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ABSTRACT

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This paper investigates the effects of the introduction of a statutory minimum wage in Germany on the wages and employment of migrants. Migrants are an overrepresented group in the low-wage sector and can be expected to particularly benefit from a minimum wage. We combine a "differential trend adjusted difference-in-differences estimator" (DTADD) and descriptive evidence to evaluate the impact of the minimum wage introduction in 2015 on hourly wages, monthly salaries, working hours and changes in employment and wage distribution. Contrary to expectations, our results show that the introduction of the minimum wage has weakened the position of migrants in the low-wage sector compared to their native counterparts. We observe an increase in part-time employment, a less pronounced decline in unemployment and a greater reduction in weekly working hours among migrants. The introduction of the minimum wage caused a temporary convergence in hourly wages between migrants and natives, which subsequently turned into a wage divergence. Migrant men in the low-wage sector have been particularly negatively affected by the introduction of the minimum wage. Moreover, increasing hourly wages have not translated into higher monthly salaries, thus widening wage inequality between migrants and natives.

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1 Introduction

In 2015, Germany introduced a nationwide statutory minimum wage of €8.50 with two main objectives: First, to protect employees in the low-wage sector from wage dumping and second, for precipitating an improvement in social security for lower income groups (The Federal Government, 2014). This introduction was justified by the reduction in the number of employees covered by collective agreements. Falling wages at the lower end of the wage distribution (Bossler and Schank, 2020) contributed to rising wage inequality in Germany (Biewen et al., 2017). Two years after the minimum wage introduction, however, approximately one quarter of the German labour force was still employed in the low-wage sector (Grabka and Schröder, 2019). Despite a growing number of studies providing evidence on the effects of the minimum wage introduction in 2015 (see, e.g., Ahlfeldt et al., 2018; Bossler and Gerner, 2020; Bossler and Schank, 2020; Caliendo et al., 2018; Caliendo et al., 2019; Dustmann et al., 2022; Garloff, 2019; Holtemöller and Pohle, 2020), none of the studies consider the effects on migrants. One in four persons in the German labour force has a migration background (Federal Statistical Office, 2020), and was much more likely to earn less than the new minimum wage threshold in 2014 than native-born employees (Amlinger et al., 2016). Research about the effects of the minimum wage on migrants has been limited almost exclusively to the U.S. (Zavodny, 2014).

For this reason, this paper analyses the unnoticed effects of the minimum wage introduction in 2015 on the labour market situation of migrants in Germany. Based on data from the German Socio-Economic Panel (SOEP), we estimate the causal effects of the minimum wage reform on hourly wages, working hours and monthly salaries of migrants and natives by application of a differential trend adjusted difference-in-differences (DTADD) analysis (suggested by Burauel et al., 2020; Dustmann et al., 2022). This approach considers an innovative research design of defining treatment and comparison groups. We distinguish different lengths for providing insights on the potential dynamics of effects over time (one-year, two-year and three-year analysis after the introduction of minimum wage). To account for a likely violation of the identifying common trends assumption, the estimation approach further allows explicit consideration of placebo effects prior to the introduction of the minimum wage. Moreover, to allow a better understanding of underlying effect patterns, we conduct distinct estimations on selected socio-economic groups (gender, age, qualification). Besides the individual effects, the minimum wage introduction has likely imposed distributional shifts, such as potential squeeze and spillover effects. For that reason, we complement the causal analysis with comprehensive descriptive analyses of labour market participation patterns and wage distribution to illustrate and discuss potential changes.

Compared to natives, migrants are often a particularly disadvantaged labour market group due to lower language proficiency, job qualifications, and the usability of their human capital (Aldashev et al., 2009; Kogan, 2011). In addition, they are more likely to be victims of statistical discrimination (Kaas and Manger, 2012). These circumstances are not necessarily the result of intentional decisions but partly arise from misaligned incentives. Consequently, migrants more often work in the low-wage sector, typically

characterized as marginal employment (so-called mini-jobs)[1] or part-time employment (Grabka and Schröder, 2019). This creates structural wage inequalities compared to native workers (Aldashev et al., 2012; Ingwersen and Thomsen, 2021). Due to this comparatively lower labour market position, migrants were expected to have benefited more from the introduction of minimum wages – at least in terms of hourly wage gains. Contrary to that, rising hiring standards could also lead migrants to compete more fiercely for jobs with natives (Butschek, 2022) implying they might benefit less or even suffer.

Our empirical results of the causal effect analysis, however, cannot confirm the positive expectations unambiguously. Our preferred two-year analysis shows an overall effect on hourly wages of 9.3 ppts that veils heterogeneity between migrants – who benefited more (10.2 ppts) – and natives (8.7 ppts). Furthermore, our analysis reveals some socio-economic heterogeneity within groups: E.g., female migrants experienced higher average wage raises than natives, but the pattern is reversed for males. However, consideration of weekly working hours as a second outcome attenuates the at first sight positive impression. The minimum wage led to a reduction of weekly working hours for migrants by about 7.0 ppts; for natives, the effect is less pronounced (5.7 ppts). The combined effects – approximated by monthly salary (third outcome) – is thus smaller than the hourly wage effect: Although it tends to be positive overall, there is an insignificant effect of 6.9 ppts for migrants. For natives, our estimates indicate an increase by 13.7 ppts, twice as large as for migrants.

Since the wage effects refer to the intensive margin only and leave out potential effects on the extensive margin, we complement the causal effect analysis by a descriptive elicitation of labour market participation and the wage distribution over the period of interest. Our results do not reveal any appreciable migrant-native difference in full-time employment deviating from the previous group-specific trends. Nevertheless, we observe a noticeable higher growth of part-time employment for migrants coinciding with the minimum wage introduction. Regarding marginal employment and unemployment, shares are falling less for migrants than for natives. We interpret this evidence, that the introduction of the minimum wage did not coincide with a shift away from precarious employment for migrants, but trends tend to have slowed down slightly. Moreover, it indicates that natives have been affected less by job losses, maybe due to an intensified competition of the least productive. The investigation of the wage distribution points to a particularly high increase in wage divergence between natives and migrants shortly before 2015, and a temporal convergence across the lower part of the wage distribution thereafter. Our results provide – at least tentative – evidence that migrants tended to became less likely to work in the low-wage sector for a short time, but this development was not persistent, and divergence started soon again.

Given all the reported patterns, our empirical results depict a worsened labour market situation of migrants relative to natives coinciding with the introduction of the minimum wage. Since migrants have comparatively less competitive labour market characteristics, on average, this puts them in a worse position than natives when seeking employment. In the end, a (too) high minimum wage then protects native workers from competition with migrants with similar qualifications (Edo and Rapoport, 2019). This can also increase the wage inequality between these groups and may further explain the sharp decline in the number

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[1] Mini-jobs are marginal employment with a maximum monthly salary of €450 or a work assignment of a maximum of 70 days per calendar year (until 09/2022). Due to the lack of contributions to social insurance, mini-jobs do not provide social security (Federal Employment Agency, 2022). In 2014, the share of employed migrants with a monthly income below €500 (the lowest reported income class) was 19.9 % compared to 11.5 % of natives (Federal Statistical Office, 2020).

of hours worked per week, evident for migrants but not for natives. Overall, the minimum wage has helped to improve hourly wages at the cost of employment relationships for migrants. Importantly, regarding the policy implications of our study, we have to emphasise that the presented results relate to a period of a booming German economy. The high inflation and recession that have both started in 2022 and will potentially persist into the coming year will further increase competition in the labour market between migrants and natives. Hence, we expect the rise in the statutory minimum wage in October 2022 up to €12.00, the so-called "poverty-proof minimum wage" (BMAS, 2022), will aggravate the less beneficial or even negative effects for migrants – and therefore increase inequality. Although intended as a holistic social protection measure, the minimum wage does not consider vulnerable groups equally: We presume reinforced allocation according to productivity differentials, exacerbating labour market segregation.

The remainder of the paper proceeds as follows: Section 2 gives a brief insight into the reasons for and the extent of the introduction of minimum wages in Germany. This is accompanied by a literature review of the evidence to date on the effects of the minimum wage with a special focus on the effects on migrants. Section 3 describes the data and sample details for our empirical analysis. Section 4 is devoted to the methodology and comprises the econometric specifications. The empirical results of our causal analysis are given in Section 5. Section 6 elicits potential mechanisms by descriptive analysis of labour market participation and wage distribution. A discussion of the results is provided in Section 7. The study closes with some conclusions in the final section.

2 Minimum Wages: Introduction in Germany and Related Evidence

2.1 Introduction in Germany

The introduction of the mandatory minimum wage in 2015 was one of the most profound social policy reforms in recent years in Germany and directly affected approximately 4 million workers (Bossler and Gerner, 2020). Before this reform, Germany was one of the few European countries and economically strong industrial nations worldwide without a statutory minimum wage (Bruttel et al., 2018; Schulten, 2021).[2] Until then, the right of free collective bargaining ("Tarifautonomie") applied, which allowed trade unions and employers' associations to negotiate wage and working conditions free from state intervention. Thus, wage pricing took place entirely through the interaction of labour supply and demand.[3] Since the end of the 1990s, however, collective bargaining coverage in Germany fell from over 70 % to below 50 % by 2014 (Garloff, 2019). Deunionization, outsourcing of service personnel, a change in working hours, and low-skilled workers being employed in low-paying firms caused an increasing lower wage tail inequality (Antonczyk et al., 2010; Bossler and Gerner, 2020; Bossler and Schank, 2020).

The main objective of the minimum wage implementation was to secure the subsistence level for the working population. The statutory minimum wage was intended to protect workers in the low-wage sector from wage dumping (BMAS, 2021). However, higher wages encourage individuals to enter the labour market, which inevitably leads to more competition and potentially more unemployment. Thus, only those who keep their jobs will benefit from the minimum wage and increased competition will negatively affect

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[2] There is no statutory minimum wage in Denmark, Norway, Sweden, Finland, Italy, Austria and Switzerland (Schulten, 2021).
[3] By setting a minimum price for labour, a redistribution takes place between consumer surplus and producer surplus.

the least-skilled workers. In a competitive market, hence, the level of the minimum wage determines the unemployment rate.

The minimum wage was introduced during a stable, long-lasting growth phase of the German economy. The gross domestic product has been growing steadily since 2006 (with a brief dip in 2008/2009), at least from 2010 to 2019. Employment also rose steadily from 2012 to 2019. The minimum wage was set at €8.50 per hour for 2015/16 and increased to €8.84 in 2017/18.[4] Based on the 2013 wage level, the initial minimum wage was approximately 50 % of the median income or roughly the 15th wage percentile, which had declined significantly before, widening wage inequality below the median (Bossler and Schank, 2020). At the time of its introduction, it was a moderate minimum wage compared to other EU countries (Eurostat, 2021). Based on a 39-hour week, an employee working full-time received a gross monthly salary of €1,440 in 2015/16 or €1,500 in 2017/18.[5]
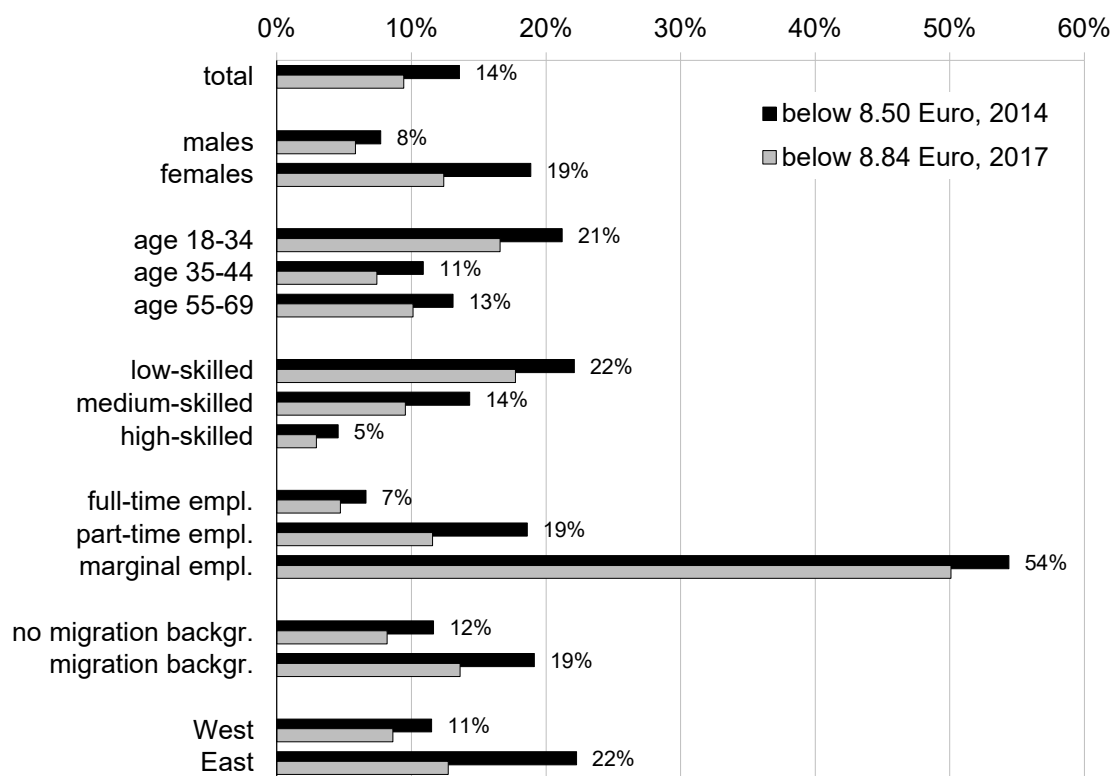
Figure 1: Employees with gross wages below minimum wage by subgroups

Notes: The figure shows the share of employees with gross hourly wages below minimum wage by different subgroups. Self-employed, apprentices, interns, handicapped workers in sheltered workshops, and branches with industrial wage floors above the statutory minimum wage are excluded from the sample. *Source*: SOEP v36. Own calculations. Illustration based on Amlinger et al. (2016).

With regard to the socio-economic situation, the 2015 introduction of the minimum wage affected employees to different degrees (see Figure 1). The direct impact on employees with a migration background (19 %) was considerably larger compared to the impact on natives (12 %). Women (19 %) were affected

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[4] Further annual increases resulted in a minimum wage of €9.82 in the first half of 2022 and to €12.00 starting in October 2022.

[5] The *Minimum Wage Act* only applies where the provisions in the existing industry or company collective agreement were previously lower. In selected sectors with a particularly large impact due to the minimum wage, wages were still allowed to be below the general minimum wage during the transitional period until the end of 2017 (The Federal Government, 2014). This applies to 2.1 % of the workforce in 2015, for example, in agriculture and forestry, in horticulture and in the textile and clothing industry. The share of migrants in industries with and without transitional arrangements is the same (own calculations).

more than twice as often as men (8 %), and younger employees were comparatively more likely to earn less than €8.50 per hour than other age groups. Furthermore, the differences were particularly noticeable by employment status and qualification: In more than half of all jobs with marginal employment (54 %), employees received an hourly wage of below €8.50, while the proportion was much lower for part-time (19 %) and full-time jobs (7 %). Low-skilled workers were strongly affected by the introduction of the minimum wage (22 %), while high-skilled workers were hardly affected (5 %). Additionally, due to the lower average wage in eastern Germany, the *wage bite* – the ratio of the minimum wage and the median hourly wage – was larger in this region (Caliendo et al., 2018).

2.2   Related Evidence

According to competitive market theory, the minimum wage introduction affects labour market opportunities in the form of wage increases and employment losses (Bruttel, 2019; Zavodny, 2014), i.e., the interplay of income and substitution effects. Employers have several options to respond to higher hourly wages: To keep labour costs stable, they may reduce the contractual weekly working hours, demanding that employees work harder or face termination (Bruttel et al., 2018; Bruttel, 2019; Holtemöller and Pohle, 2019). Workers with low productivity face a comparatively higher risk of job loss. They will increase their efforts (and thus their productivity) to forestall a possible layoff, which simultaneously helps to mitigate the higher labour costs that arise with the minimum wage (Ku, 2022). However, "*minimum wage gives employers a profit incentive to substitute away from the least-skilled towards more-skilled workers*" (Zavodny, 2014, p.3), which can lead to reduced hiring of low-skilled workers. Due to that, a statutory minimum wage may serve as a labour market screening device by which primarily better-qualified workers in the low-wage sector may transition into regular employment. As higher wages encourage additional people to enter the labour market, this forces some workers out of their current jobs. Therefore, a minimum wage theoretically causes unemployment to rise, and the least-skilled workers are particularly vulnerable to layoffs. If primarily low-wage earners become unemployed because of the minimum wage, this could both raise the average wage of the lower income groups and promote inequality in the country. Alternatively, employers could also pass along the additional labour costs to their customers by raising prices for goods and services (Bruttel et al., 2018; Bruttel, 2019). Companies that raised prices relatively frequently were less likely to lay off employees in return (Link, 2022). However, a reduction in investments and adjusted work requirements are equally conceivable (Caliendo et al., 2019). Eventually, additional costs may force predominantly small employers to exit the market (Dustmann et al., 2022).

On the other hand, the employees themselves could also initiate a reduction in working hours, for example, if they wish to work less while keeping the same monthly salary (Bruttel, 2019). Caliendo et al. (2019) therefore recommend also considering monthly salaries when evaluating the effects of the minimum wage reform. Several studies found that the average contractual working hours in regular employment fell significantly following the minimum wage implementation in Germany (Bonin et al., 2020), preventing higher hourly wages from translating into higher monthly salaries (Caliendo et al., 2019).

With regard to its primary objectives, the introduction of the minimum wage has significantly increased the hourly wages at the bottom of the distribution at an above-average rate from 2014 to 2016 (e.g., Bruttel, 2019; Caliendo et al., 2019; Dustmann et al., 2022). Therefore, it may play a key role in the reduction of

wage inequality in Germany (Grabka and Schröder, 2019). In particular, low-skilled employees and marginally employed persons experienced an over-proportional increase in hourly wages (Caliendo et al., 2019; Amlinger et al., 2016; Burauel et al., 2020). However, the estimated reduction in wage inequality may also arise from job losses in the low-wage sector, although these effects seem to be small (Bossler and Gerner, 2020; Bossler and Schank, 2020; Caliendo et al., 2018; Garloff, 2019). Regardless, the new wage floor has led to a notable wage compression slightly above the minimum wage (Bruttel, 2019) and spillover effects on higher wages.[6]

In contrast to the expected effects on the wage distribution, the employment effects of a minimum wage were less clear in advance. The predicted decline of approximately half a million jobs led to widespread concerns among the German population (Arni et al., 2014; Knabe et al., 2014). The actual decline appears to have been far less extensive. Almost all studies, however, confirm the expected significant negative effect on total employment (e.g., Bonin et al., 2018; Bossler et al., 2018; Bossler and Gerner, 2020; Caliendo et al., 2018; Garloff, 2019; Holtemöller and Pohle, 2019). Nevertheless, there might be some ambiguity left since a few studies report slightly positive effects (e.g., Ahlfeldt et al., 2018; Bruttel et al., 2018). In this regard, the type of employment relationship determines the extent to which employees have been afflicted by the minimum wage (Caliendo et al., 2018). Holtemöller and Pohle (2019, p.189) "*find a robust negative effect of the minimum wage on marginal and a robust positive effect on regular employment.*" Other studies also observe a sharp decline in the number of mini-jobs (e.g., Amlinger et al., 2016; Bruttel et al., 2018), whereas full-time and part-time employment remained almost unaffected (Caliendo et al., 2018). This decline in marginal employment has therefore largely determined the decline in overall employment. Moreover, the empirical literature is quite consistent in reporting that approximately half of the marginal employment was converted into regular employment as a result of the minimum wage introduction (Amlinger et al., 2016; Bonin et al., 2018; Bruttel, 2019; Caliendo et al., 2018; Caliendo et al., 2019). The other half of all marginally employed persons, however, left the labour market or became unemployed (Bruttel, 2019).

Despite the observed reduction in wage inequality, Bruttel (2019) concludes that – as frequently observed in other states – "*the minimum wage has not helped to reduce welfare dependency and the risk of poverty*" in Germany (Bruttel, 2019; p.11). This conclusion is derived from at least four reasons. First, the share of low-wage employees has not declined due to the minimum wage introduction (Grabka and Schröder, 2019). Second, "*many employees in the low-wage sector still do not generate adequate earned income and depend on wage-replacement benefits*" (Grabka and Schröder, 2018, p.120). This is explained by the fact that workers' previous incomes in the low-wage sector plus potential social benefits roughly correspond to the monthly income after minimum wage implementation. Third, the minimum wage is sufficient only for single full-time employees, which comprise only 3 % of all top-up payment recipients in Germany. For households with additional household members without income (e.g., partner, children), a monthly salary on a minimum wage basis is (still) not sufficient to cover basic costs (Bruttel, 2019). Thus, the vast majority of minimum wage earners continue to rely on social benefits. Fourth, unemployment

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[6] Bossler and Schank (2020) observe that the minimum wage introduction had an impact on monthly salaries up to the 50th percentile, although the extent of wage spillover towards higher wage groups is ambiguous (Bruttel et al., 2018, Bruttel, 2019).

effects are concentrated among low-wage families (Neumark and Wascher, 2002), which increases labour market segmentation.

2.3 Effects on Migrants

Regarding the expected effects of a minimum wage for migrants, opposing forces prevent an unambiguous prediction. Due to the worse labour market situation of migrants compared to natives, a minimum wage may contribute to closing the migrant-native wage gap in Germany. Since there is a strong overrepresentation of people with a migration background at the bottom of the wage distribution, their hourly wages would rise to a greater extent than those of native Germans would due to the minimum wage. However, at the same time, migrants' employment opportunities may also excessively deteriorate in response to the minimum wage (Zavodny, 2014). They may have trouble entering the labour market or keeping their jobs, and they benefit from higher wages only if they are in employment. Reasons for the lower average wages of migrants compared to natives are manifold, but their lower human capital endowment is the key to productivity disadvantages. The lower level of human capital results from a lower level of education and generally poorer language skills (Ingwersen and Thomsen, 2021). For migrants with own migration experience (first-generation migrants), the imperfect transferability of human capital (due to the limited compatibility of the home and host labour markets) leads to significantly lower returns compared to human capital acquired in Germany (Aldashev et al., 2009; Basilio et al., 2017). For migrants of successive generations, lower levels of human capital result partly from migrant-specific challenges in the German education system (Christl et al., 2018). However, wage differentials between migrants and natives cannot be attributed to productivity differences alone. They also exhibit less bargaining power vis-à-vis the (potential) employer than natives (Signorelli, 2020). Migrants also point to statistical discrimination, which (partly) arises from cultural differences (Ingwersen and Thomsen, 2021). Thus, an employer's reservations about hiring, retention, and promotion can lead to a preference for native-born workers (Kaas and Manger, 2012). Nevertheless, irrespective of the actual causes or their relevance, there is a clear selection of migrants into low-income occupations and sectors (Humpert, 2013).

Currently, very few studies analyse the effects of the minimum wage on migrants or different ethnic groups, and this research is limited exclusively to English-speaking countries. The available evidence thus refers to less institutionalized labour markets than in Germany. Wursten and Reich (2021) and Derenoncourt and Montialoux (2021) reveal that minimum wage policies in the U.S. have narrowed the wage gap between whites and African Americans and improved employment opportunities for black workers. The minimum wage even further reduces the racial wage gap among less-educated workers. Similar developments can be observed in the UK, where the introduction of the minimum wage has led to a wage gap reduction between ethnic minorities and white workers in the lower wage groups (Clark and Nolan, 2021). In addition, both the minimum wage in the UK (when it was introduced) and the national minimum wage in the U.S. were set comparatively low in relation to median income. In this regard, Edo and Rapoport (2019) observe that, in the U.S., high federal minimum wages preserve native-born workers from competition with migrants with similar qualifications. Consequently, the relative level of the minimum wage could affect the labour force participation of ethnic minorities and could thus influence wage inequality between migrants and natives. Nevertheless, it is unresolved whether the overall quite positive results can also be transferred to Germany and similar countries.

Even though the literature does not explicitly address migrants in Germany, some insights can be derived based on how migrants have fared after the introduction of the minimum wage. Caliendo et al. (2019) emphasize that low-skilled and marginal workers in particular have benefited substantially from the introduction of the minimum wage, explicitly mentioning – but not analysing – people with a migration background. Nevertheless, low-wage earners face adverse consequences from the introduction of a minimum wage: Although they benefit from the hourly wage raise, they are exposed to an increased risk of job loss and a reduction in working hours (Neumark et al., 2004). Therefore, we conjecture that migrants are more strongly affected than natives by the introduction of the minimum wage in Germany, both positively and negatively. Migrants may tend to benefit more from the minimum wage due to their overrepresentation in the low-wage sector, and the average wage of migrants in the low-wage sector is slightly lower than that of natives, which should generate higher wage growth. On the other hand, imposed wage increases lead to budget adjustments by employers, which may result in job cuts. Migrants may be at a disadvantage in the increased competition for jobs if they are competing with native-born Germans with equal job qualifications. Hence, only workers who remain employed – with the same number of working hours – can truly benefit from the introduction of the minimum wage.

3   Data Description

3.1   Data and Sample Restrictions

For the empirical analysis, we use 2007 to 2018 survey data from the German Socio-Economic Panel (SOEP).[7] This timeframe includes an appropriate period to account for wage developments prior and after to the minimum wage introduction. It further reduces possible bias due to anticipation effects. Simultaneously, (wage) changes in the first, second and third year of the minimum wage introduction can be included. SOEP is a wide-ranging and representative longitudinal panel study of approximately 30,000 persons interviewed annually on issues related to income, employment, education, living conditions and health (Goebel et al., 2019). A particular asset of these data is the identification of migration status beyond the concept of citizenship. In the analysis, we consider (1) persons with a migration background who were born in Germany but have at least one parent who immigrated to Germany (indirect migration background, second and subsequent generations of immigrants) or who immigrated themselves (direct migration background, first-generation immigrants) as "migrants" and (2) persons who have no known migration history as "natives" (DIW-SOEP, n.d.).[8] In this regard, the group of migrants is characterized by some heterogeneity (origin, time of residence, language proficiency, place of educational acquisition, the reason for migration, etc.). Labour market barriers and lower upward mobility, however, apply equally to individuals from both direct and indirect migration backgrounds (Speckesser, 2013).

Our main variable of interest, 'gross hourly wage,' is obtained by dividing the individual gross wages for each month by the contractual working hours of the last week in the main job extrapolated to monthly

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[7] Migration samples from after 2013 are not included to minimize bias from refugee samples and immigrants immediately before the minimum wage introduction in 2015.

[8] The group "without migration background" also includes persons with German citizenship who were born in Germany and with missing information about their parents. Since some of them could also be descendants of migrants, the number of persons with a migration background group may be slightly underestimated (DIW-SOEP, n.d.).

hours.[9] Contractual working hours have the advantage over actual working hours in that a bias in hourly wages due to additional overtime pay is not included. Wages from side jobs are not considered. We assume that there are 4.35 weeks in each month for the calculation. We further apply symmetric trimming to the wage growth rates by dropping the upper and lower one percent from the analysis to correct for outliers. Information on the individual's employment status is taken directly from the dataset. We consider the age range from 18 to 69 years and use the provided survey weights at the individual level to mitigate a potential bias due to the overrepresentation of high-income households and immigrants in SOEP data. With these restrictions in place, the estimation sample includes 134,525 observations with wages, subdivided into 19.9 % migrants (thereof 70.3 % with a direct migration background and 29.7 % with an indirect migration background) and 80.1 % natives on average.[10]

3.2   Sample Description

Migrants and natives differ significantly in most labour market characteristics: Table 1 shows the mean characteristics of these two groups in the period of 2012-2014 (pre-minimum wage) and their absolute and relative changes towards the period 2015-2017 (post-minimum wage introduction). We look at these two periods to capture the average differences between the two groups in terms of labour market characteristics directly before and in terms of the change immediately after the minimum wage introduction. The share of low-skilled workers with a migration background is considerably higher than that of native workers, while the opposite is true for medium-skilled persons. The share of high-skilled workers is almost identical. Hence, migrants have, on average, a lower level of educational attainment than natives. Migrants are also more often employed in marginal employment (13 %), although this proportion decreased towards 2015-2017 compared to native workers (8 %). Women are between two to three times more likely than men to work in marginal employment depending on their migration background (see Table A.1 in the appendix for more detailed descriptive statistics). Both groups had significant gains in part-time employment, where the share of native employees (21 %) is slightly higher than among migrants (19 %). Similarly, migrants (68 %) were slightly less likely to work full-time in 2012-2014 than natives (70 %), and women (50 %), on the other hand, were much less likely to work full-time than men (88 %). However, there was no appreciable change in either group in 2015-2017, confirming the results of previous studies for migrants (see Section 2.2). The unemployment levels show a notable difference. Whereas the share of unemployed native workers decreased substantially by 12 % by the 2015-17 period, there was no significant change for migrants. The fact that migrants (and women) are less often full-time regularly employed, which tends to be associated with a lower wage level (see Figure 1), highlights the extent to which migrants (and women) are affected by the minimum wage. Meanwhile, the gender ratio among migrants in the labour market has changed in favour of women.

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[9] We disregard all workers who have no eligibility for the minimum wage: (1) workers in jobs that are not bound by the statutory minimum wage (self-employed, apprentices, interns, and handicapped workers in sheltered workshops). (2) Workers in industries with higher minimum wages than the statutory minimum wage. (3) Workers in an industry with a transitional period of minimum wage introduction.

[10] The official share of employed persons with a migration background was 18.5 % in 2014 (Federal Statistical Office, 2020).

Table 1: Workers' characteristics by migration background 2012-2014 and changes towards 2015-2017

Characteristics of workers	Migrants			Natives		
	mean, 2012-2014	change towards 2015-2017		mean, 2012-2014	change towards 2015-2017	
		absolute	%		absolute	%
Labour force participation	0.73	0.02	3***	0.75	0.01	1***
… employed	0.88	0.00	0	0.93	0.01	1
… registered unemployed	0.13	0.00	1	0.07	-0.01	-12***
Salary						
gross hourly wage	15.54	1.61	10***	17.83	1.52	9***
Std. Dev.	8.82	1.12	13***	10.65	2.17	20***
p10	7.07	0.98	14***	8.05	0.92	11***
p15	7.66	0.96	13***	8.96	0.89	10***
p20	8.62	0.71	8***	9.96	0.93	9***
p50	13.79	1.15	8***	15.80	1.44	9***
gross monthly salary	2,277.32	270.99	12***	2,712.54	173.92	6***
Employment						
working hours (contractual)	33.24	-0.01	0	34.43	-0.39	-1***
full-time employment	0.68	0.00	0	0.70	-0.01	-2***
part-time employment	0.19	0.01	8**	0.21	0.02	10***
marginal employment	0.13	-0.01	-9**	0.08	0.00	-2
Qualification						
low-skilled	0.41	-0.03	-6***	0.24	-0.02	-7***
medium-skilled	0.34	0.01	2	0.49	0.00	0
high-skilled	0.25	0.02	9***	0.27	0.02	6***
labour market experience	14.40	0.44	3**	18.89	0.35	2***
job tenure	7.48	0.30	4**	12.05	0.11	1
Company						
firm size: <20 empl.	0.24	0.02	7**	0.20	-0.01	-3*
firm size: 20-199 empl.	0.26	-0.02	-8***	0.26	-0.02	-6***
firm size: 199-1999 empl.	0.21	0.00	-1	0.22	0.00	1
firm size: >2000 empl.	0.28	0.01	5*	0.29	0.03	10***
Personal information						
age	39.70	0.94	2***	44.17	0.79	2***
gender (male=1)	0.55	-0.02	-4***	0.51	-0.01	-1
No. of obs. (employed)	**8,048**	**6,738**		**26,786**	**21,762**	

Notes: Self-employed, apprentices, interns, handicapped workers in sheltered workshops, and branches with industrial wage floors above the statutory minimum wage are excluded from the sample. *Source*: SOEP v36 2012-2017, own calculations incl. survey weights.

A first look at wage developments reveals that both groups experienced a significant and comparable increase in the median gross hourly wage of nearly 10 % during the 2015-2017 period (Table 1). The relative increase was even greater at the 10th wage percentile for migrants (+14 %) than for natives (+11 %). Due to these considerable level differences, there was a slight convergence at the lower end of the wage distribution. Meanwhile, natives made slightly larger gains in the higher wage groups. Thus, from the 20th decile onwards, there is a discernible wage spread and spillover effects of wages tend to differ between groups in consideration. In both groups, we observe a strong significant increase in wage dispersion. Due

to the different employment status, the differences in monthly salaries are even more extensive. The differences between migrants and natives in the development of the average gross monthly salary are particularly noticeable: While migrants show a considerable increase of 12 %, this is only half as high for natives (6 %). In summary, these descriptive results indicate different patterns correlating with the introduction of the minimum wage for migrants and natives. We also observe considerable gaps in hourly wages by gender and migration background (Table A.1).

4   Econometric Methodology

In order to quantify how migrants and natives were affected by the introduction of the minimum wage, we use a causal effects analysis. The methodological framework refers to the approach used by Burauel et al. (2020) and Dustmann et al. (2022) and enables us to identify the effects of the minimum wage reform on three outcomes of interest, i.e. hourly wages, weekly working hours and monthly salaries. The effect of the minimum wage is estimated by using a "*differential trend adjusted difference-in-differences*" (DTADD) approach, in which the observed wage change in the treatment group is contrasted with the (counterfactual) wage change in the control group. Therefore, the treatment effect is represented by the difference between wage changes in the treatment group and the wage changes perceived in the control group. This identification strategy is based on the underlying assumption that wages below the minimum wage threshold (treatment group) would have developed identically to those just above the minimum wage threshold (control group) if the minimum wage was not introduced. To empirically support the plausibility of this assumption, we consider previous wage trends in the model. The analysis particularly focuses on the minimum wage effects on migrants compared to natives. To complement the causal evaluation, we additionally conduct comprehensive descriptive analyses for uncovering and discussing distributional shifts, such as potential squeeze and spillover effects.

Table 2: Treated group and control groups

group	wages in 2013/14	wage changes towards 2015/16
treated group	< €8.50	▪ (subordinate) overall wage trend ▪ wage increase above the threshold of €8.50
control group	€8.50 - €10.00	▪ overall wage trend ▪ small additional wage increase due to indirect effects of the minimum wage introduction (wage spillover)
peer group	€10.00 - €12.00	▪ overall wage trend ▪ (almost) unaffected by the minimum wage introduction

Source: Own illustration.

For the causal effect analysis, we divide the employees into three groups based on their location in the wage distribution prior to the minimum wage introduction (t_0) (see also Burauel et al., 2020; Dustmann et al., 2022). In our application, the wage thresholds correspond to the rounded single (€10.32) and double standard deviations (€12.14) of the average hourly wage of the group under treatment. The first group includes workers who earned an hourly wage below the minimum wage threshold of €8.50 in 2013

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and 2014.[11] These workers were directly affected by the introduction of the minimum wage in 2015 and therefore constitute the "treated group". Due to their close proximity to the minimum wage threshold, workers with hourly wages just above the minimum wage (€8.50 to €10.00/hour) form our "control group". However, this group may experience indirect effects of the minimum wage introduction. For example, there may be payment raises to maintain some distance between wage levels for different groups of workers (within firms) to reflect differences in skill demands or productivity. For subsequent robustness checks, we therefore implement a third group: The "peer group" comprises all workers *"higher up in the initial wage distribution"* (€10.00-12.00/hour) and should be (almost) unaffected by the introduction of the minimum wage. Table 2 shows an outline of the treated group and both control groups. Our main interest lies in the comparison of the change in the hourly wages of the treated group (hourly wages below €8.50) and the control group (hourly wages €8.50-€10.00). Since the groups show no significant differences with regard to age, gender, educational level, and migration background, they are not too different to expect equal or at least largely comparable labour market perspectives (in the absence of a minimum wage).

We estimate three model variants with different time horizons to reflect immediate (one-year analysis, 2014-2015 vs. 2013-2014), robust (two-year analysis, 2014-2016 vs. 2012-2014) and medium-term effects (three-year analysis, 2014-2017 vs. 2011-2014). The total effect of the minimum wage can be considered in the longer time horizon only when the transition periods in certain industries have expired. Perceptible anticipation effects of the minimum wage implementation, e.g., higher hourly wage growth rates in the lower wage segment between 2013 and 2014 compared to previous years, suggest that a one-year analysis considering 2014 and 2015 only may have limited validity. We prefer the two-year analysis as it reduces the impact of short-term wage fluctuations, a lagged minimum wage implementation and an adjustment of the hiring behaviour. We use a regression analysis to control for different individual and job-specific characteristics of the treated group, the control group and the peer group influencing hourly wage changes. For the empirical model, we use the following main specification:

$$\Delta w_{it} = \beta_0 + \beta_1 T_{it} + \beta_2 T_{it} \times Y_{it} + \beta_3 T_{it} \times Y_{it-k} + \beta_4 X_{it} + \beta_5 Z_{it} + \alpha_t + \varepsilon_{it} \ . \tag{1}$$

where in the two-year analysis Δw_{it} represents the logarithmic change in individual hourly wage between t_0 and t_{+2} compared to the wage growth between t_{-2} and t_0. The treatment group indicator T_{it} takes the value of one if a worker earned an hourly wage below €8.50 in period t_0 and zero otherwise. Thus, β_1 depicts the average hourly wage growth of individuals in the treated group. The interaction term between the treatment group indicator T_{it} and the time vector Y_{it} indicates deviations from the average hourly wage growth of the treated group within a particular year. The corresponding coefficient β_2 therefore reveals hourly wage changes caused by the minimum wage introduction (minimum wage effect). The placebo estimate (β_3) is used to test our critical identification assumption of common trend wage growth in the treatment and the control group. We estimate wage growth in the pre-reference period k (2010-2012 in the two-year analysis). To allow a quantitative and causal interpretation of the minimum wage effect (β_2), β_3 should be zero. If this does not hold, confounding effects may bias the causal design. Since we can rule out any other systematic reforms affecting wage changes during the period of analysis, most likely are

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[11] We choose a two-year baseline to reduce potential anticipation effects in the year prior to the minimum wage introduction.

anticipation effects. The matrix X_{it} captures individual characteristics: age, gender, living in a partnership, (migration background), place of residence, educational level, and labour market experience. Matrix Z_{it} contains further job-specific characteristics: firm size, job tenure, time-limited contract, and economic sector. Finally, we consider year-fixed effects, α_t, to take general wage trends into consideration. All of these are relevant for the individual wage setting and regarded in the model to improve the precision of the estimated coefficients of interest.

Since we do not want to consider within-group effects, but rather emphasize the different effects of the minimum wage introduction on individuals with and without a migration background, we adjust the model for this purpose as follows. We form two separate treated groups: The first treated group contains only migrants, and the second treated group contains only natives. The control group remains unchanged in both cases and includes all workers regardless of their migration background. This model specification isolates comparable effects of minimum wage introduction depending on the migration background of the treated group, contrasted with the counterfactual case constellation approximated by the common control group of individuals not affected by the minimum wage introduction. Besides the estimation of effects in the whole sample as a reference for interpretation, we estimate effects for migrants and natives separately. Moreover, to allow more insights into underlying effect patterns, we complement all analyses with distinct estimations on selected socio-economic groups. For this purpose, we focus on the most relevant groups and provide results by gender, age cohorts and different qualification levels. The corresponding results enable revealing potential (socio-economic) effect heterogeneity.

5 Empirical Results

5.1 Effects on Hourly Wages

Table 3 summarizes the main estimation results for changes in contractual hourly wages for all workers eligible for the minimum wage. We present the results of the one-year analysis (columns 1-3), the two-year analysis (columns 4-6) and the three-year analysis (columns 7-9) and show the change in the hourly wage of the treated groups (hourly wage below €8.50) compared to the control group (hourly wages €8.50-€10.00).[12] Columns 1, 4 and 7 refer to the effects in the whole sample and provide reference levels for the more detailed estimations for the ethnic groups. Since the dependent variable is defined in logarithmic form, the coefficient estimates can be approximately interpreted as percentage changes. Three coefficients are of particular importance: (1) the coefficient estimate of the treatment group indicator denotes the average wage trends of the treated group relative to the control group. (2) The coefficient estimate of the interaction term (DTADD) displays the additional wage increase of the treated group due to the minimum wage introduction, i.e. the causal effect of the minimum wage introduction. (3) The placebo interaction term controls for our key assumption, i.e., whether the wages of the treated group and the control group have evolved identically in the pre-minimum wage period.

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[12] The final empirical model specification was selected based on different specifications of eq. (1) regarding the covariates considered. Table A.2 in the appendix provides regression results of nine specifications.

Table 3: Minimum wage effect on hourly wage growth by migration background-specific treated group

	Dependent variable: Logarithmic change in gross hourly wage								
	One-Year Analysis			Two-Year Analysis			Three-Year Analysis		
	Total	**Migrants**	**Natives**	**Total**	**Migrants**	**Natives**	**Total**	**Migrants**	**Natives**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
One-Year Analysis									
Hourly wage < €8.50[1]	0.025**	0.028	0.019						
$[T_{it}]$	(0.010)	(0.018)	(0.012)						
× DTADD 2014-2015[2]	0.093***	0.087*	0.096***						
$[T_{it} \times Y_{it}]$	(0.020)	(0.032)	(0.023)						
× Placebo 2012-2013[2]	-0.048**	-0.053	-0.043*						
$[T_{it} \times Y_{it-k}]$	(0.022)	(0.049)	(0.023)						
Two-Year Analysis									
Hourly wage < €8.50[1]				0.040***	0.044	0.039***			
$[T_{it}]$				(0.013)	(0.028)	(0.014)			
× DTADD 2014-2016[2]				0.093***	0.102***	0.087***			
$[T_{it} \times Y_{it}]$				(0.022)	(0.038)	(0.024)			
× Placebo 2010-2012[2]				-0.045	-0.095	-0.042			
$[T_{it} \times Y_{it-k}]$				(0.032)	(0.100)	(0.033)			
Three-Year Analysis									
Hourly wage < €8.50[1]							0.056***	0.096***	0.051***
$[T_{it}]$							(0.015)	(0.029)	(0.016)
× DTADD 2014-2017[2]							0.066**	0.010	0.078***
$[T_{it} \times Y_{it}]$							(0.026)	(0.051)	(0.027)
× Placebo 2008-2011[2]							-0.078**	-0.163	-0.083**
$[T_{it} \times Y_{it-k}]$							(0.037)	(0.216)	(0.037)
Control Variables									
Year fixed effects $[\alpha_t]$	yes	yes	yes	yes	yes	yes	yes	yes	yes
Socio-demographic info. $[X_{it}]$	yes	yes	yes	yes	yes	yes	yes	yes	yes
Job characteristics $[Z_{it}]$	yes	yes	yes	yes	yes	yes	yes	yes	yes
Constant	0.065**	0.097**	0.049	0.085**	0.112***	0.093**	0.173***	0.151***	0.217***
	(0.030)	(0.039)	(0.030)	(0.037)	(0.051)	(0.037)	(0.048)	(0.055)	(0.050)
Observations	2,106	1,066	1,710	2,387	1,155	2,046	2,450	1,139	2,158
Obs. treated group	1,436	396	1,040	1,573	341	1,232	1,603	292	1,311
Obs. control group	670	670	670	814	814	814	847	847	847
Adj. R[2]	0.078	0.057	0.080	0.115	0.085	0.112	0.135	0.121	0.140

Notes: The table shows the effect of the minimum wage introduction on the change in gross hourly wages. Self-employed, apprentices, interns, handicapped workers in sheltered workshops, and branches with industrial wage floors above the statutory minimum wage are excluded from the sample. 1) Treated group (<€8.50/hour): (1),(4),(7) all workers, (2),(5),(8) with migration background, (3),(6),(9) without migration background. Control group (€8.50-€10.00/hour): (1)-(9) all workers. 2) DTADD and placebo are the respective different interaction terms, depending on the treated group. *Source*: SOEP v36 2008-2017, own calculations. Robust standard errors, clustered at the individual level. Standard errors in parentheses. Significance levels: * p<0.1, ** p<0.05, *** p<0.01.

We turn directly to the **two-year analysis**, which is our preferred time horizon and is supposed to reveal the most robust effect patterns. Hourly wages of workers earning less than €8.50 grew on average by 4.0 percentage points (ppts) faster than the control group (€8.50-€10.00) between 2010 and 2016 (column 4). The DTADD interaction term for 2014–2016 further signifies that the introduction of the minimum wage has caused an additional wage increase of 9.3 ppts. The placebo coefficient is insignificant, hence, the wages of the treated groups increased at the same rate before the introduction of the minimum wage as those of the control group, supporting our main identifying assumption. The estimated wage

increases (DTADD) can thus be interpreted as a causal result of the minimum wage introduction (Table 3). The overall wage change of our estimation, wage trend plus minimum wage effect, is in line with the magnitude of Burauel et al. (2020) and Dustmann et al. (2022), but with a stronger minimum wage effect.

Our empirical estimates show different minimum wage effects for workers with and without a migration background. In the period from 2014 to 2016 (two-year analysis), the introduction of the minimum wage resulted in an additional 10.2 ppts wage increase for workers with a migration background compared to the control group, while native workers only experienced an increase of 8.7 ppts (Table 3).[13] As the underlying average wage trend between migrants and natives is almost the same (about 4 %), this indicates that the introduction of the minimum wage led, at least temporarily, to a slight wage convergence between natives and migrants.
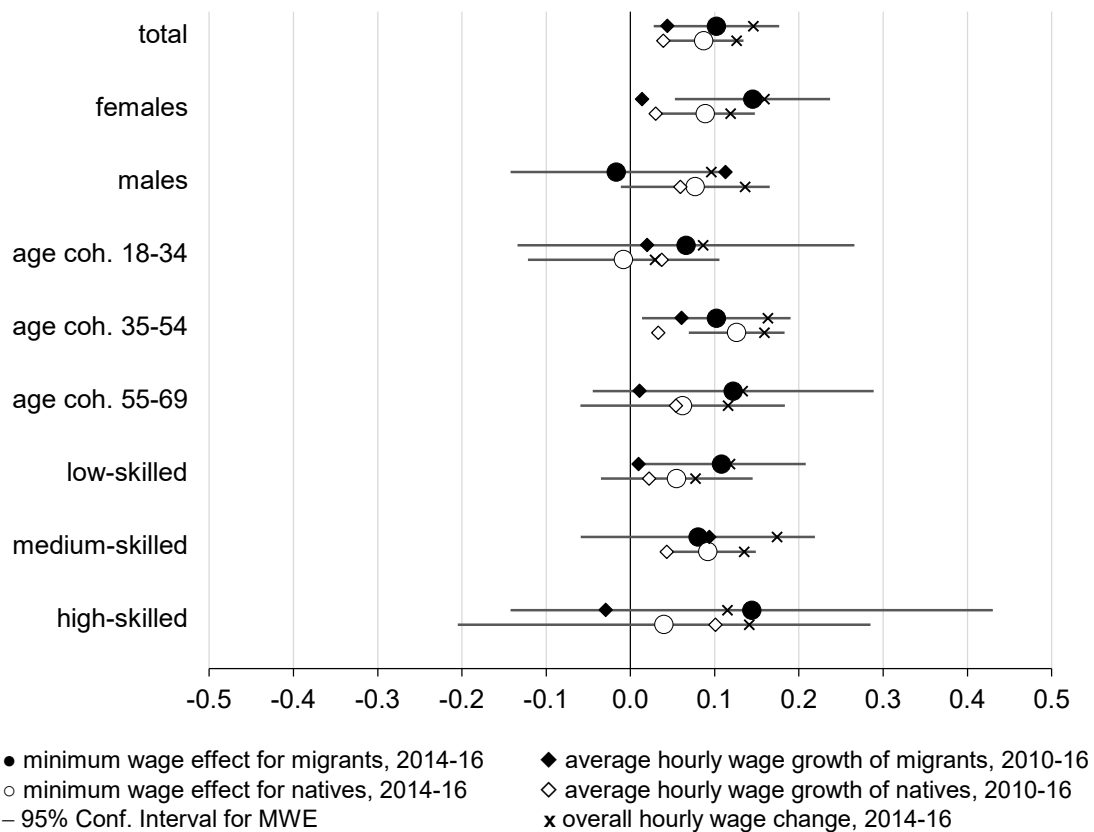
Figure 2: Minimum wage effect on hourly wage growth by migration background, 2014-2016

Notes: The dependent variable is the logarithmic change in gross hourly wage between 2014 and 2016. Treated group according to migration background, control group comprises all workers. Robust standard errors, clustered at the individual level. Detailed regression results for migrants are in Table A.4 and for natives in Table A.5 in the appendix. Self-employed, apprentices, interns, handicapped workers in sheltered workshops, and branches with industrial wage floors above the statutory minimum wage are excluded from the sample. *Source*: SOEP v36 2010-2016, own calculations.

However, this trend in convergence is only temporary as revealed by the results of the one-year analysis and the three-year analysis. In the period from 2014 to 2015 (**one-year analysis**), the introduction of the minimum wage resulted in an additional 9.6 ppts wage increase for native workers compared to the control group, while workers with a migration background experienced an increase of 8.7 ppts. Nevertheless, these

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[13] The minimum wage effect on hourly wages is only significant for migrants with a direct migration background (see Table A.3).

estimates should be interpreted with great care since the short-run may reflect some accompanying effects, e.g. due to potentially delayed implementation of the minimum wage. After three years (**three-year analysis**), the minimum wage effects are considerably smaller. The effect for migrants (1.0 ppts) has vanished mostly and is no longer statistically significant, but there is still a much stronger effect for native-born workers (7.8 ppts). Accordingly, the strong effects of the minimum wage tend to fade out in the longer term (Table 3). The declining effect is particularly important since it also comprises the minimum wage adjustment to €8.84 in 2017.[14]

The impact of the minimum wage introduction differs not only by migration background but also visibly by gender, age groups and qualification. Figure 2 shows the effect heterogeneity according to these characteristics obtained from separate model estimations. It visualizes the average wage trend, the minimum wage effect and the overall wage change differentiated by migration background for the two-year analysis. We consider the genders separately because women are much more likely to work part-time or in marginal employment than men and are therefore overrepresented in the treated group (Table A.1). Our empirical results show that the wage trend for women is only weakly positive, but that the minimum wage effect is even larger – for female migrants (14.5 ppts) distinctly stronger than for female natives (8.9 ppts). On the other hand, we observe a comparatively stronger average wage growth for men; while at the same time male migrants experience even a slightly negative minimum wage effect of -1.7 ppts (see also Table A.4 and Table A.5 in the appendix). This could be a consequence of increased job competition above the minimum wage threshold, in which migrants may have been outcompeted by natives.

In addition, we estimate age cohort-specific effects because primarily young workers may be affected by the introduction of the minimum wage (see Figure 1). The results in Figure 2 confirm that the minimum wage effects in the two-year analysis are also different by migration background and age cohorts. The minimum wage effect is comparatively small for young workers (18-34 years in 2014) and comparatively large for older workers (55-69 years in 2014). In both cases, the effect for migrants clearly exceeds that for natives while the previous wage trend for them is almost zero. The effect sizes in the middle age cohort (35-54 years in 2014) are in between, and comparable for both migrants and natives. Younger and older migrants thus benefited much more from the introduction of the minimum wage. Only through the minimum wage, overall wage growth has exceeded that of natives (see also Table A.4 and Table A.5 in the appendix). Besides female migrants, low-skilled migrants benefited strongly from the introduction of the minimum wage (Figure 2). Previously stagnant wages experienced an immediate increase of 10.8 ppts. In contrast, the effects were significantly smaller for low-skilled natives (5.5 ppts). The effects for medium-skilled workers are in line with the main effects. The small share of high-skilled workers in the low-wage sector, by contrast, does not allow for interpretable minimum wage effects. Overall, we find a consistently strong negative coherence between the previous average wage trend and the minimum wage effect. For female migrants, young and old workers, and low-skilled workers there are preceding wage trends close to zero, but the minimum wage effects are strongly positive (see also Table A.4 and Table A.5 in the appendix).

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[14] Due to industry-specific transition periods for the implementation of the minimum wage until the end of 2017, the two-year analysis and the three-year analysis additionally include employees from industries that had completed their transition periods. Table A.6 in the appendix provides the results excluding the industries in the transition period. As expected, the general wage increase as well as the minimum wage effects are smaller, as wages in these sectors were lower on average and wage gains tended to be higher.

5.2 Effects on Working Hours

Rising hourly wages do not necessarily lead to higher monthly income. One possible response to the raised wages could be a reduction in weekly working hours, whether voluntarily or involuntarily. For example, employers have to bear higher costs and the upper earnings limit in marginal employment is reached with fewer working hours. Since only full-time employment at the minimum wage provides an adequate monthly income, adjusting work hours could cause workers to remain below this necessary monthly income threshold. Our data show a notable difference between migrants and natives: While the hours worked by native workers maintained the previous trend after the introduction of the minimum wage, working hours of treated migrants, which had previously risen sharply, suddenly dropped from this point in time (see Figure A.1 in the appendix).

● minimum wage effect for migrants, 2014-16
○ minimum wage effect for natives, 2014-16
– 95% Conf. Interval for MWE

◆ average growth in working hours of migrants, 2010-16
◇ average growth in working hours of natives, 2010-16
x overall change in working hours, 2014-16
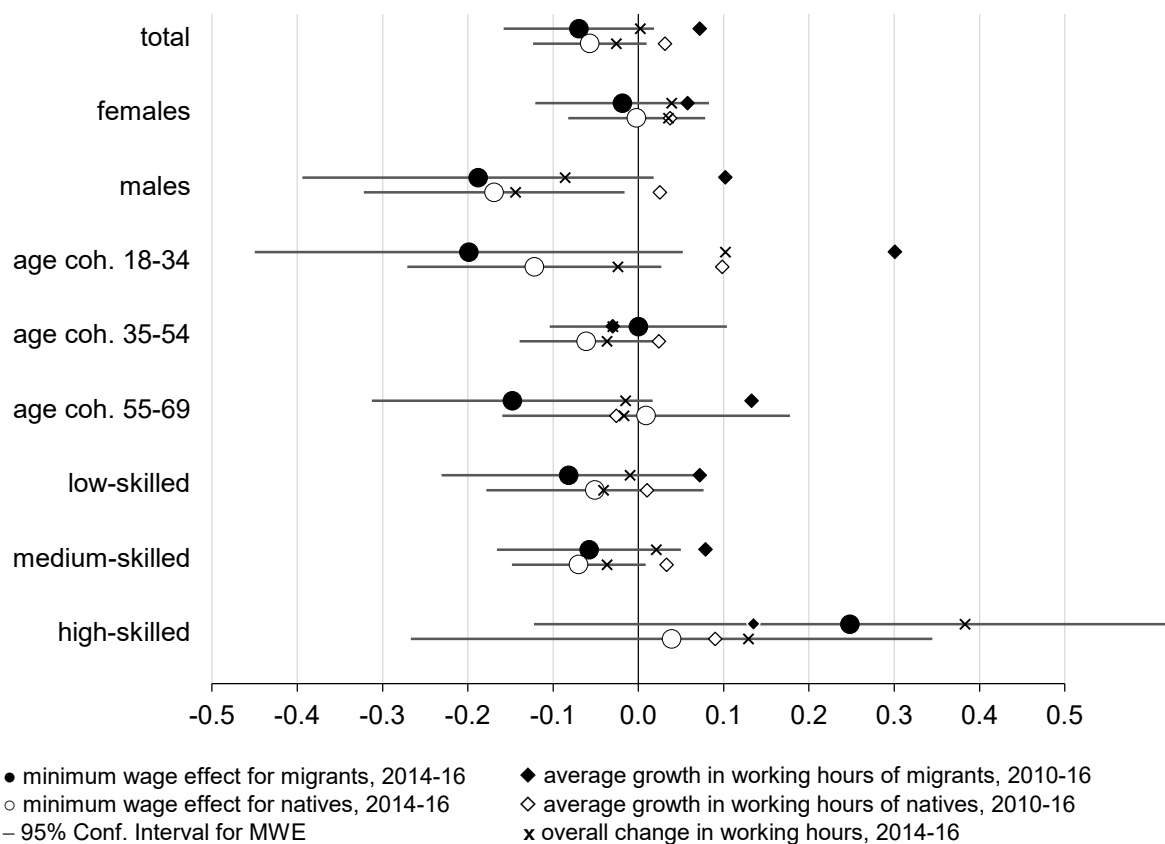
Figure 3: Minimum wage effect on the growth of weekly working hours by migration background, 2014-2016

Notes: The dependent variable is the logarithmic change in weekly working hours between 2014 and 2016. Treated group according to migration background, control group comprises all workers. Robust standard errors, clustered at the individual level. Detailed regression results for migrants are in Table A.8 and for natives in Table A.9 in the appendix. Self-employed, apprentices, interns, handicapped workers in sheltered workshops, and branches with industrial wage floors above the statutory minimum wage are excluded from the sample. *Source*: SOEP v36 2010-2016, own calculations.

We estimate the causal changes in contractual weekly working hours for the treated group following the introduction of the minimum wage. The results of the two-year analysis show an overall positive trend in the development of weekly working hours of 3.1 to 7.2 ppts for the treated group compared to the control group from 2010 to 2016. However, the introduction of the minimum wage caused a reduction in weekly

hours worked for migrants of -7.0 ppts and for natives of -5.7 ppts. Wage trend and minimum wage effect tend to equalise each other (see Figure 2 and Table A.7 in the appendix). Although insignificant, the minimum wage effect is evident only among migrants with a direct migration background, but not among those with an indirect migration background (see Table A.3 in the appendix).

Regarding the different socio-economic groups, there is some notable heterogeneity. While women have no significant change in weekly working hours, there are strongly pronounced decreases for men. Due to the minimum wage introduction both, migrant men (-18.8 ppts) and native men (-16.9 ppts) between 2014 and 2016 (two-year analysis), experienced a substantial decline in weekly working hours. Predominantly younger (-19.9 ppts) and older workers (-14.8 ppts) with a migration background had comparatively significant reductions in weekly working hours. Low-skilled and medium-skilled workers, meanwhile, show a comparable trend in weekly working hours, and both groups are similarly affected by the minimum wage-related decline.

5.3   Effects on Monthly Salary

Despite these partly opposing effects in hourly wages and weekly working hours, the monthly gross salaries from work of the treated group nevertheless increased (two-year analysis, see Figure 4 and Table A.10 in the appendix). In addition to the salary trend of 6.4 ppts of the treated group relative to the control group, the introduction of minimum wages caused a further increase in the monthly salary of 12.7 ppts. The positive effect on monthly salaries is solely attributable to migrants with a direct migration background (see Table A.3 in the appendix). Regarding the differences between migrants and natives, the positive trend was twice as large for migrants than for natives (both estimates are statistically highly significant) whereas the point estimate of the minimum wage is with 13.7 ppts distinctly higher for natives than that for migrants with 5.3 ppts. This implies that migrants benefited less from the minimum wage introduction also in terms of their monthly salary growth – widening the wage gap between the two groups even further.

Consideration of different socio-economic groups again reveals a heterogeneous pattern (Figure 4). While there is only a slightly positive monthly salary trend for women of about 3 ppts, we observe simultaneously an extraordinarily strong positive minimum wage effect, both for female migrants (18.7 ppts) and native women (17.1 ppts). The introduction of the minimum wage also caused a significant monthly pay raise for low-skilled workers. In this group, women are overrepresented (Table A.1). Again, the effect is considerably higher for natives (20.6 ppts) than for migrants (13.0 ppts). In contrast, the effect is weaker for medium-skilled workers, with natives (7.7 ppts) benefiting more than migrants (4.2 ppts). For male migrants, on the other hand, the salary trend is much steeper, but the minimum wage effect is also strongly negative (-17.0 ppts) (Figure 4). One possible explanation for why male migrants did not explicitly benefit from the introduction of the minimum wage could be the strong positive monthly salary trend that had already caused a convergence of wages between the treatment and control groups in the low-wage sector beforehand. With wages now roughly equal between these two groups, but productivity still different, cutbacks may predominantly hit male migrants, e.g., through layoffs or work hour reductions, who on average have lower human capital endowments than natives. This explains, among other things, the non-existent effect on hourly wages, the negative effect on hours worked, and finally, the negative effect on

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monthly salary. With 50 % of women in the low-wage sector working part-time or mini-jobs (men: 12 %), hourly and monthly pay cuts are less prevalent (Table A.1). The trend in monthly salary growth of about 6 ppts in the age cohorts 35-54 years and 55-69 years compared to their counterpart in the control group has multiplied by the minimum wage introduction (Figure 4). In the youngest age cohort 18-34 years, however, the minimum wage slowed down the previously strong monthly salary growth for migrants (28.4 ppts) by about 13 ppts.

● minimum wage effect for migrants, 2014-16   ◆ average monthly salary growth of migrants, 2010-16
○ minimum wage effect for natives, 2014-16   ◇ average monthly salary growth of natives, 2010-16
– 95% Conf. Interval for MWE   x overall monthly salary change, 2014-16
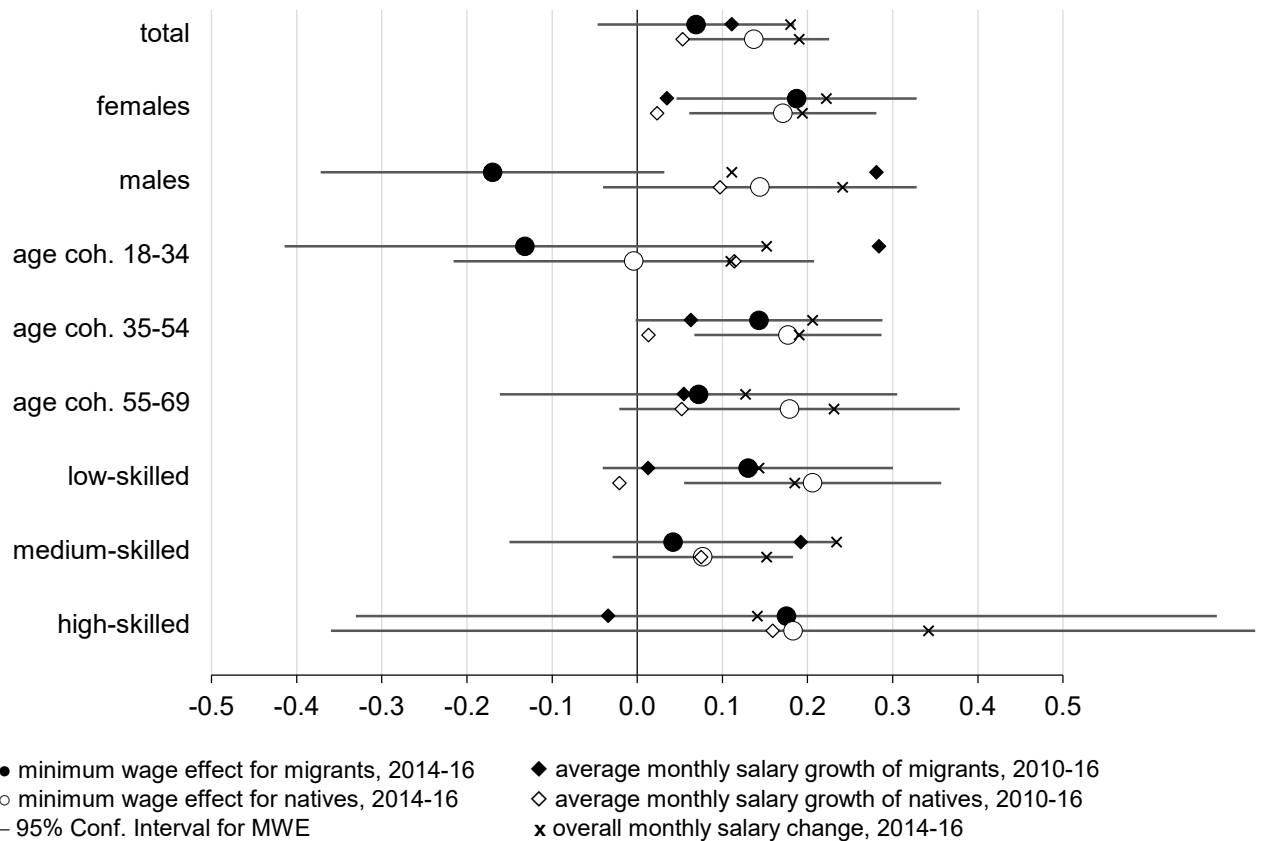
Figure 4: Minimum wage effect on monthly salary growth by migration background, 2014-2016

Notes: The dependent variable is the logarithmic change in gross monthly salary between 2014 and 2016. Treated group according to migration background, control group comprises all workers. Robust standard errors, clustered at the individual level. Detailed regression results for migrants are in Table A.11 and for natives in Table A.12 in the appendix. Self-employed, apprentices, interns, handicapped workers in sheltered workshops, and branches with industrial wage floors above the statutory minimum wage are excluded from the sample. *Source*: SOEP v36 2010-2016, own calculations.

5.4   Robustness Check: Spillover Effects

The empirical results of our main analysis show substantial effects on the hourly wage resulting from the minimum wage introduction (see Table 3 above). Nevertheless, possible spillover effects may affect the size of the estimated minimum wage effect. Burauel et al. (2020) mention that these spillover effects can occur in terms of negative spillovers, leading ta wage compression around the minimum wage threshold. However, presumably more likely are wage increases for workers just above the threshold if employers try to maintain the wage structure to a certain degree. To determine whether our control group is unaffected by the introduction of the minimum wage, we perform the following robustness check. We contrast the treated group with the peer group (€10.00-€12.00/hour) to identify potential differences in the

size of the minimum wage effect compared to the control group. Due to the substantially higher wage level of the peer group than the minimum wage, we assume their wage development to be mostly unaffected by its introduction. Under this assumption, positive differences in the effect size suggest wage spillovers from the treated group to the control group.

The wage growth of the treated group in comparison to the peer group reveals an increase of hourly wages by 14.2 ppts in the second year due to the introduction of the minimum wage (see Table A.13 in the appendix). The estimated wage effect is thus higher than in the main analysis, i.e. compared to the control group (9.3 ppts, Table 3). The calculated spillover effect is approximately 4.9 ppts (14.2 ppts – 9.3 ppts). Consequently, if there were no spillover effects on the control group, the wages of the treated group would have increased even stronger relative to the control group. Hence, the estimates of the main analysis may reflect some kind of lower bound of the true effects. Wage spillovers change the effect sizes of minimum wage introduction equally for both migrants and natives. Since we control for spillover effects on the control group, which is independent of migration background in all variants, the spillover sizes should be nearly identical with respect to migration background. A non-existing wage spillover effect on the control group would increase the estimated minimum wage effect for natives from 8.7 to 13.5 ppts and for migrants from 10.2 to 14.2 ppts. Thus, the calculated spillover effects of approximately 4.8 ppts and 4.0 ppts are close to the overall effect of 4.9 ppts (Table A.13). An additional comparison of the control group with the peer group adds further support to possible wage spillover effects, as we find small differences in effect sizes. If the control group was as unaffected by the minimum wage introduction as the peer group, the minimum wage effect between these two groups should be close to zero.

6 Elicitation of Potential Mechanisms

6.1 Development of Labour Market Participation

Without specific consideration of migrant-native differences, the related literature documents employment losses primarily in marginal employment, while employment in full-time and part-time remained almost unaffected (e.g., Bonin et al., 2018; Caliendo et al., 2018; Holtemöller and Pohle, 2019). Figure 5 illustrates the shifts in the proportions of employment status by indices presented separately for migrants and natives.[15] These descriptive patterns cannot necessarily be causally attributed to the introduction of the minimum wage, although a direct influence is obvious. As in the existing literature, we find no appreciable deviations from the previous trend with respect to the share of full-time employed persons among migrants or natives (Figure 5, tile a). Nevertheless, there is a small dip in the share of full-time employment prior to the minimum wage introduction, compensated only by natives afterwards, but not by migrants. As a result, the gap between these two groups has widened again since 2015.

The average share of part-time employment has increased steadily since the economic crisis of 2008/09, mirroring the boom of the German economy for about a decade until 2019. In the years immediately preceding the minimum wage introduction in 2015, however, part-time employment among migrants experienced a brief drop (Figure A.2). During the implementation of the minimum wage, however, there

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[15] Figure A.2 in the appendix gives an overview of yearly relative changes in the proportions of employment status. SOEP data do not allow to measure absolute changes in employment.

was a noticeably higher growth rate in part-time employment for migrants than for natives. While the curve for natives has continued to rise unabated, the rate of increase for migrants following the introduction of the minimum wage was substantial (Figure 5, tile b). Related evidence shows the largest employment effects coinciding with the minimum wage introduction in marginal employment (mini-jobs). While there has been a flattening trend in the share of marginal employment before the minimum wage introduction, shares have fallen afterwards (Figure 5, tile c), but were less pronounced for migrants (Figure A.2). Thus, the introduction of the minimum wage did not coincide with a significant shift away from precarious employment. Nevertheless, trends tend to have slowed down. Given the slightly different patterns of migrants and natives in marginal employment before the minimum wage introduction, it is difficult to determine to what extent migrants were more affected by the decline in mini-jobs. Based on the previous trend, however, it is plausible to perceive that the observed development would not have taken place without the introduction of minimum wages.

(a) Full-time employment

(b) Part-time employment

(c) Marginal employment
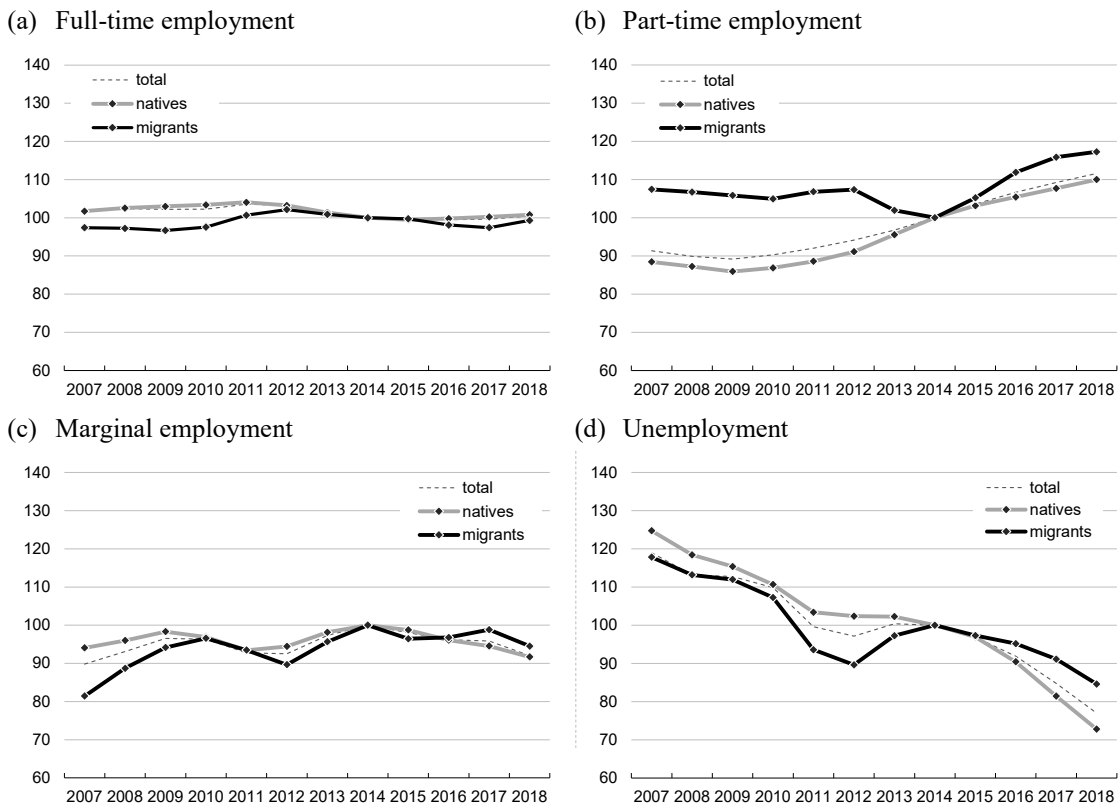
(d) Unemployment

Figure 5: Developments in employment status, 2007-2018

Notes: Index 2014=100. The index is smoothed with adjacent years. Self-employed, apprentices, interns, handicapped workers in sheltered workshops, and branches with industrial wage floors above the statutory minimum wage are excluded from the sample. *Source*: SOEP v36, 2007-2017. Own calculations incl. survey weights.

Finally, the share of unemployed persons has been steadily decreasing over the whole period in consideration (Figure 5, tile d). The drop in the unemployment share after the introduction of the minimum wage introduction, however, has not been as pronounced for migrants as it has been for natives. While the unemployment rate among natives has fallen sharply, it has declined only slightly among migrants (Figure A.2). This may be interpreted as an indication that natives have been less affected by job losses after the introduction of the minimum wage than migrants. Moreover, it supports the theoretical argument of intensified competition of the least productive (see Section 2). While part-time employment among

migrants has increased at an above-average rate, full-time employment has declined more sharply, and the rates of mini-jobs and unemployment have fallen less substantially. Given all the reported patterns, the evidence suggests a worsened labour market position of migrants relative to natives with – or even due to – the introduction of the minimum wage.

6.2   Changes in the Wage Distribution

The introduction of the minimum wage implied above-average wage increases at the lower end of the wage distribution and further wage spillover effects into higher wage cohorts (see Section 5.4). Among low-wage earners, the share of migrants is disproportionately large. Accordingly, this group of workers should have received strong increases due to the minimum wage. To allow an understanding of the likely distributional effect, Figure 6 displays the ratios between the 10th, 20th and 50th wage percentiles of migrant employees versus native employees (reference=1) for the years 2007 to 2017. The smaller the gap to the reference, the closer the wage percentiles of migrants and natives. After a considerable narrowing of the migrant-native wage gap at each of the three chosen deciles from 2007 to 2009, the wage differences in the 10th, 20th and 50th percentile between natives and migrants increased significantly from 2009 to 2014. A particularly high increase in wage divergence can be observed in 2013 and 2014. Just before the introduction of the minimum wage, the differences in the wage percentiles between migrants and natives were approximately 12 to 14 % (expressed in respective shares of 0.863 to 0.873).
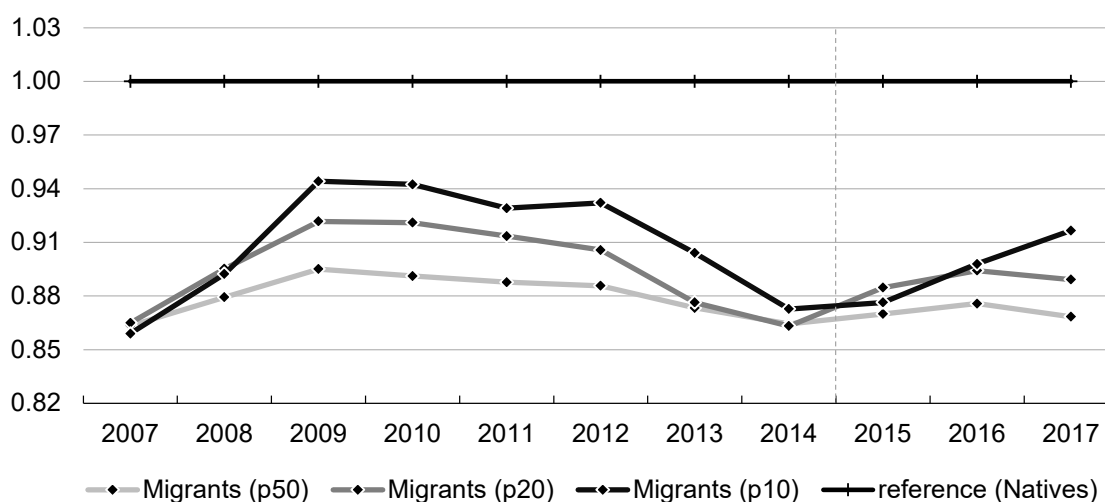
Figure 6: Wage convergence by selected wage percentiles, 2007-2017

Notes: The figure shows the ratio between the 10th, 20th and 50th wage percentiles of employees with a migration background to employees without a migration background (reference=1), 2017-2017. Wage ratios are smoothed with adjacent years. Self-employed, apprentices, interns, handicapped workers in sheltered workshops, and branches with industrial wage floors above the statutory minimum wage are excluded from the sample. *Source*: SOEP v36. Own calculations incl. survey weights.

Directly after the minimum wage introduction wages have converged across the lower wage distribution between both groups. The strongest wage convergence is observed at the 10th wage percentile, with a divergence in 2017 of only 8 % (0.917) which mirrors the estimated causal effects from Section 5.1. The 20th and 50th wage percentiles also show a reduction in differences. These differences, however, started to widen again two years after the introduction of the minimum wage. The wage divergence in 2017 between migrants and natives was 11 % (0.889) at the 20th wage percentile and 13 % (0.868) at the 50th wage

percentile. Thus, migrant-native wage inequality in 2017 was larger than in the period from 2009 to 2012 (Figure 6).
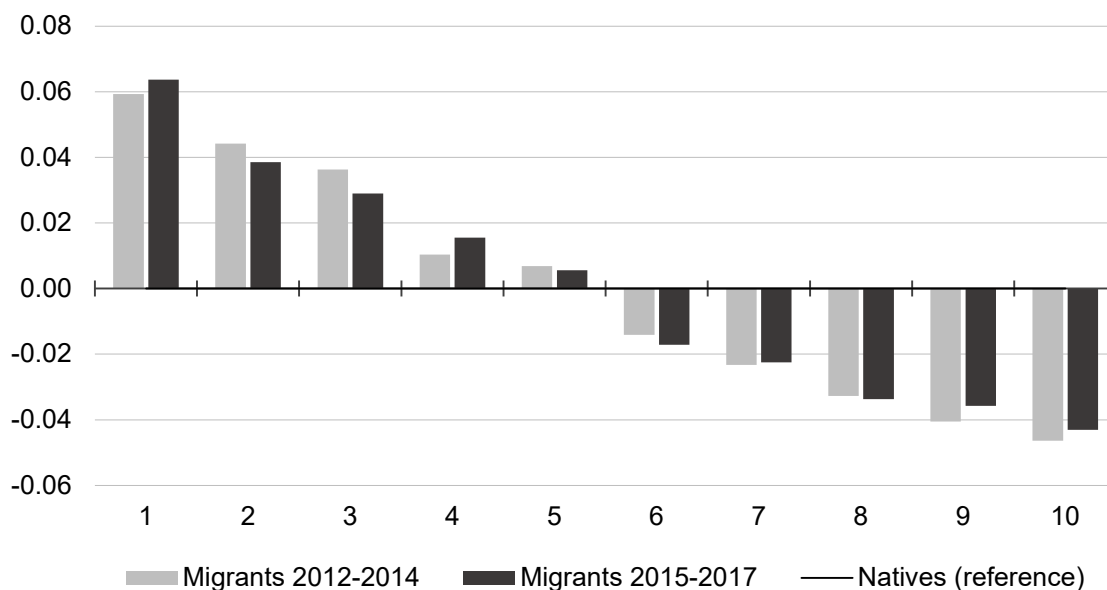
Figure 7: Deviation of migrants' wages by the wage deciles of natives

Notes: The figure shows the deviation of the proportion of employees with migration background within the wage deciles of employees without migration background, 2012-2014 and 2015-2017. Self-employed, apprentices, interns, handicapped workers in sheltered workshops, and branches with industrial wage floors above the statutory minimum wage are excluded from the sample. *Source*: SOEP v36. Own calculations incl. survey weights. Illustration based on Clark and Nolan (2021).

The changes at the lower end of the wage distribution coinciding with the introduction of the minimum wage also had an impact on the overall wage distribution. The wage distribution of migrants has partly converged towards the wage distribution of natives. Figure 7 shows the deviation of the proportion of migrants within the wage deciles of natives for the periods 2012-2014 and 2015-2017.[16] For example, a deviation of 0.05 within a wage decile means that the share of migrants is 5 ppts higher than the share of natives. The sum of all ten deviations is zero by definition. In the period 2012-2014, migrants over-proportionally fell into the first to third wage deciles of natives (+5.9 to +3.6 ppts). While both groups nearly corresponded to each other in the fourth to sixth wage decile (+1.0 to -1.4 ppts), migrants were strongly underrepresented in the seventh to tenth wage deciles (-2.3 to -4.6 ppts).

Since migrants are disproportionately overrepresented in the low-wage sector, they should have experienced more comprehensive wage increases than natives. In the period 2015-2017, however, we observe an increase in inequality in the first wage decile between natives and migrants compared to the period 2012-2014 (Figure 7). In the second and third wage deciles, the deviation between migrants and natives is mitigated but at the expense of the fourth wage decile. This finding indicates some wage compression slightly above minimum wage. Migrants remain strongly overrepresented in the lower wage deciles. Vice versa, their substantial underrepresentation in the higher wage deciles persisted (sixth to tenth), albeit with a slight decrease compared to 2012-2014 in the ninth and tenth wage decile (which does not result from the minimum wage introduction). In Figure A.3 in the appendix, we illustrate selected wage

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[16] Table A.14 in the appendix provides the underlying numbers for the figure.

ratios. It gives further hints that the introduction of the minimum wage has been accompanied by a slight wage convergence, mainly caused by wage increases in the lowest deciles.

Although not causally quantifiable, the introduction of the minimum wage led to shifts in the wage structure, thus changing the likelihood of working in the low-wage sector. We estimated linear probability models of working in the low-wage sector from 2009 to 2018 with 2014 (the year before the introduction of the minimum wage) as the reference (see Figure A.4 in the appendix). Unfortunately, the estimations lack statistical significance and should be interpreted carefully. Nevertheless, effects seem to differ for migrants and natives: For natives, the introduction of the minimum wage tended to lead to a reversal of the trend, so that with a time lag, the probability made an upward turn. Among migrants, a steady increase in the probability of working in the low-wage sector was initially observed until 2014. Immediately after the introduction of the minimum wage (2015/16), however, a significant decline in the probability becomes obvious – vice versa. Nevertheless, this potentially beneficial development is not persistent: The point estimates indicate an increase starting from 2017 onwards. A possible explanation for the negative turns for both groups could be the fact that the median wage increased more than the subsequent minimum wage raises in the first and third year (minimum wage increase) after its introduction, elevating the low-wage threshold.

7 Discussion

Our empirical analyses demonstrate that the introduction of the statutory minimum wage in Germany in 2015 led to excessive wage development of lower incomes and to shifts in employment status. For those covered by the minimum wage, we identified a large significant effect of 9.3 ppts on the hourly wages after two years of introduction compared to the control group (Table 3). Our estimated effect is thus a little higher than the findings of Dustmann et al. (2022) and Burauel et al. (2020). This difference is most likely due to a slightly different sample restriction and the use of additional control variables by Burauel et al. (2020), and the use of a different data set by Dustmann et al. (2022). Moreover, our findings reveal that there were heterogeneous effects for workers according to their ethnic background. In the two-year analysis, our preferred time horizon, the effect for migrants (10.2 ppts) exceeds those of the natives (8.7 ppts). Job cuts for lower-skilled workers may have promoted the minimum wage effect. We further observe a negative minimum wage effect among male migrants. We assume that this could be a consequence of increased job competition above the minimum wage threshold, where migrants are at a disadvantage relative to natives. According to our estimations, the probability of remaining employed directly before the minimum wage introduction is lower for migrants than for natives. This suggests potential anticipation effects in employment relationships, which have slightly affected the estimated wage growth of migrants and natives. While no effects are discernible for migrants in the third year after introduction (1.0 ppts), they continue to be considerable for natives (7.8 ppts). One possible explanation may relate to the more positive medium-term wage trend for migrants than for natives, leading to smaller minimum wage effects for the former.

Moreover, the differences in monthly salaries between these two groups have substantially widened after the introduction of the minimum wage. This is most likely caused by a deterioration in employment status and a reduction in working hours, preventing higher hourly wages from translating into higher

monthly salaries. Migrants experienced a comparatively high increase in part-time employment and, at the same time, a weaker decline in unemployment coinciding with the introduction of the minimum wage in 2015. These developments could reinforce labour market segmentation. Related to that, Butschek (2022) provides a possible explanation for why monthly salaries have fallen and unemployment rates have declined less among migrants. According to his findings, hiring standards have increased following the introduction of the minimum wage, as the "demand for a higher quality workforce" has increased. Since migrants have comparatively less competitive labour market characteristics on average, this puts them in a worse position than natives when seeking employment. In the end, (too) high minimum wages – as in Germany – then protect native workers from competition with migrants with similar qualifications (Edo and Rapoport, 2019). This can also increase the wage inequality between those groups. It may further explain why the sharp decline in the number of hours worked per week is evident among migrants but not among natives.[17]

Women and low-skilled workers benefited from this clear interaction between weekly working hours and monthly salaries through rising monthly salaries. In contrast, the introduction of the minimum wage caused a decline in average working hours and monthly salaries for men and young workers. Our descriptive before-after comparison of the wage distribution confirms a growth in inequality in the lower wage deciles coinciding with the introduction of the minimum wage. Taken together, our evidence points to a temporary wage convergence between migrants and natives of the previously perceptible wage divergence, due to or at least coinciding with the introduction of the minimum wage. Overall, the introduction of the minimum wage has helped to improve the hourly wage level of workers in the low-wage sector but partly at the cost of employment relationships – especially for migrants. The presented findings are thus consistent with those of Neumark et al. (2004) on minimum wage increases in the U.S.

Although not as pronounced, there is a trade-off between wage increases and potential employment losses. This raises doubts about the effectiveness of the minimum wage as an antipoverty tool. The overrepresented group of migrants benefited even less from the minimum wage, expressed by the smaller increase in monthly salary relative to the natives. Coinciding with the minimum wage introduction their share of full-time employment has declined slightly, while their share of part-time employment and unemployment has increased relative to natives. The minimum wage thus increased the hourly wage for migrant workers at the bottom of the wage distribution. At the same time, it seems to have reduced employment opportunities – at least for some of them.

Policy implications have to consider that all the results presented relate to the period of a booming German economy – both in terms of GDP and employment. The currently high inflation and the already started recession of the German economy, which is forecasted to persist during 2023, will further increase competition and make the situation even more difficult for the affected groups. Based on our findings, we expect that the rise in the statutory minimum wage in October 2022 will widen inequality at the cost of disadvantaged groups in the German labour market – and particularly so for migrants. Due to its substantially high increase from €9.82/hour (until June 2022) to €12.00/hour in October 2022, the minimum wage equals approximately 60 % of the median income in 2022. This is now a comparatively high level and will reduce the competitiveness of migrants relative to natives (see Edo and Rapoport, 2019). Given our findings on a much lower level of the minimum wage, we expect that negative effects for migrants will

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[17] Identified for the workforce also by Bonin et al. (2020).

be exacerbated by this sharp minimum wage increase; further aggravated by the combination with the challenging general situation of the German economy as a whole. This comprises further wage divergence and a more adverse employment trend for migrants. Our analysis shows that the minimum wage – although intended as a holistic social protection measure – does not consider vulnerable groups, such as (ethnic) minorities or migrants in particular. The intensified competitive situation can therefore lead to a reinforced allocation of workers by their productivity, which would further exacerbate labour market segregation. We therefore question whether the introduction of the "poverty-proof minimum wage" (BMAS, 2022) of €12.00 will be an effective means to help migrants and other minorities in the labour market. Answering this question empirically will be a task for future research.

8 Conclusion

We have analysed the development in wages and labour market participation of migrant and native workers in following the statutory minimum wage introduction in Germany in 2015. To the best of our knowledge, this is the first study that explicitly addresses the impact of the minimum wage introduction on migrants in Germany. We estimated the causal effect of the minimum wage introduction using a "differential trend adjusted difference-in-differences" (DTADD) approach, in which the observed wage change in the treated group is contrasted with the (counterfactual) wage change in a control group of presumably non-affected but economically similar individuals. To elicit further mechanisms and effects, we provided additional comprehensive descriptive evidence to evaluate changes in employment status and wage distribution. In combination with our causal estimates, this evidence allows to us draw a comprehensive picture of the impacts of the minimum wage on migrants.

The results of the causal effect analysis show that the introduction of the minimum wage caused different impacts on the hourly wages of natives and migrants. In the first year, the minimum wage effect for natives (9.6 %) exceeded that of migrants (8.7 %). In the second year, however, migrants in the treated group experienced considerable minimum-wage-related wage growth in the interim (10.2 %), which disappeared completely in the third year (1.0 %). Contrary to that, for natives, the effect remained high in both the second (8.7 %) and third year (7.8 %) after the introduction of the minimum. This alignment of hourly wages of migrants and natives was thus only temporary. Rising wage inequality caused by the minimum wage becomes evident from the third year after its introduction.

This widening wage inequality between migrants and natives is even more evident in terms of monthly wages. While we observe an effect-induced increase in monthly wages of 13.7 % for natives, we obtain only an insignificant effect of 6.9 % for migrants. This divergence can be attributed largely to a deterioration in migrants' employment status and a decrease in working hours. Our complementary descriptive analyses provide indications that support the comparatively worse effects on migrants identified by our causal evaluation: The share of part-time employment among migrants has risen sharply after the introduction of the minimum wage, while the share of unemployed persons has fallen less than among native workers. In addition, the trends in full-time and marginal employment indicate a less beneficial outcome for migrants, coinciding with the minimum wage. We interpret this evidence as an indication of an increased risk of labour market segmentation in Germany due to the minimum wage, emphasizing the already pertinent

labour market gaps between migrants and natives. Our evidence points to the fact that these shifts may have affected the distribution of wages. Immediately prior to the introduction of the minimum wage, we can establish a pattern of increasing divergence between migrants and natives in the lower wage deciles – at least temporally. This divergence is particularly pronounced in the 10th wage percentile, and to a smaller extent up to the 50th wage decile. Our descriptive analysis further implies a widening in the migrant-native wage gap in the first wage decile after the introduction of the minimum wage, while there is wage compression directly above the minimum wage threshold (second and third wage deciles). This descriptive finding mirrors the estimated wage spillover, affecting only parts of the wage distribution.

We emphasize that one of the main objectives of the minimum wage, the reduction of inequality, was not achieved – at least for the migrant-native inequality. Although the introduction of the minimum wage was associated with significant hourly wage increases for earners of the lowest wages in the market, migrants benefitted from this only to a limited extent. Moreover, due to reduced weekly working hours, the increased hourly wages are not reflected in monthly salaries. Given this weaker wage development and a comparatively disadvantageous change in employment status, it is reasonable to suggest a decline in the labour market position of migrants after the minimum wage introduction of €8.50. Based on our evidence, we expect the minimum wage increase up to €12.00 in October 2022 – in combination with the current and prospective recession – to further aggravate the situation for disadvantaged groups, especially so for migrants. The substantial minimum wage increase will intensify competition between migrants and natives in Germany. Consequently, wages and employment between migrants and natives at the lower end of the wage distribution will presumably further diverge – at the cost of migrants.

Acknowledgements

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Appendix

Tables

Table A.1: Workers' mean characteristics by gender and migration background 2012-2014

Characteristics of workers	Mig.BG Migrants	Natives	Gender Males	Females	Males Migrants	Natives	Females Migrants	Natives	Total
labour force participation	0.73	0.75 ***	0.80	0.70 ***	0.80	0.80	0.65	0.71 ***	0.75
… employed	0.64	0.70 ***	0.73	0.64 ***	0.70	0.74 ***	0.57	0.66 ***	0.69
… registered unemployed	0.09	0.05 ***	0.07	0.06 ***	0.10	0.06 ***	0.08	0.05 ***	0.06
Salary									
gross hourly wage	15.54	17.83 ***	19.40	15.25 ***	17.23	19.97 ***	13.43	15.64 ***	17.39
Std. Dev.	8.82	10.65 –	11.17	8.93 –	9.57	11.49 –	7.25	9.21 –	10.36
p10	7.07	8.05 –	8.96	7.05 –	8.21	9.20 –	6.47	7.30 –	7.82
p50	13.79	15.80 –	17.24	13.79 –	14.94	17.91 –	11.94	14.08 –	15.33
gross monthly salary	2,277.32	2,712.54 ***	3,225.29	1,991.14 ***	2,827.76	3,327.70 ***	1,605.67	2,075.42 ***	2,628.73
Employment									
working hours (contractual)	33.24	34.43 ***	37.85	30.31 ***	37.72	37.89	27.62	30.89 ***	34.20
full-time employment	0.68	0.70 ***	0.88	0.50 ***	0.88	0.88	0.43	0.51 ***	0.70
part-time employment	0.19	0.21 ***	0.06	0.36 ***	0.06	0.06	0.35	0.36	0.20
marginal employment	0.13	0.08 ***	0.05	0.13 ***	0.06	0.05 ***	0.21	0.11 ***	0.09
Qualification									
low-skilled	0.41	0.24 ***	0.31	0.24 ***	0.47	0.27 ***	0.35	0.22 ***	0.28
medium-skilled	0.34	0.49 ***	0.41	0.51 ***	0.29	0.44 ***	0.39	0.53 ***	0.46
high-skilled	0.25	0.27 ***	0.28	0.25 ***	0.24	0.29 ***	0.26	0.25	0.27
labour market experience	14.40	18.89 ***	20.12	15.80 ***	16.38	21.08 ***	11.99	16.63 ***	18.03
job tenure	7.48	12.05 ***	12.06	10.20 ***	8.11	13.10 ***	6.71	10.96 ***	11.16
Company									
firm size: <20 empl.	0.24	0.20 ***	0.15	0.27 ***	0.19	0.14 ***	0.30	0.26 ***	0.21
firm size: 20-199 empl.	0.26	0.26	0.27	0.25 ***	0.26	0.27	0.25	0.26	0.26
firm size: 199-1999 empl.	0.21	0.22 ***	0.24	0.20 ***	0.23	0.24	0.18	0.20 ***	0.22
firm size: >2000 empl.	0.28	0.29 ***	0.32	0.25 ***	0.30	0.33 ***	0.24	0.25 **	0.29
Personal information									
Age	39.70	44.17 ***	43.59	43.01 ***	39.95	44.53 ***	39.38	43.80 ***	43.31
gender (male=1)	0.55	0.51 ***	-	-	-	-	-	-	0.52
No. of obs. (employed)	**8,048**	**26,786**	**16,522**	**18,312**	**4,240**	**12,282**	**3,808**	**14,504**	**34,834**

Notes: Self-employed, apprentices, interns, handicapped workers in sheltered workshops, and branches with industrial wage floors above the statutory minimum wage are excluded from the sample. *Source*: SOEP v36 2008-2017, own calculations incl. survey weights. Significance levels: * p<0.1, ** p<0.05, *** p<0.01.

Table A.2: Minimum wage effect on hourly wage growth – different model specifications

	Dependent variable: Logarithmic change in gross hourly wage								
	One-Year Analysis			Two-Year Analysis			Three-Year Analysis		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
One-Year Analysis									
Hourly wage < €8.50	0.021**	0.023**	0.025**						
$[T_{it}]$	(0.010)	(0.010)	(0.010)						
× DTADD 2014-2015	0.102***	0.101***	0.093***						
$[T_{it} \times Y_{it}]$	(0.020)	(0.020)	(0.020)						
× Placebo 2012-2013	-0.046**	-0.047**	-0.048**						
$[T_{it} \times Y_{it-k}]$	(0.021)	(0.021)	(0.022)						
Two-Year Analysis									
Hourly wage < €8.50				0.043***	0.044***	0.040***			
$[T_{it}]$				(0.012)	(0.013)	(0.013)			
× DTADD 2014-2016				0.093***	0.091***	0.094***			
$[T_{it} \times Y_{it}]$				(0.022)	(0.022)	(0.022)			
× Placebo 2010-2012				-0.050	-0.048	-0.045			
$[T_{it} \times Y_{it-k}]$				(0.031)	(0.031)	(0.032)			
Three-Year Analysis									
Hourly wage < €8.50							0.059***	0.057***	0.056***
$[T_{it}]$							(0.013)	(0.014)	(0.015)
× DTADD 2014-2017							0.081***	0.079***	0.066**
$[T_{it} \times Y_{it}]$							(0.026)	(0.026)	(0.026)
× Placebo 2008-2011							-0.095*	-0.091**	-0.087**
$[T_{it} \times Y_{it-k}]$							(0.035)	(0.035)	(0.037)
Control Variables									
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
Socio-demographic info.		yes	yes		yes	yes		yes	yes
Job characteristics			yes			yes			yes
Constant	0.022*	0.065***	0.063**	0.035*	0.118***	0.099**	0.039*	0.162***	0.171***
	(0.012)	(0.023)	(0.031)	(0.018)	(0.029)	(0.038)	(0.021)	(0.037)	(0.049)
Observations	2,206	2,199	2,106	2,507	2,498	2,387	2,590	2,581	2,450
Obs. treated group	684	681	670	836	832	814	876	872	847
Obs. control group	1,522	1,518	1,436	1,671	1,666	1,573	1,714	1,709	1,603
Adj. R^2	0.080	0.083	0.078	0.110	0.120	0.115	0.116	0.130	0.134

Notes: The table shows the effect of the minimum wage introduction on the change in gross hourly wages. Self-employed, apprentices, interns, handicapped workers in sheltered workshops, and branches with industrial wage floors above the statutory minimum wage are excluded from the sample. *Source*: SOEP v36 2008-2017, own calculations. Robust standard errors, clustered at the individual level. Standard errors in parentheses. Significance levels: * p<0.1, ** p<0.05, *** p<0.01.

Table A.3: Minimum wage effects separate by migrants with a direct and an indirect migration background

	Gross hourly wage			Weekly working hours			Gross monthly salary		
	All Migrants	**Direct Mig.BG**	**Indirect Mig.BG**	**All Migrants**	**Direct Mig.BG**	**Indirect Mig.BG**	**All Migrants**	**Direct Mig.BG**	**Indirect Mig.BG**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Two-Year Analysis									
Hourly wage < €8.50[1]	0.044	0.044	0.075	0.072**	0.073*	0.105*	0.111***	0.069	0.301***
$[T_{it}]$	(0.028)	(0.030)	(0.063)	(0.036)	(0.043)	(0.056)	(0.041)	(0.046)	(0.070)
$\times$ DTADD 2014-2016	0.102***	0.093**	0.125	-0.070	-0.085	-0.001	0.069	0.097	-0.019
$[T_{it} \times Y_{it}]$	(0.038)	(0.042)	(0.076)	(0.045)	(0.052)	(0.079)	(0.059)	(0.063)	(0.127)
$\times$ Placebo 2010-2012	-0.095	-0.053	-0.278***	-0.119	-0.104	-0.180	-0.304**	-0.206	-0.718***
$[T_{it} \times Y_{it-k}]$	(0.100)	(0.119)	(0.090)	(0.111)	(0.135)	(0.156)	(0.152)	(0.173)	(0.173)
Control Variables									
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
Socio-demographic info.	yes	yes	yes	yes	yes	yes	yes	yes	yes
Job characteristics	yes	yes	yes	yes	yes	yes	yes	yes	yes
Constant	0.112**	0.138***	0.090*	0.227***	0.183**	0.169**	0.344***	0.262***	0.294***
	(0.051)	(0.049)	(0.049)	(0.083)	(0.085)	(0.067)	(0.106)	(0.099)	(0.101)
Observations	1,155	1,085	884	1,188	1,109	901	1,246	1,165	932
Obs. treated group	341	271	70	366	287	79	395	314	81
Obs. control group	814	814	814	822	822	822	851	851	851
Adj. R^2	0.085	0.089	0.065	0.049	0.048	0.052	0.058	0.042	0.090

Notes: The table shows the effect of the minimum wage introduction on the change in gross hourly wages, weekly working hours, and monthly salaries. Self-employed, apprentices, interns, handicapped workers in sheltered workshops, and branches with industrial wage floors, and branches in a transition period are excluded from the sample. 1) Treated group (<€8.50/hour): (1),(4),(7) with migration background, (2),(5),(8) with direct migration background, (3),(6),(9) with indirect migration background. Control group (€8.50-€10.00/hour): (1)-(9) all workers. *Source*: SOEP v36 2008-2017, own calculations. Robust standard errors, clustered at the individual level. Standard errors in parentheses. Significance levels: * p<0.1, ** p<0.05, *** p<0.01.

Table A.4: Minimum wage effect on hourly wage growth of migrants, Two-Year Analysis

Migrants	Dependent variable: Logarithmic change in gross hourly wage								
	(1) Total	(2) Females	(3) Males	(4) Age coh. 18-34 y.	(5) Age coh. 35-54 y.	(6) Age coh. 55-69 y.	(7) Low- skilled	(8) Medium -skilled	(9) High- skilled
Two-Year Analysis									
Hourly wage <€8.50[1]	0.044	0.014	0.113**	0.020	0.061*	0.011	0.010	0.094*	-0.029
$[T_{it}]$	(0.028)	(0.033)	(0.056)	(0.068)	(0.035)	(0.066)	(0.038)	(0.050)	(0.110)
× DTADD 2014-2016	0.102***	0.145***	-0.017	0.066	0.102**	0.122	0.108**	0.080	0.144
$[T_{it} \times Y_{it}]$	(0.038)	(0.047)	(0.064)	(0.102)	(0.045)	(0.085)	(0.051)	(0.071)	(0.146)
× Placebo 2010-2012	-0.095	-0.102	0.103	0.000	-0.142	-0.117	-0.028	-0.142*	-0.789***
$[T_{it} \times Y_{it-k}]$	(0.100)	(0.112)	(0.065)	(.)	(0.092)	(0.233)	(0.149)	(0.085)	(0.206)
Constant	0.112**	0.073	0.192**	0.084	0.211**	-0.199	0.158*	0.084	0.380
	(0.051)	(0.064)	(0.087)	(0.170)	(0.097)	(0.393)	(0.081)	(0.072)	(0.319)
Observations	1,155	770	385	215	715	225	495	572	88
Obs. treated group	814	770	385	215	715	225	495	572	57
Obs. control group	341	259	82	75	204	62	187	123	31
Adj. R²	0.085	0.079	0.114	0.116	0.090	0.077	0.079	0.097	0.200

Notes: The table shows the effect of the minimum wage introduction on the change in gross hourly wages of migrants (Two-Year Analysis). Self-employed, apprentices, interns, handicapped workers in sheltered workshops, and branches with industrial wage floors above the statutory minimum wage are excluded from the sample. 1) Treated group (<€8.50/hour): with migration background. Control group (€8.50-€10.00/hour): all workers. *Source*: SOEP v36 2010-2016, own calculations. Robust standard errors, clustered at the individual level. Standard errors in parentheses. Significance levels: * p<0.1, ** p<0.05, *** p<0.01.

Table A.5: Minimum wage effect on hourly wage growth of natives, Two-Year Analysis

Natives	Dependent variable: Logarithmic change in gross hourly wage								
	(1) Total	(2) Females	(3) Males	(4) Age coh. 18-34 y.	(5) Age coh. 35-54 y.	(6) Age coh. 55-69 y.	(7) Low- skilled	(8) Medium -skilled	(9) High- skilled
Two-Year Analysis									
Hourly wage <€8.50	0.039***	0.030*	0.059**	0.037	0.033*	0.054	0.022	0.043***	0.101
$[T_{it}]$	(0.014)	(0.015)	(0.030)	(0.030)	(0.018)	(0.035)	(0.027)	(0.016)	(0.069)
× DTADD 2014-2016	0.087***	0.089***	0.077*	-0.008	0.126***	0.062	0.055	0.092***	0.040
$[T_{it} \times Y_{it}]$	(0.024)	(0.030)	(0.045)	(0.058)	(0.029)	(0.062)	(0.046)	(0.029)	(0.125)
× Placebo 2010-2012	-0.042	-0.039	-0.020	-0.173	0.002	-0.087	-0.029	-0.055	-0.034
$[T_{it} \times Y_{it-k}]$	(0.033)	(0.038)	(0.066)	(0.139)	(0.041)	(0.064)	(0.067)	(0.039)	(0.139)
Constant	0.093**	0.059	0.170**	0.031	0.142**	-0.012	0.132**	0.112**	-0.337*
	(0.037)	(0.041)	(0.070)	(0.134)	(0.064)	(0.220)	(0.061)	(0.049)	(0.174)
Observations	2,046	1,518	528	384	1,198	459	687	1,220	139
Obs. treated group	814	511	303	140	511	163	308	449	57
Obs. control group	1,232	1,007	225	244	687	296	379	771	82
Adj. R²	0.112	0.112	0.100	0.084	0.107	0.097	0.092	0.132	0.121

Notes: The table shows the effect of the minimum wage introduction on the change in gross hourly wages of natives (Two-Year Analysis). Self-employed, apprentices, interns, handicapped workers in sheltered workshops, and branches with industrial wage floors above the statutory minimum wage are excluded from the sample. 1) Treated group (<€8.50/hour): without migration background. Control group (€8.50-€10.00/hour): all workers. *Source*: SOEP v36 2010-2016, own calculations. Robust standard errors, clustered at the individual level. Standard errors in parentheses. Significance levels: * p<0.1, ** p<0.05, *** p<0.01.

Table A.6: Minimum wage effect on hourly wage growth without branches in a transition period

	Dependent variable: Logarithmic change in gross hourly wage								
	One-Year Analysis			Two-Year Analysis			Three-Year Analysis		
	Total	**Migrants**	**Natives**	**Total**	**Migrants**	**Natives**	**Total**	**Migrants**	**Natives**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
One-Year Analysis									
Hourly wage < €8.50[1]	0.025**	0.040***	0.056***						
$[T_{it}]$	(0.010)	(0.013)	(0.015)						
× DTADD 2014-2015[2]	0.093***	0.096***	0.072***						
$[T_{it} \times Y_{it}]$	(0.021)	(0.023)	(0.026)						
× Placebo 2012-2013[2]	-0.048*	-0.053	-0.044*						
$[T_{it} \times Y_{it-k}]$	(0.022)	(0.048)	(0.023)						
Two-Year Analysis									
Hourly wage < €8.50[1]				0.027	0.044	0.094***			
$[T_{it}]$				(0.018)	(0.028)	(0.029)			
× DTADD 2014-2016[2]				0.087***	0.105***	0.029			
$[T_{it} \times Y_{it}]$				(0.034)	(0.038)	(0.050)			
× Placebo 2010-2012[2]				-0.045	-0.096	-0.042			
$[T_{it} \times Y_{it-k}]$				(0.032)	(0.100)	(0.033)			
Three-Year Analysis									
Hourly wage < €8.50[1]							0.019	0.039***	0.050***
$[T_{it}]$							(0.012)	(0.014)	(0.016)
× DTADD 2014-2017[2]							0.097***	0.094***	0.079***
$[T_{it} \times Y_{it}]$							(0.024)	(0.025)	(0.027)
× Placebo 2008-2011[2]							-0.088**	-0.161	-0.083**
$[T_{it} \times Y_{it-k}]$							(0.037)	(0.214)	(0.037)
Control Variables									
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
Socio-demographic info.	yes	yes	yes	yes	yes	yes	yes	yes	yes
Job characteristics	yes	yes	yes	yes	yes	yes	yes	yes	yes
Constant	0.068**	0.097**	0.055*	0.080*	0.110**	0.087**	0.171***	0.159***	0.213***
	(0.030)	(0.040)	(0.030)	(0.038)	(0.051)	(0.037)	(0.048)	(0.055)	(0.050)
Observations	2,065	1,049	1,675	2,352	1,141	2,015	2,422	1,127	2,133
Obs. treated group	659	659	659	804	804	804	838	838	838
Obs. control group	1,406	390	1,016	1,548	337	1,211	1,584	289	1,295
Adj. R²	0.079	0.056	0.080	0.114	0.085	0.112	0.136	0.131	0.141

Notes: The table shows the effect of the minimum wage introduction on the change in gross hourly wages. Self-employed, apprentices, interns, handicapped workers in sheltered workshops, and branches with industrial wage floors, and branches in a transition period are excluded from the sample. 1) Treated group (<€8.50/hour): (1),(4),(7) all workers, (2),(5),(8) with migration background, (3),(6),(9) without migration background. Control group (€8.50-€10.00/hour): (1)-(9) all workers. 2) DTADD and placebo are the respective different interaction terms, depending on the treated group. *Source*: SOEP v36 2008-2017, own calculations. Robust standard errors, clustered at the individual level. Standard errors in parentheses. Significance levels: * p<0.1, ** p<0.05, *** p<0.01.

Table A.7: Minimum wage effect on the growth of weekly working hours by migration background

	One-Year Analysis			Two-Year Analysis			Three-Year Analysis		
	Dependent variable: Logarithmic change in weekly working hours								
	One-Year Analysis			Two-Year Analysis			Three-Year Analysis		
	Total	**Migrants**	**Natives**	**Total**	**Migrants**	**Natives**	**Total**	**Migrants**	**Natives**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
One-Year Analysis									
Hourly wage < €8.50[1]	0.032**	0.053**	0.026						
$[T_{it}]$	(0.016)	(0.024)	(0.020)						
× DTADD 2014-2015[2]	-0.033	-0.045	-0.028						
$[T_{it} \times Y_{it}]$	(0.027)	(0.042)	(0.031)						
× Placebo 2012-2013[2]	-0.025	-0.103**	-0.008						
$[T_{it} \times Y_{it-k}]$	(0.027)	(0.048)	(0.031)						
Two-Year Analysis									
Hourly wage < €8.50[1]				0.039**	0.072**	0.031*			
$[T_{it}]$				(0.018)	(0.036)	(0.019)			
× DTADD 2014-2016[2]				-0.056*	-0.070	-0.057*			
$[T_{it} \times Y_{it}]$				(0.030)	(0.045)	(0.034)			
× Placebo 2010-2012[2]				-0.055	-0.119	-0.047			
$[T_{it} \times Y_{it-k}]$				(0.045)	(0.111)	(0.047)			
Three-Year Analysis									
Hourly wage < €8.50[1]							0.023	0.059	0.016
$[T_{it}]$							(0.021)	(0.038)	(0.022)
× DTADD 2014-2017[2]							-0.029	-0.042	-0.031
$[T_{it} \times Y_{it}]$							(0.036)	(0.055)	(0.039)
× Placebo 2008-2011[2]							-0.071	-0.085	-0.061
$[T_{it} \times Y_{it-k}]$							(0.057)	(0.063)	(0.058)
Control Variables									
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
Socio-demographic info.	yes	yes	yes	yes	yes	yes	yes	yes	yes
Job characteristics	yes	yes	yes	yes	yes	yes	yes	yes	yes
Constant	0.150***	0.142***	0.130***	0.296***	0.227***	0.262***	0.320***	0.293***	0.292***
	(0.042)	(0.053)	(0.044)	(0.064)	(0.083)	(0.062)	(0.075)	(0.091)	(0.080)
Observations	2,180	1,095	1,760	2,506	1,188	2,140	2,576	1,174	2,260
Obs. treated group	1,505	420	1,085	1,684	366	1,318	1,718	316	1,402
Obs. control group	675	675	675	822	822	822	858	858	858
Adj. R[2]	0.022	0.038	0.013	0.042	0.049	0.036	0.045	0.061	0.040

Notes: The table shows the effect of the minimum wage introduction on the change in weekly working hours. Self-employed, apprentices, interns, handicapped workers in sheltered workshops, and branches with industrial wage floors above the statutory minimum wage are excluded from the sample. 1) Treated group (<€8.50/hour): (1),(4),(7) all workers, (2),(5),(8) with migration background, (3),(6),(9) without migration background. Control group (€8.50-€10.00/hour): (1)-(9) all workers. *Source*: SOEP v36 2008-2017, own calculations. Robust standard errors, clustered at the individual level. Standard errors in parentheses. Significance levels: * p<0.1, ** p<0.05, *** p<0.01.

Table A.8: Minimum wage effect on the growth of weekly working hours of migrants, Two-Year Analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
				Dependent variable: Logarithmic change in weekly working hours					
Migrants	**Total**	**Females**	**Males**	**Age coh. 18-34 y.**	**Age coh. 35-54 y.**	**Age coh. 55-69 y.**	**Low-skilled**	**Medium-skilled**	**High-skilled**
Two-Year Analysis									
Hourly wage <€8.50[1]	0.072**	0.058	0.102	0.301***	-0.030	0.133*	0.072	0.079	0.135
$[T_{it}]$	(0.036)	(0.037)	(0.083)	(0.104)	(0.040)	(0.072)	(0.052)	(0.053)	(0.118)
✕ DTADD 2014-2016	-0.070	-0.019	-0.188*	-0.199	0.000	-0.148*	-0.082	-0.058	0.248
$[T_{it} \times Y_{it}]$	(0.045)	(0.052)	(0.105)	(0.128)	(0.053)	(0.084)	(0.076)	(0.055)	(0.189)
✕ Placebo 2010-2012	-0.119	-0.145	0.034	0.000	-0.022	-0.021	-0.116	0.006	-1.213***
$[T_{it} \times Y_{it-k}]$	(0.111)	(0.130)	(0.184)	(.)	(0.128)	(0.191)	(0.165)	(0.146)	(0.218)
Constant	0.227***	0.187**	0.244*	0.400	0.200	0.289	0.443***	0.041	0.156
	(0.083)	(0.093)	(0.126)	(0.276)	(0.150)	(0.440)	(0.150)	(0.095)	(0.583)
Observations	1,188	790	398	231	729	228	514	581	93
Obs. treated group	822	516	306	144	515	163	213	453	57
Obs. control group	366	274	92	87	214	65	202	128	36
Adj. R^2	0.049	0.034	0.078	0.097	0.056	0.025	0.087	0.034	0.141

Notes: The table shows the effect of the minimum wage introduction on the change in weekly working hours of migrants (Two-Year Analysis). Self-employed, apprentices, interns, handicapped workers in sheltered workshops, and branches with industrial wage floors above the statutory minimum wage are excluded from the sample. 1) Treated group (<€8.50/hour): with migration background. Control group (€8.50-€10.00/hour): all workers. *Source*: SOEP v36 2010-2016, own calculations. Robust standard errors, clustered at the individual level. Standard errors in parentheses. Significance levels: * p<0.1, ** p<0.05, *** p<0.01.

Table A.9: Minimum wage effect on the growth of weekly working hours of natives, Two-Year Analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
				Dependent variable: Logarithmic change in weekly working hours					
Natives	**Total**	**Females**	**Males**	**Age coh. 18-34 y.**	**Age coh. 35-54 y.**	**Age coh. 55-69 y.**	**Low-skilled**	**Medium-skilled**	**High-skilled**
Two-Year Analysis									
Hourly wage <€8.50	0.031*	0.037	0.025	0.098*	0.024	-0.026	0.010	0.033	0.090
$[T_{it}]$	(0.019)	(0.023)	(0.037)	(0.054)	(0.024)	(0.043)	(0.031)	(0.026)	(0.074)
✕ DTADD 2014-2016	-0.057*	-0.002	-0.169**	-0.122	-0.061	0.009	-0.051	-0.070*	0.039
$[T_{it} \times Y_{it}]$	(0.034)	(0.041)	(0.078)	(0.076)	(0.040)	(0.086)	(0.065)	(0.040)	(0.156)
✕ Placebo 2010-2012	-0.047	-0.060	-0.032	-0.289*	-0.076	0.070	-0.008	-0.044	-0.214
$[T_{it} \times Y_{it-k}]$	(0.047)	(0.057)	(0.127)	(0.173)	(0.062)	(0.063)	(0.090)	(0.055)	(0.167)
Constant	0.262***	0.311***	0.121	0.696***	0.227***	0.628	0.356***	0.172**	0.412
	(0.062)	(0.083)	(0.086)	(0.242)	(0.087)	(0.447)	(0.110)	(0.076)	(0.249)
Observations	2,140	1,581	559	414	1,252	469	731	1,265	144
Obs. treated group	822	516	306	144	515	163	312	453	57
Obs. control group	1,318	1,065	253	270	737	306	419	812	87
Adj. R^2	0.036	0.036	0.024	0.067	0.040	0.049	0.050	0.031	0.140

Notes: The table shows the effect of the minimum wage introduction on the change in weekly working hours of natives (Two-Year Analysis). Self-employed, apprentices, interns, handicapped workers in sheltered workshops, and branches with industrial wage floors above the statutory minimum wage are excluded from the sample. 1) Treated group (<€8.50/hour): without migration background. Control group (€8.50-€10.00/hour): all workers. *Source*: SOEP v36 2010-2016, own calculations. Robust standard errors, clustered at the individual level. Standard errors in parentheses. Significance levels: * p<0.1, ** p<0.05, *** p<0.01.

Table A.10: Minimum wage effect on monthly salary growth by migration background

| | One-Year Analysis | | | Two-Year Analysis | | | Three-Year Analysis | | |
	Total	Migrants	Natives	Total	Migrants	Natives	Total	Migrants	Natives
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
One-Year Analysis									
Hourly wage < €8.50[1]	0.047**	0.075	0.036						
$[T_{it}]$	(0.019)	(0.028)	(0.023)						
× DTADD 2014-2015[2]	0.096***	0.043	0.122***						
$[T_{it} \times Y_{it}]$	(0.035)	(0.056)	(0.041)						
× Placebo 2012-2013[2]	-0.084**	-0.115*	-0.072*						
$[T_{it} \times Y_{it-k}]$	(0.036)	(0.068)	(0.040)						
Two-Year Analysis									
Hourly wage < €8.50[1]				0.064***	0.111***	0.053**			
$[T_{it}]$				(0.024)	(0.041)	(0.025)			
× DTADD 2014-2016[2]				0.127***	0.069	0.137***			
$[T_{it} \times Y_{it}]$				(0.041)	(0.059)	(0.045)			
× Placebo 2010-2012[2]				-0.103*	-0.304**	-0.084			
$[T_{it} \times Y_{it-k}]$				(0.057)	(0.152)	(0.059)			
Three-Year Analysis									
Hourly wage < €8.50[1]							0.091***	0.144***	0.086***
$[T_{it}]$							(0.027)	(0.046)	(0.029)
× DTADD 2014-2017[2]							0.095*	-0.038	0.127**
$[T_{it} \times Y_{it}]$							(0.049)	(0.080)	(0.052)
× Placebo 2008-2011[2]							-0.174**	-0.492**	-0.148**
$[T_{it} \times Y_{it-k}]$							(0.069)	(0.246)	(0.069)
Control Variables									
Year fixed effects $[\alpha_t]$	yes	yes	yes	yes	yes	yes	yes	yes	yes
Socio-demographic info. $[X_{it}]$	yes	yes	yes	yes	yes	yes	yes	yes	yes
Job characteristics $[Z_{it}]$	yes	yes	yes	yes	yes	yes	yes	yes	yes
Constant	0.230***	0.266***	0.161***	0.348***	0.344***	0.300***	0.434***	0.515***	0.413***
	(0.055)	(0.080)	(0.053)	(0.075)	(0.106)	(0.074)	(0.086)	(0.107)	(0.092)
Observations	2,240	1,124	1,798	2,647	1,246	2,252	2,770	1,250	2,425
Obs. treated group	1,588	422	1,116	1,796	395	1,401	1,865	345	1,520
Obs. control group	682	682	682	851	851	851	905	905	905
Adj. R^2	0.037	0.030	0.037	0.057	0.058	0.052	0.081	0.095	0.079

Notes: The table shows the effect of the minimum wage introduction on the change in gross monthly salary. Self-employed, apprentices, interns, handicapped workers in sheltered workshops, and branches with industrial wage floors above the statutory minimum wage are excluded from the sample. 1) Treated group (<€8.50/hour): (1),(4),(7) all workers, (2),(5),(8) with migration background, (3),(6),(9) without migration background. Control group (€8.50-€10.00/hour): (1)-(9) all workers. *Source*: SOEP v36 2008-2017, own calculations. Robust standard errors, clustered at the individual level. Standard errors in parentheses. Significance levels: * p<0.1, ** p<0.05, *** p<0.01.

Table A.11: Minimum wage effect on monthly salary growth of migrants, Two-Year Analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
				Dependent variable: Logarithmic change in gross monthly salary					
Migrants	**Total**	**Females**	**Males**	**Age coh. 18-34 y.**	**Age coh. 35-54 y.**	**Age coh. 55-69 y.**	**Low-skilled**	**Medium-skilled**	**High-skilled**
Two-Year Analysis									
Hourly wage <€8.50[1] $[T_{it}]$	0.111*** (0.041)	0.035 (0.044)	0.281*** (0.094)	0.284*** (0.104)	0.063 (0.051)	0.055 (0.104)	0.013 (0.053)	0.192*** (0.066)	-0.034 (0.117)
× DTADD 2014-2016 $[T_{it} \times Y_{it}]$	0.069 (0.059)	0.187*** (0.072)	-0.170 (0.103)	-0.132 (0.144)	0.143* (0.074)	0.072 (0.119)	0.130 (0.087)	0.042 (0.098)	0.175 (0.258)
× Placebo 2010-2012 $[T_{it} \times Y_{it-k}]$	-0.304** (0.152)	-0.244* (0.145)	-0.430 (0.567)	0.000 (.)	-0.355 (0.220)	-0.053 (0.146)	-0.216 (0.209)	-0.180 (0.185)	-1.960*** (0.301)
Constant	0.344*** (0.106)	0.288*** (0.107)	0.428** (0.174)	0.614* (0.329)	0.331* (0.189)	0.334 (0.495)	0.700*** (0.192)	0.061 (0.131)	0.822 (0.535)
Observations	1,246	821	425	246	755	245	541	608	97
Obs. treated group	851	531	321	148	531	172	321	472	58
Obs. control group	395	290	105	98	224	73	220	136	39
Adj. R²	0.058	0.039	0.109	0.029	0.048	0.051	0.097	0.057	0.285

Notes: The table shows the effect of the minimum wage introduction on the change in gross monthly salary of migrants (Two-Year Analysis). Self-employed, apprentices, interns, handicapped workers in sheltered workshops, and branches with industrial wage floors above the statutory minimum wage are excluded from the sample. 1) Treated group (<€8.50/hour): with migration background. Control group (€8.50-€10.00/hour): all workers. *Source*: SOEP v36 2010-2016, own calculations. Robust standard errors, clustered at the individual level. Standard errors in parentheses. Significance levels: * p<0.1, ** p<0.05, *** p<0.01.

Table A.12: Minimum wage effect on monthly salary growth of natives, Two-Year Analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
				Dependent variable: Logarithmic change in gross monthly salary					
Natives	**Total**	**Females**	**Males**	**Age coh. 18-34 y.**	**Age coh. 35-54 y.**	**Age coh. 55-69 y.**	**Low-skilled**	**Medium-skilled**	**High-skilled**
Two-Year Analysis									
Hourly wage <€8.50[1] $[T_{it}]$	0.053** (0.025)	0.023 (0.029)	0.097** (0.049)	0.114 (0.074)	0.013 (0.034)	0.052 (0.048)	-0.021 (0.044)	0.075** (0.032)	0.159 (0.118)
× DTADD 2014-2016 $[T_{it} \times Y_{it}]$	0.137*** (0.045)	0.171*** (0.056)	0.144 (0.094)	-0.004 (0.108)	0.177*** (0.056)	0.179* (0.102)	0.206*** (0.077)	0.077 (0.054)	0.183 (0.277)
× Placebo 2010-2012 $[T_{it} \times Y_{it-k}]$	-0.084 (0.059)	-0.098 (0.072)	-0.014 (0.122)	-0.335 (0.225)	-0.074 (0.076)	-0.025 (0.081)	-0.015 (0.107)	-0.111 (0.076)	-0.205 (0.253)
Constant	0.300*** (0.074)	0.348*** (0.095)	0.232** (0.116)	0.357 (0.280)	0.290** (0.119)	0.395 (0.484)	0.420*** (0.119)	0.241** (0.099)	0.274 (0.372)
Observations	2,252	1,662	590	431	1,315	500	770	1,327	155
Obs. treated group	851	531	320	148	531	172	321	472	58
Obs. control group	1,401	1,131	270	283	784	328	449	855	97
Adj. R²	0.052	0.041	0.127	0.096	0.027	0.099	0.058	0.047	0.053

Notes: The table shows the effect of the minimum wage introduction on the change in gross monthly salary of natives (Two-Year Analysis). Self-employed, apprentices, interns, handicapped workers in sheltered workshops, and branches with industrial wage floors above the statutory minimum wage are excluded from the sample. 1) Treated group (<€8.50/hour): without migration background. Control group (€8.50-€10.00/hour): all workers. *Source*: SOEP v36 2010-2016, own calculations. Robust standard errors, clustered at the individual level. Standard errors in parentheses. Significance levels: * p<0.1, ** p<0.05, *** p<0.01.

Table A.13: Minimum wage effect on hourly wage growth relating to the peer group

	Dependent variable: Logarithmic change in gross hourly wage								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Total	**Females**	**Males**	**Migrants**	**Female migrants**	**Male Migrants**	**Natives**	**Female Natives**	**Male Natives**
Two-Year Analysis									
Hourly wage <€8.50[1] $[T_{it}]$	0.023* (0.012)	0.007 (0.014)	0.060** (0.027)	0.048 (0.030)	0.022 (0.037)	0.120** (0.059)	0.019 (0.013)	0.008 (0.014)	0.037 (0.030)
✕ DTADD 2014-2016 $[T_{it} \times Y_{it}]$	0.142*** (0.021)	0.166*** (0.024)	0.074* (0.040)	0.142*** (0.037)	0.198*** (0.044)	-0.007 (0.066)	0.135*** (0.023)	0.152*** (0.026)	0.103** (0.046)
✕ Placebo 2010-2012 $[T_{it} \times Y_{it-k}]$	-0.065** (0.030)	-0.082** (0.035)	0.017 (0.059)	-0.123 (0.100)	-0.148 (0.112)	0.128** (0.062)	-0.059* (0.030)	-0.078** (0.035)	0.025 (0.062)
Constant	0.100*** (0.037)	0.047 (0.043)	0.161** (0.063)	0.097** (0.046)	0.023 (0.057)	0.152** (0.068)	0.106*** (0.037)	0.065 (0.043)	0.133** (0.065)
Observations	2,845	2,111	734	1,613	1,104	509	2,504	1,852	652
Obs. treated group	1,272	845	427	1,272	845	427	1,272	845	427
Obs. peer group	1,573	1,266	307	341	259	82	1,232	1,007	225
Adj. R²	0.093	0.095	0.116	0.067	0.072	0.114	0.081	0.084	0.089

Notes: The table shows the effect of the minimum wage introduction on the change in gross hourly wages (Two-Year Analysis). Self-employed, apprentices, interns, handicapped workers in sheltered workshops, and branches with industrial wage floors above the statutory minimum wage are excluded from the sample. 1) Treated group (<€8.50/hour): (1),(2),(3) all workers, (4),(5),(6) with migration background, (7),(8),(9) without migration background. Peer group (€10.00-€12.00/hour): (1)-(9) all workers. 2) DTADD and placebo are the respective different interaction terms, depending on the treated group. *Source*: SOEP v36 2008-2017, own calculations. Robust standard errors, clustered at the individual level. Standard errors in parentheses. Significance levels: * p<0.1, ** p<0.05, *** p<0.01.

Table A.14: Number, share and deviation of migrants' wages by the wage deciles of natives

			2012-2014			
decile	wage decile cap, in Euro	number of natives	number of migrants	share of natives	share of migrants	deviation migrants to natives
1	8.05	3,089	1,407	0.114	0.174	0.059
2	10.23	2,565	1,128	0.095	0.139	0.044
3	12.26	2,772	1,126	0.103	0.139	0.036
4	14.08	2,639	876	0.098	0.108	0.010
5	15.80	2,423	783	0.090	0.097	0.007
6	17.82	2,507	638	0.093	0.079	-0.014
7	20.31	2,490	559	0.092	0.069	-0.023
8	23.65	2,649	530	0.098	0.065	-0.033
9	30.06	2,879	536	0.107	0.066	-0.041
10	max.	2,970	516	0.110	0.064	-0.046
sum		**26,983**	**8,099**	**1.000**	**1.000**	**0.000**

			2015-2017			
decile	wage decile cap, in Euro	number of natives	number of migrants	share of natives	share of migrants	deviation migrants to natives
1	8.97	2,184	1,069	0.102	0.162	0.060
2	11.03	2,169	912	0.101	0.138	0.037
3	13.24	2,205	868	0.103	0.131	0.028
4	15.09	2,059	740	0.096	0.112	0.016
5	17.24	2,321	759	0.108	0.115	0.007
6	19.36	1,730	425	0.081	0.064	-0.016
7	21.98	2,060	495	0.096	0.075	-0.021
8	25.54	2,055	415	0.096	0.063	-0.033
9	32.02	2,232	459	0.104	0.069	-0.035
10	max.	2,418	467	0.113	0.071	-0.042
sum		**21,433**	**6,609**	**1.000**	**1.000**	**0.000**

Notes: Number, share and deviation of the proportion of employees with migration background within the wage deciles of employees without migration background, 2012-2014 and 2015-2017. Self-employed, apprentices, interns, handicapped workers in sheltered workshops, and branches with industrial wage floors above the statutory minimum wage are excluded from the sample. *Source*: SOEP v36. Own calculations incl. survey weights.
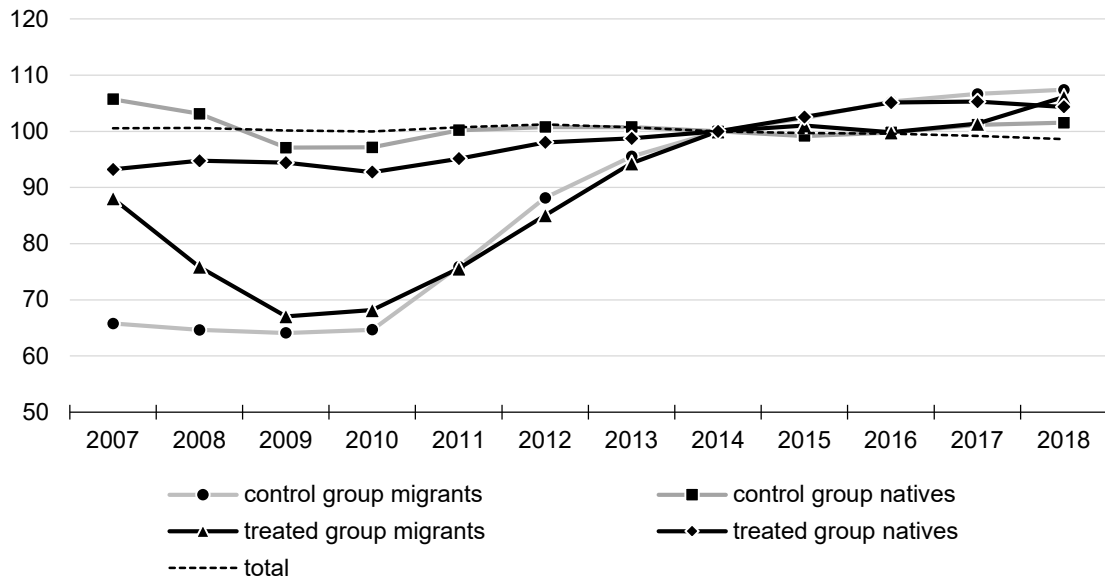
Figures

Figure A.1: Development of contractual weekly working hours by migration background, 2007-2018

Notes: This figure shows the development of contractual weekly working hours of the treatment and control group with regard to the migration background. Index 2014=100. Index is smoothed with adjacent years Self-employed, apprentices, interns, handicapped workers in sheltered workshops, and branches with industrial wage floors above the statutory minimum wage are excluded from the sample. Hourly wage of the treated group (<€8.50) and the control group (€8.50-10.00) in 2013/14. *Source*: SOEP v36, 2007-2017. Own calculations incl. survey weights.
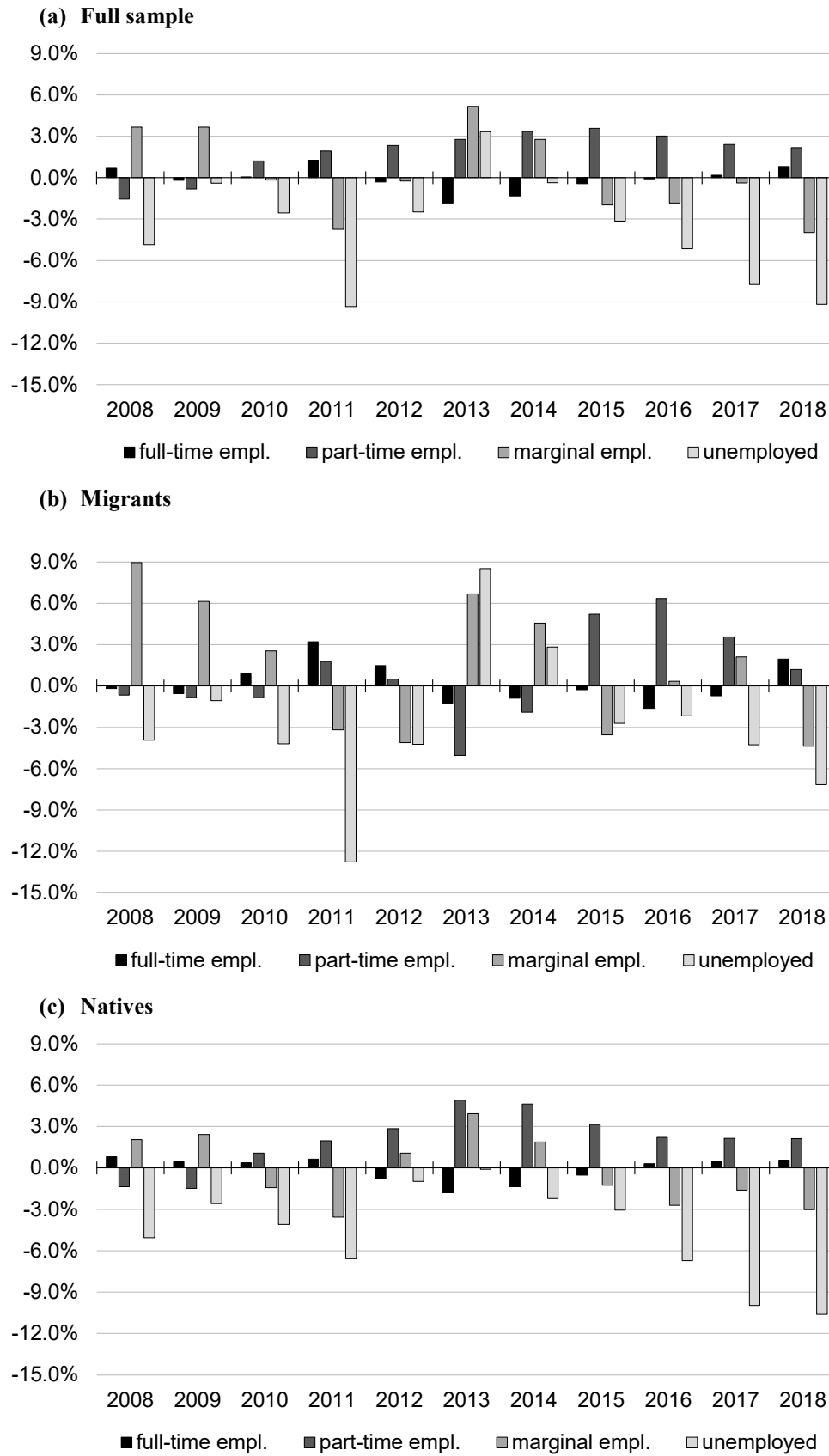
(a) Full sample

(b) Migrants

(c) Natives

Figure A.2: Changes in the proportions of employment statuses by migration background, 2007-2018

Notes: This figure shows the changes in the proportions of employment statuses by migration background. Self-employed, apprentices, interns, handicapped workers in sheltered workshops, and branches with industrial wage floors above the statutory minimum wage are excluded from the sample. *Source*: SOEP v36, 2007-2018. Own calculations incl. survey weights.
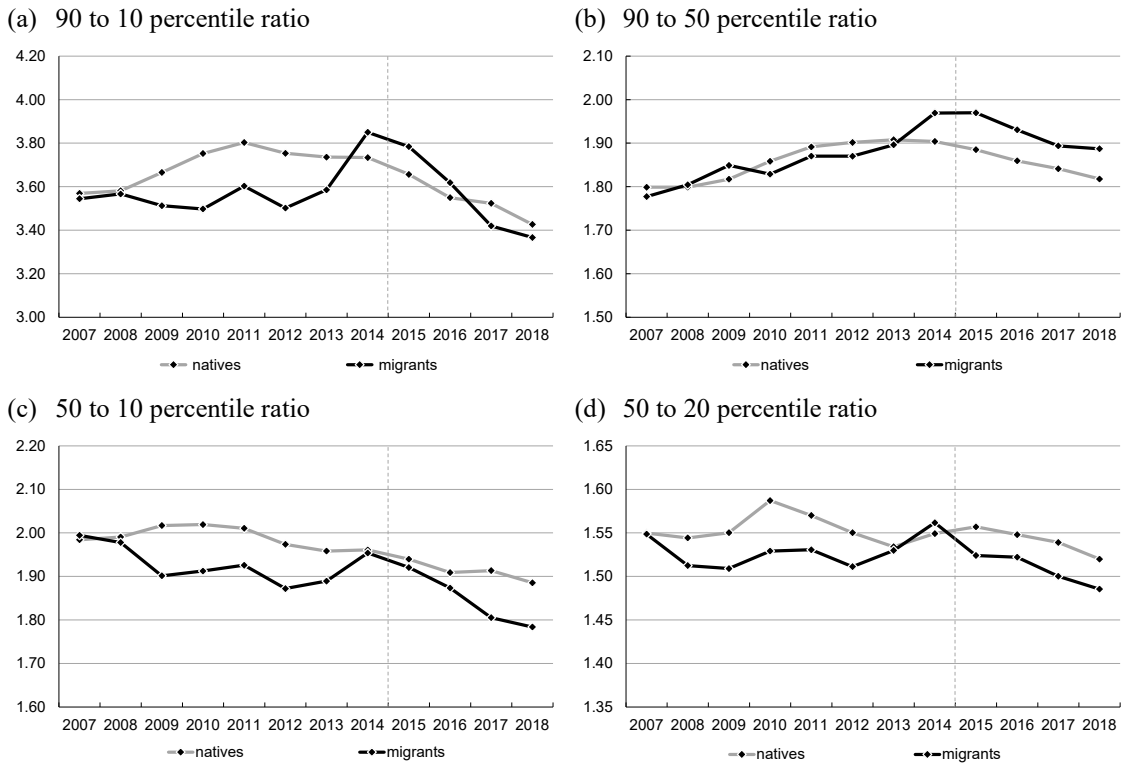
(a) 90 to 10 percentile ratio

(b) 90 to 50 percentile ratio

(c) 50 to 10 percentile ratio

(d) 50 to 20 percentile ratio

Figure A.3: Wage ratios by migration background, 2007-2018

Notes: The figure shows the ratios between selected wage percentiles for employees with migration background and without migration background. Wage ratios are smoothed with adjacent years. Self-employed, apprentices, interns, handicapped workers in sheltered workshops, and branches with industrial wage floors above the statutory minimum wage are excluded from the sample. *Source*: SOEP v36 2007-2017. Own calculations incl. survey weights.
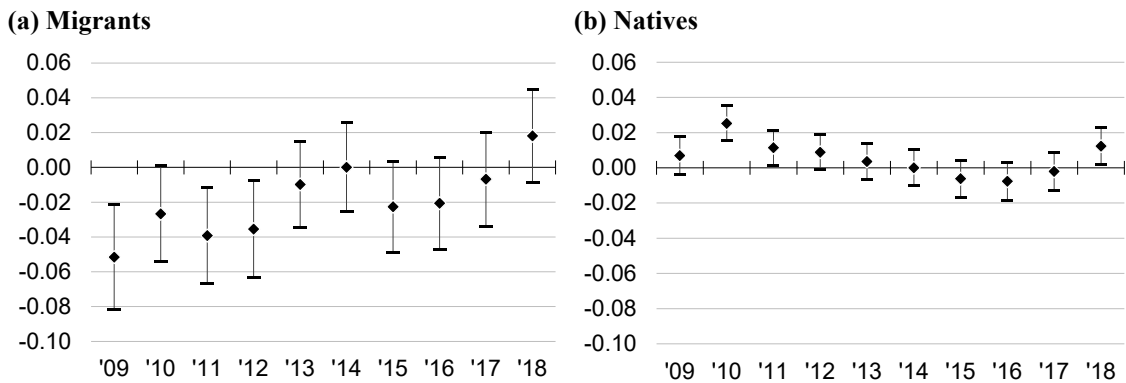
(a) Migrants

(b) Natives

Figure A.4: Probability of working in the low-wage sector by migration background, 2009-2018

Notes: This figure shows the probability of working in the low-wage sector by migration background. Linear Probability Model (LPM), 2014 = 0. Self-employed, apprentices, interns, handicapped workers in sheltered workshops, and branches with industrial wage floors above the statutory minimum wage are excluded from the sample. *Source*: SOEP v36, 2009-2018. Own calculations.