

# How effective are enforcement measures for compliance with the minimum wage?

## Evidence from Germany<sup>\*</sup>

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# Preliminary version: please do not cite!!!

### Abstract

The extent of non-compliance with minimum wages is heavily debated, but little is known about the effectiveness of enforcement measures. In Germany, the law stipulates sectoral variation in the obligatory hours recording and audits: some sectors are subject to these enforcement measures while others are virtually exempted. Based on the German administrative employment data, we exploit the variation in enforcement measures to analyze the effect on non-compliance. As an empirical strategy, we use entropy balancing together with difference-in-differences estimates and find mixed evidence on the compliance-enhancing effect of the enforcement measures. However, two years after the introduction of the minimum wage, we still measure a significant proportion of subminimum wages. The gains in compliance are not offset by more pronounced employment losses in the respective industries.

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<sup>\*</sup> We thank the Data and IT-Management department of the IAB for data provision and we thank Lisa Feist for particularly helpful research assistance.

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## 1. Introduction

In January 2015, a national minimum wage became effective in Germany, one of the hitherto few major industrial countries without one. Minimum wages are a contentious policy instrument the specific effects of which are an empirical question (compare e.g. Brown, 1999). While several studies assess the employment effects of Germany's minimum wage introduction (e.g. Bossler and Gerner, 2019; Caliendo et al., 2018, 2017; Garloff, 2016; Frentzen et al., 2018), few studies have investigated compliance and enforcement.<sup>1</sup> This is surprising as the labor market effects of a minimum wage depend on enforcement and compliance. Indeed two studies of the minimum wage introduction in Germany (Caliendo et al., 2018; Bruttel et al., 2018) suggest non-compliance as an explanation for "the near absence of an effect on regular employment" (Caliendo et al., 2018).<sup>2</sup> To understand the labor market effects of a minimum wage, it is therefore important to investigate enforcement and compliance. At least three broad categories of questions arise: (1) How large is the extent of noncompliance? (2) How effective is enforcement at increasing compliance? (3) How does enforcement affect the employment? This article focuses on the second type of question while also providing some evidence relating to the other two question types in the context of Germany's introduction of a national minimum wage.

One reason why the empirical literature is scarce is that the study of minimum wage compliance and enforcement faces challenges. First, due to its nature, non-compliance is subject to measurement error (e.g. Ronconi, 2010). Like the rest of the literature, we cannot solve this issue in principle. However, being able to use a very large administrative data set, we believe that the results contain information about the true relationship between enforcement and compliance. Second, compliance and enforcement are endogenous: Enforcement should affect compliance, and compliance should affect enforcement (e.g. Ashenfelter and Smith, 1979). The approach we take in this paper to analyze the effects of enforcement measures on compliance is to use sectoral variation in minimum wage enforcement stemming from preceding labor market regulations. Specifically, to curtail the endogeneity of compliance and enforcement, we employ a difference-in-difference strategy in which control sectors are chosen by an entropy balancing algorithm to match the enforcement sectors' pre-2015 trend in minimum wage bite.

To preview our results, we find that around 20% of wages that are below € 2000 per month and that fall under the minimum wage law fall short of the hourly minimum wage of € 8.50, with considerable variation by sector and individual characteristics. As for the current enforcement regime, some – but

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<sup>1</sup> The existing evidence regarding the German minimum wage is surveyed in the next section.

<sup>2</sup> Metcalf (2008) discusses non-compliance as an explanation for the lack of apparent employment effects of the national minimum wage in Britain. He classifies it as a possible but not probable explanation in this context.

not all – estimates point to a slight reduction in non-compliance with the minimum wage. We do not see evidence that increased compliance is achieved by laying off workers.

The remainder of this article is organized as follows: In the next section, we summarize related literature and highlight theoretical predictions regarding minimum wage compliance. In Section 3, we describe the institutional background and in Section 4 the data sources. In Section 5, we show the incidence of wages below minimum wage by enforcement. Section 6 contains the empirical analysis of the effects of enforcement on (non-)compliance. The final section concludes.

## **2. Literature review**

This paper relates to several strands of literatures, namely the literature on minimum wage compliance, evaluations of minimum wage effects and models linking enforcement and labor market outcomes. The following presentation focusses on the effects of the German minimum wage introduction, with references to international or general contributions.

### **2.1. Minimum wage compliance**

Ashenfelter and Smith (1979) seems to be the first modern economics paper to draw a significant amount of attention to compliance with minimum wages. In the spirit of Allingham and Sandmo's (1972) theoretical analysis of tax evasion, they laid out an economic model of firms' minimum wage compliance decisions. Grenier (1982) and Chang and Ehrlich (1985) later criticized, modified and generalized this model. In their theoretical analysis, Chang and Ehrlich (1985) conclude that the incentive for non-compliance increases with the minimum wage bite<sup>3</sup>, and more so when the elasticity of labor demand is high (in absolute terms). Not surprisingly, the models also predict that compliance typically increases with the strength of enforcement. Besides their purely theoretical groundwork, Ashenfelter and Smith (1979) also suggested a (relative) measure of compliance that counts disemployment effects as compliant behavior and intentionally excludes above-minimum wages from the basis of calculation. This proposed measure of compliance, too, has attracted criticism (Sellekaerts and Welch, 1984) and seldom been applied, with many studies measuring non-compliance by the fraction of covered subminimum wage employments among the total covered workforce. Nevertheless, Ashenfelter and Smith's contribution appears to have been instrumental in sparking a theoretical and, perhaps to a lesser extent, empirical literature on minimum wage compliance.<sup>4</sup> We

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<sup>3</sup> "Bite" is an expression for how high the minimum wage is with respect to the wages paid in its absence.

<sup>4</sup> Like Ashenfelter and Smith (1979), Sellekaerts and Welch (1984) study compliance with a US minimum wage; Weil\* (2005) focuses on the case of the US apparel industry; Ronconi\* (2010) and Viollaz\* (2018) investigate the case of Argentina; Bhorat et al. (2012\*, 2013, 2015) South Africa; Rani et al. (2013) several so-called developing countries and Marinakis (2014) several Latin American countries; recently Garnero (2018) studied compliance with the Italian minimum wage. Starred citations also investigate enforcement variation, instrumented or as partial correlations.

take an approach closer to Ashenfelter and Smith (1979) by analyzing the fraction of subminimum wage employments among lower wages only.

For Germany, the empirical literature on minimum wage compliance is still in its infancy. We are aware of four descriptive (German-language) reports (Burauel et al. 2017; Günther and Frentzen, 2017; Pusch and Seifert 2017; Pusch 2018). In absolute terms, the reported number of entitled employees paid below minimum wage ranges from 650,000 to 2.8 million employees. This variation demonstrates the difficulty to measure non-compliance accurately, but also shows that non-compliance is quantitatively meaningful even when looking at the most conservative numbers. Hence, it demonstrates that non-compliance with minimum wages is an important subject to study.

The German Economic Institute (DIW) published non-compliance figures based on the German Socio-Economic Panel (SOEP; Burauel et al. 2017). The non-compliance figures of their analysis lie between 1.8 million and 2.8 million employees paid below the minimum wage.<sup>5</sup> In a robustness check that allows for ten per cent measurement error, the number of entitled employees paid below minimum wage falls down up to about 1 million. Using the same data set and focusing on contractual hours plus paid overtime, researchers of the WSI, a union-financed research institute, estimate 2.2 million non-compliant employments (Pusch 2018).<sup>6</sup> The absolute numbers correspond to between seven and eleven per cent of the covered employment contracts.

The German Statistical Office published numbers of employees below minimum wage based on the Structure of Earnings Survey. This employer survey includes official earning records of a well-defined sample of employees from within each of the selected plants (Günther and Frentzen 2017). Excluding all employees with exemption clause, the authors report about 750,000 employees below minimum wage in 2015 and 650,000 in 2016. Two observations make the data source particularly reliable. First, it covers official earnings records, reported also to the social security administration. The data are highly accurate and can demonstrate plausible and distinct peaks in hourly wages after the minimum wage introduction. However, participation in the 2015 and 2016 surveys was voluntary, raising the concern of selective participation.

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<sup>5</sup> The 1.8 million figure is for 2016 and based on contractual working hours, and the 2.8 million figure for 2015 and based on reported actual working hours. The numbers are higher for 2015 and when calculated using reported *actual* hours.

<sup>6</sup> Being a household survey, the SOEP arguably does not suffer from a non-response incentive for non-compliant agents (as employees are not the perpetrators of minimum wage violations), although hourly wage measures might be less precise than in e.g. administrative data. Regardless, even SOEP figures may fail to capture some type of noncompliance, e.g. when an employee colludes in feigning the requirements for entering a minimum-wage exempted employment contract form.

## 2.2 Employment effects and other margins of adjustment

Compliance with the minimum wage is only one aspect of the minimum wage literature, with the bulk of the empirical literature focusing on employment effects and other margins of adjustment.<sup>7</sup> From a theoretical perspective, the employment effect of a minimum wage can go in different directions, with classical models predicting employment losses (see e.g. Stigler 1946) and monopsonistic models allowing for employment gains (see e.g. Stigler, 1946; Bhaskar and To, 1999; Bhaskar et al., 2002; Manning 2003; Manning, 2006; Ashenfelter et al., 2010). The effects of enforcement and compliance on the employment impact of a minimum wage also depend on the competitiveness of the market (Chang and Ehrlich, 1985; Yaniv, 2001; Danziger, 2009; Danziger, 2010; Basu et al., 2010). The available empirical studies of the German minimum wage introduction find limited employment effects, at least in the short run. Caliendo et al. (2018), based on a regional variation in bite, conclude that employment adjustment may not have exceeded 80,000 jobs across Germany. One explanation for the absence of major employment effects maybe the absence of meaningful monthly wage effects, as suggested in a companion paper, Caliendo et al. (2017). Instead, the authors find a significant working hours reduction, a potential channel to comply with the new law. Looking at labor demand adjustments in response to the German minimum wage introduction using firm data, Bossler and Gerner (2019) demonstrate that employment adjustments of German firms tend to increase with the wage effect of the minimum wage, following the argument of a downward sloping labor demand curve. They detect an employee-level wage effect of about 10 per cent and a disemployment probability of about 3 per cent, in combination implying a labor demand elasticity of 0.3. From these elasticities, we can expect that larger wage effects due to higher compliance rates, could lead to larger disemployment effects. However, this assumes a constant labor demand elasticity, which is an out of sample prediction from Bossler and Gerner (2019). Garloff (2016) finds no relation between sectoral minimum wage bite and overall employment or unemployment growth, but an increase in growth of regular employment at the expense of marginal employment.

Finally, it is worth noting that enforcement is typically costly and itself a policy choice (compare e.g. Becker, 1968; Stigler, 1970; Polinsky and Shavell, 2000). One implication is that because of cost-benefit considerations, complete enforcement is rarely desirable (Stigler, 1970; Polinsky and Shavell, 2000). Another implication is that enforcement should be concentrated in areas where violations are most likely (Chang and Ehrlich 1985; Ronconi, 2010). Indeed already Ashenfelter and Smith (1979) reported evidence that enforcement efforts are “concentrated on sectors where violations are most likely to occur”. As we will see in the empirical analysis, this is also true for the German minimum wage.

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<sup>7</sup> For a discussion of other adjustment margins, see Bruttel et al. (2018) for the German, and Metcalf (2008) for the British context respectively.

### 3. Institutional background and enforcement measures

After the federal elections in 2013, the ruling coalition of the Christian Democratic Union and the Social Democratic Party agreed on the introduction of a national hourly minimum wage, following other major western countries in that respect. The minimum wage was initially set at 8.50€/hour and took effect on 1 January 2015. At the recommendation of the Minimum Wage Commission, constituted in equal parts of employer and employee representatives, it was raised to 8.84€/hour in 2017. The minimum wage applies to all employees, but with some exceptions, notably youths below 18 years of age, apprentices, certain interns and volunteers.<sup>8</sup> During a transitional period of two years, certain pre-existing sector-specific minimum wages overrode the national minimum wage, whether from above or from below.<sup>9</sup> Since 2017, sector-specific minimum wages are only effective if they exceed the national minimum wage. In our empirical analysis, we exclude the respective sectors to build an analysis sample in which such special regulations do not play a role.

Regarding the enforcement of the minimum wage, the legislators opted for making use of pre-existing laws and capabilities. Arguably, the government did so to be able to introduce the minimum wage quickly and without major immediate investments in new enforcement capacities. Specifically, only sectors mentioned in an “anti-moonlighting” law and so-called mini-job employments are required to document and retain records of daily working hours. Moreover, the customs authorities, which had already been in charge of verifying compliance with sector-specific minimum wages and detecting illicit employment under the anti-moonlighting law, were also assigned the task to verify compliance with the national minimum wage. The customs authorities can in principle audit plants for minimum wage compliance in any sector, regardless of whether it was subject of previous legislation or not. In practice, however, it may prove difficult to establish minimum wage non-compliance without a plant’s obligation to register and keep records of working hours. In 2015, the authorities prioritised information and awareness raising over enforcement.<sup>10</sup> Nonetheless, pegging minimum wage enforcement to pre-existing sector-specific regulations, although not without an administrative rationale, resulted in systematically unequal treatment of plants in terms of detection probabilities for minimum wage non-compliance. For our analysis, we will define *enforced* sectors by whether mentioned in §2a of the anti-moonlighting law, while excluding sectors with sectoral minimum wages under the Posted Workers Act [AEntG].

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<sup>8</sup> The long-term unemployed are also exempted for the first six months of their new employment spell.

<sup>9</sup> During this transition period, newspaper deliverers were only entitled to a fraction of the national minimum wage.

<sup>10</sup> „Wegen dieser Notwendigkeiten hat die FKS im Jahr 2015 den Schwerpunkt ihrer Aktivitäten im Zusammenhang mit der Einführung des Mindestlohns nach dem MiLoG auf die Aufklärung der Arbeitgeber und Arbeitnehmer gelegt. Verstöße gegen den gesetzlichen Mindestlohn wurden in dieser Phase nur vereinzelt festgestellt. Nach Abschluss der Einführungsphase galt es dann, mögliche Umgehungsformen beim gesetzlichen Mindestlohn durch die FKS aufzudecken und entsprechend zu ahnden.“ Dreizehnter Bericht der Bundesregierung über die Auswirkungen des Gesetzes zur Bekämpfung der illegalen Beschäftigung 2017 (Bundestagsdrucksache 18/12755), p. 16.

**Table1: Sector variation in enforcement measures**

	Branches		Enforcement measures	
	Sector names	# of 5-digit sectors	Compulsory documentation of working hours	Likelihood of enforcement investigation in 2016
Control group	all remaining sectors	660	No	1.1 %
Treated group	restaurants, hospitality, hotels, transportation and logistics, forestry, exhibitions and fairs	73	Yes	4.9 %
Excluded group I (sector specific mw and included in the list of treated sectors)	main construction sector, roofing, electrical trade sector, meat industry, cleaning, scaffolder, painting	25	Yes, already ahead of the mw introduction	6.1 %
Excluded group II (sector specific minimum wage)	stone cutters, care taking, temporary agency work, further training industry	81	Yes, already ahead of the mw introduction	

Sources: Sector classification as in Bossler and Möller (2018). Number of establishments with full time employees of the Establishment History Panel 2016. Minimum wage commission (2018) for the number of investigations at the establishment level.

Table 1 shows the resulting numbers of treated and untreated sectors using the German sectoral classification (WZ) to a depth of five digits. In our analysis sample, 73 industries are classified in the *enforcement group* and 660 industries are assigned to the control group. In total, 106 industries already had other enforcement measures before the minimum wage was introduced and were therefore excluded from the analysis sample. Table 1 also shows that the enforced industries are required to document hours work (for social security employees with wages below € 2000 per month) while the control group is not required to record hours. The last column also demonstrated that the likelihood of investigation at a workplace is 4.5 times higher in the treatment group than in the control group.

Table 1 demonstrates that there is a heterogeneity in enforcement measures across industries. Such enforcement may only affect the labor market contracts if

1. Sanctions are sufficiently high and
2. Enforcement is perceived as sufficiently likely

The penalties for non-compliance with the minimum wage law are statutorily similar for all employers and span several areas. Violations with the hourly minimum wage come along with a direct fine of up to € 500,000. Violations of documentation, registration or examination requirements can be fined with up to € 30,000. Moreover, fines exceeding € 200 are documented in the central business register, which authorities have to consult for public procurement contracts exceeding € 30,000. Public administrations shall temporarily exclude companies fined € 2,500 or more from public procurement biddings. Another class of penalties consists of damage claims. Employees themselves can sue for minimum wage law compatible remuneration also retrospectively. Even when an employee does not sue, the social security institutions can demand restitution for unpaid social security contributions. In summary, violations can cause substantial fines as well as long run consequences such as exemptions from public procurement.

Condition 2 is the focus of our empirical analysis. A precondition for effective deterrence is employers are aware of the enforcement. Survey data from IAB-QUEST provide some information in this respect. In this survey conducted by the Institute of Employment Research, about 300 establishments were asked about the bureaucratic burden associated with hours recordings associated with the minimum wage. The survey was conducted in early 2016, more than 12 months after the minimum wage introduction. The respective question asks whether the bureaucratic burden has increased in course of the minimum wage introduction. The survey gave the employers three outcome categories for their response: (a) did not increase, (b) increased, and (c) heavily increased. Because reported changes in these specific administrative burdens should be correlated with awareness of the enforcement measures, we analyze the survey responses by sectoral enforcement. Specifically, in an ordinal probit regression, we regress the survey response on the enforcement sector indicator, controlling for states (16 categories), establishment size (7 categories), the share of minijobs, and the share of female employees.

**Table 2: Bureaucratic burden associated with the minimum wage, ordered logit**

	Bureaucratic burden...		
	did not increase	increased	heavily increased
Enforcement	-0.130** (0.056)	-0.014 (0.009)	0.145** (0.061)
Unconditional averages	0.313	0.313	0.374
Observations		282	

Notes: Employers response to the question whether the minimum wage increased the bureaucratic burden at the respective establishment. Coefficients are partial effects on each of the three response categories indicated by column headings (did not increase, increased, and heavily increased). Asterisks indicate significance levels: \* 10 %, \*\* 5 %, and \*\*\* 1 %. Control variables for German states (16 categories), establishment size (7 categories), the share of minijobs, and the share of female employees. Data source: IAB-QUEST Survey 2016, 326 establishments without sectoral minimum wage and establishments with at least one employee receiving below € 8.50 per hour of work ahead of the minimum wage introduction.

Table 2 presents the respective predicted average marginal effects for the three outcome categories. The result clearly shows that employers in enforcement sectors are more likely to report an increase in the bureaucratic burden in course of the minimum wage introduction and are less likely to report that the bureaucratic burden did not change.

Summing up, we observe a big difference in enforcement measures by industries. While fines for non-compliance can be quite substantial in all sectors, the actual threat of application differs arguably. Moreover, the differences in reported administrative burden between enforced and unenforced sectors suggest that employers in the enforced industries are aware of the enforcement measures, at least in terms of an increased bureaucratic burden associated with recording working hours. This suggests that compliance may be different in enforced industries compared with otherwise similar control sectors.

#### **4. Data**

The major data source is a 10 percent sample of administrative employment data (Employee History; BeH), containing individual employment information from compulsory social security notifications, which is available at the Institute for Employment Research (IAB). We also use some establishment-level variables from an aggregated version of the same data (Establishment History Panel; BHP).

The size of the administrative data allows us to have large numbers of observations in low-wage jobs. We are able to compare compliance in treated and non-treated industries, controlling for individual, establishment and industry characteristics. The main drawback of the data is the non-availability of detailed working time information and therefore the lack of information on hourly wages. While the data allow to distinguish part-time, full-time and mini-jobs, there is no information on hours worked, and no hourly wage.

To obtain measures of the minimum wage bite (from before the minimum wage introduction) and compliance (after the minimum wage introduction), we follow two approaches. First, we use monthly wages for full-time workers. The data contain highly reliable information on the gross wages in the reported employment period, as well as exact dates of the beginning and the end of employment. We compute wages per month and compare these monthly wages to a cut-off wage level representing the hypothetical monthly wage for a full-time worker (with 165 hours/month) earning exactly the legal minimum wage. Second, we refine our measure of monthly wages to an hourly wage measure using external information on average working hours measured at the industry level. While an hourly wage measure might look much more precise to analyze compliance at a first glance, it may on the other hand add an additional error if the industry-level working hours are inaccurately measured or if they contain high variation of hours within industries.

In the administrative data collection process, employers are required to report an employment spell for each employee at least once a year, even if the respective employee is continuing the same job. Hence, the reported job episodes have a maximum duration of one year, and are shorter if a job does not cover the whole year. From the universe of employment records, we select a random 10 percent sample of all persons who had least one job during the years 2013 to 2016. Of the sampled persons, we select all episodes in full-time employment covering June 30th of the years 2012 to 2016.

We correct some implausibilities in the data: We regard employment spells of employees younger than age 13 as unreliable<sup>11</sup> and delete them as well as notifications of employees older than age 65, as this is the legal retirement age. If more than one job of the same person in the same establishment is observed on June 30th of a year, we only keep the job that is most recently reported. We allow that the same individual has several jobs if these take place in different establishments. In the case of more than two full-time jobs reported at the same date, we eliminate these episodes. Regarding wages, we eliminate job episodes without reported wages (e.g. notifications of employment interruptions). We further eliminate full-time jobs with reported wages of less than 451 Euro per month. These notifications should represent marginal jobs (so called minijobs) that were erroneously classified as full-time.

As noted, a major challenge for this study is that we cannot compute hourly wages from our data. We follow Garloff (2016, 2017) and use a fixed threshold of 1400 € as the minimum wage level for full-time workers. This assumes ca. 165 hours worked per month. The bite of the minimum wage is mostly coded as a binary variable indicating a job with a monthly wage below 1400 €. We use an industry level version of the bite, the share of full-time jobs with monthly earnings below 1400 € in the years before the introduction of the general minimum wage, to identify industries that are comparable with respect to the potential impact of the minimum wage.

Our enforcement variable is defined as belonging to an industry in which obligatory recording of working times has been introduced together with the minimum wage. As noted before, these industries are listed in the “anti-moonlighting” law and they are identified in our data using the 5-digit-level of the industry classification of 2008 (see Table 1). In industries with bargained sector-specific minimum wages according to the Posted Workers Act (AEntG) as well as in the temporary agency work industry, obligatory recording of working times has been required well before the introduction of the general minimum wage. These industries are excluded from our analysis. We also exclude the public

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<sup>11</sup> The legal minimum age for employment is 15 years, so it is unclear, whether the notifications of younger workers represent exemptions from this general rule or whether the date of birth is falsely assigned.

sector, as non-compliance with the minimum wage is very unlikely there, and private households, which are exempted from mandatory working time recording.

To check whether our measure classifying workers below the minimum wage is systematically biased by differences in hours worked between West and East Germany, or differences by industries and gender, we use information from the Quarterly Earnings Survey (Vierteljährliche Verdiensterhebung). This is an establishment survey run by the Federal Statistical Office (Destatis), which covers the manufacturing and the service sector. Agriculture and private households are not included. Furthermore, the survey covers only establishments with 10 or more employees (establishments with 5 or more employees in some smaller industries). While the main use of the data is to provide information for the official earnings statistics, the large advantage is the availability of detailed working time information. This information is elicited as „paid hours per week“. The industry coding is on a 2-digit or 3-digit level and therefore somewhat broader than the 5-digit-coding available in the employment history data. The mean number of working hours in an industry is differentiated by region (East/West) and gender. We use the data from the second quarter of every year from 2012 to 2016.

For the calculation of separation rates, we concatenate notifications for the same worker and the same establishment and construct employment episodes possibly spanning over several notifications following one another in time. This allows determining the number of ongoing and terminating episodes for each month starting in January 2013. An employment episode counts for the number of ongoing employment relationships from the month it is first observed to the month preceding the last observation of the spell. Since our data end in December 2016, a large share of employment spells is incomplete and we stop the calculation of separation rates in November 2016.

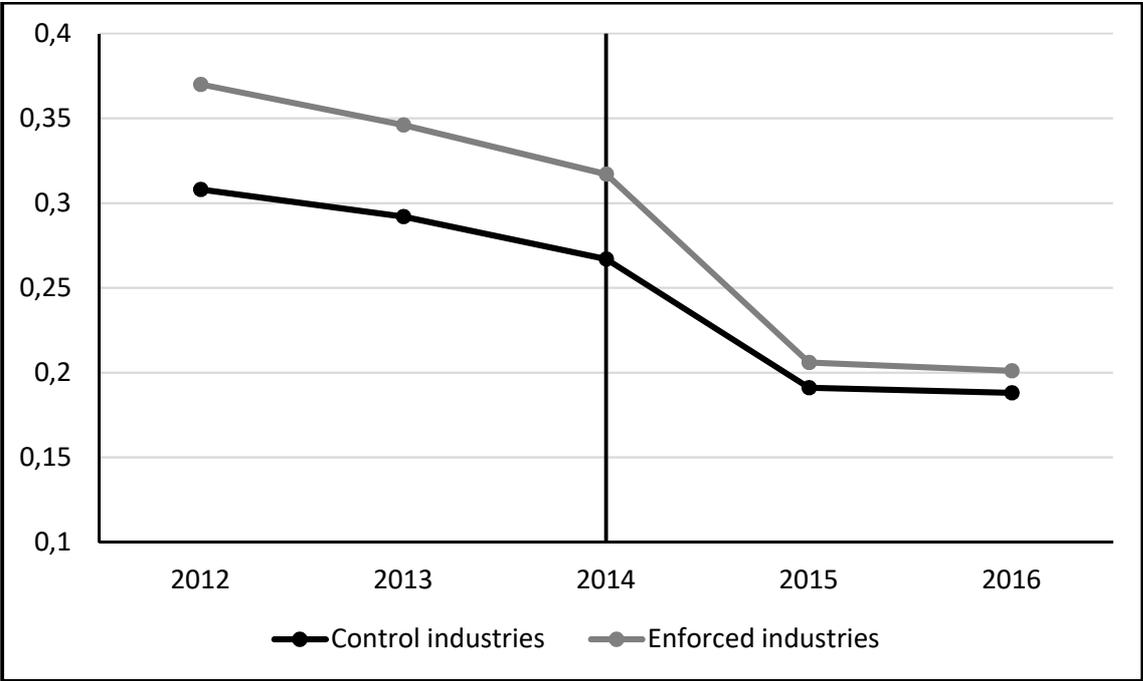
Our control variables are constructed at different levels: we use individual characteristics including gender, nationality, occupational degree. We also control for establishment age, which is computed in years using the first appearance of an establishment in the administrative employment records, and for establishment size, coded as a categorical variable. We distinguish West and East Germany with a binary indicator. Industry variables are computed using average values of job-related characteristics.

## **5. Compliance in enforcement and control industries**

As a first step of our empirical analysis, we look at the fraction of workers paid below the wage threshold over the analysis period from 2012-2016 for enforced industries and the control group. Figure 1 illustrates the averages of  $I[wage_{it} < €1400]$  for the two groups over time. Before the introduction of the minimum wage, the fraction of workers paid below the minimum wage level was about 6 percentage points higher in enforced sectors compared with the control group. This illustrates that the enforced sectors were on average more severely affected by the minimum wage legislation.

There is a downward trend for both groups, indicating positive wage trends in the lower half of the wage distribution already before the introduction of the national minimum wage. A sharp drop between 2014 and 2015 indicates the effect of the minimum wage, which significantly decreased the fraction of workers paid below the respective threshold. In 2015 and 2016, the fraction of workers paid below € 1440 per month is still at a higher level among the enforced industries. This suggests that (on average) the targeting of enforced sectors based on the anti-moonlighting law has some justification, possibly narrowing the gap in compliance between enforced and other industries. Among the sample of workers with monthly earnings below € 2000 the calculated level of non-compliance of about 20% is remarkable.

**Figure 1: Fraction of workers below minimum wage before and after the reform**



Note: Fractions of workers below € 8.50, 2012-2016 by enforcement. The vertical line marks the last period before the treatment.

Data source: BEH, analysis sample.

Difference-in-difference regressions as specified in equation (1) allow for a more analytical look at our data:

$$y_{it} = \sum_{t=2013}^{2016} enforced_s * year_t * \delta_t + \sum_{t=2013}^{2016} year_t * \gamma_t + enforced_s * \varphi + \varepsilon_{it} \quad (1)$$

The model includes an interaction between the enforcement group and year dummies, where the respective coefficients are represented by  $\delta_t$ , common time effects for each of the years in the sample  $\gamma_t$ , and a common group effect  $\varphi$  for the enforcement sectors. The dependent variable  $y_{it}$  represents an indicator for monthly wages below € 1400 and in alternative estimations an indicator for hourly wages below € 8.50, where working hours are imputed as described in the data section.

**Table 3: Effect of enforcement sectors on wages below the minimum wage threshold**

	Dependent variable: I[monthly wage < 1400€/month]			Dependent variable: I[hourly wage < 8.50€/h]		
	(1) OLS	(2) Sector-FE	(3) Match-FE	(4) OLS	(5) Sector-FE	(6) Match-FE
Enforcement*D2013	-0.007*** (0.002)	-0.007*** (0.002)	-0.001 (0.002)	-0.005** (0.002)	-0.005** (0.002)	0.002 (0.002)
Enforcement*D2014	-0.011*** (0.003)	-0.013*** (0.003)	-0.002 (0.003)	-0.005* (0.003)	-0.006** (0.003)	0.012*** (0.003)
Enforcement*D2015	-0.048*** (0.003)	-0.051*** (0.003)	-0.048*** (0.004)	-0.033*** (0.003)	-0.035*** (0.003)	-0.024*** (0.004)
Enforcement*D2016	-0.048*** (0.003)	-0.055*** (0.003)	-0.051*** (0.005)	-0.038*** (0.003)	-0.043*** (0.003)	-0.034*** (0.005)
Enforcement	0.060*** (0.003)	-	-	0.058*** (0.003)	-	-
D2013	-0.016*** (0.001)	-0.018*** (0.001)	-0.034*** (0.001)	-0.011*** (0.001)	-0.014*** (0.001)	-0.030*** (0.001)
D2014	-0.029*** (0.001)	-0.031*** (0.001)	-0.067*** (0.002)	-0.025*** (0.001)	-0.028*** (0.001)	-0.068*** (0.002)
D2015	-0.107*** (0.002)	-0.110*** (0.002)	-0.154*** (0.002)	-0.111*** (0.002)	-0.115*** (0.002)	-0.168*** (0.002)
D2016	-0.109*** (0.002)	-0.114*** (0.002)	-0.169*** (0.002)	-0.119*** (0.002)	-0.125*** (0.002)	-0.190*** (0.003)
Constant	0.290*** (0.001)	0.309*** (0.001)	0.336*** (0.001)	0.330*** (0.002)	0.350*** (0.001)	0.381*** (0.001)
N	1,345,055	1,345,055	1,345,055	1,380,649	1,380,649	1,380,649

Notes: Reported coefficients are from linear difference-in-differences estimations. Establishment-level clustered standard errors are in parentheses. Asterisks based on establishment-level clustered standard errors indicate significance levels: \* p<0.1, \*\* p<0.05, and \*\*\* p<0.01. Data: BEH 2012 - 2016, analysis sample.

Table 3 presents the regression results for the monthly wage indicator in columns 1 to 3 and for the hourly wage indicator in columns 4 to 6. In columns 1 and 4, OLS regressions are estimated, whereas the other columns contain results from fixed effects models. The fixed effects control for industry in the models in columns 2 and 5, and alternatively for job matches (combined person-establishment effects) in columns 3 and 6. The results largely corroborate the patterns illustrated in Figure 1. Contrasting enforcement and other industries, the level difference of jobs paid below the minimum wage threshold already before the minimum wage introduction is roughly 6 percentage points. The interaction effects show that this initial level difference vanishes over time, while there remains a small gap after minimum wage introduction. The results are qualitatively very similar for the indicator based on hourly wages.

The results of Figure 1 and Table 1 are interesting in itself, i.e. they show that the minimum wage has had a larger bite in enforcement sectors, the level of non-compliance is somewhat larger in enforced

sector, and the wage adjustment was somewhat larger in enforced sectors. At this point of analysis, however, the results are not sufficient to link the observed wage adjustment in the enforced industries to the effectiveness of measures to reduce non-compliance. This is because they do not allow us to discriminate between an effect of the enforcement and an effect of the minimum wage itself irrespective of the enforcement measures.

To estimate an isolated effect of enforcement measures, we would want to compare two jobs being equally affected by the minimum wage but differ in whether the jobs are subject to enforcement. We provide an attempt to mimic such a situation by controlling for the bite of the minimum wage in the following section.

## 6. Effect of enforcement measures on non-compliance

To eliminate any effects that stem from minimum wage-induced wage adjustments, we use a matching method – entropy balancing<sup>12</sup> – that creates a synthetic control group of jobs that closely resembles the jobs in the enforcement group with respect to characteristics from the period before the minimum wage introduction. Hence, we build a counterfactual of jobs in non-enforcement industries that are similarly affected by the minimum wage. The underlying assumption is that minimum wage induced wage adjustments are the same for the enforcement group and the counterfactual, and therefore any remaining reactions to the introduction of the minimum wage should be due to their differential treatment with respect to enforcement.

The estimation includes two steps. First, the enforcement and the control group are balanced based on pre-treatment variables. Entropy balancing provides weights for the control units such that the enforcement and the control group match exactly on the mean values of a set of covariates.<sup>13</sup> Second, the enforcement effect is obtained in a difference-in-difference model, similar to the one already used, but now based on the balanced data.

In the entropy balancing, we use different sets of covariates:

1. Enforcement and control group are balanced on the sector level bite of the years 2012, 2013 and 2014 ( $bite_{s,t=2012,2013,2014}$ ), the sector level percentage bite<sup>14</sup>, and the shares of employees paid below € 2000 per month ( $sample_{s,t=2012,2013,2014}$ ), which is a central sample selection criterion in our analysis.

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<sup>12</sup> See Hainmüller (2012) and Hainmüller and Xu (2013).

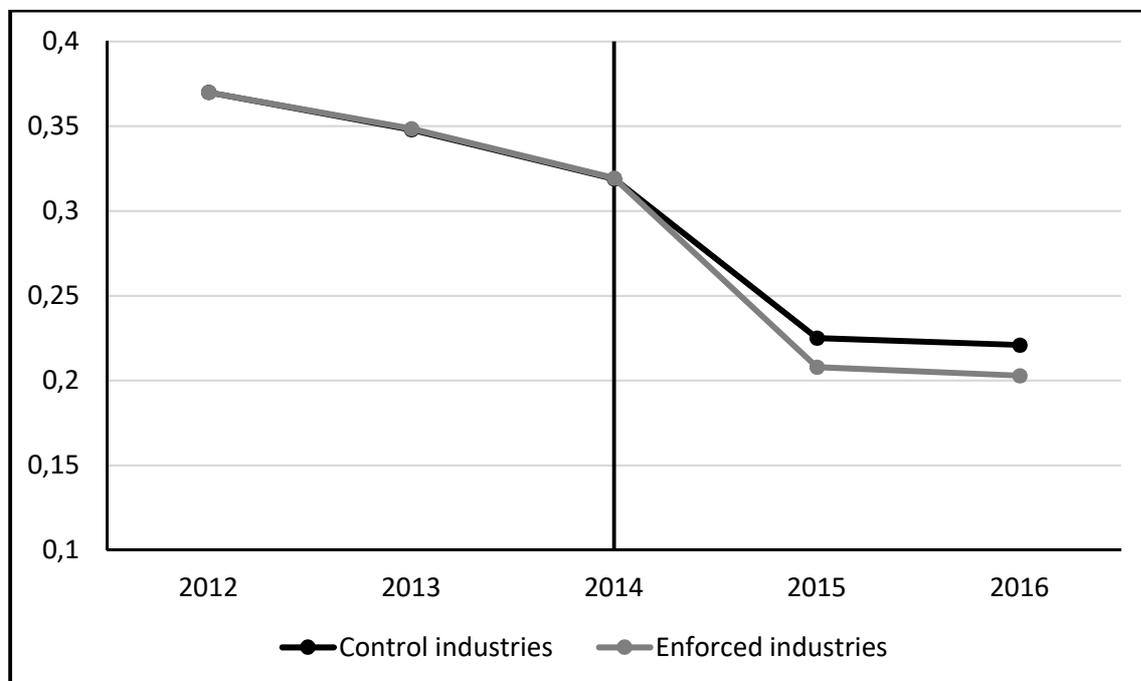
<sup>13</sup> In principle, the ebalance procedure allows to impose restrictions also on higher-order moments.

<sup>14</sup> The sector level percentage bite is calculated as the percentage difference of monthly wages to the assumed minimum wage level of 1400 Euro, including only wages below this level and average over jobs in the respective industry and year.

2. Enforcement and control group are balanced on the sector level bite, the sector level percentage bite, the sample selection variable, and on a set of sector-level shares of individuals characteristics measured in 2013.
3. Enforcement and control group are balanced on the sector level bite the sector level percentage bite, the sample selection variable, and a set of individual characteristics, establishment age and establishment size.

The mean values of the weighted data obtained from the first set of balancing variables yield the time-series displayed in Figure 2. The weighted control group closely resembles the enforcement group in the years ahead of the minimum wage introduction, i.e., by putting a larger weight on jobs in more severely affected sectors in the control group. This illustration shows that entropy balancing produces equal pre-introduction bite in treatment and control sectors to support our assumption that the minimum wage induced adjustment in the enforcement and the control industries should be very similar. Hence, differences in the proportion of wages below the minimum wage level in the years 2015 and 2016, after the minimum wage introduction, can plausibly be attributed to their differential treatment in terms of enforcement. Figure 2 suggests that even for jobs in very similar industries, the likelihood to be paid below the minimum wage level might be higher if the worker is employed in an enforcement industry.

**Figure 2: Fraction of workers below minimum wage before and after the reform**



Note: Fractions of workers below € 8.50, 2012-2016 by enforcement. The vertical line marks the last period before the treatment. Data source: BEH, analysis sample.

We quantify the size of this effect using again difference-in-difference estimation, as specified in equations (2) and (3):

$$I[wage_{it} < \text{€}1400] = \sum_{t=2012}^{2016} treated_s * year_t * \delta + \sum_{t=2012}^{2016} year_t * \gamma + X_{it} * \beta + \varphi_s + \varepsilon_{it} \quad (2)$$

$$I[wage_{it} < \text{€}1400] = \sum_{t=2012}^{2016} treated_s * year_t * \delta + \sum_{t=2012}^{2016} year_t * \gamma + X_{it} * \beta + \theta_{m(j,i)} + \varepsilon_{it} \quad (3)$$

These specifications allow us to observe the differential effect of enforcement on a job being in one of the enforcement industries rather than in one of the control industries by year of observation. Equation (2) contains a sector-specific fixed effect and equation (3) controls for an employer-employee-match effect. Columns (1) and (2) in Table 4 contain results from the first set of variables included in the entropy balancing, while the results in columns (3) and (4) are based on the second and columns (5) and (6) on the third set of balancing variables.

**Table 4: Effect of enforcement sectors on wages below the minimum wage threshold, monthly wages**

	Dependent variable: I[monthly wage < 1400€/month]					
	(1)	(2)	(3)	(4)	(5)	(6)
	Balancing model 1		Balancing model 2		Balancing model 3	
	Sector-FE	Match-FE	Sector-FE	Match-FE	Sector-FE	Match-FE
Enforcement*D2013	0.000 (0.003)	0.001 (0.003)	-0.000 (0.008)	-0.006 (0.009)	-0.002 (0.003)	0.001 (0.003)
Enforcement*D2014	-0.000 (0.003)	0.002 (0.004)	0.002 (0.011)	-0.009 (0.011)	-0.005 (0.004)	-0.000 (0.005)
Enforcement*D2015	-0.024*** (0.004)	-0.030*** (0.006)	-0.002 (0.011)	-0.027* (0.015)	-0.027*** (0.005)	-0.031*** (0.007)
Enforcement*D2016	-0.026*** (0.004)	-0.032*** (0.006)	-0.005 (0.011)	-0.035** (0.016)	-0.028*** (0.005)	-0.035*** (0.007)
Enforcement	-	-	-	-	-	-
D2013	-0.025*** (0.002)	-0.035*** (0.002)	-0.024*** (0.008)	-0.027*** (0.008)	-0.023*** (0.003)	-0.034*** (0.003)
D2014	-0.044*** (0.003)	-0.067*** (0.003)	-0.046*** (0.010)	-0.056*** (0.010)	-0.039*** (0.004)	-0.065*** (0.004)
D2015	-0.138*** (0.003)	-0.167*** (0.005)	-0.160*** (0.010)	-0.169*** (0.014)	-0.136*** (0.004)	-0.165*** (0.006)
D2016	-0.145*** (0.004)	-0.180*** (0.005)	-0.166*** (0.011)	-0.176*** (0.014)	-0.143*** (0.004)	-0.177*** (0.006)
Constant	0.374*** (0.006)	0.401*** (0.019)	0.443*** (0.014)	0.418*** (0.041)	0.402*** (0.006)	0.404*** (0.023)
N	1,344,909	1,344,909	1,344,909	1,344,909	1,344,909	1,344,909

Notes: Reported coefficients are from linear difference-in-differences estimations. Balancing variables are measures of the industry wage/minimum wage incidence 2012-2014 in models (1) and (2). In addition to these variables, models (3) and (4) use 2013 industry shares of women, foreigners, skill groups, worker age, age of firm and firm size, while models (5) and (6) use actual individual characteristics of workers and firms. Robust standard errors in parentheses. Asterisks indicate significance levels: \* p<0.1, \*\* p<0.05, and \*\*\* p<0.01. Data: BEH 2012 - 2016, analysis sample.

The results in Table 4 show small and insignificant interaction effects for the years before the minimum wage was introduced, demonstrating that the enforcement group and control group are quantitatively similar after applying the respective balancing weights. The interactions show negative signs for the years 2015 and 2016, implying that the proportion of wages below € 1400 is reduced more heavily in the enforcement group. This could point to a slight compliance enhancing effect of the enforcement. The results appear to be similar across specifications. However, the estimates are somewhat smaller and turn insignificant in column (3), a regression with sector fixed effects. Here, the counterfactual is derived from balancing additionally on industry-specific shares of different groups of workers. We will have a look at the most important control industries to explain the differences in our results across specifications.

To provide some more information, Table 5 lists the most important control industries after applying the balancing weights. The individual weight results from the balancing procedure. The “industry weight”, reflecting the importance of a particular industry for the control group, is obtained by summing up the weights by industry and year and taking averages. Among the most important industries are dental practices, car washes and private security services. These industries are not included in the enforcement group, because they are not listed in the anti-moonlighting law, but they are similar regarding the incidence of low wages and other industry and job characteristics before the introduction of the minimum wage.

Remarkably, balancing models 1 und 3 largely coincide in the ten most important control industries. By contrast, the majority of the most important control industries from model 2 is not contained in the industry sets from the other two models. This is a first plausible explanation for differences in the presented enforcement effects in Table 4. Moreover, the individual weights in the control industries of balancing model 2 show large values in some cases, larger than those from model 1 and 3. This means that there are control industries consisting of a rather small number of jobs, which receive a large weight by our balancing procedure. This is a second reason for differences in the estimation results in Table 4 and it implies less precisely estimated effects. Because of these large weights, the results of the second specification should be interpreted with caution. Nevertheless, it is the only specification, which points to a zero enforcement effect, and we do not want to suppress this result. While adding sectoral employment characteristics should improve balancing of industries relative to model 1, the large weights in model 2 indicate that this may also result in problems of finding a sufficiently large number of close control observations.

**Table 5: Ten most important industries in the balanced control groups (by balancing model)**

Classification number (WZ08)	Industry	Individual weight	Average number of employees	Industry weight
<b>Balancing Model 1</b>				
86230	Dental practice activities	1.28	6803.4	8723.7
47240	Retail sale of bread, cakes, flour confectionery and sugar confectionery in specialized stores	1.83	2787.6	5092.0
10710	Manufacture of bread; manufacture of fresh pastry goods and cakes	0.53	7471.2	3955.1
86220	Specialist medical practice activities	0.50	6014.6	3022.0
86902	Activities of midwives and man midwives, physiotherapists and other paramedical practitioners in the field of massage, hydrotherapy, etc.	0.95	2837.2	2707.2
80100	Private security activities	0.47	4941.8	2302.9
47761	Retail sale of flowers, plants, seeds and fertilizers in specialized stores	1.29	1563.0	2015.6
82200	Call Center	0.47	3617.6	1717.1
96022	Beauty treatment	4.17	411.8	1716.6
81291	Cleaning of means of transport	5.95	258.0	1535.0
<b>Balancing Model 2</b>				
45202	Washing, polishing, etc. of motor vehicles	20.76	478.2	9928.0
46320	Wholesale of meat and meat products	13.64	505.4	6892.6
81100	Combined facilities support activities	2.45	1965.8	4820.0
47820	Retail sale via stalls and markets of textiles, clothing and footwear	156.30	20.2	3157.2
81291	Cleaning of means of transport	11.67	258.0	3011.6
77210	Renting and leasing of recreational and sports goods	57.96	51.6	2990.9
47301	Retail sale on behalf of others of automotive fuel in specialized stores	1.23	2061.0	2541.0
93210	Amusement parks and theme parks	3.55	591.2	2101.5
47210	Retail sale of fruit and vegetables in specialized stores	5.33	345.2	1838.7
28211	Manufacture of solar heat collectors	48.06	36.6	1759.0
<b>Balancing Model 3</b>				
80100	Private security activities	1.37	4941.8	4599.5
86230	Dental practices activities	0.45	6803.4	4369.5
47240	Retail sale of bread, cakes, flour confectionery and sugar confectionery in specialized stores	1.13	2787.6	3694.9
10710	Manufacture of bread; manufacture of fresh pastry goods and cakes	1.78	7471.2	3548.9
86902	Activities of midwives and man midwives, physiotherapists and other paramedical practitioners in the field of massage, hydrotherapy, etc.	0.47	2837.2	2267.4
47761	Retail sale of flowers, plants, seeds and fertilizers in specialized stores	0.81	1563.0	1881.5
47810	Retail sale via stalls and markets of food, beverages and tobacco products	1.68	173.8	1816.2
81291	Cleaning of means of transport	1.26	258.0	1808.1
45202	Washing, polishing, etc. of motor vehicles	0.58	478.2	1732.9
86220	Specialist medical practice activities	0.28	6014.6	1702.1

Notes: "Individual weight" describes the weight of each individual observation in the respective sector. "Average number of employees" describes the yearly number of observations in an industry. "Industry weight" is the product of the individual weight and the number of workers in the industry, which indicates the importance of the respective sector in the control group.

Table 6 replicates the main results of enforcement effects identified through entropy balancing, but uses an hourly wage measure to indicate individuals paid below the minimum wage level, where hours are imputed from an external survey, the German "Vierteljährliche Verdiensterhebung", on industry-

specific working hours and earnings (see chapter 4). The results again point to a stronger reduction in the incidence of wages below the minimum wage level in the enforcement industries. However, as in the estimates based on monthly wages, when using the weighted control group from the second balancing model, which accounts for pre-existing worker characteristics at the industry level, the results become insignificant.

**Table 6: Effect of enforcement sectors on wages below the minimum wage threshold, hourly wages**

		Dependent variable: I[hourly wage < 8.50€/hour]					
		(1) Balancing model 1		(3) Balancing model 2		(6) Balancing model 3	
		Sector-FE	Job-FE	Sector-FE	Job-FE	Sector-FE	Job-FE
Enforcement*D2013		0.000 (0.004)	-0.000 (0.004)	0.002 (0.009)	-0.008 (0.010)	-0.004 (0.005)	-0.007* (0.004)
Enforcement*D2014		-0.000 (0.005)	0.006 (0.006)	0.001 (0.012)	-0.001 (0.014)	-0.009 (0.005)	-0.002 (0.006)
Enforcement*D2015		-0.017*** (0.006)	-0.020** (0.008)	0.015 (0.013)	-0.006 (0.019)	-0.023*** (0.007)	-0.025** (0.010)
Enforcement*D2016		-0.022*** (0.006)	-0.029*** (0.009)	-0.007 (0.015)	-0.034* (0.021)	-0.030*** (0.008)	-0.039*** (0.011)
Enforcement		-	-	-	-	-	-
D2013		-0.018*** (0.004)	-0.026*** (0.004)	-0.019** (0.009)	-0.018* (0.010)	-0.014*** (0.004)	-0.019*** (0.004)
D2014		-0.034*** (0.004)	-0.059*** (0.006)	-0.034*** (0.012)	-0.052*** (0.014)	-0.025*** (0.005)	-0.050*** (0.006)
D2015		-0.134*** (0.005)	-0.168*** (0.007)	-0.165*** (0.013)	-0.182*** (0.018)	-0.128*** (0.007)	-0.163*** (0.009)
D2016		-0.148*** (0.006)	-0.190*** (0.009)	-0.163*** (0.015)	-0.185*** (0.020)	-0.140*** (0.008)	-0.179*** (0.010)
Constant		0.470*** (0.007)	0.445*** (0.021)	0.537*** (0.016)	0.457*** (0.046)	0.495*** (0.009)	0.445*** (0.026)
N		1,380,534	1,380,534	1,380,534	1,380,534	1,380,534	1,380,534

Notes: Reported coefficients are from linear difference-in-differences estimations. Balancing variables are measures of the industry wage/minimum wage incidence 2012-2014 in models (1) and (2). In addition to these variables, models (3) and (4) use 2013 industry shares of women, foreigners, skill groups, worker age, age of firm and firm size, while models (5) and (6) use actual individual characteristics of workers and firms. Robust standard errors in parentheses. Asterisks indicate significance levels: \* p<0.1, \*\* p<0.05, and \*\*\* p<0.01. Data: BEH 2012 - 2016, analysis sample.

As already noted in the discussion of the minimum wage literature, the observed gains in compliance in the enforcement industries might be driven by employment reactions if establishments choose to reduce employment rather than to adjust wages to the minimum wage level. Even if the literature suggests that employment effects are rather small on aggregate, there might be a stronger employment reaction in the enforcement industries because establishments have to cope not only with the introduction of the minimum wage but possibly also with a higher administrative burden and/or stricter audits by the customs authorities.

**Table 7: Enforcement Measures and Industry-Level Separation Rates**

	Unbalanced Sample		Balanced Sample	
	(1)	(2)	(3)	(4)
Enforcement	0.013*** (0.003)	0.007*** (0.002)	0.000 (0.006)	0.000 (0.004)
D2014	-0.000 (0.001)	-0.000 (0.001)	0.002 (0.001)	0.002 (0.001)
D2015	-0.001 (0.001)	-0.001 (0.001)	0.001 (0.002)	0.001 (0.002)
D2016	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.002)	-0.001 (0.002)
Enforcement*D2014	0.000 (0.002)	0.000 (0.002)	-0.002 (0.003)	-0.001 (0.003)
Enforcement*D2015	-0.002 (0.002)	-0.002 (0.002)	-0.004 (0.003)	-0.004 (0.003)
Enforcement*D2016	-0.002 (0.002)	-0.002 (0.002)	0.001 (0.004)	0.001 (0.004)
Western Germany	0.010*** (0.001)	0.010*** (0.001)	0.011*** (0.003)	0.011*** (0.003)
Female (share)		-0.009*** (0.003)		-0.005 (0.009)
Foreign (share)		0.027 (0.027)		0.092*** (0.025)
Age (mean)		-0.000 (0.000)		-0.000 (0.001)
Skilled (share)		-0.065*** (0.023)		-0.026 (0.016)
High-skilled (share)		-0.028 (0.018)		0.002 (0.019)
Constant	0.022*** (0.001)	0.076*** (0.024)	0.038*** (0.007)	0.054** (0.026)
N	65,330	65,330	65,330	65,330

Notes: Results from industry level OLS regressions, unbalanced and balanced samples. The balanced sample results from an entropy balancing of industry level data using variables describing the occurrence of low wages as well as variables describing the industry composition in terms of individual and establishment characteristics. The dependent variable is the monthly separation rate for fulltime jobs with initial monthly earnings of less than 2000 Euro. Separation rates are defined as the number of terminated jobs in an industry per month, divided by the number of existing jobs existing in the same industry at the end of the preceding month, calculated separately for Western and East Germany, using the 5-digit NACE industry level and excluding industries with negotiated minimum wages. Results for a set of calendar month controls are not reported. Robust standard errors in parentheses. Asterisks indicate significance levels: \*  $p < 0.1$ , \*\*  $p < 0.05$ , and \*\*\*  $p < 0.01$ . Data: BEH 2013 - 2016, analysis sample.

In Table 7, we present results of regressions of the monthly separation rate for the period from 2013 to 2016, using indicators for years and calendar months as well as interactions of the yearly indicators with the enforcement variable as covariates. We would expect at least a temporary rise in the separation rate in all industries (reflected in the yearly indicators) or a comparably larger increase in the separation rate in the enforcement industries (reflected in the interactions of years and enforcement indicator). However, we do not find any evidence of changes (albeit temporary) in the

separation rate over time, neither for the control nor for the enforcement industries.<sup>15</sup> We conclude that the elimination of jobs has not been an important adjustment strategy of establishments in our sample when confronted with the minimum wage introduction.

## **7. Conclusions**

We analyse non-compliance with the newly introduced German minimum wage and the effectiveness of measures to enforce compliance. The minimum wage was set at € 8.50 per hour of work at its introduction in 2015 and through 2016. Enforcement measures consist of mandatory working hour recordings and unannounced audits by the German customs authorities, which were mandated to audit the minimum wage. For practical reasons, there is industry variation in enforcement measures: some industries must record working hours and are substantially more likely to be audited while other industries are exempted. This creates a natural experiment allowing us to analyze the effectiveness of enforcement measures.

Our results suggest on average, enforced sectors tended to have a higher proportion of wages below 8.50 € before the introduction of the national minimum wage. After the introduction in 2015 and in 2016, the enforced sectors still have higher chances that wages are below this now binding wage floor. These two findings suggest that on average, authorities concentrated enforcement efforts on industries with higher risk of non-compliance. To a first approximation, this represents an enforcement implementation at moderate costs because the customs staff (and potentially also establishments in the enforcement industries) are already trained to perform audits (being audited). On the other hand, a path-dependency of enforcement laws creates some degree of arbitrariness because a number of exempt sectors appear to have similar risk of non-compliance than enforced sectors, e.g. bakeries, retailing, and car washing, see Table 5.

To separate the compliance effects of enforcement measures from the wage and employment effects of the national minimum wage introduction, we employ an entropy balancing procedure. On a very detailed industry level and using large individual data, this allows us to compare the outcomes in the enforcement industries with the outcomes of appropriately weighted observations from non-enforcement industries.

For firms, there are different strategies to achieve compliance with the minimum wage law. One alternative to wage adjustment is to eliminate the jobs in question. The lack of significant differences between enforcement and control industries with respect to changes in the job separation rate

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<sup>15</sup> As an interesting result from Table 7, we find evidence of a higher separation rate in the enforcement industries when using unbalanced data. The effect disappears when comparing only jobs from industries with similar pre-minimum wage characteristics from the balanced data.

suggests that job elimination is not the primary channel in which the enforcement measures affect compliance. Concerning wage adjustment, we find some evidence that non-compliance has decreased more strongly in the enforcement industries as compared to similar industries not included in the list of the anti-moonlighting law. Using different sets of variables in the entropy balancing, as well as different measures of wage compliance, we find that the significant effect of enforcement on non-compliance does not hold in all specifications. Hence, we should be careful not to overemphasize a positive effect of enforcement activities on compliance.

The level of non-compliance in our data is still fairly high, more so in the enforcement industries than in the control industries. In addition, our results are based on full-time earnings. For part-time earnings and especially for minijobs the situation might be worse. It is not clear why jobs with earnings below the legal minimum wage continue to exist. One reason might be the limited resources of the customs authorities, making the threat of unannounced audits less effective. Moreover, even with working time-recording, it might be difficult to detect the incidence and magnitude of underpayment, except of very obvious cases. Another reason – and this is what critics of the minimum wage would possibly argue, is that these jobs are inherently non-productive and would cease to exist if the minimum wage was perfectly enforced. Another reason could be that the affected workers do not have enough “voice” to claim the minimum wage.

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