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Effects of the German Minimum Wage on Wages and Household Income

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Abstract: This article examines the effects of the introduction of the statutory minimum wage on the distribution of individual income from wages, as well as gross and net means-weighted income of workers in Germany. For the first time, data from the Survey of Income and Consumption was used, in which incomes are recorded in great detail. Both descriptive findings and the results of Unconditional Quantile Regressions indicate that the incomes of workers in regions with a high level of minimum wage intervention experienced significant increases after the introduction of the minimum wage, ranging into the middle band of the income distribution. Accordingly, the minimum wage has positively influenced the incomes of a large number of employee households.

Keywords: minimum wage; income distribution; Germany; Unconditional Quantile Regressions

JEL Classification: D31; J31; J38

1 Introduction

In recent years, there has been increasing interest in the distributional effects of minimum wages. Mostly positive effects of minimum wages on the incomes of dependent employees in a number of countries have been shown in the international literature (to name just a few: Aeberhardt, Givord, and Marbot 2012 for France; Dube 2019 for the USA; Vandekerckhove, van Gyes, and Goos 2018 for Belgium). Studies on the distributional effects of the statutory minimum wage in Germany carried out to

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date have mainly focused on the effects on individual income from wages of dependent employees. Recent studies in this line of research were written by Bossler and Schank (2023) who identified considerable effects in the lower half of the wage income distribution (on a wage per day basis) and Dustmann et al. (2022) who found both statistically and economically significant and positive minimum wage effects on daily wages of workers. Research into the effects of minimum wages on household incomes in Germany has been more limited. There are some studies that have used survey data on net household income or receipt of social transfers. Even though those surveys are far smaller than the administrative datasets used in the studies mentioned above, significant effects on net household income could be shown (e.g. Pusch et al. 2021; Schröder et al. 2020).

In this study we use *Unconditional Quantile Regressions* (UQR), which have previously been applied to study the distributional impact of the minimum wages in a number of countries (France: Aeberhardt, Givord, and Marbot 2012; US: Dube 2019; Germany: Bossler and Schank 2023). The minimum wage effect is measured by elasticities of the considered income measures to the regional minimum wage bite in difference-in-difference terms embedded in the UQR estimations. The data stem from a large household survey in Germany, the *Survey of Income and Consumption* (German: Einkommens- und Verbrauchsstichprobe, EVS). The EVS comprises comprehensive household income information, it allows us to consider minimum wage effects on a number of income measures. As the EVS is conducted only every five years, we consider the year 2018 for measuring the combined effect of the minimum wage introduction and its first uprating (in 2017) on individual wage income, needs-weighted gross and net household income.

So far, none of the above-mentioned studies have estimated the minimum wage effects for individual wage income, needs-weighted gross and net household income. This is the major novum of this study as it allows a comparison of the relative size of income effects at the individual level considering only individual wage income and after consideration of other income sources at the household level (not all minimum wage earners live in poor households). First, using individual information, we combine all income from wages at the individual level, also including secondary jobs. There might be deviations from other studies considering time spent in jobs (which can be also secondary jobs), as some of the low paying secondary mini-jobs[1] are combined with wage incomes of holders higher up in the income scale, in our study. However, the effect of this combination of different wage incomes does not seem to be very large. Our measured minimum wage effects on individual income from wages are broadly in line with those of Bossler and Schank (2023). We can confirm their results with a different data set.

1 These are a peculiarity of the German labour market. Income from "mini-jobs", be it as a first job or a second job, paying up to 538 euros (2024; up to Oct. 2022: 450 euros) is not subject to income tax.

Second, as we are working with a household survey, we can also do the same analysis as with wage income for the gross and net household income of workers. The largest effects are to be expected for individual incomes from dependent main employment, since the minimum wage has a direct effect on individual employees. If gross household incomes from wages are considered, effects are expected to be more stretched out along the line of distribution, since minimum wage recipients can also live with better-off partners and minimum wage effects thus spread more widely in the income distribution. As regards gross household income, since these also contain other income components, such as income from public transfers, which partly decline with increases in earnings from wages, weaker effects are to be expected especially at the lower end of the line of distribution. In addition, capital income and income from self-employment may decline in some households due to the minimum wage. The last estimations were carried out for net disposable household income. We expect minimum wage effects on net household income to be lower in the middle of the income distribution as compared to effects on gross household income due to the functioning of the tax progression.

Third, we also account for possible endogenous effects of the minimum wage, such as employment flows of people of working age (not just job losses, also possible inflows into the labour market, as have been argued by Krebs and Drechsel-Grau 2021 or changes from dependent work into self-employment or vice versa). We expect the minimum wage effects to be less pronounced here, mostly due to the fact that only about 68 % of the German population of working age (19–65 years[2]) are workers, another 6 % are self-employed, about 4 % are apprentices. According to the EVS, about 22 % of the working age population are not involved in paid work. This can be for a number of reasons: participation in higher education, disability, reduction in earning capacity pensions, care responsibilities, early pensions etc. In many of these cases it can be assumed that the wage level is not the reason for being out of work.

The article is structured as follows. In Section 2 we give an overview of the background to the introduction of the statutory minimum wage in Germany. Section 3 presents the state of research on the effects of the statutory minimum wage on incomes in Germany. Section 4 describes the data used. Section 5 provides an overview of the development of individual income from wages, hourly wages

2 This working age delineation was chosen as the EVS does not record the exact birth date but only birth years. Persons aged below 18 without completed apprenticeship are not eligible for the minimum wage. This is probably the case for most in this age class. Based on the birth year alone, thus, it is only safe to exclude them when including only people in the selection who are at least 19 years old based on the difference of their birth years. The same logic applies to the pension age delineation as the upper age bracket, where we choose 65 as an age where people can still work which can technically and also practically also be the case in higher age (anyway, in our baseline specifications only workers are considered).

and household income (gross and net) during the period under study. Subsequently, in Section 6 Unconditional Quantile Regressions are applied for the minimum wage effects on the distribution of individual as well as household income from wages, gross household income and net household income of employees and all persons of working age. Section 7 summarises the results.

2 The Statutory Minimum Wage in Germany: Background and Institutional Framework

The autonomy of collective bargaining enshrined in the German constitution (Grundgesetz) ensures that the parties to collective agreements in Germany have the right to shape wage determination (with exceptions, such as the churches and charitable institutions). In principle, this policy has been applied broadly for the vast majority of employees for decades, as shown by the very high collective bargaining coverage well into the 1980s (Bosch, Schulten, and Weinkopf 2021). However, in the 1990s, after reunification, this system began to show cracks. In east Germany, which did not have an established structure of collective bargaining parties, trade union membership and collective bargaining coverage fell sharply shortly after reunification. In addition, there was a deep crisis in the construction sector after the end of the reunification boom. At the same time, there was significant competitive pressure from companies and posted workers from other EU countries (Apel et al. 2012). This formed the background for the introduction of the first sectoral minimum wages declared by law to be generally binding, which from 1997 also extended to companies not bound by collective agreements and their employees.

However, the actual background for the introduction of the statutory minimum wage was the expansion of the low-wage sector (low wages are defined as wages below 2/3 of the median hourly wage), which since the end of the 1990s had also increasingly affected the west German labour market. While the low-wage share was still around 12 % of the workforce in 1998, it rose to 18 % in only 5 years (Kalina and Weinkopf 2017: 3). From 2001 onwards, Germany found itself in an economic crisis that lasted several years, and from 2004 onwards a series of labour market reforms (Hartz reforms) were passed in this context, in which working conditions were deregulated. Among other things, there was an expansion of marginal employment in the form of mini-jobs, which were exempt from income tax and for which the maximum number of hours was abolished. The regulations for the use of temporary work were also deregulated. For the unemployed, the reasonableness conditions for accepting a job offer were tightened, which subsequently also put pressure on wages (Deutscher Bundestag 2006). The binding force of collective agreements continued to decline during this period.

Although employment began to grow again from around 2006, the share of low wages continued to stagnate at a high level of around a quarter of the workforce in subsequent years (Kalina and Weinkopf 2017: 3). Trade unions and employers were apparently increasingly less able to shape the low-wage sector by means of collective agreements (Dütsch et al. 2023; Schulten and Pusch 2019). Generally binding sectoral minimum wages (as a possible alternative) did come about in some sectors (e.g. temporary work – for a current overview see Bispinck 2023), but their wider implementation failed. The debate on the introduction of a statutory minimum wage as a wage anchor to prevent a further reduction of the lowest wages, therefore gained increasing weight – even among trade unions, some of which (especially the industrial trade unions) had previously viewed the minimum wage with scepticism. In 2006, there was a majority decision at a congress of the DGB (German Federation of Trade Unions) to support the introduction of a statutory minimum wage.

The statutory minimum wage was introduced on 1 January 2015 by the then Grand Coalition at an initial level of 8.50 euros per hour. Exceptions to the statutory minimum wage exist for workers under 18 years of age who have not completed vocational training, apprentices and the long-term unemployed. The Minimum Wage Commission, composed equally of representatives of employers and trade unions and academics (without voting rights), draws up a proposal for the adjustment of the minimum wage every 2 years, which is then implemented by the legislator. In the first years, the Minimum Wage Commission followed the collectively agreed wage index with its proposals. Nevertheless, the minimum wage was still increased at a slower pace and over time the Kaitz index fell from 48.6 % (2015) to 46.7 % in 2021 (Herzog-Stein et al. 2023: 18).

Against the backdrop of a renewed public debate on the appropriate level of the minimum wage, the minimum wage was increased to 12 euros on 1 October 2022, deviating from the usual adjustment path, which at that point in time corresponded to approximately 63 % of the median wage (Mindestlohnkommission 2023: 31). As a result of this large increase, the statutory minimum wage in Germany is currently close to the target values of 60 % of the gross median wage or 50 % of the gross average wage, which are anchored in the recently adopted EU Minimum Wage Directive (EU 2022, Article 5 (4)).

3 Distribution Effects of the Minimum Wage in Germany

Research on the relationship between the minimum wage and various income measures at the household and personal level has produced a large number of

empirical contributions in recent years. An overview of international studies would go too far for this article, the focus of which is the statutory minimum wage in Germany, for which a number of studies on income effects have already been published. An overview of these studies is given in Table 1. The overview shows that the majority of studies so far have been conducted on employee's income from wages. We will discuss some of these studies (the most pertinent) in the following.

Bossler and Schank (2023, Table 2) identified significant minimum wage effects in the year 2017 which reach up to the 5th decile of the wage income distribution. For example, for the 2nd decile (where the relative effect is highest) a minimum wage effect of approx. 24 percent in employee's wage income can be calculated in regions with an average minimum wage bite (own calculation based on the point estimate of the elasticity). The absolute employee wages in this area of the distribution are low at about 650 euros. However, the increases are comparable in magnitude to the results established by Himmelreicher (2020), who documented a similar rate of increase (27 percent) in wage income for jobs at the 20th percentile of the hourly wage distribution in the period from 2014 to 2018. Somewhat lower results were estimated by Dustmann et al. (2022) who found a minimum wage-related increase in daily wages of about 10.7 per cent for the lowest wage group. In contrast, Caliendo et al. (2018) did not find any increases in employee's wage income as a result of the minimum wage. They attribute this result to the reductions in working hours. However, the effects documented by the authors only include the year 2015. In the study by Bossler and Schank (2023), the effects become larger over time.

According to a study by Schröder et al. (2020), the effects of the minimum wage on net household incomes in Germany are significantly smaller than in some of the studies mentioned above for employee's wage income. In households with at least one minimum-wage employee (in 2014), disposable income increased by 4.3 percent between 2014 and 2016 compared to the control group. This finding is probably mainly due to the fact that minimum wage recipients are also to be found partly in higher areas of the household income distribution and income increases triggered by the minimum wage are therefore not only concentrated at the lower end of the distribution.

Another study on the income effects of the minimum wage was presented by Pusch et al. (2021), who were able to show effects up to the 30th percentile of the distribution of the means-weighted household net incomes of employees. They also find a decrease in the probability of receiving means-tested social benefits after the introduction of the statutory minimum wage. However, this cannot be attributed to the regional depth of intervention of the minimum wage. With a different specification of treatment and control group, Bruckmeier and Schwarz (2022), on the other hand, were able to show effects of the minimum wage on social benefit receipt, which

Table 1: Studies for the income effect of the statutory minimum wage in Germany.

Study	Method	Data	Income measure or measuring concepts	Main finding/effects of the min. wage
Bach et al. (2022)	DiD, micro simulations	SOEP	Poverty risk	Poverty risk – regional (insig.), – individual (–)
Backhaus and Müller (2019)	Micro simulations, descriptive statistics	SOEP	Net household income, inequality, poverty risk	Min. wage not suitable for reducing poverty
Bossler & Schank (2023)	DiD, UQR	SIAB	Gross monthly wages, inequality	Daily wages (+) Wage inequality (–)
Bossler and Gerner (2020)	DiD	IAB BP	Gross wages per worker	(+)
Bruckmeier and Becker (2018)	DiD, Descriptive statistics	PASS	Risk of poverty	(–) but not robust
Bruckmeier and Schwarz (2022)	DID	SIG	Gross monthly wages, transfer dependency	Employee compens. (+) Transfers (–)
Burauel et al. (2020)	DTADD	SOEP	Gross monthly wages	(+)
Caliendo et al. (2018)	DiD	SOEP	Gross monthly wages	Insignificant
Dustmann et al. (2022)	DiDiD	AMS, BeH	Gross daily wages	(+)
Himmelreicher (2020)	Descriptive statistics	VSE, SOEP	Gross monthly wages	(+)
Mindestlohnkommission (2018, chap. 2)	Descriptive statistics	VVE	Gross monthly wages 2014–2016	(+) especially in east Germany
Pusch et al. (2021)	DiD, UQR	PASS	Net household income	(+)
Schmitz (2019)	DiD	BA statistics	Transfer dependency	(–) in east Germany
Schröder et al. (2020)	DiD	SOEP	Net household income	(+)

Source: own compilation; abbreviations: DiD, difference-in-difference; DiDiD, difference-in-difference-in-difference; UQR, unconditional quantile regression; DTADD, differential trend adjusted difference-in-difference; SOEP, Socio-Economic Panel; SIAB, Sample of Integrated Labour Market Biographies; IAB BP, IAB Establishment Panel; PASS, Panel Study Labour Market and Social Security; AMS, Labour Market Mirror (Arbeitsmarktspiegel); BeH, Employee History; VVE, Quarterly Earnings Survey.

decreased for recipients of unemployment benefit II when income from wages increased due to the minimum wage.

Last but not least, job losses caused by the minimum wage can also influence the distribution of income. Neumark, Schweitzer, and Wascher (2005), for example, come to the conclusion that an increase in the risk of poverty in the USA is due to the minimum wage and attribute this to job losses. If job losses were a dominant effect of the minimum wage, an increased receipt of social benefits and thus, as a rule, lower incomes could be expected. However, the literature on the employment effects of the statutory minimum wage in Germany has so far documented only minor effects (neutral: Garloff 2016; Herr et al. 2018, negative: Bonin et al. 2018; Bossler and Gerner 2020; Caliendo et al. 2017a).

4 Data

The Survey of Income and Consumption (EVS, *Einkommens- und Verbrauchsstichprobe*) is a household survey conducted every five years by the German Federal Statistical Office, the aim of which is a detailed recording of income and consumption expenditure in households. The survey is organised as a cross-sectional survey. Individual households cannot be observed over time. In addition to income and consumption data, the survey also collects some socio-demographic information. The EVS survey is implemented as a deliberate (non-probabilistic) selection of survey units (households) within the framework of a quota procedure (Statistisches Bundesamt 2017: 18). The reference for quota and extrapolation is the statistics of the micro census (MZ) which also serves as a reference for a number of other surveys in Germany. The net household income itself is one of the quota characteristics and is intended to ensure a representative income stratification. However, households with incomes above 18,000 euros are not surveyed in the EVS. The EVS therefore does not cover the upper end of the income distribution (Statistisches Bundesamt 2017: 19).

The Scientific Use Files of the EVS used here (Grundfile 3) comprise about 42.000 observations in each wave and represent an 80 % sample of the EVS (FDZ Bund Länder 2020). For the households surveyed, there is information for up to six employees, including wage components, employment status and working hours. Much of this information is only available at the quarterly level, so there are some uncertainties to be considered in the following analyses. Income components from employment and working hours are explicitly asked for in reference to the main job.7F[3] In addition, the income from a dependent secondary gainful activity is also queried.8F.[4]

3 Questionnaire household book p. 11, Statistische Ämter des Bundes und der Länder 2018.

4 Questionnaire household book p. 16, Statistische Ämter des Bundes und der Länder 2018.

One advantage of the EVS over the SOEP dataset, which is otherwise frequently used in minimum wage research for Germany, is the relatively high number of observations (see above) and the detailed recording of income and wage components. This leads, on average, to higher recorded wages and incomes (see Appendix A1 for a comparison with SOEP). It can therefore be assumed that incomes are measured more comprehensively in the EVS. Disadvantages are that the survey is only conducted every 5 years, there is a smaller scope of socio-demographic information and the nature of the survey is cross sectional.

For the following evaluations, only dependent employees (excluding apprentices) between 19 and 65 years of age or their households were taken into account. In the case of marginal employment (often called mini-jobs), there was a change in the questionnaire during the transition from EVS 2008 to EVS 2013, which is why the weighting factors for 2008 were adjusted with the help of data from the administrative statistics (BA 2023).[5] The adjustment was made in such a way that essential characteristics of the distribution of marginally employed persons after reweighting corresponded to those of the administrative statistics (distribution by gender, age, west and east Germany) and the relative coverage corresponded to that of the subsequent 2013 and 2018 waves (about 2/3 of the number of observations in the administrative statistics, see Annex A1).

In 2008, the EVS survey was, in some respects, carried out differently. In particular this is the case with the status of apprentices, which was not queried – in contrast to the subsequent waves. For this reason, the apprentices were approximated in a comparable way for the sample delimitation in all three waves via age (up to 22 years) and the absence of a vocational training diploma.16F[6] The apprentices thus delimited were not included in the employee sample for the descriptive overview, as apprentices are exempt from the statutory minimum wage. However, it has also been argued in the literature that there is a correlation between minimum wage and training investment (Acemoglu and Pischke 2003). For this reason, the regressions in Section 6 are also conducted with apprentices (and all other persons of working age, to allow for endogenous movements).

For the regression analyses in Section 6, a regional bite of the minimum wage, measured as the regional share of jobs below the minimum wage before its introduction, based on the Structure of Earnings Survey (VSE, *Verdienststrukturerhebung*) is used (Figure 1). This minimum wage bite measure was provided by the Federal Statistical Office (in Annex A2 we include also estimation results based on the EVS-based measure of the regional minimum wage bite). While the EVS-based measure of the regional minimum wage bite can only be calculated for main jobs due to the availability of working time information, the VSE figure also takes into

5 For a comparison of the three EVS waves used, see FDZ Bund Länder (2019).

6 According to a comparison with SOEP, about 80 per cent of the trainees can be recorded in this way.

account wages from secondary jobs. Both data sources nonetheless show a high correlation; the minimum wage thus had a greater prevalence in the east German states in particular (to be found in the top of Figure 1: Brandenburg, Mecklenburg-Vorpommern, Sachsen, Sachsen-Anhalt, Thüringen), a finding also known from previous research (Mindestlohnkommission 2016: 39). For this reason, the greatest effects of the statutory minimum wage are also to be expected for east Germany and were already documented early on in research (Amlinger et al. 2016). In the following presentation of the development of incomes, special attention is therefore also paid to the development in east Germany.

5 Descriptive Overview of Individual and Household Income Developments

5.1 Individual Income from Wages, Hourly Wages, Extrapolated Case Numbers

The development of employee's wage income, working hours and hourly wages in the three waves of the EVS used is shown in Table 2 (price-adjusted, base year 2015).

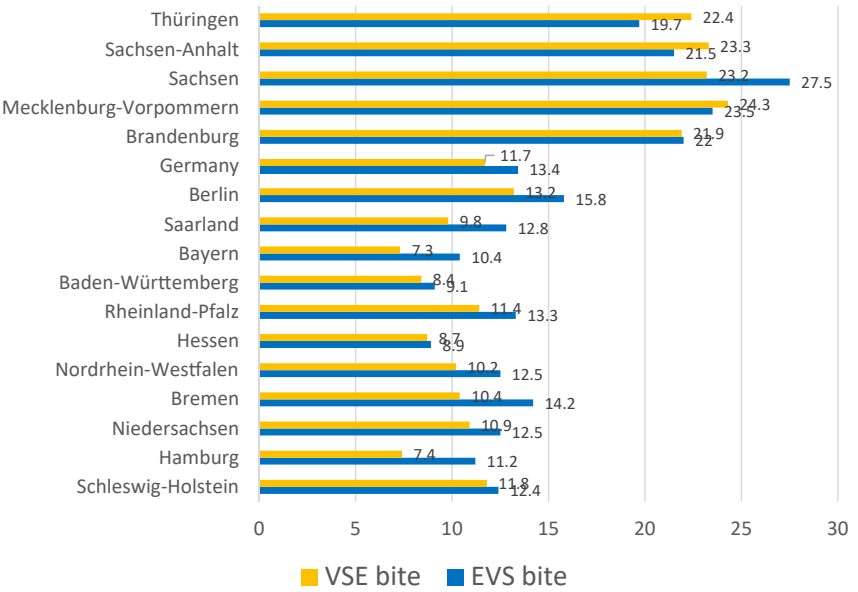

Figure 1: EVS- and VSE-based measures, showing the depth of intervention of the minimum wage in Germany as a whole and by federal state (in %). Source: EVS 2013 (Grundfile 3), own calculations, VSE 2014: Statistisches Bundesamt (2016).

Table 2: Development of individual wage income, hourly wages (in 2015 prices) and working hours of employees in the EVS.

	2008	2013	2018
Employee wage income in €/month	2,615	2,703	3,105
Agreed weekly working hours	33.8	33.0	33.1
Hourly wage (with agreed weekly working hours) in €	17.41	18.17	20.54
Proportion of employees in the minimum wage range (<= 8.50 + 0.50 € in 2008/2013; <= 8.84 + 0.50 € in 2018)	15.6 %	13.3 %	8.2 %
Share of employees with low wages (<2/3 P50, in %)	23.5	23	20.2
Number of employees, extrapolated (*N*)	33,433,323	34,777,475	37,459,724
n	38,063	37,956	37,886

Source: EVS 2008, 2013, 2018 (Grundfile 3), own calculations, minimum wage range calculated as reference minimum wage + 0.50 € (see footnote 6).

Especially after 2013, there is an increase in employee's wage income and hourly wages, which may be partly related to the minimum wage introduced in 2015, but partly also to labour-market developments (the unemployment rate fell from 7.5 % to 5 % in the period under consideration, BA 2023). The share of employees with hourly wages up to the minimum wage (notionally set at 8.50 euros for 2008 and 2013) also fell significantly after 2013.[7] Immediately before the introduction of the statutory minimum wage, the share of employees in the main job with an hourly wage up to the minimum wage was about 13 %. This is consistent with previous research based on other data sources such as the VSE and SOEP (Mindestlohnkommission 2016: 39). A comparable evaluation with the SOEP data set frequently used in minimum wage research for Germany, documented in the Appendix A1, shows that the development of wage income, hourly wages and working hours is similar in both data sets. The wage structures are also similar (measured by the minimum wage share and the low-wage ratio).

With regard to the extrapolated case numbers, the EVS is close to the figures of the administrative statistics. These show approx. 27.5 million employees in the most important form of employment subject to social security contributions in June 2008. The next group in terms of numbers, marginally employed as a main employment, accounted for about 4.9 million employees (BA 2023). Together, these totalled about 32.4 million dependent employees in June 2008 according to the administrative

7 For 2018, the threshold was set at the minimum wage + €0.50 in the sense of not underestimating the number of employees with a minimum wage, as a scattering of hourly wages around the actual value can occur in the hourly wage calculation due to rounding of the underlying values, among other things, and it can be assumed that there is a greater accumulation in the distribution of hourly wages with the minimum wage.

statistics, whereby about 2 million civil servants who are also entitled to the minimum wage are not reported in the administrative statistics of the Federal Employment Service (BA 2023). However, these were counted in the EVS evaluation.[8] In the other years, similar ratios apply with regard to the employees covered.

5.2 Gross and Net Household Incomes

Total gross household income is determined in the EVS as the sum of household income from dependent employment, public transfers, self-employment, assets and imputed rent of owner-occupied residential property.[9] For considerations of income distribution, we also undertake a needs-weighting according to the new OECD scale in order to take into account differences in the scale of households.[10] Net incomes are determined by deducting income-related taxes and contributions from gross household incomes. The development of gross and net household incomes in the EVS is shown in Table 3. As income from wages experienced strong growth between 2013 and 2018 (see above, Section 5.1), it is not surprising that the overall household gross and net income development between these years was also dynamic. Previously, there was stagnation between the years 2008 and 2013.

Table 3: Development of real incomes (in euros, 2015 prices) of employee households in the EVS.

	2008	2013	2018
Gross household income	5,102	5,132	5,656
Gross household income, needs-weighted	3,179	3,259	3,623
Net household income	3,792	3,718	4,023
Net household income, needs-weighted	2,338	2,344	2,557
Number of households, extrapolated	23,764,630	24,346,459	26,210,352
N	27,818	28,007	27,735

Source: EVS 2008, 2013, 2018 (Grundfile 3), own calculations.

8 Extrapolation with SOEP, own calculations.

9 According to Statistisches Bundesamt (2017, p. 12) those are calculated as follows: "For households living in their own property, the income from property, following international standards, a so-called imputed owner's rent was included in the […] Here, their net value is taken into account. That is, expenses for the maintenance of owner-occupied residential property are deducted from the calculated owner rental value."

10 Weight of the 1st adult: 1, further adults: 0.5 each, children: 0.3. The household income is divided by the sum of the weights for the needs weighting.

As shown in Figure 1 in Section 4, the influence of the minimum wage is much greater in east Germany than in west Germany. Against this background, a comparison of income development in east and west Germany is also interesting. Table 4 shows the relative development of the needs-weighted gross household income of employees differentiated by income sources in east and west Germany as well as according to the relative position in the income distribution in the respective region considered (lower range: percentile 0 to percentile 30, middle and upper range accordingly).

In the period from 2008 to 2013, east German workers in the lower part of the income distribution experienced a noticeable decline of −7.5 % in income from dependent employment. There was also a slight decline in the middle of the east German income distribution from 2008 to 2013. Mirroring this development, income from public transfers in east Germany rose into the middle-income range during this period. In west Germany, employees recorded a better development of income from wages up to the middle of the income distribution during this period, although there was also a slight decline in income from dependent employment among low earners there.

With the introduction of the minimum wage the development changed, especially in east Germany. In all areas of the east German income distribution, significant increases in income from dependent employment were recorded in the period 2013 to 2018. The jump is most significant in low incomes up to P30 of the east German income distribution. But in the middle of the distribution, the growth of income from paid employment also surpasses the west German development, behind which it had previously lagged. However, west German workers at the lower end of the income distribution also saw a significant increase in income from wages compared to the previous period.

There was a less systematic picture for the other income components, which are however less important in absolute size. An increase in property income (incl. income from imputed rent) is noticeable for the middle and upper part of the income distribution in east Germany. This can possibly be interpreted as a catch-up effect (e.g. convergence of the rates for owner-occupied housing and other components of wealth).[11] In addition, there is a relative stagnation in income from public transfers in the lower income range in east and west Germany during the period of the introduction of the minimum wage, while this form of income was increasing in the middle and upper part of the income distribution. This is reminiscent of the results identified by Bruckmeier and Schwarz (2022), who were able to show an effect of the

11 According to the EVS, the share of employees with home ownership actually decreased from 50.5 % to 47.7 % between 2008 and 2018 in east Germany, it was decreasing faster in west Germany (from 54.6 % to 50.4 %). At the same time, the value of imputed rents for employees was increasing faster in east Germany (+33.3 %) than in west Germany (+23.7 %).

Table 4: Development of real needs-weighted gross household incomes of employees in total and according to income sources in east and west Germany[a] in percent.

Percentile of income distribution	Gross income		Income from wages		Income from public transfers		Income from self-employm.		Income from wealth[b]	
	East	West	East	West	East	West	East	West	East	West
2008–2013										
P0–P30	−2.7	0.3 %	−7.5 %	−0.7 %	22.9 %	9.0 %	−18.2 %	−0.9 %	−15.0 %	−8.0 %
P30–P70	0.4 %	3.5 %	−0.1 %	2.9 %	9.0 %	5.2 %	−10.7 %	20.5 %	6.6 %	1.2 %
P70–P100	3.7 %	4.7 %	4.2 %	4.0 %	2.2 %	1.5 %	−13.6 %	0.6 %	5.1 %	1.6 %
2013–2018										
P0–P30	15.0 %	9.7 %	21.2 %	12.2 %	−1.0 %	1.6 %	−3.7 %	26.6 %	4.6 %	1.0 %
P30–P70	15.1 %	10.7 %	17.3 %	12.1 %	9.3 %	8.0 %	−7.8 %	7.3 %	7.6 %	2.7 %
P70–P100	14.0 %	11.6 %	13.8 %	11.2 %	10.6 %	4.3 %	0.6 %	9.9 %	10.4 %	2.5 %

Source: EVS 2008, 2013, 2018 (Grundfile 3), own calculations; [a]Berlin was included in west Germany, [b]including imputed rent.

minimum wage on the level of transfer payments. However, income from dependent employment is by far the most important source of income for dependent employees. This is even the case for employees in the lowest 30 % of the income distribution in east and west Germany (see Table A5 in the Appendix A3). In this respect, changes in income from wages also tend to play the most important role in the overall income development of employees.

6 Income Effects of the Statutory Minimum Wage: Results of Unconditional Quantile Regressions

6.1 Unconditional Quantile Regressions

Similar to other articles investigating minimum wage effects on income and wage distribution (for France: Aeberhardt, Givord, and Marbot 2012; for the US: Dube 2019; for Germany: Bossler and Schank 2023), we use so-called Unconditional Quantile Regressions (UQR) introduced by Firpo, Fortin, and Lemieux (2009, 2018) as a regression method. UQR provide a very descriptive interpretation for effects at the percentiles of the income distribution. The UQR method is based on so-called RIF regressions and differs greatly from ordinary least squares regressions. RIF stands for recentred influence function and is the sum of the influence function (IF) and the statistic under consideration to which the IF refers. In UQR or RIF regressions, marginal effects of the explanatory variables under consideration on the expected value of the RIF function are calculated (Firpo, Fortin, and Lemieux 2009). In our regressions, we embedded a DiD regression equation with a continuous variable measuring the regional depth of intervention (see Section 4) into a RIF regression to assess the impact of the minimum wage at different percentiles of the income distribution via the effect of variation of the regional minimum wage bite. Since some variables in the estimates are clustered variables at the state level (minimum wage bite, regional economic GDP), clustered bootstrap estimations were performed. Specifically, we estimate the following DiD regressions:

$$\log(y_{ijt}) = \text{const} + o^{*} b_j + a_{2013}{}^{*} I(t = 2013) + a_{2018}{}^{*} I(t = 2018) + \beta_{trend}{}^{*} (t - 2008)/5{}^{*} b_j + \beta_{2018}{}^{*} I(t = 2018){}^{*} b_j + \delta^{*} X_{ijt} + \varepsilon_{ijt}$$

The dependent variable $\log(y_{ijt})$ on the left-hand side of the regression equation is the logarithmised price-adjusted income variable of person i in region j in year t, where t in the data set can stand for the survey years 2008, 2013 and 2018. On the right-hand side of the regression equation follow from left to right:

1. a measure of the minimum wage bite in region *bj* (see the measures presented in Section 4, 1st variant: measure from the VSE, which has also been used in other studies (Mindestlohnkommission 2016: 39), 2nd variant for a robustness check: measure from the EVS for which results can be found in Annex A2),
2. uniform annual effects across the regions for 2013 and 2018,
3. an interaction term with the regional minimum wage bite and the time trend (Placebo test, or control for time trend before introduction of the minimum wage),
4. an interaction term with the regional minimum wage bite for the year 2018 as the actual minimum wage effect.
5. In addition, we control for individual and household characteristics with the vector X_{ijt} (age, education level, gender, sector, nationality, household type) as well as for the federal state-specific GDP (delayed by two years, analogous to Caliendo et al. 2017b).
6. ε_{ijt} denotes the disturbance term.

As we also include a bite-specific trend (see above), next to an interaction of the bite with the year 2018 dummy (as the year where the treatment effect is measured), the treatment effects no longer capture the simple difference in comparison with the control group (lower bite regions). Instead, the treatment effect interaction is identified by deviations from the bite-specific time trends. Hence, the bite-specific time trend is assumed to provide a good counterfactual approximation of what would have happened in the respective labour markets if the minimum wage had not been introduced.

In a first step, the regressions were only carried out for dependent employees of typical working age (19–65 years old, excluding apprentices) in order to show income effects of the minimum wage within this group, whereby minimum wage-related changes in dependent employment were explicitly not taken into account.

In a second step, the regressions were carried out for all persons of typical working age (19–65 years) in order to also be able to show effects of shifts in the labour force structure that may be related to the introduction of the minimum wage. Examples are job losses (especially the number of mini-jobs as a main employment has decreased, cf. Bonin et al. 2018), opposite entries into dependent employment due to better matching (Krebs and Drechsel-Grau 2021), but also transitions into self-employment, and interactions with vocational training and further education (Acemoglu and Pischke 2003). Overall, the effects of the minimum wage can be expected to be smaller here, also due to the fact that the extrapolated number of persons is about 50 % higher than that of employees and, in addition to the self-employed and apprentices, also includes many inactive persons (e.g. the

unemployed, students, housewives, early pensioners with reduced earning capacity without gainful employment and other inactive persons). For these inactive persons, lower effects of the minimum wage are to be expected due to constraints of access to the labour market.

The regressions were carried out for the following income variables:

1. individual wages from the main job,
2. gross household income from wages (means-weighted[12]),
3. gross household income (household income from dependent employment + public transfers + self-employment + assets + imputed rent, means-weighted),
4. net household income (gross household income – taxes – social contributions, means-weighted).

The order of the estimates is based on the expected size of the effects of the minimum wage. The largest effects are to be expected for individual incomes from dependent main employment, since the minimum wage has a direct effect on individual employees. If gross household incomes from wages are considered, effects are expected to be more stretched along the line of distribution, since minimum wage recipients can also live with better-off partners and minimum wage effects thus spread more widely in the income distribution. Job losses can also dampen the effects. As regards gross household income, since these also contain other income components, such as income from public transfers, which partly decline with increases in earnings from wages, weaker effects are to be expected especially at the lower end of the distribution. In addition, capital income and income from self-employment may decline in some households due to minimum wage. The last estimations were carried out for net disposable household income. We expect minimum wage effects on net household income to be lower in the middle of the income distribution as compared to effects on gross household income due to the working of the tax progression.

As we are dealing with cross-sectional data (the EVS is not a panel), we consider the incomes of all surveyed employees. In other studies (e.g. Dustmann et al. 2022) this is not always the case, which means that the way in which the minimum wage affects people with volatile employment histories (which make up a higher share in the low wage sector) sometimes leads to underrepresentation. This makes our approach of working with cross-sectional data somewhat more representative, as volatile part time employment with low wages tends to be concentrated at the lower end of the wage income distribution.

12 The following estimates for household income are performed on data needs-weighted with the new OECD scale to account for economies of scale from joint householding, see Section 5.2).

6.2 Individual Income from Wages

The results of RIF regressions for the individual income from wages of employees are shown in Table 5 (calculated with the VSE measure, estimates with the EVS measure are documented in Tables A3 and A4 the Appendix A2 as for the following regressions in Sections 6.3–6.5). In order to be able to estimate the magnitudes of the increases at the deciles with the estimated elasticities, the wages at the decile boundaries are also shown in the bottom row.

Using the results of the regressions, a comparison can be made with the study of Bossler & Schank (2023), who used administrative data from the Federal Employment Agency (the end year of their study is 2017, thus somewhat different from the end year 2018 in this article). A quantitatively significant difference can be found above all at the 10th percentile of the distribution, for which Bossler and Schank (2023) estimate a significantly lower elasticity of 0.29. However, it is probably mainly due to the fact that the lowest range of the wage income distribution consists mainly of mini-jobs as main and side jobs. Mini-jobs as secondary jobs are not examined here. For this reason, the 10th percentile in the present study, at €683, is already above the earnings threshold of mini-jobs, while in the study carried out by Bossler and Schank (2023) it is still in the range of marginal employment.[13] A low estimated elasticity is therefore not surprising, since the possible wage income increases of mini-jobs after the introduction of the minimum wage remained limited by the earnings threshold of mini-jobs which was €450 (in 2013 and 2018, €400 in 2008).

Trends in regions with a high level of the minimum wage bite are present at a number of percentiles. They are insignificant for the 40th and 50th percentiles, at which significant and also relevant (in terms of magnitude) effects of the minimum

Table 5: Effects of the minimum wage on individual wages at deciles of the distribution.

	P10	P20	P30	P40	P50	P60	P70
Trend * bite (VSE)	−2.59***	−0.61*	−0.40*	−0.33	−0.26	−0.28*	−0.24*
Dummy 2018 * bite (VSE)	2.01*	1.37**	1.22***	0.88***	0.56**	0.41**	0.25
Values at the decile limits in €	683	1,296	1,773	2,188	2,564	2,942	3,401

Source: EVS 2008, 2013, 2018 (Grundfile 3), own calculations; *n*: 113,905; */**/***: significant with error probability <10 %/<5 %/<1 %.

13 In 2013, there were a good 7 million marginally employed persons (5 million in main jobs and 2.3 million in side jobs, BA (2023), table geb_SB). This was clearly more than 10 % of all dependent employment relationships (in the administrative statistics approx. 37 million, BA (2023), tables SVB_SB and geb_SB).

wage are measured. With the above-mentioned restriction, especially for the 10th percentile, and the deviating control of the trends (due to the data available in the EVS only every 5 years), the results are otherwise similar to those of Bossler and Schank (2023).

6.3 Gross Household Income from Wages

Compared to individual wages (see above, Section 6.2), lower minimum wage effects are to be expected for means-weighted gross household income from wages (Section 6.1). The upper part of Table 6 shows the results for employees only, the lower part the results for all persons of working age from 19 to 65 years. Especially for the latter, the time trends indicate a better fulfilment of the DiD assumption of the parallel trend compared to the estimates for individual wages documented above.

The relative and absolute effects of the minimum wage are interpreted according to the estimated elasticities of income at the considered percentile to the regional minimum wage bite in the year 2018. Thus, the estimated elasticity of 2.1 at the 10th percentile of the distribution among employees means that a 1 percentage point higher regional minimum wage bite leads to a 2.1 % increase of income after the minimum wage introduction. The absolute income from wages here is €918. To calculate the absolute increase, the estimated elasticity at the percentile must be multiplied by the absolute income value at the decile. The absolute effect of a one percentage-point higher bite then corresponds to an increase of €19 per month after the introduction of the minimum wage (point estimate). However, as the actual differences in the bite between regions are in many cases larger than just

Table 6: Effects of the minimum wage on gross household income from wages (needs-weighted) at deciles of the distribution.

	P10	P20	P30	P40	P50	P60	P70
Employees							
Trend * bite (VSE)	−0.47	−0.11	−0.45**	−0.31	−0.22	−0.22	−0.16
Dummy 2018 * bite (VSE)	2.06***	1.12**	1.18***	0.70**	0.38	0.21	0.06
Values at the decile limits in €	919	1,430	1,811	2,162	2,507	2,889	3,354
All persons aged 19–65							
Trend * bite (VSE)	−0.19	0.51*	0.23	−0.17	−0.14	−0.17	−0.17
Dummy 2018 * bite (VSE)	1.33**	0.68	0.55*	0.78**	0.40*	0.17	0.07
Values at the decile limits in €	507	1,107	1,524	1,888	2,251	2,634	3,085

Source: EVS 2008, 2013, 2018 (Grundfile 3), own calculations; *n* workers: 113,905, *n* all persons aged 19–65: 156,610; */**/***: significant with error probability <10 %/<5 %/<1 %.

one percentage point (see Section 4), the minimum wage has led to higher absolute increases of household incomes especially in east German states. If all other persons of working age are considered in addition to employees, the increase at this point in the distribution is still 1.3 % of regional minimum wage bite, or about €7 a month (point estimate). This is significantly less than when considering workers alone (Section 6.2), also due to the lower underlying income value when considering all persons of working age at the 10th percentile of the distribution is much lower (€507).

Overall, the effects on gross household income from wages are weaker at the lower end of the distribution when considering all persons of working age than when considering employees, and at the 2nd decile of the distribution the effect is below the significance threshold. The low values at the decile boundaries up to percentile 20 also indicate that the share of persons not in employment (with income from wages from other household members nevertheless available) is higher in this area of the distribution. Moreover, minimum wage-related job losses may also contribute to lower measured effects of the minimum wage. Nevertheless, there are significant and positive effects on gross household income from dependent employment between the 3rd and 5th deciles. At the 4th decile of the distribution, the effect is about 0.78 % or just under €15 per month per percentage point of regional minimum wage bite. All those figures have to be multiplied by the regional minimum wage bite, when the regional minimum wage shall be calculated. Corresponding absolute increases of wage income in euros per month can be substantial, reaching 3-digit levels in east German regions.

6.4 Gross Household Income (All Income Sources Combined)

In addition to the income from wages considered above, gross household income also includes all other sources of income (income from public transfers, self-employment, assets, rental value of owner-occupied housing). Especially at the lower end of the distribution, lower effects of the minimum wage on gross incomes are to be expected due to transfer withdrawal (means-tested public transfers). This affects a considerable number of employees: according to an evaluation by Pusch et al. (2021), about 1.2 million employees with hourly wages up to the minimum wage received means-tested transfers in 2013. The results of RIF regressions for means-weighted gross household incomes are shown in Table 7.

As expected, when looking at gross household incomes, the minimum wage effects are smaller than the effects on household incomes from wages, especially at the lower end of the distribution. Lower estimates for gross household income as compared to estimates for income from wages seem plausible, as especially for the

Table 7: Effects of the minimum wage on gross household incomes (means-weighted) at deciles of the distribution.

	P10	P20	P30	P40	P50	P60	P70
Employees							
Trend * bite (VSE)	0.11	−0.08	−0.24*	−0.30*	−0.23	−0.21	−0.27
Dummy 2018 * bite (VSE)	0.96***	0.90***	0.72***	0.69***	0.33*	0.13	0.12
Values at the decile limits in €	1,558	2,027	2,407	2,761	3,128	3,547	4,042
All persons aged 19–65							
Trend * bite (VSE)	0.68***	0.79***	0.35**	0.04	−0.14	−0.12	−0.23
Dummy 2018 * bite (VSE)	0.01	−0.02	0.24	0.37*	0.44*	0.15	0.14
Values at the decile limits in €	1,117	1,593	2,015	2,400	2,787	3,209	3,718

Source: EVS 2008, 2013, 2018 (Grundfile 3), own calculations; *n* workers: 113,905, *n* all persons aged 19–65: 176,692; */**/***: significant with error probability <10 %/<5 %/<1 %.

lowest quantiles there should be a marked reduction of social benefits when gross income from wages increase, this was also identified in a study by Bruckmeier and Schwarz (2022). For workers, the effects range up to the 50th percentile, with some significant time trends before the introduction of the minimum wage. If all persons of working age are considered, significant effects occur at the 40th and 50th percentile, where the assumption of parallel trends is also fulfilled. The relatively lower estimates for the lower deciles of all persons of working age could be related to some higher estimated trend coefficients which – if over-estimated – can crowd out some of the minimum wage effects.

6.5 Net Household Income

Net household incomes are calculated from gross household incomes after deduction of taxes and social contributions. Overall, statistically significant effects in the RIF regressions for workers extend to the 50th percentile of net household income (Table 8). If the estimates are extended to all persons of working age, significant effects are found at the 40th and 50th percentiles, as in the case of gross household incomes, where the parallel trends assumption is also fulfilled. When comparing the size of the estimates of net household income with the estimates of gross household income (Table 7 above) for employees only, those are lower for net household income (except for 3rd and 5th decile where they are about as high). Lower estimates for net estimates would seem plausible, given that the tax burden increases when gross incomes from wages move higher, as the latter is subject to progressive income taxation. Therefore, it seems odd that, when all persons of working age are

Table 8: Effects of the minimum wage on net household incomes (means-weighted) at deciles of the distribution.

	P10	P20	P30	P40	P50	P60	P70
Employees							
Trend * bite (VSE)	−0.09	−0.10	−0.16	−0.21	−0.15	−0.08	−0.03
Dummy 2018 * bite (VSE)	0.93***	0.72***	0.73***	0.53***	0.34**	0.04	−0.17
Values at the decile limits in €	1,259	1,559	1,808	2,041	2,274	2,541	2,861
All persons aged 19–65							
Trend * bite (VSE)	0.49***	0.42**	0.24*	0.05	0.01	−0.01	−0.01
Dummy 2018 * bite (VSE)	−0.05	0.37**	0.24*	0.42**	0.24*	0.02	−0.11
Values at the decile limits in €	996	1,314	1,587	1,838	2,096	2,363	2,690

Source: EVS 2008, 2013, 2018 (Grundfile 3), own calculations; *n* workers: 113,905, *n* all persons aged 19–65: 176,692; */**/***: significant with error probability <10 %/<5 %/<1 %.

considered, the estimated elasticity for net household income is larger than that for gross household income at the 2nd decile of the distributions. Means-weighted gross household income here is as low as 1,593 euros, which should result in a low marginal taxation rate. However, at this point of the considered income distributions (gross and net) there seems to be a strong deviation from the estimated trends (much stronger in the case of gross income). When both models are estimated without trends, the estimated elasticity for net income is lower than that of gross income at the second decile (net elasticity: 1.2, gross elasticity: 1.55). This may, however seem unsatisfactory, if one assumes that the trend provides a good approximation of what would have happened without the introduction of the minimum wage.

7 Summary

In this study, data from the Survey of Income and Consumption (EVS) was used for the first time to examine the effects of the introduction of the statutory minimum wage in Germany. The EVS is a very detailed and, compared to other surveys, comprehensive survey of the income situation of households in Germany, with data from around 42,000 households in each of the waves considered: 2008, 2013 and 2018. Descriptive evaluations show substantial increases in wages in the lower and middle segments of the gross income distribution in east Germany, especially for the period after the introduction of the minimum wage. Since the minimum wage has a high prevalence in east Germany, this finding suggests a positive income effect of the statutory minimum wage. The development of gross and net household incomes overall was also very dynamic in the lower range of the income distribution after the introduction of the minimum wage.

These results are confirmed by means of Unconditional Quantile Regressions for employees' incomes. The results of the regressions for individual wages show – similar also in magnitude to the results from the study of Bossler and Schank (2023) – clear effects that range roughly into the middle of the wage income distribution. As we used a measure of regional bite of the minimum wage (share of minimum wage jobs among all jobs), our results indicate that the minimum wage had a strong income-increasing effect especially in east Germany where there is a high prevalence of low wages as compared to west Germany. The estimated effects on total gross and net household incomes of workers are somewhat smaller, which is also not surprising, as the minimum wage addresses workers' wages directly and not household incomes (which also derive income from other sources). In addition to the wider dispersion of minimum wage recipients across the entire household income distribution, a relative reduction in social benefit recipients at the lower end of the income distribution (as has been shown by Bruckmeier and Schwarz 2022) may have also contributed to this, which is also visible in the descriptive evaluations. Nevertheless, it is still interesting to see that household incomes are still positively affected, which is in line with the U.S. study carried out by Dube (2019).

Estimates for the minimum wage effect on net household income are broadly in line with the study carried out by Pusch et al. (2021) who based their results on the PASS survey, but indicate smaller increases at the 1st and 2nd decile in 2018. With respect to this difference at the lower end of the distribution, a possible limitation for difference-in-difference analysis may be seen in the increase of the marginal employment earnings threshold in 2013 (from 400 to 450 euros) – 2 years prior to the minimum wage introduction. This change is seldom mentioned in the German minimum wage literature, but it may complicate placebo tests or the modelling of trends in difference-in-difference estimations, possibly leading to biased estimates especially at the lower end of the income distribution where mini-jobbers tend to be concentrated (many of them being welfare recipients, students or even pensioners (see Pusch et al. 2021, p. 199).[14] Since the increase of the minimum wage to 12 euros per hour in October 2022 the earnings threshold for mini-jobs has been linked to the development of the minimum wage, so that this problem for evaluation could be less important in the future.

The measured income effects for employees may be influenced by other endogenous minimum wage effects such as job losses or entries, transitions into/out of education or self-employment. For this reason, additional regressions were

14 The problem may affect placebo tests as well as estimated pre-existing trends. However, many of the close to 1 million mini jobbers in pension age and several 100.000 mini jobbers in typical school age are not in the age selection of our study (19–65 years).

carried out for all persons of typical working age (between 19 and 65 years). The measured effects on household income are smaller here and more concentrated in the middle band of the considered income distributions; significant effects are found at the 40th and 50th percentiles of the distribution of gross and net household income. On the other hand, smaller minimum wage effects in the whole working age population are not surprising given the much higher number of people considered (about 50 % more as compared to workers alone, including many inactive), many of whom simply do not intend to work for a number of reasons. Since the minimum wage (by design of the policy) only intends to affect the wages of workers, it is therefore intuitive that the overall population (including unemployed and inactive individuals) experiences less of an income effect. Against this backdrop, it could be still considered an interesting result that even when all persons of working age are considered, the minimum wage has lifted incomes in the middle band of the income distribution in low wage regions.

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Annex

A1 Comparison of Individual Income from Wages, Hourly Wages, Household Gross and Net Income, and Case Numbers in EVS and SOEP

For a comparison of incomes and essential characteristics of employment, data from the SOEP survey of the DIW is used, which is a household survey with about 15,000 households and 30,000 persons (Goebel et al. 2019). In addition to much other information, the dataset includes information on employee earnings and hours worked. The information on earnings is not as detailed as in the EVS, and some supplements and special payments which can be relevant for the minimum wage are not recorded. Therefore, under-reporting of employee wage income is to be expected in the SOEP. In the case of household income, the SOEP collects not only current information but also income from the previous year. The tables show personal data (Table A1: employees) and household data for households with employees (Table A2). Hourly wages were calculated using contractual working hours.

To ensure comparable employment structures, an adjustment was made for marginally employed persons (mini-jobbers) in the extrapolation factors in the EVS 2008. Mini-jobs were recorded differently in the EVS 2008 than in subsequent

surveys due to a different questionnaire design. Therefore, the weighting factors for mini-jobs were adjusted according to regional distribution (west, east), age groups (19–24, 25–54, 55–65) and gender so that the relative shares of the respective subgroup (e.g. women, 18–24 years old, west Germany) correspond to the shares of the subgroup in the administrative statistics.[15] In addition, the extrapolated number of observations of mini-jobs for the year 2008 as a whole was adjusted to the relative coverage of mini-jobs in the EVS 2013 (in the years 2013 and 2018, extrapolated approx. 2/3 of the number of observations of the administrative statistics were recorded in the EVS, this ratio was also used for the reweighting for 2008).

Additional evaluations showed that the income ratios of mini-jobs and employees subject to social security contributions appear plausible after the reweighting in 2008; the number of employees additionally receiving unemployment benefit II (these are disproportionately often marginally employed and have a high low-wage share) also appears to be well represented after the reweighting (approx. 900,000 in 2008 and 2013 in the EVS, close to the figures of the administrative statistics). Without the reweighting, particularly low-paid workers in west Germany would be underrepresented for the year 2008.

The extrapolated number of employees is higher in the EVS and closer to the administrative statistics than in the SOEP dataset (official statistics data: employees subject to social security contributions, exclusive mini-jobs, and civil servants in 2008 together approx. 34.5 million, but including employees under 18 and of retirement age, see Section 4.1).

Overall, it can be seen that individual income from wages, hourly wages (Table A1) and overall household income (Table A2) are higher in the EVS than in SOEP, which is probably related to the more comprehensive coverage of wage components. In the hourly wages calculated with the EVS, a number of wage components that can be counted towards the minimum wage were taken into account, which is not always recorded in SOEP.[16] On the other hand, income from self-employment and assets

15 The characteristics were chosen because marginal employment relationships have a characteristic frequency distribution in these characteristics (more frequent in west Germany, among women, less frequent in the middle age group).

16 Income from employment: basic wage (gross), for marginally employed persons and employees in midi job zone without basic wage: income from additional earnings (see above), one-off payments (Christmas bonus, holiday bonus), profit-sharing (e.g. bonus payment, success premiums), other income (e.g. company car, travel and meal allowances, company flat (tenant), company flat (subtenant), overnight stays, other income (e.g. company car, travel and meal allowances). e.g. bonus payment, performance bonuses), other income (e.g. company car, travel and meal allowances), company flat (tenant), company flat (subtenant), overnight stays, food, beverages, consumption of food and beverages outside the home.

Table A1: Personal data, SOEP EVS comparison, employees between 19 and 65 years, 2015 prices.

	2008		2013		2018	
	Average	***n***	**Average**	***n***	**Average**	***n***
Individual pay						
EVS	2,615	38,063	2,703	37,956	3,105	37,886
SOEP	2,542	7,334	2,562	13,477	2,753	12,494
Agreed weekly working hours						
EVS	33.8	40,219	33.0	39,975	33.1	40,766
SOEP	33.8	7,334	33.7	13,477	33.6	12,494
Hourly wage						
EVS	17.41	38,063	18.17	37,956	20.54	37,886
SOEP	16.69	7,334	16.84	13,477	18.19	12,494
Proportion of employees in the minimum wage range (<= 8.50 + 0.50 € in 2008/2013; <= 8.84 + 0.50 € in 2018)						
EVS	15.6	38,063	13.3	37,956	8.2	37,886
SOEP	13.7	7,334	13	13,477	11.2	12,494
Share of employees with low wages (<2/3 P50, in %)						
EVS	23.5	38,063	23.0	37,956	20.2	37,886
SOEP	22.4	7,334	21.7	13,477	20.4	12,494
Number of employees, extrapolated (*N*)						
EVS	33,433,323	40,230	34,777,475	40,960	37,459,724	41,506
SOEP	29,875,951	7,334	30,135,359	13,477	33,619,708	12,494

Source: EVS 2008, 2013, 2018 (Grundfile 3), SOEP v37, own calculations.

Table A2: Household data, SOEP EVS comparison, households with employees aged 19–65, 2015 prices.

	2008		2013		2018	
	Average	***n***	**Average**	***n***	**Average**	***n***
Gross household income						
EVS	5,102	27,818	5,132	28,007	5,656	27,735
SOEP	4,927	5,747	4,928	9,549	5,344	8,470
Gross household income, needs-weighted						
EVS	3,179	27,818	3,259	28,007	3,623	27,735
SOEP	3,076	5,747	3,106	9,549	3,374	8,470
Gross household income from wages						
EVS	3,836	27,818	3,807	28,007	4,224	27,735
SOEP	3,195	6,397	3,298	11,349	3,446	10,649
Net household income						
EVS	3,792	27,818	3,718	28,007	4,023	27,735
SOEP	3,462	5,747	3,454	9,549	3,692	8,470

Table A2: (continued)

	2008		2013		2018	
	Average	***n***	**Average**	***n***	**Average**	***n***
Net household income, needs-weighted						
EVS	2,338	27,818	2,344	28,007	2,557	27,735
SOEP	2,138	5,747	2,157	9,549	2,314	8,470
Number of households, extrapolated						
EVS	23,764,630	27,818	24,346,459	28,007	26,210,352	27,735
SOEP	21,094,873	6,397	21,090,988	11,349	22,193,514	10,649

Source: EVS 2008, 2013, 2018 (Grundfile 3), SOEP v37, own calculations.

tends to be under-reported in the EVS due to the cut-off threshold for household income of 18,000 euros per month. Due to the higher extrapolated number of dependent employees (see above), the EVS extrapolation of households with employed persons in the years under consideration is approximately 2.5–3 million higher than in the SOEP data set (Table A2).

A2 Income Effects of the Statutory Minimum Wage, with EVS Measure of the Incidence of the Minimum Wage

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Table A3: Minimum wage effects on individual pay and needs-weighted gross and net household incomes at deciles of the distribution, dependent employees between 19 and 65 years of age.

	P10	**P20**	**P30**	**P40**	**P50**	**P60**	**P70**
Individual pay							
Trend * bite (EVS)	−3.32***	−0.95**	−0.60**	−0.55*	−0.42**	−0.39**	−0.31**
Dummy 2018 * bite (EVS)	3.39**	2.02***	1.56***	1.24***	0.80***	0.55**	0.35**
Household income from wages							
Trend * bite (EVS)	−0.80*	−0.27	−0.57**	−0.41	−0.37	−0.39	−0.27*
Dummy 2018 * bite (EVS)	2.64***	1.51***	1.43***	0.85**	0.60	0.46	0.21
Gross household income							
Trend * bite (EVS)	0.02*	−0.16	−0.33*	−0.41**	−0.37*	−0.33	−0.32*
Dummy 2018 * bite (EVS)	1.16***	1.07***	0.85***	0.82***	0.47**	0.27	0.18
Net household income							
Trend * bite (EVS)	−0.15*	−0.21	−0.23*	−0.29**	−0.25	−0.16	−0.05
Dummy 2018 * bite (EVS)	1.08***	0.86***	0.82***	0.59***	0.43**	0.11	−0.16

Source: EVS 2008, 2013, 2018 (Grundfile 3), own calculations; *n*: see Tables 6–8; */**/***: significant with error probability <10 %/<5 %/<1 %.

Table A4: Minimum wage effects on means-weighted gross and net household incomes at deciles of the distribution, all persons between 19 and 65 years of age.

	P10	P20	P30	P40	P50	P60	P70
Gross household income from wages							
Trend * bite (EVS)	0.04	0.35	0.14	−0.27	−0.20	−0.30	−0.29
Dummy 2018 * bite (EVS)	1.26*	0.96	0.78	0.98*	0.49*	0.36	0.25
Gross household income							
Trend * bite (EVS)	0.66***	0.80***	0.27**	−0.01	−0.22	−0.24	−0.29*
Dummy 2018 * bite (EVS)	0.04	−0.02	0.38*	0.42**	0.52**	0.27	0.19
Net household income							
Trend * bite (EVS)	0.45***	0.41***	0.19**	0.00	−0.06	−0.10	−0.05
Dummy 2018 * bite (EVS)	0.02	0.42*	0.29**	0.48**	0.28*	0.10	−0.09

Source: EVS 2008, 2013, 2018 (Grundfile 3), own calculations; *n*: see Tables 6–8; */**/***: significant with error probability <10 %/<5 %/<1 %.

A3 Income Levels from Different Sources in East and West Germany

Table A5: Real needs-weighted gross household income of employees in total and by income source in east and west Germany[a] (in €, 2015 prices).

Percentile of income distribution	Gross income		Income from wages		Income from public transfers		Income from self-employm.		Income from wealth[b]	
	East	West	East	West	East	West	East	West	East	West
2008										
P0–P30	1,468	1,753	1,059	1,264	246	253	33	37	144	225
P30–P70	2,541	3,074	2,036	2,460	192	211	75	60	327	492
P70–P100	4,442	5,518	3,557	4,376	216	239	181	221	586	795
2013										
P0–P30	1,428	1,759	980	1,256	303	276	27	36	122	207
P30–P70	2,552	3,181	2,035	2,530	209	222	67	72	349	498
P70–P100	4,608	5,779	3,705	4,553	221	243	156	222	616	808
2018										
P0–P30	1,642	1,930	1,188	1,409	300	280	26	46	128	209
P30–P70	2,937	3,520	2,387	2,835	228	240	62	77	375	511
P70–P100	5,255	6,449	4,216	5,065	244	253	157	244	680	828

Source: EVS 2008, 2013, 2018 (Grundfile 3), own calculations; [a]Berlin was included in west Germany, [b]including imputed rent.

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