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Ronald Bachmann
Marion Penninger
Sandra Schaffner

The Effect of Minimum Wages on Labour Market Flows – Evidence from Germany

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Universitätsstr. 150, 44801 Bochum, Germany

Technische Universität Dortmund, Department of Economic and Social Sciences
Vogelpothsweg 87, 44227 Dortmund, Germany

Universität Duisburg-Essen, Department of Economics
Universitätsstr. 12, 45117 Essen, Germany

Rheinisch-Westfälisches Institut für Wirtschaftsforschung (RWI)
Hohenzollernstr. 1-3, 45128 Essen, Germany

Editors

Prof. Dr. Thomas K. Bauer
RUB, Department of Economics, Empirical Economics
Phone: +49 (0) 234/3 22 83 41, e-mail: thomas.bauer@rub.de

Prof. Dr. Wolfgang Leininger
Technische Universität Dortmund, Department of Economic and Social Sciences
Economics – Microeconomics
Phone: +49 (0) 231/7 55-3297, e-mail: W.Leininger@wiso.uni-dortmund.de

Prof. Dr. Volker Clausen
University of Duisburg-Essen, Department of Economics
International Economics
Phone: +49 (0) 201/1 83-3655, e-mail: vclausen@vwl.uni-due.de

Prof. Dr. Roland Döhrn, Prof. Dr. Manuel Frondel, Prof. Dr. Jochen Kluve
RWI, Phone: +49 (0) 201/81 49-213, e-mail: presse@rwi-essen.de

Editorial Office

Sabine Weiler
RWI, Phone: +49 (0) 201/81 49-213, e-mail: sabine.weiler@rwi-essen.de

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Ronald Bachmann, Marion Penninger, and Sandra Schaffner[1]

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Abstract

Using a linked employer-employee data set on the German construction industry, we analyse the effects of the introduction of minimum wages in this sector on labour market dynamics at the establishment level, i.e. turnover and churning flows, as well as accessions and separations and their underlying worker flows. The fact that minimum wages in Germany are sector-specic enables us to apply a between approach using other industries as control groups in a difference-in-differences framework. Furthermore, we use a within approach with high-wage workers as control group. While the within approach shows that the minimum wage reduced worker flows in East Germany, the between approach yields positive effect on labour market dynamics in West Germany. Our results can be explained by differences between East and West Germany with respect to the bite of the minimum wage, as well as the much higher prevalence of posted workers in West Germany. Furthermore, spillover effects to high-wage workers are likely to have played a role in East Germany.

JEL Classification: J23, J38, J42, J63

Keywords: Minimum wage; labour market flows; difference-in-difference; linked employer-employee

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1 Ronald Bachmann, RWI and IZA; Marion Penninger, Institut für Arbeitsmarkt- und Berufsforschung; Sandra Schaffner, RWI. *– This paper is a substantially revised and extended version of REP 358 entitled "Lost in transition? Minimum wage effects on German construction workers". We thank participants of the annual conferences of the European Society of Population Economics and the Verein für Socialpolitik, and of seminars at RWI and ZEW for helpful comments and suggestions. We are grateful to Marvin Deversi and Barbara Treude for excellent research assistance.* *– All correspondence to: Ronald Bachmann, RWI, Hohenzollernstr. 1-3, 45128 Essen, Germany, e-mail: bachmann@rwi-essen.de*

1 Introduction

The labour market effects of minimum wage legislation have been a very active research area in labour economics during the last decades. In this context, the impact of minimum wages on employment levels has taken centre stage, without a general consensus emerging yet (e.g. Card and Krueger, 1994; Allegretto, Dube, and Reich, 2011; Neumark, Salas, and Wascher, 2014). However, even without strong effects on employment levels, minimum wages may have an impact on gross worker flows. This is important for the efficiency of the economy, as well as for individual and social welfare for several reasons. First, changes in job separation rates directly affect employment security, which is usually highly valued by workers. Second, altered hiring rates are likely to affect the duration of unemployment if some of the hirings come from unemployment. Third, worker turnover is associated with costs for firms and workers, e.g. for job search and vacancy posting. Finally, studying the impact on gross worker flows is important because it may provide an explanation for the (lack of) effects of minimum wages on employment levels.

From a theoretical point of view, there are two potential channels through which one can expect effects of minimum wages on labour market dynamics. On the one hand, the introduction of minimum wages can lead to transitional labour market flows. Within a search-and-matching framework with endogenous job destruction (Mortensen and Pissarides, 1994), job matches with productivity below a certain level at the time of the introduction of minimum wages are destroyed, which leads to an increase in employment outflows. Furthermore, with two-sided heterogeneity, there may be an increase in churning flows (Burgess, Lane, and Stevens, 2001) as the introduction of minimum wages may change the optimal combination of firm and worker characteristics. There will therefore be an increase in hirings and firings without a net change in employment. This channel thus unambiguously leads to an increase in worker flows.

On the other hand, the introduction of minimum wages may have an effect on equilibrium outcomes. First, with stochastic match productivity and a binding minimum wage – i.e. a minimum wage above the reservation wage before the introduction of the minimum wage – in a model à la Mortensen and Pissarides (1994) job destruction unambiguously rises. Second, if the minimum wage leads to a compression of the wage distribution, this will *ceteris paribus* lead to less on-the-job search and thus a lower level of direct job-to-job transitions (van den Berg and Ridder, 1998). Third, the effects on hirings depend on the reaction of both workers and firms, i.e. the elasticities of job search and of vacancy creation. The ultimate effect of minimum wages on equilibrium labour market dynamics is thus not clear ex ante and boils down to an empirical question.

In this paper, we examine the effects of the introduction of minimum wages on labour market

dynamics in the German main construction industry (*Bauhauptgewerbe*) in 1997.[1] This industry is of particular interest because for Germany, it constitutes one of the largest economic sectors (1.3 million workers in 1997), it is the sector where minimum wages were introduced first, and it is by far the largest sector covered by minimum wage legislation. As explained in more detail in the next section, the German regulation concerning minimum wages is special in that there was no statutory minimum wage at the national level until 2015. Instead, minimum wages may be introduced at the level of the sector through the Posting of Workers Law (*Arbeitnehmerentsendegesetz*). This institutional set-up provides a unique opportunity for the study of the causal effects of minimum wages because economic sectors which are not affected by the minimum wage legislation in the main construction industry can be used as control groups.

Our analysis focuses on the effects of the aforementioned minimum wage introduction on worker flows. In particular, we examine hiring and separation rates, as well as individual worker transitions to and from employment, at the firm level taking into account different worker origin and destination states. In order to identify the causal effects of the minimum wage introduction, we conduct a difference-in-differences analysis using two types of control groups, one stemming from firms and workers within the main construction industry, another one from another economic sector. The empirical analysis is based on a unique linked employer-employee data set of the German construction industry. This data set is derived from administrative sources and contains all the firms and workers who were in dependent-status employment in the construction industry, as well as in the industries chosen as control groups, during the time period under investigation.

We contribute to the literature on minimum wage effects in two ways. First, we add to the international evidence on the effects of minimum wages on labour market dynamics. Whereas the research of effects on employment stocks is very broad, employment dynamics are only in the focus as of recently. This issue has up to now only been investigated for few countries like Canada (Brochu and Green, 2013), Portugal (Portugal and Cardoso, 2006), and the US (Dube, Lester, and Reich, 2011, Dube, Lester, and Reich, 2016). Most of the studies find hiring and separation rates to be lower due to minimum wage increases. In this context, our outstanding data set allows us to use different control groups in order to identify the causal effect of the minimum wage introduction on worker flows.

Second, we complement the evidence on the effects of minimum wages in Germany. König and Möller (2009) analyze the minimum wage effects on wage growth and the individual employment retention probability in the main construction sector. Rattenhuber (2014) focuses on the consequences in wage distribution and Müller (2010) on the employment effects in the same sector. Using a spatial approach and controlling for district spillovers by taking discontinuities on the district borders into

[1] The minimum wage was €8 per hour for blue collar workers in East Germany and €8.69 in West Germany when the regulations came into force on January 1, 1997.

account, vom Berge, Frings, and Paloyo (2013) analyze the effects on wage growth and employment growth. In contrast, Frings (2013) concentrates on employment effects in other subsectors of the construction industry where different minimum wage rates were introduced. Bachmann, Bauer, Kluve, Schaffner, and Schmidt (2008) and Bachmann, Bauer, and Frings (2014) use establishment surveys in order to examine the attitude of employers towards minimum wages and possible employment impacts for postal services and other sectors.[2] With our analysis, we go one step further and do not only look at the effects on employment stocks, but on gross worker flows. These are of interest *per se* because worker flows are fundamental for worker well-being (e.g. because they mirror employment security), and they provide insights into the mechanisms leading to employment effects, or the absence of such effects. Similar aspects may be expected to be at work as a result of the introduction of a statutory minimum wage in Germany on 1st January 2015.

The paper is structured as follows. In the next section, we describe the institutional background of the German minimum wage regulations. In the third section, we present the data set used in the analysis. The fourth section contains a description of our empirical methodology, and the fifth section presents the descriptive and econometric evidence. The final section summarizes and concludes the discussion.

2 Institutional Background

Germany used to be one of the few countries in the European Union without a generally binding statutory minimum wage. Instead, before 1st January 2015, minimum wages could only be introduced at the industry level. The main reason for the introduction of the first sectoral minimum wage in Germany in 1997 was that many workers from different countries of the European Union as well as third countries were posted to the German construction sites. These workers were mostly paid according the regulations of their home country, which often implied wages below the level of wages paid to German workers. The number of posted workers from Central and Eastern Europe (CEE) that could work in Germany in the 1990s was strictly regulated.[3] Among other things, high unemployment in a region meant that fewer (or no) posted workers were allowed to work in this region. As a result of these regulations, the number of posted workers was much lower in East Germany than in West Germany (Apel, Bachmann, Bender, vom Berge, Fertig, König, Kröger, Möller, Paloyo, Schaffner, Tamm, Umkehrer, and Wolter, 2012).

[2] A second body of the German minimum wage literature consists of "ex-ante" studies simulating the minimum wage effects (cf. Bauer, Kluve, Schaffner, and Schmidt, 2009, and Müller and Steiner, 2008).

[3] The number of posted workers from EU member states was not limited according to the free movements of services. But the number of posted workers from the EU was considerably lower than the number of posted workers from CEE.

The legal framework for the introduction of the minimum wage is the Posting of Workers Law, which allows the extension of specific collective agreements to all firms and workers in an industry, independently of their membership in an employer association or a trade union. Minimum wages can thus be introduced by extending a collective agreement which includes a specific wage floor. The latter applies to domestic and foreign workers alike. Therefore, after the introduction of the minimum wage, it was also binding for posted foreign workers in the construction sector.

The Posting of Workers Law specified strict requirements at the beginning for a collective agreement to be declared generally binding. First, the initial collective agreement must be representative, whereby the number of workers covered by the collective agreement in the respective industry plays an important role. Second, the extension of the collective agreement should be in the public interest. Third, the social partners need to apply jointly for an extension, which requires a high degree of consensus. Then a committee consisting of three representatives of the respective trade union and employer association has to give its consent. Since 1998, the Federal Ministry of Labour and Social Affairs can also declare the collective agreement generally binding without consulting any additional governmental bodies or institutions if the sector is in the scope of the Posting of Workers Law.

The collective bargaining agreement which lead to the introduction of minimum wages in the German construction industry was concluded on 2nd September 1996 and declared generally binding on 12th November 1996. The minimum wage became effective on 1st January 1997 at a level of 17 DM (€8.69) for West Germany and 15.64 DM (€8.00) for East Germany. In September 1997, the minimum wage was lowered to 16 DM (€8.18) and 15.14 DM (€7.74) for West and East Germany, respectively. Generally, workers are paid the minimum wage according to whether their place of work (construction site) is in East or West Germany. West German workers who work (temporarily) in East Germany, however, receive the West German rate.

At the time of its introduction, the minimum wage was binding for 4 percent of the workers in West Germany and for 24 percent of the workers in East Germany (Apel et al., 2012). The Kaitz index – the ratio of the minimum wage to the median wage – was also at a higher level in East Germany (85 percent) than in West Germany (64 percent).

3 Data

The data set used in the empirical analysis is based on the Integrated Employment Biographies (IEB) of the Institute for Employment Research (*Institut für Arbeitsmarkt- und Berufsforschung - IAB*). The IEB data cover all individuals who are employed subject to social security, recipients of social security benefits, or registered with the Federal Employment Agency (*Bundesagentur für Arbeit - BA*) as a jobseeker. Given that the data are derived from administrative sources, the data quality is very

high and the information contained very precise.[4] The structure of the IEB is described in more detail in Dorner, Heining, Jacobebbinghaus, and Seth (2010).

From the IEB, we extract individual information for workers who are either in employment covered by social security in the main construction industry or in the control industry (see Table 1), or who are unemployed. For both labour market states, we only choose those individuals who were employed at least once in the main construction sector or in the industry chosen as control group for the time period between 1993 and 1999, which includes the introduction of the minimum wage in 1997 (for the empirical method and the control groups chosen, see Section 4).

The data set consists of employment and unemployment spells and provides several variables describing workers' characteristics such as year of birth, level of education, sex, job status, occupation, nationality, daily gross wage, and unemployment benefits. Given the administrative nature of our data set, parallel employment spells may occur for individuals. We therefore restrict our sample to the main employment spell of blue and white collar employees working full-time, as well as trainees. We thus do not consider workers in marginal employment and part-time workers, who hardly play any role in the main construction industry. Furthermore, we exclude spells with the duration of one day from our sample.

On the employer side, the data include a unique establishment identifier as well as information on industry affiliation and the employer's regional location. The establishment identifier and the information on the universe of employees in the individual data set allows us to aggregate the information at the establishment level and thus to create a panel data set which contains gross worker flows for every establishment.[5] We thus obtain a unique linked employer-employee data set for the German construction sector and the control industry.

The main variables of interest in our analysis are the accession and separation flows of the blue collar workers for each establishment, which we compute using the underlying information on the employment histories of the individual workers. Note that the accession and separation rates are based only on blue collar workers as the minimum wage regulations are binding only for this group. We count all hirings and separations per establishment in a time period of three months – between 1st April and 30th June of each year. The denominator of the different flow definitions is composed of all blue collar workers being employed in the corresponding establishment on the first day of the

[4]The German social security system requires firms to record the stock of workers at the beginning and the end of each year as well as all changes in employment relationships within the year. So the exact date for hirings, quits or dismissals of employees eligible for social security benefits during the year is reported. Civil servants, self-employed workers and retired persons are not included in the data.

[5]In the data set, the observation unit on the employer side is the establishment, firms cannot be identified. In the following we use the terms "establishment" and "firm" synonymously for our observation unit.

observation period (April 1). Section 4 contains the detailed definition of the different flow variables.[6]

Additionally, we generate establishment-specific variables which serve as control variables in the following multivariate analyses. The average hourly wage of the male blue collar workers controls for different wage levels in the establishments.[7] We also generate a wage dispersion variable, which is defined as the difference between the 1st and the 9th wage decile within an establishment. We control for the age distribution within a firm with different percentiles of the age distribution. The variable "winter employment" indicates the average number of days worked at the establishment during the preceding winter season. This variable accounts for a special feature of the construction sector, namely the winter time from November to March, where special rules apply concerning canceled working hours due to bad weather. Additionally, we include dummies for nine different types of regions to control for different regional labour market conditions. In order to prevent outlier firms with very high average wages to drive the results we focus only on those firms with an average wage of blue collar workers of less than 15 DM in East and 18 DM in West Germany. As a further robustness check we also restrict our analysis to firms with less than 20 employees which is the great majority of construction firms.

Finally, one important constraint of the data set should be mentioned. The information on posted workers from other countries is not included in the data set. This is unfortunate given that the Posting of Workers Law was introduced to protect the domestic workers in the German main construction sector from competition from posted workers.[8] Hence, the data do not allow us to investigate the effects of the minimum wage introduction on posted workers.

4 Empirical Strategy

4.1 Identifying labour market flows

Our aim is to investigate the effect of the minimum wage introduction on worker flows in the construction industry in Germany. We therefore distinguish two labour market states, employment and non-employment (see Section 3 for details about the data set). The state of non-employment is

[6] In order to separate new or exiting establishments from ID-changes or spin-offs we apply the indicator of Hethey and Schmieder (2010).

[7] Note that the (daily) wages in the IEB are censored at the social security contribution limit. This does not constitute a problem in our case because we use the median wage for the computation of average wages within the firm, and because censoring for blue collar workers is low. Additionally, the underlying individual data set used does not contain hourly wages. As described above, it contains only information on daily wages as well as a qualitative variable on working time. Hence, we extract the information of another micro data set, the Mikrozensus, to impute the daily working hours in our sample. With this information we calculate the individual hourly wages for blue collar workers in our data set.

[8] Unfortunately, there is also no other data set which allows a causal analysis of the effects of minimum wages on posted workers in our context.

defined as non-participation, i.e. not being observed in the data, or unemployment, i.e. receiving unemployment benefits.

The dynamics of a labour market are characterized by the turnover and churning rate. The turnover is the sum of all inflows (H) and outflows (S): $T = S + H$ whereas churning is defined as the minimum of both separations and hirings: $C = min(S, H)$. Hirings and separations can be further divided. Transitions of workers who change from one job to another job in a different firm within a seven-day period are counted as job-to-job flows (S_{EE}); if employment spells at the same firm are interrupted by a period of inactivity (i.e. the individual is not observed in the data set) of seven days or less, this does not count as a transition. Transitions from employment to unemployment are counted as employment-to-nonemployment flows (S_{EN}), as are transitions out of employment which are not followed by an employment or unemployment spell within the next seven days (i.e. the individual is not observed for more than seven days after the employment spell). Therefore, the number of separations (S) consists of the sum of the two underlying separation flows:

$$S = S_{EE} + S_{EN}. \tag{1}$$

Similarly to the number of separations, the number of hirings (H) in one firm can be derived by the number of hirings from another job (H_{EE}) and from non-employment (H_{NE}).

In our empirical analysis, we examine the transition rates of the months April – June 1996, the year before the minimum wage introduction, with the corresponding time period of the year 1997. The turnover, churning, separation and hiring rates in each firm are derived by dividing the figure for the respective flow by the number of blue collar workers (E) employed on the first day of the observation period (1st April of the years under investigation).

When computing labour market flows, we explicitly take into account that the construction industry is characterized by a fair amount of workers who leave their job temporarily, e.g. workers that are unemployed during winter and re-employed in the same firm in spring. We therefore restrict our analysis to spring and furthermore define "recalls" as transitions of workers who leave one firm to unemployment or to non-participation and re-enter employment in the same firm within three months without being employed by another firm during this period. Being recalled to a firm is thus similar to a continuous employment spell. In the results presented below, we therefore discard transitions identified as "recalls". This implies that the hiring of a worker does not count as an accession if the worker was with the same employer at some point during the previous three months, and has had no other intervening employment spell since then. On the other hand, a job separation is not counted if the worker returns to the same establishment within the next three months.[9]

[9]Including recalls in the analysis yields very similar results, which are available from the authors upon request.

4.2 The Difference-in-Differences Approach

To identify the causal effects of the minimum wage introduction on labour market dynamics, we apply a difference-in-differences framework using two approaches in order to define the treatment and control groups. In the *within* approach, both the treatment and the control group come from the main construction industry, with the treatment group being affected by the introduction of the minimum wage, and the control not being (directly) affected. In the *between* approach, all establishments in the main construction sector serve as treatment group, and the control group consists of the establishments in the control industry, which is described in detail in Section 4.3.

Based on these differentiations between treatment and control groups, we specify the following difference-in-differences model:

$$D_{it} = \alpha_0 + \alpha_1 Treat_i + \alpha_2 After_t + \alpha_3 Treat_i * After_t + \gamma \mathbf{X}_{it} + \varepsilon_{it}, \tag{2}$$

where D_{it} is the respective transition rate of an establishment i at time t. $Treat_i$ is a dummy variable that indicates whether firm i is part of the treatment group, $After_t$ takes the value 1 if t is after the introduction of the minimum wage and zero otherwise. $\mathbf{X}_{it}$ is a matrix of different additional control variables as described in Section 3.

The coefficient of the difference-in-differences operator α_3 measures the causal effect of the minimum wage if two underlying assumptions are fulfilled. First, the minimum wage introduction does not affect the control group. Hence, for example in the case of the *between* approach, spill-over effects from the main construction industry to the control branches should be as small as possible. This is particularly important because the main construction industry is characterized by interdependencies with many other industries. Second, the evolution of the variables of interest over time would not differ between the treatment and the control group in case no minimum wage was introduced. This assumption clearly cannot be tested as we cannot observe the counterfactual situation, i.e. no minimum wage in the main construction sector after 1997. The comparison of the time trends between the two groups before the minimum wage introduction as well as similar characteristics of both groups give an indication of the quality of the control groups. For a comprehensive overview of the difference-in-differences approach see Lechner (2011).

In the main construction sector, there is a relatively large number of firms who do not display any hirings or separations. Therefore, we observe a substantial share of observations with 0 as dependent variable. Furthermore, it is possible that the distribution of hirings and separations is governed by two separate processes. The first process determines the discrete decision of whether a firm experiences no hirings (or separations) or whether it experiences any positive number of hirings (or separations). The second process determines the intensity of hirings (or separations) given that the firm displays a

positive number of hirings (or separations). In order to allow for the possibility that the introduction of minimum wages has a different impact on these two processes, we apply a simple two step approach.

In the first stage, we estimate the discrete process "no transitions" vs. a positive number of transitions, where "transitions" stands for all our variables of interest (turnover, churning, etc.):

$$D_{it}^{*} = \alpha_0 + \alpha_1 Treat_i + \alpha_2 After_t + \alpha_3 Treat_i * After_t + \gamma \mathbf{X}_{it} + \epsilon_{it} \tag{3}$$

applying a probit model for all firms, with the dependent variable being one if we observe a positive number of transitions and zero if there are not transitions at the respective firm in the observation period. We calculate the marginal effects based on the formula of Puhani (2012). In the second stage, we estimate the transition rate for all firms with a positive number of transitions by applying simple OLS:

$$D_{it} = \beta_0 + \beta_1 Treat_i + \beta_2 After_t + \beta_3 Treat_i * After_t + \delta \mathbf{X}_{it} + u_{it} \quad \text{if } D_{it}^{*} = 1. \tag{4}$$

We apply OLS since the second stage is a positive number between 0 and 100 (a percentage rate).

4.3 Selection of the Control Groups

The choice of a good control group is essential in order to identify the causal effect of the minimum wage introduction. For the analysis at hand, we choose different control and treatment groups as mentioned above. First, we use a *between* approach, which allows us to analyse the overall effects on the main construction industry in comparison to another industry serving as the control group. The industry used as control group should be chosen in such a way that no minimum wage regulations were in force during the time period analysed. Still, there is generally a trade-off between the two assumptions mentioned above: On the one hand, an industry which is very close to the main construction industry (upstream or downstream) is likely to fulfill the common trend assumption to a strong extent. On the other hand, it has a higher likelihood of being affected by spill-overs from the main construction industry.

In order to find the best control industry, we compared key figures of the construction sector with those of potential control industries in the years before the introduction of the minimum wage in 1997. As key figures, we chose the growth rates of the first and fifth quartiles of the wage distributions as well as the employment growth rate. The mean square deviation of the evolution of these variables during the time period 1993–1996 serves as statistical similarity index and selection criterion for the potential control groups. Based on this similarity index, we finally chose the "Manufacture of sand-lime brick, concrete and mortar" as control industry because it is likely to fulfill the common trend assumption.

Furthermore, given that this control industry is an upstream industry, potential effects of the minimum wage introduction in the main construction sector on this industry are only likely to occur through demand-side effects. However, there is clear evidence that the sales volume and investments in the main construction industry do not show a reaction to the minimum wage introduction in 1997 (IAB, RWI, and ISG, 2011). Therefore, indirect effects of the main construction minimum wage on the control industry are highly unlikely.

In the *between* approach described above, we analyse the overall effect of the minimum wage on the main construction industry. However, it is very likely that the effect of the minimum wage in the main construction industry differs by firms, depending on the wages paid before the minimum wage introduction. Therefore, in the *within* approach, we also analyse the effect of the minimum wage within the main construction sector. For this analysis, we assign the firms to the treatment and control group based on the number of workers with wages below the minimum wage in 1996, i.e. the sample consists of workers at firms which were in existence in both 1996 and 1997. In particular, the control group consists of those firms without workers below the minimum wage, and the treatment group consists of those with at least one worker below the minimum wage.[10]

5 Empirical evidence

In the following, we present the results from the two approaches described above, the *between* and the *within* approach. For both approaches, we provide descriptive as well as econometric evidence for worker flow rates at the establishment level, separately for East and West Germany. As described in Section 4.1, the rates considered are the turnover rate, the churning rate, the hiring and separation rates, as well as detailed hiring and separation flow rates, i.e. hiring rates directly from another job (EE) or from nonemployment (NE), and separation rates to another job (EE) or to nonemployment (EN). Table 2 shows the descriptives for our sample used in the subsequent analysis. We observe that the firms are mainly of medium size whereas firms in East Germany are bigger than in West Germany. In West Germany on average 9 percent of the employees in a firm in the main construction sector earned less than the minimum wage while it was 31 percent in the East. The (fictive) share of workers below the minimum wage was lower in the control industry.

We generally only present the marginal effect of the DiD coefficient, i.e. α_3 in Equation 3 and β_3

[10] As a robustness check, those firms where more than 20 percent of the workers were below the minimum wage before its introduction serve as treatment group, and those firms with less than 20 percent of the workers below the minimum wage serve as control group. The results were qualitatively very similar. Consequently, in this setting with control and treatment group within the same industry, we analyse the effect of the minimum wage only on the firms which are directly affected.

in Equation 4. For the turnover regression, the complete results are displayed in Table 3, which shows that the results of the coefficients are generally in line with expectations. For example, in firms with higher wages the turnover is higher, while it is lower with a high wage dispersion.

Furthermore, the negative coefficients on "After introduction" reflects the general development of declining turnover between 1996 and 1997 which can be seen in the descriptive evidence in Tables 4 – 9. They seem to reflect the recessionary background of the main construction industry, which was in decline since the mid-1990s.

5.1 The between approach

At the most aggregate level of labour market flows, it becomes apparent that turnover in East and West Germany decreases both in the main construction and in the control industry (upper panel of Table 4). However, this decrease is less pronounced in the main construction industry than in the control industry, leading to a positive DiD coefficient (upper panel of Table 12). In East Germany, this is the case at the first stage, in West Germany both at the first and the second stage. These results imply that for the main construction industry as a whole, the introduction of the minimum wage caused an increase of the firms that display positive turnover in East and West Germany; in West Germany, in addition turnover was raised for those firms featuring positive worker turnover.

As for churning, the results show that the minimum wage introduction in the main construction industry did not have a significant effect in East Germany (lower panels in Tables 4 and 12). By contrast in West Germany, one can observe a significant effect at the first stage, i.e. the minimum wage significantly raised the share of firms engaging in churning. Again, this is due to the churning rate falling less strongly in the treatment group than in the control group.

Looking at the hiring and separation rates, it becomes apparent that hirings in West Germany significantly increased at the first stage, but not at the second stage (upper panels in Tables 5 and 13. Therefore, the minimum wage raised the share of establishments with positive hiring rates, but did not have an effect given that an establishment had a positive hiring rate. As for separations, there are also positive effects at the first stage in West Germany. For East Germany, there is some evidence that the minimum wage introduction increased separations at the second stage (significant at the 10 percent level only).

Turning to the hiring sources, i.e. hirings from employment (job-to-job transitions leading to hirings) and hirings from non-employment (hirings from unemployment and non-participation), we find no significant effects for hirings coming directly from a different job, i.e. direct job-to-job transitions leading to hirings, neither in East Germany nor in West Germany (Tables 6 and 14). As the descriptive evidence makes clear, this comes from job-to-job transitions in East and West Germany

falling in the treatment and in the control group to a roughly equal extent. By contrast, hirings from non-employment were strongly affected by the minimum wage introduction: In both East and West Germany, there is a positive effect on NE hirings at the first stage, i.e. the minimum wage raised the share of firms hiring workers from non-employment (significant at the 10 percent level in East Germany). The minimum wage did not have a significant effect at the second stage in this context, however.

For the detailed separation rates, a more heterogeneous picture emerges. While the effect of the minimum wage on separations leading directly to a new job is limited in East Germany, there is some evidence of a positive impact on the corresponding flow rate in West Germany (Tables 7 and 15). Separations leading to worker flows to non-employment are more clearly affected. This takes different forms in East and West Germany, however. While in East Germany, one can observe a positive impact at the second stage only, West Germany features a positive impact at the first stage only.

Summarising the results from the *between* approach, it becomes apparent that the introduction of minimum wages had a significant impact on labour market dynamics in Germany: Turnover was increased in both East and West Germany; in addition, churning was increased in West Germany. These effects mainly took place by affecting the first stage of our empirical specification, i.e. the minimum wage raised the share of establishments which display positive turnover, rather than increasing the size of turnover for establishments featuring positive turnover. Furthermore, we observe that both, hirings and separations were increased by the minimum wage introduction. Finally, our analysis of detailed hiring and separation rates shows that job-to-job transitions were virtually unaffected by the minimum wage introduction in the main construction industry; therefore, the effects uncovered for turnover, churning, hirings and separations are almost exclusively due to increased worker flows between employment and nonemployment.

These results thus show a significant impact of 4.89 percentage points for the turnover share (i.e. the first stage of the turnover process) in East Germany, and of 4.62 percentage points in West Germany. This corresponds to an increase of 6.9 percent and 8 percent of the turnover share in East and West Germany, respectively, i.e. the effect is relatively large.

5.2 The within approach

As described in detail in Section 4.2, the *within* approach compares worker flow rates at establishments in the main construction industry which were strongly affected by the minimum introduction with worker flow rates at establishments in the same industry which were hardly affected. For turnover, it becomes apparent that the introduction of the minimum wage led to a reduction at the first stage of the turnover process in East Germany; for West Germany, there are no effects (Tables 4 and 12).

This means that the share of firms in East Germany featuring positive turnover was decreased. This result is completely explained by a significant reduction of the churning rate in East Germany, which does not occur in West Germany. The result for East Germany is likely to be due to the compressed nature of the wage distribution after the introduction of the minimum wage, which implies much lower incentives for workers to change job. As for hirings and separations, we find that the minimum wage introduction reduced both rates in East Germany (Tables 9 and 13). Again, this effect is confined to the first stage, the second stage is not affected at all in East Germany.

Turning to the detailed hiring rates, we find a positive effect on the second stage of hirings which go together with a direct job-to-job transition in East Germany (Tables 10 and 14). This means that for firms with a positive EE hiring rate, this hiring rate increases. While this effect is apparently not strong enough to influence the result on aggregate hirings for East Germany described above, we also find that the rate at which firms hire non-employed workers was reduced at the first stage in East Germany. In West Germany, NE hirings at the second stage and job-to-job hirings were unaffected by the minimum wage introduction.

Finally, we examine the effect of the minimum wage introduction on separations leading to a new job match (job-to-job separations) and separations to non-employment separately (Tables 11 and 15). For East Germany, we find that the minimum wage lowered job-to-job separation rates at the first stage. Separation rates to non-employment were also reduced at the first stage, but increased at the second stage. This means that while the share of firms with positive separation rates to non-employment was lowered by the minimum wage, this rate was raised for the firms with positive separation rates to non-employment. Finally, for West Germany, we do not find significant effects on detailed separation rates.

Summarizing the results from the *within* approach, it becomes apparent that the effects at an aggregate level were confined to East Germany, where turnover and churning were reduced. For West Germany, we did not find any significant effects at this level of aggregation. The results for East Germany can mainly be explained by a reduction of the share of firms with positive hiring and separation rates, with respect to both direct job-to-job separations and transitions between nonemployment and employment.

5.3 Comparison of the between and the within approach

Comparing the results from the between approach and the within approach, it becomes apparent that the two approaches do not lead to the same conclusions, particularly in East Germany. With the between approach, we find a general increase in labour market dynamics: Turnover, and especially hirings from nonemployment, increased after the introduction of the minimum wage. In West Ger-

many we additionally observe an increase in separations. By contrast, the findings from the within analysis indicate that turnover, churning, hirings and separations in East Germany are reduced by the minimum wage introduction. Therefore, the two approaches yield contradicting results for turnover East Germany; for the other outcome variables, we generally obtain negative results from the *within* approach for East Germany and positive results from the *between* approach for West Germany.

These results can be explained by three factors. First, the bite of the minimum wage was much lower in West Germany than in East Germany. Consequently, potentially negative effects on the competitive position of firms can mainly be expected in East Germany. Second, the minimum wage in the construction industry was mainly introduced for protectionist reasons. Therefore, the minimum wage is likely to have reduced the competition from posted workers, which were mainly active in West Germany (see Section 2). This improved the competitive position of West German firms, who could therefore engage in churning flows in order to optimize the composition and quality of their workforce. Therefore, potentially positive effects on labour market dynamics, and especially on churning flows, are likely to arise in West Germany. These two factors together can explain why the results are generally negative for East Germany (from the within approach) and positive for East Germany (from the between approach).

The third explanatory factor is due to the fact that the treatment and control groups in the two approaches are different, and that the two approaches therefore answer different questions. In the between approach, the entire main construction industry (including those who already paid wages above the minimum wage) serves as treatment group, i.e. the approach yields evidence on the effects of the minimum wage on the entire main construction industry. In the within approach, the treatment group consists of those firms in the main construction industry who paid wages below the minimum wage in the year before its introduction. This approach therefore shows the effect of the minimum wage on the firms directly affected relative to the non-affected firms in the main construction industry.

Given this methodological background, the most likely explanation for the contradictory results for turnover in East Germany are spillover effects within the main construction industry, which have been previously found for the roofing sector in Germany (Aretz, Arntz, and Gregory, 2013). This means that the minimum wage had an effect on the firms that already were above the minimum wage before its introduction. The reason for this is that those firms saw their competitive position improved by the introduction of the minimum wage because potentially less productive firms paying lower wages (including firms relying heavily on posted workers) were partly priced out of the market or had to raise their prices in order to cover rising wage costs. This result is also in line with evidence that more productive firms are more likely to be in favour of minimum wages because this raises their rivals' costs (Bachmann et al., 2014).[11]

[11] Furthermore, using an alternative control group with strong input-output linkages to the main construction indus-

Taken together, these three factors imply that high-wage firms in East Germany and the majority of firms in West Germany became more attractive to workers, and were therefore able to engage in an increase of churning flows, which goes together with increased turnover, hirings and separation flows. In East Germany, however, the minimum wage also exerted negative effects because many East German firms saw their costs increase because of the minimum wage. Therefore, the effects on the competitive position of East German firms were split (negative/neutral for low-wage firms, positive for high-wage firms), and they were mainly positive for West German firms. Consequently, while in the *between* approach, no significant effects become visible in East Germany because positive and negative effects cancel out, in West Germany one can observe positive effects in the *between* approach. As these positive effects extend to the entire industry (mainly because competition from posted workers was probably reduced), no significant results emerge from the *within* approach in West Germany.

6 Summary and Conclusions

In this paper, we analyse the causal effects of the introduction of minimum wages on labour market flows in the German main construction industry in 1997. In particular, we examine overall hirings and separations, as well as job-to-job transitions and the flows between employment and non-employment at the establishment level. The fact that minimum wages in Germany are sector-specific allows us to use a difference-in-differences framework with a comparable industry as control group (*between* approach). We complement this analysis with a *within* approach comparing firms paying wages below the minimum level before its introduction with firms paying higher wages.

Our analysis shows for West Germany that the introduction of minimum wages lead to an increase of churning flows and a corresponding increase of turnover, hiring and separation flows, which becomes visible in the *between* approach. We argue that this is due to the majority of firms in West Germany benefiting from the minimum wage introduction because it improved their competitive position relative to posted workers and firms from East Germany. Consequently, they became more attractive to workers, and were therefore able to engage in churning activities. As these positive effects extend to the entire industry (mainly because competition from posted workers was reduced), no significant results emerge from the *within* approach in West Germany. The significant effects uncovered are in all likelihood due to the minimum wage changing the cost structure and potentially operations of firms, making adjustments to their workforce necessary. Given this explanation, we expect these effects to be temporary phenomena.

In East Germany, competition from posted workers was also reduced, but to a smaller extent. At

try, we find results similar to those from the within approach (results available from the authors upon request). This also speaks in favour of the importance of spillover effects.

the same time, however, the minimum wage exerted negative effects because many East German firms saw their costs increase because of the minimum wage. In sum, these effects seems to cancel out, and therefore the *between* approach does not identify significant effects for East Germany. On the contrary, we find negative effects in East Germany with the *within* approach, which can be justified through the negative effects on low-wage firms as well as spillover effects and an improved competitive position of high-wage firms in East Germany.

We also find evidence for a reduction of the share of firms featuring job-to-job separations in East Germany. This effect can be explained by the evolution of the wage distribution in East Germany, which became more compressed after the introduction of minimum wages in 1997. A more compressed wage distribution reduces the incentives of employed workers to engage in on-the-job search, as the expected gains from searching while employed are reduced, which in turn lowers job-to-job transitions (van den Berg and Ridder, 1998).

Our results, especially the ones for East Germany where minimum wages in the main construction sector are strongly binding, thus add interesting insights into the effects of minimum wages. First, our results suggest that, by compressing the wage structure, minimum wages potentially reduce job-to-job transitions.

Second, we show that the introduction of minimum wages may well increase labour market flows, as becomes visible from the between approach for West Germany. This stands in contrast to the previous literature which has found a dampening effect of minimum wages on accessions and separations for Canada (Brochu and Green, 2013), Portugal (Portugal and Cardoso, 2006) and the US (Dube et al., 2011). It seems likely that our result is due to our focus on short-run effects, where transitory dynamics, rather than equilibrium effects, dominate. In addition, the result is likely to be due to the specificities of the main construction industry, which is generally characterised by a large number of posted workers, high turnover rates and a high prevalence of recalls. Finally, as pointed out above, spillover effects may play an important role. This is of high relevance from a methodological point of view given that a within-type approach is likely to be applied in future evaluations of the statutory minimum wage in Germany which was introduced on 1st January 2015.

Third, our results complement and add to the literature on minimum wages in Germany. In particular, we qualify the result by König and Möller (2009) who found effects of the minimum wage in the German main construction industry on employment security, which were however relatively small, especially in West Germany. The much larger effects uncovered by our analysis are likely to be due to the longer time period (1st April to 30th June) that is used for identifying labour market flows.

Finally, a word of caution regarding further interpretation of the results is in order, in particular

with respect to expectations about the effects of the statutory minimum wage introduced on 1st January 2015. Our results are unlikely to hold for minimum wage effects for the entire economy because the main construction industry displays several peculiarities. The most important one is the large number of foreign, posted workers before the introduction of minimum wages. Given that minimum wages were introduced in this sector for mainly protectionist reasons, this group of workers may have experienced negative labour market effects. Unfortunately, there is no data to identify a causal effect of minimum wages on this group. Second, sector-specific minimum wages in Germany, including the minimum wage for the main construction industry, were introduced with the explicit agreement of employer associations and trade unions in the respective industries. This means that only industries where there was an agreement on the introduction of minimum wages indeed adopted a minimum wage. Because of these peculiarities, our results should not be generalised to the effects of minimum wages in other sectors, or to the effects of a generally binding minimum wage. Nevertheless, the basic mechanisms underlying our results are likely to be of high relevance for the analysis of the statutory minimum wage introduced at the beginning of 2015.

Appendix

Table 1: Definition of treatment and control group of between approach

Treatment group	Industry code	Sector
Main construction industry	590	General civil engineering activities
	591	Building construction and civil engineering
	592	Civil and underground
	593	Construction of chimneys and furnaces
	594	Plasterers and foundry dressing shops
	600	Carpentry and timber construction
	614	Floor tilers and paviors
Control group		
Upstream industry	146	Manufacture of sand-lime brick, concrete and mortar

Notes:
Industry codes according to the Classification of Economic Activities of the German Federal Employment Agency 1973 (Wirtschaftszweige nach BA-Klassifikation 1973), (WZ 73).
For information on the selection procedure of the control groups see Section 4.3.

Table 2: Sample descriptives, averages for 1996-1997

Sample descriptives		East Germany	West Germany
	Main construction industry complete	45,845	125,618
Number of firms	Upstream industry	2,150	5,344
	Main construction industry treated	26,279	28,101
	Main construction industry nontreated	9,289	77,532
	Main construction industry complete	623,039	1,098,653
Number of employees	Upstream industry	33,295	86,558
	Main construction industry treated	459,845	388,853
	Main construction industry nontreated	110,882	650,209
Firm characteristics (averages)			
	Main construction industry complete	11.42	7.85
Number of employees	Upstream industry	12.81	13.10
	Main construction industry treated	14.23	12.13
	Main construction industry nontreated	10.10	7.49
	Main construction industry complete	35.60	36.52
Median Worker age	Upstream industry	39.22	40.28
	Main construction industry treated	35.83	36.18
	Main construction industry nontreated	36.06	37.15
	Main construction industry complete	9.03	12.15
Wage level	Upstream industry	9.92	13.76
	Main construction industry treated	8.75	10.92
	Main construction industry nontreated	10.43	13.08
Share of employees	Main construction industry complete	31.13	9.19
below MW at introduction	Upstream industry	19.63	3.05
(in %)	Main construction industry treated	42.26	34.84
	Main construction industry nontreated	0	0

Table 3: Turnover - Detailed regression results

	Within						Between					
	East Germany			West Germany			East Germany			West Germany		
							First stage					
DiD	-0.120	(-2.39)	**	0.007	(-0.22)		0.234	(2.68)	***	0.200	(3.97)	***
Treatment Group	0.934	(19.53)	***	0.567	(23.20)	***	0.402	(5.60)	***	0.039	(0.94)	***
After introduction	-0.064	(-1.50)		-0.010	(-0.76)		-0.400	(-4.72)	***	-0.218	(-4.45)	***
Hourly wages	0.197	(17.24)	***	0.097	(24.41)	***	0.037	(4.41)	***	0.040	(12.24)	***
Wage dispersion	-1.753	(-14.33)	***	-1.178	(-20.67)	***	-2.587	(-21.41)	***	-1.621	(-30.05)	***
Share winter empl.	-0.005	(-8.91)	***	-0.006	(-22.16)	***	-0.005	(-9.24)	***	-0.006	(-22.65)	***
Age	-0.017	(-1.94)	*	-0.009	(-8.91)	***	0.002	(0.27)		-0.009	(-8.44)	***
Age p25	-0.038	(-8.35)	***	-0.036	(-18.31)	***	-0.043	(-9.63)	***	-0.036	(-18.93)	***
Median age	0.093	(1.60)		-0.000	(-0.16)		0.011	(1.82)	*	-0.002	(-0.90)	
Age p75	0.022	(6.32)	***	0.031	(21.13)	***	0.025	(7.15)	***	0.033	(22.33)	***
District types	yes			yes			yes			yes		
Constant	-1.216	(-8.04)	***	-0.264	(-3.64)	***	0.250	(1.66)	*	0.439	(5.49)	***
N	34,014			98,163			35,983			103,968		
R^2	0.063			0.057			0.051			0.050		
							Second stage					
DiD	0.004	(-0.22)		0.007	(0.61)		0.038	(1.35)		0.035	(2.32)	**
Treatment Group	-0.115	(-7.66)	***	-0.063	(-7.32)	***	0.015	(0.21)		0.078	(5.95)	***
After introduction	-0.020	(-1.24)		-0.069	(-11.64)	***	-0.052	(-1.95)	*	-0.100	(-6.92)	***
Hourly wages	-0.074	(-23.63)	***	-0.064	(-40.22)	***	-0.055	(-21.27)	***	-0.055	(-37.61)	***
Wage dispersion	0.047	(1.90)	*	0.102	(7.96)	***	0.111	(4.68)	***	0.135	(11.05)	***
Share winter empl.	-0.003	(-14.62)	***	-0.005	(-31.29)	***	-0.003	(-15.09)	***	-0.005	(-32.58)	***
Age	-0.055	(-19.68)	***	-0.010	(-23.64)	***	-0.058	(-21.30)	***	-0.010	(-25.14)	***
Age p25	0.003	(2.19)	**	0.007	(7.99)	***	0.004	(2.77)	***	0.007	(9.10)	***
Median age	0.000	(0.13)		0.002	(1.92)	*	0.000	(0.02)		0.001	(1.65)	
Age p75	-0.006	(-5.76)	***	-0.006	(-11.12)	***	-0.007	(-6.23)	***	-0.006	(-11.62)	***
District types	yes			yes			yes			yes		
Constant	2.102	(38.84)	***	2.200	(66.61)	***	1.773	(33.09)	***	1.968	(59.39)	***
N	24,042			56,664			25,193			59,844		
R^2	0.109			0.166			0.104			0.166		

Data: Integrated Employment Biographies (IEB) of the Institute for Employment Research (Institut für Arbeitsmarkt- und Berufsforschung - IAB), see Section 3 for details.
Notes: Z/t-values in parentheses. Note that the results for first stage are raw regression coefficients and no marginal effects. All standard errors are clustered on the level of districts. */**/*** significance at the 10/5/1% level. For the description of the variables and the estimation method, see Sections 3 and 4.

Table 4: Turnover and churning rates - Descriptive evidence, between approach

	East Germany		West Germany	
Year	Treatment	Control	Treatment	Control
1st stage: Turnover				
1996	0.713	0.611	0.574	0.574
1997	0.681	0.524	0.570	0.518
2nd stage: Turnover				
1996	0.315	0.252	0.278	0.189
1997	0.290	0.191	0.270	0.152
1st stage: Churning				
1996	0.359	0.265	0.239	0.260
1997	0.317	0.235	0.235	0.222
2nd stage: Churning				
1996	0.099	0.071	0.092	0.054
1997	0.098	0.063	0.094	0.048

Data: Integrated Employment Biographies (IEB) of the Institute for Employment Research (Institut für Arbeitsmarkt- und Berufsforschung - IAB), see Section 3 for details. *Notes:* The treatment and control groups are defined in Section 4.3. The 1st and 2nd stage correspond to the outcome variables in Equations 3 and 4, respectively.

Table 5: Hiring and separation rates - Descriptive evidence, between approach

	East Germany		West Germany	
Year	Treatment	Control	Treatment	Control
1st stage: Hirings				
1996	0.580	0.499	0.435	0.472
1997	0.527	0.410	0.433	0.424
2nd stage: Hirings				
1996	0.204	0.186	0.206	0.147
1997	0.178	0.121	0.188	0.107
1st stage: Separations				
1996	0.492	0.377	0.378	0.361
1997	0.471	0.350	0.373	0.316
2nd stage: Separations				
1996	0.171	0.116	0.140	0.080
1997	0.174	0.107	0.145	0.075

Data: Integrated Employment Biographies (IEB) of the Institute for Employment Research (Institut für Arbeitsmarkt- und Berufsforschung - IAB), see Section 3 for details. *Notes:* The treatment and control groups are defined in Section 4.3. The 1st and 2nd stage correspond to the outcome variables in Equations 3 and 4, respectively.

Table 6: Detailed hiring rates - Descriptive evidence, between approach

	East Germany				West Germany			
	EE		NE		EE		NE	
Year	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
1st stage								
1996	0.208	0.186	0.537	0.459	0.112	0.147	0.402	0.436
1997	0.146	0.124	0.491	0.372	0.102	0.139	0.401	0.379
2nd stage								
1996	0.067	0.066	0.182	0.161	0.061	0.052	0.192	0.133
1997	0.065	0.043	0.161	0.111	0.059	0.042	0.174	0.094

Data: Integrated Employment Biographies (IEB) of the Institute for Employment Research (Institut für Arbeitsmarkt- und Berufsforschung - IAB), see Section 3 for details.
Notes: The treatment and control groups are defined in Section 4.3. The 1st and 2nd stage correspond to the outcome variables in Equations 3 and 4, respectively.

Table 7: Detailed separation rates - Descriptive evidence, between approach

	East Germany				West Germany			
	EE		EN		EE		EN	
Year	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
1st stage								
1996	0.246	0.217	0.404	0.276	0.127	0.150	0.324	0.295
1997	0.186	0.152	0.408	0.274	0.123	0.127	0.319	0.260
2nd stage								
1996	0.093	0.067	0.124	0.086	0.073	0.051	0.111	0.060
1997	0.087	0.070	0.138	0.084	0.075	0.042	0.120	0.060

Data: Integrated Employment Biographies (IEB) of the Institute for Employment Research (Institut für Arbeitsmarkt- und Berufsforschung - IAB), see Section 3 for details.
Notes: The treatment and control groups are defined in Section 4.3. The 1st and 2nd stage correspond to the outcome variables in Equations 3 and 4, respectively.

Table 8: Turnover and churning rates - Descriptive evidence, within approach

	East Germany		West Germany	
Year	Treatment	Control	Treatment	Control
1st stage: Turnover				
1996	0.760	0.596	0.673	0.542
1997	0.732	0.585	0.666	0.543
2nd stage: Turnover				
1996	0.299	0.264	0.260	0.263
1997	0.270	0.242	0.256	0.249
1st stage: Churning				
1996	0.405	0.240	0.333	0.206
1997	0.362	0.238	0.325	0.209
2nd stage: Churning				
1996	0.090	0.093	0.079	0.089
1997	0.089	0.083	0.082	0.088

Data: Integrated Employment Biographies (IEB) of the Institute for Employment Research (Institut für Arbeitsmarkt- und Berufsforschung - IAB), see Section 3 for details. *Notes:* The treatment and control groups are defined in Section 4.3. The 1st and 2nd stage correspond to the outcome variables in Equations 3 and 4, respectively.

Table 9: Hiring and separation rates - Descriptive evidence, within approach

	East Germany		West Germany	
Year	Treatment	Control	Treatment	Control
1st stage: Hirings				
1996	0.630	0.460	0.521	0.417
1997	0.584	0.432	0.511	0.422
2nd stage: Hirings				
1996	0.189	0.195	0.177	0.210
1997	0.161	0.167	0.161	0.189
1st stage: Separations				
1996	0.535	0.375	0.485	0.331
1997	0.511	0.391	0.480	0.331
2nd stage: Separations				
1996	0.159	0.147	0.125	0.127
1997	0.158	0.144	0.134	0.127

Data: Integrated Employment Biographies (IEB) of the Institute for Employment Research (Institut für Arbeitsmarkt- und Berufsforschung - IAB), see Section 3 for details. *Notes:* The treatment and control groups are defined in Section 4.3. The 1st and 2nd stage correspond to the outcome variables in Equations 3 and 4, respectively.

Table 10: Detailed hiring rates - Descriptive evidence, within approach

	East Germany				West Germany			
	EE		NE		EE		NE	
Year	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
1st stage								
1996	0.225	0.162	0.591	0.406	0.141	0.103	0.490	0.382
1997	0.158	0.117	0.550	0.396	0.130	0.097	0.484	0.387
2nd stage								
1996	0.057	0.080	0.168	0.176	0.042	0.072	0.163	0.200
1997	0.054	0.068	0.146	0.150	0.041	0.070	0.147	0.177

Data: Integrated Employment Biographies (IEB) of the Institute for Employment Research (Institut für Arbeitsmarkt- und Berufsforschung - IAB), see Section 3 for details.
Notes: The treatment and control groups are defined in Section 4.3. The 1st and 2nd stage correspond to the outcome variables in Equations 3 and 4, respectively.

Table 11: Detailed separation rates - Descriptive evidence, within approach

	East Germany				West Germany			
	EE		EN		EE		EN	
Year	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
1st stage								
1996	0.277	0.171	0.439	0.299	0.176	0.112	0.427	0.276
1997	0.209	0.148	0.447	0.326	0.166	0.110	0.426	0.276
2nd stage								
1996	0.084	0.094	0.114	0.114	0.058	0.082	0.097	0.101
1997	0.073	0.010	0.126	0.110	0.059	0.078	0.107	0.105

Data: Integrated Employment Biographies (IEB) of the Institute for Employment Research (Institut für Arbeitsmarkt- und Berufsforschung - IAB), see Section 3 for details.
Notes: The treatment and control groups are defined in Section 4.3. The 1st and 2nd stage correspond to the outcome variables in Equations 3 and 4, respectively.

Table 12: Turnover and churning - Difference-in-differences results

		within		between	
Turnover					
East	1st stage	-0.0216	***	0.0489	***
	2nd stage	0.0039		0.0376	
West	1st stage	0.0013		0.0462	***
	2nd stage	0.0070		0.0351	**
Churning					
East	1st stage	-0.0455	***	-0.0072	
	2nd stage	0.0024		0.0186	
West	1st stage	-0.0062		0.0315	***
	2nd stage	-0.0039		-0.0015	

Data: Integrated Employment Biographies (IEB) of the Institute for Employment Research (Institut für Arbeitsmarkt- und Berufsforschung - IAB), see Section 3 for details.
Notes: 1st stage: Marginal effects. The standard errors are calculated based on the delta method.
All standard errors are clustered on the level of districts. */**/*** significance at the 10/5/1% level. For the description of the additional covariates and the estimation method, see Sections 3 and 4.

Table 13: Hiring and separation rates - Difference-in-differences results

		within		between	
Hirings					
East	1st stage	-0.0239	**	0.0298	
	2nd stage	-0.0034		0.0230	
West	1st stage	-0.0023		0.0422	***
	2nd stage	0.0136		0.0209	
Separations					
East	1st stage	-0.0443	***	0.0184	
	2nd stage	0.0128		0.0370	*
West	1st stage	-0.0017		0.0377	***
	2nd stage	-0.0016		0.0101	

Data: Integrated Employment Biographies (IEB) of the Institute for Employment Research (Institut für Arbeitsmarkt- und Berufsforschung - IAB), see Section 3 for details.
Notes: 1st stage: Marginal effects. The standard errors are calculated based on the delta method.
All standard errors are clustered on the level of districts. */**/*** significance at the 10/5/1% level. For the description of the additional covariates and the estimation method, see Sections 3 and 4.

Table 14: Detailed hiring rates - Difference-in-differences results

		within		between	
Job-to-job hirings					
East	1st stage	-0.0128		0.0004	
	2nd stage	0.0386	**	-0.0372	
West	1st stage	0.0038		-0.0006	
	2nd stage	0.0064		0.0087	
Hirings from non-employment					
East	1st stage	-0.0337	***	0.0373	*
	2nd stage	-0.0031		0.0333	
West	1st stage	0.0008		0.0517	***
	2nd stage	0.0116		0.0106	

Data: Integrated Employment Biographies (IEB) of the Institute for Employment Research (Institut für Arbeitsmarkt- und Berufsforschung - IAB), see Section 3 for details.
Notes: 1st stage: Marginal effects. The standard errors are calculated based on the delta method. All standard errors are clustered on the level of districts. */**/*** significance at the 10/5/1% level. For the description of the additional covariates and the estimation method, see Sections 3 and 4.

Table 15: Detailed separation rates - Difference-in-differences results

		within		between	
Job-to-job separations					
East	1st stage	-0.0395	***	0.0245	
	2nd stage	-0.0124		-0.0378	
West	1st stage	-0.0043		0.0182	**
	2nd stage	0.0040		0.0120	
Separations to non-employment					
East	1st stage	-0.0285	**	0.0089	
	2nd stage	0.0244	*	0.0552	***
West	1st stage	0.0014		0.0314	***
	2nd stage	-0.0056		-0.0023	

Data: Integrated Employment Biographies (IEB) of the Institute for Employment Research (Institut für Arbeitsmarkt- und Berufsforschung - IAB), see Section 3 for details.
Notes: 1st stage: Marginal effects. The standard errors are calculated based on the delta method.
All standard errors are clustered on the level of districts. */**/*** significance at the 10/5/1% level. For the description of the additional covariates and the estimation method, see Sections 3 and 4.

References

Allegretto, S. A., A. Dube, and M. Reich (2011): "Do Minimum Wages Really Reduce Teen Employment? Accounting for Heterogeneity and Selectivity in State Panel Data," *Industrial Relations: A Journal of Economy and Society*, 50, 205–240.

Apel, H., R. Bachmann, S. Bender, P. vom Berge, M. Fertig, M. König, H. Kröger, J. Möller, A. Paloyo, S. Schaffner, M. Tamm, M. Umkehrer, and S. Wolter (2012): "Arbeitsmarktwirkungen der Mindestlohneinführung im Bauhauptgewerbe," *Zeitschrift fü Arbeitsmarktforschung*, 45, 257–277.

Aretz, B., M. Arntz, and T. Gregory (2013): "The minimum wage affects them all: Evidence on employment spillovers in the roofing sector," *German Economic Review*, 14, 282–315.

Bachmann, R., T. K. Bauer, and H. Frings (2014): "Minimum wages as a barrier to entry: Evidence from Germany," *Labour*, 28, 338–357.

Bachmann, R., T. K. Bauer, J. Kluve, S. Schaffner, and C. M. Schmidt (2008): "Mindestlöhne in Deutschland Beschäftigungswirkungen und fiskalische Effekte," RWI Materialien 43, Essen.

Bauer, T. K., J. Kluve, S. Schaffner, and C. M. Schmidt (2009): "Fiscal Effects of Minimum Wages: An Analysis for Germany," *German Economic Review*, 10 (2), 224–242.

Brochu, P. and D. A. Green (2013): "The Impact of Minimum Wages on Labour Market Transitions," *The Economic Journal*, 123, 1203–1235.

Burgess, S., J. Lane, and D. Stevens (2001): "Churning dynamics: an analysis of hires and separations at the employer level," *Labour Economics*, 8, 1–14.

Card, D. and A. B. Krueger (1994): "Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania," *American Economic Review*, 84, 772–93.

Dorner, M., J. Heining, P. Jacobebbinghaus, and S. Seth (2010): "Sample of Integrated Labour Market Biographies (SIAB) 1975-2008," FDZ-Datenreport 01/10, Nuremberg.

Dube, A., T. W. Lester, and M. Reich (2011): "Do frictions matter in the labor market? Accessions, separations and minimum wage effects," IZA Discussion Papers, Institute for the Study of Labor (IZA).

Dube, A., W. Lester, and M. Reich (2016): "Minimum Wage Shocks, Employment Flows and Labor Market Frictions," *Journal of Labor Economics*, forthcoming.

Frings, H. (2013): "The Employment Effect of Industry-Specific, Collectively Bargained Minimum Wages," *German Economic Review*, 14, 258–281.

Hethey, T. and J. F. Schmieder (2010): "Using worker flows in the analysis of establishment turnover–Evidence from German administrative data," *FDZ Methodenreport*, 6, 43.

IAB, RWI, and ISG (2011): *Evaluation bestehender gesetzlicher Mindestlohnregelungen - Branche: Bauhauptgewerbe*, Projektbericht.

König, M. and J. Möller (2009): "Impacts of minimum wages: a microdata analysis for the German construction sector," *International Journal of Manpower*, 30, 716–741.

Lechner, M. (2011): "The Estimation of Causal Effects by Difference-in-Difference Methods," *Foundations and Trends(R) in Econometrics*, 4, 165–224.

Mortensen, D. T. and C. A. Pissarides (1994): "Job Creation and Job Destruction in the Theory of Unemployment," *Review of Economic Studies*, 61, 397–415.

Müller, K.-U. (2010): "Employment Effects of a Sectoral Minimum Wage in Germany," DIW Discussion Papers 1061, Berlin.

Müller, K.-U. and V. Steiner (2008): "Would a Legal Minimum Wage Reduce Poverty? - A Microsimulation Study for Germany," DIW Discussion Papers 791, Berlin.

Neumark, D., J. M. I. Salas, and W. Wascher (2014): "Revisiting the Minimum Wages-Employment Debate: Throwing Out the Baby with the Bathwater?" *Industrial and Labor Relations Review*, 65, 608–648.

Portugal, P. and A. R. Cardoso (2006): "Disentangling the minimum wage puzzle: An analysis of worker accessions and separations," *Journal of the European Economic Association*, 4, 988–1013.

Puhani, P. A. (2012): "The Treatment Effect, the Cross Difference, and the Interaction Term in Nonlinear Difference-in-Differences Models," *Economics Letters*, 115, 85–87.

Rattenhuber, P. (2014): "Building the minimum wage: the distributional impact of Germanys first sectoral minimum wage on wages and hours across different wage bargaining regimes," *Empirical Economics*, 46, 1429–1446.

van den Berg, G. J. and G. Ridder (1998): "An Empirical Equilibrium Search Model of the Labor Market," *Econometrica*, 66, 1183–1222.

vom Berge, P., H. Frings, and A. Paloyo (2013): "High-Impact Minimum Wages and Heterogeneous Regions," Ruhr Economic Papers 408, RWI Essen.