Behavioral effects of a federal minimum wage and income inequality in Germany

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Abstract

Empirical studies on minimum wages are primarily concerned with employment while their effects on income inequality receive less attention. Yet, a popular argument for a federal minimum wage in Germany is that it will prevent in-work poverty and reduce income inequality. We examine this assertion for different minimum wage levels on the basis of a microsimulation model that accounts for the interactions between wages, the tax-benefit system and net incomes at the household level. The methodological approach of an earlier study is extended by incorporating behavioral adjustments at different margins (labor supply and demand, consumption) for the first time into a microsimulation framework at the household level. We use data from the SOEP, the IABS, and the Continuous Household Budget Survey. We show that even a high federal minimum wage will only have a minor impact on inequality among households with at least one minimum-wage worker. Low wage earners are not not concentrated in the lower parts but rather scattered over the income distribution. Wage increases often substitute welfare transfers and are subject to high marginal tax rates. A decline in labor demand could diminish the gains in net incomes up to 50% and higher product prices further reduce these gains even after consumption adjusts. Although it might decrease wage inequality substantially, the distributive impact of a minimum wage on disposable incomes is thus very limited.

KEYWORDS: minimum wage, wage distribution, employment effects, income distribution, inequality, microsimulation

JEL classification: I32, H31, J32

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Contents

1 Motivation

Income inequality has been on the rise in Germany over the last years (Grabka and Kuhn, 2012; Faik, 2012). This trend is to a certain degree related to a growing low wage sector and increasing overall wage inequality (Dustmann et al., 2009; Antonczyk et al., 2010b; Gernandt and Pfeiffer, 2007). Descriptive analyses based on data from the German Socio-Economic Panel (SOEP) confirm these findings (Table 6 in the Appendix). The share of low-wage employment between 1995 and 2010 grew particularly for men, but also significantly for women until 2005. Overall wage inequality measured by the Gini coefficient also rose significantly. The rise in inequality is also reflected in net disposable household incomes where East Germany seems to be predominantly affected as the Gini coefficient for net equivalent income increased by almost 30% between 1995 and 2010.

Since Germany remains one of a few OECD countries without a statutory minimum wage (Immervoll, 2007; Schulten, 2012), its introduction has been a dominant economic policy issue for quite some time.[1] One line of argument refers to the declining union coverage in the economy. The wage bargaining system may no longer prevent 'excessive' downward wage pressure (Antonczyk et al., 2010a; Bosch, 2007; Möller and König, 2008). In this view a modest minimum wage is a necessary complement to wage subsidies in the low-wage sector. The wage-subsidy scheme proposed by Bofinger et al. (2006), for example, includes a low hourly minimum of 4.50 € to prevent wage dumping and mitigate deadweight effects. Another argument from a social policy perspective is that earnings of people working full-time should be sufficient to reach the means-tested social minimum. A minimum wage could then serve as a means to prevent in-work poverty and help to mitigate income inequality (Bosch, 2007). Proponents of this approach, among them the Social Democratic Party and the labor unions, have suggested a legal minimum wage of 8.50 €/hour; the Leftist Party propagates a minimum wage level of 10.00 €/hour.

The extensive literature on the economic effects of minimum wages primarily focuses on employment (Neumark and Wascher, 2008). Far less attention has been devoted to the question if and to what extent a minimum wage is able to affect the distribution of disposable household incomes and thus overall inequality.[2] For

[1] See, e.g., the debate in *ifo schnelldienst 61(06), 2008*, Franz (2007), or Fitzenberger (2009).

[2] This literature includes a number of studies for the U.S., including Johnson and Browning

Germany a couple of papers analyzes the incidence of a federal minimum wage (Brenke, 2006; Bosch and Weinkopf, 2006; Kalina and Weinkopf, 2007). Knabe and Schöb (2009) discuss the interaction of a minimum wage with the German tax-and-transfer system.

In this paper we analyze the implications a federal minimum wage would have on the distribution of disposable net incomes in Germany. We investigate whether minimum wages of different magnitude would achieve the stated goal to reduce the degree and depth of income inequality among the working population. The analysis builds upon a previous paper (Müller and Steiner, 2009) where the first round effects of a statutory minimum wage on net household incomes is simulated using a tax-and-transfer microsimulation model. Focusing on the lower part of the income distribution they find that a nationwide minimum wage would be ineffective in reducing poverty, if it had no behavioral and price effects. This paper extends the analysis methodologically in several respects: Whereas Müller and Steiner (2009) ignore any behavioral adjustments due to the minimum wage, we estimate in this paper how individuals, households and firms adapt their behavior and account for these adjustments in the simulation of household incomes. We consider labor supply, labor demand and consumption effects a federal minimum would induce. To our knowledge none of the existing distributional analyses of the minimum wage has modeled those different aspects at the individual or household level.

Müller and Steiner (2009) consider a moderate minimum wage level of 7.50 €/hour; here we systematically compare different scenarios starting from a low level of 5.00 €/hour, to 8.50 €/hour, to a high minimum of 10.00 €/hour. The range represents the different strands of the political debate sketched above: a moderate level ought to prevent excessive wage dumping and deadweight effects for wage subsidies whereas a rather high minimum wage level is said to alleviate income inequality. The microsimulation analysis is based on SOEP data. In addition we exploit the IAB employment sub-sample for the labor demand estimations and the Continuous Household Budget Survey for Germany for the estimation of consumption behavior.

(1983), Burkhauser and Finegan (1989), Mincy (1990), Burkhauser et al. (1996a), Burkhauser et al. (1996b), Burkhauser and Sabia (2005), Sabia and Burkhauser (2010), Macurdy and McIntyre (2001), Addison and Blackburn (1999), Neumark and Wascher (2002), Neumark et al. (2005), Sabia and Nielsen (2012). There are also papers by Goldberg and Green (1999) for Canada and Gosling (1996), Freeman (1996) or Sutherland (2001) for the UK.

The next section discusses the distributional implications of a federal minimum wage as the link between low wages, means-tested income support and household incomes is examined. Section 3 describes the methodological approach and the data. First we discuss how we simulate the impact of different minimum wage levels on the distribution of hourly wages. Then we describe the microsimulation model that is used to translate shifts in the wage distribution into changes of net household incomes. After that we outline the estimation of labor supply, labor demand and consumption effects. Then it is shown how the different behavioral adjustments are integrated into the microsimulation model. Finally we describe the data used in this study. The empirical results are presented in Section 4. Section 5 concludes and discusses policy implications.

We show that a statutory minimum wage would have a minor impact on the overall distribution of net household incomes and the reduction of inequality among households with at least one low-wage worker. This holds even if the minimum wage would be set at a high level. If negative effects on labor demand are taken into account, the gain in net incomes is reduced by half. Considering also increases in product prices and the adaption of consumption further diminishes the gain in net income due to a minimum wage. The ineffectiveness of a minimum wage to increase net household incomes of the working poor and to reduce income inequality can be explained by the German system of means-tested income support, the spread of low wage earners over the whole range of the net income distribution, and differences in wage levels and consumption behavior among different groups of the population.

2 Distributional effects of a minimum wage

Distributional effects are addressed by two strands of the minimum wage literature (OECD, 1998; Brown, 1999). The first question that is adressed is to what extent a minimum wage affects the wage distribution and inequality of labor earnings. In the second branch of studies the issue is whether a minimum wage has an impact on the distribution of disposable household incomes and overall inequality. We sketch this research and then relate different distributional meachansims of the minimum wage to the German context.

2.1 Wage inequality

Assuming full coverage, compliance and no behavioral adjustments, all employees that earn sub-minimum wages remain employed and receive exactly the minimum wage after its introduction; other wages are not affected. The minimum wage compresses the distribution from below, creates a spike at the minimum and reduces inequality. Since these conditions are unrealistic, empirical studies try to identify different adjustment mechanisms. If the minimum reduces employment, the wage distribution might not be compressed and censored, but truncated or thinned out in the lower tail. If the minimum wage affcets the entire wage structure, the distribution will be shifted leaving relative positions and inequality only modestly affected. Grossman (1983) is one of the first to make the argument for *spillover effects* to higher parts of the wage distribution formally and provides first evidence. Both disemployment effects and wage spillovers diminish or even counteract the redistributive impact of a minimum.

DiNardo et al. (1996) semi-parametrically estimate wage distributions and isolate the effects of different factors with decomposition techniques. They show that the decrease of the real value of the minimum wage in the U.S. contributed to the rise in wage inequality between 1979 and 1988. Lee (1999) analyzes the impact of the minimum wage on the wage distribution in the U.S. during the 1980s. He utilizes regional variation in state minimum wages and concludes that a large part of the rise in inequality in the lower tail of the distribution is attributable to the decline in the real value of the minimum wage. Autor et al. (2010) re-investigate the early studies and demonstrate that the magnitude of the effect is overestimated because of errors-in-variables and correlation of state minimum wages and wage dispersion. Estimated spillovers may entirely be an artefact of measurement error.

Dickens and Manning (2004) estimate the influence of the U.K. minimum wage on the wage distribution without finding noticeable spillover effects. Stewart (2011) reaches a similar conclusion on the basis of U.K. data. Green and Paarsch (1996) estimate hazard functions to derive conditional wage densities (Donald et al., 2000) and estimate the effect of the minimum wage on the shape of the wage distribution with Canadian data. They find evidence for substantial wage increases for those who earned below the minimum wage level and also evidence for spillover effects.

Neumark et al. (2004) try to identify the effects of changes in the minimum wage on wages, employment, working hours and labor income from regional variation in minimum wages levels within a given year in the U.S. They find positive effects on wages, but negative on hours and employment which is why the change in labor income is also negative. Effects are much higher for those people with wages close to the minimum. Neumark et al. show that one period lagged effects are more important than the contemporaneous influence of the minimum. Moreover, Machin et al. (2003) estimate the effect of the U.K. minimum wage in a sector where the minimum bit hard and find a large compression of the wage distribution at the lower end. Employment or hours reductions are found to be limited which is why wage inequality was reduced significantly.

Contrary to the reduced form approaches Flinn (2002) estimates a structural job search model to infer the distributional consequences of a federal minimum wage. He models spillovers and employment reactions and is able to derive welfare effects induced by the minimum finding mixed evidence for the U.S. In the same vein Ahn et al. (2011) set up a one-shot search model with endogenous labor supply and demand. In their framework a minimum wage might lead to small (even positive) changes in the employment level. Yet this masks significant turnover on the labor market with exits and entries not being evenly distributed. Matches with subminimum wages are pushed out of the labor market in favor of more productive jobs leading to negative welfare effects of the minimum.

There is ample evidence for sizeable wage effects of the minimum in the lower part of the distribution. The findings concerning wages spillover are more ambiguous. Depending on the specific situation (minimum wage level, the affected group) some studies also find employment adjustments (via hours reductions, substitution or layoffs). We avoid assumptions about changes in the whole wage structure, but include estimated labor supply and demand adjustments in our simulation model.

2.2 Income inequality

An analysis of wage inequality does not reveal whether a minimum wage is an effective tool for redistribution. A broader measure for economic wellbeing – disposable household income – has to be considered. The size and composition of the household

and other income sources play an important role as well as the tax and transfer system. Increased wage equality does not directly translate into higher overall income equality for several reasons. First, low wage earners are not concentrated in the lower part of the income distribution; also richer households will significantly benefit from the minimum wage. Second, interactions with the tax and transfer system lead to high marginal tax rates or substitution of transfer incomes among minimum wage earners (depending on the household structure). Third, higher labor costs induced by the minimum wage might boost product prices and disproportionately affect low income households with high consumption rates. Two types of analyses can be distinguished in this literature. Simulation studies model the aforementioned relationships explicitly, whereas reduced form approaches try to identify the causal impact of the minimum wage on the distribution of household incomes.

Johnson and Browning (1983) is one of the first simulation studies that assesses the distributional effects of a stutory minimum wage on household incomes in the U.S. According to their results this effect is marginal because of the small share of low wage earners and low wage income in poor households and the large marginal tax rates low wage earners face. Burkhauser and Finegan (1989) demonstrate that the close link between low household income and the incidence of low wage employment has loosened over time. The minimum wage benefits workers who reside in households above the poverty line relatively more in the U.S. during the 1980s. Based on simulations from U.S. wage and income data Burkhauser et al. (1996a) confirm this assertion. Household composition and size as well as non-wage income are more closely related to the risk of poverty. Bluestone and Ghilarducci (1996) also argue that besides potential disemployment effects the minimum wage suffers from insufficient target efficiency. Burkhauser and Sabia (2005) replicate the incidence analyses of low wage earnings for the 1990s showing that the link between wages and equivalent income remains weak. Sabia and Burkhauser (2010) simulate the distributional effect of an increase of the federal minimum from \$7.25 to \$9.50 and show that only about 11% of those benefiting actually live in poor households.[3]

[3]Mincy (1990) reaches a more optimistic assessment of the distributional effects. He differentiates earnings gains from an increase in the minimum wage by household incomes, incorporates disemployment effects, but neither considers price effects, nor the tax system. Mincy concludes that the U.S. minimum wage reducess poverty more than previously found (see also Card and Krueger (1995)). Burkhauser et al. (1996b) show that distributional analyses of the minimum react very sensitive to the definition of income. Contrary to Mincy (1990); Card and Krueger (1995)

In their simulation exercise Macurdy and McIntyre (2001) assume no spillover effects in wages, no disemployment effects, no reductions in working hours and no adjustment of consumers' behavior. They confirm previous findings that income gains are almost evenly distributed over income quintiles. In addition, Macurdy and McIntyre explicitly look at the costs which are induced by higher product prices and borne by all households. They show that although in absolute terms richer households bear the majority of this burden, poor households lose more in relative terms because of their above-average consumption rates.

Several reduced-form studies try to causally identify the effect of the minimum wage on poverty or income inequality. Addison and Blackburn (1999) esitmate fixed-effects regressions on data from U.S. states. They show that the minimm wage did not reduce poverty in the 1980s but in the 1990s and speculate that this difference might be explained by its smaller impact on employment. Neumark and Wascher (2002) exploit regional variation in U.S. minimum wages. According to their results the minimum wage increases both the outflow from and the inflow into poverty and therefore does not reduce overall inequality. Neumark et al. (2005) estimate the effect of minimum wage increases on the whole income distribution using kernel density estimators in a difference-in-difference framework. They exploit variation in state level minima over time and find that the minimum wage increases the share of households below or near the poverty line. Sabia and Burkhauser (2010) analyze the relationship between changes in the minimum wage rate and poverty incidence at the state level in a fixed-effects regression framework. Their estimates based on CPS data show no significant effects. Sabia and Nielsen (2012) use a similar identification strategy to estimate the effect of state minimum wage increases on different measures of hardship (income poverty, financial insecurity, food or health insecurity) without finding significant relationships.

2.3 Situation in Germany

Germany has no federal minimum wage, but several sectoral minima have been established since 1997. Contract wages set at the industry level can be declared generally binding by the government on the basis of a special regulation contained

argue to rely on equivalent household income as a measure of economic well-being.

in the law on the posting of workers ("Entsendegesetz").[4] Several studies (Rattenhuber, 2011; Apel et al., 2012) show that these minima compressed the wage distribution within the sector.

Brenke (2006) documents that in West Germany a federal minimum wage would affect most marginally employed persons whereas it would bind a higher share of regularly employed people in the East. Bosch and Weinkopf (2006) report similar results on the basis of administrative employment register data. Kalina and Weinkopf (2007) show that in 2004 about 14% of all dependently employed persons would have received a hypothetical minimum wage of 7.50 €/hour, with higher shares among unskilled workers, women, youth, and people in marginal employment. Knabe and Schöb (2009) note that households eligible to means-tested unemployment benefits would hardly benefit from a minimum wage because of the benefit-withdrawal rate implicit in the German social welfare system.

Müller and Steiner (2009) confirm that workers who would receive the minimum wage are not concentrated in the lower part of the income distribution. They also analyze interactions with the German tax system and welfare state which is characterized by a high "social minimum" relative to net in-work income of low qualified people and benefit-withdrawal rates close to 100%. The basic rates for each family member depend on the age of children; the maximum amount for housing costs derives from family size. The social minimum defines the amount of means-tested unemployment benefits (UB II) for "employable" individuals.[5]

This social minimum also establishes an implicit minimum wage equaling the hourly wage which would yield the same net income in a full-time job as UB II. The illustrative calculations carried out in Müller and Steiner (2009) show that this implicit minimum is close to or exceeds the wages currently earned in the low-wage sector in Germany. In relative terms it is highest for one-earner couples with children and in East Germany. A relatively moderate minimum wage of 7.50 €/hour would increase the net household incomes above UB II levels neither for single-earner

[4] It was first introduced in the construction industry on order to prevent firms from other EU countries to compete at lower wages than the contract wage set by German employers and labor unions. Since then it has been extended to the waste industry, to roofers and electricians, to the laundry industry, to painters and varnishers, and to care services.

[5] "Employability" is defined as the ability to work at least 3 hours a day and determined by the labor agency. Persons with severe physical and mental disabilities are exempted. Outside of this definition people receive means tested "social assistance" ("Sozialgeld") which is paid at similar amounts as UB II.

couples in West Germany nor for couples with both spouses working full-time in East Germany. To become effective in this sense a minimum wage would have to be set at substantially higher levels. We therefore present a simulation with a high minimum wage of 10.00 €/hour. On the other hand, the implicit minimum wage for singles without children is substantially lower. For those households a moderate minimum wage level of 8.50 €/hour may already be sufficient. We also present simulations with a low level of 5.00 €/hour to cover the range debated in public and of existing minimum wages.[6] In addition to UB II entitlement the simulation model includes further features of the German tax-benefit system, including the joint taxation of couples, other means-tested transfers, exemptions from social security contributions, or unemployment benefit withdrawal rates below 100%.

The empirical analyis of this paper comprises all the mechanisms discussed in the literature: The position of low wage earners within the income distribution is taken into account. Interactions of the minimum wage with the German tax and transfer system are modeled at the household level. Behavioral adjustments at different margins are also included in the simulations as well.

3 Methodology

This section details our methodological approach. First, we describe the simulation of pure wage effects without behavioral adjustments. Then the simulation of net household incomes from an increase in gross hourly wages is discussed. The following subsection explains the estimation of behavioral adjustments induced by a minimum wage. After that it is shown how these adjustments are incorporated into the simulation model. Finally we give an overview over the data.

3.1 Simulation of wage effects

In a first step we calculate minimum wage effects on the distribution of wages. The observed hourly gross wage of those persons employed at a wage below the minimum

[6] A low minimum wage of 4.50 €/hour as a complement to a wage subsidy in the low-wage sector was suggested by Bofinger et al. (2006); this is equivalent to a value of about 5.00 €/hour in 2012. Low minimum wage levels can be found in some Eastern and Southern European countries. The United Kingdom, the U.S. or Italy exhibit average minimum wage levels whereas, e.g., France or the Netherlands have rather high minimum wages (Marx et al., 2012).

is replaced by a minimum wage at different levels (5.00, 8.50, 10.00 €/hour). We rule out spillover effects, i.e. wages higher than the minimum wage remain constant. For each employed person, the gross hourly wage is obtained by dividing reported earnings in the month before the interview by the number of hours worked in that month, where paid overtime hours are included.[7] We then compare the observed wage distribution and the hypothetical wage distribution conditional on the minimum wage under the assumption of no further labor market adjustments.

We make use of wage data from the latest available wave of the German Socio-Economic Panel Study (SOEP, see sub-section 3.5) collected in 2010. Since the great majority of respondents is interviewed in the first quarter of the year, we interpret these wage data to refer to the year 2009. To simulate the wage distribution in 2012 we extrapolate wages two years in the future assuming constant growth rates.[8] Another assumption concerns the treatment of very low hourly wages. To account for measurement errors in the hours and wage data we exclude wages below 3 €/hour earned in regular employment. This equals roughly the first percentile of the raw hourly wage distribution. We have included hourly wages below 3 €/hour, though, if they refer to supplementary work of people drawing unemployment benefits (so-called "Aufstocker"). We conduct sensitivity analyses of the scenarios where hourly wages below 3 €/hour remain in the analysis as measured or are set to the margin of 3 €/hour, respectively. People in full-time vocational and apprenticeship training as well as disabled employees are discarded from the sample. "Secondary jobs", i.e. jobs held in addition to the main job, are excluded in the base simulations; a sensitivity analysis is provided.

3.2 Simulation of income effects

In a second step the simulated wage increases are translated into changes of disposable household incomes. We go beyond previous papers that calculate marginal tax rates for households (Johnson and Browning, 1983) or approximate the effects of the

[7] This hourly wage measure may underestimate the effective hourly wage, for at least two reasons: First, since the majority of people in the SOEP is interviewed in the first three months of the year, fringe benefits are underrepresented. Second, 'paid hours' may partly be paid for in later months, or may be compensated for by working less than normal hours in the future.

[8] To check the sensitivity of the results with respect to this assumption we estimated dynamic panel data models instrumenting the lagged dependent variable and predicted the future wages individually. Findings did not change significantly.

tax system by looking at different household types (Macurdy and McIntyre, 2001). Following Müller and Steiner (2009) we model the link between gross wages and net incomes for each household with the microsimulation model STSM. This approach (see Creedy and Duncan (2002) for an overview) is appropriate for the distributional issues we address as it provides net disposable income for each household. The static model consists, first, of a representative micro data set (the SOEP, see sub-section 3.5 below) with the necessary information on household structure, income from different sources, working hours, and socio-demographic characteristics. Second, a tax-transfer model computes net household incomes based on various gross incomes.

The STSM (Steiner et al., 2012) contains the main features of the German tax and transfer system. Gross household income is composed of earnings from dependent employment, income from capital, property rents and other income. Earnings from dependent employment is the most important income component for the great majority of households.[9] Taxable income is calculated by deducting various expenses from gross household income. The income tax is computed by applying the income tax formula to the individual incomes of unmarried spouses; for married spouses, income is taxed jointly based on an income splitting factor of 2. Employees' social security contributions and the income tax are deducted from gross household income and social transfers are added to get net household income. Social transfers include child allowances, child-rearing benefits, educational allowances for students and apprentices, unemployment compensation, the housing allowance, and social assistance. The model accounts for nonlinearities and interactions within the German tax-benefit system, in particular means-tested income-support schemes, exemptions of very low earnings from social security contributions, and the joint income taxation of married couples imposing relatively high marginal tax rates on secondary earners.

Analogous to the wage analysis we simulate net household incomes not only under the observed wage structure but also for the counterfactual situation after the introduction of a minimum wage. We then simply compare the distribution of net equivalent incomes in both scenarios assuming that behavior of employees and firms does not adapt.

[9]The SOEP also contains information on earnings (and working hours) from a "secondary job", i.e. a job held in addition to the main job, which we add to wage income for the calculation of net household income.

3.3 Estimation of behavioral adjustments

In addition to the mechanical changes in gross wages and household incomes (given compliance and coverage) we estimate behavioral adjustments after the introduction of a federal minimum wage at different margins. The majority of empirical minimum wage studies focuses on the employment effects (Neumark and Wascher, 2008) without explicitly distinguishing labor supply and demand.[10] Employment reductions are usually attributed to reduced labor demand because of higher labor costs whereas positive employment effects are explained by improved labor supply incentives in monopsonistic labor markets. Some structural papers (Flinn, 2002; Ahn et al., 2011) disentangle different adjustment mechanisms on the labor market. In our simulation we have to rely on estimated labor supply and demand elasticities to gauge the potential employment effects. In addition we also calculate adjustments of product prices as an additional margin of adjustment and estimate the adaption of household consumption behavior.

Labor supply

Labor supply is modeled as the joint decision of spouses at the household level within a discrete choice framework.[11] As suggested by van Soest (1995) or Aaberge et al. (1995) the basis is a household utility model where utility is jointly maximized by the choice of different bundles j of disposable income and leisure:

$$\{(y_j, lm_j, lf_j); j = 1, 2, \ldots, m\} \tag{1}$$

with leisure for males (lm_j) and females (lf_j) given as $lm_j = TE - hm_j$, $lf_j = TE - hf_j$. TE is the total time endowment, hm_j and hf_j are working hours of the male and female spouse.[12] Net household incomes y_j for all hours categories and both scenarios with and without minimum wage are obtained from the microsimulation model (sub-section 3.2 above). We assume a quadratic specification of the direct

[10] For Germany some evaluation studies have been published that try to identify the employment impact of the sectoral minimum wages without finding major effects (König and Möller, 2008; Apel et al., 2012; Aretz et al., 2012; Boockmann et al., 2012; Bosch et al., 2012; Gürtzgen et al., 2012; Harsch and Verbeek, 2012; Mesaros and Weinkopf, 2012; Bachmann et al., 2012) .

[11] The model is estimated separately for different household types: couple households where both spouses' labor supply is assumed to be flexible, couple households where one spouse's labor supply is assumed to be fix, male and female single households.

[12] We assume 4 categories for men (non-employment, part-time, full-time, over time) and 5 categories for women (non-employment, low part-time, high part-time, full-time, over time).

utility function for the $i = 1, 2, \ldots, N$ households:

$$U_{ij} = \alpha_c + \alpha_y y_{ij} + \alpha_{yy} y_{ij}^2 + \alpha_{lf} lf_{ij} + \alpha_{lf^2} lf_{ij}^2 + \alpha_{lm} lm_{ij} + \alpha_{lm^2} lm_{ij}^2 + \alpha_{lflm} lf_{ij} lm_{ij} \quad (2)$$

Preference heterogeneity is introduced by a number of household- or individual-specific taste shifters X (age, children, handicap, region), i.e. the parameters α are functions of X. Adding identical and independently type I extreme value distributed error terms to the utility function yields the Multinomial Logit model (McFadden, 1974) for the choice probability of alternative k:

$$Pr_{ik} = Pr(V_{ik} > V_{ij}, = 0, \ldots, m) = \frac{exp\{U(y_{ik}, lm_{ik}, lf_{ik})\}}{\sum_{j=1}^{m} exp\{U(y_{ij}, lm_{ij}, lf_{ij})\}} \quad (3)$$

The model is estimated for the situation without a minimum wage on the SOEP data set (see sub-section 3.5 below). Participation, hours worked and the resulting changes in disposable household income are predicted for the status quo and under different minimum wage scenarios. The difference yields the labor supply effects and income changes after the adjustment of labor supply.[13]

Labor demand

Labor demand changes are determined by the increase in labor costs induced by minimum wage and by the elasticity of labor demand. When labor demand is considered other simulation studies either assume and simulate the effects of different average elasticities (Johnson and Browning, 1983; Macurdy and McIntyre, 2001), or they take estimated elasticities from the literature (Mincy, 1990). Here we use estimated labor demand elasticities, but allow for more effect heterogeneity and substitution between different labor categories that are defined by region, gender, qualification level and type of contract (full-, part-time and marginal employment)[14] For given wages, factors of production and demand for goods the direct labor demand effect for a given labor category results from substitution due to an increase in the cost of labor. Indirect effects follow from the substitution between different categories of labor which are all, but to a different degree, affected by the minimum

[13]For the households that are affected by the minimum wage the theoretically expected effect on labor supply is ambiguous, since income and substitution effects act in opposite directions.

[14]We distinguish between skilled (secondary school or vocational education) and unskilled (neither secondary school nor vocational education) full-time workers, part-time workers and marginally employed. Those groups are divided by gender, yielding 8 different categories and are estimated separately for West and East Germany. Highly skilled workers (with university degree) are assumed to be a quasi-fix factor in the short run.

wage. The demand for labor is further reduced by a decreasing demand for goods as a result of higher production costs and prices.[15]

To take these different determinants into account, we utilize empirical labor demand elasticities estimated by Freier and Steiner (2007, 2010) on data from the BA Employment Panel (BAP, see subsection 3.5 below). Given labor demand elasticities for $L = 8$ groups, the change of the demand for labor of a specific group $k(\Delta B_k)$ to a relative change in the hourly wage of this group $(\Delta w_k/w_k)$ can be estimated by:

$$\Delta B_k = \sum_{l=1}^{8} c_l \left(\sigma_{kl} + \eta\right) \left(\Delta w_l / w_l\right) B_k \tag{4}$$

where σ_{kl} is the (Hicks/Allen-) substitution elasticity, c_l is the share of the wage costs of group l in total wage costs, and η is the price elasticity of demand for goods.[16]

Consumption effects

Another margin of adjustment for firms facing higher labor costs because of a minimum wage is to pass those costs onto consumers. Johnson and Browning (1983) assume that all households bear this total cost in proportion to their income. Macurdy and McIntyre (2001) relax the one-product assumption and relate the rise in the cost of labor for different industries to prices increases for various types of goods using input-output matrices. The rise in product prices is borne by all households depending on their concumption rate and structure. We follow this procedure here and assume perfect competition and perfectly elastic supply of goods. Increases in labor costs are thus fully borne by consumers. The average wage increase for a given sector is simulated as described in sub-section 3.1 above. Price increases for goods Δp_n produced in sector n result from wage increases in the same sector Δw_n (scaled by the share of wage costs ws_n), wage increases Δw_m in all other sectors m where intermediary inputs for sector n are produced (scaled by their share of wage costs ws_m), and the share of intermediary inputs in sector n in relation to all inputs as

[15] We do not consider adjustments of the capital stock here. In the long run it is likely that low-skilled labor is substituted by capital.

[16] Bauer et al. (2009) follow a similar approach but define different labor market groups. They use a slightly different specification of the labor demand model as well as a different data base for the employment figures. Ragnitz and Thum (2008) and Knabe and Schöb (2009) use a simpler method assuming the labor demand elasticity to be the same for all groups (Müller, 2009).

measured by the input coefficient a_{mn}:

$$\Delta p_n = (\Delta w_n) ws_n + \sum_m a_{mn} (\Delta w_m) ws_m \tag{5}$$

Contrary to previous simulation studies we also consider the adaption of the consumption behavior after these price increases. We estimate Engle curves for the shares of different consumption goods on data from the Continuous Household Budget Survey for Germany (Laufende Wirtschaftsrechnungen (LWR), see sub-section 3.5 below):

$$C_{gi}/C_i = \alpha + \beta_1 log(Y_i) + x_i' \beta + u_i \tag{6}$$

where C_i is total consumption expenditures of household i, C_{gi} is expenditures on good g, Y_i is available net household income, and x_i is a vector of socio-demographic characteristics. We estimate the system for 12 non-durable consumer goods corresponding to the one-digit classification in the German income and consumption survey. C_i is also estimated as a function of current net household income and the variables included in x_i.[17]

3.4 Microsimulation with behavioral adjustments

Having estimated behavioral reactions at different margins we are able to incorporate them into our simulation model and analyze their distributional consequences. To our knowledge none of the aforementioned papers has integrated behavioral effects into a microsimulation model. Analyzing *labor supply* effects within a simulation model is common (Creedy and Duncan, 2002). As those effects turn out to be small (see section 4) we exclude labor supply from the distributional analysis without further consequences.

Based on the estimated *labor demand* changes in (4) we predict the share of people who become unemployed ($\Delta B_k/B_k$) for a given minimum wage level and for each labor type k.[18] We then draw a weighted random sample of the same size among those who are affected by the minimum wage (i.e. earn wages below the

[17] Estimation results for the consumption function are reported in Table 12 in the Appendix. Further information on measurement, the exact calculation of the burden and detailed results from the consumption share equations are available from the authors upon request.

[18] Depending on the assumed size of η the demand change is positive for some i. Since we abstract from labor supply effects and in order to simplify the analysis we disregard positive employment changes in this version of the simulation. The only group where this simplification is relevant are women working part-time in West Germany.

level of the minimum) per group k with the weights being determined linearly by the distance between the earned wage and the minimum wage. The individuals selected in this manner become unemployed under the simulated minimum wage scenario. The unemployment probability varies with individual characteristics and the distance of the observed wage from the minimum wage level. We capture the distributional implications of potential disemployment effects. The procedure is repeated 50 times and average net household incomes are simulated as described in sub-section 3.2 above to get robust results. For the simulation of *consumption effects* we use the structural parameters of (4) to predict household-specific consumption shares with the SOEP data. This enables us to simulate the effects of the federal minimum wage on consumption as described in sub-section 3.2 as pure price effect and with the behavioral adjustments after an increase in consumer prices.

Our approach is limited in several ways. The simulation of wage effects rests on the assumptions about coverage, compliance and no wage spillovers. Although we allow for more heterogeneity in behavioral adjustments than previous studies, limitations remain with respect to labor demand and consumption. For both margins we are only able to differentiate the analysis by combining individual and household characteristics. The distributional effects are therefore approximated by the resulting groups. Although different adjustment mechanisms are considered, we do not conduct a general equilibrium analysis as interdependencies between labor supply and demand or consumption and employment are not explicitly modeled. We do not simulate "third round" effects here (i.e. the distribution of saved benefits and tax revenues), since we do not want to speculate about a re-distribution mechanism.[19] Nevertheless a microsimulation approach is better suited for the distributional questions we adress here than, e.g., computable general equilibrium models.

3.5 Data

The simulation of wage effects, the microsimulation and labor supply estimation are based on data from the German Socio-Economic Panel (SOEP) which is a representative sample of households living in Germany with detailed information on household incomes, working hours and the household structure (Wagner et al., 2007). We

[19] Müller and Steiner (2011) simulate the effects of a statutory minimum wage where the gains in fiscal revenues are redistributed via an employer-oriented wage subsidy.

use the current wave for the year 2010. Since the STSM is based on retrospective information on income components for the simulation of net household incomes for a given year, wages and incomes computed on basis of the SOEP wave from 2010 refer to 2009. Because our analysis refers to the year 2012, we extrapolate incomes on the basis of realized average growth rates for 2010 and 2011, and expected growth rates for 2012.[20] The tax-benefit system is also updated to include all known changes in regulations up to 2012.

Labor demand estimations are based on the BA Employment Panel (BAP, Koch and Meinken (2004)) provided by the Federal Employment Agency. The BAP contains quarterly information on employment and wages for a 2% random sub-sample of all employees subject to social insurance between 1998 and 2003 amounting to about 600,000 observations per quarter. Freier and Steiner (2007) and Freier and Steiner (2010) provide more details. The calculation of price effects and the estimation of Engle curves is based on data from the Continuous Household Budget Survey for Germany ("Laufende Wirtschaftsrechnungen", LWR, Bundesamt (2007)). The LWR are provided by the German Federal Statistical Office and consist of repeated cross-sections (on a monthly and partly a quarterly basis) between 2002 and 2007. The data set used in this paper consists of about 25,500 observations for West Germany and nearly 7,000 observations for East Germany. The LWR contains detailed information on income, consumption, and savings at the household level.

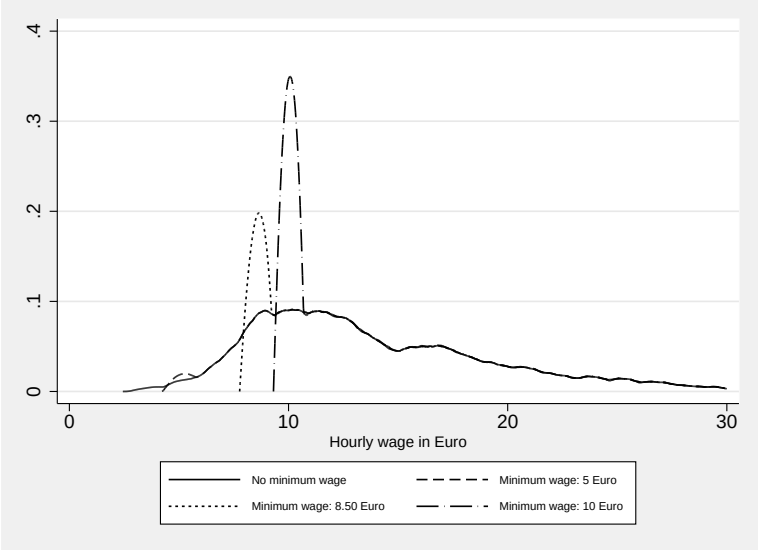
4 Empirical results

4.1 Wage inequality

The impact on the wage distribution of employed people – disregarding employment effects for the moment – crucially depends on the level at which the minimum wage is set. The kernel density estimates of the observed and simulated distributions in Figure 1 illustrate those differences. A minimum wage of 5.00 €/hour (dashed line) has only a minimal impact on the distribution. Minima set at 8.50 or 10.00 €/hour

[20] Most interviews in the SOEP refer to the first quarter of the year. We assume that incomes will increase with the annual growth rate in that year. Average annual growth rates are derived from the following indices for the years 2010, 2011 and 2012: 1.011, 1.023, 1.021 for consumer prices; 1.007, 1.030, 1.026 for wages; 1.003, and 1.05, 1.035, 1.035 for income from profits (source: national accounts; BMWi (2010); own calculations).

Figure 1: Kernel density estimates of wage distributions



Source: Own calculations based on SOEP, wave 2010.

respectively generate marked spikes in the distribution. The graph also visualizes the assumptions we make. The simulated wage distributions under a minimum wage are censored at the minimum and wages above the minimum wage level remain unchanged.[21] Given these assumptions the minimum wage by definition only affects lower parts of the wage distribution: A minimum wage of 5.00 €/hour changes only the first 5 percentiles, a minimum of 8.50 €/hour alters the distribution up to the 15th percentile and set at a level of 10.00 €/hour up to the 20th percentile.

As Table 1 shows, a minimum wage of 5.00 €/hour amounts to about 30% of the median and 33% of the average gross hourly wage in the German economy.[22] These ratios increase to about 56% and 51% under a minimum of 8.50 €/hour and to 66% and 60% for a minimum wage in the amount of 10.00 €/hour. Only about 1% of all German employees would be affected by a minimum wage of 5.00 €/hour, whereas the incidence increases to more than 11% (19%) for a minimum of 8.50 €/hour (10.00 €/hour). The introduction of a minimum wage of 8.50 €/hour would increase the total wage bill by about 650 million €/month, or 7.8 billion €/year, which is about 0.9% of the wage bill in 2012. The increase in the wage bill would be substantially lower for a moderate minimum of 5.00 €/hour and only amounts to 0.04%

[21] As mentioned above wages below 3 €/hour earned in regular employment are excluded from the analysis. Wages below 3 €/hour are included if they refer to supplementary work of people drawing unemployment benefits.

[22] People in full-time vocational and apprenticeship training as well as 'secondary jobs', i.e. jobs held in addition to the main job, are excluded here.

of the total wage bill. An increase in the minimum wage level to 10.00 €/hour on the other hand more than doubles the increase in the total wage bill to 1.5 billion €/month or almost 2% of the total wage bill.

Table 1: The effects of a minimum wage on the wage distribution, Germany total; only currently employed people, 2012

	MW=5.00 €/hour		**MW=8.50 €/hour**		**MW=10.00 €/hour**	
Incidence						
MW as % of						
Median		29.83		55.92		65.79
Mean		32.89		50.72		59.67
Affected (%)						
overall		1.14		11.39		18.97
1st decile		11.58		100.00		100.00
Change in wage sum						
1000 €/m		32,340		647,388		1,464,828
% wage sum		0.04		0.86		1.95
Wage inequality – no MW						
Gini coefficient (× 100)	25.76	(24.90; 26.62)	25.76	(24.90; 26.62)	25.76	(24.90; 26.62)
Mean log deviation (× 100)	10.74	(9.92; 11.57)	10.74	(9.92; 11.57)	10.74	(9.92; 11.57)
Atkinson ($\epsilon = 2$) (× 100)	18.35	(17.37; 19.32)	18.35	(17.37; 19.32)	18.35	(17.37; 19.32)
Wage inequality – MW						
Gini coefficient (× 100)	25.69	(24.84; 26.55)	24.27	(23.43; 25.12)	22.27	(21.42; 23.12)
Δ (Δ %)	-0.07	(-0.27)	-1.49	(-5.78)	-3.49	(-13.55)
Mean log deviation (× 100)	10.62	(9.80; 11.44)	9.32	(8.54; 10.11)	8.07	(7.31; 8.83)
Δ (Δ %)	-0.12	(-1.12)	-1.42	(-13.22)	-2.67	(-24.86)
Atkinson ($\epsilon = 2$) (× 100)	17.97	(17.03; 18.92)	15.31	(14.41; 16.22)	13.10	(12.22; 13.99)
Δ (Δ %)	-0.38	(-2.07)	-3.04	(-16.57)	-5.25	(-28.61)

Notes: Only employed people aged 18-65 are included. Wage projections for 2012 are based on average growth rates. Weighted data using sample weights to obtain population means. Δ wage bill is the difference between the wage sum with and without the minimum wage, with wage sum = $\sum$ (hourly wage × weekly working hours × 4.2); employers' social security contributions not included. The Gini coefficient is sensitive to changes in the middle of the income distribution. The mean log deviation of equivalent income is a 'bottom-sensitive' inequality measure. The Atkinson inequality measure is calculated for a high degree of inequality aversion ($\epsilon = 2$); see Cowell (2000). 95%-confidence bands are given in parentheses.

Source: Own calculations based on SOEP, wave 2010.

To assess the effects on wage inequality several synthetic measures are calculated (Table 1). According to the *Gini coefficient* which is sensitive to changes in the middle of the distribution, a minimum of 5.00 €/hour would not significantly reduce inequality. Setting the minimum at 8.00 or even 10.00 €/hour yields a sgnificantly smaller measure; inequality would decrease by about 6% or 14% respectively. The more bottom-sensitive *Mean log deviation* or *Atkinson inequality measure* yield qualitatively similar results. A minimum of 5.00 €/hour could not siginificantly decrease wage inequality the higher minima would achive this and reduce inequality by about 15% and 25% respectively. Minimum wages set at higher levels would thus substantially decrease wage inequality, if the assumptions described at the outset were to hold.

There is considerable heterogeneity in the incidence and wage effects of the min-

imum wage across regions and gender (see Table 7 in the Appendix for a minimum of 8.50€/hour). Whilst among men in West Germany only about 6% of all employees would be affected, 17% of males in East Germany and almost 13% (22%) of employed women in West (East) Germany earn wages below this minimum. Except for men in West Germany, all currently employed people in the bottom decile of the wage distribution would be bitten by the minimum wage. The minimum wage would disproportionately affect younger employees, those with low qualification, marginally employed people and those working in small firms. The magnitude of the wage changes differs little by age and qualification, but significantly by employment status. Low-pay of people in marginal employment (jobs earning less than 400€/month and without social security coverag) has been one alleged reason for introducing a minimum wage. As shown in Table 7 hourly gross wages of people holding such jobs would be raised by almost 40% in the bottom decile compared to about 25% for full-time employed people.

The wage simulations proved robust with respect to the forecasting with average growth rates. Estimating dynamic wage growth regressions and using individual growth rates does not affect the results. Another sensitivity check concerns the treatment of secondary jobs. Since the 2003 "Mini Jobs" reform, jobs with earnings below 400€/month have been exempted from employees' social security contributions if held in addition to a main job (Steiner and Wrohlich, 2005). Including those jobs leads to higher simulated wage gains in the first decile, but overall findings change only marginally without affecting our conclusions. Given the robustness of our simulation results (see also Müller and Steiner (2010)) we continue the analysis on the basis of the simulation results in Table 1.

4.2 Behavioral effects

Labor supply

Labor supply effects are small overall but naturally depend on the level of the minimum wage (see Table 8 in the Appendix). Setting the minimum at 5.00€/hour would induce virtually no labor supply response (less than 3,000 persons); at 8.50€/hour labor force participation would increase by about 65,000 persons and by almost 140,000 if the minimum wage was fixed at 10.00€/hour. The effects on total hours worked amount to about 6,000, 200,000, and 400,000 full-time equivalents,

respectively. The main explanation for these moderate effects – even after sizeable increases of gross wages – is the previously described loose relationship between hourly wages and household income (see also the results in sub-section 4.3 below). Therefore the incentives to increase the supply of labor remain rather limited.

Except for singles in East Germany labor supply effects are larger for women compared to men both with respect to participation and hours choices. Overall, households in the East show larger labor supply responses compared to West Germany as the relative level of the minimum wage is higher. Since the participation effects are fairly small, we will not consider labor supply changes in the simulation of household incomes with behavioral adjustment in this paper. Detailed estimation results for the conditional logit models are presented in Table 9 in the Appendix, all model assumptions (see (van Soest, 1995) for details) hold.

Labor demand

The simulation on labor demand effects rests on compensated own and cross wage elasticities of the demand for labor (number of workers) for different types of labor that are estimated by Freier and Steiner (2007, 2010). These elasticities are conditional on the level of output and the capital stock and estimated separately for West and East Germany. They reveal a rather complex pattern of substitution and complementarity among labor inputs (see Table 10 in the Appendix). For instance, marginally employed women in West Germany and women working part-time are substitutes in production whereas marginally employed women and skilled women with full-time jobs are complements. For a given demand for goods a relatively high increase in wages for marginally employed women induced by the minimum wage will lead to a decrease in labor demand for this group and also for skilled women in full-time, but an increase in labor demand for women working part-time. The elasticities for East Germany follow a similar pattern for this group. Note that highly skilled individuals were assumed to be quasi-fixed which is why we do not calculate labor demand effects for this group.

The second determinant of labor demand responses is the average wage change per type of labor induced by the minimum wage. In Table 11 in the Appendix the simulated wage increases are broken down to the labor types used in the labor demand estimations. The highest relative wage increase occurs for marginally em-

ployed workers; for a minimum wage of 8.50 €/hour it amounts to 13% (24%) for men and 7% (12%) for women in West (East) Germany. Part-time employed and unskilled women working full-time in East Germany would also experience notable wage rises. The incidence and wage changes obviously depend on the minimum wage level: only 14% (7%) of marginally employed men in the West (East) would be affected by a minimum wage rate of 5.00 €/hour. The incidence rate for this group increases to 38% (42%) for a level of 8.50 €/hour and to 45% (50%) when the minimum is fixed at 10.00 €/hour. The incidence rate not only increases within, but is very different between labor types for varying minimum wage levels. Looking again at marginally employed as an example, men in West Germany with an incidence rate of 14% are clearly more often affected by a minimum wage of 5.00 €/hour compared to women in the West (less than 4%) of men in the East (7%). When the minimum would be set at 10.00 €/hour men in the East (50%) and women in the West (48%) are more often affected than men in West Germany (45%).

In Table 2 the employment effects for different minimum wages are reported which were calculated on the basis of the demand elasticities, the wage changes per type of labor, and 3 different price elasticities for the demand for goods (0, -1, -2). The overall employment effects depend on the assumed level of the minimum wage and the price elasticity of the demand for goods. If the latter was perfectly inelastic, overall labor demand would decrease by about 6,000 persons for a minimum wage of 5.00 €/hour, by 70,000 individuals for a level of 8.50 €/hour, and by 135,000 persons for a level of 10.00 €/hour. In these scenarios the loss of marginal employment would partially be compensated by an increase in demand especially for part-time employed women. If the demand for goods was highly elastic with respect to price changes (assumed elasticity of -2), the overall decrease in demand for labor would amount to about 30,000, 600,000, and 1.35 million persons, respectively. Again the lion's share of employment losses concerns marginal employment. In this scenario the demand for skilled full-time labor would also shrink considerably due to the strong reduction in the demand for goods. We regard the scenario with an assumed price elasticity of demand for goods of -1 the most plausible one for the German economy. The resulting decrease in labor demand for a minimum wage of 5.00 €/hour amounts to about 18,000 persons, for a minimum wage level of 8.50 €/hour to about 340,000 individuals, and for a level of 10.00 €/hour to 740,000 persons. We use this variant

Table 2: Changes in labor demand (heads) after the introduction of a legal minimum wage, 2012

			MW=5.00 €/hour Output price elasticities			**MW=8.50 €/hour** Output price elasticities			**MW=10.00 €/hour** Output price elasticities		
			0	-1	-2	0	-1	-2	0	-1	-2
West Germany											
Full-time	Skilled	*Women*	-353	-1,697	-3,041	-9,653	-33,336	-57,019	-20,795	-78,695	-136,594
		Men	969	-1,581	-4,132	17,696	-27,244	-72,184	39,691	-70,178	-180,046
	Unskilled	*Women*	-2	-213	-424	-3,818	-7,537	-11,255	-9,424	-18,515	-27,605
		Men	67	-316	-700	3,294	-3,462	-10,219	4,427	-12,091	-28,610
Part-time		*Women*	2,007	449	-1,108	23,968	-3,478	-30,925	39,688	-27,413	-94,513
		Men	-450	-638	-826	-831	-4,146	-7,460	1,304	-6,799	-14,902
Marginally employed		*Women*	-4,886	-5,545	-6,203	-64,392	-75,994	-87,596	-116,446	-144,810	-173,175
		Men	-1,373	-1,554	-1,736	-18,671	-21,861	-25,052	-32,945	-40,745	-48,545
Total			-4,021	-11,095	-18,169	-52,406	-177,058	-301,709	-94,501	-399,245	-703,990
East Germany											
Full-time	Skilled	*Women*	270	-767	-1,803	-2,078	-33,754	-65,430	-5,572	-73,765	-141,959
		Men	191	-1,620	-3,432	3,132	-52,223	-107,579	7,458	-111,713	-230,885
	Unskilled	*Women*	145	90	34	1,282	-413	-2,108	2,163	-1,487	-5,136
		Men	-251	-439	-627	-342	-6,086	-11,829	203	-12,162	-24,526
Part-time		*Women*	-713	-1,766	-2,819	5,158	-27,026	-59,210	8,792	-60,496	-129,783
		Men	-43	-207	-370	-1,203	-6,203	-11,202	-1,186	-11,949	-22,712
Marginally employed		*Women*	-1,245	-1,589	-1,932	-13,396	-23,889	-34,381	-24,954	-47,543	-70,132
		Men	-394	-508	-622	-8,007	-11,492	-14,978	-15,107	-22,610	-30,114
Total			-2,039	-6,805	-11,571	-15,454	-161,086	-306,717	-28,203	-341,725	-655,248

Notes: Own- and cross-wage elasticities taken into account. Demand changes in numbers of employees ('heads').
Qualification categories according to Freier and Steiner (2007, 2010): 'skilled' = secondary-school education or vocational training, 'unskilled' = neither secondary-school education nor vocational training.

Source: Own calculations based on elasticity estimates taken from Freier and Steiner (2007, 2010), SOEP wave 2010.

for the simulation of household incomes that include the behavioral adjustment of labor demand in the next sub-section.[23]

Consumption

Facing minimum wage induced price increases in consumption goods households will decrease their consumption level and adjust the composition of consumed goods as relative prices change, too. In addition to the price increases we simulate the adjustment of overall consumption in this paper. Estimation results for the consumption rate are presented in Table 12 in the Appendix. The consumption rate significantly decreases with household income both in East and West Germany. Poorer households consume a larger share of their income underlining the regressive effect of the minimum wage induced price increases. The consumption rate also significantly differs with wealth, the composition of the household, the individual characteristics, the labor force participation, and the social position of all household members. We will use the structural parameters from this model to predict the consumption rate and simulate its adjustment after the introduction of a minimum wage.

4.3 Income inequality

As shown above a minimum wage set at higher levels would lead to a significant increase of hourly wages at the bottom of the distribution and reduce wage inequality in Germany. In this sub-section we present results from the microsimulation analysis on the effects of a minimum wage on household incomes and overall income inequality. First, we discuss the average effects and then look into the distributional consequences. In each sub-section a static scenario without behavioral adjustments is presented. In the second scenario labor demand adjustments are taken into account. The final simulations additionally incorporate price adjustments of firms for consumption goods and the adaption of the consumption rate by households.

[23] Our estimated employment effects are much smaller than those obtained by Bauer et al. (2009); Ragnitz and Thum (2008); Knabe and Schöb (2009). Bauer et al. assume a rather small price elasticity of demand of -0.2 value and use different compensated labor demand elasticities which imply that most labor categories are gross complements. However, the main reason for differences in simulated employment effects seem to be that Bauer et al. base their simulations on much larger relative wage changes induced by a minimum wage than we find in our study. Ragnitz and Thum (2008) use the same data set and assume a uniform labor demand elasticity of -0.7, which is also assumed in the study by Knabe and Schöb who use SOEP data instead. Müller (2009) discusses the sensitivity of the labor demand estimations.

Average effects

The overall share of households affected in Germany is 2%, 12% and about 20% for the respective minimum wage levels of 5.00, 8.50, and 10.00 €/hour (Table 3). Regional differences can also be identified for the minimum wage incidence at the household level as East German households are more frequently affected. Given a level of 8.50 €/hour the incidence rate is 10% in West and 18% in East Germany. Without behavioral adjustments a minimum wage set at 5.00 €/hour would increase net monthly incomes for those households affected by it by only about 5 € (0.2%). When the minimum wage is set at 8.50 €/hour this amount increases to 80 € (3%), and to 120 € (5%) for a level of 10.00 €/hour. The average increase in income is clearly higher for households in East Germany. For a minimum wage set at 8.50 €/hour the difference is 6% in the East vs. 2% in the West.

When behavioral effects are not considered the income change would amount to about 2.9 million €/month, or roughly 35 million €/year in total when the minimum is set at 5.00 €/hour. The total sum increases to 267 million €/month (3.2 billion €/year) and 652 million €/month (7.8 billion €/year) for minimum wages of to 8.50 €/hour and to 10.00 €/hour, respectively. Roughly the same total amount would go to West and East Germany, although only about 20% of the total population lives in the East. The absolute sums are substantially smaller compared to the total increase in the wage bill (see Table 1). The shares of net income gains from the increases in gross wages equal 9% for a minimum of 5.00 €, 41% for a minimum of 8.50 € and 45% for a minimum of 10.00 €/hour. In this simulation where agents do not adapt their behavior, the relatively smaller increase in net incomes can be explained by the substitution of means-tested income transfers by higher wage incomes and progressive taxation. Raising hourly wages through a statutory minimum at the bottom of distribution leads to the withdrawal of social transfers, higher income taxes, and increased public savings. The impact on net household incomes is diminished by those components.[24]

Under a scenario that takes employment effects into account ("with employment

[24]We do not consider fiscal effects here, but simulate the effects of an increase in wage costs through behavioral adjustments of labor demand and consumption. Potential public savings are diminished by lower output levels and higher unemployment. Bauer et al. (2009) look into the fiscal effects of a nationwide minimum wage. Müller and Steiner (2011) simulate the effects of a legal minimum wage when fiscal revenue is re-distributed by an employer-oriented wage subsidy.

Table 3: Minimum wage effects on net incomes of households affected by the minimum wage, 2012

	MW=5.00 €/hour			**MW=8.50 €/hour**			**MW=10.00 €/hour**		
	Total	West	East	Total	West	East	Total	West	East
Incidence (%)	2.0	1.8	2.7	12.2	10.5	17.8	19.8	17.4	27.5
Avg. income no MW (€/m)	2,784	3,195	1,870	2,448	2,668	2,032	2,470	2,646	2,111
Δ Average income with MW									
No behavioral effects (€/m)	5.2	-1.6	20.3	80.4	58.7	121.4	121.2	95.6	173.4
No behavioral effects (%)	0.2	-0.1	1.1	3.3	2.2	6.0	4.9	3.6	8.2
With employment effects (€/m)	-1.1	-7.0	12.0	42.6	32.5	61.8	51.6	41.5	72.3
With employment effects (%)	0.0	-0.2	0.6	1.7	1.2	3.0	2.1	1.6	3.4
Consumption price effects (€/m)	-27.7	-34.6	-12.3	-19.9	-23.3	-13.4	-15.9	-19.6	-8.2
Consumption price effects (%)	-1.0	-1.1	-0.7	-0.8	-0.9	-0.7	-0.6	-0.7	-0.4
Total consumption effects (€/m)	0.6	-3.4	9.4	24.4	17.9	36.6	32.9	24.8	49.5
Total consumption effects (%)	0.0	-0.1	0.5	1.0	0.7	1.8	1.3	0.9	2.3
Δ Total income with MW									
No behavioral effects (mill. €/m)	2.9	-0.6	3.5	266.5	127.3	139.2	652.3	345.0	307.2
With employment effects (mill. €/m)	-0.6	-2.7	2.0	141.3	70.4	70.9	277.9	149.6	128.2
Consumption price effects (mill. €/m)	-15.2	-13.1	-2.1	-66.0	-50.6	-13.4	-85.5	-70.9	-14.6
Total consumption effects (mill. €/m)	0.3	-1.3	1.6	80.8	38.8	42.0	177.2	89.5	87.7

Notes: Incidence = Households affected by the minimum wage as percentage of all households in each group. Percentage changes of average income refer to households within the respective group, percentage changes of total income are calculated relative to the whole population. Employment status refers to the situation before the introduction of a minimum wage. When accounting for employment effects of a minimum wage a fraction of the employed is simulated to become unemployed according to demand side constraints of Table 4. Wage projections for 2012 are based on average growth rates.

Source: Own calculations based on SOEP, wave 2010.

effects" in Table 3) the average monthly income gain for households affected by the minimum wage is roughly cut by half. For a minimum set at 8.50 €/hour it decreases from about 80 € to 43 €. For the low minimum wage level of 5.00 €/hour the income effect becomes even slightly negative because of the labor demand reactions. Likewise the total increase in household incomes shrinks considerably. As would be expected employment losses due to the legal minimum further reduce the modest increases in household incomes substantially.

In addition to labor demand adjustments the following simulations take also consumption effects into account. If only the prices of consumption goods increased due to a minimum wage and households did not adjust their demand for consumption goods to changes in real net household income ("consumption price effects" in Table 3), the change of net incomes becomes negative for all three minimum wage levels. Households affected by the federal minimum wage would, on average, suffer an income loss of 28 €, 20 €, and 16 € for minimum wages set at 5.00 €, 8.50 €, and 10.00 €/hour respectively. Accordingly, the total income effect would become negative. If the estimated adjustment of consumption behavior induced by changes in real net household income is also considered ("total consumption effects" in Table 3), the price effect of the minimum wage on net household incomes is partly compensated for by a reduction in the demand for goods with a relatively high income elasticity (quantity effect).[25] Except for the scenario with the low minimum wage in West Germany, the price and quantity effect together (total consumption effect) have positive effects on net household incomes. Yet, the average increase in household income is substantially reduced by about one-half compared to the simulation with employment effects.

The income effects of a minimum wage are *heterogeneous* with respect to different household types. The incidence rate is higher for couples than for singles and for households with children compared to those without. Among couples the share is also greater for families where both spouses work (see Table 13 for a minimum wage of 8.50 €/hour).[26] Since means-tested transfers are related to the presence of

[25] We are not able to consider substitution effects between different (types of) consumption goods here as we do not have detailed demand elasticities for different (groups of) goods at our disposal.

[26] Detailed results for different minimum wage levels and by region are available from the authors upon request. Müller and Steiner (2010) have shown these differences to be more pronounced in West Germany.

children in the household and to the employment status of the spouse, the minimum wage leads to smaller increases of the monthly household income for families with children. Depending on behavioral adjustments the average gain in net income is between 40 and 60% lower for households with children. Labor demand constraints are not evenly distributed over households. Families with children would be penalized more strongly. This pattern also holds for the simulations that take consumption effects into account. In the scenario where only price effects are considered singles without children are the only group that maintains a positive income difference. When quantity adjustments are allowed all household types – except for couples with only one working spouse – exhibit positive net income effects. Yet, households with children react less elastic in their consumption behavior and thus bear more of the price increase. Although households with children would be more often affected by a minimum wage, their net gain from this policy would be significantly below-average. The minimum wage is thus not well targeted at families with children.

Distributional effects and inequality

The effects of the minimum wage on overal income inequality depend on the distribution of minimum wage earners accros different income levels and the average income changes of affected households at different locations of the income distribution. The share of persons affected by the minimum wage in the bottom decile of the net equivalent income distribution is substantially smaller than the incidence rates in each of the 2nd-6th deciles (Table 4). Only in the higher deciles of the distribution does this share decline below the level it obtains in the bottom decile. This pattern holds regardless of the level of the minimum wage. A regional breakdown conducted by Müller and Steiner (2010) reveals that the minimum wage incidence varies across deciles of the net equivalence income distribution between West and East Germany. Whereas the share of people affected by the minimum is low in the first and second decile and highest between the 3rd and 7th decile in the East, the incidence rate is highest in the 2nd decile and declines after that in West Germany. Confirming the interational evidence the minimum wage would not be targeted at the poor from the perspective of the distribution of net equivalence incomes.

Without behavioral adjustments net equivalent income would increase for house-

Table 4: Effects of a minimum wage on net equivalent incomes of households affected, Germany 2012

Decile	Avg. income no MW (€/m)	Incidence MW= 5.00€ (%)	8.50€ (%)	10.00€ (%)	MW: without behavioral effects MW=5.00€/hour Δ avg. income (€/m)	(%)	MW=8.50€/hour Δ avg. income (€/m)	(%)	MW=10.00€/hour Δ avg. income (€/m)	(%)	MW: with employment effects MW=5.00€/hour Δ avg. income (€/m)	(%)	MW=8.50€/hour Δ avg. income (€/m)	(%)	MW=10.00€/hour Δ avg. income (€/m)	(%)
1st	727	1.9	13.0	17.8	14.5	1.8	41.6	5.2	62.6	7.9	10.7	1.3	22.2	2.8	31.4	3.9
2nd	985	6.1	25.4	36.6	16.8	1.7	82.9	8.4	118.7	12.1	9.2	0.9	40.8	4.1	45.6	4.6
3rd	1,175	2.2	19.9	33.5	3.1	0.3	57.2	4.9	101.4	8.6	1.5	0.1	20.5	1.8	33.3	2.8
4th	1,369	4.5	24.9	34.6	5.7	0.4	73.2	5.4	113.9	8.4	5.1	0.4	28.4	2.1	50.2	3.7
5th	1,558	3.5	21.0	33.1	4.1	0.3	41.6	2.7	75.9	4.9	-3.8	-0.3	23.4	1.5	19.7	1.3
6th	1,748	1.9	12.2	22.6	-13.1	-0.8	35.9	2.1	57.5	3.3	-10.8	-0.6	15.8	0.9	26.6	1.5
7th	1,951	2.3	12.7	19.4	13.3	0.7	36.4	1.9	54.4	2.8	-4.7	-0.2	9.9	0.5	8.2	0.4
8th	2,195	1.6	8.3	17.2	-35.7	-1.6	46.0	2.1	56.0	2.6	-40.1	-1.8	-4.5	-0.2	-14.7	-0.7
9th	2,600	0.6	5.8	13.2	6.9	0.3	37.2	1.5	54.3	2.1	6.3	0.3	26.5	1.1	19.7	0.8
10th	4,234	2.4	4.6	5.8	-8.9	-0.3	26.6	0.8	38.9	1.1	-12.5	-0.4	-2.5	-0.1	16.2	0.4
Average	1,854	2.7	14.8	23.4	5.0	0.3	55.8	3.9	85.3	5.8	-1.2	-0.1	22.7	1.5	28.2	1.8

Decile	Avg. income no MW (€/m)	Incidence MW= 5.00€ (%)	8.50€ (%)	10.00€ (%)	MW: with employment & consumption price effects MW=5.00€/hour Δ avg. income (€/m)	(%)	MW=8.50€/hour Δ avg. income (€/m)	(%)	MW=10.00€/hour Δ avg. income (€/m)	(%)	MW: with employment & total consumption effects MW=5.00€/hour Δ avg. income (€/m)	(%)	MW=8.50€/hour Δ avg. income (€/m)	(%)	MW=10.00€/hour Δ avg. income (€/m)	(%)
1st	727	1.9	13.0	17.8	-0.8	-0.1	3.8	0.6	4.3	0.7	6.3	1.0	16.2	2.5	21.9	3.4
2nd	985	6.1	25.4	36.6	-5.3	-0.6	-5.0	-0.6	2.2	0.3	4.3	0.5	15.3	1.7	29.2	3.3
3rd	1,175	2.2	19.9	33.5	-13.1	-1.2	-11.8	-1.1	-8.3	-0.8	2.3	0.2	11.6	1.1	13.7	1.3
4th	1,369	4.5	24.9	34.6	-15.1	-1.2	-12.0	-0.9	-9.3	-0.7	-4.3	-0.3	15.8	1.2	22.2	1.7
5th	1,558	3.5	21.0	33.1	-17.4	-1.2	-17.1	-1.2	-14.7	-1.0	1.2	0.1	5.7	0.4	15.6	1.1
6th	1,748	1.9	12.2	22.6	-20.5	-1.3	-15.2	-0.9	-15.9	-1.0	-4.1	-0.3	12.4	0.8	11.3	0.7
7th	1,951	2.3	12.7	19.4	-23.7	-1.3	-21.4	-1.1	-18.8	-1.0	-5.4	-0.3	4.6	0.2	10.3	0.6
8th	2,195	1.6	8.3	17.2	-14.8	-0.7	-20.1	-0.9	-23.4	-1.1	7.1	0.3	10.7	0.5	0.6	0.0
9th	2,600	0.6	5.8	13.2	-25.5	-1.1	-24.8	-1.0	-23.7	-0.9	2.2	0.1	7.2	0.3	7.6	0.3
10th	4,234	2.4	4.6	5.8	-33.5	-1.0	-24.8	-0.7	-21.9	-0.6	-9.6	-0.3	14.3	0.4	18.9	0.5
Average	1,854	2.7	14.8	23.4	-15.6	-1.1	-12.9	-0.9	-11.2	-0.8	-0.3	0.0	11.6	0.8	16.2	1.1

Notes: Deciles for the distribution of equivalent net incomes are calculated for the wage structure in 2012 (without minimum wage). Incidence = households affected by the minimum wage as percentage of all households within a given decile of the net equivalence income distribution. Δ avg. income = change of average incomes measured in equivalence units for affected households within a given decile. Wage projections for 2012 are based on average growth rates.

Source: Own calculations based on SOEP wave 2010.

holds affected by the minimum wage of 8.50 €/hour by about 55 €, or 4%, on average (see Table 4). The largest relative increase in average equivalent income would occur in the 2nd decile of the income distribution and amount to about 80 €/month, or about 8% of this group's net equivalent income in 2012. The negative difference for the very small share of affected households in certain deciles for the scenario with a minimum wage level of 5 €/hour probably follows from the loss of the splitting advantage of joint taxation of couples in Germany as soon as the second earner's income grows as a result of the minimum wage. These negative effects are not substantial, neither in relative nor in absolute terms.

In the simulations that take employment effects into account net equivalent income gains decline considerably: for a minimum wage of 8.50 €/hour the remaining average increase in equivalent income amounts to about 23 €/month (see Table 4). Especially the relatively high absolute gains in the 2nd-6th deciles are reduced substantially as those regions would be particularly affected by decreases of labor demand. When price effects for consumption goods are also considered without the behavioral adjustment of the consumption rate, the effects on net household equivalent incomes are negative throughout the whole income distribution and for all minimum wage levels. For a minimum wage set at 8.50 €/hour income losses are on average 13 €/month. When the adaption of consumers' behavior is also considered, the effects become positive again. The income gains which equal 12 €/month on average for a minimum wage of 8.50 €/hour are albeit smaller compared to the scenario without consumption effects (see Table 4). The redistributive effect of the minimum wage is also reduced in this simulation, because households in the lower income deciles have higher consumption rates and are disproportionately negatively affected by the indirect effects of the minimum wage on consumption.

To investigate the potential effects the introduction of a legal minimum wage would have on the overall income distribution, Table 8 reports standard summary inequality measures. For the scenario without behavioral adjustments of labor demand and consumption the *Gini coefficient*, which is sensitive to income changes in the middle of the distribution, does not record any significant change. The bottom-sensitive mean logarithmic deviation (MLD) measure reveals a very small decline in income inequality, which is also recorded by the Atkinson measure assuming a relatively high value for the inequality aversion parameter ($\epsilon = 2$). These very small

reductions in income inequality are comparable between West and East Germany (Müller and Steiner, 2010). Thus, in neither region would the minimum wage have any noticeable effect on overall income inequality. These findings hold for the whole range of minimum wage levels between 5.00 and 10.00 €/hour.

Table 5: Minimum wage effects on inequality measures, Germany, 2012

	MW=5.00 €/hour		**MW=8.50 €/hour**		**MW=10.00 €/hour**	
Status quo - no MW						
Gini coefficient (× 100)	27.60	(25.50; 29.70)	27.60	(25.50; 29.70)	27.60	(25.50; 29.70)
Mean log deviation (× 100)	13.09	(10.57; 15.62)	13.09	(10.57; 15.62)	13.09	(10.57; 15.62)
Atkinson ($\epsilon = 2$) (× 100)	22.88	(19.87; 25.88)	22.88	(19.87; 25.88)	22.88	(19.87; 25.88)
No employment effects						
Gini coefficient (× 100)	27.60	(25.50; 29.69)	27.43	(25.34; 29.53)	27.22	(25.13; 29.31)
Δ (Δ %)	0.00	(0.00)	0.17	(0.62)	0.38	(1.38)
Mean log deviation (× 100)	13.09	(10.57; 15.62)	12.97	(10.46; 15.48)	12.82	(10.32; 15.32)
Δ (Δ %)	0.00	(0.00)	-0.12	(-0.92)	-0.27	(-2.06)
Atkinson ($\epsilon = 2$) (× 100)	22.87	(19.86; 25.87)	22.73	(19.71; 25.74)	22.58	(19.56; 25.60)
Δ (Δ %)	-0.01	(-0.04)	-0.15	(-0.66)	-0.30	(-1.31)
Gini coefficient (× 100)	27.60	(25.20; 29.99)	27.53	(25.13; 29.93)	27.50	(25.10; 29.90)
Δ (Δ %)	0.00	(0.00)	0.07	(0.25)	0.10	(0.36)
Mean log deviation (× 100)	13.10	(10.19; 16.00)	13.05	(10.15; 15.96)	13.06	(10.16; 15.96)
Δ (Δ %)	0.01	(0.08)	-0.04	(-0.31)	-0.03	(-0.23)
Atkinson ($\epsilon = 2$) (× 100)	22.88	(19.57; 26.17)	22.85	(19.56; 26.17)	22.95	(19.67; 26.36)
Δ (Δ %)	0.00	(0.00)	-0.03	(-0.13)	0.07	(0.31)
With employment & consumption price effects						
Gini coefficient (× 100)	27.64	(25.35; 29.93)	27.63	(25.34; 29.92)	27.61	(25.32; 29.90)
Δ (Δ %)	-0.04	(-0.14)	-0.03	(-0.11)	-0.01	(-0.04)
Mean log deviation (× 100)	13.14	(10.37; 15.90)	13.13	(10.37; 15.89)	13.12	(10.35; 15.88)
Δ (Δ %)	0.05	(0.38)	0.04	(0.31)	0.03	(0.23)
Atkinson ($\epsilon = 2$) (× 100)	22.94	(19.83; 26.04)	22.93	(19.82; 26.03)	22.92	(19.81; 26.02)
Δ (Δ %)	0.06	(0.26)	0.05	(0.22)	0.04	(0.17)
With employment & total consumption effects						
Gini coefficient (× 100)	27.60	(25.33; 29.87)	27.55	(25.29;29.81)	27.50	(25.23; 29.77)
Δ (Δ %)	0.00	(0.00)	0.05	(0.18)	0.10	(0.36)
Mean log deviation (× 100)	13.09	(10.36; 15.83)	13.06	(10.33; 15.79)	13.03	(10.30; 15.75)
Δ (Δ %)	0.00	(0.00)	-0.03	(-0.23)	-0.06	(-0.46)
Atkinson ($\epsilon = 2$) (× 100)	22.87	(19.80; 25.95)	22.83	(19.76; 25.90)	22.81	(19.72; 25.88)
Δ (Δ %)	-0.01	(-0.04)	-0.05	(-0.22)	-0.07	(-0.31)

Notes: Wage projections for 2012 are based on average growth rates.
The Gini coefficient is sensitive to changes in the middle of the income distribution. The mean log deviation of equivalent income is a 'bottom-sensitive' inequality measure. The Atkinson inequality measure is calculated for a high degree of inequality aversion ($\epsilon = 2$); see Cowell (2000). 95%-confidence bands are given in parentheses.

Source: Own calculations based on SOEP, wave 2010.

The minimum wage becomes even less effective with respect to the reduction of overall income inequality when labor demand effects are taken into account. This is illustrated by the smaller differences for the inequality measures compared to simulation results not accounting for negative employment of the minimum wage. The already small redistributive effects of a minimum wage are further reduced or vanish completely when the effects on consumption are also taken into account. In fact, the income distribution under a federal minimum becomes more uneven in certain instances since negative income effects are more pronounced in the lower

deciles. This is mirrored by a slight increase in some of the inequality measures under the scenarios that include consumption effects. Contrary to the sizeable and significant reductions of hourly wage inequality (see Table 1 above) a statutory minimum wage would be ineffective in reducing overall income inequlity, even if it would be set at comparatively high levels.

5 Conclusions

In this paper we analyze the effects of the introduction of a nationwide minimum wage on the distribution of disposable household incomes in Germany. On the basis of individual- and household-level data from the German Socio Economic Panel (SOEP) we simulate wage changes, estimate behavioral adjustments at different margins and incorporate them into a micro-simulation model. This approach not only takes the distribution of minimum wage earners for different household incomes into account but also models the complex interactions between individual wages, the tax-benefit system and net household incomes. We compare scenarios with different levels of the minimum that were suggested in the recent policy debate (5.00, 8.50, 10.00€/hour).

Simulation results show that changes at the bottom of the hourly wage distribution would be substantial, if the level of the minimum wage is not set very low. Fixed at 8.50€/hour a minimum wage would significantly reduce wage inequality, even more so when it is set at a higher level of 10.00€/hour. These changes would disproportionately concern women East German and younger employees, low-qualified and marginally employed people.

In contrast to the substantial wage increases the introduction of a minimum wage would have a limited impact on average net household incomes regardless of the level at which it is set and even without behavioral adjustments. The discrepancy can be explained by the substitution of means-tested transfers and progressive income taxation. If labor demand and concumption effects are also considered, income gains are further reduced. The total income gain induced by a minimum wage of 8.50€/hour would only amount to a 40% share of the increase in the wage sum and is diminished further to slightly more than 10% when labor demand and consumption effects are taken into account. Families with children would receive substantially

smaller income increases. The minimum wage would also not be targeted at low income households. The share of minimum wage earners in the bottom decile of the distribution of net equivalent household income is markedly below the respective shares in the middle of the distribution. Although the largest relative increase in average equivalent incomes would occur in the bottom deciles of the income distribution the a legal minimum would only have negligible effects on the overall income distribution. This finding holds for the whole range of analyzed minimum wage levels between 5 and 10.00 €/hour.

The minimum wage is thus not an effective policy instrument for income redistribtion in Germany. This result is in line with other distributional studies on minimum wages. We contribute to this literature methodologically by modeling interactions of the minimum wage with the tax-and-transfer system and incorporating various behavioral adjustment mechanisms and their distributional implications into a microsimulation model. Empirically we provide more comprehensive empirical evidence for Germany than previous papers. This simulation study rests on several assumptions and does not represent an equilibrium analysis of the minimum wage. We are confident that neither of those limitations generally affects our main conclusion. The various mechanisms – the tax-and-transfer system, the position of minimum wage earners in the income distribution, employment and consumption effects – all operate in the same direction and diminish the redistributive efficiency of the minimum wage. Even if there are no negative employment effects or consumption prices would not change, the minimum would be largely ineffctive for income redistribution. Instead of the exclusive focus on potential disemployment effects the public debate should be re-directed to the question what a minimum wage can accomplish – more wage inequality – and what it will not achieve, namely alleviating poverty and lowering overall income inequality.

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Appendix

Table 6: Wage and income inequality by region, 1995-2010

	1995	(95%-CI)	**2000**	(95%-CI)	**2005**	(95%-CI)	**2010**	(95%-CI)
Gross wages - low wage share[1]								
Men West	0.02	(0.01; 0.03)	0.04	(0.03; 0.04)	0.06	(0.04; 0.07)	0.08	(0.06; 0.10)
Men East	0.03	(0.01; 0.04)	0.03	(0.02; 0.04)	0.06	(0.03; 0.09)	0.09	(0.06; 0.13)
Women West	0.05	(0.04; 0.07)	0.06	(0.05; 0.06)	0.08	(0.06; 0.09)	0.06	(0.05; 0.08)
Women East	0.04	(0.02; 0.06)	0.07	(0.05; 0.08)	0.09	(0.06; 0.13)	0.05	(0.03; 0.07)
Gross wages - Gini coefficient[1]								
Men West	0.23	(0.21; 0.25)	0.22	(0.21; 0.23)	0.23	(0.22; 0.24)	0.26	(0.24; 0.27)
Men East	0.22	(0.20; 0.24)	0.24	(0.23; 0.26)	0.25	(0.23; 0.27)	0.33	(0.24; 0.42)
Women West	0.23	(0.21; 0.25)	0.22	(0.21; 0.24)	0.24	(0.23; 0.25)	0.26	(0.23; 0.30)
Women East	0.22	(0.20; 0.25)	0.24	(0.23; 0.25)	0.28	(0.26; 0.30)	0.26	(0.23; 0.29)
Net equivalent income - Gini coefficient[2]								
West	0.26	(0.24; 0.27)	0.24	(0.23; 0.25)	0.25	(0.24; 0.26)	0.27	(0.26; 0.28)
East	0.21	(0.20; 0.22)	0.22	(0.21; 0.23)	0.25	(0.24; 0.26)	0.27	(0.26; 0.29)

Notes: [1]Hourly gross wage using longitudinal individual weights. [2]Net household equivalent income using longitudinal household weights.

Source: Own calculations based on SOEPlong, wave 2010.

Table 7: Mean hourly gross wage (in €) with and without a minimum wage of 8.50€/hour, within first decile of the hourly wage distribution, 2012

	Affected (in %)		**No MW**	**MW**		
	Overall	1st decile	€/hour	€/hour	Δ €	% Δ
Germany overall	11.39	100.00	6.53	8.50	1.97	30.17
Gender & Region						
Men West Germany	5.62	56.84	7.81	8.84	1.03	13.19
Men East Germany	16.95	100.00	5.86	8.50	2.64	45.05
Women West Germany	12.51	100.00	6.49	8.50	2.01	30.97
Women East Germany	22.21	100.00	5.63	8.50	2.87	50.98
Age						
18-25 years	22.85	100.00	6.37	8.50	2.13	33.44
26-35 years	10.61	100.00	6.74	8.50	1.76	26.11
36-45 years	9.19	100.00	6.68	8.50	1.82	27.25
46-55 years	10.44	100.00	6.38	8.50	2.12	33.23
56-65 years	12.67	100.00	6.45	8.50	2.05	31.78
Qualification						
High	4.39	100.00	6.75	8.50	1.75	25.93
Medium	11.95	100.00	6.58	8.50	1.92	29.18
Low	19.35	100.00	6.27	8.50	2.23	35.57
Employment status						
Employed full-time	5.97	100.00	6.81	8.50	1.69	24.82
Employed part-time	16.54	100.00	6.62	8.50	1.88	28.40
Marginally employed	38.75	100.00	6.13	8.50	2.37	38.66
Firm size						
$<$ 5 employees	21.42	100.00	6.33	8.50	2.17	34.28
5-10 employees	16.89	100.00	6.73	8.50	1.77	26.30
20-100 employees	15.90	100.00	6.79	8.50	1.71	25.18
100-200 employees	10.18	100.00	6.45	8.50	2.05	31.78
200-2000 employees	9.57	100.00	6.64	8.50	1.86	28.01
$>$ 2000 employees	5.30	100.00	6.90	8.50	1.60	23.19
Missing, not assignable	2.73	100.00	6.74	8.50	1.76	26.11

Notes: Wage data for 2009 are extrapolated to 2012 using average growth rates (see text), weighted using SOEP personal sample weights to obtain population means.

Source: Own calculations based on SOEP, wave 2010.

Table 8: Labor supply effects of a legal minimum wage, Germany, 2012

	MW=5.00 €/hour		MW=8.50 €/hour		MW=10.00 €/hour	
Additional labor supply (in 1,000 persons)						
Couple, both spouses flexible						
West, men	0.25	(0.03; 0.48)	5.31	(3.51; 7.12)	12.00	(8.25; 15.74)
West, women	0.24	(0.04; 0.45)	6.70	(4.46; 8.94)	14.99	(10.31; 19.67)
East, men	0.10	(0.02; 0.18)	3.34	(1.84; 4.85)	6.95	(4.05; 9.86)
East, women	0.10	(0.03; 0.18)	3.48	(1.81; 5.15)	7.23	(3.99; 10.48)
Couple, one spouse flexible						
West, men	0.02	(-0.02; 0.06)	0.29	(-0.09; 0.66)	0.96	(-0.06; 1.98)
West, women	0.36	(-0.38; 1.10)	3.53	(1.12; 5.93)	7.73	(4.07; 11.39)
East, men	0.00	(0.00; 0.01)	0.78	(-0.07; 1.63)	1.79	(-0.05; 3.64)
East, women	0.02	(-0.03; 0.08)	1.64	(0.55; 2.73)	3.65	(1.56; 5.73)
Singles						
West, men	0.20	(-0.03; 0.42)	9.30	(3.11; 15.48)	19.73	(3.11; 15.48)
West, women	0.93	(-0.64; 2.50)	15.20	(8.83; 21.57)	33.12	(8.83; 21.57)
East, men	0.25	(-0.03; 0.52)	10.27	(5.15; 15.40)	17.30	(5.15; 15.40)
East, women	0.16	(0.00; 0.33)	5.16	(3.11; 7.21)	13.01	(3.11; 7.21)
Additional working hours (in 1,000 fte's)						
Couple, both spouses flexible						
West, men	0.86	(0.24; 1.49)	21.25	(14.09; 28.14)	46.62	(14.09; 60.85)
West, women	1.64	(0.46; 2.81)	36.10	(26.19; 46.02)	81.95	(63.98; 99.91)
East, men	0.39	(0.10; 0.67)	15.47	(9.56; 21.38)	15.47	(20.05; 43.96)
East, women	0.60	(0.09; 1.11)	17.23	(11.61; 22.86)	17.23	(25.83; 48.47)
Couple, one spouse flexible						
West, men	0.03	(-0.03; 0.09)	0.68	(-0.16; 1.51)	2.06	(-0.07; 4.19)
West, women	0.53	(-0.56; 1.62)	5.86	(1.70; 10.02)	18.23	(10.15; 26.30)
East, men	0.00	(0.00; 0.01)	1.89	(-0.07; 3.85)	4.23	(0.11; 8.39)
East, women	0.08	(-0.08; 0.23)	3.92	(1.60; 6.24)	9.61	(5.04; 14.18)
Singles						
West, men	0.38	(-0.08; 0.83)	23.86	(8.61; 39.10)	50.68	(24.71; 76.65)
West, women	1.29	(-0.97; 3.54)	32.60	(20.98; 44.21)	83.12	(59.63; 106.61)
East, men	0.61	(-0.11; 1.33)	30.53	(15.53; 45.53)	51.60	(29.45; 73.76)
East, women	0.32	(-0.01; 0.64)	13.67	(8.43; 18.91)	37.77	(26.10; 49.45)

Notes: Bootstrapped 95%-confidence bands are given in parentheses.

Source: Own calculations based on STSM and SOEP, wave 2010.

Table 9: Conditional logit labor supply models, 2012

Variables	**Couples both flexible**		**Couples women fix**		**Couples Men fix**		**Singles Men**		**Singles Women**	
	Coeff.	**S.E.**	**Coeff.**	**S.E.**	**Coeff.**	**S.E.**	**Coeff.**	**S.E.**	**Coeff.**	**S.E.**
Income	1.191	10.483	-13.424	6.986	-6.439	4.151	1.714	3.687	-12.497	2.870
Income squared	0.665	0.635	1.001	0.326	0.951	0.214	0.480	0.115	0.834	0.096
Income × husband's leisure	-1.377	0.345	0.067	0.678			-1.424	0.632		
Income × wife's leisure	-0.808	0.291			-1.082	0.426			0.921	0.471
Husband's leisure	52.277	8.436	18.781	10.330			49.654	11.160		
Husband's leisure squared	-5.987	0.405	-2.027	0.882			-4.521	0.916		
Wife's leisure	21.870	7.482			18.187	7.817			0.402	7.636
Wife's leisure squared	-2.191	0.379			-0.751	0.731			-0.321	0.657
Husband's leisure × wife's leisure	0.869	1.476								
Husband's leisure × dummy1	6.680	6.426	-0.263	0.450			-0.172	0.330		
Wife's leisure × dummy1	5.143	5.791			0.397	0.854			-0.444	0.277
Husband's leisure × wife's leisure × dummy1	-1.508	1.516								
Income × dummy1	2.135	9.727								
Income squared × dummy1	-0.059	0.628								
Husband's leisure × dummy2	-5.966	2.816	-1.667	0.851			-1.517	0.865		
Wife's leisure × dummy2	-7.322	2.647			-1.904	0.384			-0.597	0.518
Husband's leisure × wife's leisure × dummy2	1.347	0.693								
Income × dummy2	-3.368	2.667								
Income squared × dummy2	0.194	0.187								
Husband's leisure × husband's age	-0.024	0.055	-0.182	0.128			-0.105	0.102		
Husband's leisure squared × Husband's age squared	0.129	0.060	0.282	0.142			0.188	0.116		
Wife's leisure × wife's age	-0.066	0.068			-0.191	0.142			-0.204	0.087
Wife's leisure squared × wife's age squared	0.195	0.077			0.324	0.147			0.343	0.100
Husband's leisure × husband's health status	1.194	0.505	2.249	1.324			1.997	0.842		
Wife's leisure × wife's health status	0.992	0.437			0.057	0.467			-0.004	0.736
Wife's leisure × dummy 3	5.477	0.438			3.139	0.855			4.855	0.822
Wife's leisure × dummy 4	2.785	0.332			3.130	0.654			2.948	0.522
Wife's leisure × dummy 5	2.245	0.208								
Husband's leisure × dummy 3			0.928	0.696			0.857	0.943		
Husband's leisure × dummy 4			0.779	0.699			0.139	1.122		

Notes: Dummy 1: Head of household (person answering the GSOEP household questionnaire) is German. Dummy 2: Household is living in East Germany Dummy 3: Children under the age of 3 in household. Dummy 4: Children between 3 and 6 in household. Dummy 5: Children between 7 and 16 in household. × indicates an interaction term.

Source: Own calculations based on STSM and SOEP, wave 2010.

Table 10: Compensated own- and cross-wage elasticities (number of workers)

West Germany	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**
East Germany	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.
Numbers in italics are own-wage elasticities.

Source: Freier and Steiner (2007, 2010).

Table 11: Changes in wages after the introduction of a legal minimum wage, 2012

			MW=5.00 €/hour				**MW=8.50 €/hour**				**MW=10.00 €/hour**			
			Affected (%)	No MW (€/hour)	MW (Δ €)	MW (Δ %)	Affected (%)	No MW (€/hour)	MW (Δ €)	MW (Δ %)	Affected (%)	No MW (€/hour)	MW (Δ €)	MW (Δ %)
West Germany														
Full-time	Skilled	*Women*	0.15	16.81	0.00	0.01	3.72	16.81	0.03	0.21	11.64	16.81	0.15	0.89
		Men	0.26	18.73	0.00	0.02	2.49	18.73	0.04	0.22	5.61	18.73	0.11	0.56
	Unskilled	*Women*	0.00	12.10	0.00	0.00	11.94	12.10	0.23	1.91	33.76	12.10	0.59	4.91
		Men	0.37	16.01	0.01	0.04	4.36	16.01	0.06	0.40	17.16	16.01	0.22	1.37
Part-time		*Women*	1.30	14.46	0.01	0.05	11.96	14.46	0.19	1.33	20.91	14.46	0.45	3.10
		Men	1.66	14.80	0.02	0.11	32.45	14.80	0.51	3.46	34.97	14.80	1.04	7.05
Marginally employed		*Women*	3.60	10.52	0.04	0.40	37.84	10.52	0.72	6.87	48.20	10.52	1.41	13.37
		Men	14.42	9.57	0.14	1.45	38.45	9.57	1.28	13.41	45.28	9.57	2.02	21.15
Total			0.72	15.70	0.01	0.06	9.50	15.70	0.13	0.83	19.47	15.70	0.36	2.29
East Germany														
Full-time	Skilled	*Women*	0.00	12.64	0.00	0.00	21.13	12.64	0.29	2.29	34.99	12.64	0.70	5.56
		Men	0.99	13.61	0.01	0.05	16.94	13.61	0.31	2.29	27.23	13.61	0.65	4.76
	Unskilled	*Women*	0.97	14.64	0.00	0.02	35.61	14.64	0.57	3.88	43.47	14.64	1.14	7.78
		Men	3.48	12.87	0.05	0.43	28.28	12.87	0.43	3.35	33.57	12.87	0.88	6.87
Part-time		*Women*	2.84	12.90	0.04	0.30	24.40	12.90	0.45	3.52	41.27	12.90	0.96	7.45
		Men	2.91	12.12	0.02	0.19	31.09	12.12	0.76	6.30	43.15	12.12	1.36	11.25
Marginally employed		*Women*	7.58	8.64	0.10	1.17	41.17	8.64	1.03	11.97	65.03	8.64	1.91	22.09
		Men	7.21	6.95	0.10	1.43	46.20	6.95	1.66	23.86	50.48	6.95	3.06	44.02
Total			1.31	12.36	0.01	0.08	26.31	12.36	0.39	3.16	45.25	12.36	0.95	7.69

Notes: Qualification categories according to Freier and Steiner (2007, 2010): 'skilled' = secondary-school education or vocational training, 'unskilled' = neither secondary-school education nor vocational training.

Source: Own calculations based on SOEP wave 2010.

Table 12: OLS-estimation of household's consumption rate

Variable	West Germany Coeff.	S.E.	East Germany Coeff.	S.E.
Log(disposable income)	-0.270***	0.010	-0.335***	0.032
Dummy1: single men without children[1]	0.213*	0.093	-0.211	0.299
Dummy2: single with children	-0.643***	0.141	-0.137	0.330
Dummy3: couple without children	-0.303**	0.103	-0.124	0.282
Dummy4: couple with more than 1 child	-0.079	0.109	0.106	0.307
Dummy5: other households	-0.467***	0.123	-0.126	0.309
Log(disposable income) × dummy1	-0.033**	0.012	-0.055	0.031
Log(disposable income) × dummy2	-0.021	0.017	-0.051	0.039
Log(disposable income) × dummy3	-0.062***	0.011	-0.047	0.033
Log(disposable income) × dummy4	-0.098***	0.014	-0.060	0.043
Log(disposable income) × dummy5	-0.086***	0.012	-0.073*	0.037
Log(disposable income) × dummy6[2]	-0.039**	0.014	-0.044	0.037
Donations & heritages	-0.000***	0.000	-0.000***	0.000
Female household head	0.009	0.006	-0.011	0.009
Dummy capital income	-0.035***	0.005	-0.040***	0.011
Dummy car in household	0.097***	0.007	0.101***	0.013
Dummy owned house	-0.019***	0.004	0.001	0.011
Dummy owned apartment	-0.025***	0.006	-0.013	0.015
Residential area in square meters	0.001***	0.000	0.001***	0.000
Age of household head	-0.008	0.007	0.041**	0.015
Age squared	0.000	0.000	-0.001*	0.000
Age cubed	0.000	0.000	0.000*	0.000
Household head working part-time[3]	0.038**	0.014	-0.006	0.037
Household head marginally working	0.056	0.072	-0.131*	0.056
Household head working, no information	0.048	0.047	0.016	0.088
Household head not working	-0.059**	0.019	0.059	0.119
Second person working full-time[4]	0.859***	0.110	0.010	0.026
Second person working part-time	0.872***	0.110	0.012	0.027
Second person marginally working	0.867***	0.110	-0.042	0.039
Second person working, no information	0.873***	0.111	(dropped)	0.000
Second person not working	0.865***	0.110	-0.002	0.026
Dummies for household head's education[5]				
University of applied science	0.005	0.005	-0.002	0.010
Technical school	-0.009	0.005	-0.033**	0.011
Apprenticeship	-0.013**	0.005	-0.040***	0.011
Other graduation	-0.028*	0.011	-0.023	0.038
In education, student	-0.011	0.017	-0.029	0.039
No graduation	-0.034**	0.013	-0.039	0.052
Social position of household head[6]				
White-collar worker	-0.020***	0.004	-0.016	0.014
Blue-collar worker	-0.016**	0.006	-0.034*	0.016
Unemployed	0.079***	0.020	-0.078	0.116
Retired person	0.134***	0.023	-0.004	0.115
Old-age pensioner	0.140***	0.024	(dropped)	0.000
Constant	2.751***	0.112	3.115***	0.320
R-squared		0.425		0.423
Number of observations		25,687		6,813

Notes: [1] Base are single female households without children and couple with one child. [2] Dummy6 stands for couple with one child. [3] Base is household head working full-time. [4] Base is no second person in household. [5] Base is college. [6] Base is public servant.
Other controls in the regression not shown in table: dummies for federal land, community size, family status, foreigners, main source of income in household, interaction terms for household head's employment and second person's employment.
* Significance at 5% level. ** Significance at 1% level. *** Significance at 0.1% level.

Source: Own calculations based on LWR, several waves.

Table 13: Heterogeneity of minimum wage effects (MW=8.50€/hour) on net incomes of households affected by the minimum wage, 2012

	Overall			Couples					Singles		
	Total	No children	With children	Total	No children	With children	Both work	One works	Total	No children	With children
Incidence (%)	12.2	9.0	17.5	17.8	14.0	20.7	18.0	14.1	8.1	6.9	11.9
Avg. income no MW (€/m)	2,448	1,742	3,062	3,089	2,467	3,420	3,020	4,295	1,412	1,122	1,964
Δ Average income											
No behavioral effects (€/m)	80.4	102.6	61.1	88.8	121.2	71.6	92.0	33.5	66.8	86.7	29.0
No behavioral effects (%)	3.3	5.9	2.0	2.9	4.9	2.1	3.0	0.8	4.7	7.7	1.5
With employment effects (€/m)	42.6	64.4	23.7	44.6	70.5	30.9	47.8	-10.1	39.3	59.2	1.6
With employment effects (%)	1.7	3.7	0.8	1.4	2.9	0.9	1.6	-0.2	2.8	5.3	0.1
Consumption price effects (€/m)	-19.9	-10.8	-27.8	-32.1	-24.5	-36.1	-30.8	-53.4	-0.2	0.9	-2.4
Consumption price effects (%)	-0.8	-0.6	-0.9	-1.0	-1.0	-1.1	-1.0	-1.2	0.0	0.1	-0.1
Total consumption effects (€/m)	24.4	36.0	14.3	24.8	37.2	18.2	26.7	-9.1	23.7	35.0	2.2
Total consumption effects (%)	1.0	2.1	0.5	0.8	1.5	0.5	0.9	-0.2	1.7	3.1	0.1
Δ Total income											
No behavioral effects (mill. €/m)	267	158	108	182	86	96	178	4	85	72	13
With employment effects (mill. €/m)	141	99	42	91	50	41	93	-1	50	49	1
Consumption price effects (mill. €/m)	-66	-17	-49	-66	-17	-48	-60	-6	0	1	-1
Total consumption effects (mill. €/m)	81	55	25	51	26	24	52	-1	30	29	1

Notes: Incidence = Households affected by the minimum wage as percentage of all households in each group. Percentage changes of average income refer to households within the respective group, percentage changes of total income are calculated relative to the whole population. Employment status refers to the situation before the introduction of a minimum wage. When accounting for employment effects of a minimum wage a fraction of the employed is simulated to become unemployed according to demand side constraints of Table 4. Wage projections for 2012 are based on average growth rates.

Source: Own calculations based on SOEP, wave 2010.