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ABSTRACT

Fiscal Effects of Minimum Wages: An Analysis for Germany*

Against the background of the current discussion on the introduction of statutory minimum wages in Germany, this paper analyzes the potential employment and fiscal effects of such a policy. Based on estimated labor demand elasticities obtained from a structural labor demand model, the empirical results imply that the introduction of minimum wages in Germany will be associated with significant employment losses that are concentrated among marginal and low- and semi-skilled full-time workers. Even though minimum wages will lead to increased public revenues from income taxes and social security benefits, they will result in a significant fiscal burden, due to increased expenditures for unemployment benefits and decreased revenues from corporate taxes.

JEL Classification: H60, J31, J88

Keywords: minimum wages, employment, public budget, fiscal effects

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1 Introduction

Hardly any other aspect of German labor market policy is currently debated more intensely than the introduction of statutory minimum wages. Its opponents argue that the installation of such a lower bound for wages into an already heavily regulated labor market threatens to lead to a substantial increase of unemployment. Undoubtedly, most German workers are covered in one way or another by collective bargaining and the German labor market has been plagued by high and persistent unemployment for a long time (see e.g. Haucap et al. 2007). Its proponents rather point at the large market power that employers wield on the labor market for unskilled workers, arguing that a *moderate* minimum wage might, at least in principle, create and not destroy jobs.[1]

Advocates of the introduction of a statutory minimum wage feel vindicated by the experience of other countries, because the evidence is not overwhelming that the introduction or rearrangement of minimum wages in the UK or the US, respectively, led to sizeable losses of employment. Yet, its sceptics warn that any innocuous results derived in a comparatively low-regulated labor market, such as that of the UK, can hardly be a sensible guide for what to expect in the German labor market. After all, the German labor market is dominated by corporatist institutions, unions and employer associations alike, and is beset by a plethora of regulations. Thus, yet another piece of regulation seems hardly desirable. What is more, some observers have commented critically on the way that, with the support of strong unions, German labor market incumbents in many sectors have utilized minimum wages to protect themselves against national and international competition. According to this view, the political support for the introduction of a statutory minimum wage from unions and from part of the employers is thus to be viewed as an attempt to extend this protection further, and will have additional negative long-run effects for the German economy (Haucap and Wey, 2008).

Unfortunately, existing empirical studies on the employment effects of minimum wages do not provide a clear guide to a more serious assessment of these contradictory arguments.[2] These studies typically follow one of two principal identification strategies. Most studies estimate structural labor demand models and use the estimated substitution elasticities to gauge the employment effects of an introduction or increase of minimum wage rates.[3] These studies have been criticized because of their strong identification assumptions. In particular, they usually assume a competitive labor market, which appears somewhat unrealistic, at least

[1] See Cahuc and Zylberberg (2004) for a discussion of different theoretical models on the employment effects of minimum wages.

[2] Brown (1999) and Neumark and Wascher (2007) provide surveys of the relevant empirical literature.

[3] That labor costs might be important for firms' competitiveness and profits has been acknowledged in many contexts, for instance in economic history (Labuske and Streb, 2008).

for continental European economies. More recent studies often take another route and invoke the idea of a natural experiment to estimate the employment effects of minimum wages in specific applications.[4] These studies rely on comparatively weak identification assumptions, but they tend to lack external validity, i.e. their results cannot be transferred to other contexts. In addition, by contrast to studies applying a structural approach, quasi-experimental studies usually just address short-run effects. Nevertheless, the majority of the existing empirical studies find negative employment effects of minimum wages (Neumark and Wascher, 2007).

So far the empirical literature on minimum wages has concentrated exclusively on employment effects. This focus reflects the fact that minimum wages are typically a measure of social policy in economies with a comparatively weak public social security system. By contrast, not only does a minimum wage appear to be an awkward instrument for poverty reduction in a country with a strong public social security system such as Germany, its introduction may also be associated with significant negative effects on the public budget. To our knowledge, the study by Bachmann et al. (2008) has been the first to suggest that fiscal effects might be an important issue in this context. Our paper refines this study and provides a thorough econometric analysis. Since the concrete level of the statutory minimum wage is a matter of intense political debate, we consider the potential consequences of the introduction of gross hourly minimum wages of 5.00 €, 7.50 €, and 10.00 €, respectively.

To provide such an assessment, we follow a research strategy that proceeds in three steps. First, we use micro-level data to analyze the extent to which the actual wages of German workers would be affected by the introduction of different minimum wage rates (Section 2). To this end we distinguish five different skill groups and estimate the shares of workers in these groups whose current wages lie *below* the three minimum wages under discussion, respectively. This step is necessary, since ascertaining that there is any treatment worth considering should always be the initial stage of an evaluation study, and minimum wages that are set below the majority of actual wages will not lead to market reactions.[5] Assuming that the implementation of the statutory minimum wage will lift the wages of those workers currently earning below this threshold up to this value, while leaving the other workers unaffected, we construct an estimate of the associated changes in average wages in all five skill groups.

In a second step, we rely on the wage elasticities estimated in Jacobi and Schaffner (2008) on the basis of a structural labor demand model, to translate

[4] The analysis by Card and Krueger (1994) is the seminal study using this identification strategy in this context.

[5] This is what appears to be behind the results of Koenig and Möller (2007) regarding the apparent absence of employment effects of minimum wages in the West German construction sector: no treatment, no effect.

these wage changes into the corresponding employment effects for the different types of workers (Section 3). In the final step, the estimates obtained in the first two steps are used to analyze the effects of minimum wages on public revenues and expenditures (Section 4). In our concluding remarks (Section 5), we derive the policy implications of our findings

Taken in a nutshell, the results of our empirical analysis suggest that the introduction of a minimum wage rate of 7.50 € will lead to an employment reduction of about 625,000 (full-time equivalent) jobs in West and more than 230,000 in East Germany. These employment losses will be concentrated predominantly among marginal workers and low- and semi-skilled full-time workers. The results further indicate that the introduction of a minimum wage of 7.50 € will burden the public budget by some 12 billion € or about one percent of the total public expenditures in 2007. Thus, the case against the introduction of statutory minimum wages into the German labor market seems quite strong.

2 Minimum Wages and the Wage Distribution

In this section we assess the effects of several candidate minimum wage rates on the wage distribution. Inspired by the current political discussion of statutory minimum wages in Germany, we discuss the effects of introducing wage floors of 5.00 €, 7.50 €, and 10.00 €, respectively. This step is important for at least two reasons. First, it allows gauging the actual relevance of minimum wages for the labor market. After all, a minimum wage that is lower than the vast majority of wages actually paid in the labor market could not be expected to lead to any market reactions. Second, distinguishing five skill groups of workers we obtain estimates of the increases in average hourly wages in each of these groups that would be associated with the introduction of each of the candidate minimum wages. Since our empirical strategy focuses on the substitutivity between different factors of production, i.e. skill groups of workers, these estimates are required for the analytical steps in the following sections.

Using data from the German Socio-economic Panel (GSOEP) for the year 2007, we calculate hourly wage distributions for five different groups of workers: (i) marginal workers; (ii) part-time workers; (iii) full-time workers without an occupational degree (low-skilled); (iv) full-time workers with an occupational degree but without a university degree (semi-skilled); and (v) full-time workers with a university degree (high-skilled). Hourly wages are constructed based on gross monthly wages and weekly working hours. Weekly hours have been defined as the contractual weekly working hours if available, otherwise as actual weekly working hours as reported by the individuals. Because of potential outliers at the bottom and the top of the wage distribution, we excluded the lowest and highest

2.5 percent of hourly wages from the following calculations.[6]

Table 1 reports the average hourly wages and their 10th and 90th percentiles, respectively, for the five different groups of workers, always distinguishing East and West German workers. It also documents within-group wage dispersion in the compressed form of a 90th/10th percentile ratio. In addition, the table reports the aggregate numbers of full time-equivalent workers in the five different groups we consider, which have been obtained using the BA-Employment Sample. Together with the corresponding system of uncompensated price elasticities, these numbers will be used in the following section to estimate the employment changes associated with the introduction of statutory minimum wages.

Not surprisingly, average hourly wages are higher in West Germany. The average wage of all workers in West Germany taken together exceeds even the average wage of high-skilled workers in East Germany slightly. Thus, we would expect the same candidate minimum wage to unfold more serious consequences in East Germany than in the West. Furthermore, as indicated by the ratio of the 90th to 10th percentile of the respective wage distribution, wage dispersion appears to be higher in East Germany for all types of workers considered but the high-skilled. It is highest for low-skilled full-time workers in both parts of Germany, while it is only substantial for marginal and part-time workers in East, but not in West Germany.

Based on these hourly wage distributions, we calculate the effects of introducing the candidate minimum wage rates of 5.00 €, 7.50 €, and 10.00 €, respectively, on average hourly wages in all five skill groups. We start from the insight that before implementing the statutory minimum wage, the average wage for skill group $j = 1, \ldots, 5$, $\bar{w}_j$, can be expressed as the weighted average of the average wage of all workers earning at most the candidate minimum wage m_l, with $l = 5.00, 7.50, 10.00$, $\bar{w}_{jl}^-$, and the average wage of all workers earning more, $\bar{w}_{jl}^+$. In this weighted average, the shares of workers receiving wages below and above these candidate minimum wage rates, ρ_{jl}^- and $\rho_{jl}^+ = 1 - \rho_{jl}^-$, serve as the appropriate weights:

$$\bar{w}_j \quad = \quad \rho_{jl}^- \bar{w}_{jl}^- + (1 - \rho_{jl}^-) \bar{w}_{jl}^+. \tag{1}$$

We then construct our estimates of the altered average wages in skill group j after the introduction of the statutory minimum, $\bar{\bar{w}}_{jl}$, assuming that wages above

[6] We also performed all estimations in this paper without trimming the data and when excluding the lowest and highest 5 percent of the wages. The estimated effects when trimming the data in this way are slightly lower than those reported below, because less individuals are affected by the minimum wage, resulting in a lower wage compression. Accordingly, the estimated effects when not trimming the data are higher because of a higher wage compression. The results for these analyses are available from the authors upon request.

the candidate minimum wages are not affected by their introduction:

$$\bar{\tilde{w}}_{jl} = \rho_{jl}^{-} m_l + (1 - \rho_{jl}^{-}) \bar{w}_{jl}^{+}. \quad (2)$$

Hence we neglect the possibility that the introduction of a minimum wage shifts the entire wage distribution. In the real world, this might very well happen, though, because, for example, firms try to realize a certain wage differential between different groups of workers to offer appropriate incentives (see, among others, Holmstrom and Milgrom, 1994, Lazear and Rosen, 1981, and Rosen, 1986).

To provide an estimate of the magnitudes of the associated wage changes, we construct measures of wage compression (c_{jl}), defined as the percentage change of the average wage associated with the introduction of candidate minimum wages, i.e.

$$c_{jl} = \left(\frac{\bar{\tilde{w}}_{jl} - \bar{w}_j}{\bar{w}_j} \right) \times 100. \quad (3)$$

Table 2 shows that the wages of marginal, part-time, and low-skilled workers, and in East Germany also of semi-skilled workers would be affected severely by the introduction of any of the candidate minimum wages. According to Table 2, a minimum wage of 5.00 €, for example, would affect 18 and 56 percent of low-skilled workers in West and East Germany, respectively. This number increases to approximately 47 and 83 percent, if a minimum wage of 10.00 € were introduced. Among semi-skilled workers, between 2 percent in West Germany and 6 percent in East Germany would be affected at a minimum wage of 5.00 € and between 13 and 39 percent at a minimum wage rate of 10.00 €. Except for a minimum wage of 10.00 € in the East, high-skilled workers would hardly be affected by any of the candidate minimum wage rates currently discussed.

In total, taking the employment numbers of the BA-Panel into account, a minimum wage of 7.50 € would affect about 12 percent of all full-time-equivalent workers or approximately 19.5 percent of all workers, which represents about 5 million workers. Using the GSOEP for the year 2004, Kalina and Weinkopf (2006) obtained a very similar result. They calculate that the introduction of such a minimum wage would affect 4.9 million or approximately 15 percent of all employment relationships. Based on the data from the *Gehalts- und Lohnstrukturerhebung* of the German Statistical Office for the year 2001, however, Ragnitz and Thum (2007) conclude that only 2.3 million or approximately 14 percent of all workers receive wages below 7.50 €. It is unclear, which factors are driving these differences between the various studies. Candidate explanations are the use of different samples, different definitions of hourly wages or different sample years. However, all studies indicate that the number of workers likely to be affected is economically relevant.

Table 2 further shows that a minimum wage of 5.00 € would only exert small effects on the wage distribution, leading to a wage compression of 1.1 and 5.6 percent for marginal workers and 1.6 and 22.1 percent for low-skilled full-time

workers in West and East Germany, respectively, while its effects on the average wages of the other groups of workers would be negligible. A minimum wage of 7.50 € would, however, lead to significant changes. Such a minimum wage would result in a wage compression of almost 9.3 and 20.3 percent among marginal workers in West and East Germany, respectively, 6.5 and 48.6 percent among low-skilled, and 2.5 and 9.1 as well as 0.6 and 3.3 percent among part-time and semi-skilled workers, respectively. Only a minimum wage rate of 10.00 € would also affect the wage distribution of (mainly East-German) high-skilled workers to a considerable degree. In that case, wage compression for this group of workers would reach approximately 4.2 percent.

Overall, only a minimum wage considerably above 5.00 € would have the potential to affect an economically relevant number of workers in both parts of Germany, in particular marginal, low-skilled, and part-time workers. Most specifically, a minimum wage of 7.50 € would lead to a sizeable wage compression for these groups. Our analysis suggests that the minimum wage rates currently discussed in the German public debate could be expected to lead to considerable reactions on the labor market. Using the estimated changes in the wage distribution for these five different types of workers as impulses, the following section investigates the employment effects of the candidate minimum wages on the basis of empirically determined own and cross-price elasticities of labor demand.

3 Employment Effects of Minimum Wages

When the government interferes into the labor market by setting the wage for a specific group of workers at a level that exceeds the previous value, this entails two related consequences. First, it raises the relative price of these workers in their role as a factor of production, and thus tends to price a fraction of them out of the market. Correspondingly, at the heart of the public debate concerning the introduction of minimum wages is the question whether it would lead to substantial losses of employment among those workers who are destined to be directly affected by this minimum wage. Yet, a comprehensive debate has also to acknowledge that – to the extent that workers of different skill groups are complements or substitutes in the production process – this statutory wage floor will also affect the employment prospect of workers whose wages are considerably higher. Some groups of workers might even benefit as substitutes. Thus, any thorough empirical assessment of the employment effects of minimum wages has to take these relationships into account. That is, it should not only consider own-price elasticities of labor demand, but also all relevant cross-price elasticities between different groups of workers.

Furthermore, this intervention raises the costs of production, reducing the employers' return on capital, and therefore threatens to lead to a lower aggregate level of economic activity. This second consequence requires the estimation of uncompensated elasticities of labor demand that jointly capture substitution

and output effects. By contrast, compensated labor demand elasticities, which are usually applied in the existing literature on labor demand, only capture net substitution effects, i.e. they assume that output is constant (Frondel and Schmidt, 2000). Since this conventional approach seems inadequate, we explicitly strive to assess the magnitudes of the relevant uncompensated elasticities.

Specifically, we provide estimates of the employment effects ΔL_{jl} of introducing a minimum wage m_l for skill group j which are based on the combination of compensated (cross-price) elasticities and scale effects. With L_j denoting the number of employees in skill group j, we derive

$$\Delta L_{jl} = \left[\sum_{k=1}^{5} (\eta_{jk} + \eta_{jY}\eta_{Yk}) \frac{\Delta w_{kl}}{\bar{w}_k} \right] L_j. \tag{4}$$

This expression acknowledges that the introduction of a statutory minimum wage would alter the average wages in all five skill groups. These changes are expressed in percentage terms as $\Delta w_{kl}/\bar{w}_k$. They are translated into effects on the employment of workers of each group j by cumulating, first, the compensated price elasticities between skill group j and groups $k = 1, \ldots, 5$, η_{jk}, and, second, a corresponding output effect due to the increased cost of labor. This second effect is itself the product of the labor demand elasticity with respect to changes in the output Y, η_{jY}, and the elasticity of output Y with respect to a change in the price of input factor k. The latter elasticity can be expressed as (a detailed derivation is provided in the Appendix):

$$\eta_{Yk} = \frac{\partial \ln(Y)}{\partial \ln(w_k)} = \frac{\partial \ln(Y)}{\partial \ln(MC)} \cdot \frac{\partial \ln(MC)}{\partial \ln(w_k)} = \eta \cdot \frac{\partial \ln(MC)}{\partial \ln(w_k)},$$

i.e. the product of the elasticity of output with respect to the aggregate price η and the elasticity of marginal costs MC with respect to changes in the price of factor k. Following Fitzenberger and Franz (2001), the latter can be derived from

$$\frac{\partial ln(MC)}{\partial ln(w_k)} \;=\; MC^{-1} \left[\sum_{j \neq k} \frac{w_j L_j}{Y} \; \eta_{jY} \; \eta_{jk} + \frac{w_k L_k}{Y} \; \eta_{kY} \; (1 + \eta_{kk}) \right],$$

with

$$MC \;=\; \sum_{j} \frac{w_j L_j}{Y} \; \eta_{jY}.$$

As a specific input for our estimation of the employment effects of minimum wages according to expression (4), we utilize the compensated price-elasticities η_{jk} estimated by Jacobi and Schaffner (2008). Together with a detailed description of

these authors' empirical approach, these elasticities are reported in the Appendix.[7] We further assume constant returns to scale, which implies that $\eta_{jY} = 1$ and use a demand elasticity of $\eta = -0.2$, inspired by the estimates reported in Fitzenberger and Franz (2001).

The estimated uncompensated elasticities are presented in Table 3. Note that the output effect is the same for all employment reactions triggered by the same wage change, reflecting the assumption of constant returns to scale. Output effects are estimated to be particularly large when the wages of semi-skilled workers increase. The own-wage elasticities are negative and the cross-price elasticities positive suggesting that all worker groups are substitutes to each other, even after taking output effects into account. In West Germany the uncompensated cross-price elasticities between marginal workers and part-time and high-skilled full-time workers are not statistically significant, and in East Germany the cross-price elasticities between marginal part-time workers and all other groups are insignificant, suggesting that this type of workers plays a different role in the production process in the two regions of Germany. Part-time workers appear to be substitutes to semi-skilled and high-skilled workers, whereas the cross-price elasticities between part-time an low-skilled workers do not appear to be statistically significant in both parts of Germany. Finally, differently to West-Germany, the cross-price elasticities between low-skilled and high-skilled full-time workers in East Germany are not significant.

Maintaining the assumption explained in the previous section that in each skill group only wages below the minimum wage are affected by its introduction, we use the estimated wage compression associated with different candidate minimum wage rates reported in Table 2 to approximate the proportionate changes in wage costs ($\Delta w_{kl}/\bar{w}_k$) resulting from the introduction of minimum wages. The number of employees in the five groups considered (L_j) as well as the respective total wage sums are taken from columns (6) and (7) of Table 1. The output Y is derived from national accounts (Statistisches Bundesamt, 2007b). Finally, since the elasticities used to evaluate the employment effects are estimates, we also report 95 percent confidence intervals, which have been obtained by using bootstrapping with 500 replications.[8]

The estimated employment effects of different minimum wage rates are reported in Table 4, distinguishing East and West Germany. According to these

[7] All compensated own-price elasticities are statistically significant negative. In West Germany all employment groups are estimated to constitute substitutes for each other. However, most of the substitution elasticities are estimated to be rather small. The highest cross-price elasticities are obtained between semi-skilled workers and the other groups. In East Germany low-skilled and part-time workers as well as high-skilled and low-skilled workers are estimated to be complements. In both cases, however, the estimated elasticities are not statistically significant.

[8] See Efron and Tibshirani (1993) for an introduction to the bootstrap method.

estimates the introduction of each of these candidate minimum wages would have negative employment effects in both parts of Germany, which range from 161,391 employees in East Germany at a minimum wage rate of 5.00 € to 1.17 million employees in West Germany at a minimum wage rate of 10.00 €. These negative effects are mainly the result of a decreasing employment among marginal and part-time workers and low- and semi-skilled full-time workers, while high-skilled full-time worker are not estimated to be affected significantly.

Overall, the estimates suggest that the introduction of minimum wages in Germany would have detrimental employment effects, which increase with the minimum wage rate. A minimum wage of 5.00 €, for example, would involve the loss of 523,000 jobs (or 2 percent of the total work-force), which increases to 1.5 million jobs (or 5.9 percent of the total work-force) at a minimum wage of 10.00 €. The part of the estimated effect which is due the output effect is given in parentheses at the bottom of the table. The share of the scale effect depends on the worker group and the amount of the minimum wage. Overall, the output effects amount to 6 percent for a minimum wage of 5.00 € and 20 percent for a minimum wage of 10.00 €.

4 Fiscal Effects of Minimum Wages

Based on the employment effects predicted in the previous section, this section analyzes the potential effects of the introduction of minimum wages for the public budget. To derive a comprehensive assessment, we separately consider the changes in (i) revenues from individual taxes and social security contributions, (ii) revenues from corporate taxes, (iii) expenditures for unemployment benefits, social assistance and active labor market policy, and (iv) expenditures for the supplement of the income of marginal workers, respectively.

4.1 Revenues

The introduction of minimum wages exerts direct as well as indirect effects on public revenues from individual taxes and social security contributions. While the former reflect the altered incomes of workers covered by the minimum wage who remain employed, the latter emerge from the employment effects of minimum wages. In order to quantify the budgetary effects of candidate minimum wages m_l, we calculate the change in the annual labor income of each group of workers j, using our measure of wage compression c_{jl} and the estimated employment changes ΔL_{jl}. Specifically, denoting average annual wages per full-time equivalent worker in group j before the introduction of minimum wages as $\bar{v}_j$ and the respective employment level as L_j, the change in annual total income due to the introduction of minimum wages is calculated as:

$$\Delta(v_j L_j) = \begin{cases} \Delta v_j L_j + \bar{v}_j(1 + c_{jl})\Delta L_{jl} & \text{if } \Delta L_{jl} \geq 0 \\ \Delta v_j(L_j + \Delta L_{jl}) + \bar{v}_j \Delta L_{jl} & \text{if } \Delta L_{jl} < 0. \end{cases} \tag{5}$$

Concerning employment changes, we assume that those workers who loose their jobs and those who gain employment receive the average wage in their respective employment group.[9]

The changes in workers' annual incomes are then evaluated by average tax rates. On the revenue side of the public budget we distinguish the income tax, the solidarity tax as well as social security contributions. Concerning the income tax we assume tax rates of 3.4 percent of gross income for low-skilled, 5.1 percent for semi-skilled and part-time, and 14.4 percent for high-skilled workers.[10] For all five groups of workers, the solidarity tax amounts to 5.5 percent of the income tax. Social security contributions add up to 40.85 percent of gross income, consisting of 19.5 percent for the pension system, 6.5 percent for the unemployment insurance system, 1.95 percent for long-term care insurance, and 13.9 percent for the health insurance. Marginal employees are assumed to pay 2 percent of their gross income for income and solidarity tax. Furthermore, they are assumed to pay the fixed amount of 28 percent of gross labor income into the social security system.

Columns (1) and (2) of Table 5 report the estimated effects of introducing a minimum wage on individual taxes and social security contributions. Summed over both regions, the effects are estimated to result in a decrease of the revenues from these sources of about 3 billion € in the case of a minimum wage of 5.00 €. This result is driven by a decrease of revenues from these sources in West Germany[11], where the revenue loss resulting from the employment reduction due to these minimum wages exceeds the revenue gains resulting from the higher incomes of those who remain employed. Even though the introduction of minimum wages would decrease employment and hence reduce the revenues from individual taxes, this negative effect is overcompensated by increased revenues resulting from an increased income of the incumbent employees in the case of minimum wages of 7.50 and 10.00 €, respectively. Overall, these gains reach about 0.8 billion € for a minimum wage of 7.50 € and about 8.2 billion € for a minimum wage of 10 €. In addition, the positive effects on revenues are the result of employment shifts towards better educated workers – and hence towards groups that pay higher income taxes – following the introduction of minimum wages.

Note that semi-skilled full-time workers are responsible for most of the additional revenues generated from minimum wages.[12] This group constitutes not

[9] This assumption may be unrealistic, because, for example, unemployed receiving employment may be clustered at the lower end of the respective wage distribution. Consequently, the estimated effects on the revenues resulting from the introduction of minimum wages represent an upper bound.

[10] The tax rates rely on the income statistics of the Federal Statistical Office, Statistisches Bundesamt (2007a), for the respective income group.

[11] Separate estimates for East and West Germany are available from the authors upon request.

[12] The respective contributions of the different worker groups are available from the authors upon

only the largest group among those we consider in our analysis, the average income of this group is also substantially higher than the income of low-skilled full-time workers. Finally, semi-skilled workers are substitutes to low-skilled, part-time, and marginal workers. Therefore, the introduction of minimum wages will lead only to moderate employment losses and small wage gains for this group.

In addition to individual taxes we also consider minimum wage effects on corporate tax revenues. The introduction of minimum wages threatens to lower the profits of firms and hence public revenues from corporate taxes for at least two reasons: (i) increases in the labor costs and (ii) negative employment effects and, correspondingly, a lower output level. The following estimates assume, that the increased wage costs and social security contributions of the firms lead to a proportional reduction of profits. This is a crude, albeit reasonable approximation. Firms, for example, may pass on parts of the increased wage costs to the consumers via higher prices, even though the possibilities for such a reaction are limited by increasing global competition. To the extent that this happens, however, the following numbers overestimate the true fiscal effects. On the other hand, our estimates also do not consider the effects of output reductions on firm's profit. This leads to an underestimation of the true fiscal effects. Unfortunately it is not possible to determine which of these effects dominates. Hence, the net effect of these potential biases cannot be evaluated.

The numbers reported in column (4) of Table 5 have been obtained by assuming an average total corporate tax burden from the corporate income tax, business tax and income tax of 25 percent of profits (see, for example, Gebhardt and Siemers, 2008, and Lietmeyer and Petzold, 2005). For all scenarios considered, the results show a significant reduction of the public revenues from corporate taxes, reaching between 1.1 and 8.2 billion €. The majority of this reduction is due to lower revenues in West Germany, while the effects in East Germany are relatively minor. The latter can be explained by the fact that only 20 percent of the employees are working in East Germany. In addition, workers in the East have lower wages and they work relatively more often part-time than West German workers. Finally, especially in the East, the introduction of minimum wages would lead to relatively strong employment losses. Because of these reasons, a minimum wage would lead to a relatively moderate increase in the wage costs, and hence to a lower estimate of the decrease of profits for East German firms.

4.2 Expenditures

Concerning public expenditures, minimum wages and the resulting wage compression and employment effects predominantly affect the budget of the German Labor Office (BA). In our assessment of the effects of minimum wages on the expenditures

request.

of the BA for unemployment benefits and active labor market policy, we maintain the following assumptions: (i) labor market flows into and out of employment are exclusively coming from and going into the pool of the unemployed without any change in the population outside the labor force; (ii) the fraction of workers receiving unemployment benefits (ALG I) and not social benefits (ALG II) remains constant[13]; (iii) a worker receiving ALG I generates annual expenditures of 13,320 € and an unemployed worker receiving ALG II generates annual expenditures of 12,480 €[14].

Columns (5) and (6) of Table 5 document that the introduction of minimum wages threatens to be associated with significant additional costs for the BA. Aggregated over the two German regions, these costs may reach between 6.7 billion € at a minimum wage rate of 5.00 € to 19.5 billion € at a minimum wage rate of 10.00 €. In all scenarios considered, these effects are significant. Again, the biggest share of these costs is generated in West Germany whereas the costs compared to the population share are higher in the East.

Workers with a low income are able to receive ALG II-benefits in addition to their labor income. If a minimum wage increases income at the lower end of the wage distribution, the number of workers entitled to these wage subsidies decreases. The associated decrease in expenditures for wage subsidies have to be taken into account when evaluating the fiscal effects of minimum wages. According to the Bundesagentur für Arbeit (2007b), 989,000 households received this type of wage subsidies in January 2007. To quantify the potential effect of reducing this number via minimum wages, we assume that workers having an income of less than 400 € receive wage subsidies of 876 €, those with an income between 400 and 800 € receive 751 €, and those with higher labor income 529 € per month. We further assume that the latter of these three groups consists predominantly of low skilled full-time working individuals.

The change in expenditures due to wage subsidies is calculated using the estimated effects on wage compression and employment changes resulting from each candidate minimum wage discussed above. We further assume that workers receiving wage subsidies are affected in the same way as other workers in their respective skill group and that these persons have the same probability of loosing their job. If workers receiving wage subsidies loose their job, we assume that they

[13] In December 2006, this proportion was about 40%.

[14] Based on data from the the Bundesagentur für Arbeit (2007a) for December 2007, these expenditures consists of average unemployment benefits of 760 € per month. To these benefits we add average monthly costs of 350 € per person receiving ALG I for measures of active labor market policy (Bundesagentur für Arbeit, 2006a). We further assume that the average monthly benefits of workers receiving ALG II are 880 € (Bundesagentur für Arbeit, 2006b) and that these workers on average generate monthly costs for active labor market policy of 160 € (Bundesagentur für Arbeit, 2006c). Note that we do not consider potential changes in administrative costs, assuming that these costs represent fix costs of the BA.

receive ALG I or ALG II. These persons are already taken into account in Columns (5) and (6) of Table 5. If workers stay on their job with a higher wage, we assume that the wage subsidies are reduced by the same amount.

Column (7) of Table 5 shows that the introduction of minimum wages reduce the expenditures for wage subsidies. On the one hand, this reduction can be explained by the fact that those workers who loose their job and get unemployed receive ALG I or ALG II. In this case they are already taken into account. On the other hand, total expenditures for wage subsidies decrease because the introduction of minimum wages results in some workers currently receiving wage subsidies to loose their entitlement. The reduction of expenditures due to these effects is about 0.6 billion € at a minimum wage of 5.00 €, and 3.2 billion € at a minimum wage rate of 10.00 €. The latter is about 37 percent of the current expenditures for wage subsidies.

Column (8) of Table 5 summarizes our estimates of the impact of minimum wages on the public budget. Our estimates suggest that the introduction of minimum wages may be accompanied with a considerable fiscal burden, reaching about 10 billion € or 9.8 percent of the total public budget expenditures of 1,016 billion € in 2007 (Statistisches Bundesamt, 2008) at a minimum wage rate of 5.00 €, about 12 billion € (or 1.2 percent of the total public budget in 2007) at a minimum wage rate of 7.50 €, up to more than 16.6 billion € (or 1.6 percent of the total public budget in 2007) at a minimum wage rate of 10.00 €.

5 Conclusion

Based on estimates of the effects of minimum wages on the wage distribution and employment level, this paper analyzes the fiscal effects of introducing minimum wages in Germany. The employment effects are obtained by estimating labor demand elasticities for different types of workers using a dynamic labor demand model. The introduction of minimum wages in Germany is estimated to have significant employment effects. A minimum wage rate of 7.50 €, for example, is estimated to decrease (full-time equivalent) employment by almost 0.86 million and a minimum wage rate of 10.00 € by more than 1.5 million. These job losses are concentrated among marginal and low- and semi-skilled full-time workers.

Because of higher wages for the incumbent workers and an increase in the demand for high-skilled workers, however, the introduction of minimum wages is associated with an increase in total labor income, which in turn implies higher public revenues from income tax and social security contributions. The higher wage costs further implies a reduction of firms' profits leading to a decrease in the public revenues from corporate taxes. In total, however, the introduction of minimum wages will decrease public revenues, because the reduction of revenues from corporate taxes can not be compensated by the revenue gains from income

tax and social security contributions. The introduction of minimum wages further leads to increased public expenditures resulting from the increased unemployment and social benefit expenditures.

The results of this paper implies that Germany should abstain from introducing minimum wages. They are associated with significant job losses, especially for those employees whose situation is intended to be meliorated by the introduction of minimum wages. This implies that minimum wages can not be regarded to be an effective policy measure to fight poverty. In addition, minimum wages are estimated to lead to a fiscal burden. Our analysis implies a fiscal burden, which can reach 12 billion € at a minimum wage rate of 7.50 € and more than 16 billion € at a minimum wage rate of 10.00 €.

References

Anderson, G. J., and R. W. Blundell (1982), Estimation and Hypothesis Testing in Dynamic Singular Equation Systems. *Econometrica* 6 , 1159-1571.

Bachmann, R., T. K. Bauer, J. Kluve, S. Schaffner and C. M. Schmidt (2008), Mindestlöhne in Deutschland - Beschäftigungswirkungen und fiskalische Effekte, *RWI-Materialien No. 43*, RWI, Essen.

Brown, C. (1999), Minimum Wages, Employment, and the Distribution of Income. In O. Ashenfelter und D. Card (Eds.), *Handbook of Labor Economics 3B*, 2101-2163. Amsterdam et al.: Elsevier.

Bundesagentur für Arbeit (2006a), Die Einnahmen und Ausgaben der Bundesagentur für Arbeit, Berichtsmonat November 2006, www.statistik.arbeitsagentur.de.

Bundesagentur für Arbeit (2006b), Ausgaben für Leistungen nach dem Zweiten Buch Sozialgesetzbuch, Berichtsmonat November 2006, www.statistik.arbeitsagentur.de.

Bundesagentur für Arbeit (2006c), Aktuelle Daten aus der Grundsicherung, Mai 2006, www.statistik.arbeitsagentur.de.

Bundesagentur für Arbeit (2007a), Leistungen nach dem SGB III, Berichtsmonat Dezember 2007, www.statistik.arbeitsagentur.de.

Bundesagentur für Arbeit (2007b), Grundsicherung für Arbeitssuchende: Anrechenbare Einkommen und Erwerbstätigkeit, August 2007, www.statistik.arbeitsagentur.de.

Cahuc, P. and A. Zylberberg (2004), *Labor Economics.* Cambridge (Mass.): MIT Press.

Card, D. and A. B. Krueger (1994), Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania. *American Economic Review*, 84, 772-793.

Efron, B. and R. J. Tibshirani (1993), *An Introduction to the Bootstrap.* London: Chapman & Hall/CRC.

Fitzenberger, B. and Franz, W. (2001) Jobs. Jobs? Jobs! Orientierungshilfen für den Weg zu mehr Beschäftigung, in: W. Franz, H. Hesse, H.J. Ramser und M. Stadler (Hrsg.), *Wirtschaftspolitische Herausforderungen an der Jahrhundertwende*, Tübingen, 3 - 42.

Frondel, M. and Schmidt, C.M. (2000), The Real Elasticity of Substitution - An Orbituary, Discussion Paper No. 341, University of Heidelberg.

Gebhardt, H., and L. Siemers (2008), *Die steuerliche Belastung des deutschen Mittelstands*, mimeo., RWI Essen, Essen.

Hamermesh, D. S. (1993), *Labor Demand*. Princeton (NJ): Princeton University Press.

Haucap, J., U. Pauly and C. Wey (2007), A Cartel Analysis of the German Labor Institutions and Its Implications for Labor Market Reforms, *Journal of Institutional and Theoretical Economics (JITE)* 163, 503-516.

Haucap, J. and C. Wey (2008), Erosion des Flächentarifsystems macht eine Wettbewerbsaufsicht auf dem Arbeitsmarkt notwendig, *DIW Wochenbericht* 06/2008, 61-65.

Holmstrom, B., and P. Milgrom (1994), The Firm as an Incentive System. *American Economic Review* 84, 972-991.

Jacobi, L. and Schaffner, S. (2008) Does Marginal Employment Substitute Regular Employment? - A Heterogeneous Labour Demand Approach for Germany, Ruhr Economic Papers 56, RWI Essen: Essen.

Kalina, T. and C. Weinkopf (2006), Ein gesetzlicher Mindestlohn auch in Deutschland?! Modellrechnungen für Stundenlöhne zwischen 5,00 und 7,50 € - und wie ist es bei den anderen? *IAT-Report* 2006-06. Institut für Arbeit und Technik (IAT): Gelsenkirchen.

Kluve, J. and C.M. Schmidt (2008), Mindestlöhne ohne Reue - eine aussichtsreiche Option für Deutschland?, Gastbeitrag für www.handelsblatt.com

Koch, I. and H. Meineken (2004), The Employment Panel of the Federal Employment Agency. *Schmollers Jahrbuch*, 124, 315-325,

König, M. and J. Möller (2007), Mindestlohneffekte des Entsendegesetzes? Eine Mikrodatenanalyse für die deutsche Bauwirtschaft, IAB Discussion Paper No. 30/2007. IAB: Nürnberg.

Labuske, K., and J. Streb (2008), Technological Creativity and Cheap Labour? Explaining the Growing International Competitiveness of German Mechanical Engineering before World War I, *German Economic Review* 9(1), 65-86.

Lazear, E., and S. Rosen (1981), Rank-order Tournaments as Optimal Labor Contracts, *Journal of Political Economy* 89, 841-864.

Lietmeyer, V., and O. Petzold (2005), Bedingungen und Ziele für eine Reform der Unternehmensbesteuerung, *Wirtschaftsdienst* 85(9), 590-599.

Müller, K.U. and V. Steiner (2008), Would a Legal Minimum Wage Reduce Poverty? A microsimulation study for Germany, DIW Discussion Paper 790, DIW:Berlin.

Neumark, D. and W. Wascher (2007), Minimum Wages and Employment. *Foundations and Trends in Microeconomics*, 1-154.

Ragnitz, J. and M. Thum (2007), Zur Einführung von Mindestlöhnen: Empirische Relevanz des Niedriglohnsektors. Ifo Dresden berichtet 3/2007, 36-39.

Rosen, S. (1986), Prizes and Incentives in Elimination Tournaments. *American Economic Review* 76, 701-715.

RWI Essen (2008), Auswirkungen der Einführung des Postmindestlohns - Befragung von Unternehmen der Branche Briefdienstleistungen, Projektbericht für das Bundesministerium für Wirtschaft und Technologie, Essen.

Statistisches Bundesamt (2007a), Jährliche Einkommensteuerstatistik 2003, Fachserie 7.1.1., https://www-ec.destatis.de.

Statistisches Bundesamt (2007b), Detaillierte Jahresergebnisse 2006 , Fachserie 18 Reihe 1.4, https://www-ec.destatis.de.

Statistisches Bundesamt (2008), Vierteljährliche Kassenergebnisse des öffentlichen Gesamthaushalts: 1.-4. Vierteljahr 2007, Fachserie 14, Reihe 2, https://www-ec.destatis.de.

Table 1: Employment and Hourly Wages in West and East Germany

	Hourly Wages (SOEP)					BA-Panel	
	Obs.	10th-percentile [€]	Mean [€]	90th-percentile [€]	90th/10th ratio	Employment [FTE]	Wage sum [mill. €]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
West Germany							
Marginal	499	4.60	9.63	17.44	3.79	3,472,464	11,193
Part-Time	1279	6.13	13.13	21.02	3.43	3,242,959	57,649
Low-Skilled	611	4.05	11.96	20.32	5.02	2,059,650	50,880
Semi-Skilled	3666	9.02	17.06	27.47	3.05	10,800,000	348,000
High-Skilled	112	9.33	20.09	32.76	3.51	1,582,436	79,552
Total	6167	6.39	15.21	25.75	4.03	21,157,509	547,275
East Germany							
Marginal	104	2.94	7.95	18.06	6.14	566,845	1,351
Part-Time	283	3.22	10.36	19.16	5.95	717,275	12,838
Low-Skilled	144	1.85	5.78	11.82	6.38	184,580	3,436
Semi-Skilled	1424	6.16	12.34	20.90	3.39	2,679,850	62,365
High-Skilled	44	7.60	14.81	21.80	2.87	449,380	17,340
Total	1999	3.91	11.28	20.04	5.12	4,597,930	97,330
Germany							
Total	8166	6.05	14.51	24.15	3.99	25,755,439	644,605

Source: Own calculations based on the GSOEP, Wave 2007.
FTE: Full-time equivalents.

Table 2: Minimum Wages and Wage Compression

Skill Group	Share of workers below m_l [%]	Average hourly wage below m_l [€]	Average hourly wage above m_l [€]	Average hourly wage without m_l [€]	Average hourly wage with m_l [€]	Wage compression [%]
West Germany						
			Minimum Wage m_l = 5.00€			
Marginal	14.28	4.29	10.52	9.63	9.73	1.06
Part-Time	6.62	4.03	13.77	13.13	13.19	0.49
Low-Skilled	17.66	3.94	13.69	11.96	12.15	1.57
Semi-Skilled	2.00	3.98	17.33	17.06	17.08	0.12
High-Skilled	3.63	3.66	20.71	20.09	20.14	0.24
			Minimum Wage m_l = 7.50€			
Marginal	51.32	5.76	13.71	9.63	10.52	9.26
Part-Time	15.64	5.43	14.55	13.13	13.45	2.46
Low-Skilled	29.51	4.86	14.94	11.96	12.74	6.52
Semi-Skilled	5.97	5.66	17.78	17.06	17.17	0.64
High-Skilled	5.30	4.70	20.95	20.09	20.24	0.74
			Minimum Wage m_l = 10.00€			
Marginal	74.14	6.63	18.23	9.63	12.13	25.92
Part-Time	34.23	7.19	16.22	13.13	14.09	7.32
Low-Skilled	46.88	6.28	16.98	11.96	13.71	14.57
Semi-Skilled	13.28	7.40	18.54	17.06	17.40	2.02
High-Skilled	10.09	6.60	21.60	20.09	20.43	1.71
East Germany						
			Minimum Wage m_l = 5.00€			
Marginal	30.90	3.55	9.91	7.95	8.39	5.62
Part-Time	17.53	3.25	11.87	10.36	10.66	2.96
Low-Skilled	56.43	2.74	9.71	5.78	7.05	22.05
Semi-Skilled	6.39	3.31	12.95	12.34	12.44	0.87
High-Skilled	0.97	4.89	14.91	14.81	14.81	0.01
			Minimum Wage m_l = 7.50€			
Marginal	62.07	4.90	12.93	7.95	9.56	20.27
Part-Time	35.65	4.86	13.40	10.36	11.30	9.07
Low-Skilled	72.36	3.62	11.43	5.78	8.59	48.57
Semi-Skilled	22.63	5.69	14.28	12.34	12.74	3.32
High-Skilled	8.93	6.30	15.65	14.81	14.92	0.72
			Minimum Wage m_l = 10.00€			
Marginal	79.51	5.84	16.14	7.95	11.26	41.66
Part-Time	58.12	6.39	15.86	10.36	12.45	20.26
Low-Skilled	83.34	4.26	13.35	5.78	10.56	82.72
Semi-Skilled	39.39	6.99	15.81	12.34	13.52	9.62
High-Skilled	22.90	7.30	17.04	14.81	15.43	4.17

Source: Own calculations based on the GSOEP, Wave 2007.

Table 3: Uncompensated elasticities of substitution

Percentage change in the employment of:	**With respect to a percentage change in the wage of:** Marginal	Part-Time	Low-Skilled	Semi-Skilled	High-Skilled
West Germany					
Marginal	-0.889†	0.058	0.146†	0.456†	0.026
	(0.040)	(0.057)	(0.069)	(0.100)	(0.074)
	[-0.005]	[-0.019]	[-0.020]	[-0.129]	[-0.029]
Part-Time	0.015	-0.644†	0.033	0.268†	0.125†
	(0.015)	(0.066)	(0.057)	(0.112)	(0.055)
	[-0.005]	[-0.019]	[-0.020]	[-0.129]	[-0.029]
Low-Skilled	0.039†	0.036	-0.861†	0.479†	0.104†
	(0.018)	(0.054)	(0.067)	(0.089)	(0.049)
	[-0.005]	[-0.019]	[-0.020]	[-0.129]	[-0.029]
Semi-Skilled	0.019†	0.045†	0.075†	-0.388†	0.046†
	(0.005)	(0.023)	(0.016)	(0.038)	(0.023)
	[-0.005]	[-0.019]	[-0.020]	[-0.129]	[-0.029]
High-Skilled	0.005	0.087†	0.069†	0.192†	-0.556†
	(0.014)	(0.039)	(0.031)	(0.092)	(0.087)
	[-0.005]	[-0.019]	[-0.020]	[-0.129]	[-0.029]
East Germany					
Marginal	-0.733†	0.091	0.120	0.284	0.033
	(0.091)	(0.063)	(0.119)	(0.264)	(0.246)
	[-0.003]	[-0.025]	[-0.008]	[-0.133]	[-0.036]
Part-Time	0.011	-0.728†	-0.024	0.418†	0.117†
	(0.008)	(0.049)	(0.018)	(0.064)	(0.039)
	[-0.003]	[-0.025]	[-0.008]	[-0.133]	[-0.036]
Low-Skilled	0.045	-0.074	-0.638†	0.609†	-0.147
	(0.042)	(0.053)	(0.123)	(0.174)	(0.156)
	[-0.003]	[-0.025]	[-0.008]	[-0.133]	[-0.036]
Semi-Skilled	0.007	0.081†	0.036†	-0.422†	0.093†
	(0.006)	(0.021)	(0.011)	(0.033)	(0.029)
	[-0.003]	[-0.025]	[-0.008]	[-0.133]	[-0.036]
High-Skilled	0.003	0.082†	-0.032	0.330†	-0.588†
	(0.019)	(0.032)	(0.035)	(0.088)	(0.098)
	[-0.003]	[-0.025]	[-0.008]	[-0.133]	[-0.036]

Source: Jacobi and Schaffner (2008), Tables 2 and 3, and own calculations.
Boot-strapped standard errors in parentheses. Output effect in brackets.
†: Statistically significant at least at the 5%-level.

Table 4: Employment Effects of Minimum Wages

Worker Group	**Minimum Wage** $m_l =$ 5.00 €	7.50 €	10.00 €
West Germany			
Marginal	47,472	-172,384	-622,237
	[40,053;54,891]	[-210,161;-134,607]	[-714,993;-529,481]
	(-2,458)	(-11,820)	(-31,337)
Part-Time	-8,014	-33,402	-102,138
	[-13,960;-2,068]	[-59,463;-7,341]	[-163,355;-40,921]
	(-2,249)	(-10,816)	(-28,674)
Low-Skilled	-110,745	-180,947	-286,420
	[-114,349;-107,142]	[-195,631;-166,262]	[-318,779;-254,060]
	(-1,369)	(-6,584)	(-17,454)
Semi-Skilled	-284,464	-238,423	-169,402
	[-289,627;-279,301]	[-260,937;-215,909]	[-222,992;-115,812]
	(-7,288)	(-35,048)	(-92,916)
High-Skilled	-6,345	-391	12,006
	[-7,661;-5,028]	[-6,425;5,643]	[-2,518;26,530]
	(-1,093)	(-5,257)	(-13,938)
Total	-362,096	-625,547	-1,168,190
	[-385,544;-338,649]	[-732,617;-518,476]	[-1,422,636;-913,744]
	(-14,458)	(-69,525)	(-184,318)
East Germany			
Marginal	-19,783	-54,549	-102,476
	[-47,415;7,849]	[-102,476;6,381]	[-203,082;-1,870]
	(-2,154)	(-6,394)	(-15,175)
Part-Time	-17,513	-44,803	-85,467
	[-22,780;-12,246]	[-85,467;-33,232]	[-104,640;-66,295]
	(-2,791)	(-8,286)	(-19,665)
Low-Skilled	-32,976	-59,865	-92,007
	[-42,212;-23,739]	[-92,007;-39,691]	[-125,068;-58,946]
	(-684)	(-2,029)	(-4,815)
Semi-Skilled	-78,226	-63,057	-64,440
	[-89,879;-66,572]	[-64,440;-37,610]	[-106,261;-22,619]
	(-10,074)	(-29,902)	(-70,965)
High-Skilled	-12,893	-12,581	-12,921
	[-19,712;-6,073]	[-12,921;2,570]	[-38,267;12,425]
	(-1,705)	(-5,061)	(-12,011)
Total	-161,391	-234,855	-357,311
	[-221,999;-100,782]	[-357,311;-101,582]	[-577,317;-137,304]
	(-17,408)	(-51,672)	(-122,630)

Source: Own calculations based on the elasticities reported in Jacobi and Schaffner (2008). 95 percent confidence intervals in brackets. Output effects in parentheses.

Table 5: Fiscal Effects of Minimum Wages (in Mill. €)

	Minimum Wage		
	5.00 €	7.50 €	10.00 €
Income and Solidarity Tax	-361	124	1,147
	[-461;-261]	[-168;416]	[541;1,752]
Social Security	-2,516	653	7,032
	[-3,078;-1,954]	[-1,064;2,370]	[3,352;10,647]
Corporate Taxes	-1,085	-3,475	-8,209
	[-655;-1,515]	[-2,159;-4,791]	[-5,408;-11,010]
Unemployment Benefits			
ALG I	-2,789	-4,584	-8,128
	[-3,237;-2,341]	[-5,807;-3,303]	[-10,656;-5,600]
ALG II	-3,920	-6,443	-11,423
	[-4,549;-3,291]	[-8,162;-4,643]	[-14,976;-7,870]
Wage Subsidies	580	1,528	3,190
	[597;565]	[1,598;1,457]	[3,339;3,041]
Total	-10,090	-12,197	-16,391
	(5.28%)	(16.73%)	(31.99%)

Source: Own calculations. 95 percent confidence intervals in brackets. Shares of output effects in parentheses.

A Estimation of price-elasticities of labor demand

Following Jacobi and Schaffner (2008), we postulate a system of cost share equations that is derived from a standard translog cost function,

$$S_{it} = \beta_i + \sum_{j=1}^{5} \beta_{ij} \ln w_{jt} + \beta_{iy} \ln Y_t + \beta_{ik} \ln K_t + \beta_{iv} \ln V_t + \beta_{it} Q_t + u_{it}, \quad (6)$$

where S_{it} is the wage bill of workers of group $i = 1, \ldots, 5$, expressed as a share of the overall wage costs in an industry at time t, while w_j indicates the wage of group j, output is represented by Y_t, K_t is the capital stock, V_t intermediate input, Q_t a vector of period dummies, and u_{it} a random disturbance term. Thus, capital and intermediate inputs are treated as quasi-fixed inputs and output is held constant as well. Since the shares S_{it} always sum to unity, each of the share equations can be expressed as a linear combination of the others. Therefore the system of share equations is singular and cannot be estimated without additional identifying restrictions. Typically, one of the equations is omitted and the following conditions, which are implied by the linear homogeneity of the cost function, are taken into account:

$$\sum_{i=1}^{5} S_i = 1 \quad (7)$$

and

$$\sum_{i=1}^{5} \beta_i = \sum_{j=1}^{5} \beta_{ij} = \sum_{i=1}^{5} \beta_{ix} = 0 \qquad \forall x = y, k, v, t. \quad (8)$$

The static model specified in equation (6) assumes that firms always produce on their long-run optimal level, i.e. it is assumed that costs are minimized with respect to all input factors and that adjustment occurs instantaneously and without costs. The assumption of instantaneous adjustment, however, does not appear to be realistic, because firms have incomplete information on future input and output prices. Furthermore, the adjustment of output and employment in reaction to price changes involves costs such as hiring and firing costs or costs for firm-specific training. Because of these costs, adjustment is typically delayed, leading to an autocorrelation of the error terms of the cost function as well as the share equations.

To take adjustment costs into account, Jacobi and Schaffner (2008) employ the General Error Correction Model (GECM) proposed by Anderson and Blundell (1982). Under the assumption that the lag structures of the dependent and independent variables are the same, specification tests suggest that the best-fitting dynamic specification of the GECM includes only one lag. Using the summing-up conditions,

Jacobi and Schaffner (2008) leave out the last cost share equation and estimate the following model

$$\begin{aligned}\Delta S_{it} &= \sum_{j=1}^{5} a_{ij}\Delta \ln w_{jt} + \sum_{x} a_{ix}\Delta \ln x_t \\ &\quad -\sum_{j=1}^{4}\left[d_{ij}\left(S_{j,t-1} - \beta_j - \sum_{k=1}^{4}\beta_{jk}\ln\frac{w_{k,t-1}}{w_{5,t-1}} - \sum_{x}\beta_{ix}\ln x_{t-1}\right)\right] \\ &\quad +u_{it} \end{aligned} \tag{9}$$

for $i = 1, \ldots, 4$. The authors use a fixed-effects approach to account for heterogeneity on the industry level and seasonal effects. Based on model (9), the own-price (η_{ii}) and cross-price elasticities (η_{ij}) of factor demand can be calculated as:

$$\eta_{ij} = \frac{\beta_{ij}}{S_i} + S_j \qquad \forall i \neq j \tag{10}$$

$$\eta_{ii} = \frac{\beta_{ii}}{S_i} + S_i - 1 \qquad \forall i \tag{11}$$

The estimates are performed using different data sources. Information on employment and wages on the industry level is taken from the *Employment Panel*, a 2% sample drawn from quarterly employment statistics of the Federal Employment Agency, which registers all individuals subject to social security contribution at a given date (see Koch and Meineken, 2004). Note that the data does not cover civil servants and most self-employed individuals. The empirical analysis of Jacobi and Schaffner (2008) covers the period from the 2nd quarter of 1999, which is the first wave with information on marginal part-time workers, to the fourth quarter of 2005.

The data set contains roughly 226,000 individuals, providing information on basic individual characteristics, occupational characteristics and some characteristics of the establishment. Wages are censored above by the assessment threshold for social security contributions ("Bemessungsgrenze"). Median wages are, however, not affected by censoring. Missing information on the level of education is imputed using information of previous or subsequent waves (for non-students only). Furthermore, individual data is aggregated on the 2-digit industry level, excluding agriculture, fishery, forestry, mining, and private households to guarantee reliable figures for each cell. Due to the smaller sample size, more industries have to be grouped in Eastern Germany. The final data set used for estimation represents a panel of 27 waves and 40 industries for West and 23 industries for East Germany.

To generate the total number of full-time equivalent employees and the medium gross wage per hour by employment category for each wave and industry, Jacobi and Schaffner (2008) merged the Employment Sample with data on working hours

from the *Microcensus*. Because the Microcensus provides data only on a yearly basis, the same information on working hours is used for each wave within a given year.

Data on the output (gross value added), the net capital stock, intermediate inputs, and deflators on the 2-digit industry level are taken from national accounts (Statistisches Bundesamt, 2007b). Because information is not available on the regional level, the authors use the same national data for West and East Germany. Quarterly data on the net capital stock is not available. Therefore, quarterly data of investment is used assuming that depreciation is constant within each year. All variables are measured in constant prices of the year 2000.

B Taking the output effect into account

Additionally to the approach of Jacobi and Schaffner (2008), we estimate uncompensated elasticities. In a translog cost function approach, profit functions have to be estimated simultaneously to quantify output effects. Because of the lack of adequate profit data, we rely on the approach of Fitzenberger and Franz (2001) who estimate output effects without a profit function.

Their approach is based on the commodity demand Y in an industry, which is defined as an isoelastic function of the output price p:

$$\ln(Y) = ln(D) + \eta \cdot ln(p), \tag{12}$$

where D is an industry- and time-specific autonomous demand term. It is assumed that firms (industries) maximize their profits under monopolistic competition:

$$max\ p(Y) \cdot Y - C(Y),$$

where C(Y) is the cost function and $p(Y)$ is the inverse function of (12). The first-order condition is

$$\begin{aligned} \frac{Y^{1/\eta}}{D^{1/\eta}}\left(1+\frac{1}{\eta}\right) &= \frac{dC(Y)}{dY} = MC \\ \Rightarrow \eta &= \frac{d\ln(Y)}{d\ln(MC)}, \end{aligned}$$

where MC are the marginal costs of production. Under the assumption of a constant elasticity η, the output elasticity with respect to a change of the wage in group k, η_{Yk}, can be written as

$$\eta_{Yk} = \frac{\partial \ln(Y)}{\partial \ln(w_k)} = \frac{\partial \ln(Y)}{\partial \ln(MC)} \cdot \frac{\partial \ln(MC)}{\partial \ln(w_k)} = \eta \cdot \frac{\partial \ln(MC)}{\partial \ln(w_k)}.$$

The advantage of this approach is that it is only necessary to estimate $\frac{\partial \ln(MC)}{\partial \ln(w_k)}$ and the demand elasticity η instead of the profit function.

The marginal costs MC are defined as

$$MC = \sum_i w_i \frac{\partial L_i}{\partial Y}.$$

To simplify, Fitzenberger and Franz (2001) assume that the labor demand elasticities η_{iY} are constant with respect to changes in the output. The marginal costs are given by

$$MC = \sum_i \frac{w_i L_i}{Y} \ \eta_{iY}.$$

The differentiation of the marginal costs with respect to the different wages w_i leads to

$$\begin{aligned} \frac{\partial ln(MC)}{\partial ln(w_k)} &= MC^{-1} \left(\sum_{i \neq k} \frac{w_i L_i}{Y} \ \eta_{iY} \ \eta_{ik} + \frac{w_k L_k}{Y} \ \eta_{kY} \ (1 + \eta_{kk}) \right) \\ &= \frac{1}{\sum_i \frac{w_i L_i}{Y} \ \eta_{iY}} \left(\sum_{i \neq k} \frac{w_i L_i}{Y} \ \eta_{iY} \ \eta_{ik} + \frac{w_k L_k}{Y} \ \eta_{kY} \ (1 + \eta_{kk}) \right). \end{aligned}$$

C Additional Tables

Table 6: Compensated elasticities of substitution

Percentage change in the employment of:	**With respect to a percentage change in the wage of:**				
	Marginal	Part-Time	Low-Skilled	Semi-Skilled	High-Skilled
			West Germany		
Marginal	-0.8837	0.0773	0.1662	0.5845	0.0557
	(0.04)	(0.06)	(0.07)	(0.11)	(0.08)
Part-Time	0.0203	-0.6248	0.0531	0.3974	0.1540
	(0.02)	(0.07)	(0.06)	(0.12)	(0.06)
Low-Skilled	0.0448	0.0544	-0.8401	0.6078	0.1331
	(0.02)	(0.06)	(0.07)	(0.10)	(0.05)
Semi-Skilled	0.0247	0.0640	0.0955	-0.2590	0.0748
	(0.01)	(0.03)	(0.02)	(0.04)	(0.02)
High-Skilled	0.0101	0.1063	0.0896	0.3208	-0.5269
	(0.02)	(0.04)	(0.03)	(0.09)	(0.08)
			East Germany		
Marginal	-0.7302	0.1158	0.1280	0.4173	0.0691
	(0.09)	(0.06)	(0.11)	(0.23)	(0.24)
Part-Time	0.0136	-0.7028	-0.0152	0.5513	0.1532
	(0.01)	(0.04)	(0.02)	(0.06)	(0.04)
Low-Skilled	0.0484	-0.0491	-0.6302	0.7416	-0.1107
	(0.04)	(0.05)	(0.14)	(0.19)	(0.15)
Semi-Skilled	0.0095	0.1066	0.0445	-0.2891	0.1286
	(0.01)	(0.02)	(0.01)	(0.04)	(0.03)
High-Skilled	0.0056	0.1067	-0.0239	0.4633	-0.5517
	(0.02)	(0.04)	(0.03)	(0.09)	(0.09)

Source: Jacobi and Schaffner (2008), Tables 2 and 3.
Boot-strapped standard errors in parentheses.