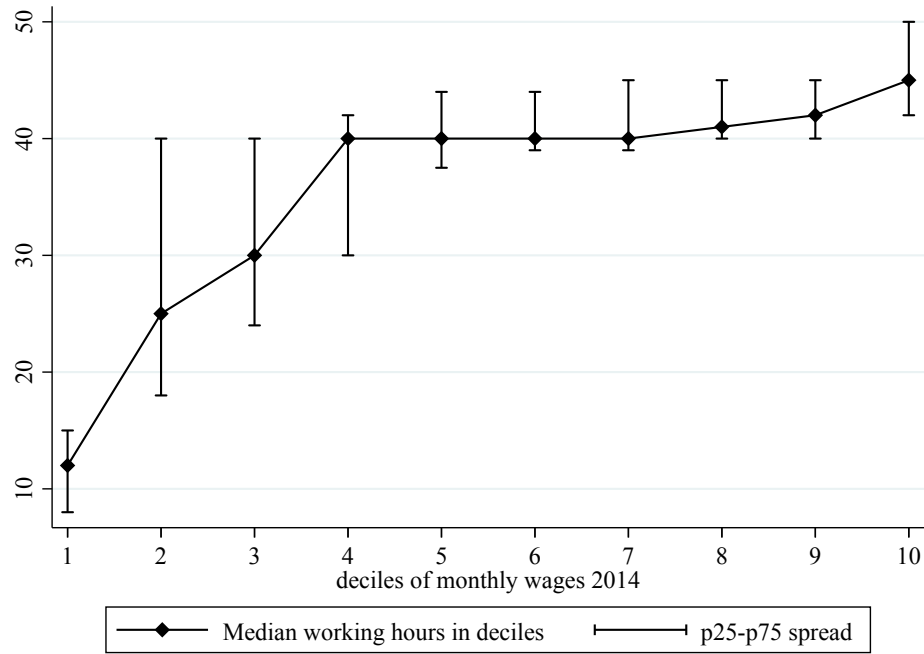


A Online Appendix: Supplementary Tables and Figures

Figure A.1: Distribution of actual working hours in deciles of monthly wages



Notes: SOEP v35 (Sample 1), authors' calculations. For each decile of the distribution of monthly wages in 2014, the figure depicts the median number of actual working hours, as well as the 25th and 75th percentiles of the distribution of actual working hours.

Table A.1: Descriptive statistics, average values

	2013	2014	2015	2016	2017	2018
Female	0.48	0.48	0.49	0.49	0.49	0.51
Age	42.47	43.24	43.87	44.26	45.09	45.94
German citizenship	0.91	0.90	0.92	0.91	0.90	0.90
Children in household	0.48	0.47	0.47	0.49	0.49	0.49
Married	0.55	0.56	0.56	0.57	0.58	0.59

Notes: SOEP v35, own calculations.

Table A.2: Quintiles of the regional-specific hourly wage distribution in 2013

	Q1	Q2	Q3	Q4	Q5
Actual wages: observations	2,335	2,478	2,485	2,511	2,486
average	6.11	10.63	14.43	19.25	29.94
Contractual wages: observations	2,127	2,252	2,254	2,277	2,257
average	6.60	11.26	14.99	19.95	31.14

Notes: SOEP v35, own calculations.

Table A.3: The pooled effect 2015-2018 in robustness checks

	Coef FE	p-value p-value	Coef OLS	p-value p-value
I. Pooled effect 2015-2018				
Mean	0.028***	0.001	0.036***	0.006
By quintiles				
Q1	0.159***	0.000	0.120***	0.001
Q2	0.034*	0.071	0.040**	0.012
Q3	0.005	0.723	-0.007	0.667
Q4	0.000	0.978	0.007	0.603
Q5	-0.005	0.745	0.014	0.409
II. Using imputed wages				
Mean	0.026***	0.004		
By quintiles				
Q1	0.150***	0.000		
Q2	0.049**	0.012		
Q3	0.004	0.780		
Q4	0.007	0.603		
Q5	-0.011	0.499		
III. Inclusion on non-exposed sectors				
Mean	0.024***	0.002		
By quintiles				
Q1	0.152***	0.000		
Q2	0.037**	0.044		
Q3	0.010	0.470		
Q4	0.001	0.951		
Q5	-0.003	0.838		
IV. Using Kaitz from VSE 2014 as bite measure				
Mean	0.006	0.408		
By quintiles				
Q1	0.071**	0.020		
Q2	0.018	0.251		
Q3	-0.003	0.773		
Q4	-0.002	0.887		
Q5	-0.011	0.384		
V. Regional-level aggregation				
Mean	0.014	0.358		
By quintiles				
Q1	0.105***	0.001		
Q2	0.019	0.332		
Q3	-0.011	0.520		
Q4	0.003	0.839		
Q5	0.020	0.254		

Notes: SOEP v35, own calculations.

The tables contains results of DiD estimation for the post-reform period.

All specifications contain individual, year and regional fixed effects. Specifications I-IV also contain individual-specific fixed effects.

All specifications also include controls for age, German citizenship, presence of children aged below 16 in the household, marital status, two-periods lagged regional GDP. Standard errors are robust.

Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

B Online Appendix: Construction of eligibility status from SOEP data

In order to identify respondents who are eligible for the minimum wage and divide them into sub-groups, we use the rich information from the SOEP questionnaire on current employment as well as employment history and age. Using this information, we derive a (mutually exclusive) labor market status for each respondent. Such a classification is undoubtedly a simplification of the number of possible labor market statuses observed in reality, but it is needed to operationalize the extent to which respondents are affected by the minimum wage reform. The labor market status is defined in several steps; the order is important as it mirrors the assumed dominance of the statuses over each other. *As an example*, we depart from the non-employment status, which by definition does not need any information from the survey questionnaire (Step 1). Then, in Step 2 we employ survey information that helps to classify a respondent as a full-time employee and, if all the imposed conditions are binding, the labor market status is updated from non-employed to full-time employment. Further, in Step 11, we employ the information of the currently employed, but with the job that started less than 6 months ago and was preceded by an unemployment spell of more than 12 months. If these conditions are binding, then the labor market status receives an additional update to exempt the formerly long-term unemployed.

Step 1: Non-employment. We start by declaring all respondents non-employed. Using additional information from the questionnaire, this status is over-written as follows.

Step 2: Full-time employment with social security. Respondents who fulfilled the following conditions: paid social security contributions (plb0022), not self-employed (plb0059, plb0060, plb0061, plb0062), working more than 30 hours by contract (plb0176, if this information is unavailable, we use actual hours worked plb0186).

Step 3: Part-time employment with social security. Respondents with social security contributions (plb0022), not self-employed, working 30 hours or less by contract (plb0176; however, if this information is unavailable, we use actual hours worked plb0186), aged 18 and older.

Step 4: Unemployed, not working. Registered unemployed (plb0021) with zero or missing information on wages or hours worked.

Step 5: Unemployed, working. Registered unemployed (plb0021) with either non-zero wages or hours worked.

Step 6: Mini-jobs. Marginally employed (plb0187), not registered as unemployed, and aged over 18.

Step 7: Employed in sectors with specific minimum wages. Employed with information on sector of employment and in sectors that have a minimum wage regulation, irrespective of whether it is below or above the uniform minimum wage of €8.50. The setting of minimum wages often applies not to the overall sectors, as defined by the NACE classification, but to smaller groups, which is why we additionally employ the information on individuals' occupations. The following sectors are identified as covered by sector-specific minimum wage regulations: waste management; mainstream construction; roofing trade; building cleaners; electrician trade; painting and varnishing trade; nursing; hairdressing trade; agriculture, forestry and horticulture; chimney sweep trade; stonemason and stone sculpturing trade; scaffolder trade; meat industry; textile and clothing industry; temporary work. The sectors that could not be identified in the data: money and valuables services; professional development; manufacturers of sign and light advertising. The full list of exempted sectors is taken from Schröder (2014).

Step 8: Self-employed. Respondents reporting being self-employed with or without employees or being supporting family members (plb0059, plb0060, plb0061, plb0062).

Step 9: Civil servants. Respondents employed as civil servants (plb0065) previously unclassified in other categories.

Step 10: Exempted trainees. Respondents in any type of training or internship (plb0063).

Step 11: Exempted former long-term unemployed. Respondents who started a new job less than 6 months ago (but no earlier than January 1, 2015) and who were unemployed for at least 12 months prior to this job. Here we use both the month of the interview as well as information on the timing of the start of the last job and calendar information on previous unemployment.

Labor market categories Mutually exclusive categories that result from the step-wise application of survey information defined the labor market statuses of the respondents.

Eligibility Categories “full-time employment with social security,” “part-time employment with social security,” “marginal employment,” and “civil servants” as defined above are used in the analysis as eligible for minimum wages.

C Online Appendix: External validation of wages and hours worked in the SOEP

All analyses in the present study rely on reported monthly wages and working hours from a representative household survey, the SOEP. As explained in Section 5, survey data are susceptible to errors in answers. Potentially resulting measurement errors are particularly problematic if respondents systematically under-report earnings and over-report working hours. This appendix provides a cross-validation of SOEP-based distributions of working hours, monthly wages, and hourly wages with available company payroll micro data.

Administrative data have two potential advantages over survey data. The former (arguably) have lower measurement error than the latter and are more comprehensive in terms of coverage of specific subgroups (here: dependent employees). In Germany, the Institute for Employment Research of the Federal Employment Agency (IAB) provides large-scale labor market data, collected as part of the administration of the social insurance system. One highly respected IAB database is the Sample of Integrated Labor Market Biographies (SIAB, and its predecessor, IABS), a 2 percent random sample of employment biographies in Germany (Dustmann *et al.*, 2009). Yet administrative databases provide only a limited set of variables. For instance, SIAB contains only an indicator variable on working full- or part-time. This makes it impossible to accurately calculate hourly wages from monthly wages.

The quality of the SES data is considered to be high and hence can be used for external validation of information on wages *and* hours worked in the SOEP. A voluntary follow-up survey, the Earnings Survey (ES), was conducted in 2015 and 2016 with a markedly smaller sample size. The ES has several methodological shortcomings that call its validity into question. These include in particular the voluntary nature of the survey, problems of selectivity, and the fact that the companies report the data to the Federal Labor Office on the basis of their tax returns, which is usually followed by a check to see whether the reports on wages and working hours conform to the minimum wage (see Dütsch *et al.*, 2019). The Federal Statistical Office itself takes a critical view of the suitability of VE data for describing the wage distribution.¹⁹

The FSO provided us with (S)ES-based descriptive statistics on monthly wages, hours worked, and hourly wages as an external benchmark for validating the respective SOEP statistics for 2014 and 2015.²⁰ Because the technical conventions of the FSO regarding sample restrictions differ from those in the main body of the paper, we follow FSO's conventions for the subsequent comparisons between (S)ES and SOEP. Notably:

¹⁹See the report on the SES 2015: https://www.destatis.de/DE/Themen/Arbeit/Verdienste/Mindestloehne/Publikationen/Downloads-Mindestloehne/verdiensterhebung-mindestlohn-5611112159004.pdf;jsessionid=84D413CB78813557A665B6B8ACDC6649.live731?__blob=publicationFile

²⁰Detailed information on (S)ES are provided by Statistisches Bundesamt/Federal Statistical Office (2016, 2017a,b) in German.

- (i). (S)ES-based statistics are derived for all dependent employees. In the empirical analyses provided in the main body of the present paper, we exclude employees from sectors with a sector-specific minimum wage and employment in private households.
- (ii). (S)ES-based statistics consider actual and statistically imputed cases. Our analyses in the main body of this paper do not consider cases with imputed earnings.
- (iii). (S)ES-based statistics are based on employment relationships. Our analyses in the main body of this paper are based on individual employees.²¹

Our first (S)ES-SOEP comparison relates to the coverage of the base population of dependent employees.²² The weighted number of employment relationships according to (S)ES and SOEP is provided in Table C.4. The table indicates a higher number of employment relationships in SOEP, which may be explained by differences in the number of mini-jobs in different data sources. Indeed, the number of mini-jobs is about 5.0 to 5.8 million in (S)ES but about 7.3 in SOEP, and the latter number again is comparable to official numbers from the Federal Employment Agency (Bundesanstalt für Arbeit).²³

Table C.4: Aggregate number of employment relationships in Germany (in thousands)

	(S)ES Point estimate	Lower bound Bootstrap 95 %	SOEP Point estimate	Upper bound Bootstrap 95 %
2014	37,153	39,010	39,963	40,916
2015	37,896	39,767	40,358	40,949

Note: Data from the (Structure of) Earnings Survey, (S)ES, are provided by the FSO. SOEP-based statistics are own computations.

Our second (S)ES-SOEP comparison concerns monthly wages. The upper panel of Table C.5 provides means and decile values for (S)ES and the bottom panel for SOEP. In both datasets, we find a moderate increase in mean earnings between 2014 and 2015, from €2,509 to €2,535 in (S)ES, and from €2,541 to €2,634 in SOEP. The larger increase of average earnings in SOEP is driven mostly by stronger earnings increases in the upper deciles. Nevertheless, all point estimates for (S)ES and SOEP are close, both before and after the introduction of the minimum wage, and SOEP-based bootstrap confidence intervals contain the corresponding (S)ES point estimates. In sum, there are no empirical indications of any systematic misreporting of earnings in SOEP.

²¹For mini-jobs as second jobs, SOEP provides actual but not contractual working hours. To proxy contractual working hours, we use actual working hours scaled with the ratio of average contractual and actual working hours when information on both types of hours is available.

²²Note that employment status is not used for the construction of frequency weights in the SOEP.

²³See Statistisches Bundesamt/Federal Statistical Office (2017b), p.11.

Our third comparison is of actual monthly working hours. The middle panel of Table C.5 provides the results. Working hours distributions are very similar in the two surveys. In (S)ES, mean working hours increase slightly from 30.5 to 30.9 hours between 2014 and 2015. In SOEP, the respective numbers are 31.6 and 31.9 hours per month. The decile estimates are also very similar for both databases.

Our final comparison deals with actual hourly wages. As can be seen from the bottom panel of Table C.5, both datasets indicate minor changes in average hourly wages. In (S)ES, the average increases from €17.08 in 2014 to €17.32 in 2015. The SOEP-based averages are slightly higher, and the increase is also more pronounced – from €17.78 to €18.81. The opposite holds for the values in the bottom deciles: For example, the 2014 and 2015 values for the lowest (second) decile from (S)ES are €8.24 and €8.75 (€9.55 and €9.89), respectively, while the same numbers from SOEP are €7.70 and €7.89 (€9.82 and €9.89), respectively. While we cannot rule out that reporting patterns in SOEP are responsible for this difference,²⁴ the high level of item non-response for actual working hours in (S)ES (Statistisches Bundesamt/Federal Statistical Office, 2017b, Table 1) and stronger working hours reductions in ES are other explanations. The Federal Statistical Office itself takes a critical view of the size of this reduction (Federal Statistical Office, p. 56). In sum, earnings, hours, and wage distributions from SES and SOEP are relatively similar, and we do not see structural differences that could invalidate our estimates. The results for SOEP and ES are qualitatively the same (rightward shift in the distribution of hourly wages). They differ quantitatively, however, and it is unclear to what extent the decline in working hours underlying the increase in hourly wages occurred in reality or if it was only on paper.

²⁴For example, rounding of earnings and hours might be an issue.

Table C.5: Monthly wages, actual working hours and actual hourly wages in SOEP and (S)ES

Data source	Variable	Year	Statistic	Mean	p10	p20	p30	p40	p50	p60	p70	p80	p90
(S)ES	Monthly earnings	2014	point estimate	2,509	399	794	1,427	1,871	2,275	2,656	3,080	3,671	4,720
		2015	point estimate	2,535	400	918	1,522	1,901	2,297	2,666	3,094	3,671	4,667
SOEP		2014	lower bound	2,512	400	796	1,355	1,737	2,192	2,535	2,983	3,591	4,646
			point estimate	2,541	400	850	1,400	1,805	2,250	2,600	3,071	3,700	4,800
			upper bound	2,570	400	904	1,445	1,873	2,308	2,665	3,159	3,809	4,954
		2015	lower bound	2,591	391	840	1,382	1,835	2,253	2,648	3,164	3,732	4,895
			point estimate	2,634	400	912	1,450	1,900	2,300	2,700	3,200	3,800	5,000
			upper bound	2,676	409	984	1,518	1,965	2,347	2,752	3,236	3,868	5,105
(S)ES	Actual working hours	2014	point estimate	30.53	9.67	17.00	26.00	35.00	37.50	39.00	40.00	40.00	40.00
		2015	point estimate	30.86	9.60	19.00	28.87	35.00	38.00	39.00	40.00	40.00	40.00
SOEP		2014	lower bound	31.30	8.89	20.00	30.00	34.58	37.54	38.95	40.00	40.00	40.00
			point estimate	31.57	10.00	20.00	30.00	35.00	38.00	39.50	40.00	40.00	40.00
			upper bound	31.84	11.11	20.00	30.00	35.42	38.46	40.05	40.00	40.00	40.00
		2015	lower bound	31.65	9.46	20.00	30.00	34.27	38.00	38.62	40.00	40.00	40.00
			point estimate	31.86	10.00	20.00	30.00	35.00	38.50	39.00	40.00	40.00	40.00
			upper bound	32.08	10.54	20.00	30.00	35.73	39.00	39.38	40.00	40.00	40.00
(S)ES	Actual hourly wage	2014	point estimate	17.08	8.24	9.55	11.10	12.95	14.76	16.68	19.03	22.42	28.29
		2015	point estimate	17.32	8.75	9.89	11.25	13.00	14.91	16.95	19.34	22.52	28.11
SOEP		2014	lower bound	17.50	7.62	9.65	11.40	13.40	14.98	17.10	19.53	22.69	28.89
			point estimate	17.78	7.70	9.82	11.71	13.71	15.40	17.32	19.86	23.14	29.69
			upper bound	18.07	7.77	9.98	12.02	14.03	15.81	17.54	20.19	23.58	30.50
		2015	lower bound	18.30	7.68	9.72	11.46	13.69	15.28	17.38	20.10	23.96	29.76
			point estimate	18.81	7.89	9.89	11.84	13.86	15.60	17.77	20.40	24.25	30.62
			upper bound	19.33	8.10	10.06	12.23	14.03	15.92	18.15	20.69	24.54	31.47

Note: Data from the (Structure of) Earnings Survey, (S)ES, are provided by the FSO. SOEP-based statistics are own computations. pX with $X \in \{10, 20, \dots, 90\}$ indicates the Xth percentile.