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# Does the German minimum wage benefit low income households?

## A comparison of observed outcomes and simulated potential effects

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### Abstract

Previous literature on the distributional impact of the minimum wage in Germany has either focused on earnings and hourly wages (Caliendo et al., 2017), or is based on ex-ante simulations (Müller and Steiner, 2013). This paper provides systematic descriptive ex-post evidence on the distributional implications of the German minimum wage on earnings and disposable household incomes.

We analyze different measures of hourly-wage and household-income distributions, both, for the group of affected individuals and the entire population. Most approaches identify individuals “affected” by the minimum wage based on pre-reform wages ignoring large job fluctuations and measurement error at the bottom of the wage distribution. In contrast, we define the group of affected by identifying people’s relative position in the wage distribution in each respective year.

In line with expectations, we find clear evidence for wage increases at the bottom of the wage distribution. Yet, the changes lie below the potential distributional impact that could be achieved under full compliance to the minimum wage. The impact on overall wage inequality is rather small. Moreover, the minimum wage shows itself to be a poor redistributive tool for disposable household income. Confirming ex-ante simulations we do not see affected households benefiting much from the reform. Overall income inequality has even increased slightly as disposable income of poor households grew much less than on average.

Keywords: minimum wage; wage distribution; income distribution

JEL classification: J31, D31, J03

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# 1 Introduction

One of the most frequently used arguments for the introduction of a statutory minimum wage in 2015 was based on the rising income inequality. It is argued that employees at the bottom end of the income distribution often require top up benefits to cover their daily expenses. The fact that people who are in regular work cannot afford their basic standard of living was perceived as a particular injustice. That is why an explicit political goal (renewed in the coalition agreement of the current government) is that employees working full-time should under no circumstances depend on welfare transfers. From this perspective the minimum wage is meant to serve as a redistributive tool to reduce inequality in earnings *and* income. To this date the empirical literature on the distributional impact of the minimum wage in Germany is either focused on earnings and hourly wages (Caliendo et al., 2017), or pure simulation studies rely on assumptions like full compliance or no spillovers (Müller and Steiner, 2013; Brenke and Müller, 2013).

This paper provides first empirical evidence on the distributional implications of the German minimum wage on earnings and – more importantly – on disposable household incomes. Based on the most recent distribution of the German Socio-Economic Panel (SOEP) we conduct a systematic analysis of different measures of hourly-wages and household-incomes for, both, the group of affected individuals and the entire population. We analyze different moments of the hourly wage and household income distributions as well as various inequality measures. For observational and simulation outcomes we consider differences between periods before and after the introduction of the minimum wage. With our analysis we address a range of research questions concerning distributional effects of the minimum wage that entail different policy implications for the implementation and administration of minimum wages:

First, we investigate the impact of the minimum wage on the wage distribution with a special focus on those employees who are eligible by law and located at the bottom end of the wage distribution. A systematic comparison of observational outcomes from the SOEP with a simulated full compliance scenario reveals implementation problems regarding compliance as well as measurement. A significant effect on the wage distribution is a prerequisite for a pass-through to the income distribution.

Second, we investigate the impact of the minimum wage on the distribution of disposable incomes. Can we confirm previous findings from simulation studies that average and distributional income effects are substantially smaller than distributional wage effects? The degree of a pass-through depends on many factors such as employment changes, the household composition of eligible employees, potential changes in earning behavior of household members, and taxes and transfers. We calculate disposable household incomes with a tax-transfer-simulation-model in a full compliance scenario. This serves (*ceteris paribus*) as an upper bound for the full potential of the minimum wage in a comparison exercise with income based on actually earnings.

Third, we investigate whether the minimum wage reached other, more specific

policy goals. Here we ask, e.g., whether the prevalence and amount of top-up-benefits (*Aufstocker*) has decreased, i.e. whether dependence on social welfare has been reduced by the minimum wage.

Fourth, we descriptively explore the development of the group affected by the minimum wage in terms of their employment and earnings situation. This helps to shed light on the underlying mechanisms that explain the distributional consequences the minimum wage introduction had for individual wages and household incomes beyond non-compliance and measurement problems in the data.

This paper is of descriptive nature. Due to a lack of convincing, natural control groups we refrain from a treatment/control group based research design. We therefore do not make strong causal claims. Yet, we can make claims about changes of the actual situation of those individuals and their households that have been targeted by the reform. Based on the latest SOEP wave we construct a consistent panel of individuals and households over five years between 2012 and 2016. We particularly investigate eligible people affected by the minimum wage.

The group of "affected" employees and households we determine by their position in the wage distribution and their eligibility status. Eligibility depends on their employment status according to the minimum wage law. That is, we identify those people as affected whose wage in a respective year belongs to the same share of the wage distribution as the group of people who earned less than the minimum wage prior to the reform.<sup>1</sup> More precisely, we look at the bottom 11% of employees that would be eligible for the minimum wage law. An advantage of this approach is that it takes account of the high fluctuation at the bottom end of the wage distribution and consistently focuses on the lowest wages.<sup>2</sup>

We find clear evidence for wage increases at the bottom end of the wage distribution. Yet, the changes lie substantially below the potential of the minimum wage under full compliance. The impact on wage inequality is therefore very limited. Moreover, the minimum wage proves to be a poor redistributive tool with respect to disposable household income. Confirming ex-ante studies, we do not see affected households benefiting from the reform. With respect to incomes the inequality has even increased slightly, since disposable income at the bottom end grew much less than on average.

The remainder of the paper is structured as follows. We discuss the contribution of the paper on the basis of a brief review of distributional and related minimum wage studies (section 2). The next section sketches institutional details of the federal minimum wage, exemption clauses, and existing sectoral minima (section 3). Section 4 provides details about the advantages of our data set and our methodological approach. Section 5 provides the empirical results for individual wages (sub-section 5.1),

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<sup>1</sup>We take 2013 as a reference to avoid potential anticipation effects.

<sup>2</sup>In contrast, tracking the same people based on their pre-reform wage would always lead to an upward bias of the overall wage changes due to mean reversion. Other people, who were positioned outside the labor force or at a higher position will have taken their positions within the overall wage distribution.

the employment structure of affected individuals (sub-section 5.2), disposable incomes (sub-section 5.3), transfer dependency (sub-section 5.4), and from a tracking exercise of supposedly affected individuals (sub-section 5.5). Section 6 concludes.

## 2 Literature

The main focus of the literature on minimum wages has traditionally been focused on its consequences for *employment*, since this was the main concern articulated against this policy intervention (Neumark and Wascher, 2008; Neumark et al., 2014). The employment effects of the minimum wage entails direct consequences for its distributional impact. Although this is not the primary focus of our study we have to take potential employment effects into account when interpreting our results. Besides a number of evaluations of sectoral minimum wages (Möller, 2012) for Germany a number of early evaluation studies have been published by now (Bossler and Gerner, 2016; vom Berge et al., 2016; vom Berge and Frings, 2017; Caliendo et al., 2018). Based mainly on administrative data these studies either do not find significant employment effects, or rather small negative short-run reductions in employment. There is some evidence that marginal employment (so-called mini jobs) are converted into regular jobs (Garloff, 2016; Bachmann et al., 2017).

A second strand of the minimum wage literature is focused on its impact on *wage and earnings inequality*. There is a general consensus in this research area that minimum wages are suited to mitigate inequalities at the bottom of the wage distribution. Findings vary with respect to the magnitude of this effect, though (Autor et al., 2016; Dolton et al., 2012; Stewart, 2012b,a; Autor et al., 2008; Neumark et al., 2004; Dickens and Manning, 2004; Teulings, 2003; Lee, 1999; Machin, 1997; DiNardo et al., 1996). An important question in this regard is whether a minimum wage may initiate spillovers further up into the distribution. Empirical studies on this issue reach different conclusions (Autor et al., 2016; Stewart, 2012b; Dickens and Manning, 2004). As Autor et al. (2016) point out that potential mechanisms behind wage spillovers are not fully understood. Empirical findings on spillover effects could be heavily influenced by measurement error in wage information from survey data.

Applications for Germany include Amlinger et al. (2016) or Mindestlohnkommission (2016b) which compare wage growth before and after the German minimum wage reform. Brautzsch and Schultz (2015) assess who exactly was affected by the introduction of the minimum wage. Their findings show that low wage groups such as unskilled workers, women, part-time employees in small firms, and employees in East Germany experienced the strongest wage growth after the implementation of the reform. Since multiple factors besides the minimum wage may affect the wage distribution, the observed changes are not directly attributable to minimum wage reforms and cannot be assumed to be (fully) causal. We will also deal with this issue (section 4 below). In the literature on wage inequality there are generally three sources of variation in treatment intensity which are exploited for identification: first, variation over time (Dickens and Manning, 2004; Amlinger et al., 2016; Mindestlohnkommission, 2016b); second, differential variation between economic sectors (König and Möller, 2009; Frings, 2013; Fitzenberger and Doerr, 2016), and, third, variation across regions (Lee, 1999; Dolton et al., 2012).

A third smaller, but growing area of research is devoted to the consequences a minimum wage has for the *distribution of disposable incomes, income inequality and poverty*. Income is measured at the household level and adjusted for the size of the family (corresponding to its needs). The distributional implications of a minimum wage are determined by the joint distribution of wage changes, employment changes and other factors influencing household income (e.g. product prices), but likewise by interactions with the welfare system (Freeman, 1996). Lemos (2008) sketches a transmission mechanism triggered by an initial change of the minimum wage: Direct effects on affected workers and potential spillovers to other employees alter labor supply and demand. Firms adjust prices as well as the level and mix of inputs and outputs and consumers adapt their demand until the economy reaches a new equilibrium. There are two approaches dealing with the distributional effects of the minimum wage on household incomes.

First, simulation studies attempt to mimic certain or several of those adjustment channels and estimate the consequences for the income distribution. Johnson and Browning (1983) laid the ground for the simulation approach covering interactions with the tax system and employment effects. They found the redistributive impact of the U.S. minimum to be marginal due to the small share of low wage earners and low wage income in poor households and large marginal tax rates for low wage earners. In a series of papers Burkhauser and co-authors demonstrate that the link between low household income and the incidence of low wage employment in the U.S. has loosened over time (Burkhauser and Finegan, 1989; Burkhauser et al., 1996; Burkhauser and Sabia, 2007; Sabia and Burkhauser, 2010). The minimum wage benefits workers who reside in households above the poverty line relatively more. Household composition and size as well as non-wage income are more closely related to the risk of poverty. Negative employment effects further weaken this relationship. Macurdy and McIntyre (2001) is the only simulation exercise that explicitly looks at the costs which are induced by higher product prices, although employment effects and interactions with the welfare system are disregarded. They show that although in absolute terms richer households bear the majority of the burden, poor households lose more in relative terms because of their above-average consumption rates. Among studies outside of the U.S. Gosling (1996) for the UK, Müller and Steiner (2009, 2013) for Germany and Campolieti et al. (2012) for Canada reach pessimistic conclusions about the redistributive efficiency of the minimum wage.

Second, regression approaches utilize (exogenous) variation in minimum wage regulations and estimate the consequences for various distributional indices, e.g. the incidence or depth of poverty, in a given region without referring to particular adjustment mechanisms. Neumark et al. (2005) estimate the minimum wage effects on the whole income distribution with kernel density estimators in a difference-in-difference framework and find an increase in poverty. All other empirical ex-post studies utilize panel estimators based on regional variation in federal or state-specific minimum wages over time. A sizable proportion of those studies cannot identify significant ef-

fects on the reduction of poverty (Neumark and Wascher, 2002; Burkhauser and Sabia, 2007; Sabia, 2008; Sabia and Burkhauser, 2010; Sabia and Nielsen, 2013). Other studies find moderate, statistically significant reductions in the incidence (Addison and Blackburn, 1999; Morgan and Kickham, 2001; Stevans and Sessions, 2001; Gundersen and Ziliak, 2004; DeFina, 2008; Sen et al., 2011) and also the depth of poverty (Dube, 2017) for the U.S. population or sub-groups thereof. Moreover, a recent study of Neumark et al. (2012) identifies a slight poverty-reducing effect of city-wide living wage laws. The overall picture from this literature is thus mixed. The relative weight of the different factors and mechanisms sketched above and the redistributive impact of a minimum wage seems to depend on the particular situation. Our study contributes to this strand of research trying to establish a link between the simulation evidence and observational outcomes.

Several papers dig into mechanisms that prevent minimum wages from reaching their full distributional potential such as noncompliance (Brown, 1999; Metcalf, 2008; Mindestlohnkommission, 2016b; Deutscher Bundestag, 2016a,c,b). In this case wages below the minimum wage threshold are observed for the eligible population. General equilibrium effects, such as reductions in employment or working hours (Stewart and Swaffield, 2008), are other mechanisms that mitigates the inequality-reducing effect of minimum wages (Neumark et al., 2004). Since these adjustments take time, general equilibrium effects have to be particularly taken into account in the long run. Similarly minimum wages might affect schooling (Neumark and Wascher, 1995), firms profits (Draca et al., 2013), consumer prices (Aaronson and French, 2007), or on-the-job training (Neumark and Wascher, 2001) over the long haul. We bear these alternative mechanisms in mind for the interpretation of our results below.



### 3 Minimum wage institutions in Germany

As codified by the German Minimum Wage Law, the statutory minimum wage in the amount of 8.50€ per hour at the federal level came into effect on January 1st 2015. At that time a significant number of collectively agreed sectoral minimum wages had already been put in place and for most sectors are currently still effective. Examples are, among others, the construction sector, the roofing sector, hairdressing or care services.<sup>3</sup> The majority of those sector-specific minimum wages lie above the federal minimum wage or were increased after the minimum wage reform (Amlinger et al., 2016; Möller, 2012). The federal minimum wage is thus not binding in those sectors.

The Minimum Wage Law decrees that the German Minimum Wage Commission consists of employer and employee representatives as well as scientific advisors. Adjustments of the minimum wage level are solely negotiated and recommended by the Minimum Wage Commission and then legally codified by the German parliament. As of January 1 2017 the minimum wage was raised by 0.34€ per hour (Mindestlohnkommission, 2016a). Almost all employees in Germany fall under the legislation of the federal statutory gross minimum wage. During a transitional period that ended in January 2017 exemptions applied to certain sectors with pre-existing sector-specific minimum wages. In addition, permanent exemptions are still in effect for persons below the age of 18, trainees and interns (e.g., students or apprentices completing required or elective internships of up to three months). Long-term unemployed (registered for at least 12 months) are allowed to be paid sub-minimum wages for up to six months. This exception does not play a significant role on the labor market, though (vom Berge et al., 2016). In contrast, the number of employees eligible to the minimum wage is reduced markedly by exemptions for trainees and minors.

The enforcement authority is the German Customs Administration. It regularly conducts inspections of employer firms and enforces compliance with social security laws and the Minimum Wage Law. In case of noncompliance penalties of up to 500,000€ can be imposed. Not least because of personnel shortages due to the refugee crisis enforcement was widely regarded as weak, especially in the first year after the introduction of the minimum wage. For instance, legal proceedings were only initiated in less than 2 out of 100 inspections with an average fine of about 275€ (Deutscher Bundestag, 2016c).

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<sup>3</sup>As of 1 January 2017 the full list in descending order by minimum wage levels varying from 15.63€ per hour to 7.90€ per hour and for West and East Germany includes money transports, construction (skilled workers), further training, commercial cleaning (external), trade for neon advertising signs (skilled worker), painting (skilled worker), chimney sweeping, roofing, stonemasonry, construction (skilled workers), scaffolding, electro trade, trade for neon advertising signs (unskilled worker), painting (unskilled worker), commercial cleaning (internal), care services, waste disposal, temporary agency work, meat industry, laundry services, textiles and clothing, hairdresser, agriculture, forestry, horticulture (Amlinger et al., 2016).

## 4 Data & methods

Our approach focuses on changes in distributions, moments of these distributions, or synthetic distributional measures over time. Moreover, we compare observed with simulated outcomes under specific assumptions. Wages are computed directly from SOEP data (monthly earnings divided by contractual hours). Disposable household income is calculated on the basis of a tax-transfer-simulation-model (a modified version of the model documented in Steiner et al. (2012)). Hence, we have to assume full take-up of benefits here.

After describing our data base (sub-section 4.1) we detail the various decisions we make to restrict alternative samples for the empirical analyses (sub-section 4.2). These decisions have implications for the interpretation of our results. Third, we discuss the computation of hourly wages, the underlying assumptions and measurement issues (sub-section 4.3). Last, we describe the scenario that is simulated under a full-compliance assumption (sub-section 4.4). There, we also explain the simulation of disposable household incomes. Finally, we discuss how the comparison of observed outcomes with the full-compliance scenario helps to gauge the minimum wage effect.

### 4.1 Data

The German Socio-Economic Panel (SOEP) is a representative longitudinal household study that started in 1984. As of 2015 it contains information of roughly 30,000 individuals living in about 15,000 households (Goebel et al., 2018; Wagner et al., 2007). The SOEP provides detailed information on the labor market status for all individuals. We know the type of employment relationship of those participating in the labor market, their contractual and actual weekly working hours as well as their monthly labor earnings. Earnings are distinguished for the primary job and potential side jobs. Moreover, a wide range of individual and household characteristics is available that shed light on the economic and socio-demographic background of the individuals in our sample(s). This allows us to analyze interactions of the minimum wage with the tax and transfer system in Germany and to simulate disposable incomes at the household level.

We use SOEP version 33.1.<sup>4</sup> For specific variables, in particular for the labor market status, we utilize the SOEP EVA-MIN data set. This is a specific data set that provides information for evaluation purposes and tries to establish certain standards for the preparation of the data to ensure the comparability of the results.<sup>5</sup>

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<sup>4</sup>See <http://www.diw.de/en/diw02.c.222729.en/questionnaires.html>, last accessed on 25 February, 2018.

<sup>5</sup>See [https://www.diw.de/de/diw\\_02.c.244287.de/ueber/\\_uns/menschen/\\_am/\\_diw/\\_berlin/mitarbeiter/innen.html?id=diw\\\_01.c.496963.en](https://www.diw.de/de/diw_02.c.244287.de/ueber/_uns/menschen/_am/_diw/_berlin/mitarbeiter/innen.html?id=diw\_01.c.496963.en) for further information, last accessed on 25 February, 2018.

## 4.2 Sample construction

### Baseline sample

To start with, we exclude all migration samples (M1 M2 M3 and M4) which were all introduced throughout our observation period. Given the disadvantaged labor market situation of many immigrants, these special samples are likely to affect our results. The minimum wage is a policy for employees. Thus, our analysis is focused on this group and the households they live in. Individuals in the following labor market states are included in our sample:

- people in full-time employment subject to social security contributions,
- people in part-time employment subject to social security contributions,
- marginally employed people (i.e. those individuals working in so-called mini jobs that are exempted from employees' social security contributions),
- civil servants.

Note that the self-employed and retired are not affected by the minimum wage and thus not subject to our analysis unless they live in households with other employed individuals who are not self-employed or retired.

### Eligible employees & extreme wages

Besides looking at distributional effects on the overall wage and income distributions we are, of course, interested in the effects the introduction of the minimum wage had on *eligible* employees. Systematically excluded from our sample are thus individuals who belong to at least one of the specific groups explicitly exempted from the minimum wage:

- workers aged under 18 without formal training,
- trainees and certain types of interns,
- long-term unemployed in the first 6 months of a new job and unemployed working,
- employees working in sectors where a tariff agreement regulating sector-specific minimum wages below 8.50 was already in place and is still in a given post-reform year,
- retired individuals.

In order to cope with observations with extreme (and mostly implausible) values in our sample, we censor the bottom and top percentile of the hourly wage, the total wage, and the hours distribution by replacing the values below the bottom percentile and above the top percentile with the threshold value of the respective percentile. This is in line with the censoring procedure in other studies (see, e.g., Caliendo et al., 2018, 2017).<sup>6</sup>

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<sup>6</sup>Müller and Steiner (2013) or Brenke and Müller (2013), e.g. eliminated all observations with hourly wages below 3 and above 150€ per hour.

## Definition of people affected by the minimum wage

In most evaluation studies “individuals affected by the minimum wage” are defined as those employees earning an hourly wage below the minimum wage threshold before its introduction or increase<sup>7</sup> There is a substantial problem attached to this approach that is rarely discussed in the literature. In the bottom parts of the wage distribution there is a lot of year-to-year fluctuation between jobs. As a results hourly wages of low-wage employees vary substantially between years even in the absence of any minimum wage reforms. We illustrate this variation by looking at pre-reform years in Germany. A significant share (almost 40%) of people working in a jobs paying below the minimum wage in 2012 earn a wage above the minimum wage threshold in the following year (Table 1). Even more than half of them get an hourly wage above the minimum wage another year later.

Table 1: Employees with wages below 8.50€ per hour in 2012 (only individuals eligible for the minimum wage)

Year	Share with wage > 8.50€ per hour	CI	Observations
2012	0.000	[0.000,0.000]	535
2013	0.372	[0.331,0.413]	535
2014	0.516	[0.474,0.558]	535

Source: SOEP, waves 2012-2014; own calculations.

Aside from reporting error in our survey data this pattern is in many instances also driven by job changes. The share of transitions to a new job is particularly high in the lower deciles of the wage distribution: According to our sample 40% of employees in the bottom decile and 35% of employees in the second decile changed jobs in a time interval of four years before the minimum wage was introduced (Table 2).

Given those random job fluctuations and the variation in hourly wages that is not related to the minimum wage, we chose a different approach for the definition of people affected by the minimum wage. We define as being *affected* by the minimum wage those employees in a certain range of the hourly wage distribution who according to their employment status are eligible for the minimum wage. The chosen range is determined by the share of eligible employees who earned less than EUR 8.50 prior to the minimum wage reform. We take 2013 as the baseline year to avoid bias through anticipation effects. In 2013 11% of employees eligible to the minimum wage earned less than 8.50€. Therefore, we denote the group of people who are in eligible employments and belong to the bottom 11% of the hourly wage distribution of a respective year as *affected*. That way we always define those people as *affected*, who have the lowest earnings in a given year. Hence, we concentrate consistently on the lowest wages among the group of eligible, i.e. those people targeted by the minimum wage.

<sup>7</sup>Recent applications for Germany that follow this approach are, e.g., Caliendo et al. (2018, 2017) or Bossler and Gerner (2016).

Table 2: Share of job changers by deciles of the hourly wage distribution, years 2011-2014 pooled

Decile	Share of job changes	CI	Observations
1	0.45	[0.43,0.46]	4,559
2	0.36	[0.35,0.37]	4,580
3	0.29	[0.27,0.30]	4,555
4	0.25	[0.24,0.26]	4,589
5	0.20	[0.18,0.21]	4,533
6	0.16	[0.15,0.17]	4,588
7	0.14	[0.13,0.15]	4,525
8	0.12	[0.11,0.13]	4,543
9	0.09	[0.09,0.10]	4,553
10	0.10	[0.10,0.11]	4,549

Source: SOEP, waves 2011-2014; own calculations.

### 4.3 Measurement of hourly wages

It is crucial for the empirical analysis how hourly wages are defined. The SOEP questionnaire does not contain a direct query on hourly wages. Yet, respondents are asked questions, both, about their monthly earnings as well as their contractual and actual weekly hours of work. Based on this information one can compute different concepts of hourly wages (see, e.g., Brenke and Müller, 2013, Caliendo et al., 2017, or Dütsch et al., 2017). Monthly labor earnings are simply divided by weekly working hours extrapolated to a monthly figure.

We focus on contractual working hours that are fixed in the contract the employee signed and do not fluctuate or change in the short-run. Although a minimum wage policy targets the wage paid for an employee's actual working hours, there are problems attached to this wage concept. Actual hourly wages take, e.g., (unpaid) overtime hours into account. Besides introducing additional measurement error, overtime hours are measured for the current month when the SOEP interview is conducted. Labor earnings are surveyed for the previous month only. Given the likely month-to-month fluctuations in overtime this introduces measurement issues in addition to the usual reporting error (item non-response, or rounded answers) in surveys like the SOEP.

### 4.4 Simulated outcomes

#### Full compliance scenario

As indicated above we not only compare the variables of interest over time, but also contrast the observed post-minimum wage outcomes with a simulated scenario under full compliance. For this scenario we lift all observed hourly wages in the years after the introduction of the minimum wage to the level of the statutory minimum wage of

8.50€. Wages above the minimum wage and all other variables remain unchanged. We prescind from spill-over effects and employment effects. Hence, when assuming that spill-over effects are negligible this scenario serves as an upper bound of the minimum-wage effects on income under full compliance.

### **Simulation of household incomes**

Since we are primarily interested in the distributional consequences of the minimum wage for the disposable outcomes at the household level, we have to analyze the interactions of the minimum wage with the German tax and transfer system. To this end we use a tax-benefit microsimulation model based on SOEP data (Steiner et al., 2012). The model 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.

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.

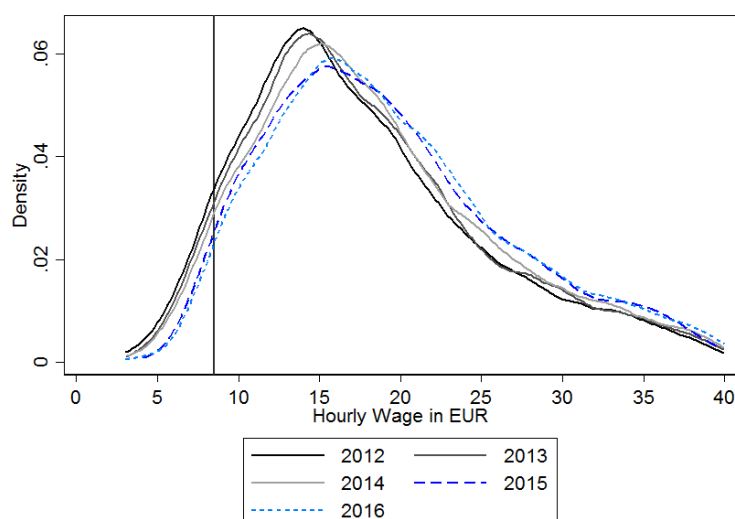
## 5 Empirical findings

A necessary condition for the minimum wage to have an impact on the distribution of disposable incomes is that it has significant effects on the wage distribution in the first place. Therefore we start our analysis with the latter (sub-section 5.1). Moreover, we document changes in the employment structure of those employees affected by the minimum wage (sub-section 5.2). In the next step we turn to the household level and analyze disposable household incomes and related distributional measures (sub-section 5.3). Then, we analyze specific minimum wage outcomes that are related to distributional policy goals associated with the minimum wage (sub-section 5.4). Finally, we track those individuals over a longer time-span that are supposed to be “affected” by the minimum wage (sub-section 5.5).

### 5.1 Wage effects

We start our descriptive analysis of the wage effects by looking at wage distributions of individuals who are eligible to the minimum wage in the time interval between 2012 and 2016. There is a small shift to the right of the distributions for all pre-reform years. After the minimum wage was introduced one can see a distinctly larger increase in wages at the bottom of the distribution for 2015 (Figure 1). This increase is persistent in 2016 with a further shift to the right, albeit in the magnitude of the earlier years. At the same time, lot of probability mass remains to the left of the minimum wage threshold of 8.50€ per hour (horizontal line) even in 2016.

Figure 1: Distributions of hourly wages, all eligible employees, 2012-2016

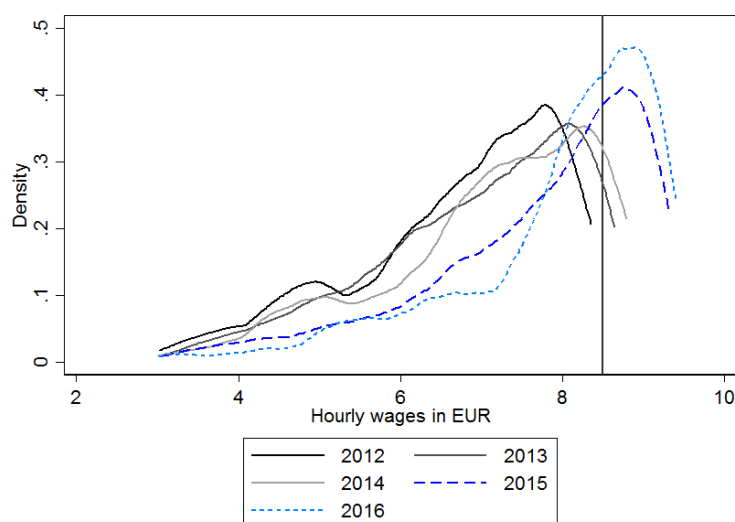


Notes: the vertical line depicts the minimum wage level of 8.50€per hour.

Source: SOEP, waves 2012-2016; own calculations.

Zooming in on people *affected* by the minimum wage in the lower parts of the distribution, this difference becomes more clearly visible (Figure 2). The spike shifts to the right in 2015 and becomes even more pronounced in 2016. The result pattern is similar when – for robustness purposes – we consider wages below the 20th quantile (Figure A1 in the Appendix).

Figure 2: Distributions of hourly wages, eligible employees affected by the minimum wage: hourly wages below the 11th quantile of the yearly hourly wage distribution, 2012-2015



Source: SOEP, waves 2012-2016; own calculations.

A number of points can be taken away from this descriptive analysis of wage distributions: First, (nominal) wage growth occurs in all years of our sample. Second, a clear minimum wage effect becomes visible in density graphs for 2015 and 2016 that is hardly within the range of ordinary wage growth. Third, there is a lot of probability mass below 8.50 threshold in those graphs for the years after the introduction of the minimum wage. This points at non-compliance during the implementation of the minimum wage, potentially to a considerable extent (see also Caliendo et al., 2017). This also points to the above-mentioned measurement issues of reporting errors and inconsistencies in the data.

A more detailed look at the share of employees observed in our data who receive wages below the minimum wage for the unbalanced and balanced panel for all and just eligible employees, respectively, helps to shed light on these issues (Table 3). We include the balanced panel to rule out com-positional changes in the sample that might affect our measures. However, the balanced sample is not representative as it includes only individuals with an observed wage in all years, hence excludes those individuals who have been without employment in any period. Since employment changes are especially common at the bottom of the wage distribution the balanced



group is more privileged by construction, more likely representing individuals in higher parts of the distribution, and consequently expected to earn higher wages. Therefore we observe smaller shares with low wages. Nevertheless, the developments in balanced and unbalanced panel are very similar. We see that the share of employees below the threshold is decreasing over time with a particularly strong and significant decrease in 2015 that is persistent in 2016. However, the share remains markedly positive in 2015 (6.2% in the unbalanced and 3.1% in the balanced sample). In 2016 this number drops only slightly for all samples. This strongly confirms the first impressions from the distributional graphs. It remains unclear to what degree this is a measurement or compliance problem. Yet, lacking controls and enforcement of the minimum wage are suggestive of the relevance of non-compliance (see also Caliendo et al. 2017).

Table 3: Share of employees with hourly wages below 8.50€ per hour in %

Year	Unbalanced panel				Balanced panel			
	All	CI	eligible	CI	All	CI	eligible	CI
2012	10.3	[9.8;10.9]	11.7	[11.1;12.3]	6.7	[5.9;7.4]	6.6	[5.8;7.4]
2013	9.1	[8.6;9.7]	10.4	[9.8;11.0]	5.9	[5.2;6.6]	5.3	[4.6;6.1]
2014	8.2	[7.7;8.8]	9.4	[8.8; 10.0]	4.7	[4.1;5.4]	4.3	[3.7;5.0]
2015	6.2	[5.7;6.6]	7.0	[6.5;7.6]	3.1	[2.6;3.6]	2.8	[2.3;3.3]
2016	6.0	[5.5;6.5]	6.6	[6.1;7.2]	2.9	[2.4;3.4]	2.4	[1.9;2.9]
N	51 241		45 130		21 525		18 810	

Notes: The balanced panel contains 4305 observations per year and 3762 for those eligible throughout this time; 95% confidence intervals in parentheses.

Source: SOEP, waves 2012-2016; own calculations.

To get a better idea of how large distributional changes are over time and to contrast these with measures based on an hourly wage distribution under full compliance, we compare the observed outcomes with a simulation scenario (defined in section 4.4). Besides looking at specific quantiles (Table 4) we use various inequality and poverty measures (Table 5): the *Atkinson inequality measure*, the *poverty rate*, and other poverty measures from the *Foster-Greer-Thorbecke (FGT)* class with different weighting parameters (see Cowell 2000, Table 4). For comparison purposes we apply the same measures for the investigation of income inequality below (section 5.3). The analysis of inequality and poverty measures is based on a sample of individuals who would be eligible for the minimum wage.

In 2015 there is a small and significant increase in the thresholds for the 1st, 5th, and 10th percentile, as well as for the median. However, changes are small and remain under the minimum wage threshold for the 1st and 5th percentile (Table 4).

According to the Atkinson index inequality does not change significantly in the years after the reform (Table 5) Under full compliance we would have observed a significant decrease, though. Since the minimum wage was targeted at the bottom end of the wage distribution we also employ poverty measures that are useful to evaluate the distributional impact for this sub-population. We find that the minimum wage does not

Table 4: Percentiles of the hourly wages distribution, inequality measures, poverty measures, only eligible employees

Year	Percentiles						median	
	P1	CI	P5	CI	P10	CI	CI	CI
2012	4.23	[3.93;4.53]	6.85	[6.69;7.00]	8.10	[7.98;8.23]	15.34	[15.17;15.52]
2013	4.72	[4.50;4.93]	6.99	[6.90;7.09]	8.40	[8.25;8.55]	15.61	[15.39;15.82]
2014	4.74	[4.60;4.88]	7.14	[7.00;7.27]	8.63	[8.52;8.74]	16.14	[15.95;16.34]
2015	5.29	[4.96;5.63]	7.88	[7.70;8.06]	9.03	[8.89;9.18]	16.80	[16.57;17.02]
2016	5.62	[5.23;6.00]	8.17	[8.05;8.30]	9.11	[8.99;9.23]	16.64	[16.40;16.88]
<i>Full compliance scenario</i>								
2015	8.50		8.50		9.03	[8.88;9.19]	16.80	[16.58;17.01]
2016	8.50		8.50		9.11	[8.99;9.23]	16.64	[16.41;16.88]

Source: SOEP, waves 2012-2016; own calculations.

Table 5: Inequality measures, poverty measures, only eligible employees

Year	Inequality		Poverty rate		Poverty measures		FGT(2)	
	Atkinson	CI	Poverty rate	CI	poverty gap	CI	CI	CI
2012	0.21	[0.20;0.22]	14.47	[13.51;15.36]	3.34	[3.13;3.55]	1.20	[1.10;1.31]
2013	0.21	[0.20;0.21]	14.90	[14.05;15.74]	3.13	[2.92;3.33]	1.07	[0.98;1.21]
2014	0.20	[0.19;0.21]	15.21	[14.53;15.89]	3.16	[2.96;3.37]	1.05	[0.96;1.19]
2015	0.20	[0.19;0.21]	14.78	[13.97;15.59]	2.87	[2.66;3.08]	0.92	[0.82;1.05]
2016	0.19	[0.18;0.20]	14.43	[13.68;15.18]	2.46	[2.25;2.67]	0.73	[0.63;0.91]
<i>Full compliance scenario</i>								
2015	0.17	[0.16;0.18]	14.78	[13.96;15.61]	1.72	[1.55;1.89]	0.24	[0.20;0.28]
2016	0.17	[0.16;0.17]	14.43	[13.66;15.20]	1.55	[1.38;1.71]	0.20	[0.17;0.25]

Notes: Poverty line at 60% of median wage. FGT(2) and FGT(3) denote  $FGT(\alpha) = \frac{1}{n} \sum_{i=1}^q \left(\frac{z-y_i}{z}\right)^\alpha$  for  $z :=$  poverty line and  $q :=$  number of poor, with  $\alpha = 2$  and  $\alpha = 3$  respectively. Source: SOEP, waves 2012-2016; own calculations.

significantly reduce the poverty rate based on hourly wages. The poverty line is above the minimum wage level such that we cannot expect changes to this measure, unless in case of spill-overs. The federal minimum is, however, able to reduce the distance to the poverty line (poverty gap) for the lowest quantiles of the distribution as shown by the results for the FGT(2) measure (Table 5). We find a significant reduction in all FGT measures after the minimum wage became effective in 2015. At the same time, the comparison with the simulated full compliance scenario shows that the minimum wage has by far not reached its full potential in reducing wage inequality at the bottom of the distribution. Depending on the measure the reduction in the simulation case is substantially larger than in observed outcomes (Table 5).

## 5.2 Changes in the employment structure of affected individuals

We now turn briefly to the structure of employment among employees *affected* by the minimum wage. Changes in the employment structure are one potential mechanism that determines to what degree wage adjustments are passed through on net-household income. Adjustment in the employment structure are rather small overall. We observe a decrease in marginal and an increase in part-time employment as well as a slight increase in median working hours in 2016.<sup>8</sup> Large shares of low-wage employees work in the trade, service, and manufacturing sectors. The only persistent changes in sector shares after the minimum-wage introduction are an increase in the transportation sector and a decrease of the manufacturing and banking sectors among the bottom 11% of employees.

## 5.3 Income effects

We now turn to the household level and analyze disposable household incomes to answer the central question of this paper: Does the minimum wage benefit low income households? As detailed above, disposable household incomes are calculated with a microsimulation model based on SOEP data. In line with the previous analysis, we compare the changes over time including the potential changes under full compliance. Similar to the wage analysis we, first, investigate specific moments of the income distribution of all households with at least one individual eligible to the minimum wage (Table 7). Aside from general income growth over the years, we do not find significant changes in the lower percentiles of the household income distribution. However, a moderate increase in mean and median household income in 2016 becomes visible, which does not seem to be driven by the minimum wage introduction. A look at the simulated full compliance scenario shows that the potential redistributive effect of the minimum wage is not higher, neither for the lower quantiles nor for the mean or median of the household income distribution (Table 7, lower panel).

Turning to inequality and poverty measures for the distribution of households with at least one eligible individual observed between 2012 and 2016 largely confirms these findings (Table 8). We observe an increase in poverty if we use flexible poverty lines because the average and median income growth in the post-reform years, especially 2016, was higher than for the bottom end of the distribution. Under full compliance with the newly introduced minimum wage laws this pattern would not have changed much. Overall inequality is not reduced and the poverty measures decrease only slightly in this simulated scenario (Table 8, lower panel). Poverty intensity also increased in 2016. The main reason is that the poverty line increased significantly together with the higher parts of the income distribution. If we keep the poverty line fix

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<sup>8</sup>Since these numbers are conditional on being in employment, these results do not contradict negative employment effects found by other papers (Bossler and Gerner, 2016; vom Berge et al., 2016; vom Berge and Frings, 2017).

Table 6: Individuals with wages in bottom 11% of hourly wage distribution – referring to the share of eligible employees who earned less than 8.50€ in 2013

	2012	2013	2014	2015	2016
Threshold wage in €	8.37	8.64	8.81	9.32	9.32
<i>Employment categories in %</i>					
- full time	46.2	46.9	47.5	48.7	43.1
- part time	14.2	15.5	16.3	16.54	18.0
- marginal	28.3	24.3	26.0	23.6	20.2
<i>Contractual working hours per week</i>					
- mean	28.5	28.6	28.1	28.7	28.3
- median	29.5	29.5	29.5	29.5	30.5
<i>Sectors (in %)</i>					
Agriculture	1.7	1.6	1.5	1.8	0.5
Energy	0.6	0.6	0.5	0.5	0.2
Manufacturing	14.2	14.6	12.4	12.2	12.1
Construction	5.2	5.3	3.8	4.8	6.1
Trade	30.4	31.9	28.7	31.2	26.6
Transport	4.8	5.2	4.2	6.2	6.1
Bank, Insurance	1.3	1.1	1.3	0.5	0.7
Services	37.5	39.0	41.4	38.7	40.2
Observations	1166	1097	991	937	821

*Notes:* In this table we look at individuals at the bottom 11% of the hourly wage distribution. These refers to the same share of individuals who earned less than 8.50€ in 2013 – at a time before the minimum wage introduction was decided. We refer to this group as the group of *affected* individuals, as the minimum wage was meant to increase the wages of this group no matter of who these people are as long as they are eligible for the minimum wage. A regular introduction of the minimum wage should have lifted all of their hourly wages to 8.50.

*Source:* SOEP, waves 2012-2016; own calculations.

to 2014 levels we do not observe such an increase (Table A1 in the Appendix). Using a fixed poverty line confirms that the maximum redistributive impact of the minimum wage under full compliance would be limited. Hence, in absolute terms households are not worse off, but relative inequality and poverty increased after the introduction of the minimum wage.

Focusing on those households that are directly affected by the minimum wage should emphasize these findings. We now analyze households where at least one employee earns a hourly wage below the 11th quantile of the wage distribution. We observe an increase in mean and median incomes in 2016 (Table 9). This is most likely not driven by the minimum wage as neither the mean nor the median would significantly increase under full compliance. In addition, we find a strong increase in the

Table 7: Percentiles of monthly disposable household equivalence income in €

Year	P5		P10		Mean		Median		N
		CI		CI		CI		CI	
2012	662	[654;671]	772	[760;783]	1757	[1726;1789]	1380	[1356;1405]	11,305
2013	682	[669;696]	791	[781;802]	1835	[1802;1868]	1455	[1431;1478]	10,394
2014	691	[681;700]	809	[795;823]	1904	[1864;1944]	1532	[1504;1560]	9,124
2015	701	[687;714]	816	[804;829]	1930	[1890;1971]	1565	[1530;1600]	8,455
2016	711	[695;726]	854	[833;875]	2293	[2227;2359]	1764	[1732;1796]	7,092
<i>Full compliance scenario</i>									
2015	703	[689;717]	821	[810;831]	1935	[1898;1973]	1572	[1556;1587]	8,455
2016	713	[702;724]	858	[843;873]	2297	[2246;2347]	1768	[1734;1801]	7,092

Notes: Equivalence weights according to the new OECD scale

Source: SOEP, waves 2012-2016; own calculations.

Table 8: Inequality and poverty measures of net household income

Year	Inequality		Poverty measures						
	Atkinson		Poverty rate		Poverty gap		FGT(2)		Poverty line
		CI		CI		CI		CI	
2012	0.48	[0.40;0.55]	13.34	[12.58;14.10]	2.88	[2.66;3.09]	1.26	[1.12;1.41]	828.29
2013	0.41	[0.38;0.45]	14.75	[13.99;15.50]	3.06	[2.85;3.27]	1.24	[1.10;1.39]	872.82
2014	0.43	[0.38;0.47]	16.49	[15.79;17.18]	3.49	[3.27;3.71]	1.40	[1.26;1.54]	919.35
2015	0.43	[0.38;0.47]	17.52	[16.34;18.69]	3.66	[3.45;3.87]	1.48	[1.34;1.61]	939.07
2016	0.46	[0.42;0.51]	20.26	[19.17;21.36]	4.79	[4.39;5.19]	1.90	[1.68;2.12]	1058.50
<i>Full compliance scenario</i>									
2015	0.43	[0.38;0.47]	17.15	[16.44;17.85]	3.62	[3.37; 3.88]	1.46	[1.33; 1.60 ]	942.92
2016	0.46	[0.41;0.51]	19.85	[18.97;20.73]	4.70	[4.41;5.00]	1.87	[1.67;2.07]	1060.68

Notes: Equivalence weights according to the new OECD scale. Poverty rate determined by year.

$FGT(\alpha) = \frac{1}{n} \sum_{i=1}^q \left(\frac{z-y_i}{z}\right)^\alpha$  for  $z :=$  poverty line and  $q :=$  number of poor.

Source: SOEP, waves 2012-2016; own calculations.

poverty rate and poverty gap in 2016 for households affected directly by the minimum wage.<sup>9</sup> The minimum wage would not be able to counteract this trend, even if there had been full compliance in 2016 (Table 9, lower panel).

## 5.4 Specific minimum wage objectives

We now look at more specific redistributive goals of the minimum wage. Policymakers often state a general reduction of households' transfer dependence and a reduction in the number of those households with employees receiving top-up benefits in addition to their labor earnings as explicit policy goals. Results based on our simulations of transfer income point to a decrease, albeit only to minor reductions in welfare depen-

<sup>9</sup>We use the poverty line of the unrestricted overall distribution here.

Table 9: Income and poverty measures of eligible employees affected by the minimum wage

Year	Income measures		Poverty measures						
	Mean	Median	CI	Poverty rate	Poverty gap	FGT(2)			
			CI	CI	CI	CI			
2012	1360	1164	[1323;1397.5]	8.54	[7.27;9.81]	1.37	[1.10;1.63]	0.42	[0.29;0.55]
2013	1382	1219	[1346;1417.5]	9.93	[8.06;11.80]	1.31	[0.98;1.63]	0.36	[0.20;0.52]
2014	1524	1244	[1443;1605]	13.48	[10.93;16.02]	1.88	[1.40;2.35]	0.52	[0.34;0.70]
2015	1517	1316	[1472;1562]	11.11	[9.62;12.60]	1.41	[1.06;1.75]	0.38	[0.20;0.56]
2016	1871	1408	[1769;1974]	21.05	[18.97;23.12]	2.95	[2.46;3.43]	0.72	[0.48;0.96]
<i>Full compliance scenario</i>									
2015	1537	1324	[1464;1610]	9.33	[7.65;11.02]	1.25	[0.89;1.61]	0.34	[0.20;0.48]
2016	1888	1415	[1767;2010]	18.75	[15.68;21.82]	2.62	[2.02;3.21]	0.64	[0.43;0.85]

Notes: Equivalence weights according to the new OECD scale.  $FGT(\alpha) = \frac{1}{n} \sum_{i=1}^q \left( \frac{z-y_i}{z} \right)^\alpha$  for  $z :=$  poverty line and  $q :=$  number of poor. Same poverty lines as in Table 8.

Data source: SOEP, waves 2012-2016; own calculations.

dency. The share of individuals that are eligible for top-up benefits is reduced from 12.4% in 2014 to 11% in 2015 and (Table 10). Overall social assistance transfers are simulated to decrease markedly in 2016. Again, this does not seem to be an effect of the minimum wage. First, there is no effect at all in 2015. Remember the main wage increases were realized in 2015, not in 2016 (see Figure 1 or Table 3 above). Second, the comparison with the full take up scenario does not show a significant further reduction in transfers under those circumstances.

These simulations represent benefit eligibility only. Whether individuals or households take up those benefits in reality is a totally different story. The overall trends of stated take up are, however, very much in line with take up as stated in the SOEP. Moreover, eligibility and hence the actual neediness of households is what policymakers should care for. We observe a slight reduction in eligibility over years. A full compliance would reduce this share but only slightly. For the average amount of social assistance, we observe no such trends but a remarkable drop in 2016. Most likely those changes are driven by overall income growth that is not related to the minimum wage reform. As mentioned this is confirmed by the findings from the full compliance scenario where patterns would not change much.

Table 10: Inequality measures, poverty measures, all eligible employees

Year	Eligible for top-up benefits (%)	Social assistance transfer € per year
2012	13.6	2541.9
2013	13.6	2392.2
2014	12.4	2220.2
2015	11.0	2319.9
2016	10.4	1888.8
<i>Full compliance scenario</i>		
2015	10.5	2242.7
2016	10.0	1839.1

*Notes:* Equivalence weights according to the new OECD scale.

*Source:* SOEP, waves 2012-2015; own calculations.

## 5.5 Tracking of supposedly “affected” individuals

We already mentioned the considerable volatility in employment conditions at the bottom of the hourly wage distribution. That is why we refrained from defining a treatment group based individuals’ pre-reform working conditions to infer general conclusions about the minimum wage introduction. Nevertheless, the possibility of tracking people along the time axis is a highly valuable feature of our panel data set for gaining insights in the dynamics of working conditions at the bottom of the wage distribution. We therefore analyze what happened to employees in our data set that earned less than 8.50€/per hour in the year 2014 before the minimum wage introduction. We also conduct a ‘placebo test’ repeating the same exercise for 2012 and track individuals prior

to the minimum wage reform.

### **5.5.1 Individuals with hourly wages below 8.50€ in 2014**

Our sample includes only individuals that were observed at least in 2014 and 2015. For the year 2015 we observe 736 individuals who received hourly wages below 8.50€ per hour in their main job in 2014 (definition of “*affected*” for this exercise), 78% of those individuals are women (Table 11). In this time period only 458 indicate to have kept the same job; 172 became unemployed. If we look at individuals who we observe also in 2016 (balanced panel), only about half of the *affected* – 319 out of 602 – kept the same job.

In both panels, individuals experienced an average wage increase in 2015, which is slightly higher for the longer panel and increased further in 2016. This reflects the wage effect of the minimum wage introduction we reported above. A remarkable share of 172 individuals (23%) lost their job from one year to the next (Table 11). The longer panel shows that this share is persistent. The wage increase for those who remained employed is higher compared to the whole sample. Contractual hours remained roughly constant and hourly wages increased. About 62% were still in the same job after one year and out of these about 65% experienced also a wage increase. For the latter the average total wage earnings of other household members decreased in 2015.

### **5.5.2 Placebo test: Individuals with hourly wages below 8.50€ in 2012**

Previous results are, of course, purely descriptive and could be the result of many causes but the reform. By conducting the same tracking exercise starting in 2012 (three years prior to the minimum wage introduction) for the following pre-reform years puts these findings in a comparative perspective.

Overall, the patterns for the pre-reform years are very similar to the years around the minimum wage introduction (Table 12). The total number of individuals below 8.50 because of generic wage growth over the years leading to a larger sample and lower average wage levels. The share of people who lose their job from 2012 to 2013 is 26%. Employment volatility seems indeed to be a general pattern among low-wage earners. From this comparison we would not conclude that the minimum wage had particularly strong negative employment effects. We would like to reiterate that this is descriptive evidence. We do not account for other factors determining low-wage employment, most notably business cycle fluctuations. Yet, both tables illustrate the severe job-insecurity for people at the bottom of the wage distribution, which is an obvious driver of poverty.



Table 11: Individuals that earn less than 8.50€ in 2014 and are eligible for the minimum wage

Year	Observed 2014-2015			Observed 2014-2016		
	2014	2014	2015	2014	2015	2016
<i>Observations</i>	856	736	736	602	602	602
Female	666 (78%)	576 (78%)	576 (78%)	470 (78%)	470 (78%)	470 (78%)
<i>Average wages</i>	810.1 €	807.6 €	840.4 €	818.7€	859.4 €	972.6 €
<i>Not employed</i>	–	–	172 (23%)	–	142 (24%)	139 (23%)
<i>Employed</i>	856	736	564 (77%)	602	460 (76%)	463 (77%)
– average wage	810.1 €	807.6 €	1043.1€	818.7 €	1067.5 €	1201.9€
– contractual hours <sup>1</sup>	27.1	27.0	27.1	27.4	27.7	27.6
– hourly wage	6.8 €	6.8 €	9.1 €	6.8 €	9.2 €	10.8 €
<i>Employed in same job</i>	–	–	458 (62.2%)	–	381 (63.3%)	319 (53%)
– contractual hours	–	–	26.7	–	27.36	26.74
– hourly wage	–	–	9.0 €	–	9.1 €	10.7 €
<i>Same job and wage increased</i>	–	–	297 <sup>2</sup> (65%) <sup>2</sup>	–	251 (66%)	244 <sup>3</sup> (76%) <sup>3</sup>
– Wages of other household members	–	–	-52.1 €	–	-118.0 €	-38,8 €

*Notes:* In this table we track those individuals that were affected by the minimum wage with respect to their wages in 2014. In 2014 all observations are employed by construction of the sample. Small numbers of observations are a result of sample restrictions and panel attrition.

<sup>1</sup> Contractual hours per week.

<sup>2</sup> Among those who stayed in the same job.

<sup>3</sup> Change in total monthly wage wrt. 2014 wages among those who kept the same job since 2014.

*Source:* SOEP, waves 2012-2016; own calculations.

There is, however, a marked difference in the growth of average and hourly wages. Besides generic year-to-year wage growth we do not see a significant wage increase as in the years 2015 and 2016 when the general minimum wage came into and was in effect. This underlines our conclusion that wage increases at the bottom of the distribution can indeed be attributed to the minimum wage. Contractual hours remain roughly constant as in the post minimum wage period.

Table 12: Individuals that earn less than 8.50€ in 2012 and are eligible for the minimum wage (Placebo Test)

<i>Year</i>	<b>Observed 2012-2013</b>			<b>Observed 2012-2014</b>		
	2012	2012	2013	2012	2013	2014
<i>Observations</i>	1.254	1.047	1.047	878	878	878
Female	911 (72.7%)	770 (73.6%)	770 (73.6 %)	646 (73.6 %)	646 (73.6 %)	646 (73.6 %)
<i>Average wages</i>	826.3€	819.1 €	823.5 €	820.9 €	811.6 €	887.4€
<i>Not employed</i>	–	–	277 (26%)	–	232 (26%)	237 (27%)
<i>Employed</i>	1.254	1.047	770	878	646	641
- average wages	826.7 €	819€	1040.6 €	821.5 €	1021.8 €	1131.1 €
- contr. hours <sup>1</sup>	28.3	28.2	28.9	28.1	28.7	28.7
- hrl. wages	6.7 €	6.6 €	8.5 €	6.7 €	8.4 €	9.4 €
<i>Employed in same job<sup>2</sup></i>	–	–	682 (65.1%)	–	577 (65.7%)	454 (51.7%)
- contr. hours	–	–	28.3	–	28.3	29.1
- hrl. wages	–	–	8.1 €	–	8.2€	8.7 €
<i>Same job and wage increased</i>	–	–	386 (57%)	–	322 (56%)	303 <sup>3</sup> (67%) <sup>3</sup>
- Wages of other household members	–	–	- 61 €	–	- 21.6 €	170.7€

*Notes:* In this table we track those individuals that have hourly wages below 8.50 € in 2012. In 2012 all observations are employed by construction of the sample. Small numbers of observations are a result of sample restrictions and panel attrition.

<sup>1</sup> Contractual hours per week.

<sup>2</sup> Same job as 2012.

<sup>3</sup> Change in total monthly wage wrt 2012 wages among those who kept the same job since 2012.

*Source:* SOEP, waves 2012-2016; own calculations.

## 6 Conclusion

This paper attempts to close an important gap in the empirical literature on the minimum wage in Germany. This case is of general interest as the introduction of the German minimum wage was one of the largest field experiments in labor and public economics in recent history. A statutory minimum wage with substantial bite, particularly in certain regions and for specific groups of employees, was introduced in a large economy with a generous welfare state. To this day, re-distributional motives for the minimum wage are articulated by policy-makers. Yet, credible empirical evidence is still lacking for Germany. One important reason is that, apart from few exemptions, the federal minimum wage applies to all employees on the labor market. There are no natural control groups available. In addition, a distributional analysis needs to take potential equilibrium effects into account.

Therefore, we decided to abstain from a “causal” research design in the narrower sense that is based on treatment and control groups. Accordingly, we do not make strong causal claims. Instead we provide systematic descriptive evidence in a number of dimensions and paint a comprehensive distributional picture in terms of hourly wages, disposable household income and specific redistributive goals. The group of people that are eligible and affected by the minimum wage is followed in a longitudinal perspective between 2012 and 2016. We construct a consistent panel of individuals and households for this period. For our distributional analyses “affected” individuals are defined according to their position relative to the cross-sectional wage distribution in a given year. Most other studies determine people affected by the minimum wage solely on the wage distribution before the reform. This approach is prone to measurement error which – as we showed – can be substantial in widely used survey data as the SOEP. Additional bias arises from year-to-year job fluctuations that are disproportionately high at the bottom of the wage distribution and lead to movements into and out of the group of potentially affected individuals. We provided evidence for this mechanism in a tracking exercise where we follow “affected” individuals.

We find unequivocal evidence for wage increases at the bottom of the hourly wage distribution. The effects are, however, substantially below the potential the minimum wage would have had under full compliance. This is the main reason for a rather small impact on wage inequality. We confirm results from *ex ante* simulations and evidence from other countries that the minimum wage is an inefficient tool for income redistribution and the reduction of poverty. Because of the limited income effects, it did not even reach its re-distributive potential. It can either not accurately target individuals in needy households. Or welfare transfers are withdrawn, especially in single earner families. Yet, the limited reduction of those employees receiving top-up benefits (so-called “Aufstocker”) indicates that the latter is also a relevant mechanism. In terms of overall income inequality the situation has even deteriorated after the introduction of the minimum wage as disposable income at the bottom end grew much slower than average incomes.

What do our results mean for the future policy discussion about minimum wages? First, we provide further evidence that the minimum wage cannot significantly reduce income inequality and poverty. This holds all the more in comprehensive welfare states with generous social insurance benefits. This result does not say anything about other goals like fair wages. In light of current discussions about substantial increases of the minimum wage level in order to eventually reach these redistributive goals, our findings may serve as a cautionary tale. Second, some of our results point to methodological issues for the analysis of minimum wage effects based on household survey data on earnings and working time. Besides manifest measurement issues in terms of hourly wages, we found substantial year-to-year job and resulting wage fluctuations. This can introduce bias in studies relying on a single pre-reform measure of the group affected by the minimum wage. Further efforts should be undertaken to improve the data base of hourly wages in Germany to enable more credible evidence on the empirical effect of the minimum wage. Third, the comparison of observed outcomes with hypothetical upper bound effects in our full-compliance scenario points to a substantial non-compliance problem of the minimum wage in the first two years after introduction. There is need for further action to implement current minimum wage regulations. It remains unclear whether this is mostly explained by cheating employers and employees. There may be certain areas where defining and measuring hourly wages is inherently problematic. There is also need for further research in this area.

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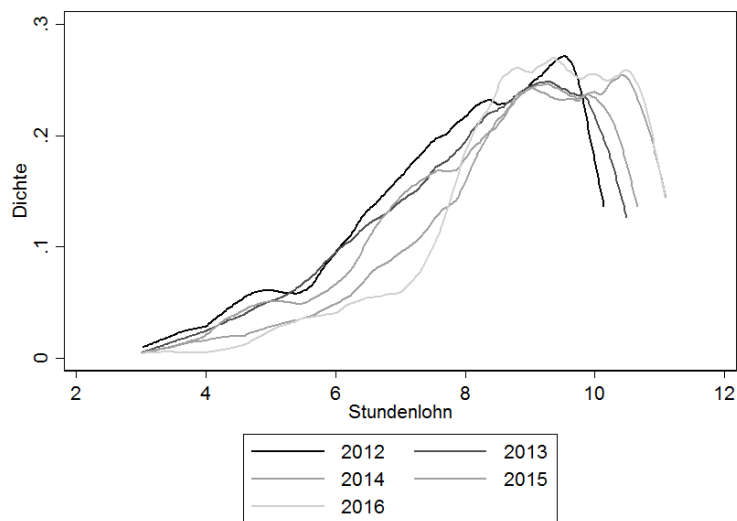
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# Appendix

## Additional figures

Figure A1: Distributions of hourly wages, eligible employees affected by the minimum wage – robustness: hourly wages below the 20th quantile of the yearly hourly wage distribution, 2012-2016



Source: SOEP, waves 2012-2016; own calculations.

## Additional tables

Table A1: Inequality measures, poverty measures of net household income

Year	Poverty measures								
	Poverty rate			Poverty gap			FGT(2)		
		CI		CI		CI		CI	
2012	19.91	19.14	20.69	4.23	4.06	4.41	1.69	1.59	1.80
2013	18.25	17.51	18.99	3.75	3.51	3.98	1.46	1.30	1.61
2014	16.48	15.61	17.36	3.49	3.23	3.75	1.40	1.23	1.57
2015	16.03	14.97	17.08	3.38	3.10	3.66	1.39	1.22	1.56
2016	13.30	12.51	14.08	2.96	2.72	3.19	1.27	1.11	1.43
<i>Full compliance scenario</i>									
2015	15.49	14.52	16.47	3.30	3.09	3.51	1.36	1.22	1.50
2016	12.89	12.17	13.60	2.88	2.65	3.12	1.24	1.07	1.40

Notes: Equivalence weights according to the new OECD scale. Poverty rate kept fix on 2014 level.

$FGT(\alpha) = \frac{1}{n} \sum_{i=1}^q \left( \frac{z-y_i}{z} \right)^\alpha$  for  $z :=$  poverty line and  $q :=$  number of poor.

Source: SOEP, waves 2012-2016; own calculations.