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The Impact of a Large Minimum Wage Hike on the Distributions of Hourly Wages, Monthly Earnings, and Working Hours

https://doi.org/10.1515/ger-2025-0099
Received December 18, 2025; accepted September 7, 2026; published online November 4, 2026

Abstract: Using high-quality employer–employee data from the German Earnings Survey, we evaluate the distributional effects of a large minimum wage hike in Germany in 2022, which raised the statutory minimum wage by more than 22 % within a single year. Our results suggest that the hike increased the hourly wages of directly affected workers and also generated spillover effects well above the new minimum wage threshold. By contrast, the distribution of monthly earnings was much less affected. We show that this is due to reductions in working hours (both regular and overtime) among workers in the middle of the full-time hours distribution.

Keywords: minimum wage; distribution regression; difference-in-differences; inequality

JEL Classification: D31; J31; J38

1 Introduction

Minimum wages are an important policy instrument aimed at limiting wage disparities, unfair competition and asymmetric power relations between employers and

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employees. Given their central role in many labor markets, research on the effects of minimum wages has been burgeoning in recent years (for an overview, see Dube and Lindner 2024). As in many other contexts, identification of the causal effects of the minimum wage is challenging because exogenous variation is rare. For this reason, a considerable share of recent minimum wage research has exploited sudden or unusually large changes in minimum wage thresholds to study their effects (e.g., Harastosi and Lindner 2019; Kawaguchi and Mori 2021; Jardim et al. 2022; Hijzen et al. 2025/2026).

This paper exploits a large, 22 % increase in the German national minimum wage to examine its effects on wages, earnings, and hours worked. The increase affected almost 6 million workers, corresponding to 14.9 % of the workforce (Mindestlohnkommission 2025). It was not only sizable but also exceptional because part of it was introduced through a discretionary intervention by the federal government rather than through the regular adjustment procedure involving the independent Minimum Wage Commission (Mindestlohnkommission), which is legally responsible for reviewing the minimum wage and recommending adjustments. Before 2022, increases in the statutory minimum wage had been modest and gradual, typically amounting to around two to three percent per year following its introduction in 2015 (Dütsch et al. 2025). The overall increase occurred in two steps in 2022: an increase from 9.82 to 10.45 euros/h on 1 July 2022, based on a recommendation by the Minimum Wage Commission, followed by a discretionary increase from 10.45 to 12.00 euros/h on 1 October 2022, enacted by the German Bundestag.

We examine the effects of the exceptionally large change in the minimum wage level in 2022 on the distributions of hourly wages, monthly earnings and working hours. We show that the increase causally boosted hourly wages for workers who were directly affected, but also for those with hourly wages well above the minimum wage level, indicating spillover effects. Despite the sizable increase in hourly wages for low-wage earners, we find much weaker effects on monthly earnings. We demonstrate that this pattern was driven by negative effects on hours worked in the middle of the full-time hours distribution. To obtain these estimates, we exploit variation in the treatment intensity of the minimum wage increase at the individual, the regional and the industry level using a difference-in-differences approach for distributions. Our methodology not only allows us to estimate the effects of the minimum wage hike on the average levels of hourly wages, monthly earnings and working hours, but also to characterize its impact on their entire distributions. This provides a more nuanced picture of these effects and allows us to identify the location of the workers affected by the intervention in the distributions of hourly wages, monthly earnings and working hours.

Our paper contributes to three strands of the literature. First, we add to the growing body of research on large minimum wage changes. These represent quasi-experimental situations in which a policy parameter (the minimum wage level) is changed in a substantial way so that its effects on a variety of outcomes can be studied. Such a setting makes it possible to analyze different adjustment margins, in particular whether firms change employment stocks (extensive margin) or working hours (intensive margin) in response to a minimum wage hike. A potential mechanism underlying a reduction in working hours while maintaining firm profitability could be increased labor productivity (Ku 2022). On the worker side, such a mechanism could increase effort requirements and workplace intensity (Clemens 2021; Lee and Park 2026).

Studies analyzing different adjustment margins include Harastosi and Lindner (2019) who examine the effects of a large and persistent minimum wage increase in Hungary on firms' employment and wage setting decisions. They find limited employment effects and large wage effects including spillovers to workers above the minimum wage level. Kawaguchi and Mori (2021) study the consequences of an indexation of the Japanese minimum wage that substantially changed its growth trajectory, also finding significant effects on wage growth, but limited or no effects on employment and working hours. Jardim et al. (2022) analyze the effects of two significant minimum wage hikes in the city of Seattle. They document positive effects on low-wage growth alongside employment reductions at the intensive margin (working hours). Negative working hours effects are also found by Wong (2019) in response to significant minimum wage increases in Ecuador. Hijzen et al. (2025/2026) examine a recent minimum wage hike in Spain of similar magnitude as the one we study for Germany. Their results indicate significant effects on directly affected workers with small positive spillovers on higher-wage workers, as well as some employment losses at the extensive margin.

Second, we contribute to an emerging literature that analyzes the effects of minimum wages on entire distributions rather than on average outcomes. Much of the literature has focussed on the effects on average outcomes, but such results are uninformative about spillovers and changes in wage inequality. Cengiz et al. (2019) pioneered the wage-bin approach which analyzes changes in the distribution over finely defined wage bins to describe the effects of minimum wage changes. Their approach is typically combined with a difference-in-differences design exploiting differences in timing or treatment intensity. Giupponi et al. (2024) employ this method based on variation in the regional intensity of minimum wage changes to study their effects across the whole wage distribution. Based on a distribution regression approach (Foresi and Peracchi 1995; Chernozhukov et al. 2013), Fortin et al. (2021) model the influence of unionization and the minimum wage on the whole wage distribution. Oliveira (2023) applies their method to study the

effects of minimum wage changes on the Portuguese wage distribution. Earlier, Redmond et al. (2021) used distribution regression to describe changes in the Irish wage distribution before and after a minimum wage increase in 2016. Fortin et al. (2021), Redmond et al. (2021) and Oliveira (2023) do not exploit 'causal' variation in treatment intensity in their analyses. Such variation is used in a distributional analysis of the German minimum wage introduction by Bossler and Schank (2023), Bossler et al. (2026b) (both based on RIF-regression) and by Biewen et al. (2022) (based on distribution regression).

Finally, we contribute to the growing literature on the specific effects of the German minimum wage. Germany is unique in that it did not introduce a national minimum wage until the year 2015. Several papers have studied the effects of this introduction (for overviews, see Caliendo et al. 2019; Dütsch et al. 2025). Burauel et al. (2020a, 2020b) and Caliendo et al. (2023) conclude that the introduction raised low hourly wages, but also reduced working hours. By contrast, Biewen et al. (2022) and Biewen and Erhardt (2025/2026) find only limited evidence for negative working hours responses. Dustmann et al. (2022) document reallocation effects induced by the introduction of the minimum wage. Bossler and Schank (2023), Bossler et al. (2026b) and Biewen et al. (2022) show that the minimum wage introduction reduced wage and earnings inequality.

There is only limited evidence on the effects of subsequent increases of the German minimum wage after its introduction. Bachmann et al. (2022) show that the minimum wage increases in 2017 and 2019 had moderate positive effects on hourly wages at the lower end of the wage distribution, alongside small negative effects on working hours, with no discernible effects on monthly earnings. As a complement to our study, Bossler et al. (2026a) examine the increase in the German minimum wage in 2022. Their findings indicate that the hike raised hourly wages and monthly earnings, while also reducing working hours. The main difference between Bossler et al. (2026a) and our paper is that our paper focusses on distributional effects, while Bossler et al. (2026a) study wage, earnings and hours changes at the individual level. Further differences can be summarized as follows. Our paper exploits variation in treatment intensity at the individual, the regional and the industry level, while Bossler et al. (2026a)'s analysis is exclusively based on individual exposure to the minimum wage increase. A great merit of Bossler et al. (2026a)'s analysis is that they use novel high-frequency panel data up to December 2022 to measure individual wage growth and hours changes around the minimum wage hike in October 2022. By contrast, our analysis extends to April 2023 – thus describing a more medium-term effect – but our results are mainly based on changes between April 2022 (before the intervention) and April 2023 (after the intervention) rather than on monthly data as in Bossler et al. (2026a). Finally, Bossler et al. (2026a) also differs in

that it additionally examines the development in employment and that it separately examines the effects of the minimum wage increases in July and October.

2 Data

2.1 German Earnings Survey

Our main analysis is based on the German Earnings Survey (ES) for 2022 and 2023 (German Statistical Office 2023, 2024). The ES is a mandatory large-scale employer-employee survey conducted by the German Statistical Office and used for official statistics. The survey is the only large-scale data base for Germany that includes information on working hours. In particular, such information is not available in the widely used Integrated Employment Biographies (IEB) provided by the IAB. The ES representatively samples around 60.000 firms per year. Firms report wages, working hours and a number of other characteristics for all their employees, resulting in very large samples sizes (8,126,220 workers in 2022, 8,736,531 in 2023). The information reported by firms is typically directly transferred from their accounting systems and is therefore considered highly valid. The survey has a longitudinal dimension in that workers can be linked across years if they stay in the same establishment. We exclude from our analysis the public sector (including education) because its records do not contain the regional identifiers used in our analysis. We also exclude workers to whom the minimum wage legislation does not apply (interns, individuals in vocational training, persons under 18 years of age). The survey provides sample weights which we use throughout our analysis.

The ES reports monthly earnings and working hours for each worker for the month of April. Between April 2022 and April 2023, the German statutory minimum wage was increased from 9.82 euros/h to 12 euros/h. The increase was implemented in two steps: from 9.82 euros/h to 10.45 euros/h in July 2022 and from 10.45 euros/h to 12 euros/h in October 2022. In our analysis, we calculate the hourly wage as monthly earnings divided by working hours including overtime. We also include a number of covariates (gender, age/tenure brackets, education categories, full-time/part-time/marginal part-time indicators, worker occupation groups, indicators for no/firm/sectoral union bargaining, firmsize categories, industry indicators, federal state indicators). For more details on our sample and sample selection, see the technical report of our study (Bachmann et al. 2025).

2.2 Supplementary Data for Pre-Trend Analysis

The ES has been available in the given form only since 2022. This makes pre-trend analyses difficult. To complement our difference-in-differences analyses with information on the development of our outcome variables (wages, earnings, working hours) in pre-treatment periods (i.e., before the minimum wage hike in 2022), we draw on two additional data sets: the German Structure of Earnings Survey (SES) for 2018, and the German Socio-Economic Panel (SOEP) for the years 2017 through 2020.

As the predecessor of the ES, the SES has a similar structure, but a much smaller sample size (715,846 observations). It was conducted only every four years, meaning that 2018 is the last available year before the introduction of the ES in 2022. We use the observed trends between the SES 2018 and ES 2022 to adjust our main analysis – the change between 2022 and 2023 – for potential pre-trends. Admittedly, the time span between 2018 and 2022 is quite large. On the one hand, this can be seen as a disadvantage, as it is not clear how informative pre-trends dating back so far are for developments in 2022 and beyond. On the other hand, the advantage is that data from 2018 bypass the years of the COVID-19 pandemic. Assuming that the COVID-19 period was largely characterized by extraordinary developments, these would not be considered relevant pre-trends for the development during the transition from 2022 to 2023.

As an additional data source for pre-trend analysis, we use the SOEP (Goebel et al. 2019). The SOEP is a yearly panel surveying approximately 30,000 individuals. Similar to the ES, it provides information on year-to-year changes at the individual level. The SOEP includes similar information on wages, working hours and worker covariates as the ES, but its comparability is not as high as that of the supplementary SES, as measurement errors are more likely to occur in self-reported survey data. In the SOEP, we examine average yearly changes of our outcome variables over the period 2017 to 2020 as pre-trend information for our main analysis, which refers to the years 2022 and 2023. Estimating pre-trends based on the SOEP for the period from 2017 to 2020 has the advantage of allowing for the inclusion of more recent developments after 2018. Still, we exclude the SOEP waves for 2021 and 2022 because of highly irregular patterns during the pandemic. In particular, we observe that year-to-year developments between 2017 and 2020 exhibit stable patterns, whereas trends after 2020 become irregular. Apart from irregular developments in wages and working hours during the pandemic, an additional reason for excluding the 2021 and 2022 waves is that the SOEP field work had to deviate from its usual practices during the pandemic, making comparable year-to-year analyses difficult (e.g., field work for 2022 was mostly carried out towards the end of the year in contrast to earlier years, leading to an overlap with the minimum wage hike in

October of that year). For the pre-trend analysis based on the SOEP to be valid, we assume that after 2022, trends in wages and working hours at the individual level would have followed similar patterns to those seen before the pandemic in 2017–20 in the absence of the minimum wage hike.

3 Econometric Methods

We employ a difference-in-differences (DiD) approach that exploits treatment variation at three alternative levels: the individual, the regional, and the industry level. In all three cases, we estimate the causal effect of the minimum wage increase through the relationship between the degree of exposure to the intervention, and the change in outcome variables before and after its implementation. Our estimations are based on the specification

$$Y_{igt} = \alpha + \gamma_g \text{TreatmentGroup}_{ig} + \lambda\ \text{Post}_{it} + \beta\ (\text{TreatmentIntensity}_{ig} \times \text{Post}_{it}) + X_{it}\delta + u_{igt}, \quad (1)$$

where Y_{igt} denotes the outcome (hourly wage, earnings, working hours) of individual i in treatment group g at time $t \in \{2022, 2023\}$, $\text{TreatmentGroup}_{ig}$ is a set of indicators for workers in different treatment groups, Post_{it} is an indicator for the post-treatment period ($\text{Post}_{it} = 1$ if $t = 2023$, and $\text{Post}_{it} = 0$ if $t = 2022$), and $\text{TreatmentIntensity}_{ig}$ is the measure of treatment intensity (defined below for each approach). The vector X_{it} represents a set of covariates (gender, age/tenure brackets, education categories, full-time/part-time/marginal part-time indicators, worker occupation codes, indicators for no/firm/sectoral union bargaining, firmsize categories, industry indicators, federal state indicators).

In this framework, β captures how changes in the outcome between 2022 and 2023 vary with the degree of exposure to the minimum wage hike. Identification relies on the standard DiD assumption that, in the absence of the reform, average changes in Y_{igt} between 2022 and 2023 would not be systematically related to $\text{TreatmentIntensity}_{ig}$ conditional on $\text{TreatmentGroup}_{ig}$ and X_{it}. Within the period of investigation, Germany experienced considerable inflation. Hence, the identification of a direct causal effect and of spillovers also relies on any inflation-compensating wage increases being constant across the wage distribution.

3.1 Treatment Intensity at the Individual Level

When considering treatment intensity at the individual level, we define $\text{TreatmentIntensity}_{ig}$ as a set of dummy variables indicating to which of the

following hourly wage brackets the worker belonged before the minimum wage increase: less than 12 euros, 12–13 euros, 13–14 euros, 14–15 euros, 15–16 euros. Workers with hourly wages over 16 euros are unlikely to be affected by the increase and serve as the reference group.

Equation (1) then exploits the idea that individuals whose hourly wage was below (or close to) 12 euros/h before the intervention should experience larger wage growth between 2022 and 2023 than individuals far above the threshold. We include in this specification a full set of individual indicators in $\text{TreatmentGroup}_{ig}$, which amounts to estimating average individual wage growth (or changes in individual working hours) between 2022 and 2023 separately for the worker groups defined above. Note that, due to the sampling design of the ES, we can only follow workers over time if they stay in the same establishment.

It is well known, however, that wage growth is typically higher for individuals with low initial wages even in the absence of changes in the minimum wage because of mean reversion (Dustmann et al. 2022). Unfortunately, we cannot determine yearly individual wage growth before 2022 in our main database (the ES) as there is no panel dimension before 2022. We therefore estimate equation (1) for yearly transitions 2017/18, 2018/19, 2019/2020 in our complementary data base SOEP. We then subtract the average of these yearly individual wage changes for the different worker groups from our main estimate β in equation (1) in order to account for the 'normal' wage growth of workers in the different groups (i.e., wage growth absent the minimum wage hike).

3.2 Treatment Intensity at the Regional Level

Following Card (1992), we consider differences in affectedness by the minimum wage increase across German regions as an alternative definition of treatment intensity. For this purpose, we define the regional 'bite' of the minimum wage increase, i.e., the fraction of workers in a region with wages below 12 euros/h in April 2022, i.e., before the increase to 12 euros/h in October 2022. Our results are very similar if we use the minimum wage gap (the average percentage necessary to reach the new minimum wage level) instead of the minimum wage bite, see Bachmann et al. (2025).

As the regional level, we use the 'German Planning Regions' which consist of 96 regional units. In the regional approach, $\text{TreatmentGroup}_{ig}$ is a full set of indicators for these regions, while $\text{TreatmentIntensity}_{ig}$ is the regional bite of the minimum wage increase as defined above. In our data, the average bite was 17.41 %. The highest bite of the least affected five percent of regions was 9.22 %, whereas the lowest bite among the most affected five percent of regions was 25.25 % (Bachmann et al. 2025).

In the case of the regional treatment definition, the idea of equation (1) is that wages, earnings and working hours react more strongly to the minimum wage change in highly affected regions than in weakly affected ones. The term $\beta \cdot \text{TreatmentIntensity}_{ig}$ reflects what part of wage, earnings or hours changes between 2022 and 2023 can be explained by the exposure to the minimum wage increase. It thus plausibly represents the causal effect of the intervention.

In order to account for potentially differential pre-trends across regions with higher or lower treatment intensity, we additionally include the SES wave $t = 2018$ as a pre-treatment period, i.e., we estimate

$$\begin{aligned} Y_{igt} = \alpha + \gamma_g \text{TreatmentGroup}_{ig} + \lambda\ \text{Post}_{it} + \beta\ (\text{TreatmentIntensity}_{ig} \times \text{Post}_{it}) \\ + \rho\ \text{Pre}_{it} + \theta\ (\text{TreatmentIntensity}_{ig} \times \text{Pre}_{it}) + X_{it}\delta + u_{igt}. \end{aligned} \tag{2}$$

where Pre_{it} is an indicator for the pre-treatment period ($t = 2018$), and $t \in \{2018, 2022, 2023\}$. The parameter θ measures to what extent regions whose later exposure to the minimum wage hike was higher already showed differential developments of the dependent variable Y_{igt} in the years before the intervention. Below, we use an annualized version of θ ($= \theta/4$) to correct our effect of interest β (which refers to a one-year change) for observable pre-trends.

As in Biewen et al. (2022), we also apply this approach to distributional thresholds to measure the effect of the minimum wage increase on different thresholds in the distributions of wages, earnings and working hours (= distribution regression). In this case, the estimating equation reads

$$\begin{aligned} 1\{Y_{igt} \leq y\} = \alpha + \gamma_g \text{TreatmentGroup}_{ig} + \lambda\ \text{Post}_{it} \\ + \beta\ (\text{TreatmentIntensity}_{ig} \times \text{Post}_{it}) \\ + \rho\ Pre_{it} + \theta\ (\text{TreatmentIntensity}_{ig} \times \text{Pre}_{it}) + X_{it}\delta + u_{igt}. \end{aligned} \tag{3}$$

where thresholds y are chosen from a suitable grid of values for the outcome variables wages, earnings and working hours (see below). The method of distribution regression was introduced by Foresi and Peracchi (1995) and refined by Chernozhukov et al. (2013). Given the large data sets and computational constraints at the Research Data Centers where we process our data, we implement distribution regression using linear probability models estimated by weighted least squares (WLS), applying the survey weights provided in the ES and SES.

We use our distribution regression results for hourly wages, monthly earnings and working hours to construct counterfactual versions of these distributions that show how these distributions would have looked like had the minimum wage not been increased. These result from subtracting for each individual in equation (3)

the part $\beta \cdot \text{TreatmentIntensity}_{ig}$ that is explained by the exposure to the minimum wage increase. Unconditional distributions are computed by aggregating up (= averaging) across individuals.

3.3 Treatment Intensity at the Industry Level

As a third treatment definition, we consider differences in exposure to the minimum wage increase across industries. We construct an industry bite measure at the 2-digit WZ08 level, computed separately for East and West Germany. This yields 152 industry–region cells as distinct treatment groups. In our data, the average bite is 14.91 %. The bite of the least affected five percent of industry–East/West cells is zero (i.e., these industries are not affected by the minimum wage increase), while the lowest bite among the most affected five percent of cells is 46.59 % (Bachmann et al. 2025). Thus, the variation in the bite is larger at the industry level than at the regional level. The application of the industry bite is completely analogous to the regional bite, i.e., $\text{TreatmentGroup}_{ig}$ is a set of indicators for the 152 industry-East/West cells, while $\text{TreatmentIntensity}_{ig}$ is the bite of the minimum wage increase in the cell of the individual.[1]

3.4 Motivation for Using Alternative Treatment Definitions

As different definitions have been used in the literature, an obvious reason to employ more than one treatment definition is to gauge the sensitivity of the estimates with respect to changes in the definition of the treatment variable. A further reason is that alternative definitions may accomdate alternative assumptions about spillover effects and potential pre-trends. Finally, some definitions of treatment intensity may provide wider variation in the treatment variable than others (e.g., higher variation in the bite across industries than across regions, see above).

Defining treatment intensity at the individual level most clearly identifies the group of individuals who are most strongly affected by the treatment. However, it is more difficult to control for individual-specific pre-trends without sufficiently comparable panel data for pre-treatment periods. On the other hand, regional and industry level definitions provide a less targeted definition of treatment, but automatically accomodate spillover effects at the regional or the industry level. They may also require less demanding assumptions on pre-trends. We will take into account these aspects when discussing our results below.

1 Note that our regression samples using the treatment intensity at the regional or the industry level slightly differ from those using treatment intensity at the individual level as the latter require the sample to be balanced.

3.5 Clustered Standard Errors

As emphasized by Bertrand et al. (2004) and Abadie et al. (2023), it is crucial in difference-in-differences designs to cluster standard errors at the level of the treatment variable. We therefore cluster standard errors at the individual, the regional and industry-East/West-cell level, respectively, depending on which dimension is chosen to define treatment intensity. For the counterfactual distributions constructed through distribution regressions, analytic standard errors are not available. In these cases, we use a multiplier bootstrap procedure in which the random multipliers are drawn at the relevant cluster level (Chang et al. 2013).

4 Empirical Analysis

4.1 Effects on Hourly Wages

Average hourly wages amounted to 23.94 euros in 2022, i.e., before the minimum wage increase to 12 euros, and to 25.08 euros in 2023, i.e., after the increase (Bachmann et al. 2025). Bossler et al. (2026a) were the first to analyze the effect of the minimum wage increase in 2022. Their results show that hourly wages of directly affected workers increased by around 6 % due to the minimum wage increase. The authors use monthly panel data of the German Earnings Survey and apply a DiD-design that is different from ours. Furthermore, their treatment group contains workers with hourly wages between 10.45 and 12 euros, while our treatment group is defined as having hourly wages below 12 euros. Finally, Bossler et al. (2026a) consider the treatment effect until December 2024, whereas we consider the longer time horizon until April 2023. Thus, the results we present in the following are not directly comparable to those derived by Bossler et al. (2026a).

Figure 1 presents the impact of the minimum wage increase to 12 euros per hour on individual hourly wage growth for workers in different initial wage brackets according to our empirical strategy. Workers whose hourly wage was below 12 euros/h in April 2022 experienced an average wage growth of around 19 % between April 2022 and April 2023. Wage growth for higher wage brackets was positive but considerably smaller (10 % in the 12–13 euros/h bracket, 8 % in the 13–14 euros/h bracket, etc.). However, as indicated by the green line in Figure 1, annual wage growth was also higher in lower wage brackets in 'normal' years without substantial changes of the minimum wage.

Subtracting both lines from each other results in net treatment effects of the minimum wage increase of around 6 % for individuals directly affected by the minimum wage hike (initial wage below 12 euros/h), as well as sizable net effects for higher wage brackets (4 % for the 12–13 euros/h bracket to around 3 % for the 15–16

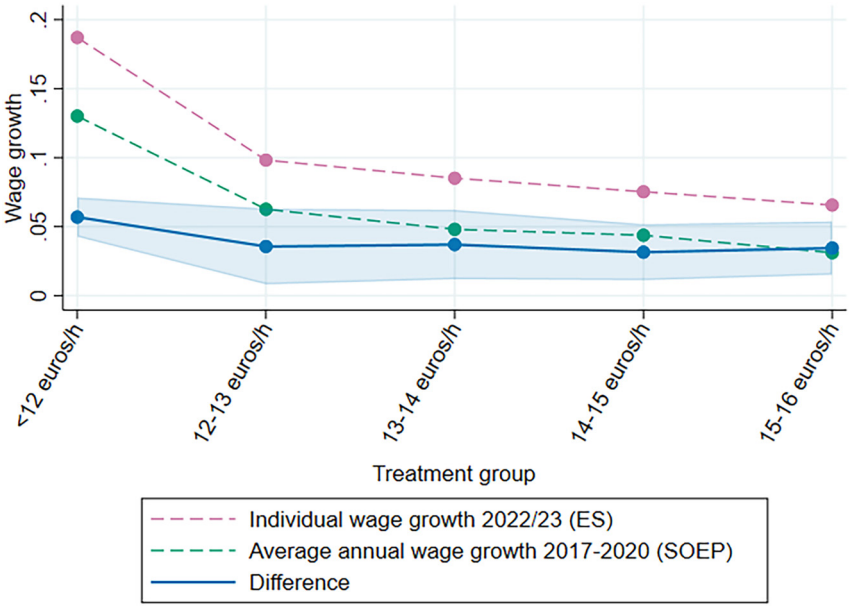


Figure 1: Effect of minimum wage increase on individual wage growth. Source: ES 2022/2023, SOEP 2017–2020. Treatment groups refer to hourly wage bracket before minimum wage increase.

euros/h bracket, see blue line in Figure 1). Recall that the green line was estimated in the supplementary data set SOEP so that comparability to the ES data may be limited. In particular, while the raw effects clearly decline towards higher hourly wages (purple line), the net effects decline only slowly (blue line), which may be an artefact of the limited comparability of the SOEP-estimates. Apart from this, our results suggests net effect of the minimum wage hike on directly affected workers of around 6 %, with sizable spillover effects on hourly wages above 12 euros/h. Our results thus match those derived by Bossler et al. (2026a) quite well.

We now extend the analysis by defining the treatment at a level above the individual one, i.e., at the level of regions and industries. Table 1 reports the corresponding difference-in-differences estimates for log hourly wages using the regional and industry bite measures as treatment intensities. With the regional bite, the minimum wage hike increased average hourly wages by 0.82 %, although the increase is not statistically significant. When we instead use the industry bite, the implied average effect is about 2.65 % and statistically significant. The pre-trend analysis indicates that hourly wages grew more slowly in high-bite regions/industries before the intervention (row 2 of Table 1), which would lead us to underestimate the effect

Table 1: Effect of minimum wage increase on log hourly wages.

	Coefficient		Average effect	
	Regional bite	**Industry bite**	**Regional bite**	**Industry bite**
Effect	0.0509	0.1637***	0.0082	0.0265***
	(0.0858)	(0.0657)	(0.0138)	(0.0106)
Pre-trend (SES 2018) (annualized)	−0.0171	−0.0527***		
	(0.0257)	(0.0126)		
Corrected effect	0.0680	0.2164***	0.0109	0.0350***
	(0.0833)	(0.0750)	(0.0142)	(0.0121)

Source: ES 2022/2023, SES 2018, own calculations. Columns 1 and 2 present regression coefficients for the treatment and annualized pre-trend effects (β and $-\theta/4$ in equation (2)). Columns 3 and 4 show average effects across individuals ($\beta \cdot \text{TreatmentIntensity}_{ig}$ averaged across individuals). Control variables included. Standard errors clustered at treatment group level. *** = statistically significant at 1 %-level.

of the intervention if these pre-trends were to persist. Adjusting for these pre-trends slightly increases the estimated causal effect of the intervention on average hourly wages (last row of Table 1).

In Table 2, we provide a heterogeneity analysis of the effects of the minimum wage hike on hourly wages. For this, we repeat the analysis for subgroups of workers (male/female, regular/marginal employment, East/West), but based on a bite definition that includes only the observations of the respective subgroup (e.g., we compute the fraction of workers with hourly wages below 12 euros/h within the supgroup of marginally employed workers). Using this definition, the average bite at the industry-East/West level was 0.2027 for females versus 0.1254 for males, 0.0940 for regular workers versus 0.5738 for marginal workers, and 0.1917 for West versus 0.549 for East Germany.[2] The estimates in Table 2 suggest that the minimum wage increase benefited women more than men, and workers in East Germany more than those in West Germany. This is in line with the expectation that the effect of the minimum wage increase is higher for groups that were more strongly affected by it. In addition, a larger regression coefficient for a particular subgroup – for example, East Germany relative to West Germany in the lower panel of Table 2 – may indicate a larger bite gap, meaning that workers earning below the new minimum wage were, on average, farther below the new threshold than their counterparts in the comparison group.

2 The subgroup-specific bites were almost the same based on the regional treatment definition.

Table 2: Heterogeneous effects of the minimum wage increase on log hourly wages, treatment definition at industry level.

	Coefficient		Average effect	
Gender				
	Female	Male	Female	Male
Effect	0.1679***	0.1733*	0.0340***	0.0217*
	(0.0334)	(0.0980)	(0.0068)	(0.0123)
Pre-trend (SES 2018) (annualized)	−0.0455***	−0.0560***		
	(0.0102)	(0.0170)		
Corrected effect	0.2133***	0.2293**	0.0433***	0.0287**
	(0.0366)	(0.1125)	(0.0074)	(0.0141)
Regular employment versus marginal employment				
	Regular	Marginal	Regular	Marginal
Effect	0.2147***	0.0669*	0.0202***	0.0384*
	(0.0804)	(0.0402)	(0.0076)	(0.0230)
Pre-trend (SES 2018) (annualized)	−0.0465***	0.0076		
	(0.0167)	(0.0088)		
Corrected effect	0.2612***	0.0593	0.0245***	0.0340
	(0.0921)	(0.0462)	(0.0087)	(0.0265)
East versus West Germany				
	West	East	West	East
Effect	0.1452*	0.2099***	0.0225*	0.0402***
	(0.0792)	(0.0348)	(0.0123)	(0.0067)
Pre-trend (SES 2018) (annualized)	−0.0558***	−0.0468***		
	(0.0151)	(0.0120)		
Corrected effect	0.2010**	0.2566***	0.0311**	0.0492***
	(0.0908)	(0.0396)	(0.0141)	(0.0076)

Source: ES 2022/2023, SES 2018, own calculations. Treatment definition at the industry level. Columns 1 and 2 present regression coefficients for the treatment and annualized pre-trend effects (β and $-\theta/4$ in equation (2)). Columns 3 and 4 show average effects across individuals ($\beta \cdot \text{TreatmentIntensity}_{ig}$ averaged across individuals). Control variables included. Standard errors clustered at treatment group level. ***/**/* = statistically significant at 1 %/5 %/10 %-level.

Marginal part-time workers are an exception from this. The effect of the minimum wage hike on their hourly wages is only marginally significant without trend-correction and becomes insignificant after trend-correction (second panel of Table 2). To understand this finding, note that the earnings threshold for marginal part-time jobs ('mini jobs') was raised from 450 to 520 euros in October 2022 at the same time as the minimum wage hike. Thus, the insignificant effect for marginal

part-time jobs does not mean that there were no wage gains for this group, but that these gains were not systematically related to the minimum wage bite. This is plausible as the increase affected all mini-job workers irrespective of their affectedness as measured by the bite variable.

We have also repeated the heterogeneity analysis for the regional bite definition. This did not yield statistically significant effects, so that we do not report these results here. It corroborates our earlier finding that variation in the bite across the regional units considered by us may be too small to identify treatment effects on average outcomes.

We next analyze the distributional implications of the reform using the distribution regression framework described in Section 3.2. For hourly wages, we estimate equation (3) on a 1-euro grid of hourly wage bins. From these regressions, we obtain predicted probabilities for each individual in 2023, which we average across workers to recover the factual cumulative distribution function (cdf) of hourly wages. Differencing the cdf yields the factual probability density function (pdf) plotted in Figure 2. To obtain the counterfactual pdf net of the effects explained by the intervention, we omit the term $\beta \cdot \text{TreatmentIntensity}_{ig}$ (the part that is explained by the exposure to the minimum wage increase) when forming individual predictions, but carry out all other steps as before. This yields the counterfactual pdf of hourly wages in which the part that is explained by the minimum wage hike is omitted (yellow bars in Figure 2). We report the results for the industry treatment definition here, the results for the regional definition are similar (Bachmann et al. 2025).

Figure 3 displays the difference between the factual and counterfactual pdfs (upper panel: without trend correction, lower panel: with trend correction). As expected, the increase of the minimum wage to 12 euros/h shifted distributional mass from below 12 euros to higher wage bins, but the effects extend beyond the new minimum rate up to around 18 euros/h. The lower panel of Figure 3 demonstrates that applying the pre-trend correction dampens some of these effects and restricts spillover effects to hourly wages of 16 euros/h.[3]

Finally, we compute the counterfactual effect of the minimum wage increase on hourly wage inequality as measured by the Gini coefficient. To this end, we apply the Gini formulas for grouped income data (wage bins in our application) developed

3 The absolute change induced by an increase in the minimum wage can be approximated by multiplying the difference between the factual and counterfactual pdf by the midpoint of the respective bin and summing the resulting products. Dividing this estimate by average hourly wages yields an effect of 0.0211 without adjustment for pre-trends and 0.0103 with adjustment for pre-trends. This calculation serves as a basic plausibility check in comparison to the average effects shown in Table 1. We would not expect an exact coincidence of the results due to the bin grouping and the limited window in which we calculate distributional effects.

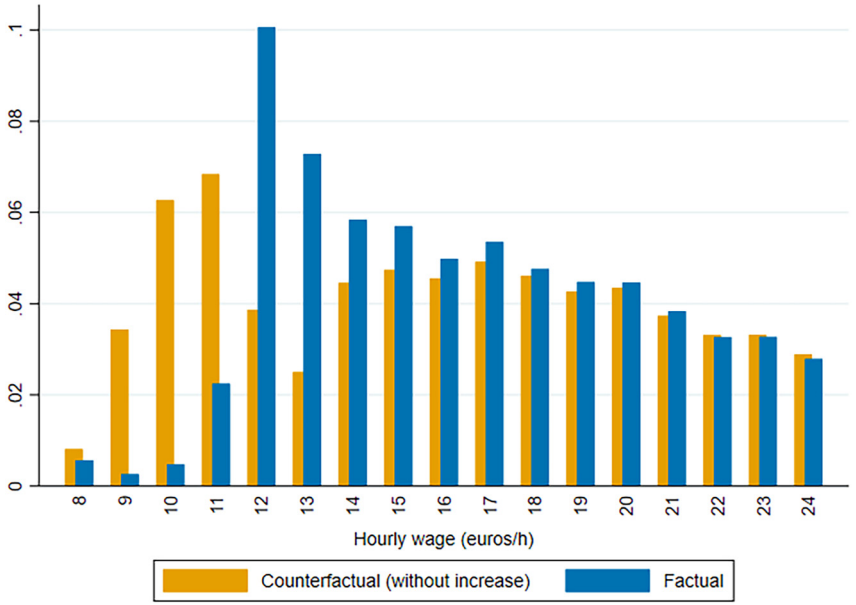


Figure 2: Effect of minimum wage increase on hourly wage distribution. Source: ES 2022/2023, own calculations. Treatment definition at the industry level. The bins are labeled by their lower limits. For example, the 10 euros/h bin represents the right open interval from 10 euros/h to 11 euros/h.

by Tillé and Langel (2012) to the factual and the counterfactual pdfs of hourly wages in 2023 (for more details, see Biewen et al. 2022). The results, reported in Table 3, indicate that the minimum wage increase reduced the Gini by 1.3–1.6 percentage points, accounting for around two thirds of the fall in the Gini for hourly wages between 2022 and 2023 (Bachmann et al. 2025).

4.2 Effects on Monthly Earnings

We now turn to the effects of the minimum wage hike on workers' monthly earnings. The key question is whether, and for which workers, the increase in low hourly wages translated into higher monthly earnings, and where these workers are located in the earnings distribution. First of all, average monthly earnings amounted to 3,453.47 euros in 2022 and to 3,646.75 euros in 2023, i.e., after the minimum wage increase. According to Bossler et al. (2026a), the minimum wage increase induced the monthly earnings to grow by around 5 % for the directly affected. For the following, keep in mind that our results are not directly comparable to those

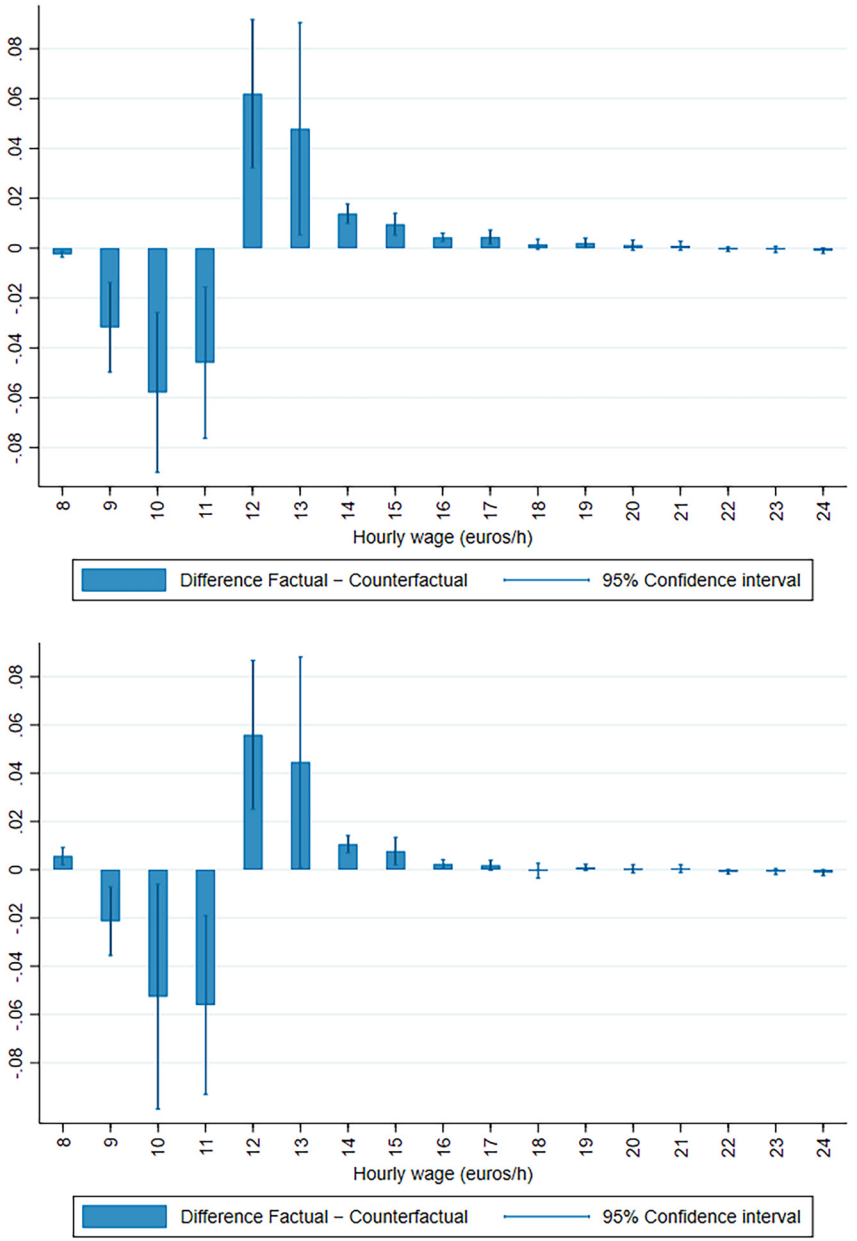


Figure 3: Effect of minimum wage increase on hourly wage distribution (Upper panel: without trend correction. Lower panel: with trend correction.). Source: ES 2022/2023. Treatment definition at the industry level. The bins are labeled by their lower limits. For example, the 10 euros/h bin represents the right open interval from 10 euros/h to 11 euros/h. 95 %-confidence intervals based on clustered bootstrap standard errors.

Table 3: Effect of minimum wage increase on the Gini of hourly wages.

	Factual	Counterfactual	Difference
Without trend correction	0.2943	0.3107	−0.0163***
			(0.0019)
With trend correction	0.2943	0.3072	−0.0129***
			(0.0018)

Source: ES 2022/2023, SES 2018, own calculations. Factual and counterfactual Gini for hourly wages in 2023. Treatment definition at the industry level. Bootstrap standard errors clustered at treatment group level. *** = statistically significant at 1 %-level.

by Bossler et al. (2026a) due to the differences described at the beginning of the previous section.

Figure 4 shows the results for individual earnings growth by initial hourly wage bracket. Workers with initial wages below 12 euros per hour did experience higher annual earnings growth between 2022 and 2023 (purple line).

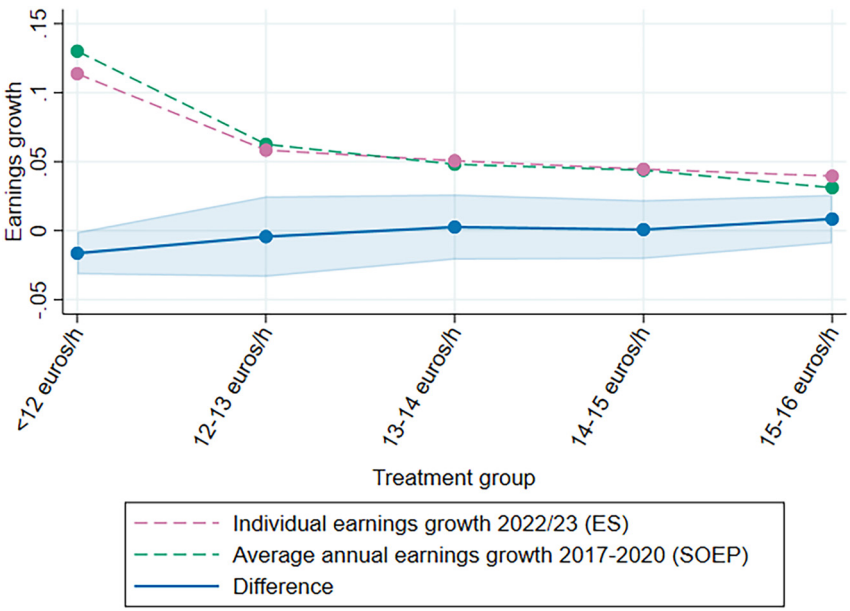


Figure 4: Effect of minimum wage increase on individual earnings growth. Source: ES 2022/2023, SOEP 2017–2020. Treatment groups refer to hourly wage bracket before minimum wage increase.

However, the green line – based on pre-reform years in the SOEP – reveals a very similar pattern in 'normal' years, with higher earnings growth also concentrated among low-wage workers in the absence of a large minimum wage change. As a consequence, the net effect of the minimum wage increase on earnings, given by the difference between the two lines (blue line), is essentially indistinguishable from zero. Thus, our results for monthly earnings for directly affected workers differ from those by Bossler et al. (2026a). Again, we cannot rule out that comparability issues between the SOEP and the ES invalidate our correction of individual pre-trends, which is automatically addressed in the monthly panel data approach used by Bossler et al. (2026a).

Table 4 reports difference-in-differences estimates for average log monthly earnings based on the regional and industry bites as treatment intensities. The average effects are small and not statistically significant, consistent with our individual-level evidence from Figure 4. However, the heterogeneity analysis in Table 5 based on the industry bite suggests that the zero overall effect masks some important subgroup patterns. In particular, we find statistically significant positive earnings effects for women and for workers in East Germany. This mirrors the heterogeneity in hourly wage effects reported in Table 2, although the earnings responses are muted in magnitude relative to the wage responses. Again, we have repeated the heterogeneity analysis for the regional bite, but hardly find significant effects in this specification. The only exception is a negative effect for West German workers, which disappears after pre-trend correction.

Table 4: Effect of minimum wage increase on log monthly earnings.

	Coefficient		Average effect	
	Regional bite	**Industry bite**	**Regional bite**	**Industry bite**
Effect	−0.1016	0.0955	−0.0163	0.0155
	(0.0918)	(0.0924)	(0.0148)	(0.0150)
Pre-trend (SES 2018) (annualized)	−0.0030	−0.0590***		
	(0.0292)	(0.0169)		
Corrected effect	−0.1046	0.1545	−0.0168	0.0250
	(0.1017)	(0.1067)	(0.0164)	(0.0173)

Source: ES 2022/2023, SES 2018, own calculations. Columns 1 and 2 present regression coefficients for the treatment and annualized pre-trend effects (β and $-\theta/4$ in equation (2)). Columns 3 and 4 show average effects across individuals ($\beta \cdot \text{TreatmentIntensity}_{ig}$ averaged across individuals). Control variables included. Standard errors clustered at treatment group level. *** = statistically significant at 1 %-level.

Table 5: Heterogeneous effects of the minimum wage increase on log monthly earnings, treatment definition at industry level.

	Coefficient		Average effect	
Gender				
	Female	Male	Female	Male
Effect	0.1144***	0.0968	0.0232***	0.0121
	(0.0401)	(0.1409)	(0.0081)	(0.0177)
Pre-trend (SES 2018) (annualized)	−0.0580***	−0.0591**		
	(0.0106)	(0.0241)		
Corrected effect	0.1723***	0.1559	0.0349***	0.0195
	(0.0445)	(0.1627)	(0.0090)	(0.0204)
Regular employment versus marginal employment				
	Regular	Marginal	Regular	Marginal
Effect	0.1421	0.0365	0.0133	0.0210
	(0.1123)	(0.0435)	(0.0106)	(0.0250)
Pre-trend (SES 2018) (annualized)	−0.0475**	0.0312***		
	(0.0212)	(0.0117)		
Corrected effect	0.1896	0.0053	0.0178	0.0031
	(0.1299)	(0.0432)	(0.0122)	(0.0248)
East versus West Germany				
	West	East	West	East
Effect	0.0719	0.1643***	0.0111	0.0315***
	(0.1116)	(0.0575)	(0.0173)	(0.0110)
Pre-trend (SES 2018) (annualized)	−0.0651***	−0.0427***		
	(0.0205)	(0.0119)		
Corrected effect	0.1370	0.2071***	0.0212	0.0397***
	(0.1295)	(0.0635)	(0.0201)	(0.0122)

Source: ES 2022/2023, SES 2018, own calculations. Treatment definition at the industry level. Columns 1 and 2 present regression coefficients for the treatment and annualized pre-trend effects (β and $-\theta/4$ in equation (2)). Columns 3 and 4 show average effects across individuals ($\beta \cdot \text{TreatmentIntensity}_{ig}$ averaged across individuals). Control variables included. Standard errors clustered at treatment group level. ***/** = statistically significant at 1 %/5 %-level.

We again use distribution regression to study the entire earnings distribution. Figures 5 and 6 show the factual and counterfactual distributions of monthly earnings based on the industry bite. The results indicate that workers earning less than 2,200 euros per month experienced modest gains through the minimum wage increase, but the total mass shifting to higher earnings bins appears limited. When

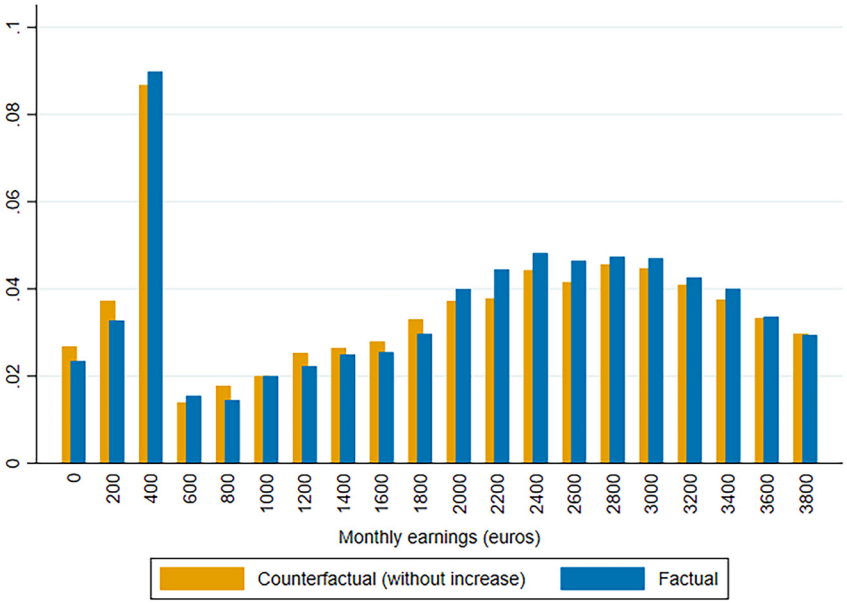


Figure 5: Effect of minimum wage increase on monthly earnings distribution. Source: ES 2022/2023, own calculations. Treatment definition at the industry level. The bins are labeled by their lower limits. For example, the 400 euros bin represents the right open interval from 400 to 600 euros.

we incorporate pre-trend corrections, the distributional effects become weaker and noisier (lower panel of Figure 6). This is consistent with the insignificant average effects in Table 4.[4]

Table 6 reports the effects on the Gini coefficient for monthly earnings. Without pre-trend correction, the minimum wage increase reduces the Gini by less than half a percentage point. This estimate does not change much after trend correction. Overall, while the minimum wage hike clearly compressed the distribution of hourly wages, its impact on the distribution of monthly earnings appears much more muted.

We have repeated the distributional analysis for monthly wages based on the regional bite. This yielded slightly stronger distributional effects for monthly wages

4 The absolute change induced by an increase in the minimum wage can be approximated by multiplying the difference between the factual and counterfactual pdf by the midpoint of the respective bin and summing the resulting products. Dividing this estimate by average monthly earnings, yields an effect of 0.0142 without adjustment for pre-trends and 0.0069 with adjustment for pre-trends.

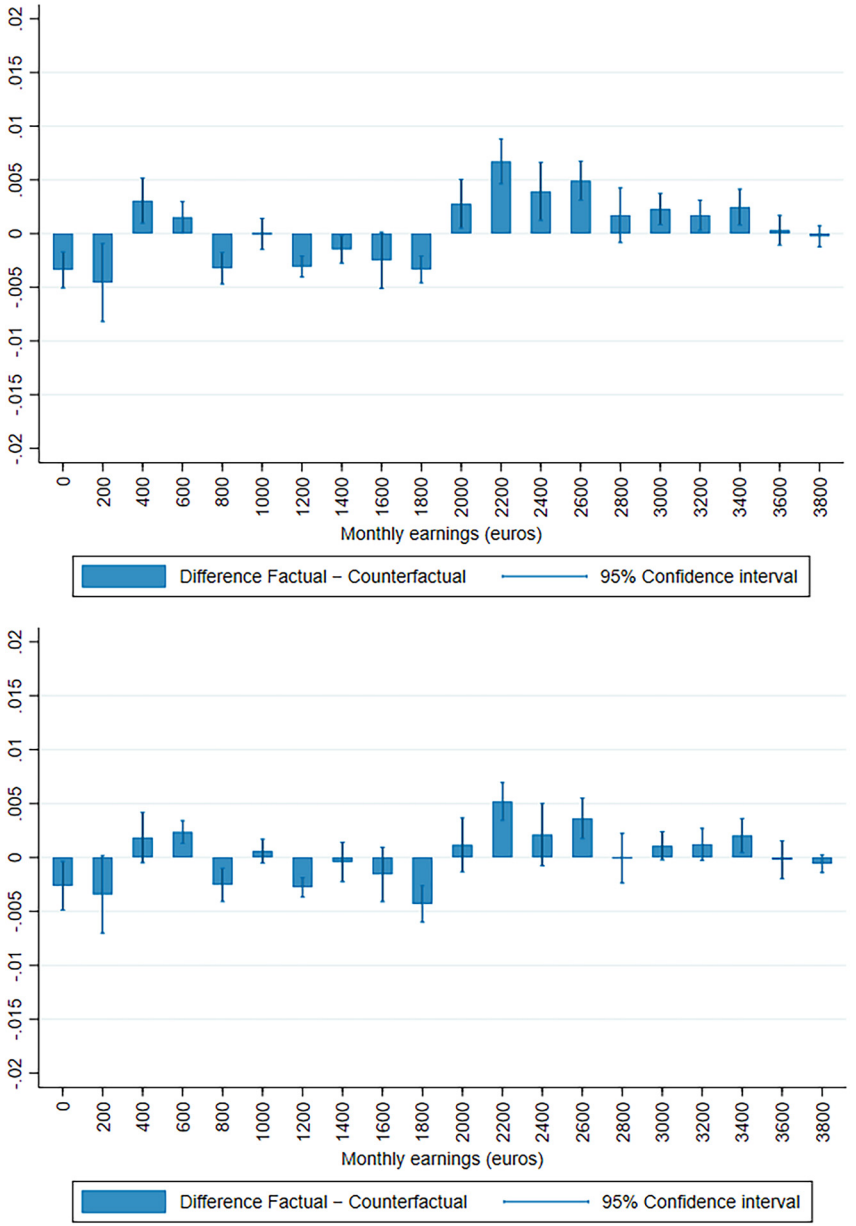


Figure 6: Effect of minimum wage increase on monthly earnings distribution (Upper panel: without trend correction. Lower panel: with trend correction.). Source: ES 2022/2023, own calculations. Treatment definition at the industry level. The bins are labeled by their lower limits. For example, the 400 euros bin represents the right open interval from 400 to 600 euros. 95 %-confidence intervals based on clustered bootstrap standard errors.

Table 6: Effect of minimum wage increase on the Gini of monthly earnings.

	Factual	Counterfactual	Difference
Without trend correction	0.4245	0.4285	−0.0040***
			(0.0035)
With trend correction	0.4245	0.4283	−0.0038***
			(0.0037)

Source: ES 2022/2023, SES 2018, own calculations. Factual and counterfactual Gini for monthly earnings in 2023. Treatment definition at the industry level. Bootstrap standard errors clustered at treatment group level. *** = statistically significant at 1 %-level.

than when using the industry bite (see Bachmann et al. 2025, for more details). Still, the results suggest that the effects of the minimum wage hike on earnings were much weaker than those on hourly wages. This points to changes in working hours, which we investigate next.

4.3 Effects on Working Hours

Average weekly working hours stood at 29.84 h in April 2022, and at 30.03 in April 2023, after the minimum wage increase. Despite the slight increase in aggregate hours worked per week between 2022 and 2023, we observe some hours reductions in lower wage bins, see Figure 7. This points to potential negative hours reactions for low-wage workers caused by the minimum wage hike.

In their analysis, Bossler et al. (2026a) find a negative causal effect of the minimum wage increase on working hours of almost two percent. Figure 8 reports changes in weekly hours by initial hourly wage bracket based on our treatment definition at the individual level. The purple line shows that workers in low-wage brackets reduced their weekly working hours between 2022 and 2023, with the largest reductions for workers whose hourly wage was below the new 12-euro minimum before the reform. At the same time, the green line – based on pre-reform years in the SOEP – indicates that working hours tended to decline from year to year even in the absence of a major minimum wage change. The net effect, given by the difference between the two (blue line), nonetheless suggests a substantial reduction in weekly hours for most of the wage groups considered. This pattern is consistent with the above findings that the reform raised hourly wages, but had limited effects on monthly earnings. In comparison to the results derived by Bossler et al. (2026a), Figure 8 finds larger effects on working hours.

Table 7 presents the average effects on weekly working hours based on the regional and industry bites as treatment intensities. Raising the minimum wage

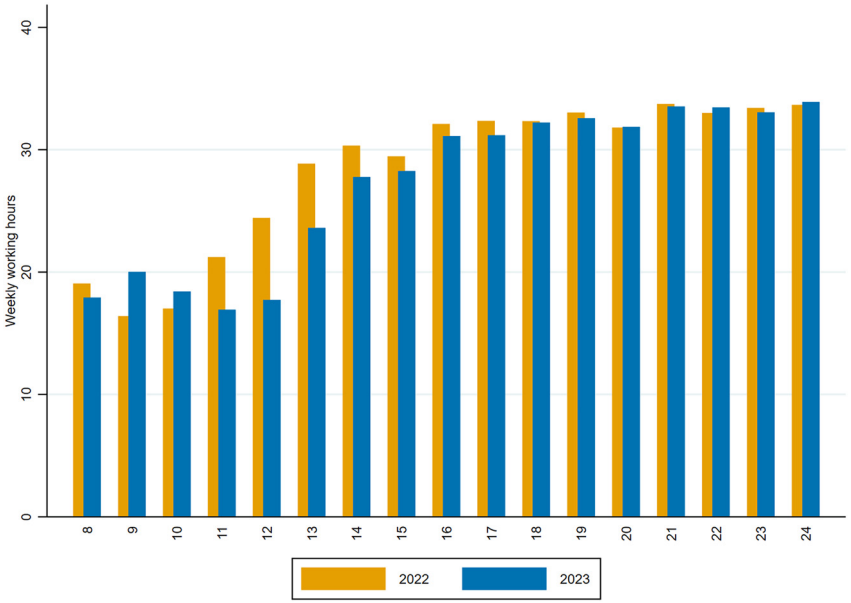


Figure 7: Weekly working hours by wage bin. Source: ES 2022/2023, own calculations.

reduces average weekly hours (including overtime) by about 0.39–0.78 h per week, depending on the treatment definition. After pre-trend correction, the corresponding reductions are roughly 0.44–0.89 h per week (see columns 3 and 4 in the upper panel of Table 7). Only a small fraction of these reductions can be attributed to declines in overtime, as shown in the lower panel of the table.

Table 8 reports heterogeneity in the hours responses based on the industry bite. The results indicate that negative hours reactions to the minimum wage increase are stronger for men than for women, in line with the more muted earnings effects for men relative to their wage gains. We find no significant hours effects for marginal part-time workers. Finally, we obtain broadly similar hours reductions in East and West Germany.

Switching to the regional treatment definition changes these results somewhat (Table 9). We still see larger effects for men than for women. The regional treatment definition also leads to a significant effect for marginal employment, albeit only after pre-trend correction. Furthermore, we find a significant effect for West Germany, but not for East Germany. While some of the effects in Table 9 obtained

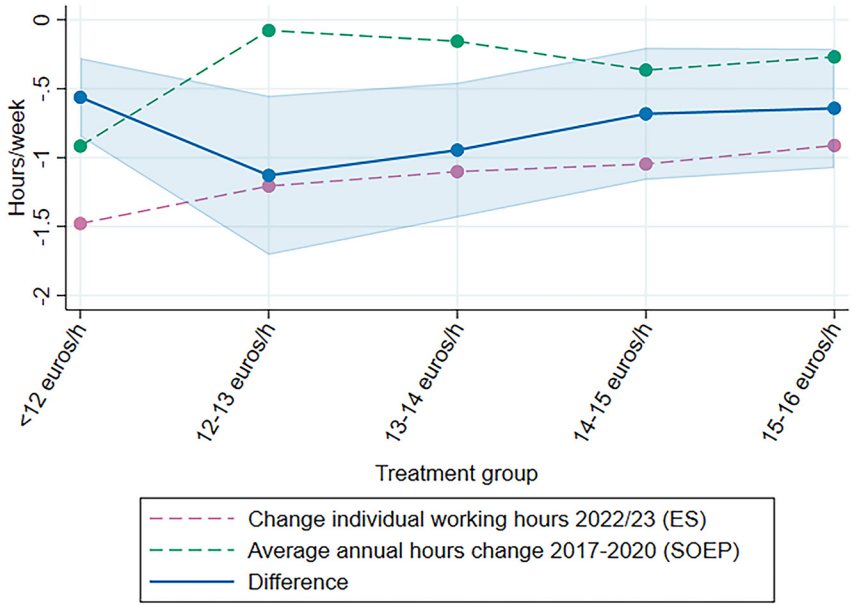


Figure 8: Effects of minimum wage increase on individual working hours. Source: ES 2022/2023, SOEP 2017–2020. Treatment groups refer to hourly wage bracket before minimum wage increase.

based on the regional bite definition appear implausibly large, the general finding of negative hours reaction to the minimum wage remains.

Bossler et al. (2026a) also find that the minimum wage increase reduced working hours of full-time workers, but they also detect such reductions for marginal part-time workers. Our analysis does not yield statistically significant hours reductions for marginal part-time workers based on the industry bite, and marginally significant effects only after trend correction when using the regional bite (Tables 8 and 9). As pointed out above, results for marginal part-time workers are difficult to interpret, as the marginal part-time earnings threshold was changed simultaneously with the minimum wage threshold. This may have had additional effects independent of the increase of the minimum wage.

To locate the hours changes within the distribution, we again use distribution regression to construct factual and counterfactual distributions of weekly working hours. Figures 9 and 10 suggest that the main shift occurs between the 35–42 h bracket, whose frequency falls by almost two percentage points, and the 30–35 h

Table 7: Effect of the minimum wage increase on weekly working hours.

	Coefficient		Average effect	
	Regional bite	**Industry bite**	**Regional bite**	**Industry bite**
Weekly working hours including overtime				
Effect	−4.8752***	−2.3971***	−0.7843***	−0.3878***
	(1.2729)	(0.8125)	(0.2048)	(0.1315)
Pre-trend (SES 2018) (annualized)	0.6605*	0.3441***		
	(0.3560)	(0.0169)		
Corrected effect	−5.5358***	−2.7412***	−0.8905***	−0.4435***
	(0.1528)	(0.1067)	(0.2541)	(0.1535)
Weekly overtime hours				
Effect	−0.6987**	−0.2108**	−0.1124**	−0.0341**
	(0.2953)	(0.1029)	(0.0475)	(0.0166)
Pre-trend (SES 2018) (annualized)	0.1357*	0.0230		
	(0.0799)	(0.0309)		
Corrected effect	−0.8344*	−0.2338*	−0.1342**	−0.0378**
	(0.3411)	(0.1278)	(0.0207)	(0.0207)

Source: ES 2022/2023, SES 2018, own calculations. Columns 1 and 2 present regression coefficients for the treatment and annualized pre-trend effects (β and $-\theta/4$ in equation (2)). Columns 3 and 4 show average effects across individuals ($\beta \cdot \text{TreatmentIntensity}_{ig}$ averaged across individuals). Control variables included. Standard errors clustered at treatment group level. ***/**/* = statistically significant at 1 %/5 %/10 %-level.

bracket, whose frequency rises by a similar amount. As established above, only part of this shift is due to reduced overtime; regular hours also decline. The lower panel of Figure 10 demonstrates that applying the pre-trend correction has little effect on these distributional patterns. Taken together, our results point to significant hours reductions as a reaction to the minimum wage hike for low-wage workers consistent with Figure 7. These appear to have been mainly induced by working hours reductions for low-wage workers in the middle of the full-time hours distribution.

4.4 Effects on Total Hours Worked

Our working hours calculations allow us to compute an estimated effect on total hours in the economy. To this end, we use sample weights included in our survey to gross up the individual effects estimated in Table 7 to the total population. Employing the survey weights to gross up our estimates, we obtain an aggregate loss of working hours of around 1,379 million using the regional estimate and 682 million using the industry estimate. These figures correspond to the average hour

Table 8: Heterogeneous effects of the minimum wage increase on weekly working hours, treatment definition at industry level.

	Coefficient		Average effect	
Gender				
	Female	Male	Female	Male
Effect	−1.5035***	−3.1340**	−0.3048***	−0.3929**
	(0.3110)	(1.2484)	(0.0630)	(0.1565)
Pre-trend (SES 2018) (annualized)	0.0592	0.5563**		
	(0.0899)	(0.2242)		
Corrected effect	−1.5627***	−3.6903**	−0.3168***	−0.4627**
	(0.3744)	(1.4555)	(0.0759)	(0.1825)
Regular employment versus marginal employment				
	Regular	Marginal	Regular	Marginal
Effect	−2.9257***	−0.1987	−0.2749***	−0.1140
	(1.0348)	(0.2661)	(0.0972)	(0.1527)
Pre-trend (SES 2018) (annualized)	0.3288*	0.0894		
	(0.1977)	(0.0907)		
Corrected effect	−3.2545***	−0.2881	−0.3058***	−0.1653
	(1.2098)	(0.3021)	(0.1137)	(0.1733)
East versus West Germany				
	West	East	West	East
Effect	−2.4122**	−2.1335**	−0.3738**	−0.4090**
	(0.9741)	(0.8347)	(0.1509)	(0.1600)
Pre-trend (SES 2018) (annualized)	0.3456*	0.3759**		
	(0.1869)	(0.1508)		
Corrected effect	−2.7578**	−2.5094***	−0.4273**	−0.4810***
	(1.1405)	(0.9579)	(0.1767)	(0.1836)

Source: ES 2022/2023, SES 2018, own calculations. Columns 1 and 2 present regression coefficients for the treatment and annualized pre-trend effects (β and $-\theta/4$ in equation (2)). Columns 3 and 4 show average effects across individuals ($\beta \cdot \text{TreatmentIntensity}_{ig}$ averaged across individuals). Control variables included. Standard errors clustered at treatment group level. ***/**/* = statistically significant at 1 %/5 %/10 %-level.

reductions of −0.78 and −0.39 h per week reported in the first row of Table 7. Using the trend-corrected estimates yields somewhat larger values. To the extent that the grossing-up weights of our sample exactly match the total working hours of the economy in a given year (which should be the case), this amounts to a reduction

Table 9: Heterogeneous effects of the minimum wage increase on weekly working hours, treatment definition at regional level.

	Coefficient		Average effect	
Gender				
	Female	Male	Female	Male
Effect	−1.8353**	−8.3504***	−0.3721**	−1.0470***
	(0.7565)	(2.2206)	(0.1534)	(0.2784)
Pre-trend (SES 2018) (annualized)	0.1910	1.5118**		
	(0.2093)	(0.5809)		
Corrected effect	−2.0263**	−9.8622***	−0.4108**	−1.2365***
	(0.9183)	(2.7591)	(0.1862)	(0.3459)
Regular employment versus marginal employment				
	Regular	Marginal	Regular	Marginal
Effect	−4.3194***	−0.4444	−0.4058***	−0.2550
	(1.2975)	(0.3478)	(0.1219)	(0.1996)
Pre-trend (SES 2018) (annualized)	0.5753	0.2393*		
	(0.3815)	(0.1287)		
Corrected effect	−4.8947***	−0.6837*	−0.4599***	−0.3923*
	(1.6203)	(0.4050)	(0.1522)	(0.2323)
East versus West Germany				
	West	East	West	East
Effect	−6.0583***	−0.4405	−0.9387***	−0.0844
	(1.3858)	(1.6278)	(0.2147)	(0.3120)
Pre-trend (SES 2018) (annualized)	0.8813**	−0.7968		
	(0.3581)	(0.5881)		
Corrected effect	−6.9396***	0.3563	−1.0753***	0.0683
	(1.6624)	(2.1458)	(0.2576)	(0.4113)

Source: ES 2022/2023, SES 2018, own calculations. Columns 1 and 2 present regression coefficients for the treatment and annualized pre-trend effects (β and $-\theta/4$ in equation (2)). Columns 3 and 4 show average effects across individuals ($\beta \cdot \text{TreatmentIntensity}_{ig}$ averaged across individuals). Control variables included. Standard errors clustered at treatment group level. ***/**/* = statistically significant at 1 %/5 %/10 %-level.

of total hours in the economy of around 2 % based on the regional estimate, and of around 1 % based on the industry definition. Note that this estimate includes disemployment effects of the minimum wage hike. Such disemployment effects have been found in Caliendo et al. (2025) and in Bossler et al. (2026b) using variation at the regional level.

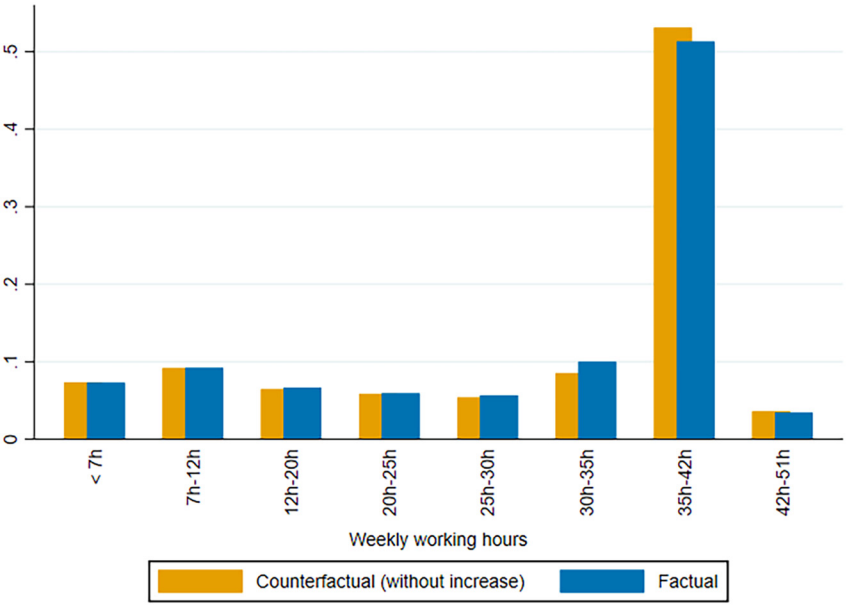


Figure 9: Effects of minimum wage increase on weekly working hours. Source: ES 2022/2023. Treatment definition at the industry level.

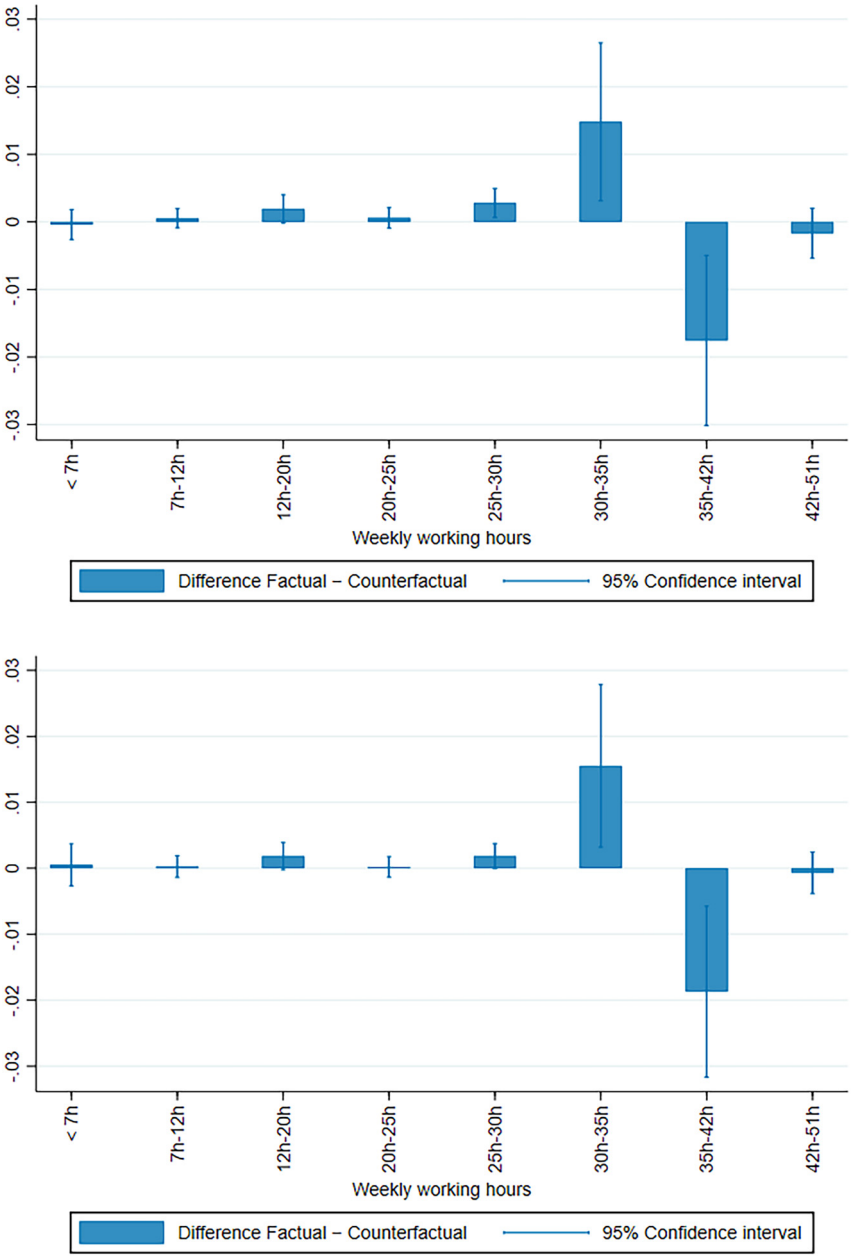


Figure 10: Effects of minimum wage increase on weekly working hours (Upper panel: without trend correction. Lower panel: with trend correction.). Source: ES 2022/2023. Treatment definition at the industry level. 95 %-confidence intervals based on clustered bootstrap standard errors.

5 Conclusions

Using high-quality employer-employee data collected by the German Statistical Office, this paper evaluates the effects of a large increase in the German statutory minimum wage between 2022 and 2023 by 22 % on hourly wages, monthly earnings and hours worked. Our results suggest that the increase raised the hourly wages of directly affected workers and also generated spillover effects well above the new minimum wage level of 12 euros/h. Overall, average hourly wages rose by 1.1–3.5 % as a consequence of the minimum wage hike. By contrast, we find statistically significant effects on monthly earnings only for specific subgroups (women and workers in East Germany), but not for the total population. The muted earnings effects are explained by working hours reductions of 1–2 % when grossed up to total hours worked in the economy. Only a fraction of these reductions is due to reduced overtime hours. We show that the working hours reductions mainly occurred in the lower part of the full-time distribution. Our heterogeneity analysis points to weaker earnings effects for men and West German workers, consistent with weaker wage responses and stronger hours reductions in these groups.

We closely match Bossler et al. (2026a) regarding the effect of the minimum wage increase on hourly wages and also find evidence for reduced working hours of full-time workers. Our effects on monthly earnings effects are somewhat smaller than those in Bossler et al. (2026a), and we do not find stable effects on marginal part-time workers whose wages and hours may have been additionally affected by the contemporaneous raise of the mini-job earnings threshold. Differences between our results and Bossler et al. (2026a) may be due to the fact that Bossler et al. (2026a) focus on short-term effects up to December 2022, whereas our analysis is based on a comparison of the April 2022 and April 2023 waves of the ES, before and after the minimum wage increase in October 2022. For directly affected workers, we view the individual-level effects measured by Bossler et al. (2026a) as more reliable than ours, as the authors can use individual-level panel data from the ES that are not affected by the limited comparability of our auxiliary individual-level data base (SOEP).

Our main analysis is based on a cross-sectional difference-in-differences approach using alternative bite measures at the industry and the regional level. We reach interesting sensitivity results regarding the use of these alternative bite measures. In most cases, our results based on the industry bite yield sharper and statistically more significant findings. This may be due to the fact that the variation in bite values across industries (plus East/West distinction) is larger than that across the 96 Planning Regions used in our regional treatment definition (see Sections 3.2 and 3.3). In other cases, our results based on the regional bite are as pronounced, or even more pronounced than those based on the industry bite (e.g., the

heterogeneity results for working hours). These differences may point to potential robustness issues when using only one treatment definition. Altogether, we view our results based on the industry bite as more informative and easier to rationalize than those based on the regional bite.

Our findings contribute to the literature on the impact of minimum wages on the wage structure, earnings, and the overall composition of hours worked. We corroborate earlier findings on spillover effects on workers above the minimum wage level (Harastosi and Lindner 2019; Gopalan et al. 2021; Giupponi et al. 2024; Hijzen et al. 2025/2026). It is remarkable that we observe such spillovers as early as half a year after the increase of the minimum wage, suggesting that employers have to adjust wages quickly in order to maintain wage differentials. Our methodology allows us to explicitly describe the effects of the minimum wage hike within the distributions of wages, earnings and working hours, providing a comprehensive and consistent picture of potential impacts, and yielding explicit impact estimates on inequality. For example, our distributional earnings estimates show shifts of mass from earnings below 2,000 euros/month to above this level, despite the absence of statistically significant aggregate earnings effects. We also show that the increase of the minimum wage led to a significant reduction of wage inequality as measured by the Gini coefficient, while the reduction of the Gini for earnings was smaller and less precisely estimated – consistent with the fact that earnings effects are muted relative to wage effects. With our results, we complement the study carried out by Bossler et al. (2026a), who focus on the group of workers most strongly affected by the minimum wage hike based on monthly panel data.

In contrast with earlier findings on possible working time effects of the German minimum wage, we obtain clear and statistically significant negative working hours responses. Combining our estimates on average wage and working hours effects leads to an elasticity of approximately −0.49 (minus 1.29 % hours worked per 2.65 % wage increase based on the industry bite), which is high by international standards (Dube and Lindner 2024). Together with other findings in the literature (Jardim et al. 2022; Wong 2019; Redmond and McGuinness 2025; Hijzen et al. 2025/2026), our results indicate that substantial minimum wage increases can be associated with potential costs in terms of hours worked and employment.

Our results on negative working hours responses have several implications for policy and welfare. First, strong reductions in working hours mitigate the aim of minimum wage legislation of improving low-wage workers' earnings situations. This could also imply that poverty and welfare receipt are not reduced significantly (Bruckmeier and Bruttel 2021). Second, on a more positive note, adjustments along the intensive margin (hours worked) could act as an alternative to adjustments along the extensive margin (layoffs). As the latter are usually accompanied by a loss of job-specific human capital, adjustments along the intensive margin are likely to

be favorable in terms of welfare. Third, as reductions in working hours are likely to be accompanied by increased productivity, work requirements and work intensity (Clemens 2021; Ku 2022), changes in these dimensions should be considered by policymakers when deciding about minimum wages.

Acknowledgments: We are grateful to the editor, Boris Hirsch, as well as two anonymous reviewers for their valuable suggestions. This article is based on a research project for the Fifth Report of the German Minimum Wage Commission. Funding by the Commission is gratefully acknowledged. We also benefited from many useful comments by members of the Commission's scientific staff, in particular Arne Baumann, Clemens Ohlert, and Juliane Pehla. The views expressed in this article are those of the authors and not those of the German Minimum Wage Commission. We thank Elisa Bührle and Marian Rümmele for research assistance as well as the staff of the Research Data Centers of the German Statistical Offices in Stuttgart and Düsseldorf for their continuous support. This paper uses the on-site versions of the German Earnings Survey 2022 and 2023 (DOI: 10.21242/62361.2023.04.00.1.1.0 and DOI: 10.21242/62361.2022.04.00.1.1.0), the German Structure of Earnings Survey 2018 (DOI: 10.21242/62111.2018.00.00.1.1.0), as well as the German Socio-Economic Panel (SOEP v38.1).
Conflict of interest: There are no sources of conflict of interest for the authors of this paper.
Research funding: This article is based on a research project for the Fifth Report of the German Minimum Wage Commission. Funding by the Commission is gratefully acknowledged. We thank the members of the Commission's scientific staff, in particular Arne Baumann, Clemens Ohlert and Juliane Pehla, for many useful comments and suggestions. The views expressed in this article are those of the authors and not those of the German Minimum Wage Commission.

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