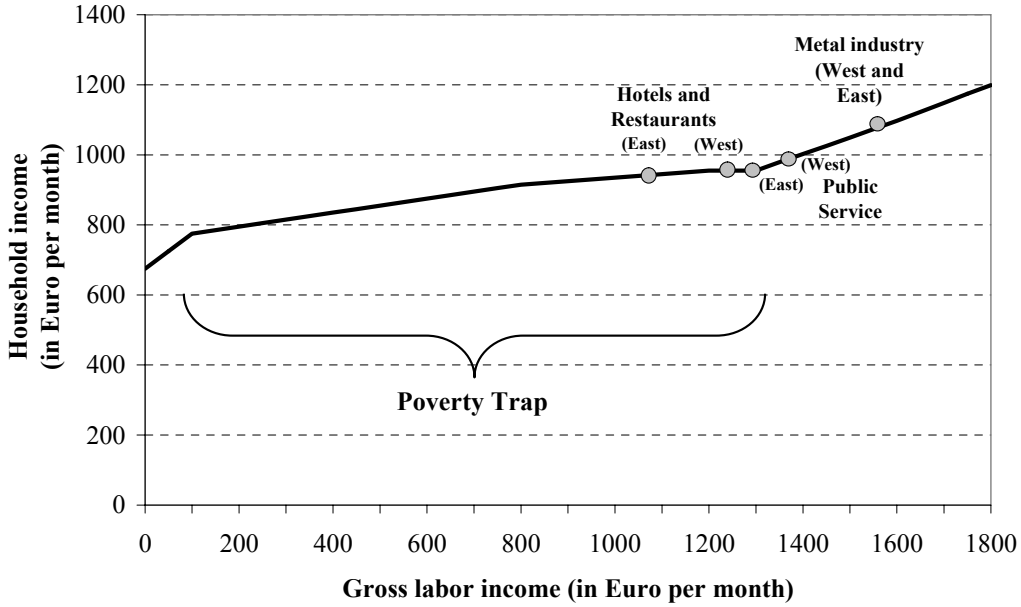
2. Germany's two-sided labor market problem

The German labor market for low-skilled workers is characterized by a two-sided problem. The high level of taxes and social security contributions in combination with implicit minimum wages and unionized wage negotiations have led to too high wages at the bottom end of the wage scale and reduced labor demand substantially. At the same time, the welfare state has cushioned the low-skilled unemployed with benefit payments that are conditioned on not being in employment and discouraged them from searching for employment with transfer reduction rates of up to 100 percent and beyond. A successful employment policy measure thus has to tackle both sides simultaneously to solve the unemployment problem. Lowering gross wages without creating incentives for the unemployed to accept job offers will fail as will improved incentives to accept jobs when gross wages remain high.

According to current German law, long-term unemployed low-skilled workers receive welfare benefits according to some defined socio-cultural minimum level of existence. In general, this minimum existence level is not far below the net wage achievable from low-paid work (cf. Boss and Elender 2005). If workers decided to accept a low-wage job, the high German benefit reduction rates mean that the net gain of a full-time job is typically too small to be attractive. If at all, the German system favors part-time work.

This poverty trap in the German system welfare system is illustrated in Figure 2.2. A single welfare recipient without children receives a monthly benefit of about 677 Euro (including a housing allowance). If he takes up regularly paid work, he can keep the first additional 100 Euro without deductions. If he earns more than that, 80 percent (of gross income between 100 and 800 Euro) or 90 percent (of gross income between 800 and 1200 Euro) per additional Euro are deducted from benefits. This increases the incentive to accept part-time jobs while the incentive to search for a full-time job instead is almost eliminated in the current system. Income above 1200 Euro per month is completely deducted from welfare benefits.

As the graph illustrates, the lowest wage brackets promise net incomes that barely create sufficient incentives to accept full-time jobs. The poverty trap constitutes the first welfare dilemma for the German labor market, because the way the welfare system is constructed creates the cases it is supposed to help.



Source: WSI (2007) and own calculations.
Legend: The solid line depicts the net household income of a single welfare recipient, depending on his gross labor income. The dots show the lowest union wage groups in selected sectors.

Figure 2.2: The poverty trap

The demand side of the labor market is impaired with a second welfare dilemma. The welfare system is basically a redistributive means to which one should contribute according to one's ability-to-pay. Unlike the tax system, which exempts income below the minimum existence level from taxation, the social security system considers all persons as able-to-pay when they are employed. All workers have to contribute from the very first Euro onwards to the social security system. This way of identifying ability-to-pay implicitly assumes that every worker is productive enough to both contribute to the welfare system and still have a net income above the minimum level of existence. This is no longer true for an increasing number of low-skilled workers. Their gross reservation wage lies

above their value-added, and thus their labor is not demanded by firms anymore. Since the unemployed are already covered by the social security system, the social security contributions they pay when taking up a new job do not create any new entitlements from the social insurance system. Health insurance coverage remains the same and additional entitlements on the pension and unemployment insurances are too small to lift individuals above the minimum existence level in case of need. From an economic point of view, social security contributions on low-paid income are thus equivalent to a labor tax. Since this tax raises gross wages above the productivity level of the low-skilled, it actually works like a prohibitive tax on labor. Wage subsidies can be interpreted as an instrument to eliminate the distortions the government has introduced in the first place.

3. The optimal design of wage subsidies: institutions matter!

The question arises how to design wage subsidies. The way in which wage subsidies work differs fundamentally between economies with flexible labor markets, in which wages are determined by the law of supply and demand, and highly regulated labor markets, where wages are bargained over between large interest groups. In Germany, collective bargaining is the main institution where rent-sharing rules are set and distributional conflicts between labor and capital are settled. The so-called 'Tarifautonomie' is a constitutional right of employer and employee organizations to negotiate labor contracts without undue governmental interference. This constitutional status leads to the labor organizations using the wage as the main distribution key for the domestic product between labor and capital. Restricting or eliminating this institution will not be possible without risking social unrest and increasing conflicts between workers and employers (cf. Schöb 2002).

If wages are fixed by collective agreements or by explicit or implicit minimum wages, gross wages cannot be altered by a wage subsidy given to workers – at least in the short and medium run. And even in the long run, insiders may be able to defend their position (see Lindbeck and Snower, 1988 and 2001). Net wages, by contrast, cannot be altered by a wage subsidy given to employers. In such an institutional setting, a wage subsidy cannot be shifted easily on either market side,

so it does matter whether the subsidy is given to employees or employers. As a consequence, policymakers need to know whether they have to stimulate labor supply or labor demand. If gross wages are too high – for the reasons discussed earlier – labor demand should be stimulated by directly subsidizing employers. If, in addition, incentives to accept new jobs are lacking, complementary policy measures such as an additional wage subsidy to employees are required.

From a fiscal point of view, any *general* subsidy – independent of whether it is given to employers or employees – will cause a fiscal deficit at the beginning as it subsidizes existing jobs right from the implementation while it takes some time before a significant number of new jobs lead to a reduction of welfare benefit payments. Public acceptability, however, requires that new labor market reforms do not impose an additional fiscal burden. This constraint not only applies in the long run but must be fulfilled even in the short run. Thus, employment policies must be strictly targeted to actions that directly reduce public expenditures. In other words, an individual job match between an employer and an employee can only enjoy a reduction in taxes and social security contributions if the creation of this match directly reduces unemployment and lowers public welfare expenditures. This rules out across-the-board tax reductions for low-skilled workers, as they are sometimes advocated (cf. German Trade Union Federation 2003).

4. The American EITC and its European offsprings

One way to reconcile social policy that aims at providing a minimum income with the economic fact that in many cases low-skilled productivity may not be sufficiently high to pay for it is to "make work pay." Instead of paying wage-replacing benefits that are decreased if a person starts working, the state could pay wage-supplementing benefits that increase a person's income if he decides to leave welfare and accepts a low-paid job. Such employment-conditional benefits serve two purposes: they lower the wedge on low wages, thereby stimulating employment, and at the same time serve as a redistributive measure that raises low wages to socially acceptable levels.

The "prototype" of such employee-oriented subsidies is the Earned Income Tax Credit (EITC) in the United States, which was introduced in 1975 as a modest program to offset social security payroll taxes for low income families with children. Subsequent reforms (major expansions in 1986, 1990, and 1993) made it one of the largest welfare programs in the US. The EITC grants a tax credit to low-income earners that functions like an employee-oriented wage subsidy. For low family income, each additional dollar earned is rewarded by a 40 cent tax credit (phase-in). Thus, a family can receive a maximum of US$ 4,008 in addition to a market income of US$ 10,020. If family income exceeds US$ 13,090, the EITC is gradually reduced (phase-out). In this income range, the benefit reduction puts a burden of 21 cent on each additional dollar earned by the family.

Similar programs have been introduced in European countries as well, even though on a much smaller scale than in the United States. While the maximum amount of the EITC corresponds to 13.4 percent of the full-time median wage in the US, Britain pays a maximum of 10.3 percent, the Netherlands 3.4 percent, France 3.3 percent, and Belgium 1.3 percent (cf. OECD 2003, p. 159). In Germany, the switch from wage-replacing benefits to wage-supplements is also being discussed. The most prominent proposal is called *Activating Social Welfare* (Sinn et al. 2002, 2006) developed by the Munich-based Ifo institute. The European Economic Advisory Group at CESifo is propagating the same idea as a "Proposal for Europe" (Corsetti et al. 2002, Ch. 6). *Activating Social Welfare* comprises three steps necessary for a successful reform. First, welfare benefits for recipients who are able to work have to be reduced significantly (up to 53 percent) so that staying on welfare without working can only be affordable for persons who have other sources of income (e.g. from the shadow economy). Second, a tax credit subsidizes low incomes such that even for low-wage work net incomes are higher than current welfare benefits. Third, for those on welfare who cannot find a job on the labor market even though they are willing to work, the state has to step in and provide public employment opportunities.

The first two steps are the typical ingredients of the "making-work-pay" recipe. While the introduction of wage-supplementing elements is rather uncontroversial, the substantial reduction of basic welfare levels would be in harsh conflict with

the legal minimum income definitions in most European countries. Welfare recipients who are willing to work but cannot find a job have the right to their socio-cultural minimum of existence. Step three of *Activating Social Welfare* is meant to circumvent this problem. If a person is not able to find a job in the labor market, the state will provide jobs in public employment companies. These jobs will pay a wage equal to the current level of welfare benefits, so that nobody willing to work will have to live below the minimum of existence. If a welfare recipient refuses to take a job in a public employment company, he can be expected to have better sources of income and can live with reduced benefits.[3] The establishment of public employment thus functions as a self-selection device: currently, the alternatives of the welfare system are either working for low wages or staying at home with slightly less benefits. With public employment programs, the options become either working for low wages or working for welfare benefits. Faced with these alternatives, only the truly needy will accept the public "workfare" jobs, others will refuse to work (legally) and have to accept drastically reduced benefits.[4]

To avoid "revolving-door" effects, i.e. that firms simply replace already employed workers with subsidy-recipients, all workers, no matter whether previously employed or not, have to receive the tax credit. Of course, this will increase the fiscal burden of the reform proposal, but corresponds to the more general goal of creating a low-wage sector without creating "working poor." For Sinn et. al. (2002, 2006), these windfall gains are not undesirable side effects, but a necessary component of a successful reform package.

In an economy with downward rigid wages above market-clearing levels, however, *Activating Social Welfare* will not create a single new job since it does not lead to a fall in labor costs. What may have been a success story in the United States might become a failure in Continental European countries without complementary policy measures. Deregulation that moves the labor market

[3] This procedure is compatible with most currently existing laws. For example, the German social code states that the state should create public jobs for those welfare recipients who do not find a job and pay them only a small allowance in addition to their benefits (§16(3) SGB II). Refusal to accept these jobs is punished with benefits reductions (§31 SGB II).

[4] A more formal, albeit very illustrative, analysis of the effects of work-requirements can be found in Besley and Coate (1992).

towards a more flexible structure is one option, but is strongly opposed by trade unions in Germany. If, due to complementary policies, gross wages fall, their members would be the losers of the reform. Only the non-represented outsiders would benefit. But even in a more flexible labor market success may be doubtful. Sufficient wage pressure from outsiders requires that public employment must be provided for all unemployed workers from the very first day *Activating Social Welfare* is introduced. Otherwise, the labor supply effect would be diluted since everyone has a constitutional right to receive the legal minimum income. Pure employee-oriented subsidies need market forces to shift the subsidies to the market side where they are needed. Thus, such a subsidy scheme must be embedded in a full-scale de-unionization of the labor market. If the reformers miss this ambitious goal because of the resistance of unions and incumbent employees, they will fail to create new jobs and leave behind huge fiscal deficits.

5. Employer-oriented subsidies: The *Magdeburg Alternative*

Since the transmission mechanism of employee-oriented subsidies to lower wages is impeded by strong labor unions and other rigidities, the alternative is to grant subsidies to the employer. This is the key element of a proposal that was launched in the German political discussion under the name *Magdeburg Alternative* (Schöb and Weimann 2003, 2005). As pointed out above, a wage subsidy alone may not be sufficient to create jobs. The *Magdeburg Alternative* therefore comprises four elements that take account of the two-sided labor market problem, eliminate potential displacement effects, and allow for a permanent change from welfare to workfare in a way that does not require further fundamental reforms.

5.1. The four elements of the *Magdeburg Alternative*

1. Reimbursing social security contributions for the lowest wage group

The *Magdeburg Alternative* reimburses the employers the total amount of social security contributions, i.e. employees' and employers' contributions, if they hire a long-term unemployed welfare recipient. Reimbursement requires that the wage for the new job does not exceed the wage in the current *lowest* union wage bracket

for the particular sector. In Germany, this would reduce labor costs by 34% in the low-skilled labor market segment.[5] Since labor costs are reduced immediately, firms benefit as of the first day of the reform, which is different to employee-oriented subsidies, these having to rely on a functioning transmission mechanism translating higher net wages into lower labor costs. The net wage of newly hired workers is exactly the same as that of incumbent workers.

2. Double marginal subsidization: additional reimbursement for existing jobs

Employer-oriented wage subsidies can be implemented in two ways. They are *general* when they are granted for both incumbent and new workers. This makes them very expensive – in the introductory phase in particular since firms receive subsidies for incumbent workers even before they start hiring additional workers. Alternatively, one can target the subsidy. In this case, the displacement of incumbent workers by subsidized workers and outsourcing endanger the success of such a scheme and raise the fiscal burden too. Our proposal provides two mechanisms to prevent these undesirable side effects.

To avoid displacement of the incumbent workers *within* the firm, the subsidy is paid only if low-skilled employment in the firm increases compared to the employment level at a certain reference date: only the number of workers exceeding this level will be subsidized. The reference date has to be in the past so that firms cannot adjust the number of workers immediately before it.[6]

Even if displacement in the same firm can be prevented by subsidizing new employees only, a firm could still outsource its low-skilled employees. In a new firm, all low-skilled workers would be subsidized. Outsourcing would yield the same effects as displacement within the same firm. But outsourcing is not costless. A new firm has to be established, administrative costs increase,

[5] In 2007, German social security contributions amount to a total of 40.6 percent, which is split between employees (20.75 percent) and employers (19.85 percent). The employer's part is added onto official gross wages. The effective reduction of labor costs is thus $1-(1-0.2075)/(1+0.1985)=0.339$.

[6] Real-life marginal employment subsidy programs frequently feature a reference date. For example, the first such program, the German *Steuergutscheine für Mehrbeschäftigung* (tax rebate for additional employment), set the employment on August 15th, 1932, or the average employment between June and August 1932, whichever was higher, as the reference employment level (Marcon 1974, p. 192).

production plans have to be reorganized, new employees (former welfare recipients) need to receive some training, etc. Although these costs have to be compared with the savings of outsourcing, a saving of 35 percent of the labor costs will still probably be high enough to encourage large-scale outsourcing. This would render the reference date solution ineffective – at additional cost.

To make outsourcing unattractive, the *Magdeburg Alternative* subsidizes not only new employees but also incumbent employees: for each newly hired low-skilled worker one incumbent worker also becomes eligible for the subsidy. This *double marginal subsidization* constitutes an incentive to keep old employees in the firm since it changes the marginal calculus of the firm. Obviously, if the hiring of one new employee also reduces labor costs for an old employee, the marginal costs of labor are even lower than with the single marginal subsidy. Hiring a new employee pays twice the subsidy, such that marginal labor costs are reduced by nearly 70 percent.

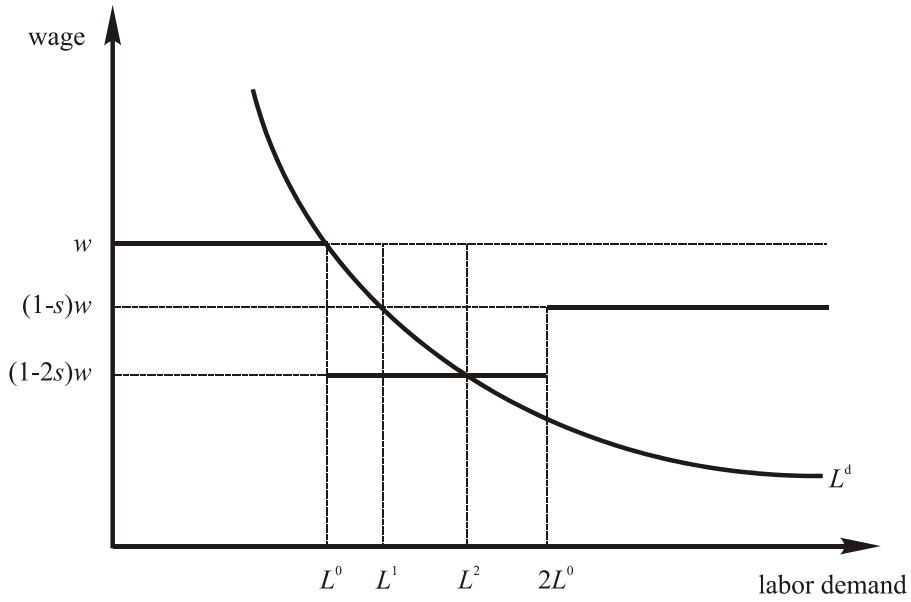


Figure 2.3: Double marginal subsidization

Figure 2.3 demonstrates the functioning of double marginal subsidization for a single competitive firm. The firm's labor demand curve is given by L^d, the status quo labor cost is denoted by w. The profit-maximizing labor demand is at L^0. If

the subsidy is restricted to the social security contributions of new employees, the marginal wage rate would drop to $(1-s)w$, where s is the single subsidy rate. The profit-maximizing level of employment would be at L^1. Double marginal subsidization reduces the marginal wage rate even further to $(1-2s)w$. Of course, this further reduction increases labor demand even more to L^2. Hence, the subsidization of the old workforce being conditional on the creation of new jobs leads to even stronger employment gains.

The incumbent firms thus face lower marginal labor costs, since a new firm receives only the single marginal subsidy for all its employees. The subsidy, however, always reduces a new firm's average labor costs by s percent while the average labor costs of the incumbent firm only falls as the firm increases employment. Its reduction in average labor costs is only $2s(L-L^0)$, which is smaller than sL as long as $L<2L^0$. This disadvantage, however, is desired: an established firm can only compensate its cost disadvantage compared to new firms by expanding its employment. Only if the established firm doubles its employment does it obtain the same reduction in average labor costs as a new firm.

3. Improving labor supply incentives

Germany has a two-sided labor market problem. An employer wage subsidy will only cure labor demand but will fail to promote labor supply of those on welfare. Complementary measures are necessary. Instead of providing costly subsidies to employees, the *Magdeburg Alternative* proposes to tighten eligibility rules: if someone refuses to work, he will lose his welfare benefit payments. In Germany, the existing social code (§31 SGB II) allows the employment agency to reduce the welfare benefits by 30 percent if a recipient refuses to work. Repeated refusals can even lead to full cancellation of benefits: if someone is given the opportunity to provide for himself and repeatedly refuses to do so, he cannot rely on society's support. These rules are only applied to those able, but not willing, to work. People in need, whether they are unable to work or cannot find a job, will receive their socio-cultural minimum income as before. Social security's important role as

the "lowest safety net" stays untouched – only the often-cited "hammock" is torn down. Rather than increasing the remuneration for work, the incentives to work are raised by lowering the reservation wage via a "tax on voluntary idleness".

4. Unlimited duration

The fundamental problem of the market for low-skilled labor is that the productivity of an increasing fraction of the workforce falls below the implicit minimum wage defined by the minimum existence level. This level is defined in relative terms, i.e. it relates to average incomes. Since the productivity of the low-skilled does not grow as fast as average productivity, more and more low-skilled workers will not be able to earn enough to cover their minimum level of existence by their own means. Welfare systems with traditional wage-replacement benefits will consequently exclude a growing fraction of the labor force from the labor market.

Wage subsidy schemes – including the *Magdeburg Alternative* – can move the state towards a workfare system where the government only pays the gap between low-paid wage income and the socially accepted minimum existence level. Such a regime shift, obviously, must be of permanent duration.

Temporary subsidy schemes have another weakness. When the subsidy is of limited duration, a firm will only hire a subsidized person if the worker's productivity is only temporarily below its labor costs, and can be increased by (on-the-job) training, etc. As soon as the subsidy runs out, the worker has to be able to produce a value-added that at least covers his costs or he will be replaced with the next subsidized worker. The resulting "revolving- door" effect is typical for limited-duration wage subsidies – it does not increase total employment but creates additional cost due to excessive training. Firms will only expand their demand for low-skilled employment if they can expect long-term benefits from it, which will only happen if firms can rely on permanent labor cost reductions.

As mentioned before, the ceiling below which wages are subsidized is related to existing negotiated wages in the lowest wage bracket. This ensures that incumbent low-skilled workers will not lose and this could thus increase political acceptance. The ceiling must not, however, be conditioned on negotiated wages in the future.

Chances would be high that the subsidy then becomes part of the bargaining mass and is redistributed between workers and firms. This would raise wages in the lowest wage bracket and reduce the employment effects. The ceiling must therefore be determined independently of future wage negotiation outcomes. For instance, this could be achieved by raising the ceiling according to average productivity. In this case, the ceiling rises proportionately with the socio-cultural existence minimum level, which is also linked to average productivity.

5.2. Employment and fiscal effects

The *Magdeburg Alternative* replaces an existing subsidy for non-employment with one that subsidizes employment instead. It is thus understood as a workfare scheme that allows the state to pay only what the individual cannot provide for himself. To show that this can reduce the state's fiscal burden substantially, we proceed in two steps. We first calculate the fiscal savings of getting a welfare recipient back to work. Then we estimate how many new jobs will be created and present an aggregate cost-benefit analysis that takes account of the additional cost due to double subsidization. These calculations are presented for the specific institutional details of the German welfare and tax systems. Nevertheless, the analysis is sufficiently general to allow its extension to other institutional settings.

Costs and benefits of getting one welfare recipient back to work

The *Magdeburg Alternative* subsidizes new jobs up to a ceiling that correspond to the status quo lowest union wage brackets. For our calculation, we assume a ceiling equal to a monthly gross wage of 1,200 Euro.[7] Since social security contributions amount to 40.6 percent of gross income in 2007 (health insurance contributions: 14.8 percent; care insurance: 1.7 percent; pension insurance: 19.9 percent; and unemployment insurance: 4.2 percent), the monthly reimbursement is 487.20 Euro.[8]

[7] The level of gross wages in the lowest wage group in the different sectors ranges from about 1,000 Euro to 1,800 Euro (WSI 2007).

[8] Employees without children pay an additional surcharge of 0.25 percent on their care insurance premium. Since this surcharge discriminates between different types of employees, we will not include it in the reimbursement of SSC to employers.

If a welfare recipient takes up a job, the government saves on his welfare benefits. For a single person without children, the monthly welfare payment is 347 Euro, plus an average housing allowance of 330 Euro. In addition, the government pays social insurance contributions for unemployed, i.e. it contributes 127.50 Euro per month to a recipient's health and care insurances and 40 Euro to his pension insurance. All transfers are paid by the federal government except 68.8 percent of the housing allowance, which is covered by the municipality.

Previous German workfare experiments have shown that some welfare recipients prefer to decline a job offer, even if that means forfeiting future benefits, e.g. because they work in the shadow economy or can rely on family support. In the German city of Leipzig, a field experiment where all welfare recipients were called on to work full-time in a municipal public works company resulted in refusal rates of one-third (Feist and Schöb, 1998). Other cities report drop-out rates between 24 and 29 percent (German Bundestag, 1998). To present a more cautionary estimate, we assume that only every sixth recipient drops out of welfare instead of taking the job. Fiscal savings will be correspondingly lower.

To a minor extent newly employed workers also pay income taxes, which further reduce the fiscal burden. Income tax revenues are split between the jurisdictions. The federal level and the states receive 42.5 percent each of income tax revenues while the municipalities receive 15 percent. The so-called *Solidaritätszuschlag*, a tax surcharge levied on individual income tax liabilities, accrues solely to the federal government.

The reimbursement of social security contributions imposes no net burden on the public budget since the fact that an unemployed welfare recipient takes up a job does not affect his claims against the social insurance system. Welfare recipients are fully insured by the health and care insurances and remain so when they take up a new job. Only in case of the pension and unemployment insurances can former welfare recipients claim larger pay-outs. The public pensions of low-wage workers, however, will generally be too small to cover the minimum existence level, so that, again, the residual has to be covered by the welfare system.[9] Any

[9] In Germany, persons aged 65+ are covered by the *Grundsicherung im Alter* (basic old-age security), which provides a basic pension at the same level as welfare benefits.

payment contributed to the pension insurance by a low-wage worker only reduces the future liabilities of the welfare system one to one and is thus revenue-neutral. The same logic applies to the unemployment insurance. All contributions of a low-wage worker reduce the future liabilities of the welfare system in the case of future unemployment. Hence, the subsidy paid to a newly employed former welfare recipient is completely revenue-neutral. The expenditures of the federal government are equal to the additional income of the public social insurance system.

Savings (+)/ Costs (-)	Federal Level	States	Health Insurance	Pension Insurance	Unem-ployment Insurance	Munici-palities	Total
Health Ins. Contributions	-70.50	---	+70.50	---	---	---	0.00
Pension Ins. Contributions	-198.80	---	---	+198.80	---	---	0.00
Basic Old-Age Security	+198.80	---	---	-198.80	---	---	0.00
Unempl. Ins. Contribution	-50.40	---	---	---	+50.40	---	0.00
Grant to Unempl. Ins.	+50.40	---	---	---	-50.40	---	0.00
Income Tax	+20.86	+20.86	---	---	---	+7.36	+49.08
Welfare Benefits	+449.96	---	---	---	---	+168.96	+618.92
Drop-Outs	+89.99	---	---	---	---	+45.41	+135.40
Monthly savings	+490.31	+20.86	+70.50	0.00	0.00	+221.73	+803.40
Annual savings	+5,883.67	+250.32	+846.05	0.00	0.00	+2,660.76	+9,640.80

Source: Own calculations

Table 2.1: Costs and benefits if a single welfare recipient is placed in a new job

Table 2.1 shows the payment flows if a single welfare recipient is placed in a job with a monthly gross wage of 1,200 Euro. As we have explained above, the reimbursement of social security contributions flows from the federal level to the social insurances and thus nets out in the aggregate. Moreover, additional claims to pension and unemployment insurances directly reduce future welfare liabilities of the federal government. Only the health insurance is a net beneficiary; it enjoys higher contributions without having to provide more services.

While the reimbursement does not constitute a net drain to the public budget, the associated savings are substantial. The largest item is previously paid welfare benefits, which save 619 Euro per new job, split into 450 Euro for the federal level and 169 Euro for the municipalities.[10] Additional savings of 135 Euro result from drop-outs. Together with additional monthly tax revenues of 49 Euro, total savings amount to 803 Euro per month or 9,641 Euro per year.

Similar calculations for different household types (married couples, families with children etc.) show that the savings of bringing one person into work are generally of the same magnitude. The average savings per new job, weighted by the relative frequency of different household types, is 9,396 Euro per year. Larger households receive higher benefits, so that bringing them back to work reduces the public welfare load more than for a single recipient without children. At the same time, other tax revenues are smaller and savings from drop-outs are lower because welfare can be reduced only for the person who declines to work.

Aggregate costs and benefits

Aggregate costs and benefits depend on how many new jobs will be created and how high the additional costs that arise are because the double marginal subsidy and possible displacement effects make it necessary to subsidize already existing jobs. We estimate that about 2.1 million full-time jobs currently exist in the German low-wage sector.[11] The current number of long-term unemployed welfare recipients is 2.8 million.

As a cautionary guess, we will assume a constant wage elasticity of labor demand of 0.5. Additionally, we will examine an optimistic and a pessimistic scenario with labor demand elasticities of 0.7 and 0.3, respectively.[12] Table 2.2 presents the

[10] With a gross wage of 1,200 Euro, even a single welfare recipient is incapable of leaving welfare completely. Hence, additional welfare benefits of 58 Euro are paid to top up his net wage. This explains why only 619 Euro of 677 Euro welfare benefits are saved.

[11] To calculate this number, we applied the share of employees in the lowest qualification group, as obtained from the German wage statistic (Hake and Kaukewitsch 2001), to the current number of total employment, and converted part-time jobs into full-time equivalents. The lowest qualification group comprises all jobs that, in case of blue-collar workers, require less than three months experience or that, for white-collar workers, do not require formal vocational training.

[12] This is in line with the empirical literature on the wage elasticity of labor demand. In his survey, Hamermesh (1993) concludes that the most probable interval for the constant-output elasticity is

employment and fiscal effects in all three scenarios. The double marginal subsidy reduces marginal labor costs by 68 percent.

	Wage elasticity of labor demand								
	0.3			0.5			0.7		
	Add. displacement (in percent)			**Add. displacement (in percent)**			**Add. displacement (in percent)**		
	0	50	100	0	50	100	0	50	100
Employment gain (in '000s)	832	832	832	1,566	1,566	1,566	2,058	2,058	2,058
Fiscal savings from hiring former welfare recipients (in mill. € p.a.)	7,818	7,818	7,818	14,716	14,716	14,716	19,339	19,339	19,339
Costs of stock subsidy (in mill. € p.a.)	4,757	4,757	4,757	8,954	8,954	8,954	11,767	11,767	11,767
Additional displacement (in '000s)	0	613	1,226	0	246	492	0	0	0
Costs of displacement (in mill. € p.a.)	0	3,505	7,010	0	1,407	2,813	0	0	0
Fiscal effect p.a. (in mill. Euro)	**3,061**	**-444**	**-3,949**	**5,762**	**4,355**	**2,949**	**7,572**	**7,572**	**7,572**
Fiscal effect per new job (in Euro)	**3,678**	**-534**	**-4,746**	**3,679**	**2,781**	**1,883**	**3,679**	**3,679**	**3,679**

Source: own calculations.

Table 2.2: Aggregate employment and fiscal effects

In the pessimistic scenario (constant elasticity of 0.3), this fall in labor costs leads to a 40.4 percent increase in labor demand. With current employment at 2.1 million persons, this corresponds to 832,096 new jobs. Since each new job saves the public budget 9,396 Euro, direct savings are equal to 7.8 billion Euro. From this, one has to subtract the expenditures for the double subsidization. If all new jobs are subject to double subsidization, the additional reimbursement is 487.20 Euro per month and job. The annual costs are thus equal to 4.8 billion Euro. We also assume that remaining regular jobs are partly replaced by subsidized jobs, which raises costs. We present the costs if no, half, or all unsubsidized workers are in some way displaced and have to be subsidized, too. If half or all of these

between 0.15 and 0.75. The unconditional elasticity, which takes output effects into account, lies on average at around unity (Cahuc and Zylberberg 2004, 211). For low-skilled workers, recent studies with German data show that their conditional elasticity is 0.5 in the manufacturing sector and 2.1 in the service sector (Addison et al. 2007).

employees have to be subsidized, the additional costs are 3.5 billion or 7.0 billion Euro, respectively. Summing up, the pessimistic scenario results in 832,096 new jobs, but might lead to net fiscal costs depending on the magnitude of displacement. In the most pessimistic case, the annual fiscal costs per new job are 4,746 Euro.

In the medium scenario (elasticity of 0.5), employment increases by 76.1 percent, which would create 1.57 million new jobs. Direct savings are 14.7 billion Euro, 9.0 billion are spent on the stock subsidy, while the costs of additional displacement are a maximum of 2.8 billion Euro. Under the various assumptions about additional displacement, our proposal would still save the public budget between 2.9 and 5.8 billion Euro per year.

With an elasticity of 0.7, labor demand increases by 120.8 percent. Referring back to Figure 2.3, in this situation firms would hit the corner solution where employment has doubled. Since the reduction of marginal wages drops from 68 percent to 34 percent when the number of new employees reaches the number already employed, this creates a barrier to further employment. Nevertheless, the employment effect in the low-wage sector is immense: employment doubles, creating 2.1 million new jobs! The cost savings for public budgets are even larger than in the medium scenario: public expenditures fall by almost 7.6 billion Euro p.a.

Even under pessimistic assumptions, the expected employment effects of the *Magdeburg Alternative* would be substantial. In most cases, the public budget would also be relieved. Table 2.3 shows how the different levels of government participate fiscally. For the medium scenario (elasticity of 0.5 and 50 percent additional displacement), all levels of government, i.e. the federal level, the states, municipalities, and social insurances, would gain. Municipalities, in particular, would gain substantially because they would have to spend 2.6 billion Euro per year less on housing. In 2006, the federal employment agency spent, on average, 4,123 Euro on active labor market policy per unemployed person (Federal Employment Agency 2007). Our proposal would make many of these programs redundant, so that we could expect additional savings not yet considered in Tables 2.2 and 2.3.

Savings (+)/ Costs (-)	Federal Level	States	Municipalities	Social Insurances	Total
Savings (according to Table 2.2)	+10,531.04	+253.88	+2,605.85	+1,325.15	+14,715.92
Costs of stock subsidy	–8954.03	- - -	- - -	- - -	–8954.03
Costs of additional displacement	–1,406.53	- - -	- - -	- - -	–1,406.53
Fiscal effect (in mill. Euro p.a.)	+170.48	+253.88	+2,605.85	+1,325.15	+4,355.36

Source: own calculations.

Note: The results refer to the scenario with a labor demand elasticity of 0.5 and 50 percent additional displacement.

Table 2.3: Aggregate cost and benefits at the different levels of government

6. Conclusion

The main reasons for low-skilled workers being at a particularly high risk of becoming unemployed apply to each and every industrial nation, and the resulting high levels of unemployment among low-skilled individuals are a problem for all developed countries. Technical progress and the high competitiveness of low-wage countries come at the cost of the job prospects of low-skilled workers in industrialized countries. International comparisons show, however, that OECD countries have experienced greatly varying degrees of success in the struggle against low-skilled unemployment.

All the attempts to reduce low-skilled unemployment have one thing in common. It is wage subsidies provided by the state, in whatever form, that are supposed to close the gap between the low productivity of the low-skilled and the minimum existence level. This does not mean, however, that it does not matter how this medicine is administered. The flexible labor markets in the USA and the UK, for example, enable workfare instruments and employee-oriented subsidies to be used to solve the dilemma of too low a labor productivity, as measured by some minimum level of existence, by shoring up the market wage with a subsidy of net wages. This approach is problematic in the regulated labor markets of Continental Europe, however, because rigid wages prevent subsidies from leading to a stimulation of demand for low-skilled jobs. At first glance, it would seem that

a satisfactory level of success could then only be achieved if the labor market were to be deregulated to a great extent. In this article, we have attempted to show that this is not necessarily the conclusion that needs to be drawn. On the contrary, the *Magdeburg Alternative* shows that a *marginal* employment subsidy that lowers gross wages can also be applied in the presence of collective wage bargaining and the achievement of the unions' goal of rigid wages.

The decisive point for a gross wage subsidy is the elimination of "revolving-door" effects and displacement effects. If it does not succeed in preventing firms from exploiting it to replace incumbent workers with subsidized workers, any reform linked to the demand side of the labor market is doomed to failure. This direct exchange of incumbent workers with subsidized workers can easily be prevented by linking the subsidy to a requirement that the number of employees in a firm should increase. By using double subsidization, i.e. the payment of a subsidy not only for the new employee but also for the incumbent employee, the outsourcing of employment is also made unattractive by the *Magdeburg Alternative.* And this is the decisive trick of the *Magdeburg Alternative*, because by doing so not only is outsourcing prevented. Massive incentives for the generation of further jobs are also created and the funding of the reform is secured.

In principle, this reform harnesses windfall gains that one would generally attempt to avoid: firms are also able to have their incumbent employees subsidized, but only if the firms do what is desired, and that is create new jobs. The creation of these additional jobs means that the reform can be self-financing because any subsidy expenditure is always accompanied by a reduction in welfare payments. For this reason, the *Magdeburg Alternative* not only creates new jobs, but also helps to consolidate the budget.

Chapter 3

Marginal versus general wage subsidies in competitive industry equilibrium[1]

1. Introduction

One of the standard textbook answers to the possible reasons for unemployment is wage rigidity.[2] Wages are set at a level exceeding that at which the labor market clears. Consequently, labor demand falls short of labor supply and unemployment occurs. One approach to reduce this type of unemployment is to subsidize wages to price people back into employment. The wage paid by the employer is moved closer to its full employment level, while the wage received by the employee remains unchanged.[3]

Even though, for a given level of real wages, a general wage subsidy can succeed in reducing unemployment, it will create large fiscal costs because in order to stimulate employment *at the margin*, the subsidy has to be paid for *all* employees. Hence, a general wage subsidy creates large windfall gains for employers that receive the subsidy for all already employed workers without even creating a single new job. The large costs of a general wage subsidy constitute an almost insurmountable political obstacle to its implementation.

Apparently, the problem of subsidizing all workers can be avoided by restricting the subsidy to additional employment. Only if a firm hires a new employee in excess of its incumbent workforce at some reference date will it receive a subsidy for this additional worker. Such a scheme is called a *marginal wage subsidy*. The arguments in favor of a marginal subsidy compared to a general subsidy seem obvious: if only

[1] A modified version of this chapter is forthcoming in *Academia Economic Papers* (Knabe 2008).

[2] Empirical investigations into the reasons for downward wage rigidity are provided by Bewley (1999), Agell and Lundborg (2003), Franz and Pfeiffer (2006), and Agell and Bennmarker (2006).

[3] Such a wage subsidy was first proposed by Kaldor (1936). Various types of wage subsidies have recently been suggested by Haveman (1996), Orszag and Snower (2000, 2003), Phelps (1997), Snower (1994), and Schöb and Weimann (2003, 2005).

additional employment is subsidized, the same employment effect could be created at much lower costs.[4]

Critics challenge this view because there seem to be various ways to get around the "additionality" requirement. For example, an incumbent firm could establish a second, new firm to which it outsources all its employees. Since the new firm's employment level on the reference date would be zero, all workers hired in the new firm would have to be subsidized, but net employment would not change. To prevent such outsourcing, one has to set economic incentives that make it more profitable to expand employment in the already existing firm instead of outsourcing. *Double marginal subsidization* provides such an incentive (see Schöb and Weimann 2003, 2005; Knabe, Schöb and Weimann 2006b). If a firm hires a new worker in excess of its reference employment level, it receives the subsidy not only for the new employee, but also for one incumbent employee. This effectively doubles the marginal labor cost reduction if employment is expanded in the incumbent firm and provides an effective means of preventing outsourcing compared to regular marginal subsidies.

Even though double marginal subsidization can prevent displacement of unsubsidized by subsidized workers at the level of an individual firm, one must be careful when transferring the firm-level effects of a marginal subsidy to more aggregate levels of the economy. In particular, one should expect that marginal wage subsidies create large between-firm displacement effects. As has been pointed out by Layard and Nickell (1980), even though some firms expand their production, hire new workers and obtain the subsidy, they do so mainly at the expense of other firms which have to reduce employment or are driven out of the market. In an extreme case, only fully subsidized firms could survive in the market, and double marginal and general subsidies would be equivalent.

We refer to this process, in which subsidy-induced employment expansions in some firms cause employment reductions in other firms, as *between-firm displacement*. Even though a thorough analysis of these displacement effects is crucial for definite economic policy advice, the literature on this topic is rather sparse. Oswald (1984) shows that a marginal wage subsidy, while increasing employment at the firm-level, affects the number of firms in equilibrium in an ambiguous way. The net effect on employment at the industry level is generally ambiguous. Luskin (1986) shows

[4]Marginal wage subsidization has been proposed by Layard and Nickell (1980), Chiarella and Steinherr (1982), Rehn (1982), and Haveman (1996). A marginal subsidy scheme was recently proposed for Germany by Schöb and Weimann (2003, 2005) and initiated some debate among economists as well as politicians (see e.g. Bothfeld et al. 2006, German Council of Economic Experts 2006, Sinn 2006a).

that marginal subsidies will be fiscally more efficient than general subsidies only if industry product demand is relatively inelastic. If this condition is not met, however, the opposite holds and general subsidies are more favourable than marginal subsidies.

The results of Oswald (1984) and Luskin (1986) have to be taken with caution. Both models rely heavily on assumptions that do not correspond to effectively implemented or proposed subsidy schemes. For example, the subsidy scheme analyzed by Oswald (1984) combines a marginal wage subsidy for employment above some reference employment level with a marginal tax on layoffs below this level. Real-life marginal wage subsidy scheme, however, have always been asymmetric in the sense that they subsidize new jobs, but do not punish firms that lay off workers.[5] Since this asymmetry affects the extent to which firms are able to lay off workers if their competitors expand, this assumption is critical for the analysis of between-firm displacement. Luskin's (1986) results hinge on the assumption that, with marginal subsidies, new entrants will receive the subsidy only if they expand their employment above the same reference level as incumbent firms. This assumption, however, is at odds with actual marginal wage subsidy programs, all of which have individualized reference levels for incumbent firms, while firms founded after the reference date typically receive the subsidy for all their workers (cf. Schmidt 1979, p. 342). Moreover, the policy implications of both studies suffer from the ambiguity of their results.

In this chapter, we resume the discussion of the industry-level effects of marginal wage subsidies. In line with the existing literature (Oswald 1984, Luskin 1986), we restrict our analysis to the partial equilibrium effects of a marginal subsidy targeted at a single competitive industry. While these studies appear to have sacrificed practical relevance for formal elegance, this chapter's contribution consists in developing a model of marginal wage subsidies that pays close attention to the institutional features of real-life marginal subsidy programs. For example, our model has firm-specific reference employment levels (contrary to Luskin 1986) and restricts the subsidy to employment expansions without penalizing employment reductions below the reference employment level (contrary to Oswald 1984). With this novel way of modelling marginal subsidies, we can overcome the ambiguities of pre-

[5] In the 1970s, many countries experimented with marginal employment subsidies. Examples are the New Jobs Tax Credit in the United States (see Perloff and Wachter 1979, Bishop and Haveman 1979), the French *Prime d'incitation à la création d'emploi* (see Kopits 1978), the Small Firms Employment Subsidy in Great Britain (see Layard 1979), and the *Lohnkostenzuschüsse* in Germany (see Schmidt 1979). All of these programs were asymmetric, i.e they subsidized employment expansions but did not tax layoffs.

vious studies and unambiguously identify the differential impact of general and marginal wage subsidies in the presence of between-firm displacement. Under relatively weak assumptions, we are able to show that marginal wage subsidies create more employment at less fiscal costs than general subsidies *despite* between-firm displacement at the industry level.

We will proceed as follows. In Section 2, we present a graphical argument to visualize the effects of double marginal subsidization on a firm's decisions and on the industry equilibrium. In Section 3, the model is analyzed formally. Section 4 concludes.

2. A graphical argument

To grasp the different effects of double marginal wage subsidies (*DMS*) compared to general wage subsidies (*GS*), it is helpful to look at a diagram showing marginal and average cost curves in order to predict the optimizing behavior of firms.

The upper part of Figure 3.1 shows the marginal and average cost curves for a firm without subsidies (MC, AC), for a newly founded firm receiving a single subsidy (MC_S, AC_{new}), and for an incumbent firm receiving the double marginal subsidy as long as employment has not doubled (MC_{DMS}, $AC_{inc.}$). Prices are denoted by p, a firm's output level by y, and the initial price and output levels are p_0 and y_0, respectively. To keep the analysis as simple as possible, we assume that labor is the only factor of production, that the production function exhibits a diminishing marginal product of labor, and that the wage rate is constant. Hence, the marginal cost schedule is increasing with the level of output. When entering the market, firms have to pay start-up costs which are sunk afterwards.[6]

With *DMS,* an incumbent firm will not receive the subsidy for output levels below y_0 because it has not created any new jobs. Its marginal cost schedule is given by MC. If the firm raises its output above y_0 and consequently hires more workers, the additional employment qualifies for the marginal subsidy. With *DMS*, the firm then receives twice the subsidy rate s per new employee because for each new employee,

[6] Without the existence of sunk costs, *DMS* and *GS* would be equivalent in the long-run industry equilibrium. With *DMS,* the average costs of an incumbent firm could never be less than those of a newly established firm if it were not for its sunk costs. Hence, incumbent firms would be displaced by new entrants for which *DMS* are equivalent to *GS*.

Sunk costs, however, are ubiquitous for firms. Baumol et al. (1983, p. 494) define sunk costs as the share of capital investment costs which cannot be recouped by resale of the asset. Examples for such investments are highly specific physical assets, the gathering of information before a firm enters a specific industry, costs of organizing the new operation, product-differentiating sales efforts etc. (Martin 1993, p. 306). Hence, it is plausible to assume that sunk start-up costs play a role in intra-industry competition.

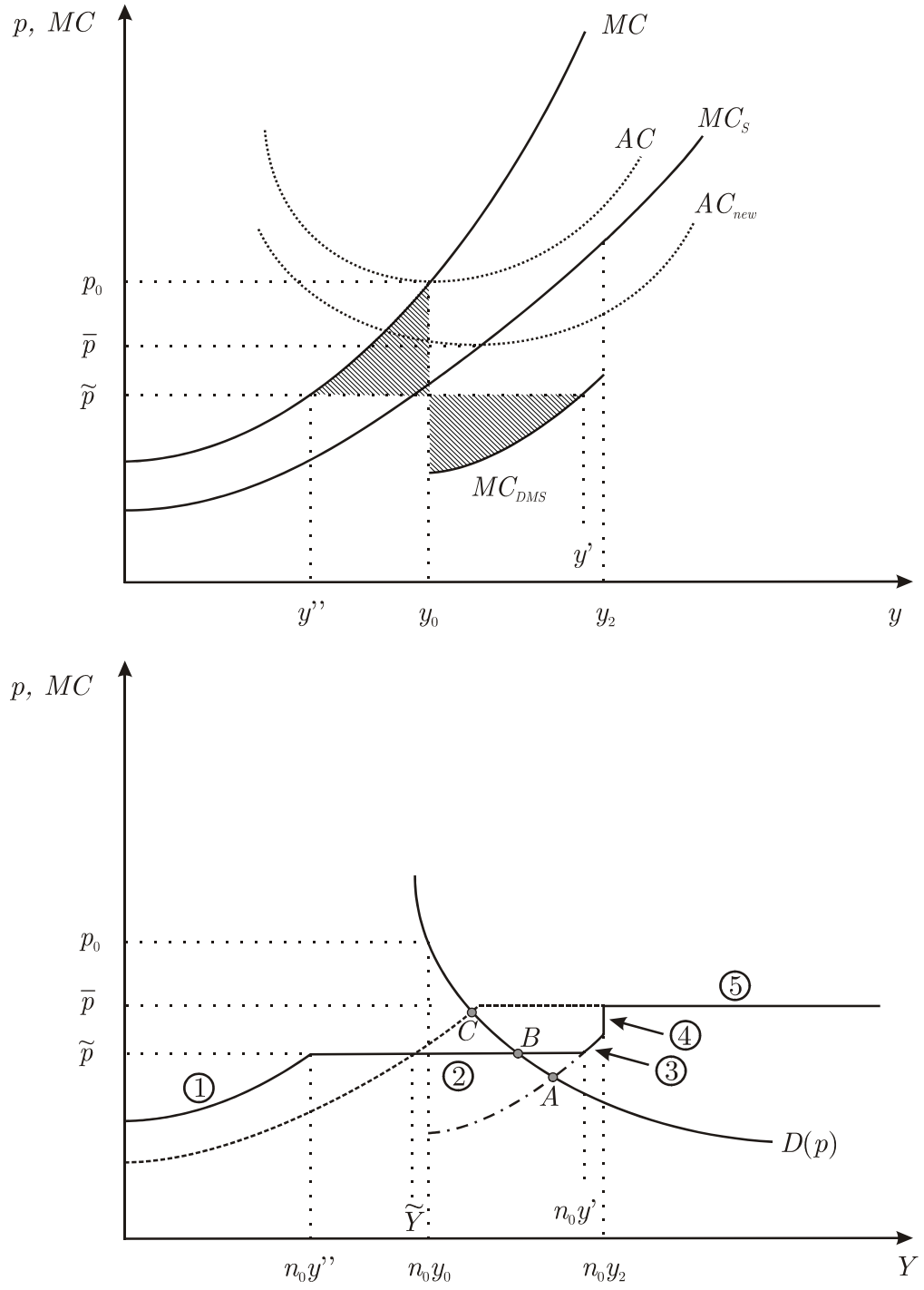


Figure 3.1: Firm-level effects and aggregate supply

one already employed worker is subsidized as well. The effect on marginal costs is equivalent to a marginal subsidy of $2s$; the corresponding marginal cost curve is given by MC_{DMS}. If the firm doubles its employment, all of its incumbent workers will be subsidized too. This point corresponds to output level y_2 in Figure 3.1.[7] At y_2, the marginal cost curve jumps up to MC_S. None of the incumbent workers is left unsubsidized, so further employment expansions will only receive the single subsidy.

A new firm entering the market has no employment on the key date, and so all its employees receive the single subsidy. Its marginal cost curve is thus given by the entire MC_S–curve. However, a newly entering firm has to bear start-up costs, and so its average cost curve is given by AC_{new}. The lowest price at which new firms start entering the market, both under *GS* and *DMS*, is denoted by $\bar{p} \equiv \min_y AC_{new}(y)$.

With the knowledge of its marginal and average cost curves, we can derive an incumbent firm's supply function. For very low output prices, the firm's supply function is given by the marginal cost curve MC, i.e. it will shrink compared to its initial production level y_0. For higher prices, there will be a critical price at which the firm makes the same profit either by shrinking to some production level less than y_0 or by expanding production to a level above y_0 and receiving the subsidy. In Figure 3.1, this critical price is denoted by $\tilde{p}$, and the two production levels yielding equal profits are y'' and y', respectively.[8] For prices above $\tilde{p}$, the firm's supply curve is given by the double subsidy marginal cost curve MC_{DMS} as long as employment has not doubled. Since employment exceeding twice the initial level receives only the single subsidy, the firm will always supply y_2 for all prices between $MC_{DMS}(y_2)$ and $MC_S(y_2)$. For all prices above this interval, the firm's supply curve is given by MC_S.

With the knowledge of marginal and average cost curves, we can derive the industry's aggregate supply function shown in the lower part of Figure 3.1 (solid line), where n_0 denotes the number of firms in initial equilibrium and Y stands for the industry's output level. For visual clarity, we have assigned numbers to the different sections of the supply curve:[9]

Section 1: The output price is less than the critical price $\tilde{p}$. All incumbent firms

[7] Note that with diminishing marginal product of labor, $y_2 < 2y_0$.

[8] By expanding from y'' to y', a firm makes inframarginal losses on all units between y'' and y_0, but inframarginal profits on all units between y_0 and y' (shown by the shaded areas in Figure 3.1). At $\tilde{p}$, the gains and losses exactly balance, so that the same level of profit arises at both output levels.

[9] It should be mentioned that the exact shape of the industry supply curve depends on the precise functional form of the production technology as well as on the level of the subsidy. Unless otherwise indicated, we will, without affecting our results qualitatively, consider only the case where all sections depicted in Figure 3.1 exist.

reduce their production level. No subsidy is paid out.

Section 2: The output price is exactly $\tilde{p}$. Some incumbent firms will expand to y', others will contract to y''. The number of firms contracting and expanding depends on the quantity of industry output demanded. Hence, some of the incumbent firms will expand at the cost of other incumbent firms. The additional employment in expanding firms has to be subsidized.

Section 3: All incumbent firms expand their employment. Most, but not all, workers are subsidized.

Section 4: All incumbent firms double their employment. All workers are subsidized.

Section 5: The output price is $\bar{p}$. All incumbent firms double their employment and produce y_2. The industry product demand not supplied by the incumbent firms is then served by new entrants, each of which produces an output level of $MC_S^{-1}(\bar{p})$. All workers are subsidized.

The lower part of Figure 3.1 can then also be used to compare the equilibria obtained with *DMS* when displacement is taken into account and when it is neglected. If there were no displacement between firms, all firms would supply along their marginal cost curve with double subsidies, MC_{DMS}. The industry supply curve would then be given by the dashed-dotted line in the lower part of Figure 3.1, and the resulting market equilibrium would occur in point A. As we have argued above, however, point A cannot be an equilibrium because the output price would be so low that all firms would want to reduce their output levels below y_0. When some firms reduce their output, aggregate supply falls and the market price rises until it reaches the price level $\tilde{p}$ at which firms are indifferent between shrinking and expanding. Taking these displacement effects into account shifts the equilibrium with *DMS* from point A to point B, which impairs the predicted equilibrium output and employment effects of *DMS*.

With *GS*, the derivation of the industry's supply curve is straightforward (dashed line in the lower part of Figure 3.1). An incumbent firm is completely subsidized at the single rate, and so its supply curve is given by MC_S. For new firms, there is no difference between *DMS* and *GS* - in either case, all their employees are subsidized at the single rate. Hence, new firms will enter the market if the output price is at least $\bar{p}$. The resulting equilibrium is indicated by point C.

Figure 3.1 compares the industry supply curves both under *DMS* and *GS*. For output levels below $\tilde{Y}$, the industry supply curve with *GS* is below the industry supply curve

with *DMS*. The *DMS*-curve is above the *GS*-curve for output levels between $\tilde{Y}$ and $n_0 y_2$. Both curves coincide for output levels above $n_0 y_2$ where new firms enter the market. A sufficient condition for a favorable output effect of *DMS* compared to *GS* is that the industry supply curve with *GS* is above the *DMS*-curve at the point where the demand curve $D(p)$ intersects the *DMS*-curve, or, in other words, that $\tilde{Y} < D(\tilde{p})$ where $\tilde{Y} = n_0 MC_S^{-1}(\tilde{p})$.[10] For an arbitrary non-increasing demand function, *DMS* will always result in a larger equilibrium output than *GS* if $\tilde{Y} < n_0 y_0$. Since, as we will show in the next section, *DMS* require at least as many, and generally more, workers to produce a given output compared to *GS*, a higher output effect is also sufficient for a larger employment effect. Comparing the fiscal effects of both subsidies, it is clear that a favorable employment effect of *DMS* is also sufficient to ensure lower fiscal costs per newly created job. On the one hand, more new jobs mean more savings in welfare expenditures, while on the other hand *DMS* create less costs because they will never subsidize more already existing jobs than *GS*.

The effects are less clear-cut if $\tilde{Y} > D(\tilde{p})$. The output effect will be favorable to *GS*, but the employment and fiscal effects of *DMS* might nevertheless still be more desirable. We will discuss this point in the next section in more detail.

3. A formal analysis

Suppose that each firm has a production technology $y = f(l)$, with $f' > 0$, $f'' < 0$, where y is a firm's output and l its labor input. This production technology results in a variable cost function $C(y)$ with $C' > 0$ and $C'' > 0$. Let marginal costs be denoted by $MC(y) \equiv C'(y)$. The wage rate is denoted by w, the single subsidy rate by s, and start-up costs by F. Total market demand is a non-increasing function of the price level denoted by $D(p)$ with $D' \leq 0$.

We first show that *DMS* are more likely to prevent firms from outsourcing their entire workforce than regular (single) marginal wage subsidies. *DMS* subsidize already employed workers' wages if new employees are hired. Let the share of an already employed worker's wage that is subsidized per new employee be denoted by X.[11] For example, if the full wage bill of an already employed worker is subsidized (the *DMS* case), then $X = 1$. If per new employee only half of an incumbent worker's wage is subsidized, $X = 1/2$. The profit function for the relevant price

[10] In Figure 3.1, $\tilde{Y} < D(\tilde{p})$ means that point C has to be to the left of – or exactly at the same point as – point B.

[11] The possibility of a variable policy parameter X was mentioned by Schöb and Weimann (2003).

intervals can then be written as

$$\pi\left(p,s,X\right)=\begin{cases} pMC^{-1}\left(p/\sigma\right)-wl_0 \\ \quad -\sigma w\left[f^{-1}\left(MC^{-1}\left(p/\sigma\right)\right)-l_0\right] & \text{if } \tilde{p}\leq p\leq \sigma MC(y_2) \\ py_2-\left(1+\sigma\right)wl_0 & \text{if } \sigma MC(y_2)<p\leq \bar{p} \end{cases}, \tag{3.1}$$

where y_0 is the firm's employment level at the reference date, y_2 is the output level at which the firm has doubled its initial employment level, i.e. $y_2 \equiv f(2l_0)$ with $l_0 \equiv f^{-1}(y_0)$, and $\sigma \equiv 1-(1+X)s$. $\tilde{p}$ is the price level at which the firm is indifferent between expanding or contracting, implicitly determined by the condition

$$\pi\left(\tilde{p},s,X\right)=\pi\left(\tilde{p},0,X\right), \tag{3.2}$$

where the right-hand side is the profit if a firm shrinks and does not receive any subsidies. $\bar{p}$ is the price level at which new firms enter the market:

$$\bar{p}=\min_{y}\left[\frac{F+(1-s)\,C\left(y\right)}{y}\right]. \tag{3.3}$$

If a firm decides to outsource all of its employees to a new firm, it will receive the single subsidy for all of them. Profits are then given by the profit function (3.1) with $X=0$ plus an additional subsidy of swl_0 for its incumbent workforce. We assume that outsourcing is costly (legal costs of establishing a new firm, etc.). If outsourcing costs are given by C_{out}, the profits of an outsourcing firm are

$$\pi\left(p,s,0\right)+swl_0-C_{out}. \tag{3.4}$$

By comparing the profits with and without outsourcing, one can determine a critical level $\hat{C}_{out}$ at which it is desirable for a firm to maintain production in the old firm instead of outsourcing it to a new firm.

$$\hat{C}_{out}=\pi\left(p,s,0\right)+swl_0-\pi\left(p,s,X\right). \tag{3.5}$$

Only if outsourcing costs exceed this critical level can marginal wage subsidies be an effective policy instrument compared to general wage subsidies.
Regular (single) marginal wage subsidies do not provide subsidies for already employed workers. This is captured by setting $X=0$ in (3.5). The critical level of outsourcing costs is then given by

$$\hat{C}_{out}=swl_0, \tag{3.6}$$

i.e. outsourcing will be desirable as long as outsourcing costs are less than the gain from receiving a subsidy for the entire existing workforce.
DMS propose to subsidize the existing workforce if new workers are hired. This will reduce the critical level of outsourcing costs:

$$\frac{\partial \hat{C}_{out}}{\partial X} = -\frac{\partial \pi\ (p, s, X)}{\partial X} < 0. \tag{3.7}$$

Subsidizing part of the existing workforce does not affect the profit from outsourcing, but it increases the profit from expanding employment in the existing firm. Hence, *DMS* provide a mechanism that can prevent displacement via outsourcing. In the remainder of this chapter, we will assume that the value of $X = 1$ proposed by Schöb and Weimann (2005) is sufficiently high to avoid outsourcing.
Analogously to the graphical analysis in the previous section and assuming that all sections shown in Figure 3.1 exist, the industry supply function with *DMS* is given by

$$Y_{MS}(p) = \begin{cases} 0 & \text{if} \quad 0 \leq p \leq MC\,(0) \\ n_0 MC^{-1}\,(p) & \text{if} \quad MC\,(0) < p < \tilde{p} \\ \left[n_0 MC^{-1}\,(\tilde{p})\,, \right. \\ \qquad \left. n_0 MC^{-1}\left(\frac{\tilde{p}}{1-2s}\right) \right] & \text{if} \quad p = \tilde{p} \\ n_0 MC^{-1}\left(\frac{p}{1-2s}\right) & \text{if} \quad \tilde{p} < p \leq (1-2s)\,MC\,(y_2) \\ n_0 y_2 & \text{if} \quad (1-2s)\,MC\,(y_2) < p < \bar{p} \\ [n_0 y_2, \infty[& \text{if} \quad p = \bar{p} \end{cases}, \tag{3.8}$$

and the industry supply function with *GS* is given by

$$Y_{GS}(p) = \begin{cases} 0 & \text{if} \quad 0 \leq p \leq (1-s)\,MC\,(0) \\ n_0 MC^{-1}\left(\frac{p}{1-s}\right) & \text{if} \quad (1-s)\,MC\,(0) < p < \bar{p}\ . \\ \left[n_0 MC^{-1}\left(\frac{\bar{p}}{1-s}\right), \infty \right[& \text{if} \quad p = \bar{p} \end{cases} \tag{3.9}$$

We now turn to the analysis of the output, employment, and fiscal effects of the two types of subsidies. For this, we will make use of the following lemma.

Lemma 3.1 *Comparing two industry equilibria, in each of which the same level of output is produced, but which differ in the number and/or size of individual firms, the level of employment is always smaller in the equilibrium in which, with the same or larger number of firms, all firms have the same output level.*

Proof. See Appendix. ■

Lemma 3.1 shows that for a given level of output, employment is larger under *DMS* due to a *technical inefficiency* in the production sector. If all firms have the same strictly concave production function, different firm sizes mean that the marginal productivity of labor is not equalized between firms. Moreover, reducing the number of firms means that each firm has to increase its level of production. This lowers the marginal productivity of labor to inefficiently low levels. Hence, a small number of large, differently sized firms require more labor inputs to produce a given output than a large number of small, equally sized firms.
As in the previous section, we define a critical level of industry output $\tilde{Y}$ by the point at which the industry supply curves with *DMS* and *GS* intersect:

$$\tilde{Y} \equiv n_0 MC^{-1}\left(\tilde{p}/\left(1-s\right)\right). \tag{3.10}$$

With the help of Lemma 3.1, we can now easily identify all the cases where *DMS* have favorable output and employment effects compared to *GS*.

Proposition 3.1 *For a specific demand function $D(p)$ with $D' \leq 0$, the output and employment effects will be at least as large with* DMS *as with* GS *if the demand function intersects the industry supply function under* DMS *to the right of the critical level $\tilde{Y}$, i.e. $D\left(\tilde{p}\right) \geq \tilde{Y}$. For any such demand function, this will be the case if the initial industry output exceeds $\tilde{Y}$, i.e. $n_0 y_0 \geq \tilde{Y}$.*

Proof. See Appendix. ■

Referring to Figure 3.1, Proposition 3.1 states that whenever the demand curve intersects the industry supply curves in a range where the *DMS*-curve lies on or below the *GS*-curve, output with *DMS* will be larger than (Sections 2, 3 and 4) or as large as (Section 5) with *GS*. The reason that *DMS* may result in higher equilibrium output lies in their *rent reduction effect*. Under both subsidy schemes, incumbent firms are to some degree protected from the competition of new entrants by the sunk character of start-up costs, and hence obtain rents. Under *GS*, for $p < \bar{p}$ demand is large enough to support all incumbent firms, each of which expands its production and receives the subsidy for all its employees. Under *DMS*, the *double* marginal subsidy provides a larger incentive for each firm to expand production than the single subsidy. If total market demand is not large enough to support all incumbent firms' desired output expansion, incumbent firms will compete for the expansion, so that some firms increase their output at the expense of other firms. The subsidy thus triggers competition between incumbent firms that, in industry equilibrium, results in lower prices, lower rents, and larger output under *DMS* than under *GS*.

Proposition 3.1 also postulates that the higher output effect of *DMS* is always associated with a higher employment effect as well. The reason lies in the technical inefficiency described by Lemma 3.1. With *GS*, any given output level is produced by equally sized firms, while with *DMS* either some firms expand while others contract or all incumbent firms become larger than they would be under *GS*. Thus, the favorable output effect of *DMS* also causes a favorable employment effect.
The second part of Proposition 3.1 states that for certain supply functions, there will be favorable output and employment effects for any demand function. The condition $n_0 y_0 \geq \tilde{Y}$ can be used to identify these supply functions. For example, all homogenous one-factor production functions fulfill this condition.

Corollary 3.1 *For all homogenous one-factor production functions with a degree of homogeneity between 0 and 1, the output and employment effects of* DMS *are (weakly) larger than with* GS.

Proof. See Appendix. ■

If $D(\tilde{p}) < \tilde{Y}$, however, the output effect will be larger with *GS*. Nevertheless, the distorted production structure with *DMS* can still lead to a larger employment effect because the technical inefficiency may require more labor to produce a smaller amount of output. If the employment gain due to the technical inefficiency effect of *DMS* (cf. Lemma 3.1) dominates the employment gain of the output effect of *GS,* employment still rises more under *DMS* than under *GS*. The necessary conditions for a favorable employment effect of *DMS* are therefore weaker than those derived in Proposition 3.1.
Formally, the necessary condition for a favorable employment effect of *DMS* in case of $D(\tilde{p}) < \tilde{Y}$ is

$$(1-\gamma)\, f^{-1}\left(MC^{-1}(\tilde{p})\right) + \gamma\, f^{-1}\left(MC^{-1}\left(\tfrac{\tilde{p}}{1-2s}\right)\right) > f^{-1}\left(MC^{-1}\left(\tfrac{p_{GS}}{1-s}\right)\right). \tag{3.11}$$

In (3.11), the share of expanding firms $\gamma \in [0,1]$ and the equilibrium price level with *GS*, p_{GS}, are implicitly determined by

$$(1-\gamma)\, n_0 MC^{-1}(\tilde{p}) + \gamma\, n_0 MC^{-1}\left(\frac{\tilde{p}}{1-2s}\right) = D(\tilde{p}), \tag{3.12}$$

$$n_0 MC^{-1}\left(\frac{p_{GS}}{1-s}\right) = D(p_{GS}), \tag{3.13}$$

respectively. The RHS of (3.11) is the employment necessary to produce the output demanded at p_{GS} when all firms act identically. The first term on the LHS of (3.11) is the level of employment in contracting firms, weighted by their share, while the second term on the LHS is the weighted employment level of expanding firms. The weight γ is determined by condition (3.12), which equates the combined output of contracting and expanding firms with the industry demand at $\tilde{p}$. As we will show below, the LHS of (3.11) can exceed its RHS even if the underlying employment effect favors *GS* due to the concavity of the production function.

It is also possible to determine a sufficient condition for the favorability of *DMS* with respect to its employment effects for all feasible non-increasing demand functions. If $n_0 y_0 < \tilde{Y}$, the largest possible difference between the equilibrium output levels with *DMS* and *GS* for a non-increasing demand function is that industry output with *DMS* stays at $n_0 y_0$, while output with *GS* goes to $\tilde{Y}$.[12] Analogously to (3.11), *DMS* will yield a larger employment effect than *GS* if

$$\begin{aligned}(1-\gamma)\, f^{-1}\left(MC^{-1}(\tilde{p})\right) + \gamma\, f^{-1}\left(MC^{-1}\left(\tfrac{\tilde{p}}{1-2s}\right)\right) \\ > f^{-1}\left(MC^{-1}\left(\tfrac{\tilde{p}}{1-s}\right)\right),\end{aligned} \tag{3.14}$$

where γ is implicitly determined by

$$(1-\gamma)\, MC^{-1}(\tilde{p}) + \gamma\, MC^{-1}\left(\frac{\tilde{p}}{1-2s}\right) = y_0. \tag{3.15}$$

The following proposition summarizes these results.

Proposition 3.2 *For some specific demand function $D(p)$ with $D' \leq 0$, the employment effects will be larger with* DMS *than with* GS *if either a) the output effect of* DMS *is larger than that of* GS*, or b) the output effect of* GS *is larger than that of* DMS*, but the technical inefficiency effect dominates the output effect (Condition 3.11).*

For any such demand function, this will be the case if the technical inefficiency effect of DMS *at the initial output level dominates the output effect of* GS *at price $\tilde{p}$ (Condition 3.14).*

Proposition 3.2 covers a wider set of demand functions for which the employment effects are favorable to *DMS* than Proposition 3.1.

[12] This will occur if $D'(p) = 0 \,\forall\, p \geq \tilde{p}$ and $D'(p) \to \infty \,\forall\, p < \tilde{p}$.

Corollary 3.2 *The set of demand functions $D(p)$ with $D'(p) \leq 0$, for which employment effects are favorable to* DMS*, is always at least as large as, and generally larger than, the set of demand functions for which the output effect is also favorable to* DMS*, described in Proposition 3.1.*

Proof. See Appendix. ■

Corollary 3.2 shows that favorable employment effects is a weaker requirement on *DMS* than favorable output effects. Hence, when introducing *DMS*, it is even more likely that favorable employment effects arise than that favorable output effects arise as compared to *GS*.

The last point to analyze is the fiscal efficiency of both subsidy schemes. Our measure of fiscal efficiency is the subsidy expenditure per net job created (as in Luskin 1986). The smaller this number, the more likely it is that the government can actually save money through less unemployment benefits expenditures, higher tax revenues from the additional employment, etc.

Under *DMS*, subsidy expenditures per net job created are given by

$$\frac{\phi s w L_{DMS}}{L_{DMS} - L_0}, \tag{3.16}$$

where L_{DMS} is total equilibrium employment and $L_0 \equiv n_0 l_0$ is total initial employment. ϕ denotes the share of subsidized workers in total employment. If $p \in \left[\tilde{p}, (1-2s)\, MC\,(y_2)\right[$ (Sections 2 and 3 in Figure 3.1), incumbent firms have not doubled their employment and some, but not all, workers are subsidized: $\phi \in]0, 1[$. If $p \geq (1-2s)\, MC\,(y_2)$ (Sections 4 and 5 in Figure 3.1), incumbent firms have doubled their employment so that all their workers are subsidized. Since new entrants are always fully subsidized, we have $\phi = 1$.

Under *GS*, subsidy expenditures per net job created are given by

$$\frac{s w L_{GS}}{L_{GS} - L_0}, \tag{3.17}$$

where L_{GS} is total equilibrium employment.

By comparing (3.16) and (3.17), one can determine the fiscally more efficient subsidy scheme.

Proposition 3.3 *The fiscal efficiency of* DMS *is at least as large as the fiscal efficiency of* GS *if*

$$\phi \frac{L_{DMS}}{L_{GS}} \leq \frac{L_{DMS} - L_0}{L_{GS} - L_0}. \tag{3.18}$$

Proposition 3.3 immediately allows us to determine the set of demand functions for which fiscal effects are favorable to *DMS*.

Corollary 3.3 *The set of demand functions $D(p)$ with $D'(p) \leq 0$, for which fiscal efficiency is at least as large with* DMS *as with* GS*, is always at least as large as, and generally larger than, the set for which employment effects are favorable to* DMS.

The proof of Corollary 3.3 is straightforward. Even if all workers had to be subsidized under *DMS* ($\phi = 1$), a favorable employment effect is sufficient for favorable fiscal efficiency because the costs of subsidizing already existing jobs are spread out among more new jobs, thereby reducing the fiscal burden per new job created. Moreover, smaller employment effects of *DMS* can also be fiscally more efficient if not all firms have doubled their employment and thus not all workers have to be subsidized in industry equilibrium.
As follows from Corollary 3.3, *GS* can only be fiscally more efficient than *DMS* if $D(\tilde{p}) < \tilde{Y}$ and the industry demand function is sufficiently inelastic around the initial equilibrium. This result contradicts Luskin's (1986) finding that only a sufficiently inelastic demand function can ensure better fiscal effects of marginal subsidies.
To sum up, under certain conditions, such as homogenous production functions or sufficiently elastic industry product demand, *DMS* cause larger output and employment effects than *GS* and are fiscally more efficient. Under weaker conditions, *DMS* can have favorable employment effects and be fiscally more efficient even if their output effect is smaller than that under *GS*. And, finally, *DMS* might be fiscally more efficient even if both output and employment effects are smaller than under *GS*.

4. Conclusion

In this chapter, we have analyzed whether a marginal wage subsidy can serve as a policy measure to reduce unemployment *despite intra-industry displacement*. In particular, we have compared a double marginal wage subsidy scheme with a standard general wage subsidy. Our aim was to determine the conditions under which a double marginal wage subsidy yields better output and employment effects than a general subsidy, and to clarify which of the subsidy schemes is fiscally more efficient.
Our results show that a double marginal subsidy generally leads to lower equilibrium prices, and hence to a higher equilibrium output level, than an equal-rate

general subsidy. The reason for this result is that double marginal subsidies give a larger marginal stimulus for output expansion than equal-rate general subsidies. The resulting increase in industry-level supply drives down the market price more strongly than with general subsidies, which raises output and employment at the industry level. If double marginal subsidies depress prices below a critical level, however, between-firm displacement occurs. Only some incumbent firms can expand their production, while all other incumbents are forced to reduce their size substantially. This displacement raises the fiscal costs of marginal subsidies and reduces their output and employment effects. Nevertheless, we were able to derive conditions under which between-firm displacement is not sufficient to counteract the positive effects of double marginal subsidies completely. Our results show that double marginal subsidies might result in lower prices as well as larger output and employment than general subsidies despite their displacement effects.

Furthermore, the employment effect of a double marginal wage subsidy generally exceeds that of the general subsidy even if both yield the same output effect. This results from a technical inefficiency induced by double marginal subsidization. With decreasing returns to scale at the firm level, an efficient production structure requires all firms to have the same size. Double marginal subsidies, however, cause some firms to expand and others to contract, which distorts the production structure and increases the amount of labor necessary to produce the same level of output. This technical inefficiency yields favorable employment effects, such that even in those cases where the output effect favors general subsidies, employment can still be larger with marginal wage subsidies.

The fiscal effect, measured as the subsidy expenditures per new job, always favors the marginal subsidy if its employment effect exceeds that of the general subsidy. However, even if their employment effect is smaller, the fiscal effect of marginal subsidies can still be favorable since their displacement of non-subsidized workers is generally less than complete.

If we make more specific assumptions about the functional form of the production technology, we can resolve the remaining ambiguities. As we have shown, homogeneity of the production function is sufficient to ensure favorable output, employment and fiscal effects of double marginal subsidization. Hence, by using a partial-equilibrium model that focuses on the displacement competition between firms in the same industry, we have shown that double marginal wage subsidies might be preferable to general subsidies despite their between-firm displacement effects.

Appendix

Proof of Lemma 3.1. Suppose that in one sector, output is produced by n_1 firms, each of which has a production level of y. In the other sector, there are n_2 firms, of which γn_2 firms each produce y' and $(1-\gamma) n_2$ firms each produce y''. If total output is the same in both sectors, we have

$$n_1 y = n_2 \left(\gamma y' + (1-\gamma) y''\right). \tag{3.A.1}$$

Employment in the first sector is given by $n_1 f^{-1}(y)$, which by inserting (3.A.1) becomes

$$n_1 f^{-1}\left(\frac{n_2}{n_1}\left(\gamma y' + (1-\gamma) y''\right)\right), \tag{3.A.2}$$

while employment in the second sector is given by

$$n_2 \left(\gamma f^{-1}\left(y'\right) + (1-\gamma) f^{-1}\left(y''\right)\right). \tag{3.A.3}$$

From the definition of the production function ($f' > 0$, $f'' < 0$), we know that the inverse production function $f^{-1}(y)$ is strictly convex. Thus, from Jensen's inequality we have

$$f^{-1}\left(\gamma y' + (1-\gamma) y''\right) < \gamma f^{-1}\left(y'\right) + (1-\gamma) f^{-1}\left(y''\right) \text{ if } y' \neq y'', \tag{3.A.4}$$

and from the definition of a convex function we have

$$f^{-1}\left(\frac{n_2}{n_1}\left(\gamma y' + (1-\gamma) y''\right)\right) \leq \frac{n_2}{n_1} f^{-1}\left(\left(\gamma y' + (1-\gamma) y''\right)\right) \text{ if } n_2 \leq n_1. \tag{3.A.5}$$

Combining (3.A.4) and (3.A.5) yields

$$n_1 f^{-1}\left(\frac{n_2}{n_1}\left(\gamma y' + (1-\gamma) y''\right)\right) < n_2 \left(\gamma f^{-1}\left(y'\right) + (1-\gamma) f^{-1}\left(y''\right)\right) \tag{3.A.6}$$

if $y' \neq y''$ and $n_2 \leq n_1$, which proves the lemma. ■

Proof of Proposition 3.1.
Let p_{DMS} and p_{GS} be defined by $D(p_i) = Y_i(p_i)$ with $i \in \{DMS, GS\}$. From the supply functions (3.8) and (3.9), it follows that

$$p > \tilde{p} \Rightarrow Y_{GS}(p) \leq Y_{DMS}(p). \tag{3.A.7}$$

If $D(\tilde{p}) > \tilde{Y} = Y_{GS}(\tilde{p})$, then $p_{GS} > \tilde{p}$. Under this condition, (3.A.7) implies that

$D(p_{GS}) \leq Y_{DMS}(p_{GS})$ and thus $p_{DMS} \leq p_{GS}$. Hence,

$$D(\tilde{p}) > n_0 MC^{-1}\left(\frac{\tilde{p}}{1-s}\right) \Rightarrow D(p_{DMS}) \geq D(p_{GS}). \tag{3.A.8}$$

If $D(\tilde{p}) = Y_{GS}(\tilde{p}) = n_0 MC^{-1}(\tilde{p}/(1-s))$, then $p_{GS} = p_{DMS} = \tilde{p}$ and $D(p_{DMS}) = D(p_{GS})$, which combined with (3.A.8) yields

$$D(\tilde{p}) \geq n_0 MC^{-1}\left(\frac{\tilde{p}}{1-s}\right) \Rightarrow D(p_{DMS}) \geq D(p_{GS}). \tag{3.A.9}$$

This proves that the output effect favors *DMS* under the first condition of the proposition.

We now have to show that employment is larger under *DMS* than under *GS*. If $p_{GS} \in [\tilde{p}, \bar{p}[$, and hence $p_{DMS} \in [\tilde{p}, \bar{p}[$, the number of firms is equal to n_0 under both subsidy schemes. Under *GS*, each firm produces $MC^{-1}(p_{GS}/(1-s))$, while under *DMS* some firms produce $MC^{-1}(p_{DMS}/(1-2s))$ and others produce $MC^{-1}(p_{DMS})$. Lemma 3.1 shows that for $D(p_{DMS}) = D(p_{GS})$ and this production structure, employment is larger under *DMS*. This holds, a fortiori, for $D(p_{DMS}) > D(p_{GS})$.

If $p_{GS} = \bar{p}$, all firms produce the same quantity $MC^{-1}(\bar{p}/(1-s))$ under *GS*, and the number of firms is given by $D(\bar{p})/MC^{-1}(\bar{p}/(1-s)) \geq n_0$. Under *DMS*, either $p_{DMS} < \bar{p}$, in which case the number of firms is equal to n_0, or $p_{DMS} = \bar{p}$, in which case the number of firms is equal to $n_0 + [D(\bar{p}) - n_0 y_2]/MC^{-1}(\bar{p}/(1-s))$ $\leq D(\bar{p})/MC^{-1}(\bar{p}/(1-s))$ since, by assumption, $\arg\min_y AC_{new}(y) \leq y_2$. Hence, under *GS* the number of firms is never smaller than under *DMS* and firms are always of equal size. In this case, Lemma 3.1 shows that the employment effects always favor *DMS*.

We are left to show the second part of the proposition. The initial equilibrium is defined by $D(p_0) = n_0 y_0$. With $\tilde{p} < p_0$ and $D'(p) \leq 0$, there does not exist a demand function $D(p)$ for which $D(\tilde{p}) < n_0 y_0$. This concludes the proof. ■

Proof of Corollary 3.1.

The condition $n_0 y_0 \geq \tilde{Y}$ can be written as

$$(1-s)\, MC(y_0) \geq \tilde{p}, \tag{3.A.10}$$

where $\tilde{p}$ is implicitly defined in (3.2) by

$$\begin{aligned}\tilde{p}MC^{-1}(\tilde{p}) - wf^{-1}\left(MC^{-1}(\tilde{p})\right) - \tilde{p}MC^{-1}(\tilde{p}/(1-2s)) \\ +wl_0 + (1-2s)\,w\left[f^{-1}\left(MC^{-1}(\tilde{p}/(1-2s))\right) - l_0\right] = 0.\end{aligned} \tag{3.A.11}$$

With $y = f(l)$, the marginal and inverse marginal cost functions are given by

$$MC(y) = \frac{w}{f'\left(f^{-1}(y)\right)}, \tag{3.A.12}$$

$$MC^{-1}(p) = f\left(f'^{-1}(w/p)\right). \tag{3.A.13}$$

Inserting into (3.A.11) gives

$$\begin{aligned}\tilde{p}f\left(f'^{-1}(w/\tilde{p})\right) - wf'^{-1}(w/\tilde{p}) - \tilde{p}f\left(f'^{-1}((1-2s)\,w/\tilde{p})\right) \\ +wl_0 + (1-2s)\,w\left[f'^{-1}((1-2s)\,w/\tilde{p}) - l_0\right] = 0.\end{aligned} \tag{3.A.14}$$

If $f(l)$ is homogenous of degree h, this is rewritten as

$$\left[1-(1-2s)^{\frac{h}{h-1}}\right]\left[\tilde{p}f\left(f'^{-1}(w/\tilde{p})\right) - wf'^{-1}(w/\tilde{p})\right] + 2swl_0 = 0. \tag{3.A.15}$$

If Condition (3.A.10) is true, we must have

$$\left[1-(1-2s)^{\frac{h}{h-1}}\right]\left[\begin{array}{c}(1-s)\,MC(y_0)\,f\left(f'^{-1}\left(\frac{w}{(1-s)MC(y_0)}\right)\right) \\ -wf'^{-1}\left(\frac{w}{(1-s)MC(y_0)}\right)\end{array}\right] + 2swl_0 \leq 0, \tag{3.A.16}$$

because a price higher than $\tilde{p}$ must yield a larger profit for an expanding firm than for a contracting firm. Since $(1-s)\,MC(y_0) = (1-s)\,w/f'(l_0)$, this condition becomes

$$\frac{1-(1-2s)^{\frac{h}{h-1}}}{(1-s)^{\frac{1}{h-1}}}\left[\frac{f(l_0)}{l_0 f'(l_0)} - 1\right] + 2s \leq 0, \tag{3.A.17}$$

which, by applying Euler's theorem, can be rewritten as

$$\frac{1-(1-2s)^{\frac{h}{h-1}}}{(1-s)^{\frac{1}{h-1}}}\left[\frac{1}{h} - 1\right] + 2s \leq 0. \tag{3.A.18}$$

This condition holds for all values $h \in]0,\,1[$ and $s \in [0,\,1/2[$. This proves the claim.

■

Proof of Corollary 3.2. Proposition 3.1 shows that all such demand functions for which the condition $D(\tilde{p}) \geq \tilde{Y}$ holds have employment effects that favor *DMS*. To

prove the corollary, we have to find at least one demand function that violates the condition and still has larger employment effects with *DMS*.

Suppose that $D(\tilde{p}) < \tilde{Y}$, so that the equilibrium price under *GS*, p_{GS}, is determined by $D(p_{GS}) = n_0 MC^{-1}(p_{GS}/(1-s))$, and $p_{GS} < \tilde{p}$. Let $D'(p) = 0 \forall p \in [p_{GS}, \tilde{p}]$. Then $D(p_{GS}) = D(\tilde{p})$, and due to the strict convexity of the inverse production function

$$\begin{aligned}(1-\gamma) f^{-1}\left(MC^{-1}(\tilde{p})\right) \\ +\gamma f^{-1}\left(MC^{-1}\left(\tfrac{\tilde{p}}{1-2s}\right)\right)\end{aligned} > f^{-1}(D(\tilde{p})/n_0) = f^{-1}(D(p_{GS})/n_0), \tag{3.A.19}$$

where γ is defined by (3.12). Thus, if there exist demand functions that violate $D(\tilde{p}) \geq n_0 MC^{-1}(\tilde{p}/(1-s))$, there are always some demand functions that create a larger equilibrium employment effect with *DMS* than with *GS*. ■

Chapter 4

Marginal wage subsidies: a rent-extracting instrument for employment creation[1]

1. Introduction

Many countries experience involuntary unemployment because wages are set at too high levels. Minimum wage regulations, the influence of insider-oriented trade unions and also social norms within firms cause downward wage rigidity and prevent wages from falling to their full employment level.[2] To fight this type of unemployment, wage subsidies have been promoted by economists for more than half a century as a promising remedy.[3] A general subsidy, which a firm receives for all its workers, reduces its labor costs and makes it profitable for the firm to hire more workers.

A main objection to general wage subsidization is its large fiscal cost. If all workers, including those already in employment, have to be subsidized, the government has to raise large amounts of public funds to finance the subsidy. This constitutes a serious obstacle to the implementation of wage subsidy programs, either because there is political resistance to increased taxation or because of concerns about the excess burden of taxation. Thus, a promising introduction of a wage subsidy scheme has to ensure that it is self-financing to fulfill this "political implementability constraint". To overcome this problem, policy proposals known as marginal wage subsidies (*MS*) recommend to restrict the subsidy to a firm's additional employment, measured with respect to a firm's employment level at some reference date. This would

[1] A modified version of this chapter has been circulated in the FEMM Working Paper Series (Knabe 2006b).

[2] Empirical investigations into the reasons for downward wage rigidity are provided by Bewley (1999), Agell and Lundborg (2003), Franz and Pfeiffer (2006), and Agell and Bennmarker (2006).

[3] Kaldor (1936) was the first to propose an employer-oriented wage subsidy. More recently, various types of wage subsidies were suggested by Snower (1994), Haveman (1996), Phelps (1997), Orzag and Snower (2000, 2003) and Schöb and Weimann (2003).

reduce fiscal costs while maintaining the same marginal stimulus to employment creation as a general subsidy (*GS*).[4]

Various criticisms have been brought forward against marginal wage subsidies, too. There appears to be an obvious way how firms could circumvent the marginal character of *MS*: firms could lay off all their incumbent workers, establish a new firm in which they hire an equal number of workers, and delegate the tasks formerly performed by their incumbent workers to these new firms. In the new firms, all workers would be eligible for marginal subsidies.[5] Such outsourcing can be avoided with double marginal subsidies (*DMS*), where for each new employee also one incumbent employee is subsidized (see Schöb and Weimann 2003, 2005; Knabe, Schöb and Weimann 2006b). This strengthens the incentives for incumbent firms to increase employment within the firm rather than outsource existing jobs in order to obtain the subsidy.

Another disadvantage of marginal subsidies is that they cannot prevent competitive, between-firm displacement. Layard and Nickell (1980) argue that if all firms in a competitive industry are offered a marginal wage subsidy, they will all want to expand their production. This will cause the price in this industry to fall. Since average costs will have fallen only little, the firms will be making losses, so that some firms will leave the industry. In the resulting equilibrium, most of the employment expansion in remaining firms will have taken place at the expense of employment in exiting firms. Since more workers have to be subsidized in equilibrium, the claimed favorability of (double) marginal subsidies compared to general subsidies vanishes.

This chapter focuses on this intra-industry competition in the presence of marginal subsidies and develops a model that allows us to identify the differential impacts of general and double marginal wage subsidies.[6] We will show that, despite the existence of between-firm displacement, the employment effects with *DMS* are always larger than with *GS*. The reason is that the fiercer competition triggered by *DMS*

[4] Marginal wage subsidization has been proposed by Chiarella and Steinherr (1982), Haveman (1996), Layard and Nickell (1980), and Rehn (1982). Recently, a marginal subsidy scheme was proposed for Germany by Schöb and Weimann (2003, 2005) and initiated some debate among economists as well as politicians (see e.g. Bothfeld et al. 2006, German Council of Economic Experts 2006, Sinn 2006a).

[5] Empirical evidence that firms take advantage of marginal subsidy schemes by outsourcing is mentioned by Schmidt (1979).

[6] We apply Occam's razor to construct our model as simple as possible to focus on the differential impact of double marginal and general subsidies. In particular, we abstract from different skill groups of labor, capital-labor substitutability, or endogenous wage setting. Even though these would surely be important factors for a complete policy evaluation of marginal and general subsidies, they have similar effects for both subsidy schemes, so that their inclusion would make the model less tractable without affecting its qualitative results.

between incumbent firms reduces their rents, leads to lower prices and thus to more employment. The indirect extraction of firms' rents allows the government to pay less for financing the subsidy scheme, so that *DMS* are also fiscally advantageous. Intuitively, an ideal self-financing employment policy would be to restore full employment by paying a general wage subsidy, which is financed by a non-distortive tax on incumbent firms' rents. If it is not possible to impose such a tax, a double marginal subsidy closely mimics such a wage subsidy-cum-profit tax scheme, and thus allows the government to implement a self-financing subsidy program. A numerical illustration of the employment and fiscal effects of *DMS* for Germany, which we compare to previously derived results that did not explicitly account for intra-industry displacement (Schöb and Weimann 2003, 2005; Knabe, Schöb, and Weimann 2006a), allows us a first estimate of the magnitude of the employment and fiscal effects and the size of the rent extraction.

We will proceed as follows. In the next section, we develop the theoretical model. In Section 3, we analyze and compare the differential impact of *DMS* and *GS* on employment, fiscal, and distributive variables. Section 4 contains the numerical illustration. Section 5 concludes.

2. The model

Suppose the economy consists of a large number of competitive firms that produce a homogeneous, tradable good. We assume for simplicity that all of the good is exported and that the proceeds from exporting are used to import a bundle of consumption goods, the world market price of which is fixed and normalized to one.[7] World demand for the output good is given by the isoelastic demand function

$$D(p) = Ap^{-\varepsilon}, \tag{4.1}$$

where p is the output price in terms of the imported consumption good, $\varepsilon > 0$ is the price elasticity of demand, and A is a scaling parameter.

We assume that labor is the only (variable) factor of production. We thus neglect firm-level substitution effects between capital and labor. Even though these effects are surely very important, the debate on the efficacy of *DMS* and *GS* has been concerned only with the intra-industry effects of such subsidies in a competitive environment (see Layard and Nickell 1980, Bothfeld et al. 2006, Sinn et al. 2006a). By restricting our attention to a one-factor production technology, we can focus specif-

[7] These assumptions allow us to ignore income effects on demand and to focus on the production of the economy's output good. A similar setup can be found in Ethier (1985).

ically on the differential effects of *DMS* and *GS* on between-firm competition and industry structure.

A firm's production function is given by

$$y \equiv f(l) = l^{\alpha}, \tag{4.2}$$

where y is a firm's output level, l denotes its labor input, and $\alpha \in]0, 1[$. Before starting production, firms face start-up costs F. These costs are sunk after entry.[8]

Households, the number of which is normalized to one, supply one unit of labor and receive wage income w if employed or unemployment benefits b if unemployed. Moreover, they receive firms' profits π and finance government expenditures – for unemployment benefits and employment subsidies – via a tax τ. The government is required to balance its budget.

Unemployment arises because the wage rate w (in terms of the consumption good) is fixed above its full-employment level.

2.1. Initial equilibrium

The initial equilibrium is characterized by the zero-profit condition for newly entering firms. The output price in the initial equilibrium has to be equal to the firms' minimum average cost. From the production function (4.2), a firm's variable cost function is given by $C(y) = wy^{1/\alpha}$, so that the price in the initial equilibrium is

$$p_0 = \min_y \left[\frac{F + C(y)}{y} \right] = \frac{F}{(1-\alpha)\, y_0}, \tag{4.3}$$

where each firm produces

$$y_0 = \left(\frac{\alpha}{1-\alpha} \frac{F}{w} \right)^{\alpha}. \tag{4.4}$$

The demand function (4.1) then determines the total output of the economy. The number of firms n is such that this total output will be supplied by individual firms,

[8] Examples for sunk start-up costs are investments in highly specific physical assets, the gathering of information before a firm enters a specific industry, costs of organizing the new operation, product-differentiating sales efforts etc. (Martin 1993, p. 306). In the context of our model, one could also think of F being a shadow, rather than direct, cost arising from legal and administrative barriers to entry (Blanchard and Giavazzi 2003).

Empirical evidence suggests that sunk costs are an important determinant of firm and industry behavior. For example, Roberts and Tybout (1997) observed that firms are more likely to remain in the export market (having paid the associated sunk costs) than to exit the market if they face unfavorable, but temporary shocks. Lambson and Jensen (1995, 1998) found that firm value is more variable in industries exhibiting higher sunk costs. Bresnahan and Reiss (1994) found that the minimum price that triggers entry by rural dentists is strictly higher than the maximum price that induces exit.

each of which produces y_0. Hence,

$$n_0 = \frac{D(p_0)}{y_0}. \tag{4.5}$$

Total employment is then given by $L_0 = n_0 y_0^{1/\alpha}$.[9]
We have to determine the initial income distribution to examine the redistributive consequences of employment subsidization policies. Government expenditures in the initial equilibrium are $\tau_0 = (1 - L_0)\, b$, operating firms obtain positive rents which exactly cover their start-up costs F, and aggregate net labor income is given by $wL_0 + b(1 - L_0) - \tau_0$. The labor share in the functional distribution of income is given by the ratio of aggregate net labor income to total output, $wL_0 / [p_0 D(p_0)] = \alpha$.

2.2. Equilibrium with general subsidies

If *GS* are introduced, all firms – incumbents as well as new entrants – receive the subsidy s for all their employees. Hence, their variable cost function becomes $C(y) = (1 - s)\, wy^{1/\alpha}$. Because the start-up costs of incumbent firms are sunk, only newly entering firms take them into account in their entry decision. Only if the output price is high enough to ensure that rents cover the start-up costs, new firms will enter. The minimum price at which new firms are induced to enter is given by

$$\bar{p} = \min_y \left[\frac{F + (1 - s)\, C(y)}{y} \right] = \frac{F}{(1 - \alpha)\, \bar{y}}, \tag{4.6}$$

where each firm produces

$$\bar{y} = \left(\frac{\alpha}{1 - \alpha} \frac{F}{(1 - s)\, w} \right)^{\alpha}. \tag{4.7}$$

The aggregate supply curve thus consists of two parts. For all prices less than $\bar{p}$, new firms will stay out of the market and incumbent firms supply a quantity at which price equals marginal variable costs. For all prices at and above $\bar{p}$, any aggregate output quantity can be supplied by incumbent and newly entering firms. Hence,

[9] This is the standard procedure to determine the long-run competitive equilibrium with free entry (see Mas-Colell et al. 1995, Section 10F).

aggregate supply with *GS* is given by

$$Y_{GS}(p) = \begin{cases} n_0 \left(\frac{\alpha p}{(1-s)w}\right)^{\alpha/(1-\alpha)} & \text{if} \quad p < \bar{p} \\ \left[n_0 \left(\frac{\alpha p}{(1-s)w}\right)^{\alpha/(1-\alpha)}, \infty\right[& \text{if} \quad p \geq \bar{p} \end{cases} . \tag{4.8}$$

The upper part of Figure 4.1 illustrates the effects of *GS* at the level of an individual firm. MC and AC are the unsubsidized marginal and average cost curves, so that (y_0, p_0) is a firm's initial equilibrium. With *GS*, marginal costs are reduced to MC_S. Since their start-up costs are sunk, incumbent firms choose to supply along the MC_S-curve at any output price. A new firm's average cost curve is given by AC_{new}. For all prices below $\bar{p}$ (the minimum average cost of a new firm), incumbent firms choose to supply along the MC_S-curve. At $\bar{p}$, new firms enter the market and aggregate supply becomes perfectly price-elastic.

The aggregate effect of *GS* in shown in the bottom part of Figure 4.1. The dashed line indicates the aggregate supply curve $Y_{GS}(p)$. The new equilibrium price with *GS* is then determined by $Y_{GS}(p_{GS}) = D(p_{GS})$.

2.3. Equilibrium with double marginal subsidies

The upper part of Figure 4.1 shows the marginal cost curve for an incumbent firm if *DMS* are introduced: below y_0, its marginal costs are given by the $MC-$curve. If output exceeds y_0, the additional employment receives the double subsidy, so that marginal costs drop to MC_{DMS}.[10] Only if output is expanded beyond $y_2 = f\left(2f^{-1}(y_0)\right)$, i.e. beyond the level at which a firm's employment doubles compared to its initial level, additional employment receives only the single subsidy and marginal costs rise to MC_S.

There will be a price level $\tilde{p}$ at which an incumbent firm makes the same profit by either contracting or expanding.[11] In Figure 4.1, this price level can be read off where the inframarginal losses on all output units between y'' and y_0 are the same as the inframarginal profits for all units between y_0 and y' (the two hatched areas

[10] Note that we restrict s to the interval [0, 1/2[. We thus rule out the case where the single subsidy exceeds 50 percent because the marginal labor cost under *DMS* would then become negative.

[11] Expanding firms obtain marginal profits for those output units in the interval $\left[y_0, y'\right]$, but face intra-marginal losses from those output units in the interval $\left[y'', y_0\right]$. At $\tilde{p}$, the two effects exactly balance.

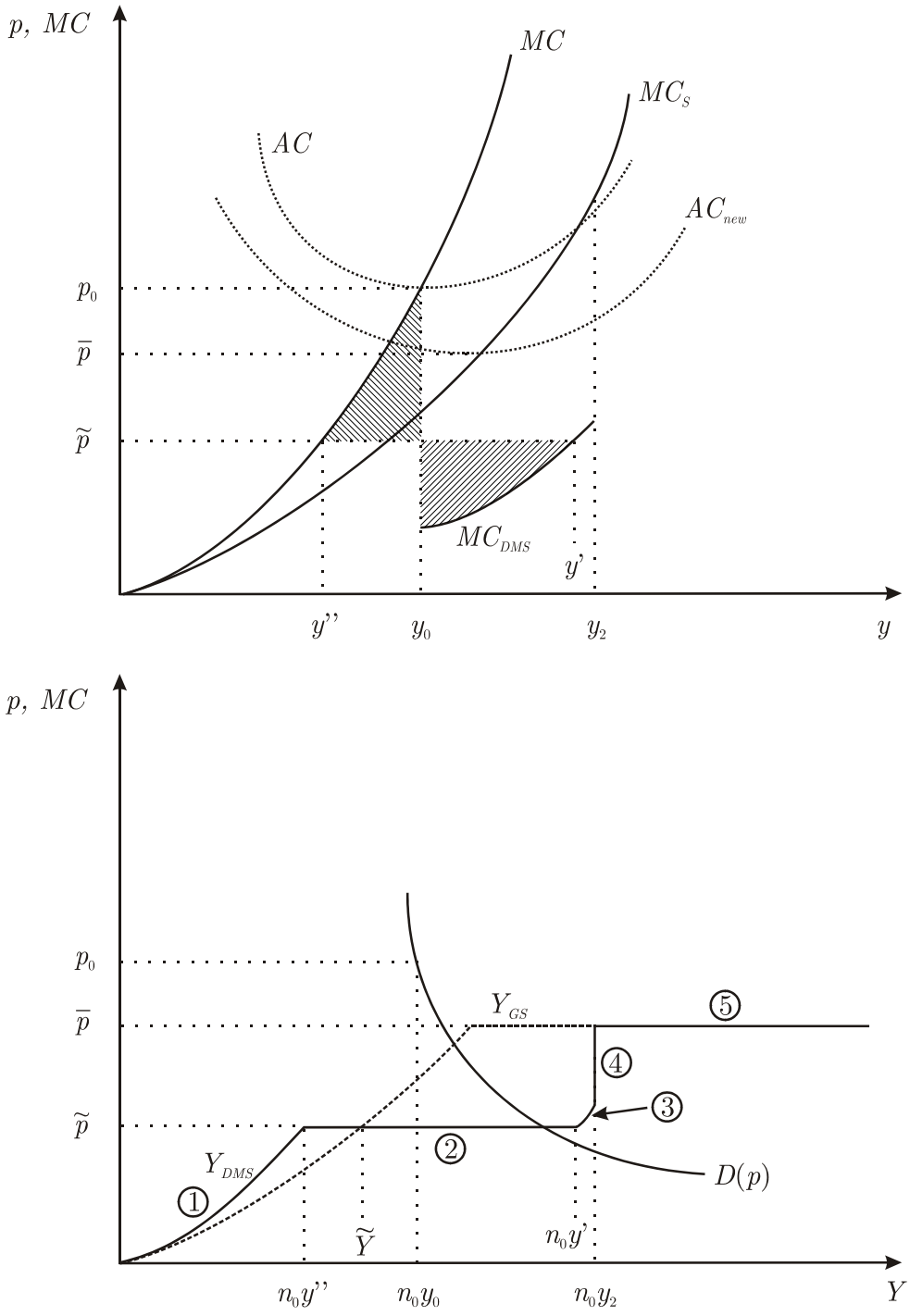


Figure 4.1: Firm-level and aggregate effects of GS and DMS

are of equal size). Formally, $\tilde{p}$ is implicitly defined by[12]

$$\tilde{p}\left(\frac{\alpha\tilde{p}}{w}\right)^{\alpha/(1-\alpha)} - w\left(\frac{\alpha\tilde{p}}{w}\right)^{1/(1-\alpha)} \tag{4.9}$$

$$= \begin{cases} \tilde{p}\left(\frac{\alpha\tilde{p}}{(1-2s)w}\right)^{\alpha/(1-\alpha)} & \\ -(1-2s)\,w\left(\frac{\alpha\tilde{p}}{(1-2s)w}\right)^{1/(1-\alpha)} - 2swy_0^{1/\alpha} & \text{if } \tilde{p} < (1-2s)\,C'(y_2) \\ \tilde{p}y_2 - (1-s)\,wy_2^{1/\alpha} & \text{if } \tilde{p} \geq (1-2s)\,C'(y_2) \end{cases},$$

where the LHS and the RHS of (4.9) are the profit of a contracting and an expanding firm, respectively.

The aggregate supply function with *DMS*, depicted by the solid line in the bottom part of Figure 4.1, thus consists of five sections.[13] If the market price is very low ($p < \tilde{p}$), all incumbent firms contract because it is not profitable to expand production despite the subsidy (Section 1). If $p = \tilde{p}$ (Section 2), some incumbent firms expand and others contract, but all firms make the same profit. If $\tilde{p} < p < (1-2s)\,C'(y_2)$, all incumbent firms increase their employment (Section 3). As long as the price is less than $(1-2s)\,C'(y_2)$ – the marginal production cost at twice the initial employment level –, it is not profit-maximizing for the firm to double employment. If $(1-2s)\,C'(y_2) \leq p < \bar{p}$, all incumbent firms exactly double their employment (Section 4). Further employment expansion would only be profitable if the output price exceeded $(1-s)\,C'(y_2)$, because only the single subsidy rate would be paid at the margin. Finally, if $p = \bar{p}$, all incumbent firms double their employment and new, completely subsidized firms enter the market (Section 5). With these considerations, one obtains a piecewise-defined aggregate supply function $Y_{DMS}(p)$ (see Appendix A). With *DMS*, the new equilibrium price is then determined by $Y_{DMS}(p_{DMS}) = D(p_{DMS})$.

3. Comparing general and double marginal subsidies

Equilibria with *GS* and *DMS* are quite different. In this section, we will compare the output, employment, and aggregate income effects of *DMS* compared to *GS* and

[12] The price level $\tilde{p}$ has to be defined piece-wise, since it could either be where expanding firms increase their employment to less than twice the initial level ($\tilde{p} < (1-2s)\,C'(y_2)$), or where they double their initial employment ($\tilde{p} \geq (1-2s)\,C'(y_2)$).

[13] Depending on the chosen functional specification, some of these sections might not exist, see Appendix A. Without loss of generality for our formal analysis, we will restrict our attention to the most general case in which all five sections feasible with our functional specification exist. In the numerical simulations in Section 4, we will include all different variants.

the initial equilibrium, and examine the impact on incumbents' rents, government deficit, and the functional distribution of income.
Let us start with the output effect.

Proposition 4.1 ***(Output)*** *Aggregate output with* DMS *is at least as large as that with* GS*, if both are provided at an equal rate. For both types of subsidy, the aggregate output level exceeds that in the initial equilibrium.*

Proof. See Appendix B. ■

The main force driving the differential effects of *DMS* and *GS* is the displacement competition between incumbent firms triggered by *DMS*. The large reduction in marginal costs under *DMS* makes all firms want to expand production compared to the initial, unsubsidized equilibrium. This drives down the market price. Since incumbent workers are not subsidized, average costs fall less than marginal cost. Firms will make losses, so some firms will significantly decrease their production level to reduce average (variable) costs. The sunkness of start-up costs, however, prevents incumbent firms from exiting the market completely despite the losses they make compared to the initial equilibrium. The displacement competition thus drives down output prices significantly and raises demand and aggregate output.
Under *GS*, no such displacement competition occurs. Since all firms are subsidized independently of whether they expand production or reduce it, firms cannot profitably underbid their competitors by expanding production. Since the subsidy is only paid at the single rate, firms' desire to expand production is smaller than under *DMS*, prices do not fall as much, and hence demand and aggregate output do not increase as much as under *DMS*.
If demand is sufficiently elastic, so that the output price reaches $\bar{p}$, new firms enter the market. In this case, both *DMS* and *GS* yield the same total output.
Let us turn to the employment effects.

Proposition 4.2 ***(Employment)*** *Aggregate employment with* DMS *is always larger than that with* GS*, if both are provided at an equal rate. For both types of subsidy, the aggregate employment level exceeds that in the initial equilibrium.*

Proof. See Appendix B. ■

DMS induce a technical inefficiency in the industry structure. Since they reward only the expansion of firms, even if it takes place at the expense of other firms, they result in larger firms than *GS*. Since marginal productivity is smaller in larger

firms, this means that average labor productivity is smaller under *DMS*, so that more labor is needed to produce the same amount of output. This technical inefficiency, combined with the generally favorable output effects of *DMS*, implies that *DMS* also cause larger employment effects than *GS*.

Our measure of aggregate domestic income I comprises aggregate net labor incomes and rents minus start-up costs. Since taxes and the payment of unemployment benefits and subsidies net out in aggregate incomes, the sum of aggregate firm rents and aggregate labor incomes is the same as aggregate firm revenues. Aggregate domestic income thus reduces to aggregate firm revenues minus start-up costs. In our model, the relationship between aggregate domestic income in the two subsidized equilibria, I_{DMS} and I_{GS} respectively, and the initial income level I_0 depends on the elasticity of world output demand.

Proposition 4.3 ***(Aggregate domestic income)*** *If world output demand is*

$$\left\{\begin{array}{l} \textit{elastic } (\varepsilon > 1) \\ \textit{unit elastic } (\varepsilon = 1) \\ \textit{inelastic } (\varepsilon < 1) \end{array}\right\}, \textit{ the income relation is } \left\{\begin{array}{l} I_{DMS} > I_{GS} > I_0 \\ I_{DMS} = I_{GS} = I_0 \\ I_{DMS} < I_{GS} < I_0 \end{array}\right\}.$$

Proof. See Appendix B. ■

By paying a subsidy, the government acts like a monopolistic intermediary because it directly influences the equilibrium output price. If demand is unit elastic ($\varepsilon = 1$), any change in the output price causes a proportional negative change in output demand, so that aggregate firm revenues stay constant. As is shown in the proof, the increased output of incumbent firms exactly suffices to satisfy the increased demand, so that no new firms enter and no additional start-up costs have to be expended. Hence, aggregate domestic income is not affected by the subsidy. If demand is elastic ($\varepsilon > 1$), an output price change leads to an overproportional negative change in demand, so that a price reduction will increase aggregate firm revenues. Since *DMS* cause competition between incumbent firms to drive down prices more and/or create larger firms (and thus leaves less room for new entrants which would cause additional start-up costs), aggregate domestic income will be larger with *DMS* than with *GS*. Vice versa, an inelastic demand ($\varepsilon < 1$) would call for higher prices and less output to maximize aggregate domestic income. In such a situation, a social planer is faced with a trade-off between employment and aggregate income effects.[14]

[14] In other words, even though $p_{DMS} = p_{GS} = \bar{p}$ (Section 5 in Figure 4.1) implies that the

We now turn to the distributive effects of *DMS* and *GS*. Our first result shows that incumbent firms lose under *DMS*.

Proposition 4.4 ***(Incumbent firms' rents)*** *The rent obtained by incumbent firms under* DMS *is always less than under* GS *or in the initial equilibrium. Incumbents' rents under* GS *are at most as large as those in the initial equilibrium.*

Proof. See Appendix B. ■

This again is a consequence of the displacement competition between incumbent firms when *DMS* are introduced. Firms have an incentive to expand production by using the subsidy to undercut their unsubsidized competitors. Since all firms attempt to do that, they compete prices down more than they would under *GS*, and thereby reduce their rents.[15] Under *GS*, incumbent firms' rents are unaffected and suffice to cover start-up costs if $p_{GS} = \bar{p}$, while these firms also suffer from rent reduction if $p_{GS} < \bar{p}$.
Since political acceptability of a subsidy program depends on its fiscal effects, it is worthwhile to examine the effect of *DMS* and *GS* on government expenditures.

Proposition 4.5 ***(Government expenditures)*** DMS *will always result in smaller government expenditures than* GS *if* $sw < b$.

Proof. Proposition 4.2 shows that employment under *DMS* always exceeds that under *GS*. If $sw < b$, any additional employee reduces government expenditures. Moreover, while *GS* always subsidize the entire workforce, the share of subsidized employees under *DMS* can never exceed unity. ■

If sw exceeded b, or in other words, if the single subsidy rate exceeded unemployment benefits' replacement ratio, each additionally employed worker would cost the government more than it saves. Since *DMS* always cause a larger employment effect than *GS*, this would raise government expenditures more under *DMS* than under *GS* if a sufficiently large number of incumbent employees has to be (double-)subsidized. It is, however, very plausible to assume that $sw < b$. As mentioned

output effect is the same for *GS* and *DMS* whether demand is elastic or inelastic, aggregate domestic income differs between the two cases. If demand is elastic and $p_{DMS} = p_{GS} = \bar{p}$, *GS* will cause more new firms to enter than *DMS*. Hence, more entry costs have to be paid that reduce incomes. With inelastic demand, it always holds that $p_{GS} < \bar{p}$ (see the proof of Proposition 4.3), so the case $p_{DMS} = p_{GS} = \bar{p}$ cannot occur. Graphically, the demand curve at $\varepsilon = 1$ always intersects the supply curve with *GS* exactly in the kink where the supply curve becomes horizontal.

[15] In the initial equilibrium, firms earned zero profits, but received positive rents due to the sunk entry costs. In the new equilibrium, incument firms make negative profits. They are, however, able to cover their variable costs and thus still earn positive rents, so that they stay in the market.

before, *DMS* restrict s to be less than 50 percent, because otherwise the double subsidy would result in negative marginal labor costs, while benefit replacement rates in OECD countries are typically far above 50 percent, especially in Europe (see Carone et al. 2004, Table 8).

The net income of incumbent workers and those persons who remain unemployed will be larger under *DMS* than under *GS*. This follows directly from Proposition 4.5. Since government expenditures are lower under *DMS* than under *GS* if $sw < b$, those persons whose employment status has not changed also have to contribute less under *DMS* than under *GS*.[16]

The above analysis suggests that there is a similarity between *DMS* and a general subsidy scheme combined with a tax on the rents of incumbent firms. *DMS* can provide a stronger employment stimulus at lower fiscal costs than *GS* because they extract incumbent firms' rents and use them for financing the subsidy scheme. If instead *GS* were introduced at a larger rate, the same employment effect could be created, while the subsidy's fiscal burden could be kept down by imposing a profit tax on the rents of incumbent firms. Such profit taxes, however, have received little support in the public finance literature because there are immense problems of operationalizing the notion of economic profit (see Rosen 2002, 270) and because constitutional restrictions, which intend to protect property ownership, implicitly define an upper limit on feasible tax rates (Fuest and Huber 1997). *DMS*, on the other hand, achieve the extraction of incumbents' rents "through the back-door" without encountering the problems of pure profit taxation. Therefore, *DMS* allow the financing of the subsidy scheme in a non-distortive way (apart from the technical inefficiency discussed above).

The final distributive measure in our analysis is the labor share in the functional distribution of income.

Proposition 4.6 ***(Labor share)*** DMS *cause the labor share to rise compared to the initial equilibrium, while* GS *have no effect on the functional distribution of income.*

Proof. See Appendix B. ■

One of the well-known properties of the group of Cobb-Douglas-type production

[16] The exact distibutional consequences depend on the specific type of taxation. If, for example, taxation is lump-sum, employment rises, and total government expenditures do not change compared to their initial level, the lump-sum tax per person does not change, so that the income of incumbent workers and the remaining unemployed is not affected. If, however, taxation is proportional, employment rises, and government expenditures do not change, the newly employed pay higher taxes, so that the tax rates for incumbent workers and the remaining unemployed can be reduced, thereby making them better off.

functions, to which (4.2) belongs, is the constancy of the functional distribution of income if all factors of production receive a competitive compensation (see Mankiw 2003, 71). In our case, however, firm incomes are not competitive compensations, but rents arising from the sunkness of start-up costs. The firms' share in total income can thus only stay constant as long as their ability to secure these rents is unaffected. Since *GS* treat all firms identically, the subsidies do not affect the rent-capturing ability of incumbent firms and the labor share stays constant. With *DMS*, on the other hand, competition between incumbent firms reduces their rent-capturing abilities and thus leads to an increased labor share. Hence, in addition to their employment-promoting effect, *DMS* also serve as a redistribution device.

The *DMS*–scheme is sometimes criticized for raising barriers to entry and thus hindering technological progress because it gives a greater marginal cost advantage to incumbents than to entrants. This criticism seems to be misplaced. Even though the marginal cost reduction is larger for incumbents, their average cost reduction is smaller than that of new entrants because not all employees will be subsidized. Hence, incumbents will always make less profits than new entrants which gives the entrants a competitive advantage. In other words, the status quo was characterized by barriers to entry because incumbent firms were protected by the sunkness of their entry costs. *DMS* are a mechanism which causes incumbents to compete away their entry-cost rents, and thus even reduces barriers to entry.

To sum up, *DMS* cause larger output and employment effects and are less expensive for the government than *GS*. We have shown that this advantageousness of *DMS* persists even if we account for displacement competition between firms. *DMS* reduce the fiscal costs of the subsidy scheme by indirectly making use of incumbent firms' rents to finance the employment expansion.

4. Numerical illustration

In this section, we present a numerical illustration of our model to illustrate the general magnitude of the differential effects of *DMS* and *GS* on employment and distributional variables and apply it to check the robustness of previous estimations of the effects of *DMS*-proposals for Germany.

The simple view of marginal employment subsidies relies on the principle that firms produce where prices equal marginal cost. A straightforward extension of this "marginalist" principle is that a double marginal subsidy has the same employment effect as a general subsidy at the double rate, because both types of subsidies reduce marginal costs by the same amount. This approach would be valid if individual firms operated on separate markets or if they were collective price-takers, for

example because the world-market price could not be affected by domestic firms. In both cases, there could be no inter-firm displacement effects, and only the marginal cost reduction would be relevant for a firm's production decision. Since *DMS* offer the double reduction in marginal costs, this "marginalist" view predicts that *DMS* provide large employment gains and fiscal relief.

Critics of *DMS* claim that the alleged favorable effects of marginal subsidization are only due to the failure of the "marginalist" view to take inter-firm displacement effects into account (Bothfeld et al. 2006, Sinn 2006a). They argue that inter-firm displacement will force all firms with some unsubsidized employment out of the market, so that only completely subsidized firms remain. Hence, the critics predict full displacement, in which case *DMS* would effectively be equivalent to *GS*. In this chapter, we have developed a model that shows that both approaches – predicting full displacement or no displacement at all – are too simplistic. *DMS* will indeed trigger strong inter-firm displacement, but this does not make them equivalent to *GS*.

We will now quantitatively compare the differential effects of *GS* and *DMS*. For the double marginal subsidy, we apply both the "marginalist" approach and the model developed in this chapter. Henceforth, we will refer to the two approaches as *DMS without displacement* and *DMS with displacement*, respectively. We revert to the same base parameters as the most recent calculations on the German *DMS*-proposal *Magdeburg Alternative* developed by Schöb and Weimann (2005).[17] The *Magdeburg Alternative* is specifically targeted to low-skilled, low-wage jobs. The size of the target group, i.e. the number of low-skilled unemployed persons in Germany, is estimated to be 2.8 million, while 2.1 million low-skilled persons are employed. Bringing one additional low-skilled unemployed back into work saves the public budget 15,192 Euro p.a. (gross savings without subsidy costs), while annual gross labor costs (including employer's social security contributions) are 17,258 Euro.[18] To reproduce these parameters in our model, we set $b/w = 0.88$.

[17] Schöb and Weimann (2003, 2005) apply the "marginalist" approach to determine the effects of the *Magdeburg Alternative.* They recognize that displacement might occur, but model it without any repercussion on aggregate employment (cf. Chapter 2 of this dissertation).

[18] By bringing one low-skilled unemployed back into work at a monthly wage of 1,200 Euro, the government saves on average 637 Euro in welfare benefits. Moreover, the average amount of taxes and social security contributions paid is 515 Euro, while no new claims to the social insurances arise (welfare recipients were covered by health and basic pension insurances already). In addition, past experiences show that some welfare recipients prefer to decline a job offer and forfeit future benefits (Feist and Schöb 1998). This saves, on average, another 114 Euro per new job. Thus, the total amount saved is 1,266 Euro per month, or 15,192 Euro per annum. Annual labor costs of 17,258 Euro are obtained by adding employer's social security contributions (19.85 percent) to the monthly wage of 1,200 Euro.

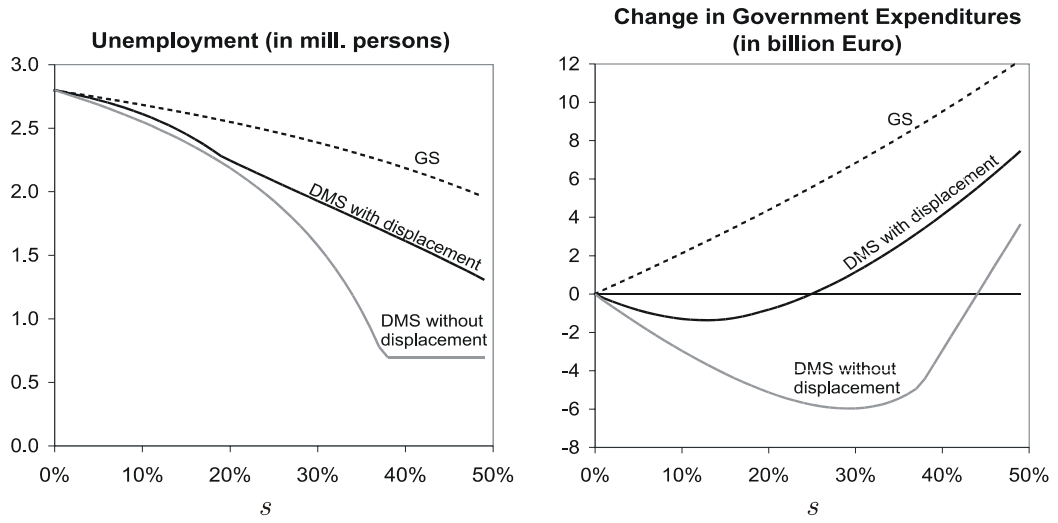


Figure 4.2: Comparison between DMS with and without displacement and general subsidies

Schöb and Weimann (2005) assume a wage elasticity of labor demand of 0.5, which corresponds to a price elasticity of output demand of $\varepsilon = 0.4$. The other parameters are set at $\alpha = 0.67$, $F = 1$, and $A = 0.438$.

The numerical results of the comparison between *GS* and the two *DMS*-models with and without displacement are presented in Figure 4.2. When neglecting displacement, double marginal subsidies have tremendous employment gains and significantly reduce government expenditures. For a 35 percent subsidy rate examined by Schöb and Weimann (2005), employment would rise by 1.7 million persons. Government expenditures would fall by 5.5 billion Euro.[19]

While the employment effect obtained by neglecting displacement depends only the reduction in marginal costs, the *DMS*–model developed in this chapter demonstrates that the employment reaction to a double marginal subsidy depends on the interplay of marginal costs, average costs, and between-firm competition. Figure 4.2 shows that double marginal subsidies have a strong employment effect even if between-firm displacement is taken into account. The numerical illustration suggests, however, that it is not as strong as that predicted when neglecting any displacement.[20]

[19] It is noticable that the *DMS*-method without displacement predicts a constant unemployment rate and sharply rising government expenditures for $s \geq 0.375$. For these subsidy rates, all firms would double their employment and experience a sharp increase in their marginal cost (because further employment expansions receive only the single subsidy). Hence, increases in the subsidy rate do not create more employment, but only raise the necessary expenditures.

[20] As can be seen in Figure 4.2, the employment-enhancing effect of larger subsidy rates under *DMS* with displacement becomes weaker for $s \geq 0.2$. The reason is that, for subsidy rates below 20 percent, an increase in s causes expanding firms to become larger, while for s exceeding 20 percent,

In particular, employment expands by only 1.03 million jobs.[21] Also with respect to the government budget, the numerical results are less favorable to double marginal subsidization than those predicted without displacement. At a subsidy rate of 35 percent, the *DMS*–method with displacement predicts that government expenditures rise by 2.5 billion Euro per annum.

Figure 4.2 shows that policymakers are offered a "free-lunch" at small subsidy rates, where employment gains can be achieved with fiscal savings, while they face a trade-off between employment expansion and fiscal consolidation for larger subsidy rates. For example, a subsidy rate of 13 percent would maximize fiscal savings. Government expenditures could be reduced by 1.35 billion Euro, and 280,000 new jobs could be created. At a subsidy rate of 25 percent, *DMS* would be revenue-neutral, but bring about 720,000 new jobs. With subsidy rates above 25 percent, the employment effects are even larger, but come at the cost of rising public expenditures.[22]

Compared to *GS*, double marginal wage subsidies score better under both methods. For any rate of subsidy, general subsidies lead to smaller employment effects at larger fiscal costs than double marginal subsidies. According to our numerical results, *GS* at a subsidy rate of 35 percent cause employment to rise by half a million new jobs and the government budget to rise by 8 billion Euro per annum, independently of the method used.[23]

To sum up, double marginal wage subsidies create more employment at smaller fiscal costs than general subsidies. Our results suggest, however, that the quantitative effects are smaller than those suggested if between-firm displacement is neglected. The choice of the subsidy rate confronts policymakers with a trade-off. At small subsidy rates, they can enjoy a "double dividend" of both employment gains and

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they will already have doubled their employment and will not expand further. Hence, the marginal price and employment effects of higher subsidy rates are smaller if $s \geq 0.2$.

[21] This number shows the net employment effect. It is comprised of 1.5 million additional jobs in expanding firms and an employment reduction of 470,000 jobs in shrinking firms.

[22] For comparison, the *DMS*-method without displacement at a subsidy rate of 13 percent predicts 341,000 new jobs and fiscal savings of 3.71 billion Euro, while at a rate of 25 percent, the respective predictions are 870,000 new jobs and savings of 5.77 billion Euro.

For a more complete evaluation of the fiscal effects of the different subsidy schemes, one also has to take into account savings in other active labor market programs, the draining of the shadow economy, the reversal of international outsourcing movements, and institutional peculiarities, such as the conversion of unsubsidized part-time jobs for secondary earners to subsidized full-time jobs for welfare recipients in Germany. These effects will, however, only affect the magnitude of the fiscal effects, without changing the ordering of the differential effects between *GS* and the *DMS*-approaches.

[23] At the abovementioned subsidy rate of 13 percent, *GS* would create only 150,000 new jobs at 2.76 billion Euro additional costs. At a subsidy rate of 25 percent, 330,000 new jobs at 5.54 billion Euro costs could be created by *GS*.

fiscal savings. Contrary to *GS*, the fiscal effect is non-monotonous in the subsidy rate, so that if policymakers want to achieve larger employment gains, these can only be achieved at fiscal costs.

5. Conclusion

Marginal wage subsidies are claimed to generate larger employment effects at smaller fiscal costs than general wage subsidies, but their effectiveness suffers from inter-firm displacement effects. Incumbent firms might expand due to the marginal subsidy, but mainly by capturing the market share of competing firms, which consequently have to cut employment. The stronger the displacement effect, the lower becomes the net employment gain and the higher becomes the fiscal cost per newly created job.

Our model confirms part of this story but also shows that the overall assessment has to be substantially modified. Indeed, it is the case that inter-firm displacement of considerable magnitude takes place in equilibrium under double marginal subsidies. Nevertheless, the larger marginal stimulus to output expansion leads to a lower output price than would occur under general subsidization, which in turn causes a larger output demand and employment gain. Since it creates more employment without necessarily subsidizing all employees, double marginal subsidization is always cheaper for the government than general subsidization.

Its fiscal advantage arises because double marginal subsidization reduces the ability of incumbent firms to capture the rents associated with their cost of market entry and thus functions like a tax on pure economic profits. The government has to pay less for the subsidy scheme because it can indirectly make use of incumbent firms' rents to finance it.

Double marginal subsidies lower barriers to entry in existing industries because, even though incumbent firms receive a larger subsidy at the margin under double marginal subsidization than under general subsidies, the reduction of their rents in equilibrium reduces the protection they enjoy against new entrants from their established market position. In entirely new sectors, all firms will be treated equally under double marginal and general subsidization, so that double marginal subsidies have no disadvantage in this case either.

The numerical illustration of our model yields more cautious results about the quantitative effects of recent double marginal subsidy-proposals than those predicted by previously used methods that neglect between-firm displacement. The employment effects are still substantial, albeit smaller than former simulations suggested. Moreover, we find that policymakers are offered a "double dividend" at modest subsidy

rates because employment gains and fiscal savings can be realized at the same time. At larger subsidy rates, however, policymakers face a trade-off between employment expansion and fiscal austerity.

To conclude, our model shows that marginal wage subsidies, when designed as double marginal subsidies, create more employment at less fiscal cost than general wage subsidy programs. The driving force behind this result is that double marginal subsidization extracts incumbent firms' rents through intense price competition, and indirectly puts them to use for employment creation. In this respect, double marginal subsidies closely mimic a policy which finances a general wage subsidy by a non-distortive profit tax on incumbent firms. Thus, if politicians want to devise a self-financing subsidy scheme, but are precluded from applying taxes on pure economic rents, double marginal wage subsidies are a superior policy instrument for employment creation to general wage subsidies.

Appendix A

In Sections 2 and 3, we restricted our attention to the case where the aggregate supply function with *DMS* consists of five parts. Formally, the five-part aggregate supply function with *DMS* can be written as

$$Y_{DMS}(p) = \begin{cases} n_0 \left(\frac{\alpha p}{w}\right)^{\alpha/(1-\alpha)} & \text{if} \quad p < \tilde{p} \\ \left[n_0 \left(\frac{\alpha p}{w}\right)^{\alpha/(1-\alpha)}, \; n_0 \left(\frac{\alpha p}{(1-2s)w}\right)^{\alpha/(1-\alpha)} \right] & \text{if} \quad p = \tilde{p} \\ n_0 \left(\frac{\alpha p}{(1-2s)w}\right)^{\alpha/(1-\alpha)} & \text{if} \quad \tilde{p} < p < (1-2s)\, C'(y_2) \\ n_0 y_2 & \text{if} \quad (1-2s)\, C'(y_2) \leq p < \bar{p} \\ [n_0 y_2, \infty[& \text{if} \quad p \geq \bar{p} \end{cases} . \tag{4.A.1}$$

Here, we will show under which conditions this is correct and which other cases might occur.

Generally, the aggregate supply function could consist of up to six different sections. The first section is where the market price is so low that all incumbent firms want to reduce production. In the second section, the output price is where firms are indifferent between expanding or contracting, so that a horizontal supply curve results. The third and fourth sections describe the case where all incumbent firm expand production, but do not (Section 3) or do (Section 4) double their employ-

ment. A fifth section could arise if incumbent firms find it profitable to expand their employment to more than twice its initial level, while new entrants do not find it profitable to enter the market. The sixth section arises where the output price is at the minimum average costs of new entrants. New firms enter the market, and the supply curve becomes perfectly price-elastic.

Depending on the form of the production function, not all of these section necessarily occur. With the functional specification laid out in Section 2, we can rule out the existence of some of these sections and show that other sections exist independently of the chosen parameter values.

Section 1 always exists because $MC(0) = 0$. Hence, at no positive output price will incumbent firms find it optimal to leave the market completely.

Section 2 will exist for any admissible parameter values, because, as can easily be seen by contradiction, $\tilde{p} < \bar{p}$ always holds. If $\tilde{p} \geq \bar{p}$ and $\bar{p} < (1-2s)\,C'(y_2)$, it must hold that

$$\begin{bmatrix} \bar{p}\left(\frac{\alpha\bar{p}}{w}\right)^{\alpha/(1-\alpha)} \\ -w\left(\frac{\alpha\bar{p}}{w}\right)^{1/(1-\alpha)} \end{bmatrix} \geq \begin{bmatrix} \bar{p}\left(\frac{\alpha\bar{p}}{(1-2s)w}\right)^{\alpha/(1-\alpha)} - (1-2s)\,w\left(\frac{\alpha\bar{p}}{(1-2s)w}\right)^{1/(1-\alpha)} \\ -2swy_0^{1/\alpha} \end{bmatrix}, \tag{4.A.2}$$

which, after inserting (4.6), becomes

$$(1-\alpha)(1-s)^{\alpha}\left[1-\left(\frac{1}{1-2s}\right)^{\alpha/(1-\alpha)}\right]+2\alpha s \geq 0. \tag{4.A.3}$$

This condition is never fulfilled for $\alpha \in]0,1[$ and $s \in [0, 1/2[$. If $\tilde{p} \geq \bar{p}$ and $\bar{p} \geq (1-2s)\,C'(y_2)$, the same logic leads to the condition

$$(1-\alpha)(1-s)^{\alpha/(1-\alpha)} - 2^{\alpha}(1-s)^{\alpha} + 2\alpha(1-s) \geq 0. \tag{4.A.4}$$

Moreover, $\bar{p} \geq (1-2s)\,C'(y_2)$ requires that

$$2^{1-\alpha} - \frac{(1-s)^{\alpha}}{1-2s} \leq 0. \tag{4.A.5}$$

Conditions (4.A.4) and (4.A.5) cannot be fulfilled at the same time for $\alpha \in]0,1[$ and $s \in [0, 1/2[$. Therefore, we always have $\tilde{p} < \bar{p}$, and Section 2 always exists.

The third section exists if $\tilde{p} < (1-2s)\,C'(y_2)$, while the fourth section exists if $\bar{p} > (1-2s)\,C'(y_2)$. Whether these conditions are fulfilled depends on the parameter values chosen. It is possible that one of the two sections does not exist. Both sections, however, cannot be non-existing at the same time because $\tilde{p} < \bar{p}$.

The fifth section (where incumbent firms more than double their employment, but new firms do not enter) cannot exist with our functional specification. This section would only exist if $\bar{p} > (1-s)\,C'(y_2)$, which holds if $[2(1-s)]^{1-\alpha} - 1 < 0$. This condition is never fulfilled for $\alpha \in]0, 1[$ and $s \in [0, 1/2[$.
Since the sixth section always exists, our functional specification restricts the multitude of aggregate supply curves to three different cases. If $\tilde{p} < (1-2s)\,C'(y_2) < \bar{p}$, all sections, except the fifth, exist. If $\tilde{p} < \bar{p} \leq (1-2s)\,C'(y_2)$, the fourth and fifth sections do not exists, and if $(1-2s)\,C'(y_2) \leq \tilde{p} < \bar{p}$, the third and fifth sections do not exist.

Appendix B

Proof of Proposition 4.1. Since the production function (4.2) is homogenous of degree α, we have

$$(1-s)\,C'(y_0) \geq \tilde{p}. \tag{4.A.6}$$

This can easily be seen by inserting this inequality into (4.9), which, if the condition holds, yields

$$\frac{1-(1-2s)^{\alpha/(\alpha-1)}}{(1-s)^{1/(\alpha-1)}}\left(\frac{1}{\alpha}-1\right)+2s \leq 0. \tag{4.A.7}$$

Since this holds for all values of $\alpha \in]0, 1[$ and $s \in [0, 1/2[$, condition (4.A.6) must hold.
From (4.A.6), it follows that $Y_{DMS}^{-1}(n_0 y_0) \leq Y_{GS}^{-1}(n_0 y_0)$, and $Y_{DMS}^{-1}(Y) \leq Y_{GS}^{-1}(Y) < p_0 \;\forall\; Y \geq n_0 y_0$. Since $D'(p) < 0$, this implies that $p_0 > p_{GS} \geq p_{DMS}$ and $D(p_0) < D(p_{GS}) \leq D(p_{DMS})$. ■

Proof of Proposition 4.2. It always requires more workers to produce a given output with *DMS* than with *GS* because the firms' production function (4.2) exhibits decreasing marginal productivity of labor, and the number of firms is smaller with *DMS* than with *GS*, and/or firms are of unequal sizes with *DMS* while they are of equal size with *GS*. (A general proof of this result is provided by Knabe (2006a), cf. Chapter 3 of this dissertation). Since Proposition 4.1 states that output with *DMS* is at least as large as with *GS*, the employment effect of *DMS* always has to be larger than that of *GS*. ■

Proof of Proposition 4.3. First note that the critical demand elasticity which separates the two parts of the *GS*–supply curve is exactly $\varepsilon = 1$. This critical elasticity is determined by the condition $A\bar{p}^{-\varepsilon} = n_0\bar{y}$. From (4.6), (4.7), and (4.4), we have $\bar{p} = (1-s)^{\alpha} p_0$ and $\bar{y} = (1-s)^{-\alpha} y_0$, so that the condition becomes

$(1-s)^{-\alpha\varepsilon} = (1-s)^{-\alpha}$, which is only fulfilled for $\varepsilon = 1$.
From Proposition 4.1, we know that $p_{DMS} \leq p_{GS} < p_0 \forall \varepsilon > 0$. In case of elastic demand ($\varepsilon > 1$), $p_{DMS} \leq p_{GS}$ implies that revenues with *DMS* are at least as large as with *GS*. Moreover, we know that for $\varepsilon > 1$, more new firms will enter under *GS* than under *DMS*. Hence, $n_{DMS} < n_{GS}$, which causes larger start-up costs with *GS*. Therefore, $I_{DMS} > I_{GS}$. Comparing *GS* to the initial equilibrium, we have $I_{GS} = \bar{p} D(\bar{p}) - \bar{n} F$ and $I_0 = p_0 D(p_0) - n_0 F$, which results in $sgn(I_{GS} - I_0) = sgn\left((1-s)^{\alpha(1-\varepsilon)} - 1\right) > 0 \forall \varepsilon > 1$. Hence, $I_0 < I_{GS} < I_{DMS}$.
For $\varepsilon = 1$, firm revenues and the number of firms are the same under *DMS*, *GS*, and initially. Hence, $I_0 = I_{GS} = I_{DMS}$.
In case of inelastic demand ($\varepsilon < 1$), we have a strict inequality $p_{DMS} < p_{GS} < p_0$, which implies that firm revenues are smallest with *DMS* and second smallest with *GS*. Since the number of firms is always n_0, we have $I_0 > I_{GS} > I_{DMS}$. ■

Proof of Proposition 4.4. Let $R_{DMS}(p)$, $R_{GS}(p)$, and R_0 be the rents of an incumbent firm under *DMS*, *GS*, and in the initial equilibrium, respectively. Since $R_{GS}(\bar{p}) = F$ and $R_0 = F$ by the zero-profit condition for new entrants, and $\partial R_{GS}(p)/\partial p > 0$, we have $R_{GS}(p) \leq R_0 \forall p \leq \bar{p}$.
Since $p_{DMS} \leq p_{GS}$ and $\partial R_{GS}(p)/\partial p > 0$, it is sufficient to show that $R_{GS}(p) > R_{DMS}(p)$ for any given $p \in \left[\tilde{p}, \bar{p}\right]$ to prove the proposition. We check whether this condition holds for the three relevant price intervals separately.
For $p = \tilde{p}$, $R_{DMS}(p) = R_{GS}(p)|_{s=0}$. Since $\partial R_{GS}/\partial s > 0$ and $s > 0$, we have $R_{GS}(p) > R_{DMS}(p)$.
For $p \in \left]\tilde{p}, (1-2s) C'(y_2)\right[$, an incumbent's rent under *DMS* can be written as

$$\begin{aligned} R_{DMS}(p) &= p\left[y_{DMS} - (1-s) w y_{DMS}^{1/\alpha}\right] - sw\left[2y_0^{1/\alpha} - y_{DMS}^{1/\alpha}\right] \\ &= R_{GS}(p)|_{y=y_{DMS}} - sw\left[2y_0^{1/\alpha} - y_{DMS}^{1/\alpha}\right], \end{aligned} \tag{4.A.8}$$

where $y_{DMS} = [\alpha p/((1-2s) w)]^{\alpha/(1-\alpha)}$. It follows that $R_{DMS}(p) < R_{GS}(p)|_{y=y_{DMS}}$. Moreover, $R_{GS}(p) \geq R_{GS}(p)|_{y=y_{DMS}}$, since the rent would not be maximized otherwise. Hence, $R_{GS}(p) > R_{DMS}(p)$.
In the interval $p \in \left[(1-2s) C'(y_2), \bar{p}\right]$, $R_{DMS}(p) = R_{GS}(p)|_{y=y_2}$. Since $y_2 > [\alpha/((1-s) w)]^{\alpha/(1-\alpha)}$ in the relevant price interval, we have $R_{GS}(p) > R_{GS}(p)|_{y=y_2}$.
Therefore, $R_{GS}(p) > R_{DMS}(p) \forall p \in \left[\tilde{p}, \bar{p}\right]$. ■

Proof of Proposition 4.6. The labor share in the initial equilibrium is α. Under *GS*, each firm produces $y_{GS} = [\alpha p_{GS}/((1-s)w)]^{\alpha/(1-\alpha)}$. The number of firms is then given by $n_{GS} = D(p_{GS})/y_{GS}$. Making use of these expressions, the labor share under *GS* becomes

$$\frac{(1-s)wL_{GS}}{p_{GS}D(p_{GS})} = \frac{(1-s)wn_{GS}y_{GS}^{1/\alpha}}{Ap_{GS}^{1-\varepsilon}} = \alpha. \tag{4.A.9}$$

Let ϕ be the share of subsidized workers under *DMS,* and $L_{DMS}(p)$ and $L_{GS}(p)$ be the total employment under *DMS* and *GS* if p is the equilibrium price. From Proposition 4.2, (4.A.9), and $\phi \leq 1$, it follows that

$$\frac{(1-\phi s)wL_{DMS}(p_{DMS})}{p_{DMS}D(p_{DMS})} > \frac{(1-s)wL_{GS}(p_{DMS})}{p_{DMS}D(p_{DMS})} = \alpha. \tag{4.A.10}$$

This shows that *DMS* always results in a larger labor share than *GS*. ■

Chapter 5

Subsidizing extra jobs: promoting employment by taming the unions[1]

1. Introduction

When wages are above market-clearing levels and cause unemployment, wage subsidies could alleviate unemployment by narrowing the gap between the labor cost borne by firms and the minimum compensation demanded by workers. Comprehensive wage subsidy schemes, however, are associated with two major drawbacks. First, subsidizing wages creates large windfall gains for all workers already in employment. This makes wage subsidization very expensive to the government. Second, if the subsidy can be redistributed through the wage bargaining process, the effectiveness of wage subsidies in promoting employment is endangered. The literature on tax incidence in economies with imperfect labor markets has demonstrated that under certain institutional arrangements wage subsidies may actually be shifted completely into higher net wages. In this special case, labor costs stay constant and unemployment does not fall (see Layard Nickell and Jackman 1991).[2]

The fiscal cost of wage subsidization can be significantly reduced by restricting the subsidy to extra jobs created in addition to a firm's incumbent workforce.

[1] This chapter was written in collaboration with Ronnie Schöb.

[2] Nevertheless, recent theoretical and empirical work shows that wage subsidies generally have a positive effect on employment (see e.g. Daveri and Tabellini 2000, Nickell and Layard 1999).

Layard and Nickell (1980) were the first who showed that this type of *marginal* employment subsidies can generate more jobs than general subsidies costing the same amount.[3] Indeed, the theoretical findings are all together very much in favor of a marginal rather than general wage subsidy scheme and several field experiments with such subsidy schemes confirmed the theoretical findings.[4]

Surprisingly, academic research lost interest in marginal employment subsidies in the meantime. The positive summarizing evaluation of marginal employment subsidies in the otherwise so influential book by Layard, Nickell and Jackman (1991) should have stimulated further research. Instead, it appears to have become the closing words on this issue – so far.

This chapter aims at reviving the interest in the analysis of marginal employment subsidies. We develop a general equilibrium model with imperfect labor and output markets (Section 2) for which we can identify a benchmark scenario in which wage taxes and general subsidies do not affect employment at all (Section 3). We then turn to the formal analysis of marginal employment subsidies (Section 4). The theoretical literature has focused on *symmetric* marginal wage subsidies where firms are rewarded when they increase employment but are punished when they reduce their workforce. Real-life marginal wage subsidy programs, however, are *asymmetric*. They subsidize employment expansions but do not punish shrinking firms. This small difference has severe consequences for the incidence of marginal employment subsidies. One might expect that the additional punishment of layoffs under symmetric subsidization may be good for employment, but the opposite is true. The punishment threat of a symmetric marginal employment subsidy makes it more costly for firms to lay off workers when trade unions aggressively raise wages. Trade unions can thus shift a large share of the wage subsidy towards higher net wages. In our benchmark case, this

[3] This result was qualitatively confirmed in different theoretical frameworks by Chiarella and Steinherr (1982), Whitley and Wilson (1983), Oswald (1984), Hart (1989), and Layard, Nickell and Jackman (1991).

[4] In the 1970s, many countries experimented with marginal employment subsidies. Examples are the New Jobs Tax Credit in the United States (see Perloff and Wachter 1979, Bishop and Haveman 1979), the French *Prime d'incitation à la création d'emploi* (see Kopits 1978), the Small Firms Employment Subsidy in Great Britain (see Layard 1979), and the *Lohnkostenzuschüsse* in Germany (see Schmidt 1979).

effect is so strong that symmetric marginal subsidies do not affect employment at all. In the asymmetric case without punishment, by contrast, firms may be more willing to shrink and lay off a substantial fraction of its workforce when wages become too high. This tames the trade unions. Rather than shifting the whole wage subsidy into higher gross wages, trade unions can raise the wage at most to the level at which the firm becomes indifferent whether to hire more workers or to shrink and lay off workers. This wage restraint leads to positive employment effects of asymmetric marginal employment subsidies.

When the subsidy raises aggregate employment, the threat of shrinking becomes less frightening for the trade union. High subsidy rates may induce some trade unions to let their firm shrink while other firms continue to expand. The general equilibrium thus exhibits displacement between incumbent firms. Although this displacement may lower employment, we show that the government can promote employment further if it sets the wage subsidy sufficiently high. However, these additional employment gains come at a huge welfare loss. Employment will be concentrated in very few firms which sell their goods at low prices while the majority of firms shrink and sell their goods at higher prices. This distorts the optimal consumption pattern: the variety of goods is diminished substantially. Our numerical simulations (Section 5) illustrate that employment and welfare move in the same direction for moderate subsidy levels, but that the trade-off becomes severe for larger subsidy rates.

In how far these results carry over to the long run with free entry crucially depends on the way in which new firms are treated (Section 6). When they are eligible for the subsidy, their whole workforce has to be subsidized. Any incumbent firm could take advantage of this by setting up a new firm to which it relocates all its business activities. A marginal employment subsidy would then become equivalent to a general wage subsidy in the long run. Alternatively, the government could grant the subsidy to incumbent firms only. In this case, the marginal employment subsidy will continue to tame the trade unions even in the long run. As marginal subsidies normally reduce profits, new firms will not enter and our short-run analysis carries over to the long run. Only if the desire for

variety is very high, profits rise and new firms will enter. This may lead to lower, though still positive employment effects compared to the short run, but the larger variety of goods will increase welfare even further.

2. The model

We apply a general equilibrium model as laid out by Layard, Nickell and Jackman (1991). Rents are created by firms who can set prices above marginal costs in monopolistically competitive goods markets. These rents are distributed between firm owners and workers through collective wage setting by firm-level labor unions. Unemployment arises because it reduces union's wage pressure to the level where rent claims by firms and unions are compatible with each other.[5]

Worker households

The economy consists of many identical worker-consumer-households, the number of which we normalize to one. Each household j provides one unit of labor and derives its utility from consuming a variety of m goods. Following Dixit and Stiglitz (1977) and Blanchard and Giavazzi (2003), we formulate the utility function as

$$V_j = m_0^{1/(1-\sigma)} \left[\sum_{i=1}^{m} C_{ij}^{(\sigma-1)/\sigma} \right]^{\sigma/(\sigma-1)}, \tag{5.1}$$

where σ is elasticity of substitution between the various product varieties and C_{ij} is the amount of variety i consumed by household j. m_0 is the initial number of goods available and serves as a normalization parameter. The household's budget constraint reads

$$\sum_{i=1}^{m} P_i C_{ij} = \begin{cases} W_j(1-t) + \Pi_j & \text{when employed} \\ B + \Pi_j & \text{when unemployed} \end{cases} \tag{5.2}$$

[5] Simplified versions of these type of models are presented in e.g. Heijdra and van der Ploeg (2002) and Sørensen and Whitta-Jacobsen (2005).

where W_j is the nominal wage rate of household j, Π_j is the profit share of household j, B is the nominal unemployment benefit payment, t is the wage tax, and P_i is the price of variety i.

Summing up over all households yields

$$\sum_j \sum_{i=1}^{m} P_i C_{ij} \equiv PC \,, \tag{5.3}$$

with

$$C = \left(\frac{m}{m_0} \right)^{1/(1-\sigma)} \sum_j V_j \quad \text{and} \quad P = \left[\frac{1}{m} \sum_{i=1}^{m} P_i^{1-\sigma} \right]^{1/(1-\sigma)} \tag{5.4}$$

being the quantity and price indices (see Dixit and Stiglitz 1977 for details).[6] Aggregate demand for good i is then given by:

$$C_i = \frac{C}{m} \left(\frac{P_i}{P} \right)^{-\sigma} . \tag{5.5}$$

Firms

Each firm produces one good for which it is a monopolist. We assume a constant-returns-to-scale technology with labor being the only input factor, i.e. $y_i = N_i$, $i \in [1,...,m]$ where N_i is the amount of labor employed by firm i, and y_i is its output level. The firm can set the good's price P_i but takes the gross wage $W_i(1-s)$ as given, where s is an ad-valorem wage subsidy. Firm i's profit is $\Pi_i = (P_i - W_i(1-s))N_i$.[7] Using $C_i = y_i = N_i$, the profit-maximizing price set by firm i is

$$P_i = (1+\mu_f)(1-s)W_i \tag{5.6}$$

[6] In the case with identical prices for all goods, the quantity index reduces to $C = mC_i$ and the price index to $P = P_i$.

[7] For expositional convenience, we use the term "profit" for the short-run profit that equals the producer rent, i.e. we do not subtract start-up costs.

with $\mu_f = (\sigma - 1)^{-1}$ denoting the (constant) markup the firm sets over marginal cost. Conditions (5.5) and (5.6) give us the labor demand functions

$$N_i(s,...) = C_i = \frac{C}{m}\left(\frac{P_i}{P}\right)^{-\sigma} = \frac{C}{m}\left(\frac{(1+\mu_f)(1-s)W_i}{P}\right)^{-\sigma} \forall i\,. \qquad (5.7)$$

Firms have to pay start-up costs F when they enter the market. These costs are sunk after the firm has entered.

Welfare

The term $m_0^{1/(1-\sigma)}$ in the utility function (5.1) normalizes the maximum potential welfare for the initial number of m_0 to one.[8] Maximum welfare is achieved when households consume all $m = m_0$ goods in equal amounts. In this case, we have $C = mC_i = 1$. Intuitively, the concavity of (5.1) reflects the desire for variety: a household who is indifferent between two consumption bundles (1,0) and (0,1) always prefers the mixed bundle (0.5, 0.5) (see Dixit and Stiglitz 1977, p. 297). Welfare losses may occur when labor is idle due to (involuntary) unemployment or when goods are consumed in different quantities. Both types of welfare losses may occur in our model both in the short run and in the long run. In addition, long-run welfare may rise when additional varieties become available.

Wage Determination

Each firm's workforce is organized in a firm-level labor union that can unilaterally determine the firm-specific wage rate. We apply a union objective function Ω of the Stone-Geary type:

$$\Omega(W)_i = \left[(1-t)W_i - W^o\right]^{\phi} N_i\,. \qquad (5.8)$$

The union benefits from firm-level employment N_i and the difference between the net wage earned by each worker employed by firm i and the outside option W^o.

[8] This can be seen from maximizing C subject to the economy's resource constraint of one unit of labor.

The weight $\phi \in]0, \sigma[$ indicates the relative importance of wage gains compared to employment.[9]

The outside option W^o is determined by the expected net wage available to a worker who loses his current job. A laid-off worker will either find employment in a different firm, where he can expect to earn the economy-wide average wage W, or he will be unemployed and receive unemployment benefits B. The probability of finding a job is given by the aggregate employment rate y. Hence, the workers' outside option is

$$W^o = y(1-t)W + B(1-y). \tag{5.9}$$

Maximizing the trade unions' objective function (5.8) with respect to W_i yields

$$W_i = (1+\mu_u)\frac{W^o}{(1-t)} \text{ with } \mu_u = \frac{\phi}{\sigma - \phi}. \tag{5.10}$$

To maximize its utility, a union will set a markup μ_u on the (gross equivalent) of the expected outside wage. Note that both firm-level unions and individual firms take the prices and wages set by other firm-union-pairs as given.

General equilibrium

In general equilibrium, the rents claimed by monopolistically competitive firms and by labor unions have to be compatible with each other. If unions tried to reach a real wage above (below) the level compatible with firms' price setting, inflationary (deflationary) pressures would arise. Hence, the general equilibrium occurs where price stability – or, for that matter, non-accelerating inflation – is secured.

[9] The parameter ϕ is useful for numerically simulating the model because it secures "reasonable" unemployment levels in general equilibrium. The specification (5.8) encompasses the common utilitarian trade union model with risk-neutral workers as a special case for ϕ=1 (see Farber 1986, 1061).

We apply the symmetry condition for both the labor market and the goods markets: $W_i = W$ and $P_i = P$. Then, the firm's pricing rule (5.6) becomes the aggregate price-setting (PS) equation

$$\frac{W}{P} = \frac{1}{(1+\mu_f)(1-s)}. \tag{5.PS}$$

Firms add a constant markup onto any nominal wage the trade unions set: firms will always adjust their goods' prices such that the equilibrium real wage remains constant.

To determine the wage-setting condition, we consider unemployment benefits that are proportional to the average net wage rate, i.e. $B = b(1-t)W$. The aggregate wage setting (WS) equation then follows from (5.9), (5.10), and the symmetry condition,

$$\frac{W}{P} = (1+\mu_u)\left[y + b(1-y)\right]\frac{W}{P} \quad \Leftrightarrow \quad y = \frac{1-(1+\mu_u)b}{(1+\mu_u)(1-b)} = 1 - \frac{\mu_u}{(1+\mu_u)(1-b)}. \tag{5.WS}$$

The WS-condition shows that, with a constant net replacement ratio, labor taxes and subsidies do not have any general equilibrium employment effects (cf. Layard, Nickell and Jackman 1991). A lower unemployment rate would raise the unions' outside option and lead to higher wage claims, which would lead to continuous increases in the outside option and wages. Since the reverse holds for higher unemployment rates, there is a unique unemployment level compatible with price stability.

The conditions (5.PS) and (5.WS) thus specify both the equilibrium unemployment rate and the real wage. In our benchmark case, equilibrium employment is determined in the labor market while the distribution of income, given by the real wage, is determined in the goods markets. The wage tax, which is implicitly determined by the balanced government budget $y(t-s)W = (1-y)B$, influences neither employment nor the level of gross wages because it affects the unions' outside option proportionally to net wages.

In what follows, we start with the analysis of the short run where the number of firms is fixed at $m = m_0$. The long run with free entry of new firms will be postponed until section 6.

3. The irrelevance of general employment subsidies

A general employment subsidy (GS) lowers a firm's labor costs and thereby allows the firm to charge a lower price for its product (see equation (5.6)). Since all subsidized firms reduce their prices, the resulting deflationary effect increases aggregate demand C and employment in all firms. Rising aggregate employment lifts the unions' outside option W^o, which triggers upward wage pressure. This counteracts the deflationary effect of the wage subsidy until price stability is restored. For the special case of a constant net replacement ratio, the whole subsidy is shifted towards higher gross wages (as can be seen from totally differentiating the PS-condition). According to the WS-condition, equilibrium employment does not change either. Since net-of-subsidy labor costs also remain constant, neither firms' profits nor aggregate workers' income change. Hence, in our general-equilibrium framework GS has neither allocative nor distributive effects as it leaves both employment and net wages unchanged. This result will serve as a benchmark and should thus be summarized as

Proposition 5.1: *For a constant net replacement ratio, a general employment subsidy has no effect on either employment or the distribution of income.*

This neutrality result confirms a more general insight from the tax incidence literature that (linear) tax instruments will affect employment only when the tax burden can be shifted away from labor income to other income sources.[10] This is ruled out here. Indeed, our result would also hold if unemployment benefits were tax-exempt, in which case a subsidy is just a swap between higher employment subsidies and higher wage taxes. Our assumption of a constant net replacement ratio is thus more restrictive than necessary but will be very helpful to analyze the potential employment effects of marginal employment subsidies in isolation.

[10] Pflüger (1997) discusses several tax reforms in a similar framework and finds employment effects only when the government can actually shift the tax burden to other income sources.

4. Marginal employment subsidies

4.1. Symmetric marginal employment subsidies

In the theoretical literature, a specific type of marginal employment subsidies, which we will call "symmetric marginal employment subsidies" (SMS), has been discussed as an alternative policy instrument to general wages subsidies (see Layard and Nickell 1980, Oswald 1984, Layard, Nickell and Jackman 1991). The idea is to subsidize extra jobs, but at the same time tax employment reductions. Formally, such a SMS is equivalent to a general subsidy combined with a tax on a firm's initial workforce. This becomes apparent from a single firm *i*'s profit function with a SMS (see Layard et al. 1991, p. 491):

$$\Pi_i = (P_i - W_i)N_i + sW_i(N_i - N_{i0}) = \big(P_i - (1-s)W_i\big)N_i - sW_iN_{i0}, \quad (5.11)$$

where N_{i0} is the firm's initial employment level. The first way of writing the profit function shows that the subsidized wage applies to all workers hired in excess of N_{i0}, while the second expression reveals that SMS is effectively a general subsidy on all workers combined with a lump-sum tax. Such a lump-sum tax does not affect the profit-maximizing behavior of a single firm so that the firms' price setting will be the same as under GS. Likewise, firm-level union wage setting will be unaffected by SMS. Thus, SMS and GS have the same effect on gross wages and no effect on employment.

The only difference lies in the lump-sum tax component which reduces the net fiscal expenditures for the SMS program. In general, the balanced-budget tax rate *t* will be:

$$tWy = b(1-t)W(1-y) + sW(y-y^*) \Leftrightarrow t = \frac{b(1-y) + s(y-y^*)}{y + b(1-y)}, \quad (5.12)$$

with $y^* = 0$ for GS and $y^* = y_0 = mN_{i0}$ for SMS. As can be seen from $dt/dy^* < 0$, the wage tax t is lower and the net wage is higher with SMS. Net profits are lowered by the lump-sum tax the firm has to pay. This leads to

Proposition 5.2: *For a constant net replacement ratio, a symmetric marginal employment subsidy has no effect on employment, but redistributes income from profit to labor income.*

While the result of Proposition 5.1 stems from our assumption of a constant net replacement ratio, the strong result of Proposition 5.2 also hinges on the assumption of a monopoly trade union. Indeed, our results are in contrast to Layard, Nickell and Jackman (1991) who find a positive employment effect of SMS in a Nash-bargaining framework. With Nash bargaining, the union is unable to raise the wage up to a level where employment is the same as without the subsidy. At this level, the total rent to be distributed would be the same as without the subsidy, but the union would receive a larger share at the cost of firm's profits. This worsens the union's bargaining position, because it would have more to lose if the firm threatened to stop negotiating, and wages have to fall. Distributional effects do not matter in the monopoly trade union framework though. The monopoly union sets the wage rate irrespectively of the (non-negative) profit level of the firm. Additional benefits for the firm thus do not enter its arbitrage calculus.[11]

Our restrictive assumptions that lead to Propositions 5.1 and 5.2 thus ensure that our benchmark scenario is most adverse to favorable employment effects arising from wage subsidies. If any type of wage subsidy has a positive employment effect under these assumptions, it will have a positive employment effect under assumptions more favorable to wage subsidies, *a fortiori*.

4.2. Asymmetric marginal employment subsidies

Real-life marginal wage subsidy programs are *asymmetric* in the sense that they subsidize extra jobs but do not punish shrinking firms. Examples are the New Jobs Tax Credit in the United States, the French *Prime d'incitation à la création d'emploi*, the Small Firms Employment Subsidy in Great Britain, and the *Lohnkostenzuschüsse* in Germany, all of which applied asymmetric marginal

[11] This result is an application of a general result, according to which comparative statics results for the monopoly union model and the Nash-bargaining model are different when changes affect the firm's revenue function (see Holmlund 1989).

subsidies (AMS).[12] To account for this asymmetry, firm *i*'s profit function has to be rewritten as

$$\Pi_i = (P_i - W_i)N_i + sW_i \max(N_i - N_{i0}, 0)\,. \tag{5.13}$$

Under AMS, a firm can pursue two different strategies. One strategy is to expand employment above its initial level, receive the subsidy for the extra jobs, and sell large amounts of output at low prices ("expansion"). The other strategy is to keep employment at or below its initial level, forgo the subsidy, and sell lower levels of output at higher prices than its competitors ("shrinking"). Depending on the wage set by the firm-level union, a firm chooses whichever strategy yields the larger profit. In the expansion strategy, the firm has to raise its employment beyond N_{i0}. Its marginal cost is then $(1-s)W_i$, and it maximizes its profit by setting $P_i = (1+\mu_f)(1-s)W_i$. If the firm decides to shrink, charging a markup on its marginal cost will yield a price $P_i = (1+\mu_f)W_i$. A firm will prefer expanding to shrinking if, for a given wage W_i,

$$\pi_i^+ \equiv \mu_f (1-s)W_i N_i(s) - sW_i \frac{y_0}{m} \geq \mu_f W_i N_i(0) \equiv \pi_i^-\,. \tag{5.14}$$

The left-hand side of (5.14) is a firm's profit from the expansion strategy, π_i^+, which consists of the profit the firm would make if the subsidy *s* was paid for all employees $N_i(s)$ (cf. equation (5.7)) minus the subsidy-exemption for all incumbent workers. The right-hand side denotes the firm's profit in the shrinking strategy, π_i^-.

Figure 5.1 illustrates how the firm's output decision depends on the wage rate set by its union. Without subsidies, the firm faces a wage rate W_{i0}. It maximizes its profit by selling y_{i0} units of output. When the marginal subsidy is introduced, and wages do not change, the firm's marginal cost schedule is at W_{i0} for output levels below y_{i0}, but at $(1-s)W_{i0}$ for output levels above this reference level. The firm maximizes its profit by selling the increased output y_{i0}^+ at a lower price. If the

[12] See Perloff and Wachter (1979) and Bishop and Haveman (1979) for the US, Layard (1979) for Great Britain, Kopits (1978) for France, and Schmidt (1979) for Germany.

firm's union raises its wage to e.g. $\widetilde{W}_i$, the marginal cost schedule shifts upwards, but retains its downward jump at y_{i0} to $(1-s)\widetilde{W}_i$ (dashed line). There are two local profit-maxima where marginal revenue *MR* equals marginal cost: the firm could either expand to y_i^+, or it could shrink to y_i^-. The firm chooses the output level that yields the higher profit. By switching from y_i^- to y_i^+, the firm would make infra-marginal losses on all units between y_i^- and y_{i0}, but would make profits on all units between y_{i0} and y_i^+. In Figure 5.1, the infra-marginal losses and profits are represented by the two shaded triangles. We have drawn $\widetilde{W}_i$ as the "indifference wage" at which the two areas have the same size. At $\widetilde{W}_i$, the firm is indifferent between shrinking and expanding, i.e. $\pi_i^+(\widetilde{W}_i) = \pi_i^-(\widetilde{W}_i)$. For lower wage levels, the firm would strictly prefer to expand. If the firm-level union raises the wage above this threshold, however, the firm would prefer to shrink.

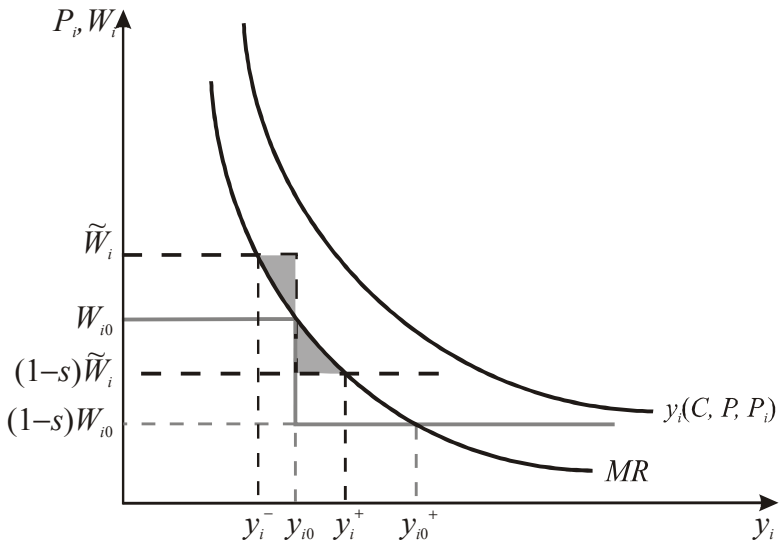

Figure 5.1: The firm's output decision for given demand

This discontinuity in the firm's output supply behavior constitutes the main difference between AMS and SMS. It provides firms with a credible threat that they shrink and cut jobs if unions set too high wages. This constrains unions in their ability to shift the subsidy into higher gross wages. If the loss in employment weighs larger than the benefit from higher wages, a union prefers to set the wage

just equal to the indifference wage $\widetilde{W}_i$ to extract the maximum rent from a still expanding firm.

To identify potential general equilibria with AMS, we first look at cases where all unions are unconstrained in their wage-setting and set wages according to their first-order condition (5.10) as the full markup on their (common) outside option. One can show that if all firms decide to shrink, any single firm would have an incentive to deviate and expand. Conversely, if all firms expand, any single firm would have an incentive to shrink. Hence, we can rule out equilibria in which trade unions set the firm-level wage according to the first-order condition (5.10). This should be summarized in a

Lemma 5.1: *There is no Nash equilibrium with AMS in which all unions set their wage as the full markup on their outside option.*

Proof: *See appendix.*

In any general equilibrium with AMS, at least some unions have to be constrained in their wage-setting by the indifference wage $\widetilde{W}_i$. At the indifference wage $\widetilde{W}_i$, a firm never shrinks in equilibrium because its union would always reduce its wage marginally to induce the firm to expand. This leaves us with only two potential equilibria:

- Case A: all unions set the indifference wage $\widetilde{W}_i$, and all firms choose to expand,
- Case B: some unions set the indifference wage $\widetilde{W}_i$ so that their firms expand, while other unions choose a higher wage and let their firms shrink.

4.2.1. Case A: all unions prefer expansion, and all firms expand

If all firms try to expand, they will all set their price as a markup over subsidized marginal cost. The PS-condition remains unaffected. Individual unions, however, prefer to deviate from their first-order condition (markup wage-setting) because unconstrained wage-setting would cause their firms to shrink. Unions will set the

highest possible wage $\widetilde{W}_i$ that just ensures that firms expand (cf. Figure 5.1). If all unions behave this way, the new wage-setting equation is given by $W = \widetilde{W}$, where $\widetilde{W}$ is determined by condition (5.14), holding with equality,

$$\pi_i^+(\widetilde{W}) = \pi_i^-(\widetilde{W}). \tag{5.15}$$

Inserting (5.PS) into (5.15), and using $C = y$ since all firms set the same prices, gives the equilibrium employment rate:

$$y = \frac{sy_0}{\mu_f\left[(1-s)-(1-s)^{\sigma}\right]}. \tag{5.16}$$

Inspection of (5.16) shows that $y > y_0$ and $dy/ds > 0$ for all $s \in]0,1[$, which leads us to

Proposition 5.3: *An asymmetric marginal employment subsidy has a positive employment effect if all unions prefer that their firms expand.*

Proof: *See appendix.*

AMS restrict the unions' ability to shift the whole subsidy into higher gross wages because their firms would then prefer to shrink. As long as unions value the potential loss of jobs more than the potential wage gains from shrinking, they will be better off with the indifference wage $\widetilde{W}_i$. Part of AMS – contrary to SMS – then leads to a reduction in prices, and the resulting deflationary pressure raises output and employment.

4.2.2. Case B: some firms expand and other firms shrink

Equation (5.16) shows that if *s* becomes sufficiently large, aggregate employment exceeds one. At full employment, however, each firm-level union has an incentive to raise the wage and let its firm shrink because any worker whom the firm lays off could easily find a job at the same wage rate elsewhere but those who remain would be strictly better off. Therefore, Case A cannot be a feasible equilibrium for all values of *s*.

As long as there is some unemployment, any individual union has to compare its utility from expansion (at a wage $\widetilde{W}_i$) with the utility from shrinking (at a wage $(1+\mu_u)W^o > \widetilde{W}_i$). Figure 5.2 illustrates the two different strategies.

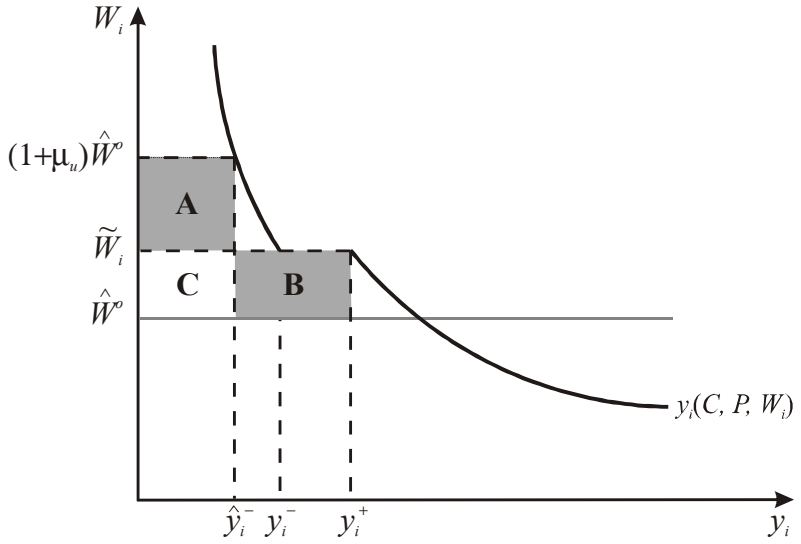

Figure 5.2: The union's indifference between shrinking and expanding

As described above, the asymmetry of the AMS schedule causes a jump in a firm's labor demand function at the wage $\widetilde{W}_i$. When the union sets the wage to $\widetilde{W}_i$, the firm expands employment to y_i^+. If the union sets the wage according to (5.10), the firm reduces the employment level to $\hat{y}_i^-$. The union compares the rents gained by its members over their outside option under both strategies. For the low-wage strategy, the rent is given by the areas A + C. For the high-wage strategy, the rent is given by the two rectangles B + C. If the value of the outside option is relatively small, i.e. $W^o < \hat{W}^o$, the union will prefer the low-wage strategy, and *vice versa* for attractive outside options $W^o > \hat{W}^o$. At $\hat{W}^o$, the union is indifferent between both strategies. Figure 5.2 depicts this critical level of the outside option where A and B are of the same size.

Increasing the subsidy causes expanding firms to become larger and employ more workers. This raises the outside option above $\hat{W}^o$, such that some unions would find it beneficial to raise their wages above $\widetilde{W}$ and let their firms shrink. This is

the *displacement effect* of AMS. Some firms expand employment, while other firms shrink and lay off a substantial part of their workforce. Since shrinking firms set higher prices, this displacement causes inflationary pressures that counteract the subsidy's deflationary effect. The aggregate employment effect becomes generally ambiguous and depends on whether the inflationary effect from rising prices in shrinking firms is large enough to outweigh the deflationary effect from the subsidy.

We now turn to the formal analysis of Case B. In any equilibrium with displacement, some firm-union-pairs expand while some other (of otherwise identical) firm-union-pairs shrink. This requires that all unions are indifferent between the two strategies, which will be the case if the following condition holds:

$$\Omega^{+} \equiv \left[(1-t)\frac{\widetilde{W}_i}{P} - \frac{W^o}{P} \right]^{\phi} y_i^{+} = \left[\mu_u \frac{W^o}{P} \right]^{\phi} y_i^{-} \equiv \Omega^{-}, \tag{5.17}$$

where

$$y_i^{+} = \frac{C}{m}\left(\frac{P_i^{+}}{P} \right)^{-\sigma} \text{ with } P_i^{+} = (1+\mu_f)(1-s)\widetilde{W}_i$$

and

$$y_i^{-} = \frac{C}{m}\left(\frac{P_i^{-}}{P} \right)^{-\sigma} \text{ with } P_i^{-} = (1+\mu_f)(1+\mu_u)\frac{W^o}{(1-t)}$$

are the employment levels in expanding firms and in shrinking firms, respectively. The left-hand side of equation (5.17) is a union's utility $\Omega^{+} = \Omega(\widetilde{W}_i)$ from setting the indifference wage $\widetilde{W}_i$ as determined by (5.15) that induces the firm just to expand. The right-hand side is the union's utility $\Omega^{-} = \Omega\left((1+\mu_u)W^o(1-t)^{-1}\right)$ from setting the full markup according to (5.10), in which case the firm will shrink.

The m incumbent firms are divided in m^+ expanding and $m^- = m - m^+$ shrinking firms. In equilibrium with $\widetilde{W}_i = \widetilde{W} \ \forall i$, the economy-wide average wage $\overline{W}$ is then determined by weighting firms' wages with their employment share:

$$\overline{W} = \frac{m^+ y_i^+}{y}\widetilde{W} + \frac{m^- y_i^-}{y}\left(\frac{(1+\mu_u)}{(1-t)}W^o\right). \tag{5.18}$$

The aggregate employment level is obtained by

$$y = m^+ y_i^+ + m^- y_i^- . \tag{5.19}$$

The outside option is then given by

$$W^o = [y + b(1-y)](1-t)\overline{W} . \tag{5.20}$$

The last remaining piece necessary to determine the general equilibrium is the average price level that can be determined by inserting markup prices into equation (5.4) and dividing by P:

$$\frac{m^+}{m}\left(\frac{P_i^+}{P}\right)^{1-\sigma} + \frac{m-m^+}{m}\left(\frac{P_i^-}{P}\right)^{1-\sigma} = 1. \tag{5.21}$$

The six equations (5.15) and (5.17)-(5.21) determine the equilibrium values of y, C, $\overline{W}/P$, m^+, $\widetilde{W}/P$ and W^o/P. This system of equations does not have a closed-form solution, but it is possible to analyze the employment effects when the subsidy rate is raised to very high levels.

Proposition 5.4: *If an asymmetric marginal employment subsidy approaches 100 percent, the economy reaches full employment whereas welfare falls to zero.*

Proof: *See appendix.*

Increasing the subsidy rate induces some firm-union pairs to shrink. These firms set higher prices, which cause inflationary pressures counteracting the subsidy's deflationary effect. If the subsidy rate is raised to sufficiently high levels, however, Proposition 5.4 shows that the subsidy's deflationary effect dominates

its inflationary counter-effect. The power of AMS to impose a wage cap on unions is thus sufficiently strong to allow the economy to run almost at full employment without triggering inflation.

Full employment, however, comes at huge welfare costs. While in Case A, welfare and employment go hand in hand (they are actually equivalent due to the symmetric structure of the model), this is no longer true when firms split up into small, high-price firms and large, low-price firms. At a given level of aggregate employment, this reduces welfare compared to a situation in which all firms behave identically. A higher subsidy rate will induce more firm-union pairs to shrink, while the remaining firm-union pairs become larger. Consumers are left with less variety in their shopping baskets. For the limiting case $s \to 1$, Proposition 5.4 indicates that the number of expanding firms approaches zero, while the few expanding firms employ almost the complete aggregate workforce $(m^+ \to 0,\ m^+ y_i^+ \to y)$. Despite larger output levels of the remaining good(s), variety-loving consumers are clearly worse off by this extreme reduction in the available range of (affordable) products. Hence, an AMS sacrifices the consumers' desire for variety for gains in aggregate employment.

Proposition 5.4 indicates the existence of Case B. The question remains whether Case A always exists so that introducing AMS at a very small rate would always increase both employment and welfare. If there had not been any employment gains compared to the situation without subsidies, the outside option would not have improved and there would not be any incentive to shrink. Therefore, starting at $s = 0$ and marginally increasing the subsidy rate will always lead to a Case A – equilibrium before switching to Case B. Proposition 5.5 summarizes.

Proposition 5.5: *The marginal introduction of an asymmetric marginal employment subsidy always raises both employment and welfare.*

Proof: *See appendix.*

5. Numerical simulation

Since no closed-form solution of the equilibrium in Case B can be obtained – except for the limiting case of $s \to 1$ – we apply a numerical simulation to analyze the effects of AMS for "intermediate" subsidy rates. How strongly welfare is linked to aggregate employment in Case B depends on the consumers' taste for variety, which is represented by the elasticity of substitution σ. To account for its influence, we consider four different scenarios:

- a high desire for variety, which implies a low substitutability ($\sigma = 1.5$);
- two intermediate scenarios with $\sigma = 2$ and $\sigma = 3$;
- a low desire for variety, which is represented by a high substitutability ($\sigma = 10$).

In all scenarios, we set the net replacement rate to $b = 0.5$ (which is in line with stylized facts for the OECD; see Carone et al. 2004, Table 8). The union's weight on wages ϕ is adjusted to ensure an unemployment rate of ten percent in the initial situation without subsidies.[13]

Figure 5.3 plots the employment, welfare, and distributional effects of AMS for all four scenarios. There is always a range of moderate subsidy rates for which Case A exists. As was to be expected, higher values of ϕ reduce the maximum attainable employment level in Case A. In the first scenario with $\phi = 0.075$, for example, unions value employment much more than wages, such that an AMS with $s = 0.13$ can increase aggregate employment up to 99.7 percent before unions start to raise wages and let their firms shrink. In the fourth scenario, on the other hand, unions value wages much more ($\phi = 0.5$). The transition from Case A to Case B occurs at a subsidy rate of $s = 0.02$ and an aggregate employment rate of 95.3 percent. The critical subsidy rate, above which Case B sets in, falls as σ rises. Individual firm-union-pairs react more strongly to a given subsidy rate if they face more elastic product demand. This produces stronger employment effects, and the switch to Case B occurs at lower subsidy rates.

[13] Empirical estimates of ϕ are typically in the range of 0.2 to 0.4, but can reach values as high as 0.88 for some unions (see Cahuc and Zylberberg 2004, 379, for an overview).

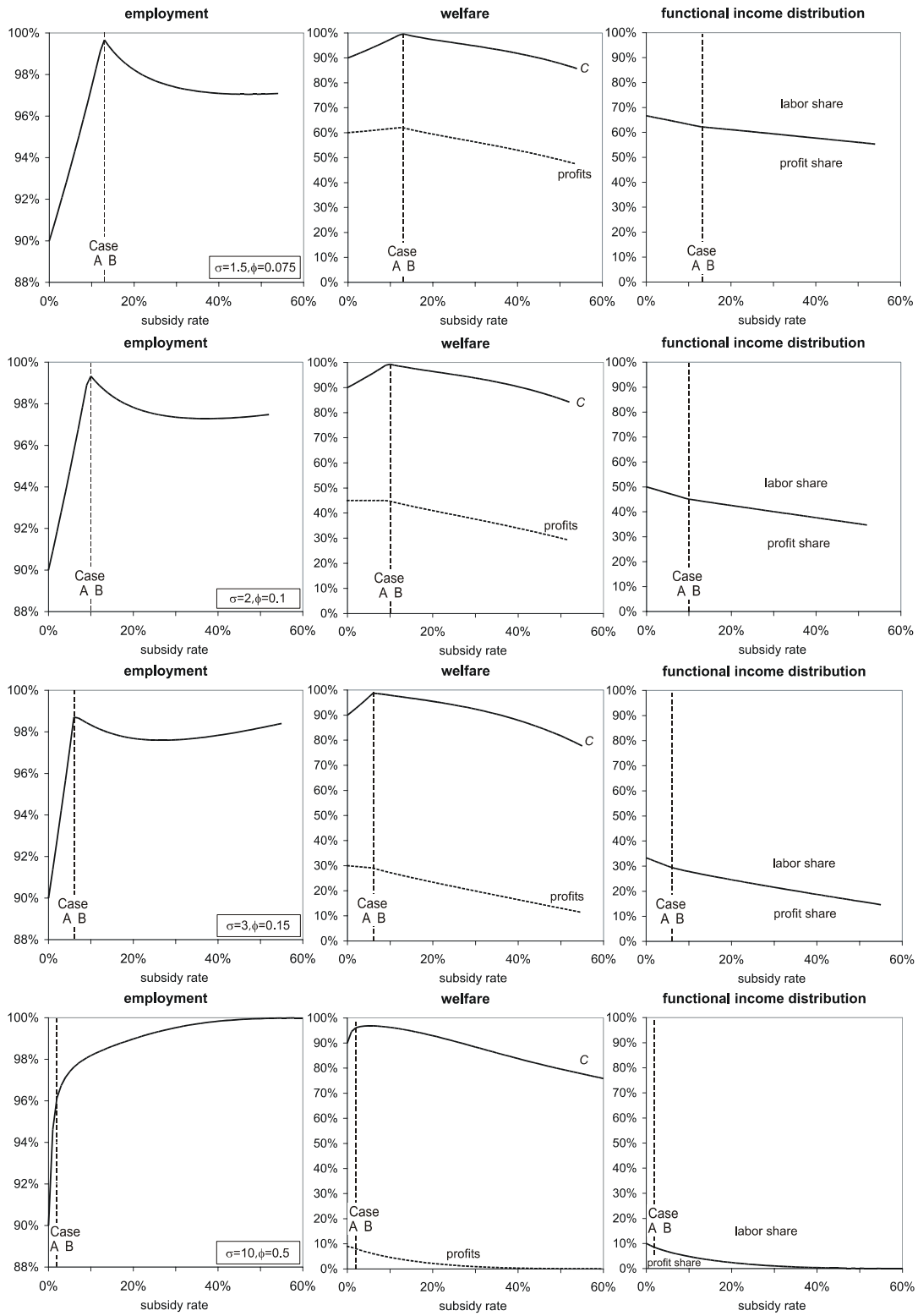

Figure 5.3: Numerical simulations

Our simulations suggest that the employment and welfare effects in Case B are not monotonous. Aggregate employment can fall immediately after switching to Case B. This non-monotonous employment effect has its roots in the non-monotonous composition of the workforce. At the transition between Cases A and B, the share of workers employed in expanding firms $m^+ y_i^+ / y$ has to be equal to one. When the first firm decides to shrink, this share has to fall. Workers in shrinking firms earn a higher wage than workers in expanding firms, so average wages increase and wage pressure rises. This inflationary effect counteracts the subsidy's deflationary effect and causes employment to fall. Although the overall effect is ambiguous for some interval in Case B, we know from Proposition 5.4 that $m^+ y_i^+ / y$ converges to one for $s \to 1$. Hence, the employment share of expanding firms has to increase eventually, which lowers the average wage, reduces inflationary wage pressure, and increases employment.

In comparison, the four scenarios show that the negative effect on employment lessens as σ rises. A higher price elasticity of product demand means that shrinking firms become smaller. This lowers the share of workers employed in shrinking firms and thereby reduces their impact on aggregate wage pressure. In the fourth scenario with $\sigma = 10$, the upward wage pressure is too weak to overcompensate the subsidy's deflationary effect and employment rises monotonically in *s*.

If employment falls, welfare must fall as well. Less employed workers produce less output, and diverging prices between expanding and shrinking firms make it more difficult for consumers to satisfy their taste for variety. This happens in Case B of the first three scenarios. In the fourth scenario, however, aggregate employment rises monotonically in Case B. Moreover, consumers are able to substitute the various goods relatively well, such that variety is less important. Our simulations show that this suffices to raise welfare for a range of subsidy rates even in Case B. While the transition from Case A to Case B takes place at a subsidy rate of 1.2 percent, the welfare index *C* is maximized at a higher subsidy rate of 5.3 percent.

AMS has strong distributional effects. Even if unions cannot shift the subsidy fully into higher wages, they are able to lift their members' net wages. Firms have to pay these higher wages for all their employees, but receive the subsidy only for extra workers. This lowers the share of profits in the functional income distribution in all four scenarios. Since total production might increase, however, this does not necessarily mean that absolute profits have to fall. In Case A, profits rise if $\sigma < 2$, stay constant if $\sigma = 2$, and fall if $\sigma > 2$. In Case B, profits are decreasing in *s* in all scenarios.

6. The long run

In the long run, firms may freely enter and exit the market. If, by developing a new variety and selling it on the market, a new firm could earn enough profits to cover its start-up costs *F*, it enters. If not, it stays out. Incumbent firms stay in the market as long as their short-run profits are positive because their start-up costs are sunk.[14]

The treatment of new firms is crucial for the long-run efficacy of marginal employment subsidies. Since a new firm's reference employment level is zero, all its workers count as extra jobs that, in principle, would be eligible for AMS. This procedure is problematic, however, because any incumbent firm would try to take advantage of it by setting up a new firm to which it would relocate all its business activities and its workforce. It could then enjoy full subsidization even without creating a single new job. If all incumbent firms converted to new firms, all workers in the economy would be subsidized. This would make AMS equivalent to a general subsidy and eliminate all positive employment effects.

Alternatively, the government could exclude new firms that are founded after the reference date from subsidization. New firms would make less profit than

[14] For a discussion of sunk cost see e.g. Martin (1993, 304) who also lays out why sunk cost are not just a short-run phenomenon, but remain relevant in the long run.

incumbent firms, which prevents the conversion of incumbent into new firms.[15] Keeping incumbent firms in the market is essential for a positive long-run employment effect because it is the asymmetry of the subsidy scheme that tames the trade unions. The long-run equilibrium then depends on whether new firms will enter.

Incumbent firms' profits fall in s if $\sigma > 2$ (see proof of Proposition 5.6 in the appendix). New firms always make less profit than incumbent firms because they are not subsidized. Hence, new firms strictly prefer not to enter the market. For $\sigma = 2$, incumbent firms' profits stay constant in s, such that they earn just enough to cover start-up costs. New firms make less profit and prefer to stay out. Only for $\sigma < 2$, where incumbent firms' profits are increasing in s, is it possible that new firms earn enough to cover their start-up costs. Therefore, there has to be a critical level $\bar{\sigma} \in]1,2[$ at which new firms are, in equilibrium, just indifferent between entering the market and staying out. Only if σ is less than this critical level will new firms enter. Otherwise, the long-run effects of AMS will be exactly the same as in the short run. This result is worth being stated as

Proposition 5.6: *An asymmetric marginal employment subsidy yields the same employment and welfare effects in the long run as in the short run if* $\sigma \geq \bar{\sigma}$ *with* $\bar{\sigma} < 2$*, in which case new firms prefer not to enter the market.*

Proof: *See appendix.*

Only if $\sigma < \bar{\sigma} < 2$, new firms earn enough profits to cover their start-up costs and enter the market. The resulting equilibrium can then be described by a system of equations similar to that of Case B because new entrants always behave like (unsubsidized) shrinking firms. In fact, equations (5.15) and (5.18)-(5.21) have to

[15] A second alternative would be to grant higher marginal employment subsidies to incumbent firms until the average employment subsidy becomes the same for new and incumbent firms (see Knabe, Schöb and Weimann 2006b for details).

be fulfilled unchanged. The total number of firms in the market, *m*, is determined by the condition that new firms make just enough profits to cover their start-up cost:

$$\mu_f(1+\mu_u)\frac{W^o/P}{1-t}y_i^- = \frac{F}{P} = \frac{\mu_f}{1+\mu_f}\frac{y_0}{m_0}. \tag{5.22}$$

The left-hand side of (5.22) is a new firm's profit. The right-hand side is the level of start-up costs, which is given by a firm's profit in the initial equilibrium with $s = 0$, i.e. $F = \mu_f W y m_0^{-1}$. Equation (5.22) can be simplified to

$$\left[(1+\mu_f)(1+\mu_u)\frac{W^o/P}{(1-t)}\right]^{1-\sigma}\frac{C}{y_0}\frac{m_0}{m} = 1. \tag{5.23}$$

Again, all *m* firms are divided into m^+ expanding and m^- shrinking firms. As in the short run, in equilibrium unions are either indifferent between expanding and shrinking or strictly prefer expansion. The number of expanding firms is restricted to $m^+ \le m_0$ because only incumbent firms receive a subsidy and can pursue the expansion strategy. Similarly to (5.17), we can write this condition as

$$\Omega^+ \ge \Omega^- \text{ and } m^+ \le m_0, \tag{5.24}$$

where at least one of the two expressions has to hold with equality. Hence, the long-run equilibrium if new firms enter is given by the system of equations (5.15), (5.18)-(5.21), (5.23), and (5.24). The long-run employment and welfare effects can then be described as

Proposition 5.7: *If $\sigma < \bar{\sigma}$, new firms enter. If all incumbent unions are indifferent between the expanding and shrinking strategies (as in the short-run Case B), AMS yield the same employment effect in the long run as in the short run. If all incumbent unions prefer the expanding strategy, long-run employment is less than short-run employment but larger than in the initial equilibrium. AMS always increase welfare in the long run.*

Proof: *See appendix.*

The first part of the proposition describes the situation where the entry of new firms raises the number of shrinking and expanding firms proportionally. In this case, the relative division of firms is unchanged, and employment is unaffected by the entry of new firms. In its second part, Proposition 5.7 refers to the case where the entry of new firms increases the share of shrinking firms in the economy. Since shrinking firms set higher prices than expanding firms, this releases inflationary pressure that reduces employment compared to the short run. This inflationary counter-effect, however, is not sufficient to outweigh the positive effects of AMS altogether. Hence, AMS will increase employment compared to the initial equilibrium even in the long-run. Since consumers love variety, an increase in the number of firms always increases welfare for a given level of aggregate production. We have shown that AMS always increase aggregate employment above its initial level, from which follows that AMS always increase welfare also in the long run.

We conduct a numerical simulation to illustrate the difference between the short-run and long-run effects of AMS (Figure 5.4). For $\sigma \geq \overline{\sigma}$, short-run and long-run effects coincide, so we can restrict our attention to the case of $\sigma < \overline{\sigma}$. For an initial unemployment rate of 10 percent and $b = 0.5$, the critical value $\overline{\sigma}$ is around 1.58. In Figure 5.4, we choose a very small value of $\sigma = 1.3$ to make the difference between the short run (solid line) and the long run (dashed line) visible. The left and middle figures show the results of Proposition 5.7. In Section 1 (for subsidy rates between 0 and 15.5 percent), new firms enter but unions in incumbent firms prefer to expand. In this case, the share of shrinking firms increases, and the resulting inflationary pressure reduces employment. Welfare increases more in the long run than in the short run because new firms enter and increase the variety of available goods. At $s = 0.155$, welfare increases from 0.9 to 0.995 (increase by 10.5 percent) in the short run, but rises to 1.126 (increase by 25.1 percent) in the long run because of an increase in firms (varieties) by 3.8

percent. In Section 2 (subsidy rates between 15.5 and 24 percent), new firms enter but incumbent unions remain indifferent between expanding and shrinking. As Proposition 5.7 shows, the entry of new firms does not affect aggregate employment compared to the short run. Welfare, however, increases due to the entry of new firms. In Section 3, new firms do not want to enter, and the long run equilibrium is the same as the short-run equilibrium.

Figure 5.4 shows that the entry of new firms might harm aggregate employment, although the quantitative effect is rather small. The welfare of variety-loving consumers, however, increases substantially.

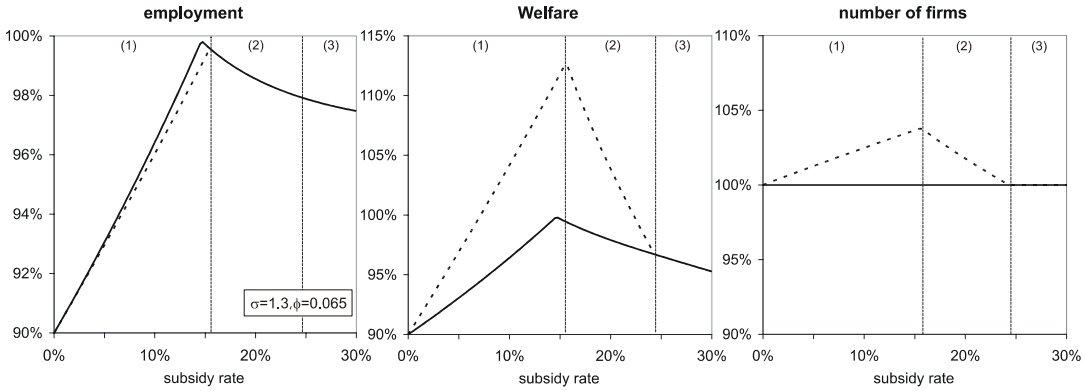

Figure 5.4: The short run (solid line) and the long run (dashed line)

7. Conclusion

Asymmetric marginal employment subsidies that support extra jobs without punishing lay-offs are superior to both general employment subsidies and symmetric marginal employment subsidies. The driving force behind this result is the fact that the asymmetry of the subsidy scheme makes it less costly for firms to lay off a substantial fraction of their workforce when trade unions raise wages too aggressively. The credible threat of the firm to shrink tames the unions, causes wage moderation and raises aggregate employment and welfare. For moderate

subsidy rates, all unions prefer to restrain their wage claims and let their firms expand. In this case, raising the subsidy rate improves both employment and welfare. At high subsidy rates, labor market conditions improve so much that some unions start to enforce higher wages and let their firms shrink. This displacement of firms might have an ambiguous effect on employment but definitely lowers welfare as it distorts the households' consumption decisions. This shows that asymmetric marginal wage subsidies are an effective means to fight unemployment and to increase welfare. Nevertheless, they should be applied with caution.

We have discussed several features that prevent the exploitation of the subsidy scheme by incumbent firms. One practical problem remains. Even though incumbent firms may not simply convert themselves into new firms, they could outsource their workforce to another incumbent firm. In our model, the insourcing firm would then produce two varieties. Net employment would not change but the 'transferred' workforce would be eligible for AMS. In the extreme case, all incumbent firms merge into one single firm and (almost) the complete workforce would be subsidized. AMS would degenerate to a general subsidy, and aggregate employment and welfare would return to their initial, non-subsidized levels. Such outsourcing activities, however, could be reduced by setting a threshold above which employment expansions in incumbent firms are not subsidized anymore. Such restrictions have already been implemented in real-life marginal subsidy programs. For example, the New Jobs Tax Credit in the United States restricted the maximum subsidy to the smaller of 25 percent of a firm's total wage bill or 100,000 US-$ per firm and year (Perloff and Wachter, 1979). Another option would be to restrict the subsidy to a certain number relative to the incumbent workforce. For example, one could introduce a ceiling at twice the reference employment level (see Knabe, Schöb and Weimann 2006a,b). Such restrictions

can prevent misuse of the subsidy and thereby preserve the asymmetry of the subsidy scheme. One should keep in mind, however, that even if these precautions fail, and firms manage to circumvent the marginal subsidy and get their entire workforce subsidized, the resulting long-run equilibrium would be the same as the one without any subsidy. AMS would then still be a welfare-enhancing policy due to its favorable short-run effects.

Our analysis clearly shows that institutions, and their correct implementation in economic models, matter. The very fact that a small modification in the modeling of marginal subsidy schemes leads to substantially different results emphasizes the importance of institutional details for economic analysis, and in particular for the study of tax incidence. Besides contributing to the literature on the incidence of employment subsidies, this chapter therefore also fits into the growing literature that reintroduces institutions in economic theory.

Appendix

Proof of Lemma 5.1. If no firm wants to expand and receive the subsidy, and their unions set their wages accordingly, the resulting equilibrium is the initial equilibrium without any subsidy. The aggregate price setting equation PS is then given by $W/P = (1+\mu_f)^{-1}$, and the wage setting equation is given $y = y_0$. Any single firm would strictly prefer shrinking if

$$\mu_f (1-s) W_i \frac{C}{m}\left[(1+\mu_f)(1-s)\frac{W_i}{P}\right]^{-\sigma} - sW_i \frac{y_0}{m} < \mu_f W_i \frac{C}{m}\left[(1+\mu_f)\frac{W_i}{P}\right]^{-\sigma}. \quad (5.A.1)$$

By inserting $W/P = (1+\mu_f)^{-1}$, the wage setting equation, and using the symmetry condition $C = y$ for the quantity index,[16] the condition for a preference to shrink (5.A.1) simplifies to

[16] If all firms are identical and set the same price, the quantity index in (5.4) simplifies to $C = mC_i = y$.

$$\mu_f\left[(1-s)^{1-\sigma}-1\right]-s<0\,. \tag{5.A.2}$$

The left-hand-side of (5.A.2) is zero for $s=0$. For all $s\in\,]0,1]$, however, it is increasing in *s*:

$$\frac{\partial}{\partial s}\left[\mu_f\left[(1-s)^{1-\sigma}-1\right]-s\right]=(1-s)^{-\sigma}-1\geq 0,\ \ \forall s\in[0,1], \tag{5.A.3}$$

i.e. (5.A.1) cannot hold. If all other firm-union-pairs shrink, any single firm would prefer to expand. There is no Nash equilibrium in which all firms strictly prefer to shrink.

If all firms pursued an expansion strategy, and their unions expect them to do so, the resulting equilibrium is the same as with a SMS: the aggregate price setting equation (5.PS) and the aggregate wage setting equation (5.WS) apply. Any single firm will strictly prefer expansion if condition (5.17) holds as a strict inequality

$$\mu_f(1-s)W_i\frac{C}{m}\left[(1+\mu_f)(1-s)\frac{W_i}{P}\right]^{-\sigma}-sW_i\frac{y_0}{m}>\mu_f W_i\frac{C}{m}\left[(1+\mu_f)\frac{W_i}{P}\right]^{-\sigma}\,. \tag{5.A.4}$$

As all other firms expand, we can substitute in the (5.PS) condition on both sides. By further inserting $y=1-\left[\mu_u/\left((1+\mu_u)(1-b)\right)\right]=y_0$, derived from (5.WS), and using again the symmetry condition $C=y$ for the quantity index, the condition (5.A.4) for a single firm to expand simplifies to

$$\mu_f\left[(1-s)-(1-s)^{\sigma}\right]-s>0\,. \tag{5.A.5}$$

At $s=0$, the left-hand side of (5.A.2) is zero. For all $s\in\,]0,1]$, condition (5.A.2) becomes smaller in *s* (using $\mu_f=(\sigma-1)^{-1}$):

$$\frac{\partial}{\partial s}\left[\mu_f\left[(1-s)-(1-s)^{\sigma}\right]-s\right]=(1+\mu_f)\left[(1-s)^{\sigma-1}-1\right]\leq 0,\ \ \forall s\in[0,1]. \tag{5.A.6}$$

Condition (5.A.4) cannot hold. If all other firm-union-pairs expanded, an individual firm would prefer to shrink. There is no Nash equilibrium in which all firms strictly prefer to expand. ■

Proof of Proposition 5.3. With $s = 0$, using L'Hôpital's rule, we have for condition (5.16):

$$\lim_{\substack{s\to 0\\ s>0}} y = \lim_{\substack{s\to 0\\ s>0}} \frac{y_0}{\underbrace{\mu_f}_{=1/(\sigma-1)} \left[\sigma(1-s)^{\sigma-1} - 1\right]} = y_0 . \tag{5.A.7}$$

For marginal changes in *s*, we find

$$\frac{\partial y}{\partial s} = \frac{y_0 \mu_f \left[(1-s) - (1-s)^{\sigma}\right] - s y_0 \mu_f \left[\sigma(1-s)^{\sigma-1} - 1\right]}{{\mu_f}^2 \left[(1-s) - (1-s)^{\sigma}\right]^2} \tag{5.A.8}$$

Let the numerator of (5.A.8) be denoted by *A*. Since we have $A\big|_{s=0} = 0$ and $\partial A/\partial s = y_0 \mu_f s\sigma(\sigma-1)(1-s)^{\sigma-2} > 0 \forall s \in]0,1[$, equilibrium employment is increasing in *s*. ■

Proof of Proposition 5.4. We discussed in the main text that, for a given level of *y*, *C* is maximized if all varieties are consumed at the same level. This is the case if all goods have the same prices. In this case, the quantity index simplifies to $C = y$. Since aggregate employment is restricted to [0,1], it is clear that we must also have $C \le 1$. Rewriting (5.15), inserting (5.7) and (5.14), yields

$$\frac{\widetilde{W}}{P} = \left(\frac{s y_0}{\mu_f (1+\mu_f)^{-\sigma} C\left[(1-s)^{1-\sigma} - 1\right]} \right)^{-1/\sigma}, \tag{5.A.9}$$

from which, for $C \le 1$, we have

$$\lim_{s\to 1}\left[(1-s)\frac{\widetilde{W}}{P}\right] = \lim_{s\to 1}\left[\left(\frac{s y_0}{\mu_f (1+\mu_f)^{-\sigma} C\left[(1-s) - (1-s)^{\sigma}\right]} \right)^{-1/\sigma} \right] = 0 . \tag{5.A.10}$$

Inserting in (5.17) with the explicit forms of P_i^+ and P_i^- yields

$$1 = \lim_{s\to 1}\left[\frac{m^+}{m}\underbrace{\left((1+\mu_f)(1-s)\frac{\widetilde{W}}{P}\right)^{1-\sigma}}_{\to\infty}\right] + \lim_{s\to 1}\left[\frac{m-m^+}{m}\left(\frac{(1+\mu_f)(1+\mu_u)}{(1-t)}\frac{W^o}{P}\right)^{1-\sigma}\right], \quad (5.A.11)$$

which implies $\lim_{s\to 1} m^+ = 0$. Moreover, the second term on the right-hand-side of (5.A.11) must not be infinitely large. This requires that the term in round brackets must not be zero, i.e.

$$\lim_{s\to 1}\frac{W^o/P}{1-t} > 0. \quad (5.A.12)$$

From (5.17), we know that

$$\lim_{s\to 1}\left\{\left[\frac{\widetilde{W}}{P}-\frac{W^o/P}{(1-t)}\right]^{\phi}\underbrace{\left((1+\mu_f)(1-s)\frac{\widetilde{W}}{P}\right)^{-\sigma}}_{\to\infty}\right\} = \lim_{s\to 1}\left\{(\mu_u)^{\phi}(1+\mu_f)^{-\sigma}(1+\mu_u)^{-\sigma}\left[\frac{W^o/P}{(1-t)}\right]^{\phi-\sigma}\right\}. \quad (5.A.13)$$

(5.A.12) then requires the right-hand-side of (5.A.13) to be finite. The left-hand-side of (5.A.13) can only be finite if

$$\lim_{s\to 1}\frac{\widetilde{W}}{P} = \lim_{s\to 1}\frac{W^o/P}{(1-t)}. \quad (5.A.14)$$

By combining (5.18) and (5.20), we obtain

$$\frac{W^o/P}{(1-t)} = \frac{m^+ y^+\frac{[y+b(1-y)]}{y}}{1-(1+\mu_u)m^- y^-\frac{[y+b(1-y)]}{y}}\frac{\widetilde{W}}{P}. \quad (5.A.15)$$

For $s \to 1$, using (5.A.14), we obtain after some rearranging

$$1 = \left[\frac{m^+ y^+}{y} + (1+\mu_u)\left(1 - \frac{m^+ y^+}{y}\right) \right] \left[(1-b)y + b \right]. \qquad (5.A.16)$$

$\lim_{s\to 1} y = 0$ cannot constitute an equilibrium. By inserting $y = 0$ into the second bracketed term in (5.A.16), this condition reduces to $1-(1+\mu_u)b = -\mu_u b \left(m^+ y^+ \right) \Big/ y \le 0$. Substituting into the (5.WS) condition shows that this requires $y_0 \le 0$, which is incompatible with a positive employment rate in the initial equilibrium.

Other solutions of (5.A.16) can be found for $0 < y < 1, m^+ y^+ < y$. These solutions cannot describe a general equilibrium for $s \to 1$ either. Multiplying both sides of (5.21) by *C* gives

$$C = m^+ \frac{C}{m}\left((1+\mu_f)(1-s)\frac{\widetilde{W}}{P} \right)^{1-\sigma} + (m - m^+)\frac{C}{m}\left(\frac{(1+\mu_f)(1+\mu_u)}{(1-t)}\frac{W^o}{P} \right)^{1-\sigma} \qquad (5.A.17)$$

$$= m^+ y^+ \underbrace{\left((1+\mu_f)(1-s)\frac{\widetilde{W}}{P} \right)}_{\to 0} + \underbrace{m^- y^-}_{>0} \underbrace{\left(\frac{(1+\mu_f)(1+\mu_u)}{(1-t)}\frac{W^o}{P} \right)}_{>0}$$

Equation (5.A.17) requires $\lim_{s\to 1} C > 0$., which would give $\lim_{s\to 1} \widetilde{W}/P \to \infty$ (from 5.A.9) and $\lim_{s\to 1} (W^o/P)/(1-t) \to \infty$ (from 5.A.14). From (5.A.17), it then follows that $\lim_{s\to 1} C \to \infty$, which, as we stated in the beginning of this proof, is impossible.

The only valid solution of (5.A.16) left is $m^+ y^+ = y = 1$. For the case $\lim_{s\to 1} (W^o/P)/(1-t) = const.$, we use the second line of (5.A.17) to obtain

$$\lim_{s\to 1} C = \lim_{s\to 1} \left[m^+ y^+ \underbrace{\left((1+\mu_f)(1-s)\frac{\widetilde{W}}{P} \right)}_{\to 0} + \underbrace{m^- y^-}_{\to 0} \underbrace{\left(\frac{(1+\mu_f)(1+\mu_u)}{(1-t)}\frac{W^o}{P} \right)}_{>0} \right] = 0 \,. (5.A.18)$$

For $\lim_{s\to 1}(W^o/P)/(1-t)\to\infty$, we make use of the first line of (5.A.17):

$$\lim_{s\to 1} C = \lim_{s\to 1}\left[\underbrace{m^+ y^+\left((1+\mu_f)(1-s)\frac{\widetilde{W}}{P}\right)}_{\to 0} + \left(\underbrace{\frac{m^-}{m}}_{\to 1}\underbrace{\left(\frac{(1+\mu_f)(1+\mu_u)}{(1-t)}\frac{W^o}{P}\right)^{1-\sigma}}_{\to 0}\right)C\right]. \quad (5.A.19)$$

Equation (5.A.19) is only fulfilled if $\lim_{s\to 1} C = 0$. This concludes the proof. ■

Proof of Proposition 5.5. A Case A-equilibrium exists if all unions prefer to expand after a marginal introduction of the subsidy. This requires (cf. condition (5.17)):

$$\left[\frac{\widetilde{W}}{P}-\frac{W^o}{(1-t)P}\right]^{\phi}\left((1+\mu_f)(1-s)\frac{\widetilde{W}}{P}\right)^{-\sigma} > \left[\mu_u\frac{W^o}{(1-t)P}\right]^{\phi}\left((1+\mu_f)(1+\mu_u)\frac{W^o}{(1-t)P}\right)^{-\sigma}. \quad (5.A.20)$$

By inserting the equilibrium outcomes $\frac{1}{(1-t)}\frac{W^o}{P} = [y+b(1-y)]\frac{\widetilde{W}}{P}$ and $\frac{\widetilde{W}}{P} = \frac{1}{(1+\mu_f)(1-s)}$, (5.A.20) simplifies to

$$\underbrace{[(1-b)(1-y)]^{\phi} - [(1-b)y+b]^{\phi-\sigma}(\mu_u)^{\phi}(1-s)^{\sigma}(1+\mu_u)^{-\sigma}}_{\equiv A} > 0. \quad (5.A.21)$$

For $s=0$, inserting (5.WS) into (5.A.21) gives $A\big|_{s=0}=0$. Introducing AMS at the margin at $s=0$ then yields

$$\left.\frac{\partial A}{\partial s}\right|_{s=0} = \sigma + \left.\frac{dy}{ds}\right|_{s=0}(1-b)\underbrace{\left[(\sigma-\phi)(1+\mu_u)-\phi\left(\frac{1+\mu_u}{\mu_u}\right)\right]}_{=0} > 0, \quad (5.A.22)$$

which implies that (5.A.20) is always fulfilled, i.e. in the equilibrium arising from a marginal introduction of AMS, unions will always prefer expansion. ■

Proof of Proposition 5.6. We start with Case A. We first show that new, unsubsidized firms always make less profit than incumbent firms. The profit of a new firm that does not receive any subsidy is given by (using $W_i/P = (1+\mu_u)(1-t)^{-1}(W^o/P)$ and equation (5.9)):

$$\frac{\Pi^{new}}{P} = \mu_f \frac{W_i}{P}\frac{C}{m}\left[(1+\mu_f)\frac{W_i}{P}\right]^{-\sigma}$$
$$= \mu_f \frac{C}{m}(1+\mu_f)^{-\sigma}(1+\mu_u)^{1-\sigma}\left[(1-b)y+b\right]^{1-\sigma}\left(\frac{\widetilde{W}}{P}\right)^{1-\sigma}. \quad (5.A.\ 23)$$

An incumbent firm's profit is given by

$$\frac{\Pi^{inc}}{P} = \mu_f(1-s)\frac{\widetilde{W}}{P}\frac{C}{m}\left[(1+\mu_f)(1-s)\frac{\widetilde{W}}{P}\right]^{-\sigma} - \frac{\widetilde{W}}{P}\frac{sy_0}{m_0}, \quad (5.A.24)$$

where m_0 is the initial number of firms. Inserting (5.A.7) and comparing (5.A.23) and (5.A.24) at $m = m_0$ then gives

$$\frac{\Pi^{inc}}{P} > \frac{\Pi^{new}}{P} \Leftrightarrow (1+\mu_u)\left[(1-b)y+b\right] > 1. \quad (5.A.25)$$

Since $(1+\mu_u)\left[(1-b)y+b\right] = 1$ at $y = y_0$ (where y_0 is defined by the WS condition), (5.A.25) is fulfilled for all $y > y_0$: new firms always make less profits than incumbent firms.

Next, we determine how an incumbent firm's profit depends on *s*, given that no new firm has yet entered. Inserting (5.19) into (5.A.24), and applying $\left[\frac{(1-s)^{1-\sigma}-1}{(1-s)-(1-s)^{\sigma}}\right]^{1/\sigma} = \frac{1}{1-s}$ to simplify the resulting expression, gives

$$\frac{\Pi^{inc}}{P} = \left(\frac{s}{(1-s)^{2-\sigma}-(1-s)}\right)(1+\mu_f)^{-1}\frac{y_0}{m}. \quad (5.A.26)$$

Differentiating with respect to *s* shows that

$$\frac{d\left(\Pi^{inc}/P\right)}{ds} = \frac{(1-s)^{2-\sigma} - (1-s) - s\left[1-(2-\sigma)(1-s)^{1-\sigma}\right]}{\left[(1-s)^{2-\sigma} - (1-s)\right]^2}(1+\mu_f)^{-1}\frac{y_0}{m}. \quad (5.A.27)$$

As the second derivative yields $d^2\left(\Pi^{inc}/P\right)/ds^2 = (1-\sigma)(2-\sigma)(1-s)^{-\sigma}$, we have

$$\begin{aligned} \frac{d\left(\Pi^{inc}/P\right)}{ds} \begin{Bmatrix} > \\ = \\ < \end{Bmatrix} 0 &\Leftrightarrow (1-s)^{2-\sigma} + (2-\sigma)s(1-s)^{1-\sigma} \begin{Bmatrix} > \\ = \\ < \end{Bmatrix} 1 \\ &\Leftrightarrow \sigma \begin{cases} 1<\sigma<2 \\ \sigma = 2 \\ \sigma > 2 \end{cases} \end{aligned} . \quad (5.A.28)$$

Incumbent firms make zero profits if $s = 0$ so that they make (weakly) negative profits for $s > 0$ and $\sigma \geq 2$. As new firms make less profits, they will not enter the market.

For case B, we first show that new firms would always make negative profits if $\sigma \geq 2$. By inserting (5.A.7) into (5.A.24), we can rewrite the profit of an expanding incumbent firm as

$$\frac{\Pi^{inc}}{P} = C^{1/\sigma}\left[\frac{\mu_f(1+\mu_f)^{-\sigma}\left[(1-s)^{1-\sigma}-1\right]}{sy_0}\right]^{1/\sigma}\frac{y_0}{m}s\left[\frac{(1-s)^{1-\sigma}}{(1-s)^{1-\sigma}-1} - \frac{m}{m_0}\right]. \quad (5.A.29)$$

We know that Case B is characterized by a consumption distortion, so that C is less than in Case A, *ceteris paribus*. (5.A.29) shows that $\partial\Pi^{inc}/\partial C > 0$, such that profits in Case B will be even less than they would have been if Case A had prevailed at the same s. Hence new firms never want to enter if $\sigma \geq 2$. ■

Proof of Proposition 5.7. We distinguish two cases. In the first case, unions are indifferent between expanding and shrinking. Equation (5.24) reads $\Omega^+ = \Omega^-$ and $m^+ \leq m_0$. In this case, the system of equations is solved exactly like in the short run. Hence, equations (5.15) and (5.17)-(5.21) solve the equilibrium values of y, C, $\overline{W}/P$, m^+/m, $\widetilde{W}/P$ and W^o/P. Equation (5.23) determines m, but has no influence on the other equilibrium outcomes. Thus, y and C retain their short-run

values. If C is constant, but m increases, it follows from (5.4) that welfare ($\sum_i V_i$) has to increase.

In the second case, all incumbent unions prefer expansion, i.e. $\Omega^+ > \Omega^-$ and $m^+ = m_0$. Rewriting (5.19) with the explicit forms of y_i^+ and y_i^- gives

$$y = \frac{m_0}{m} C\left(\frac{P_i^+}{P}\right)^{-\sigma} + \frac{m - m_0}{m} C\left(\frac{P_i^-}{P}\right)^{-\sigma}. \tag{5.A.30}$$

For given short-run equilibrium values of y and C, an increase in m decreases the RHS of (5.A.30) because $P_i^+ < P_i^-$. C is restricted by $C \le y$, such that an increase in C cannot equilibrate (5.A.30). Since $dP_i^- / dy > 0$ (via y's impact on the outside option), y has to fall to restore the equality. Hence, aggregate employment will be less in the short-run than in the long-run.

To compare the long-run effect with the initial equilibrium, we combine (5.18) and (5.20), and insert $m^+ = m_0$, $m^- = m - m_0$, and the explicit forms of y_i^+ and y_i^-, to obtain

$$\begin{aligned} \frac{W^o/P}{(1-t)} - [y + b(1-y)]\frac{C}{y}\left(1 - \frac{m_0}{m}\right)(1+\mu_f)^{-\sigma}(1+\mu_u)^{1-\sigma}\left(\frac{W^o/P}{(1-t)}\right)^{1-\sigma} \\ = [y + b(1-y)]\frac{m_0}{m}\frac{C}{y}(1+\mu_f)^{-\sigma}(1-s)^{-\sigma}\left(\frac{\widetilde{W}}{P}\right)^{1-\sigma}. \end{aligned} \tag{5.A.31}$$

We know from (5.A.14) and (5.A.10) that $\partial(\widetilde{W}/P)/\partial s > 0$. Also,

$$(1-s)^{-\sigma}\left(\frac{\widetilde{W}}{P}\right)^{-\sigma} = \frac{y_0}{\mu_f (1+\mu_f)^{-\sigma} C}\frac{s}{(1-s)-(1-s)^{\sigma}}, \tag{5.A.32}$$

with

$$\frac{\partial}{\partial s}\frac{s}{(1-s)-(1-s)^{\sigma}} = \frac{(1-s)-(1-s)^{\sigma}+s\left[1-\sigma(1-s)^{\sigma-1}\right]}{\left[(1-s)-(1-s)^{\sigma}\right]^2}. \tag{5.A.33}$$

Denoting the numerator of (5.A.33) by A, we obtain $A\big|_{s=0} = 0$ and $\partial A/\partial s = s\sigma(\sigma-1)(1-s)^{\sigma-2} > 0 \forall s \in]0,1[$. Hence, (5.A.32) is increasing in s. It follows that, for any equilibrium values of C and y, increasing s increases the

right-hand side of (5.A.32), which requires an increase in $(W^o/P)/(1-t)$ to balance the equation. From (5.23), it follows that C has to increase. The entry of new firms raises m, which strengthens the necessary increase in C. At $s = 0$, we have $C = y = y_0$, so that increasing s raises welfare and employment above their initial levels. ■

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