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How robust are simulated employment effects of a legal minimum wage in Germany?

A comparison of different data sources and assumptions

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Abstract:

Several empirical minimum wage studies have recently been published that simulate employment effects of a federal minimum wage in Germany. We disentangle various factors that explain the variation in previous simulation results. Based on data from the German Socio-Economic Panel and the newly available 'Verdienststrukturerhebung 2006' we conduct robustness analyses that systematically test the range in the outcomes of different labor demand simulations. We find that labor demand effects are sensitive to measurement errors in wages, the representativeness of the sample with respect to several types of labor inputs as well as estimated and assumed labor demand and output price elasticities. Interactions of those determinants may lead to substantial differences in simulation outcomes.

JEL classification: J23, J31, J38

Keywords: minimum wage, wage distribution, employment effects, labor demand

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Zusammenfassung:

In der letzten Zeit sind einige empirische Analysen veröffentlicht worden, in denen die Beschäftigungseffekte eines flächendeckenden gesetzlichen Mindestlohnes in Deutschland simuliert werden. In der vorliegenden Studie wird das Zusammenspiel verschiedener Faktoren untersucht, die die Variation in den Simulationsergebnissen erklären. Auf der Basis von Daten des Sozioökonomischen Panels und der Verdienststrukturerhebung 2006 werden Robustheitstests durchgeführt, die systematisch Abweichungen in den Ergebnissen von Arbeitsnachfragesimulationen testen. Es zeigt sich, dass geschätzte Arbeitsnachfrageeffekte sensitiv auf Messfehler in Stundenlöhnen, die Repräsentativität des Untersuchungssamples im Hinblick auf verschiedene Arbeitsinputs sowie geschätzte und unterstellte Arbeitsnachfrage- und Outputpreiselastizitäten reagieren. Interaktionen zwischen diesen Determinanten können zu substanziellen Abweichungen in den Simulationsergebnissen führen.

1 Introduction

In recent years the debate about the introduction of a statutory minimum wage for Germany has gained steam (see the debate in ifo Schnelldienst 6/2008 or the review in Schulten, 2009). Several empirical studies have been published that simulate the potential employment effects of a minimum wage.[1] The findings range from job losses of 1.2 million (Bachmann et al. 2008) to a comparably moderate net decrease in labor demand of 0.15 million (Müller & Steiner, 2008a). Various factors could be responsible for such substantial differences in the simulations: the data sets and related measurement errors, or the assumptions underlying the theoretical framework to calculate the labor demand effects. Differences in findings are only sporadically acknowledged in the existing papers, yet so far no attempt has been made to look at all potential factors responsible for the variation of the simulation results. Policy makers constantly and understandably complain about sizable differences in economic evaluations and forecasts, as long as no plausible explanations are offered. If the margin of findings is too broad, they do not help to illuminate potential consequences of specific policies.

This paper tries to systematically analyze the robustness of wage and labor demand effects of a minimum wage of 7.50 €/hour with regard to different data sources, measurement errors in wages and employment, as well as assumptions imposed and approaches employed for the simulation of employment effects. The aim is to get a clear picture of the likely consequences of a federal minimum wage in Germany, in particular of the magnitude of negative effects on the demand for labor. We use data from the latest wave of the German Socio-Economic Panel (SOEP) and the newly available 2006 wave of the 'Verdienststrukturerhebung' (VSE) provided by the German Statistical Office to compare different assumptions and data sources. We find that labor demand effects are sensitive to measurement errors in wages, the representativeness of the sample with respect to several types of labor – especially marginally employed – as well as estimated and assumed labor demand elasticities. Interdependencies of those determinants may lead to substantial differences in simulation outcomes.

The paper is structured as follows: section 2 briefly reviews the methodological issues of simulating the effects of a statutory minimum wage on the distribution of wages and the demand for labor and identifies critical determinants for the magnitude of the estimated effects. Section 3 compares the existing minimum wage studies for Germany with respect to the data sets used, the assumptions imposed, and the wage and employment effects found. Section 4 presents the empirical results. Section 5 concludes.

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[1] Recent ex ante evaluation studies include Kalina & Weinkopf (2007), DIW (2006), Bachmann et al. (2008), Ragnitz & Thum (2007, 2008), Knabe & Schöb (2008), Müller & Steiner (2008a). The lone ex post analysis on employment effects of the minimum wage was conducted by König & Möller (2008).

2 Methodological remarks

The simulated effects on the demand for labor are determined, first, by the wage and employment levels on which the simulations are based. Depending on the data set chosen measurement errors with respect to low wages or certain types of employment may occur. Second, it is crucial which theoretical and empirical framework is employed to calculate the effects on labor demand with the most obvious choice regarding labor demand elasticities. In this section we will briefly touch on both methodological points.

Choice of data set: measuring low wages and employment levels

In previous studies three different data sets have been used to calculate wage and employment changes induced by the minimum: the German Socio-Economic Panel (SOEP), the BA-Employment Panel (BAP) and the 'Gehalts- und Lohnstrukturerhebung' (GLS). Representativeness is assured by using the population weights of the respective data set. The *SOEP* is a household survey which is representative for dependent employees but suffers from a small number of observations in special segments of the labor market (Haisken-DeNew & Frick, 2005). People report wage income on a monthly basis but working hours on a weekly basis which may induce measurement errors for calculated hourly wages, especially at the bottom of the wage distribution. The number of jobs is underrepresented in individual-specific analyses that focus on the first job reported by the SOEP respondent. This happens as soon as a person holds several jobs, e.g. has a secondary (often marginal or part-time) employment contract.

The *BAP* is representative only for employment subject to social security contributions (Schmucker & Seth, 2008). Information about marginal employment is also included but may be overrepresented in this case-based data set, if individuals have several short-term contracts over the course of the calendar year. The main restriction of this data set for a minimum wage analysis is the lack of information about working hours. Papers like Freier & Steiner (2007) or Jacobi & Schaffner (2008) where labor demand elasticities are estimated on the basis of the BAP impute hourly wages on the sectoral level from the German Micro Census. Bachmann et al (2008) or Bauer et al. (2008) use the BAP only to measure employment levels.

The *GLS* is a linked employer-employee data set provided by the German Federal Statistical Office (Hafner, 2006). The 2001 wave does not include employees in firms with less then 10 employees and several sectors of the economy (e.g. agriculture, public services, health care and social services). For the empirical comparison with the SOEP of this paper we use the latest wave of this data set from the year 2006 which goes under the name of 'Verdi-

enststrukturerhebung' (*VSE;* see Statistisches Bundesamt, 2009). The large sample size (> 1 million observations) enables precise estimations for sub-groups of employees. The VSE's greatest advantage is that the hourly wage measures are more reliable than in household surveys like the SOEP, since the information comes directly from the firm and is based on the employment contract. Measurement errors due to incomplete memory of the respondent, discrepancies between reported working hours and wage income are therefore less of a problem. On the other hand several drawbacks of the data have to be acknowledged. First and foremost firms with less than or equal to 10 employees are not represented in the sample. Second, certain sectors (agriculture, public sector and household services) are still not included in the latest wave. Both gaps lead to a systematic under-representation of certain individuals. Marginally employed, e.g., work more often in small firms (see Müller & Steiner 2008b). Third, the VSE is not a panel data set and lacks information about the household context.[2] In the simulations of this paper wage data for the SOEP and VSE is extrapolated up to the year 2008 with a constant realized growth rate for the year 2007 and a constant predicted growth rate for the year 2008.[3]

Since the omission of small firms in the VSE would lead to a downward bias of the wage and employment effects of the minimum wage, we use the SOEP data to adjust the VSE data. On the basis of the SOEP we calculate correction factors for each wage and employment indicator as well as for every sub-group and simulation scenario in the following way:

$$(1) \qquad corr_i = m_i^{all} / m_i^{no\ firm<10},$$

with $corr_i$ being the adjustment factor and m_i being any wage or employment measure for the full sample and the restricted sample without small firms for a given sub group *i*. Since we only observe $m_i^{no\ firm<10}$ in the VSE data we adjust this measure be pre-multiplying $corr_i$. We will show and discuss the magnitude of this adjustment by robustness tests for the VSE data without information on small firms in section 4 below.

Calculating wage effects

To simulate effects of the minimum wage on the wage distribution one compares the empirical distribution of hourly wages to a hypothetical distribution under the proposed minimum

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[2] For 30% of male and 50% of female individuals in marginal employment 'actual' and 'contracted' working hours are missing in the VSE and were filled in by hot-deck imputation using nearest-neighbor propensity score matching. Estimation and matching results are available from the author upon request.

[3] Like in Müller & Steiner (2008a, b) SOEP data are used for wage information of the previous calendar year. Müller & Steiner (2008b) show that simulation results do not change significantly if wages are extrapolated on the basis of individual growth rates within a dynamic wage growth model.

wage (*MW*). Most studies work with *MW=7.50 €/hour* since this is frequently proposed in the public debate. We will use this value throughout the paper. For the hypothetical distribution hourly wages below or equal to the federal minimum are replaced by *MW*. One can then readily calculate the wage adjustment for the empirical mean of all observations, certain percentiles or groups of the labor market.

$$(2) \qquad \%\Delta w_{it}^{MW} = \frac{w_{it}^{MW} - w_{it}^{SQ}}{w_{it}^{SQ}}$$

Here $\%\Delta w_{it}^{MW}$ is the percentage change in wages for certain types of jobs or segments of the labor market *i* in period *t*. The change depends on the average level of wages under the status quo (w_{it}^{SQ}) and the hypothetical mean wage after the minimum wage is introduced (w_{it}^{MW}).

Measuring hourly wages determines the degree of wage compression induced by the minimum and in turn the simulated effects on labor demand. Therefore the choice of the data set and potential measurement errors at the bottom of the hourly wage distribution in those data sets may account for differences in the results. All papers compared in section 3 in principle follow this simple approach. The studies differ, however, with respect to *i* and *t*: while some papers only consider the overall wage distribution, others differentiate between skill groups and types of employment, others also between West and East Germany and women and men. Not all analyses extrapolate wages up to the current year, although nominal wages from earlier years do not represent the wage effects of a minimum wage in the current year.

Note that in this simple approach spill-over effects on wages are ruled out which leads to a pile-up of wages at the minimum wage with hourly wages above the threshold remaining constant after the introduction of the minimum. There are theoretical approaches modeling spill-over effects explicitly (see e.g. Dickens et al., 1998) as well as empirical papers providing evidence for wage effects on higher quantiles of the wage distribution (see Autor et al., 2009 for a recent example). Under these more general assumptions the magnitude of wage and ultimately employment effects might be higher than in the simulations we consider in this paper.

Simulating labor demand effects

The ex ante evaluation of labor demand effects can be based on different labor market models. Fitzenberger (2009) gives an excellent brief review of the theoretical and empirical debate on the employment effects and relates it to the German situation. Within the neo-classical textbook-model of a competitive labor market employment effects of the introduction or increase of a statutory minimum wage above the market equilibrium wage results in lower em-

ployment levels (see overview in Brown, 1999). In this case employment is solely determined by the downward-sloping labor demand curve with the magnitude of employment losses depending on the labor demand elasticity. If there is imperfect competition on the labor market (or in some segments), e.g. firms have market power, the effects depend on further assumptions. In a standard monopsony model without wage discrimination a minimum wage set between the wages paid by the employer and the competitive market equilibrium leads to higher wages and employment. If the minimum is set above the equilibrium, employment decreases similar to the competitive market model (Neumark & Wascher, 2007). Some new papers show that even when the minimum is set below the competitive-market equilibrium negative employment effects occur under heterogeneous skills in the labor force (see Cahuc and Laroque, 2009). Positive employment effects of the minimum wage can also be explained by models of segmented labor markets (see Lang & Kahn, 1998) or within general equilibrium search models (Flinn, 2006; Ahn et al., 2005).

There are two main approaches to simulate ex ante employment effects of a minimum wage in Germany. The first which is used by Ragnitz & Thum (2007) as well as Knabe & Schöb (2008) is based on the textbook neoclassical model with a decreasing iso-elastic labor demand function of the form $L(w) = (w^{SQ})^{\varepsilon}$ with ε being an assumed labor demand elasticity of -0.75. Employment losses ($\%\Delta L^{MW}$) result from the difference between the proposed minimum wage (MW) and w^{SQ} cumulated over all employees affected by the minimum:

$$(3) \qquad \%\Delta L^{MW} = \left(\frac{MW}{w^{SQ}} \right)^{\varepsilon}$$

The approach does not distinguish between different types of labor, although heterogeneity is incorporated by individual-specific w^{SQ} as a measure of productivity. Substitution between different labor market groups is ruled out in this framework, though. The second approach which is employed by Bachmann et al. (2008), Bauer et al. (2008), and Müller & Steiner (2008a) explicitly takes labor-labor substitution into account. For a given capital stock labor demand effects for group i (ΔL_i) are thus determined not only by group-specific relative wage changes ($\%\Delta w_{it}^{MW}$) and the group's share of total wage costs (c_{it}), but also by wage elasticities of labor demand.[4] Regarding demand elasticities direct and indirect effects can be distin-

[4] Müller & Steiner (2008a) distinguish between skilled (secondary-school education or vocational training) and unskilled (neither secondary-school education nor vocational training) full-time workers, part-time workers and marginally employed; highly skilled workers are assumed to be a quasi-fix factor in the short run. The groups are divided by gender yielding 8 different categories. Bachmann et al. (2008) and Bauer et al. (2008) distinguish high-, semi-, and low-skilled full-time workers, part-time and marginal employment. In all studies elasticities are also estimated separately for West and East Germany.

guished. For given wages and production factors as well as a given demand for goods the direct effect results from the substitution that follows the increase in the cost of labor compared to other factors. Indirect effects result from the substitution between different labor categories that are all, but to a different degree, affected by the minimum wage. These effects are captured in the model by the (Hicks/Allen-) substitution elasticities (σ_{ij}). Labor demand is further reduced by a decreasing demand for goods as a result of higher production costs and prices which is depicted by the price elasticity of the demand for goods (η).[5] The index runs from *i=1, .., J* according to the distinguished groups (see footnote 4). The partial minimum wage effect could be positive for certain groups if they were substitutes for other employees:

$$(4) \qquad \Delta L_i = \sum_{j=1}^{J} c_j (\sigma_{ij} + \eta)(\%\Delta w_{it}^{MW}) L_i$$

To sum up the methodological discussion differences in simulation results are determined by the choice of the data set which influences the induced wage changes ($\%\Delta w_{it}^{MW}$), the level of employment in total and for different groups (L_i) and the relative size of wage costs (c_j). Depending on the labor demand model chosen the estimated or assumed labor demand and output price elasticities ($\varepsilon, \sigma_{ij}, \eta$) also affect simulation results. We will now compare the existing studies with respect to those determinants.

3 Comparison of existing studies

The discussion of the last section showed that differences in simulation results may be attributed to discrepancies in the measurement of wages and employment levels as well as the framework under which labor demand effects are calculated. Table 1 points out and compares key differences in existing empirical minimum wage studies for Germany that help to explain the wide range of simulation results.[6] First, the analyses are based on various *data sets*. Some studies – like Müller & Steiner (2008a) or Knabe & Schöb (2008) – work solely with household survey data from the SOEP. All SOEP based studies adjust population weights for missing items in the wage and employment variables. In addition, Knabe & Schöb (2008) reweight the data to conform to aggregate figures for full-, part-time and marginal employment reported by the Federal Statistical office of Germany. Others papers, like Bachmann et al. (2008) and Bauer et al. (2008), combine the SOEP with administrative data from the BAP.

[5] Adjustments of the capital stock are usually not considered in this framework. In the long run it is likely that low-skilled labor is substituted by capital.

[6] Table 1 lists only ex ante evaluations of the labor demand effects for the whole German economy. Therefore König and Möller's (2008) paper which is an ex post evaluation of the sectoral minimum wage in the German construction sector is not included in this comparison.

Ragnitz & Thum (2007) use data from the GLS 2001. In this paper we employ the latest, more comprehensive version of this type of data, named VSE 2006.

Second, depending on the data set and restrictions on the wage distribution (imposed in some, not all of the papers) the *measured wage levels* in the first decile are markedly different. Bachmann et al. (2008), for instance, report an average wage of 4.38 €/hour in the bottom decile, whereas Müller & Steiner (2008a) who exclude wages below 3 €/hour because they consider them to be unreliable[7] find a mean of 5.95 €/hour in the first decile of their sample, similar to Bauer et al. (2008). The average hourly wage in the data set Ragnitz and Thum (2007) use amounts to about 5.00 €/hour for the year 2001. The mean in the first decile is in all data sets influenced by very low wages at the bottom of the distribution which, for many observations, are below 1 €/hour.

The SOEP is more affected by implausibly low hourly wages. We will come back to this in the next section and discuss which assumptions are more realistic. Measured wage levels do not only affect the average wage growth induced by a federal minimum wage but also the share of people affected. In Bachmann et al. (2008) the share of people affected amounts to 25 %, in Knabe & Schöb (2008) as well as Ragnitz & Thum (2007) the share is about 13 % of all employees. Müller and Steiner (2008a) report an average incidence of only about 10 %.

Third, the various data sets not only yield diverse wage levels but also differ with respect to the *number of employees represented*. For those studies that differentiate between different types of employment the quantities of marginally employed are of particular interest as their mean hourly wages are lower compared to other types of employment. Using data from the BAP the studies by Bachmann et al. (2008) and Bauer et al. (2008) are based on nearly 26 million employees in total, among them ca. 4 million marginally employed persons. They assume that wage changes calculated with SOEP data translate to the BAP employment figures. After re-weighting their sample Knabe & Schöb (2008) even start with nearly 33 million employees (also about 4 million marginally employed) whereas Ragnitz' & Thum's (2007) calculations are based on only about 18 million employees. This is explained by the above-mentioned gaps in the GLS data with regard to certain sectors and firms with less than 10 employees. Müller & Steiner (2008a) work with a more restricted SOEP sample[8] that represents about 24 million people and 2.7 million marginally employed.

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[7] Unemployment benefit recipients who work to boost their transfer income (so-called 'Aufstocker') may exhibit hourly wages below 3 €/hour. These cases are not excluded from their sample.

[8] The age restriction of 18-65 years is due to the fact that the data is used in a microsimulation model investigating the income effects of the minimum wage including the adaption of labor supply and demand. The analysis of employment effects focuses on the core working age population. Moreover, the results are based on the first jobs of the respondents. In another paper Müller & Steiner (2008b) discuss the robustness of the wage effects with respect to the inclusion of secondary jobs. We will address this issue in the next section.

Table 1 Wage and employment effects of a minimum wage of 7.50 €/hour in Germany – a comparison of different empirical studies

Study	Data Source	Restriction on wage distribution/ forward projection of wages	Wage effects			Labor demand elasticities		Employment effects		Notes
			avg. wage 1st decile (€/h)	avg. wage growth (%)	people affected by MW (%)	(comp.) price elasticities	elasticities with respect to change of output and price of input	No. employees overall, (marginal employment)	Δ employment (%Δ employment)	
Bachmann et al. (2008)	SOEP, wave 2006; BAP, wave 2005	no restrictions on wage distribution, wages not extrapolated	4.38 €/h	5.72 %	25.3 %	estimated, 5 skill groups (Jacobi & Schaffner, 2008)	[1]	25,936,867 (3,973,570)	-1,189,430 (-4.59 %)	wage data from SOEP, employment data from BA-Employment Panel
Bauer et al. (2008)	SOEP, wave 2007; BAP, wave 2006	2.5% of hourly wages distribution cut off at bottom and top, wages not extrapolated	6.05 €/h[2]	[1]	19.5 %	estimated, 5 skill groups (Jacobi & Schaffner, 2008)	output: 1 input of labor: -0.2	25,755,439[3] (4,039,309)[3]	-860,000 (-3.34 %)	wage data from SOEP, employment data from BA-Employment Panel
Ragnitz/ Thum (2007)	GLS, wave 2001	no restrictions on wage distribution, wages not extrapolated	4.59 €/h[4]	2.44 %[4]	12.8 % (West: 11.3% East: 26 %)	assumed constant labor demand elasticity: -0.75		18,500,000[5]	-1,100,000 (-6.08 %)	apprentices included, certain sectors and firms <10 employees not included
Knabe/ Schöb (2008)	SOEP, wave 2007	hourly wages < 2.75€/h set to 2.75€/h, extrapolated to 2010	[1]	[1]	12.8 %	assumed constant labor demand elasticity: -0.75		32,869,740 (3,926,480)	-842,033 (-2.6 %)	
Müller/ Steiner (2008a)	SOEP, wave 2007	hourly wages < 3€/h and >150€/h excluded, extrapolated to 2008	5.95 €/h	1.01 %	10.0 %	estimated, East/West, 4 skill groups (Freier & Steiner, 2007)	different scenarios: 0, -0.5, -1.0	24,100,000 (2,666,401)	-141,405 (-0.59 %)	
Present study	VSE, wave 2006	hourly wages < 3€/h and >150€/h excluded, extrapolated to 2008	7.03 €/h	0.39 %	5.6 %	estimated, East/West, 4 skill groups (Freier & Steiner, 2007)	different scenarios: 0, -0.5, -1.0	25,019,000 (2,408,000)	-290,653 (-0.48 %)	

[1] Not reported. [2] Refers to the hourly wage in 10th percentile, not the average hourly wage in the first decile. [3] Full-time equivalents. [4] Figure not reported; the author's own calculations with data from GLS 2001 after eliminating observations with negative hourly wages. [5] Figure not reported; the author's own calculation on numbers reported in the study with respect to absolute figures and the share of people affected by the minimum wage as reported.

Fourth, the studies diverge with respect to the assumed *labor demand* and *output price elasticities*. Ragnitz' & Thum's (2007) like Knabe's & Schöb's (2008) calculations are based on a uniform labor demand elasticity of -0.75. They do not analyze different types of employment and substitution between these groups. Bachmann et al. (2008) and the follow-up study by Bauer et al. (2008) are based on empirical labor demand elasticities for different skill groups and types of employment (estimated by Jacobi & Schaffner, 2008). The substitution patterns depend on cross-price elasticities and relative wage changes between the groups. Bauer et al. (2008) also explicitly assume a production function with constant returns to scale, i.e. an elasticity of one with respect to output changes. Moreover they work with an elasticity of -0.2 with respect to the increase in wage costs. Müller & Steiner (2008a) also apply the latter approach on the basis of estimated labor demand elasticities (Freier & Steiner, 2007). They simulate employment effects for different output price elasticities of 0, -0.5 and -1.

Against the background of the factors compared and how those factors are related it becomes clear why the *results* of the labor demand simulations exhibit such glaring differences. The large employment loss of 1.2 million jobs predicted by Bachmann et al. (2008) is driven by very low wages measured with SOEP data which lead to a steep increase in average wages as a consequence of the minimum wage. Since their numbers of employees are based on the BAP, the quantity of marginally employed is larger compared to the levels found with SOEP data. The estimated elasticities are also somewhat larger compared to those used by Müller & Steiner (2008a). The restriction of the observed wage distribution at the bottom and top in the follow-up study by Bauer et al. (2008) in itself reduces the negative employment effects by more than one percentage point from about -4.5 % to -3.3 % of the labor force. Knabe & Schöb (2008) also find considerable negative effects of -0.85 million jobs. They restrict the sample at the bottom of the wage distribution and also report a markedly lower share of people affected by the minimum wage. They re-weight their SOEP sample to represent nearly 33 million employees which is by far the largest number of all studies compared. Moreover, they assume homogeneous labor as well as a constant labor demand elasticity. With that same approach Ragnitz and Thum (2008) simulate an even larger decrease in employment of 1.1 million people. Although they report an identical share of people affected by the minimum, their GLS sample represents only about 18 million employees. The resulting relative employment loss of 6 % is highest among all analyses of Table 1. The comparably steep average increase in wages is driven by apprentices who are included in their sample. All other papers exclude apprentices because minimum wage laws in all likelihood would not apply to them. On the opposite the moderate negative effects of -150,000 employees found by Müller & Steiner (2008a) can be explained by a narrower sample leading to markedly lower average wage in-

creases, a lower total labor force represented, a smaller number of marginally employed as well as substitution effects between marginal and predominantly part-time employment. Moreover the labor demand elasticities used for the simulation are smaller then those used by Bachmann et al. (2008) and Bauer et al. (2008).

The preceding comparison showed why simulation results may diverge and that similar findings occasionally are based on very different data sets. The questions to be answered in the empirical analysis of this paper are: Which factors are most crucial to explain the differences in the simulation results? Are very low hourly wages at the bottom of the wage distribution realistic or can they be attributed to measurement error? How should observations with low wages at the bottom of distribution be treated? To tackle these questions empirically we will test some of the assumptions on the basis of the latest wave of SOEP data and compare the results with newly available data from the VSE 2006.

4 Empirical results

This section presents results of a robustness analysis for wage and employment effects of the minimum wage with respect to the measurement of hourly wages and employment levels, the identification of people affected by the minimum wage and some central assumptions made for the simulation of labor demand effects. First, we discuss the issue of measuring hourly wages. Second, we compare the total numbers of employed as well as labor demand effects. We use the latest wave of the SOEP from the year 2007 and compare different simulations with results from the 2006 wave of the VSE.

Wage effects

Table 2 shows how many employees would be affected and how the wage distribution would change after the introduction of a minimum wage of 7.50 €/hour when employment effects are ignored. The upper part of Table 2 is based on SOEP data under different sample restrictions. As in Müller & Steiner (2008a) the standard scenario (1) is based only on wages and working hours of the first reported job (secondary wage income is neglected), restricted to individuals 18-65 years of age and hourly wages between 3 €/hour and 150 €/hour.[9] Simulations (2) to (5) relax different assumptions at a time: in (2) the complete wage distribution is analyzed as long as wages are positive; in (3) hourly wages lower than 3 €/hour are set to the margin of 3 €/hour and remain in the sample; in (4) no age restrictions are imposed; and (5) uses the assumptions from (1) but takes also hourly wages from secondary jobs into account.

[9] Like in Müller & Steiner (2008a, b) benefit recipients that have a marginal job to top up their income are excluded from this restriction, see footnote 3 above.

Table 2 Wage distribution before and after the introduction of a minimum wage of 7.50 €/hour, people affected, currently employed people only, Germany, 2008

	SOEP									
	(1) Standard		(2) No restriction on distribution		(3) Wages <3 €/h set to 3 €/h		(4) No age restriction		(5) Secondary jobs included	
People affected (%)										
overall	9.39		11.14		11.14		9.92		11.66	
within 1st decile	95.00		100.00		100.00		100.00		100.00	
	No MW	MW	No MW	MW	No MW	MW	No MW	MW	No MW	MW
1st-10th percentile	6.02	7.50	5.20	7.50	5.40	7.50	5.97	7.50	5.45	7.50
	(1.48; 24.58)		(2.30; 44.23)		(2.10; 38.89)		(1.53; 25.63)		(2.05; 37.61)	
1st-5th percentile	5.09	7.50	3.82	7.50	4.23	7.50	5.07	7.50	4.42	7.50
	(2.41; 47.35)		(3.68; 96.34)		(3.27; 77.30)		(2.43; 47.93)		(3.08; 69.68)	
6th-10th percentile	6.98	7.50	6.57	7.50	6.57	7.50	6.95	7.50	6.49	7.50
	(0.52; 7.45)		(0.93; 14.16)		(0.93; 14.16)		(0.55; 7.91)		(1.01; 15.56)	
11th-15th percentile	8.12	8.12	7.86	7.88	7.86	7.88	8.09	8.09	7.72	7.77
	(0.00; 0.00)		(0.02; 0.25)		(0.02; 0.25)		(0.00; 0.00)		(0.05; 0.65)	
16th-25th percentile	9.62	9.62	9.39	9.39	9.39	9.39	9.60	9.60	9.15	9.15
	(0.00; 0.00)		(0.00; 0.00)		(0.00; 0.00)		(0.00; 0.00)		(0.00; 0.00)	
Median	14.50	14.50	14.50	14.50	14.49	14.49	14.41	14.41	14.22	14.22
	(0.00; 0.00)		(0.00; 0.00)		(0.00; 0.00)		(0.00; 0.00)		(0.00; 0.00)	
Mean	15.94	16.09	15.80	16.03	15.82	16.03	15.89	16.04	15.89	16.10
	(0.15; 0.94)		(0.23; 1.46)		(0.21; 1.33)		(0.15; 0.94)		(0.21; 1.32)	
	VSE									
	(6) Standard (with small firms)		(7) No restriction (with small firms)		(8) Wages <3 €/h set to 3 €/h (with small firms)		(9) Without small firms		(10) With apprentices (without small firms)	
People affected (%)										
overall	7.11		7.61		7.61		5.58		8.86	
within 1st decile	76.90		66.89		66.89		59.93		88.79	
	No MW	MW	No MW	MW	No MW	MW	No MW	MW	No MW	MW
1st-10th percentile	6.52	7.64	6.14	7.69	6.16	7.69	7.03	7.73	5.83	7.52
	(1.12; 17.14)		(1.55; 25.30)		(1.53; 24.76)		(0.70; 9.96)		(1.69; 28.99)	
1st-5th percentile	5.71	7.50	4.97	7.50	5.02	7.50	6.13	7.50	4.66	7.50
	(1.79; 31.24)		(2.53; 50.97)		(2.48; 49.43)		(1.37; 22.35)		(2.84; 60.94)	
6th-10th percentile	7.41	7.79	7.21	7.87	7.21	7.87	7.97	7.98	7.00	7.54
	(0.39; 5.20)		(0.66; 9.15)		(0.66; 9.15)		(0.01; 0.13)		(0.54; 7.71)	
11th-15th percentile	8.37	8.37	8.28	8.30	8.28	8.30	8.98	8.98	8.32	8.32
	(0.00; 0.00)		(0.02; 0.25)		(0.02; 0.25)		(0.00; 0.00)		(0.00; 0.00)	
16th-25th percentile	9.67	9.67	9.54	9.54	9.54	9.54	10.60	10.60	9.98	9.98
	(0.00; 0.00)		(0.00; 0.00)		(0.00; 0.00)		(0.00; 0.00)		(0.00; 0.00)	
Median	15.01	15.01	14.98	14.98	14.98	14.98	15.95	15.95	15.61	15.61
	(0.00; 0.00)		(0.00; 0.00)		(0.00; 0.00)		(0.00; 0.00)		(0.00; 0.00)	
Mean	16.91	17.03	16.92	17.07	16.93	17.07	17.91	17.98	17.44	17.60
	(0.11; 0.68)		(0.15; 0.89)		(0.14; 0.82)		(0.07; 0.39)		(0.17; 0.97)	

Notes: Wage data for 2006 are extrapolated to 2008 using average growth rates (2007: 1.02, 2008: 1.025). Only employed people aged 18-65 are included. Percentiles are defined for the wage distribution without the minimum wage. Means are calculated within the range of given percentiles. The numbers in parentheses refer to absolute and relative differences in the two wage measures. Weighted data using sample weights to obtain population means.

Source: Own calculations based on SOEP 2007 and VSE 2006.

The lower part of Table 2 is based on the VSE where simulation (6) imposes the same restrictions as in the SOEP standard specification (1); in scenario (7) the wage distribution is not restricted similar to (2); and in (8) wages below 3 €/hour are set to the margin if 3 €/hour as it is done in (3). Note that in simulations (6) through (8) the VSE sample is adjusted for the missing information on small firms (see section 2 above). Scenario (9) simulates the wage effects without this adjustment for small firms and variant (10) adds apprentices to the sample as in Ragnitz & Thum (2007).

Under the standard assumptions in simulation (1) nearly 10 % of all employees would be affected by the minimum wage with the share reaching almost 100 % in the bottom decile. Minimum wage effects are concentrated at the bottom of the wage distribution where the wage change induced by the minimum amounts to 1.48 €/hour which is about 25 %. Women are more strongly affected than men and workers in East Germany more than West German employees (see Tables A1 and A2 in the appendix).

Although the VSE data are corrected for missing information on small firms the same indicators are somewhat lower under the standard scenario (6): only about 7 % of employees are affected by a minimum wage of 7.50 €/hour. Wage effects are also limited on the first decile of the distribution where the average wage without the minimum is about 6.50 € leading to a wage increase of about 17 % following the introduction of the minimum wage. Since all assumptions are identical to the SOEP sample (1) the discrepancies in results can be explained by differences in the data sets. First, employees in certain sectors are omitted in the VSE. As Tables A3 and A4 in the appendix show, the share of people affected by the minimum for employees in agriculture and forestry that are missing in the VSE lies above the average. In addition, marginally employed people (40 %) who often work in those sectors are more strongly affected by the minimum compared to part-time (11 %) and full-time workers (5 %). Second, although the sample under scenarios (1) and (6) is restricted between 3 €/hour and 150 €/hour the observed wages at the bottom of the distribution seem to be clearly higher in the VSE. This discrepancy becomes clearer when several sample restrictions are relaxed.

How do the wage effects change under different assumptions? Not restricting the wage distribution at all in (2), setting very low wages to 3 €/hour in (3), or considering in addition secondary jobs in (5) has notable consequences for the percentage of workers affected in the SOEP sample. The share of employees affected by the minimum wage jumps highest from 10 % to more than 11.5 % under simulation (5). Relaxing the age constraints in (4) shows only minor effects. Differently restricted SOEP samples yield also substantially lower average wages in the bottom decile triggering stronger minimum wage effects. The largest average wage increase occuring with 2.30 €/hour (about 44 %) in variant (2) nearly doubles the find-

ings from the standard simulation. This shows how sensitive wage effects react to restrictions of the simulation sample at the bottom.

Relaxing the restrictions on the hourly wage distribution in the VSE sample has much smaller consequences for the simulation results. When the distribution is not restricted at all in simulation (7), the share of people affected increases only slightly to about 7.6 %. The relative change in the average wage of the bottom decile is pushed from 17 % in (6) to about 25 % in (7) showing that very low wages below 3 €/hour are rarely found in the VSE sample. This seems to be much more of a problem in the SOEP data. Therefore the wage distribution from the SOEP sample should be restricted at the bottom.

Simulation (9) shows the wage effects for the VSE sample without adjusting the data for missing information from employees in small firms. All indicators are significantly smaller compared to the standard scenario (6): the share of people affected is only about 5.5 % and the average wage change in the bottom decile induced by the minimum amounts to 0.70 €/hour or about 10 %. Tables A3 and A4 in the appendix demonstrate on the basis of SOEP and VSE data that the share of people affected by the minimum decreases monotonically with the firm size and is about twice as high in companies with less than 10 employees compared to firms with 100-200 employees and more than five times higher than in large companies with over 2000 employees. It is thus crucial to correct for missing information on small firms, if wage effects are simulated on the basis of the VSE sample. The consequences for the simulation of labor demand effects are discussed below.

Finally, including apprentices in the VSE data in (10) has a huge effect on the percentage of employees affected as well as the average wage increase in the bottom decile. The downward bias in wage effects compared to the SOEP from simulation (9) is completely reversed. The inclusion of apprentices in (10) pushes the empirical mean in the bottom decile to 5.80 €/hour which lies below the VSE scenario (6) and even below the SOEP simulation (1). The effect would be even higher, if the sample in (10) was not restricted at 3 €/hour because apprentices commonly earn very low hourly wages. Since they would in all likelihood not be subject to a statutory minimum wage, leaving apprentices in the VSE sample substantially biases the wage measures in the low wage segment downwards. All this explains findings based on GLS data which are comparable to SOEP findings, albeit on the basis of a completely different sample of individuals.

To conclude this sub-section we have shown that the simulation of wage effects crucially depends on the chosen sample and how this sample is restricted at the bottom of the wage distribution. Due to the omission of small firms and sectors with an above-average share of low wage employment raw samples from the SOEP and VSE are not directly comparable.

As mentioned above it is likely that wage information in the VSE is better. The fact that the share of wages below 3 €/hour is markedly smaller than in the SOEP seems to support the practice to restrict the sample at the bottom as is done by the majority of existing studies. How these differences in wage effects translate into employment effects will be discussed in the following sub-section.

Employment effects

The calculation of employment effects is based on the approach by Müller & Steiner (2008a) (see section 2 above). Table 3 therefore breaks down employment levels as well as wage levels and wage increases by different types of employment and skill levels (skilled and unskilled full-time, part-time and marginal employment).[10] As substitution elasticities (see Table A5 in the appendix) are estimated for men and women as well as West and East Germany, we also report separate results for these groups. The standard SOEP sample (1) represents about 24 million employees in total, among them 4 million in East Germany. If secondary jobs are included in variant (5), the size grows to about 26.5 million employment relationships in total. Secondary jobs are predominantly based on marginal employment contracts leading to a jump in employment levels of this group from 2.7 million to 4.7 million. The rest of the difference is made of part-time jobs which make out less then 300,000 additional employed; we do not find full-time employees in this group.[11] This kind of sample restriction has thus a significant impact on simulated labor demand effects not only by means of wage changes but also through employment levels on which the simulations are based. The sample restrictions (2) through (4) yield no or only minor effects for the estimated employment levels.

The standard VSE data sample (6) including the adjustment for small firms represents about 25.5 million workers (about 4 million in East Germany) which means that the VSE employment levels are slightly above those from the SOEP. There are several divergences to the SOEP figures: the levels for skilled and unskilled full-time employment in West Germany are higher in the VSE whereas in the East the full-time employment is rather similar in both samples. On the other hand – except for men in West Germany – the level of marginal employment is clearly higher in the SOEP data. These differences can be explained by missing sectors in the VSE sample (e.g. agriculture and forestry with above-average share of people affected, see table A3 in the appendix) that are not added here.

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[10] Since highly-skilled full-time employment is assumed to be a quasi-fix input factor by Freier & Steiner (2007) we do not report them in Tables 4 and 5.

[11] Since employment status is not reported for secondary jobs we use the legally defined threshold of 400 €/month for employee's exemption from social security contributions. Moreover we assume a threshold of 30 hours per month worked in a secondary job to distinguish full- and part-time employment.

Table 3 Number of employed people and changes in wages, West & East Germany, 2008

West Germany			(1) SOEP				SOEP robustness				(6) VSE with small firms[1]				VSE robustness			
			No MW		MW		Employed (1,000) No MW				No MW		MW		Employed (1,000) No MW			
			Em-ployed (1,000)	Avg. wage (€/hour)	Wage change (Δ€)	Wage change (Δ%)	(2) No restric-tion	(3) <3 = 3 €/h	(4) No age restr.	(5) Sec. jobs	Em-ployed (1,000)	Avg. wage (€/hour)	Wage change (Δ€)	Wage change (Δ%)	(7) No restric-tion[1]	(8) <3 = 3 €/h[1]	(9) no small firms	(10) appren-tices
Full-time	skilled	*women*	3,543	14.85	0.06	0.41	3,543	3,543	3,543	3,555	3,655	16.63	0.04	0.25	3,657	3,657	2,918	2,918
		men	7,180	17.79	0.03	0.19	7,180	7,180	7,188	7,180	8,777	21.39	0.01	0.05	8,783	8,783	7,694	7,694
	unskilled	*women*	584	11.33	0.10	0.90	584	584	584	584	646	13.25	0.06	0.45	647	647	557	557
		men	1,013	16.36	0.04	0.27	1,013	1,013	1,036	1,013	1,293	14.41	0.18	1.22	1,294	1,294	1,120	1,120
Part-time		*women*	4,824	14.14	0.17	1.22	4,824	4,824	4,882	4,904	4,431	15.40	0.03	0.17	4,433	4,433	2,833	2,833
		men	537	14.56	0.30	2.06	537	537	548	716	1,042	22.07	0.09	0.42	1,044	1,044	694	694
Marginally em-ployed		*women*	1,909	8.99	0.74	8.27	1,909	1,909	2,014	2,966	1,271	9.02	0.44	4.85	1,297	1,297	957	957
		men	428	10.48	0.58	5.56	428	428	526	1,221	548	9.16	0.46	5.06	561	561	428	428
Total			20,018				20,018	20,018	20,357	22,135	21,663				21,718	21,718	17,199	17,199

East Germany			(1) SOEP				SOEP robustness				(6) VSE with small firms[1]				VSE robustness			
			No MW		MW		Employed (1,000) No MW				No MW		MW		Employed (1,000) No MW			
			Em-ployed (1,000)	Avg. wage (€/hour)	Wage change (Δ€)	Wage change (Δ%)	(2) No restric-tion	(3) <3 = 3 €/h	(4) No age restr.	(5) Sec. jobs	Em-ployed (1,000)	Avg. wage (€/hour)	Wage change (Δ€)	Wage change (Δ%)	(7) No restric-tion[1]	(8) <3 = 3 €/h[1]	(9) no small firms	(10) appren-tices
Full-time	skilled	*women*	892	11.53	0.17	1.45	892	892	892	896	917	14.15	0.14	1.02	918	918	773	773
		men	1,652	13.20	0.10	0.78	1,652	1,652	1,652	1,652	1,543	14.65	0.08	0.55	1,544	1,544	1,288	1,288
	unskilled	*women*	56	11.37	0.23	2.01	56	56	56	56	66	12.70	0.30	2.33	66	66	54	54
		men	136	11.05	0.12	1.12	136	136	138	136	103	10.84	0.20	1.84	104	104	74	74
Part-time		*women*	795	12.11	0.27	2.21	795	795	796	817	968	12.64	0.19	1.53	968	968	546	546
		men	169	11.22	0.36	3.25	169	169	173	184	158	16.22	0.13	0.82	158	158	123	123
Marginally em-ployed		*women*	208	7.68	1.00	13.05	208	208	210	366	147	8.72	0.93	10.61	157	157	104	104
		men	123	9.01	0.44	4.87	123	123	154	231	102	8.10	1.00	12.37	109	109	68	68
Total			4,030				4,030	4,030	4,070	4,337	4,003				4,021	4,021	3,031	3,031

Notes: Qualification categories according to Freier & Steiner (2007): 'skilled' = secondary-school education or vocational training, 'unskilled' = neither secondary-school education nor vocational training. [1] Extrapolated for firms <10 employees using group-specific correction factors on the basis of SOEP data.

Source: Own calculations based on SOEP 2007 and VSE 2006.

Table 4 Changes in labor demand (heads), West & East Germany, 2008

West Germany			**SOEP**							**VSE**				
			(1) Output price elasticities			Sample restrictions[1]				Output price elasticities			Sample restrictions[1]	
			(1a) 0	(1b) -1	(1c) -2	(2) no restric-tion	(3) wages <3 €/h set to 3 €/h	(4) no age re-striction	(5) sec. jobs included	(6a) 0	(6b) -1	(6c) -2	(9) with-out small firms[2]	(10) ap-prentices included
Full-time	skilled	*women*	-13,433	-32,772	-52,110	-45,818	-42,341	-31,732	-29,159	-4,514	-39,735	-74,956	-11,942	-11,970
		men	14,874	-24,316	-63,505	-34,449	-31,936	-24,547	-23,250	65,239	-19,345	-103,928	-6,239	-6,242
	unskilled	*women*	-907	-4,097	-7,286	-7,037	-6,228	-4,211	-3,983	1,851	-4,374	-10,600	-1,501	-1,503
		men	4,010	-1,521	-7,053	-2,671	-2,359	-1,773	-1,741	-33,961	-46,425	-58,888	-869	-866
Part-time		*women*	31,887	5,557	-20,773	17,186	13,388	3,565	159	29,793	-12,908	-55,609	6,673	6,711
		men	5,132	2,198	-735	-7,090	-4,231	1,551	3,323	-16,675	-26,718	-36,760	-90	-103
Marginally employed		*women*	-81,463	-91,880	-102,297	-152,576	-134,777	-92,239	-123,380	-48,335	-60,587	-72,840	-26,948	-27,047
		men	-10,024	-12,362	-14,699	-27,862	-23,369	-16,141	-27,315	-24,838	-30,118	-35,397	-6,704	-6,735
Total			**-49,924**	**-159,191**	**-268,459**	**-260,318**	**-231,852**	**-165,527**	**-205,346**	**-31,440**	**-240,209**	**-448,978**	**-47,621**	**-47,755**
East Germany			**SOEP**							**VSE**				
			Output price elasticities			Sample restrictions[1]				Output price elasticities			Sample restrictions[1]	
			(1a) 0	(1b) -1	(1c) -2	(2) no restric-tion	(3) wages <3 €/h set to 3 €/h	(4) no age re-striction	(5) sec. jobs included	(6a) 0	(6b) -1	(6c) -2	(9) with-out small firms[2]	(10) ap-prentices included
Full-time	skilled	*women*	-1,684	-13,689	-25,694	-21,290	-19,386	-13,900	-13,339	-3,898	-14,196	-24,494	-10,088	-10,103
		men	2,517	-19,717	-41,952	-31,051	-28,925	-20,064	-19,091	3,261	-14,070	-31,400	-9,401	-9,404
	unskilled	*women*	787	31	-725	2,363	1,826	92	-153	1,410	672	-66	330	336
		men	-6	-1,838	-3,670	-4,091	-3,709	-1,911	-1,599	-229	-1,390	-2,550	-671	-672
Part-time		*women*	1,468	-9,230	-19,927	-7,132	-7,681	-9,032	-9,787	11,835	963	-9,910	-1,487	-1,469
		men	-64	-2,336	-4,607	-10,743	-9,335	-2,772	-2,109	57	-1,716	-3,489	-831	-833
Marginally employed		*women*	-7,810	-10,607	-13,403	-25,202	-21,107	-10,766	-14,484	-13,518	-15,175	-16,832	-6,644	-6,691
		men	-2,305	-3,960	-5,616	-14,113	-11,464	-5,523	-8,068	-4,388	-5,532	-6,676	-4,312	-4,316
Total			**-7,098**	**-61,346**	**-115,594**	**-111,259**	**-99,781**	**-63,875**	**-68,629**	**-5,470**	**-50,444**	**-95,418**	**-33,104**	**-33,153**

Notes: Own- and cross-wage elasticities taken into account. Demand changes in numbers of employees ('heads'). Qualification categories: 'skilled' = secondary-school education or vocational training, 'unskilled' = neither secondary-school education nor vocational training. [1] Robustness checks use an output price elasticity of -1. [2] Extrapolated for firms <10 employees using group-specific correction factors on the basis of SOEP data.

Source: Own calculations based on elasticities by Freier & Steiner (2007), SOEP 2007 and VSE 2006.

The robustness tests under (9) and (10) where the VSE sample is not corrected for missing information from small firms show that simulated employment levels react very sensitive to this sample definition. This leads not only to a decline in the overall employment levels from 25.5 million workers in (6) to about 20.2 million in (9). More importantly employment figures for certain groups are clearly underrepresented in the unadjusted VSE sample: marginally employed total about 1.6 million compared to 2.7 million in the corrected sample. Levels for part-time employment are also markedly lower without the small-firm adjustment whereas levels of full-time employment are only slightly below the unadjusted data.

Looking briefly at relative wage levels and increases induced by the minimum we find common patterns for both data sets: marginally employed persons have the lowest hourly wages of all groups and thus experience the steepest increases followed by part-time employees, unskilled and part-time workers. Apart from marginally employed in East Germany the change of wages in all groups is in most cases lower in the VSE compared to the SOEP.

The results for the labor demand simulations are presented in Table 4. All calculations are based on the elasticities shown in Table A5 in the appendix, the group-specific wage and employment values of Table 3, and three different price elasticities for the demand for goods (0, -1, -2).[12] The overall employment effects depend on the assumed price elasticity of demand. If the demand for goods was perfectly inelastic, labor demand in the standard SOEP simulation (1a) would decrease only by about 57,000 persons. In this scenario the loss of marginal employment would partially be compensated for by an increase in demand especially for part-time employed women. If the demand for goods was extremely elastic with respect to price changes (assumed elasticity of -2, scenario (1c) in Table 4), the decrease in demand for labor would in total amount to almost 400,000 persons. The lion's share of employment losses concerns marginal employment. Under this scenario the demand for skilled full-time labor would also shrink considerably. We will use scenario (1b) with an assumed price elasticity of the demand for goods of -1 which is also quite elastic but still plausible for the German economy as our standard simulation. In this case labor demand decreases by about 220,000 jobs.

The simulations on the basis of VSE data in (6) exhibit a similar pattern: The total employment losses range from 35,000 jobs under a completely inelastic demand for goods in (6a) to about 545,000 jobs under an extremely elastic demand for output goods (6c) showing again that the simulation results crucially depend on the underlying elasticities. The standard simulation with an output elasticity of -1 yields a job loss of 290,000 which is somewhat

[12] No empirical elasticity estimates at the required level of aggregation are currently available for Germany.

higher than the figures on the basis of the SOEP in (1b) because of higher simulated employment levels (see Table 3 above). The largest employment losses occur for marginally employed people and are partially compensated for by gains for part-time employed women.

Columns 4 to 7 in Table 5 present the robustness checks for the SOEP sample that were already presented for the wage effects assuming a price elasticity for the demand of goods of -1. Except for scenario (4) where age restrictions on the sample are relaxed and findings remain virtually unchanged, different sample restrictions lead each to considerable changes in results. The largest decrease in employment is induced in (2) when observed wages are not restricted at all at the bottom of the distribution. In this case the employment losses increase by the amount from 220,000 in (1) to more than 370,000 individuals. If very low wages were set to 3 €/hour as it is done in simulation (3) the decrease of employment would still amount to about 310,000 employees. Leaving sample restrictions as they are in the standard simulation (1) but also considering secondary jobs in variant (5) leads to a simulated decrease in labor demand of nearly 275,000 employees. Again, this substantial variation between different SOEP simulations result from the fact that enlarging the sample affects the wage level and the number of employees represented in the sample. If several simulation parameters differ, e.g. larger assumed elasticities are combined with a larger sample or lower measured wage levels and thus larger increases of wages, results will diverge considerably.

The robustness checks with the VSE data confirm the sensitivity of the simulation results as well. If the data is not adjusted for the missing information on small firms with less then ten employees in (8), simulated employment effects would be much lower: the total job loss is estimated at about 81,000 (48,000 in the West and 33,000 in the East). These relatively large differences result from the fact that employment levels as well as wage changes are adjusted in scenario (6) and enter the simulation of employment effects multiplicatively.

5 Conclusion

The aim of the paper was to investigate the robustness of wage and labor demand effects of a minimum wage of 7.50 €/hour with respect to the data sets used and different labor demand models. This should help to understand the variation in the results of existing studies and ultimately get a clearer picture of the likely consequences of a federal minimum wage in Germany. In the empirical analysis we used data from the SOEP and compared the findings with the newly available 2006 wave of the ‘Verdienststrukturerhebung’ (VSE) which is provided by the German Statistical Office.

The methodological discussion showed that the choice of the data set influences the wage changes induced by the minimum as well as the level and structure of employment. De-

pending on the labor demand model chosen for the simulation the estimated or assumed labor demand elasticities also affect the results. Since those factors enter the calculation of employment effects multiplicatively, differences in the simulation parameters can entail considerable differences in the outcome of the simulation exercise. This proved to be true, both in the comparison of existing studies and the own robustness checks conducted in this paper.

The comparison of published studies showed that they are based on a number of data sources (SOEP, BAP, GLS) with different restrictions imposed on the sample (low wages, apprentices etc.) which has consequences for the wage effects and the representativeness with respect to different segments of the labor force. The range of findings in the studies becomes understandable against this background. Maybe even more strikingly, sometimes quite similar results are based on calculations with completely different samples and parameters. Our own empirical robustness checks reiterate these points. One has to be very careful with measurement errors at the bottom of the wage distribution. The comparison with the VSE 2006 showed that calculated hourly wages below 3 €/hour in the SOEP are not very reliable. Therefore the sample should be restricted at the lower end of the wage distribution which is common practice in the more recent studies for Germany.

Another crucial point is the representativeness with respect to the labor force, especially with respect to certain types of employment like marginal jobs. Looking only at first reported jobs in the SOEP or using the VSE without correcting for the omission of small firms leads to an under-representation of marginal employment and thus an understatement of the minimum wage effect. The solutions which are proposed in existing SOEP studies (using employment data from the BAP, re-weighting the data to represent aggregate statistics) assume that the wage changes calculated with the SOEP also hold for the additional marginal jobs. We showed that this might not be true in any case. It seems to be more consistent to identify marginally employed directly in the SOEP using the existing information about secondary jobs and calculate wage changes induced by the minimum for each individual observation.

From a methodological standpoint approaches that take heterogeneous labor and substitution effects explicitly into account seem to be more fruitful. Existing studies and our own simulations have shown that the incidence and likely employment effects are markedly different for various types of employment. The VSE data set with its large sample size and reliable information about hourly wages might prove useful for more complex approaches that model spill-over effects into other parts of the wage distribution. This has so far been a neglected topic in empirical minimum wage studies for Germany.

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Appendix

Table A1 Wage distribution before and after the introduction of a legal minimum wage of 7.50 € / hour, currently employed people only, Germany, 2008, SOEP simulation (1)

	Total Germany		Men West		Men East		Women West		Women East	
	No MW	MW	No MW	MW	No MW	MW	No MW	MW	No MW	MW
1st-10th percentile	6.02	7.50	7.68	8.34	6.28	7.50	5.44	7.50	5.52	7.50
	(1.48; 24.58)		(0.66; 8.59)		(1.22; 19.43)		(2.06; 37.87)		(1.98; 35.87)	
1st-5th percentile	5.09	7.50	6.26	7.56	5.73	7.50	4.60	7.50	4.57	7.50
	(2.41; 47.35)		(1.30; 20.77)		(1.77; 30.89)		(2.90; 63.04)		(2.93; 64.11)	
6th-10th percentile	6.98	7.50	9.12	9.12	6.89	7.50	6.27	7.50	6.47	7.50
	(0.52; 7.45)		(0.00; 0.00)		(0.61; 8.85)		(1.23; 19.62)		(1.09; 17.00)	
11th-15th percentile	8.12	8.12	10.81	10.81	7.76	7.80	7.52	7.65	6.99	7.50
	(0.00; 0.00)		(0.00; 0.00)		(0.04; 0.52)		(0.13; 1.73)		(0.51; 7.30)	
16th-25th percentile	9.62	9.62	12.47	12.47	8.87	8.87	8.67	8.67	7.68	7.73
	(0.00; 0.00)		(0.00; 0.00)		(0.00; 0.00)		(0.00; 0.00)		(0.05; 0.65)	
Median	14.50	14.50	17.43	17.43	12.34	12.34	13.11	13.11	11.86	11.86
	(0.00; 0.00)		(0.00; 0.00)		(0.00; 0.00)		(0.00; 0.00)		(0.00; 0.00)	
Mean	15.94	16.09	19.16	19.22	13.72	13.85	13.97	14.18	12.79	13.03
	(0.15; 0.94)		(0.07; 0.37)		(0.12; 0.87)		(0.21; 1.50)		(0.23; 1.80)	
People affected (%)										
Overall		9.75		4.1		12.01		12.75		19.04
within 1st decile		97.56		41.06		100.00		100.00		100.00

Table A2 Wage distribution before and after the introduction of a legal minimum wage of 7.50 € / hour, currently employed people only, Germany, 2008, VSE simulation (6) including small firms

	Total Germany		Men West		Men East		Women West		Women East	
	No MW	MW	No MW	MW	No MW	MW	No MW	MW	No MW	MW
1st-10th percentile	6.52	7.64	7.48	8.08	6.10	7.50	6.33	7.64	5.54	7.50
	(1.12; 17.14)		(0.60; 7.97)		(1.40; 22.89)		(1.31; 20.67)		(1.96; 35.38)	
1st-5th percentile	5.71	7.50	6.33	7.53	5.35	7.50	5.63	7.50	4.90	7.50
	(1.79; 31.24)		(1.20; 18.94)		(2.15; 40.27)		(1.87; 33.13)		(2.60; 53.15)	
6th-10th percentile	7.41	7.79	8.64	8.64	6.88	7.50	7.05	7.78	6.18	7.50
	(0.39; 5.20)		(0.00; 0.00)		(0.62; 9.01)		(0.73; 10.30)		(1.32; 21.31)	
11th-15th percentile	8.37	8.37	10.26	10.26	7.61	7.65	7.92	8.05	6.73	7.50
	(0.00; 0.00)		(0.00; 0.00)		(0.04; 0.52)		(0.14; 1.73)		(0.77; 11.37)	
16th-25th percentile	9.67	9.67	12.21	12.21	8.58	8.58	9.10	9.10	7.63	7.70
	(0.00; 0.00)		(0.00; 0.00)		(0.00; 0.00)		(0.00; 0.00)		(0.08; 1.03)	
Median	15.01	15.01	17.77	17.77	11.43	11.43	13.71	13.71	11.62	11.62
	(0.00; 0.00)		(0.00; 0.00)		(0.00; 0.00)		(0.00; 0.00)		(0.00; 0.00)	
Mean	16.91	17.03	19.96	20.01	14.19	14.34	14.67	14.81	12.81	13.06
	(0.11; 0.68)		(0.05; 0.26)		(0.15; 1.06)		(0.14; 0.93)		(0.25; 1.95)	
People affected (%)										
overall		7.11		3.94		11.38		7.77		19.16
within 1st decile		76.90		39.31		100.00		63.46		100.00

Notes: VSE data adjusted for missing information on small firms.
Only employed people aged 18-65 are included. Percentiles are defined for the wage distribution without the minimum wage. Means are calculated within the range of given percentiles. The numbers in parentheses refer to absolute and relative differences in the two wage measures. Weighted data using sample weights to obtain population means.

Source: Own calculations based on SOEP 2006.

Table A3 Comparison of SOEP and VSE, Germany, 2008: People affected by a minimum wage of 7.50€/hour in %, overall and within first decile of the hourly wage distribution

	SOEP		VSE		VSE with apprentices	
	Overall	1st Decile	Overall	1st Decile	Overall	1st Decile
Germany, overall	9.75	97.56	5.59	55.95	8.86	88.79
Region						
West Germany	8.50	98.07	4.22	50.68	7.74	89.10
East Germany	15.57	96.29	13.36	68.78	15.36	87.89
Gender						
Men	5.50	55.13	3.65	36.55	7.07	70.81
Women	13.86	100.00	8.13	81.48	11.22	100.00
Age						
18-25 years	24.12	97.63	15.46	61.73	39.88	94.92
26-35 years	8.48	98.25	5.62	55.97	6.42	84.14
36-45 years	9.44	98.52	4.05	52.63	4.14	82.35
46-55 years	7.21	95.31	4.37	53.83	4.40	82.42
56-65 years	7.99	97.48	5.65	56.87	5.65	84.95
Qualification						
High	4.04	92.62	2.05	84.46	2.64	94.68
Medium	10.07	98.25	3.25	55.73	3.52	81.10
Low	17.73	97.19	7.31	49.80	24.44	93.95
Employment status						
Employed full-time	5.15	96.19	2.84	55.30	2.84	78.00
Employed part-time	11.18	97.56	4.36	49.17	4.36	81.19
Marginally employed	39.97	98.9	34.46	59.28	34.45	87.95
Sector						
Agriculture, forestry	22.34	100.00				
Mining, energy and water supply	0.04	100.00	0.50	63.27	6.39	98.77
Chemical., synthetics., wood, paper industry.	4.61	98.52	3.15	55.93	6.18	89.18
(Building) construction industry	7.97	94.79	1.98	46.48	6.44	92.39
Iron, steal, and heavy industry	4.77	94.19	2.36	49.52	5.93	91.30
Engineering, electric, precision engineering, light industry	2.25	96.93	1.07	56.47	4.51	94.86
Textile, food industry, tobacco	17.75	100.00	12.95	60.20	15.39	84.78
Wholesale and retail trade	14.79	98.52	7.32	58.96	11.68	88.61
Railways, postal service, transportation	13.32	97.51	7.65	63.42	10.15	88.72
Public services	5.76	97.16	3.88	65.86	6.87	92.63
Private services	15.35	97.20	11.03	47.98	13.99	84.70
Missing, not assignable	13.51	96.98	9.06	66.98	10.89	88.55
Firm size						
< 5 employees	21.10	98.06				
5-10 employees	17.15	98.74				
10-20 employees	17.74	97.58	8.94	61.20	12.64	88.34
20-100 employees	10.61	98.78	8.84	57.01	12.20	86.57
100-200 employees	7.79	93.98	6.43	55.75	9.56	87.33
200-2000 employees	4.28	95.91	3.04	45.42	6.65	90.71
> 2000 employees	3.49	95.49	2.55	78.85	4.92	97.70

Notes: Wage data for 2006 are extrapolated to 2008 using average growth rates (2007: 1.02, 2008: 1.025), Sample: individuals aged 18-65 years, hourly wages 3€/h-150€/h, no apprentices, weighted data using sample weights to obtain population means.

Source: Own calculations based on SOEP 2007 and VSE 2006.

Table A4 Comparison of SOEP and VSE, Germany, 2008: Mean hourly gross wage (in €/hour) with and without a minimum wage of 7.50€/hour, within first decile of the hourly wage distribution,

	SOEP			VSE			VSE with apprentices		
	MW: € / hr	Δ€	%Δ	MW: € / hr	Δ€	%Δ	MW: € / hr	Δ€	%Δ
Germany, overall	7.50	1.48	24.58	7.73	0.70	9.96	7.52	1.69	28.99
Region									
West	7.50	1.62	27.55	7.77	0.62	8.67	7.52	1.78	31.01
East	7.50	1.11	17.37	7.65	0.91	13.50	7.52	1.42	23.28
Gender									
Men	7.12	0.76	10.67	8.16	0.47	6.11	7.66	1.49	24.19
Women	7.50	2.20	36.86	7.54	1.10	15.31	7.50	1.93	34.65
Age									
18-25 years	7.50	1.35	21.95	7.69	0.83	12.10	7.51	2.37	46.11
26-35 years	7.50	1.39	22.75	7.73	0.69	9.80	7.53	1.21	19.15
36-45 years	7.50	1.63	27.77	7.76	0.61	8.53	7.53	0.98	14.94
46-55 years	7.50	1.41	23.15	7.75	0.65	9.15	7.53	1.01	15.49
56-65 years	7.50	1.56	26.26	7.74	0.77	11.05	7.53	1.15	18.03
Qualification									
High	7.51	1.32	21.36	7.57	1.13	17.55	7.51	1.60	27.07
Medium	7.50	1.52	25.42	7.72	0.67	9.50	7.53	1.08	16.74
Low	7.50	1.39	22.75	7.77	0.57	7.92	7.51	2.31	44.42
Employment status									
Employed full-time	7.50	0.99	15.21	7.71	0.60	8.44	7.54	0.84	12.56
Employed part-time	7.50	1.74	30.21	7.79	0.55	7.60	7.53	0.90	13.57
Marginally employed	7.50	1.77	30.89	7.73	0.85	12.34	7.52	1.26	20.13
Sector									
Agriculture, forestry	7.50	1.21	19.24						
Mining, energy and water supply	7.50	0.24	3.31	7.71	1.02	15.25	7.50	2.68	55.49
Chemical., synthetics., wood, paper industry.	7.50	1.61	27.33	7.72	0.72	10.29	7.52	1.82	31.93
(Building) construction industry	7.50	1.33	21.56	7.80	0.62	8.65	7.52	2.46	48.62
Iron, steal, and heavy industry	7.51	2.08	38.31	7.77	0.55	7.61	7.52	2.03	36.98
Engineering, electric, precision engineering, light industry	7.50	1.41	23.15	7.72	0.71	10.13	7.51	1.96	35.32
Textile, food industry, tobacco	7.50	1.05	16.28	7.69	0.68	9.71	7.53	1.33	21.49
Wholesale and retail trade	7.50	1.70	29.31	7.71	0.72	10.30	7.52	1.85	32.57
Railways, postal service, transportation	7.50	1.10	17.19	7.69	0.92	13.59	7.52	1.71	29.43
Public services	7.50	1.43	23.56	7.67	0.96	14.31	7.51	1.86	32.86
Private services	7.50	1.48	24.58	7.80	0.53	7.30	7.53	1.33	21.45
Missing, not assignable	7.50	1.44	23.76	7.66	0.96	14.33	7.52	1.57	26.39
Firm size									
< 5 employees	7.50	1.67	28.64						
5-10 employees	7.50	1.55	26.05						
10-20 employees	7.50	1.20	19.02	7.70	0.81	11.77	7.52	1.79	31.18
20-100 employees	7.50	1.32	21.36	7.72	0.68	9.66	7.52	1.59	26.81
100-200 employees	7.50	1.28	20.58	7.73	0.67	9.49	7.52	1.60	27.03
200-2000 employees	7.50	1.78	31.12	7.82	0.57	7.86	7.52	1.82	31.93
> 2000 employees	7.50	1.54	25.80	7.62	1.27	20.00	7.50	1.88	33.45

Notes: Wage data for 2006 are extrapolated to 2008 using average growth rates (2007: 1.02, 2008: 1.025), Sample: individuals aged 18-65 years, hourly wages 3€/h-150€/h, no apprentices, weighted data using sample weights to obtain population means.

Source: Own calculations based on SOEP 2007 and VSE 2006.

Table A5 Compensated own- & cross wage elasticities

Heads West	FT, U, M	FT, S, M	PT, M	ME, M	FT, U, W	FT, S, W	PT, W	ME, W
FT, U, M	-0.510	0.419	0.003	-0.001	0.050	0.034	-0.048	0.055
FT, S, M	0.085	-0.200	0.001	0.004	0.032	0.062	0.002	0.017
PT, M	0.023	-0.001	-0.070	-0.110	0.031	-0.268	0.204	0.186
ME, M	-0.019	0.316	-0.246	-0.130	-0.093	0.187	0.148	-0.162
FT, U, W	0.108	0.367	0.012	-0.013	-0.370	-0.055	-0.081	0.030
FT, S, W	0.020	0.136	-0.014	0.005	-0.009	-0.160	0.071	-0.051
PT, W	-0.044	0.007	0.033	0.011	-0.044	0.196	-0.260	0.099
ME, W	0.255	0.495	0.144	-0.058	0.056	-0.805	0.483	-0.570
Heads East	FT, U, M	FT, S, M	PT, M	ME, M	FT, U, W	FT, S, W	PT, W	ME, W
FT, U, M	-0.300	-0.086	-0.076	0.028	-0.036	0.487	-0.008	-0.008
FT, S, M	-0.002	-0.110	-0.008	0.005	0.006	0.091	0.015	0.005
PT, M	-0.135	-0.235	-0.290	0.006	0.114	0.235	0.302	-0.002
ME, M	0.172	0.476	0.019	-0.300	0.152	-0.778	0.332	-0.073
FT, U, W	-0.060	0.099	0.116	0.041	-0.250	-0.273	0.237	0.091
FT, S, W	0.044	0.128	0.012	-0.011	-0.014	-0.230	0.076	-0.010
PT, W	-0.010	0.063	0.055	0.018	0.040	0.245	-0.440	0.032
ME, W	-0.038	0.323	-0.008	-0.053	0.248	-0.582	0.437	-0.330

Notes: FT, U, M – Full-time unskilled men; FT, S, M – Full-time skilled men; PT, M – Part-time men; ME, M – Marginally employed men; FT, U, W – Full-time unskilled women; FT, S, W – Full-time skilled women; PT, W – Part-time women; ME, W – Marginally employed women.

Source: Elasticities taken from Freier & Steiner (2007).