THE EMPLOYMENT AND WAGE SPILLOVER EFFECTS OF SLOVENIA'S 2010 MINIMUM WAGE INCREASE

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Abstract

We analyse the effects of a large increase in Slovenia's minimum wage in March 2010 using administrative data covering the entire population of labour force participants. We find that the minimum wage increase had a significant and sizable negative effect on the job retention of minimum wage recipients, especially of young and low-education workers, and also led to an increased probability of job-to-job transitions for minimum wage recipients. In addition, we find evidence of spillover effects of the minimum wage increase on wages higher in the wage distribution, with the effects monotonically decreasing with wages but still present at 150 percent of the new minimum wage. The results are based on a difference-in-differences approach in which the treatment group is comprised of workers whose wages at the time of the introduction of the minimum wage raise were below the new minimum wage, and the control group is comprised of workers whose wages were slightly above the new minimum wage.

Keywords: Minimum wage, worker flows, employment, wages, wage distribution, labour productivity, spillover effects, Slovenia

Introduction

In March 2010, Slovenia dramatically increased the statutory minimum wage, from 597 to 734 euros gross per month, or by 22.9 percent. The magnitude of this increase strongly exceeded that of previous minimum wage adjustments following the introduction of a minimum wage in 1995, and, oddly, coincided with the economic slowdown that started in 2008. After the increase, which placed Slovenia second among all EU countries by the ratio of minimum to average wage, the number of minimum wage earners has been steadily increasing and by 2014 more than doubled.

Both the theoretical and empirical literature on the effects of minimum wages on labour market outcomes has been voluminous – without reaching a consensus about employment effects. Recent studies based on

micro data and quasi-experimental approaches mostly show that high minimum wages negatively affect worker and job flows, reduce employment and inhibit its recovery (see, for example, Neumark, Schweitzer and Wascher 2004 for the United States, and Abowd, Kramarz, Margolis and Philippon 2000, and Portugal and Cardoso 2006, for France and Portugal, respectively). Studies also show that these effects are stronger for vulnerable groups and that they disproportionally affect sectors with high shares of minimum wage recipients. But there are also many empirical studies that report positive and/or statistically insignificant effects of minimum wages on employment and labour market transitions (for example, Card and Krueger 1995, Stewart 2004, and Dickens and Draca 2005; see an overview by Neumark and Wascher 2010).

Less controversial is the evidence that minimum wage increases affect wage distribution.

Wages of workers at the bottom of the wage distribution are most directly affected, but minimum wages also affect wages higher up in the wage distribution via spillover effects (see Neumark, Schweitzer and Wascher 2004 for an overview). This effect has led several authors to conclude that minimum wages have an important contribution to reducing wage inequality in developed countries (see Neumark and Wascher 2010).

In recent years, the minimum wage policy in Slovenia has come under heated debate. Trade unions defend the current level and indexation practices related to minimum wage, pointing to anti-poverty effects of the minimum wage and the reduction of wage inequality in recent years. But others – including the government think-tank IMAD as well as the OECD and European Commission – warn about the negative effects of the 2010 increase of the minimum wage on international competitiveness of the Slovenian economy.[9] Noting that Slovenia recorded one of the largest reductions in economic activity in EU in the post-2008 crisis and at the same time undergone the largest increase in the minimum wage, IMAD (2013) also attributed a loss of 7,000 jobs in the short term, and 18,000 in the long term, to the post-2009 minimum wage hike.[10]

[9] In its latest communication, the European Council (2014) voiced a concern over the limited progress in implementing its last year's recommendation on the minimum wage, and OECD (2013, p. 7) recommends: "Following a 23 percent hike in 2010, the authorities should ensure that the minimum wage declines relative to the median wage over time and adopt a new social agreement introducing wage moderation over an extended period of time to support Slovenia's competitiveness."

[10] The estimates are predictions based on the estimation of nation-wide labor demand function by Brezigar Masten, Kovačič, Lušina and Selan (2010).

The objective of this paper is to rigorously evaluate employment and wage distribution effects of the 2010 Minimum Wage Law, taking advantage of an exceptionally rich, administrative microdata of both workers and firms. On the employment and labour market transition front, the paper addresses the questions whether the minimum wage hike increased the flow of workers from employment into unemployment, inactivity, or another job; and whether it reduced the probability of entry to employment for the likely candidates for minimum wage, for example, for young and low-skilled workers. On the wage distribution front, the paper addresses the question whether the sharp increase in the minimum wage increased the concentration of low-wage workers, and whether there have been spillover effects that increased wages of higher-paid workers.

We find that the minimum wage increase had a significant and sizable negative effect on the job retention of minimum wage recipients, especially of young and low-education workers, and also led to an increased probability of job-to-job transitions for minimum wage recipients. In addition, we find evidence of spillover effects of the minimum wage increase on wages higher in the wage distribution, with the effects monotonically decreasing with wages but still present at 150 percent of the new minimum wage. The results are based on a difference-in-differences approach in which the treatment group is comprised of workers whose wages at the time of the introduction of the minimum wage raise were below the new minimum wage, and the control group is comprised of workers whose wages were slightly above the new minimum wage. The analyses are done at the level of individual workers using administrative data on the population of Slovenian labour force participants spanning the 2005-2012 period. The data permit us to precisely identify minimum wage recipients – thus overcoming a common problem in wage studies using administrative data – and track the individuals over time, which facilitates the precision of the estimates.

The paper is organized as follows. Section 2 provides the institutional background by describing the February 2010 Minimum Wage Law, presents the dynamics of nominal and relative minimum wages as well as the number of minimum wage earners after the Law took effect, and compares Slovenia's minimum wage to the one in other EU Member States. Section 3 describes data and methodology of the study. Section 4 presents the results of the effects of the minimum wage increase in March 2010 on employment transitions and wage distributions. Section 5 concludes.

Minimum wage in Slovenia

In Slovenia, a legally mandated minimum wage was introduced in 1995.

The concept of the minimum wage replaced the system of "guaranteed wage" – a relic from the socialist past that relied on solidarity to

guarantee the payment of minimum wages.[11] The 1995 minimum wage law reflected the consensus among social partners to raise the prevailing minimum gross earnings to about 40 percent of the average national gross wage. It is estimated that at the time of introduction, the minimum wage de-facto increased by 48 percent (Laporšek 2014). Since 1995, minimum wage legislation has undergone numerous changes, most of them concerning the level of the minimum wage and the adjustment mechanism of the minimum wage to macroeconomic parameters (Kresal 2001, Brezigar Masten et al. 2010).

The most substantial changes in minimum wage legislation were introduced with the February 2010 Law on Minimum Wages. First, the law strongly increased the amount of the minimum wage – from 597 EUR to 734 EUR gross, or by 22.9 percent – to correspond to the value of the minimum consumption basket per person (see IMAD 2013). Second, the law altered the adjustment mechanism of the minimum wage to macroeconomic parameters. The new law introduced automatic, full indexation to consumer price index growth – and allowed for additional increases to reflect wage, employment or GDP growth (Article 3). Because of the unprecedented rate of increase, the February 2010 law stipulated that employers could apply for a gradual transition – consisting of three discrete jumps – to the new mandated minimum wage, to be completed by December 31st, 2011.[12]

The February 2010 Minimum Wage Law strongly increased the ratio between the minimum and the average nominal wage and helped the real minimum wage grow much faster than average real wage. In 2009, the ratio between the minimum and the average nominal wage was 41.2 percent, and it increased to 47.6 percent in 2010 (43.2 for firms with gradual adjustment schedule), 49.1 percent in 2011 (45.8 for firms with gradual adjustment schedule), 50 percent in 2012, and 51.5 in 2013 (Figure 1). Moreover, the February 2010 Minimum Wage Law created a huge divergence of growth between real minimum wage and real average wage. Compared to 2009, by 2013 the minimum wage in real terms increased by 31 percent (by 22.5 percent in 2010 alone – see Figure 1). In contrast, reflecting the decline of general economic activity as well as austerity measures in the public sector,

[11] The solidarity reflected in the determination of the so-called ”socially warranted earnings fund” of the firm (see Vodopivec 1993).

[12] The conditions for adopting a gradual transition were very lenient. A gradual increase of the minimum wage could be adopted by firms for which immediate transition would lead to large losses that would jeopardize the existence of these firms or to layoffs of a large number of workers for business reasons (Art. 9 of the Mininum Wage Law). According to the Labour Inspectorate (2010) a gradual transition to the stipulated minimum wage was adopted by 1611 companies.

the real average wage recorded growth only in 2010, when it grew by 1.8 percent, to be followed by small, steady decreases during 2011–13.[13]

It comes as no surprise that in the wake of February 2010 Minimum Wage Law, the number of minimum wage earners more than doubled. In February 2010, there were 17,552 minimum wage earners – 2.7 percent of total workforce, and in March 2010 that number increased to 43,325 – 6.7 percent of total workforce (Figure 2).[14] The number of minimum wage earners increased also in subsequent years so that in 2013, on average, there were 50,569 minimum wage earners – 8.3 percent of the workforce. The vast majority of minimum-wage earners (84 percent in 2013) were employed in the private sector. As regards sector of activity, almost 80 percent of all minimum wage earners was employed in four industries: manufacturing (31 percent), retail (18 percent), other business services (15 percent) and construction (12 percent). All together, market services employed 68 percent of all minimum wage earners (data for December 2013).

Growth in number of firms employing at least one minimum wage earner followed a similar pattern and sharply increased in March 2010. The number of firms with at least one minimum wage earner increased from 3243 (7.3 percent of all firms) in February 2010 to 7378 (16.8 percent of all firms) in March 2010 (Figure 3). A marked increase in the number of firms that employ at least one worker with the minimum wage is observed at the beginning of the year, reflecting the gradual adaptation to the new minimum wage (up to and including the year 2011) and the regular January legislative alignment with the consumer price index in the previous year. According to the latest available data, as of December 2013 there were 8507 firms (21.7 percent of all firms) employing at least one minimum wage earner.

The strong March 2010 increase of the minimum wage brought Slovenia to the forefront among the EU countries by the ratio of the minimum to the average wage. Among all 21 EU Member States that mandate a national minimum wage, in 2012 this ratio was the highest in France (49.8 percent), followed by Slovenia (48.3 percent) and Malta (46.8 percent) – see Table 1.[15] Slovenia's ratio exceeded the average of all 21 EU Member States by 10 percentage points – in most countries, this ratio ranged

[13] In fact, positive aggregate private sector nominal wage growth during 2009–2013 was largely driven by composition effects in the structure of employment, as lower-paid workers suffered disproportionately large job losses during Slovenia's recession (Kajzer, Hribernik, Perko and Selan 2013).

[14] According to the Monthly Reports on Paid Wages (SORS 2014). Firms included in these reports cover 86 percent of total Slovenia's employment.

[15] Minimum wages in other countries – notably in Austria, Germany and Scandinavian countries – are determined via collective agreements (see Laporšek 2013). In Scandinavian countries, minimum wages tend to exceed government-mandated minimum wages of countries in continental Europe.

between 30 and 40 percent. Slovenia held second place, again behind France, also by the ratio of the minimum to the median wage (see Table 1).

Although several other countries have increased the real value of the minimum wagein recent years, Slovenia's adoption coincided with an unusually large contraction of GDP. Among the countries which during 2008–2012 increased the minimum wage in real terms, Slovenia's increase was by far the largest (followed by Slovakia, Latvia and Bulgaria). At the same time, Slovenia was one of three EU Member States that in this period recorded the highest real GDP decline (IMAD 2013). In contrast, the highest real GDP growth during this period occurred in Poland that recorded a reduction of the minimum wage in real terms.

Data and methodology

Data

The data used in this paper are created by linking several administrative databases covering the entire Slovenian workforce. For each worker, the data contains information on employment, unemployment and wages for the 2005–2012 period. Individuals' records from various databases are linked via their unique, masked personal identification number. The resulting database combines the following administrative data sources:

(a) *Work history data*. It contains starting and ending dates of an employment spell, the type of appointment, occupation, employer identification code, and personal characteristics (gender, age, and education). The data are collected as part of social insurance and are maintained by the Statistical Office of Slovenia.

(b) *Data on registered unemployment*. It contains starting and ending dates of an unemployment spell, destinations of exit from unemployment, as well as information on the receipt of unemployment insurance benefits. Personal and family characteristics pertaining to each spell are also included. The data are provided by the Employment Service of Slovenia.

(c) *Worker earnings data*. It contains information on earnings associated with each employment spell of an individual (amount of earnings, number of hours worked, starting and ending date of earnings period). This database is provided by the Pension and Disability Insurance Institute of Slovenia.

In addition, the following two firm-level data sources are used:

(a) *Firm-level minimum wage recipient data.* It contains information on gross wages paid for regular hours and overtime and data on number of workers and minimum wage earners at the firm level. The source of the data are 1-ZAP/M forms, maintained by the

Agency of the Republic of Slovenia for Public Legal Records and Related Services.

(b) *Data on delayed adoption of the new minimum wage.* It contains information on the number of firms who have applied for a gradual, two-year delayed adoption of the minimum wage. The data are provided by the Labour Inspectorate of the Republic of Slovenia.

It has to be stressed that the rich database used in this analysis enhances the accuracy of identification of workers to be included in the treatment group beyond that of studies done for other countries. The effects of the minimum wage increase can be identified at a more granular level than in studies that exploit variation in regulatory binding sectors (e.g. Card and Krueger 1995; Machin, Manning & Rahman 2003) or regional variation in minimum wage levels (e.g. Card and Krueger 2000) that is commonly used in the literature. In addition, analyses of individual-level administrative data often suffer from measurement error in identifying minimum wage recipients (e.g. Currie and Fallick 1996, and Abowd et al. 2000; for a discussion on importance of a suitable datasets see also Stewart 2002): the nature of the data can make it difficult to precisely distinguish workers receiving minimum wages from their slightly higher paid counterparts, especially in the presence for overtime pay, bonuses, or part-time work. The richness of the data at hand facilitates an accurate identification of such workers – a critical component given that this information is used to form the treatment and control groups, as discussed below.

Methodology

Below we outline the strategy to identify both employment and wage distribution effects of the minimum wage change, and then present the specification of estimated models for the analysis of labour market outcomes of interest: changes in employment transitions and distribution of wages.

Identification strategy

To identify the effects of the minimum wage increase on selected labour market outcomes, in particular, to exclude potentially distorting factors which may systematically affect the outcomes of interest, we use a difference-in-differences approach based on "before-and-after" as well as "treatment-and-control" comparisons. As we are dealing with the examination of a legislative change, a proper experimental approach is not feasible. Instead, we employ a "quasi-experimental" approach where the policy change itself produces different groups of workers: some are directly affected by the minimum wage increase and hence form a natural treatment

group, while others are not directly affected and hence form a control group. Comparing the differences in labour market outcomes for these two groups before and after the minimum wage change thus identifies the effect of the change in the minimum wage level – and, moreover, arguably allows for a causal interpretation.

Speaking formally, we define $D \in \{0,1\}$ as the treatment operator equal to 1 if an individual receives treatment (i.e. is subject to a binding minimum wage increase) and zero otherwise. Let $Y(1)$ denote the treated outcome and $Y(0)$ denote the non-treated outcome. Additionally, let Y_t and Y_{t+1} denote the outcomes prior to and after the 2010 minimum wage increases, respectively. The difference-in-differences estimator θ_{did} is then given by

$$\theta_{DiD} = (E[Y_{t+1}(1) \mid D = 1] - E[Y_t(0) \mid D = 1]) - (E[Y_{t+1}(0) \mid D = 0] - E[Y_t(0) \mid D = 0]) \quad (1)$$

In order for the estimator $\boldsymbol{\theta_{did}}$ to provide an unbiased and consistent estimate of the average treatment effect in panel data, two assumptions must hold. First, the control and treatment groups must be subject to equal time trends – in this case, the underlying macroeconomic time trends must have affected the treatment and control groups equally. Secondly, treatment effects must be homogenous – i.e., the minimum wage increase must have impacted those in the treatment group in the same manner that a (counterfactual) increase would have affected the control group. Under these conditions,

$$\theta_{DiD} = E[Y_{t+1}(1) - Y_{t+1}(0)], \quad (2)$$

so that the difference-in-differences estimator $\boldsymbol{\theta_{did}}$is an unbiased and consistent estimate of the average treatment effect.

Treatment and control groups are defined based on the position of workers in the wage distribution at the time of the introduction of the February 2010 law (see Table 2). The *treatment group* consists ofworkers who were directly affected by the legislative change, i.e., of workers whose wages at the time of the introduction of the February 2010 law were below the new minimum wage. This group is called a *sub-minimum group* (g_1). The c*ontrol group I* consists of workers who, at the time of the introduction of the February 2010 law, received wages in the band between the new level of the minimum wage and the level of 1.2 times the new minimum wage. This group is called a *supra-minimum group* (g_2). The residual *controlgroup II* consists of high paid workers.

As workers in the treatment group differ in terms of how much their wage had to be increased to reach the new minimum wage, we divide this group into two sub-groups: (i) lower sub-minimum group, containing

workers who received wages between the old minimum wage and wage up to 10 percent higher than the old minimum wage; and (ii) upper sub-minimum group with wages higher than in the previous group but lower than the new minimum wage.

Empirical model – effects on employment transitions

The effect of the minimum wage increase on the probability of remaining in employment is estimated on all individuals employed as of March 2010 and is modelled using the following specification:

$$Pr[e_{it+1} = 1 | e_{it} = 1] = \alpha_1 g_{1it} + \alpha_3 g_{3it} + x_{it}^{'}\beta + \gamma_t + \varepsilon_{it}. \quad (3)$$

where the dependant variable is binary and equal to 1 if individual *i* was employed at time $t + 1$and 0 otherwise, conditional he/she was employed in time *t*. The variable g_{1it} is a binary variable equal to 1 if $wm_t \leq w_{it} < wm_{t+1}$, and 0 otherwise; g_{3it} is equal to 1 if $wm_{t+1} \times (1 + c) \leq w_{it}$ and 0 otherwise (see Table 2). The supra-minimum group g_2, which includes those for whom $wm_{t+1} \leq w_{it} < wm_{t+1} \times (1 + c)$, is the reference – control group. The vector x_{it} contains explanatory demographic variables for individual *i* in time *t*. These include gender, age, tenure at current employer, education, type of employment contract (fixed-term or permanent), economic activity of employer. Parameter γ_t captures the time varying effects and ε_{it} the stochastic error.

The model for estimating job-to-job transitions is identical to the one in (90) with the exception of the dependant variable, which is equal to 1 if an individual is employed at time $t + 1$ at the same employer as in time *t* and 0 otherwise.

To analyse the impact of the changed legislation on transitions into employment (from unemployment or other jobs), future versions of this paper will also examine the above question using a competing risks semi-parametric framework that takes censoring into account. Under this framework, individuals can transition into multiple, competing states – in our case, into indefinite employment contracts, fixed-term employment contracts, or unemployment. Each of these *K* competing states are associated with a specific hazard function$\lambda_k(t, p, X)$:

$$\lambda_k(t, \boldsymbol{p}, \boldsymbol{X}) = \lambda_{k,0}(t) \cdot e^{(\boldsymbol{p}\gamma_k + \boldsymbol{X}\beta_k)} \quad (4)$$

where **p** is a an indicator variable denoting the policy period, **X** is a set of control variables, $\lambda_{k,0}(t)$ is the non-parametric baseline hazard for state *k*, and γ_k and β_k are parameters to be estimated. Put differently, each specific hazard function is the instantaneous rate of transitioning into state *k* at time *t* conditional on survival until time *t* or later. A benefit of the competing risks

approach is that it can isolate the precise effect of the policy change by calculating the difference in the change of the hazard rate for transitioning to fixed-term employment $\gamma_{fixed-term}$ and the hazard rate for transitioning to permanent employment $\gamma_{permanent}$. The coefficients in the model will be estimated via maximum likelihood method.

Empirical model – effects on wage distribution

The spillover effects of the minimum wage increase are also estimated using the difference in differences framework, following similar approaches by Stewart (2012) and Neumark et al. (2004). The analysis compares changes in wages between the period preceding the large increase in the minimum wage with the following period across workers at different wage levels. We interpret disproportionate wage increases for individual closer to the new, higher minimum wage as spillover effects of the minimum wage increase.

The dependant variable in the model to be estimated is wage growth between consecutive years, denoted $\frac{w_{2it}-w_{1it}}{w_{1it}}$. Here we distinguish between periods without large minimum wage changes, and periods from the introduction of the new minimum wage in March 2010 onwards. The model to be estimated can be specified as

$$\frac{w_{2it}-w_{1it}}{w_{1it}} = \alpha_0 + \beta g_i + \gamma t_i + \theta g_i t_i + \delta x_{it}^{'} + \varepsilon_{it}. \quad (5)$$

The variable g_i is a binary variable equal to 1 for individuals in the treatment group and 0 for those in the control. The variable t_i is equal to 0 for observations referring to periods without minimum wage changes and 1 otherwise. The parameter θ denotes the difference-in-difference estimator of the effect of minimum wage increase. The vector x_{it} contains explanatory demographic variables for individual i in time t. These include gender, age, tenure at current employer, education, type of employment contract (fixed-term or permanent), economic activity of employer, and type of employer (e.g. sole proprietor, LLC).

The choice of observation period is important for accurately gauging the estimates of spillover effects. The baseline period (t_i = 0) is defined as the year between September 2008 and September 2009. This choice is dictated by the prior minimum wage adjustments – in August 2008, the nominal minimum wage was increased by 4 percent, and in August 2009, the minimum wage increased by 1.4 percent. The latter change was arguably small compared to the 22.7 percent increase in March 2010. In order to ensure comparability, the follow-up period (t_i = 1) is defined as the period from September 2009 and September 2010.

In an attempt to exclude the effect of factors which could indirectly affect the growth of an individual's earnings, we restrict the spillover analysis to a subset of the population. The sample on which the model is estimated is restricted to those employed full-time for the entirety of the period between 2008 and 2010 at a given employer. In addition, we exclude individuals whose educational credentials improved during this period. Also, we include only those employed in the non-agricultural business sector. In the public sector wage bargaining is highly centralized; in addition, comparably few workers are paid the minimum wage.

Results

Below we present the results of the minimum wage increase in March 2010 on employment transitions and wage distribution.

The effect of the minimum wage increase on worker transitions

Two types of worker transitions are analysed: separation from employment and transition to another job.

Separation from employment

The minimum wage increase in March 2010 had a negative effect on job retention. In comparison to the control group – the supra-minimum group – one year after the minimum wage increase workers of the lower sub-minimum group had 5.6 percent, and workers of the upper sub-minimum group had 1.8 percent lower probability of staying in employment (see Table 3, specification I). By contrast, high paid workers group had a 3.7 percent higher probability of staying in employment than workers in the control – the supra-minimum – group.

Other coefficients of specification I are also of interest. First, the probability of staying in employment increases with age and tenure (results that hold true also for other specifications presented in Table 3). One explanation for this finding relates to the layoff cost. For example, younger workers have lower tenure and are often involved in temporary forms of employment, resulting in lower dismissal costs for the employers. Second, the probability of staying in employment is higher for workers on permanent employment. This is an expected result, as the costs of the separation of worker under permanent contract are higher for both the worker and employer. Third, the probability of staying in employment is lower among low-education workers, possibly because low-education workers are less likely to quit given their lower re-employment prospects compared to high-education workers. And fourth, the probability of staying in employment is lower in service industries, where the share of minimum wage earners is considerably higher.

The adverse effects of the minimum wage increase on the probability of staying employed were higher for young and for low-education workers. As shown in specification II (Table 3), one year after the legislative change young workers in the lower sub-minimum group had 7.2 percent, and workers of the upper sub-minimum group had 2.2 percent lower probability of staying employed than comparable young workers in the supra-minimum group. Similar to the specification for all workers, high paid young workers also had a higher probability of staying in employment than workers in the control – the supra-minimum – group. Interestingly, the probability of staying in employment was higher among low-education young workers (Table 3, specification II).[16] As expected, the minimum wage hike also reduced the probability of job retention among older workers, but the magnitude of the marginal estimates is smaller than for young workers (Table 3, specification III). This reflects the disadvantaged position of the young in the labour market compared to older workers, a phenomenon well established in the literature.

Specifications IV and V (Table 3) present results for low- and high-education workers. They show that low-education workers in the treatment group – those low-education workers directly affected by the legislative change – had between 2.5 to 6.2 percent lower probability of staying employed than low-education workers in the supra-minimum group (see specification IV). Although the probability of staying employed decreased also for high-education workers (specification V), the relative differences between sub- and supra-minimum groups were smaller than among low-education workers. These results suggest that firms might have reacted to the minimum wage hike by substituting low-education workers by more productive, high-education workers or by avoiding hiring low-education workers. The estimates are in line with most of the empirical studies in the field (see Neumark and Wascher 2010 for an overview).

Estimates in Table 4 extend the results presented above by applying a multinominal probit model to analyse the effect of the minimum wage increase on the probability of making a transition from employment to non-employment, that is, by allowing for two types for exit: to unemployment and inactivity. The results are consistent with previous findings, showing that workers included in the treatment groups – in both lower and upper sub-minimum groups – were more likely to exit from employment to both unemployment and inactivity. The exit probability is especially high for transition into inactivity – workers in the sub-minimum group had 2.1 to 5.3

[16] One possible explanation for this result is that young low-education workers have longer work experience than young high-education workers and, therefore, higher probability of being employed under the permanent contract.

percent higher probability of exiting to inactivity than workers in the supra-minimum group (see Table 4, specification II).

Results presented above compare the probability of staying employed between workers directly affected by the minimum wage increase and workers with slightly higher wages than the new minimum wage in the period after the legislative change. A more appropriate approach to estimate the effects of the new law is a difference-in-differences approach, comparing differences in probability of staying employed between sub- and supra-minimum groups before and after the change (see the section on identification strategy above).

The difference-in-differences approach confirms that the new minimum wage law had negative effect on job retention. As shown in Table 5, the difference in probability of staying employed for workers in the sub-minimum group in comparison to workers in the supra-minimum group additionally decreased in the period after the legislative change – from –0.7 percent in 2008–09 (–1.5 percent in 2009–10) to –2.8 percentage points in 2010–11. The results also show that the minimum wage increase had a disproportionally large negative effect on job retention of vulnerable groups of workers. For young workers, the difference in probability of staying employed between the sub-minimum and supra-minimum groups declined from –1.6 percent in 2008–09 (–2.3 percent in 2009–10) to –4.1 percentage points in 2010–11, and for low-education workers from –1.0 percent in 2008–09 (–1.7 percent in 2009–10) to –3.8 percent in 2010–11.

The above approach is not a full-fledged difference-in-differences approach, as the "before" and the "after" differences between treatment and control groups are estimated in separate regressions, and the difference-in-differences calculated from them. A more sophisticated approach – where the difference-in-differences estimate will be obtained as a parameter estimate in a regression – is underway. As another improvement to be included in the final version of the paper, we plan to estimate semi-parameteric hazard rate model as alternative estimation methods to logit/probit models.

Probability of transition to another job

The results also show that minimum wage hike increased the probability of job-to-job transitions. Table 6 shows that individuals in sub-minimum groups had a higher probability of changing job than comparable individuals in the control – the supra-minimum – group. The probability of moving to another job is especially high among workers in the lower sub-minimum group – they had 3.8 percent higher probability of being employed in another job after one year than comparable workers in the supra-minimum group (Table 6, specification I). A plausible interpretation of this result is

that these workers were more likely to lose their employment after the minimum wage increase and were forced to move to another job.

The probability of changing jobs was higher among young and low-education workers. Young workers in the lower sub-minimum group had 4.1 percent, and those in upper sub-minimum group 1.7 percent, higher probability of moving to another job than young workers in the control – the supra-minimum – group (Table 6, specification II). Similarly, low-education workers in the lower sub-minimum group had 4.3 percent, and those in upper sub-minimum group 2.8 percent, higher probability of moving to another job than low-education workers in the control – the supra-minimum – group(Table 6, specification IV). Noteworthy are also parameter estimates of control variables. For example, women and workers with high tenure are less likely to change jobs, and transitions between jobs are less likely to occur in industrial activities as compared to market services.

How does the probability of job-to-job transitions differ between the old and the new minimum wage laws? Comparison of estimates (Table 7) shows that under the new law, workers in the treatment group – those directly affected by the minimum wage increase – were relatively more likely to have changed their jobs than under the old law. That is, the difference in probability of changing job for workers in the sub-minimum in comparison to the supra-minimum group increased in the period after the minimum wage increase from 2 percent in 2009–10 to 2.8 percent in 2010–11. The probability of changing job increased especially among young workers (from 1.1 to 2.4), whereas there were no major differences among low-education workers.

The effect of the minimum wage increase on distribution of wages

The increase in the minimum wage in March 2010 has remarkably increased the concentration of low wage workers at the minimum. As shown in Figure 4, the legislative change caused an increased concentration at the bottom of the wage distribution and, due to a sharp increase of the minimum wage earners, created a spike at the minimum. A small concentration of minimum wage earners can be also observed at the reduced minimum wage rate in 2010, which was applied by firms in financial distress (those firms could adhere to a gradual transition to a new minimum wage, see above). The effect of the minimum wage increase on the wage distribution was more pronounced in market services, where the share of minimum wage earners was high also before the legislative change (see Figure 5).

The minimum wage hike exacerbated disparities in the wage distributions between young and adult workers as well between low- and high-education workers. As shown in Figures 6 and 7, the new law increased the concentration of minimum wage earners at the minimum

among young workers and especially among low-education workers. In this group we can also observe considerable spikes at the reduced minimum wage rate, implying that a larger share of these workers were employed in firms in financial difficulties. Interestingly, the concentration of minimum wage earners increased also among high-education workers, yet the effect was rather small.

The minimum wage change also coincided with wage increases higher up in the wage distribution, although at diminishing rate. Table 8 reports the regression difference-in-differences estimates on the effect of minimum wage increase on wage growth. The estimates reveal positive and statistically significant spillover effects of the minimum wage increase that are more pronounced for wage levels near the new minimum wage. In particular, workers in the lowest treatment group – whose wages were up to 10 percent higher than the new minimum wage – recorded 3.4 percentage points higher wage growth compared to workers in the control group I. For workers in higher treatment groups – those higher up in the wage distribution – the estimated elasticities become smaller, although they are still statistically significant.

The robustness of the above results is confirmed by using an alternative control group (control group II): workers with wages between the median and the average wage (before the minimum wage increase). In this case, the spillover effects are even more pronounced, also due to the lower growth of control group wages. For example, wages of workers in the lowest treatment group – those with up to 10 percent higher wage than the new minimum wage – have exceeded the growth of the control group II wages by 4.5 percentage points. The spillover effects are statistically significant, but monotonically decreasing, for other treatment groups with higher wages.

Due to considerable differences in the wage distribution and in the concentration of minimum wage earners at the minimum between industries, we estimated spillover effects also separately for workers employed in industrial activities and in market services (Table 9). Spillover effects are observed in both sectors, with more pronounced effects recorded in market services. Compared to control group I, wages of workers in the lowest treatment group increased by up to 2 percentage points in industrial activities and by up to 4.4 percentage points in market services. Spillover effects extend also higher up in the wage distribution, especially in the market services.

Conclusion

Based on rich microlevel data, this paper analyses the effects of the introduction of the Februay 2010 minimum wage law in Slovenia on transitions from employment and on distribution of wages. The results show

that the resulting minimum wage hike increased the probability of transitions from employment – to unemployment, inactivity and another job – for workers directly affected by the minimum wage increase, an effect particularly pronounced for young and low-education workers. Moreover, the minimum wage hike increased the number of minimum wage recipients, created a spike at the bottom of wage distribution, and via spillover effect statistically significantly increased wages that were up to 30 percent higher than the new minimum wage.

The above results underpin a key dilemma in setting the minimum wages: while the minimum wage increase helps to redistribute earnings to low-paid workers, this redistribution may well happen at the expense of employment, an effect that disproportionally affects precisely the groups the minimum wage is intended to help: the young and low-education workers. To be able to provide more reliable guidance for Slovenian policymakers, analysis of several additional aspects related to the minimum wage hike are of essence, ranging from obtaining a more precise estimate of the jobs shed, assessing the change in the share of earnings going to low-paid workers, and, above all, delving into the productivity consequences of the minimum wage hike – both short- and long-term ones. Minimum wage policy can affect productivity through a variety of channels, through substitution effects and adjustments in technology and in business processes.

It has to be stressed that the above results are preliminary, to be refined with further, more detailed analyses. Among others, we will complement the empirical results of logit/probit models by estimating hazard rate models, and improve the application of the difference-in-differences method in estimating employment transition models by directly estimating the average treatment effect. In addition, we intend to further verify the legitimacy of the construction of the treatment and control groups – a necessary condition for interpreting the estimates as reflecting causality and not merely statistical association.

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Tables and figures

Table 1: The minimum wage as the percentage of average and median wages of workers employed full time in EU member states, 2012

% average wage			% median wage
France	49.8	France	61.5
Slovenia	48.3	Slovenia	59.5
Malta	46.8	Portugal	57.7
Belgium	44.6	Hungary	53.9
Ireland	43.7	Latvia	50.9
The Netherlands	41.2	Belgium	50.7
Hungary	39.6	Lithuania	47.8
Portugal	39.6	Ireland	47.6
United Kingdom	38.8	United Kingdom	47.2
Latvia	38	Slovakia	47
Poland	37.9	The Netherlands	46.9
Bulgaria	37.8	Poland	46.5
Slovakia	36.8	Romania	45.2
Lithuania	35.7	Spain	44.2
Croatia	35.6	Greece	43.4
Spain	34.9	Luxembourg	42
Luxembourg	34.5	Czech Republic	36
Romania	31.2	Estonia	35.7
Czech Republic	30.6	Bulgaria	..
Estonia	30	Croatia	..
Greece	29.5	Malta	..
Average	**38.3**	**Average**	**48.6**

Notes:

Data for Bulgaria, Croatia and Malta were collected from Eurostat (2014). Data for other countries were obtained from OECD.Stat (2014). Data gathered from OECD.Stat refer to all employed workers, whereas data from Eurostat only to workers employed in activities B – S (NACE Rev. 2).

.. no data available

Sources: Eurostat 2014; OECD.Stat 2014.

Table 2: Definition of treatment and control groups

Name of the group	Purpose	Condition
g_1: Sub-minimum group	Treatment	$wm_t \leq w_{it} < wm_{t+1}$
g_2: Supra-minimum group	Control I	$wm_{t+1} \leq w_{it} < wm_{t+1} \times (1 + c)$
g_3: High-paid workers	Control II	$wm_{t+1} \times (1 + c) \leq w_{it}$

Legend: w_{it} denotes wage of individual i in the period t (i.e., before the minimum wage increase), wm_t is the minimum wage in period t, wm_{t+1} is the minimum wage in period $t + 1$ (i.e., after the minimum wage increase), c denotes the width of the band of the control group (for example, 20 percent of the new minimum wage).

Table 3: Probability of staying employed one year after the minimum wage increase, (probit) marginal effects

	All workers	**Young workers (age ≤ 30)**	**Older workers (age > 30)**	**Low-education workers**	**High-education workers**
	I	II	III	IV	V
Reference group: *workers with wages up to 20 percent higher than the new minimum wage (supra-minimum group)*					
Lower sub-minimum group	**–0.056*** **	**–0.072*** **	**–0.053*** **	**–0.062*** **	**–0.051*** **
	(0.001)	(0.003)	(0.002)	(0.002)	(0.002)
Upper sub-minimum group	**–0.018*** **	**–0.022*** **	**–0.018*** **	**–0.025*** **	**–0.015*** **
	(0.001)	(0.003)	(0.001)	(0.002)	(0.001)
High-paid workers	0.037***	0.047***	0.037**	0.027***	0.043***
	(0.001)	(0.003)	(0.001)	(0.002)	(0.001)
Explanatory variables *(all variables, with exception of age and tenure, are binary)*					
Women	–0.001	–0.013***	0.001	–0.005***	0.001
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
Age	0.031***	0.136***	0.036***	0.038***	0.026***
	(0.000)	(0.009)	(0.000)	(0.000)	(0.000)
Age^2	–0.000***	–0.002***	–0.000***	–0.000***	–0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Tenure	0.003***	0.003***	0.004***	0.004***	0.002***
	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)
Low-education workers	–0.005***	0.016***	–0.009***		
	(0.001)	(0.002)	(0.001)		
Permanent employment	0.049***	0.081***	0.043***	0.058***	0.045***
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
Industrial activities	0.011***	0.049***	0.007***	0.016***	0.009***
	(0.001)	(0.003)	(0.001)	(0.001)	(0.001)
Pseudo R^2	0.10	0.10	0.12	0.11	0.12
Number of observations	697,063	83,134	613,929	276,439	420,624

Statistical significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Notes:

[1] The dependent variable: probability of staying employed in period $t + 1$, conditional on employment in period t.

[2] Robust standard errors in parentheses.

Table 4: Multinominal probit model of transition probabilities (reference groups: workers who stayed employed)

	Exit to unemployment	*Exit to inactivity*
	I.	II.
Reference group: *workers whose wages are up to 20 percent higher than the new minimum wage (supra-minimum group)*		
Lower sub-minimum group	**0.011*** **	**0.053*** **
	(0.001)	(0.002)
Upper sub-minimum group	**0.007*** **	**0.021*** **
	(0.001)	(0.001)
High-paid workers	–0.032***	–0.021***
	(0.001)	(0.001)
Explanatory variables *(all variables, with exception of age and tenure, are binary)*		
Women	–0.002***	–0.001
	(0.001)	(0.001)
Age	–0.012***	–0.023***
	(0.000)	(0.001)
Age^2	0.000***	0.000***
	(0.000)	(0.000)
Tenure	0.004***	0.003***
	(0.000)	(0.000)
Low-education workers	–0.022***	–0.045***
	(0.001)	(0.001)
Permanent employment	–0.005**	0.002***
	(0.001)	(0.001)
Pseudo R^2	0.14	0.17
Number of observations	662,634	662,634

Statistical significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Notes:

[1] The analysis includes workers, who were employed in March 2010. The probability of exit to non-employment is estimated one year after the legislative change.

[2] Robust standard errors in parentheses.

Table 5: Probability of staying employed (marginal effects) – comparison of estimates before and after the legislative change

Reference group: *workers whose wages are up to 20 percent higher than the new minimum wage (supra-minimum group)*	**Before the legislative change**		**After the legislative change**
	2008–2009	*2009–2010*	*2010–2011*
All workers	–0,007***	–0,015***	–0,028***
	(0,001)	(0,001)	(0,000)
Young workers	–0,016***	–0,023***	–0,041***
	(0,001)	(0,001)	(0,001)
Low-education workers	–0,010***	–0,017***	–0,038***
	(0,001)	(0,001)	(0,000)

Statistical significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Notes:

[1] The dependent variable: probability of staying in employed in period $t + 1$, conditionally that the person was employed in period *t.*

[2] For each specification we estimated the conditional probit model. We present only marginal effects for the sub-minimum groups or workers, who have been directly affected by the legislative change. The parameter estimates of other explanatory variables are similar to those in Table 3.

Table 6: Probability of changing job one year after the legislative change, marginal effects

	All workers	**Young workers (age ≤ 30)**	**Older workers (age > 30)**	**Low-education workers**	**High-education workers**
	I	II	III	IV	V
Reference group: *workers whose wages are up to 20 percent higher than the new minimum wage (supra-minimum group)*					
Lower sub-minimum group	**0,038*** **	**0,041*** **	**0,039*** **	**0,043*** **	**0,036*** **
	(0,002)	(0,006)	(0,002)	(0,002)	(0,003)
Upper sub-minimum group	**0,025*** **	**0,017*** **	**0,026*** **	**0,028*** **	**0,023*** **
	(0,001)	(0,004)	(0,001)	(0,002)	(0,002)
High-paid workers	–0,048***	–0,070***	–0,045***	–0,047***	–0,049***
	(0,001)	(0,004)	(0,001)	(0,002)	(0,001)
Explanatory variables *(all variables, with exception of age and tenure, are binary)*					
Women	–0,021***	0,002***	–0,025***	–0,030***	–0,017***
	(0,001)	(0,003)	(0,001)	(0,009)	(0,001)
Age	–0,004***	0,012	–0,003***	0,001*	–0,007***
	(0,000)	(0,014)	(0,000)	(0,001)	(0,000)
Age^2	0,000***	0,000***	0,000***	–0,000***	–0,000***
	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)
Tenure	–0,009***	–0,008***	–0,012***	–0,005***	–0,003***
	(0,001)	(0,001)	(0,002)	(0,001)	(0,001)
Low-education workers	–0,007***	–0,029***	–0,005***		
	(0,001)	(0,003)	(0,001)		
Permanent employment	0,003***	0,009***	0,007***	0,001***	0,006***
	(0,001)	(0,003)	(0,001)	(0,002)	(0,001)
Industrial activities	–0,037***	–0,129***	–0,028***	–0,042***	–0,032***
	(0,001)	(0,005)	(0,001)	(0,001)	(0,001)
Pseudo R^2	0,09	0,11	0,11	0,08	0,09
Number of observations	638,753	74,455	564,298	247,706	391,047

Statistical significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Notes:

[1] The dependent variable: probability of changing job in period $t + 1$, conditional on employment in period t.

[2] Robust standard errors in parentheses.

Table 7:*Probability of changing employer (marginal effects) – comparison before and after the legislative change*

Reference group: *workers whose wages are up to 20 percent higher than the new minimum wage (supra-minimum group)*	**Before the legislative change**	**After the legislative change**
	2009–2010	*2010–2011*
All workers	–0,020***	0,028***
	(0,001)	(0,001)
Young workers	0,011**	0,024***
	(0,004)	(0,001)
Low-education workers	0,028***	0,031***
	(0,001)	(0,002)

Statistical significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Notes:

[1] The dependent variable: probability of changing job in period $t + 1$, conditionally that the person was employed in period *t.*

[2] For each specification we estimated the conditional probit model. We present only marginal effects for the sub-minimum groups or workers, who have been directly affected by the legislative change. The direction of other explanatory variables is similar as in Table 6.

Table 8: Regression difference-in-differences estimates of the spillover effect

Treatment group (% of minimum wage in March 2010)	*Control group I*	*Control group II*
100 – 110 %	0.034***	0.045***
	(0.002)	(0.001)
111 – 120 %	0.024***	0.035***
	(0.002)	(0.001)
121 – 130 %	0.017***	0.028***
	(0.002)	(0.001)
131 – 140 %	0.012***	0.023***
	(0.002)	(0.001)
141 – 150 %	0.009***	0.020
	(0.002)	(0.001)

Statistical significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Notes:

[1] The dependent variable: wage growth between year 1 and 2. In the table above we present only regression coefficients and standard errors for the difference-in-differences estimates (parameter θ).

[2] Control group 1: workers with wages higher than 150 percent of the new minimum wage, but lower than the median wage. Control group II: workers with wages higher than the median wage, but lower than the average wage.

[3] Robust standard errors in parentheses.

[4] Number of observations: 72.910 – 83.552 in specifications with control group I; and 134.584 – 145.226 in specifications with control group II.

Table 9: Regression difference-in-differences estimates of the spillover effect, industry and market services

Experimental group (% of minimum wage in March 2010)	**Industry**		**Market services**	
	Control group I	*Control group II*	*Control group I*	*Control group II*
	I	II	III	IV
100 – 110 %	0.020*** (0.002)	0.028*** (0.002)	0.044*** (0.002)	0.055*** (0.002)
111 – 120 %	0.015*** (0.002)	0.022*** (0.002)	0.030*** (0.002)	0.041*** (0.002)
121 – 130 %	0.010*** (0.002)	0.017*** (0.002)	0.021*** (0.002)	0.032*** (0.002)
131 – 140 %	0.007** (0.002)	0.014*** (0.002)	0.014*** (0.002)	0.025*** (0.002)
141 – 150 %	0.005** (0.002)	0.013*** (0.002)	0.011*** (0.002)	0.022*** (0.002)

Statistical significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Notes:

[1] The dependent variable: wage growth between year 1 and 2. In the table above we present only regression coefficients and standard errors for the difference-in-differences estimates (parameter θ).

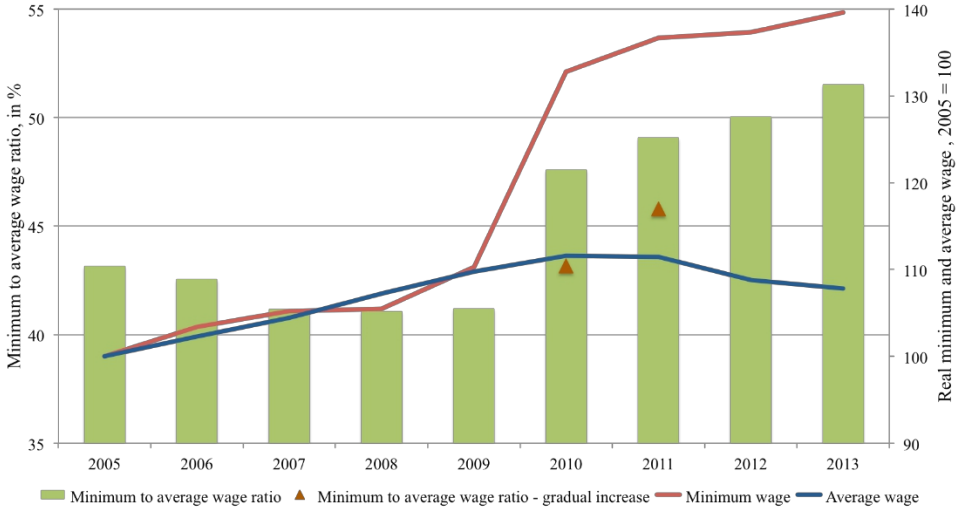
[2] Control group 1: workers with wages higher than 150 percent of the new minimum wage, but lower than the median wage. Control group II: workers with wages higher than the median wage, but lower than the average wage.

[3] Robust standard errors in parentheses.

[4] According to the NACE Rev. 2, industrial sectors are B–E, whereas market services refer to industries F–N and R–S.

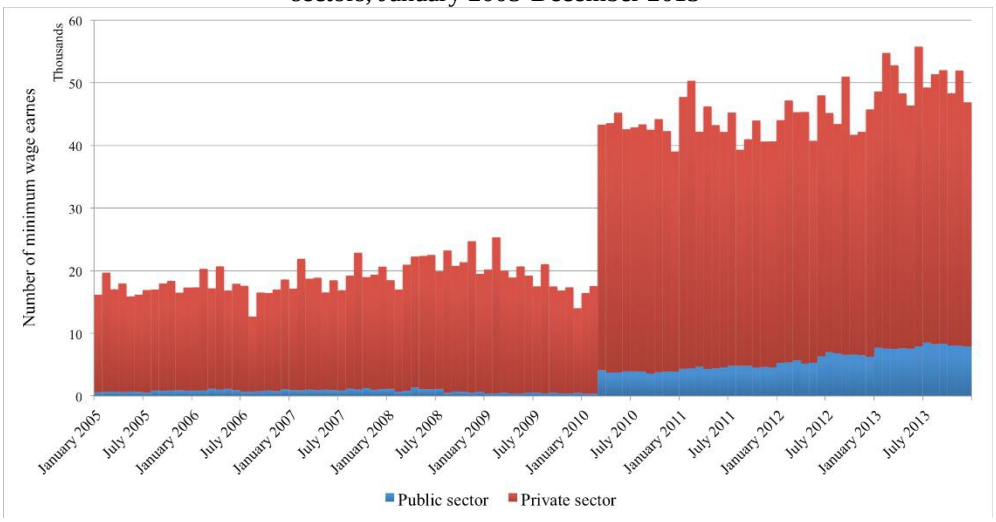
[5] Number of observations in industry sector: 31.361 – 35.478 in specifications with control group I; and 53.994 – 56.176 in specifications with control group II. Number of observations in market services: 40.733 – 48.978 in specifications with control group I; and 79.273 – 87.518 in specifications with control group II.

Figure 1: The ratio between the minimum and average gross wage, real minimum wages and real average gross wages, 2005–2013



Sources: Authors' calculation based on data from SORS (2014) and overview of minimum wage legislation.

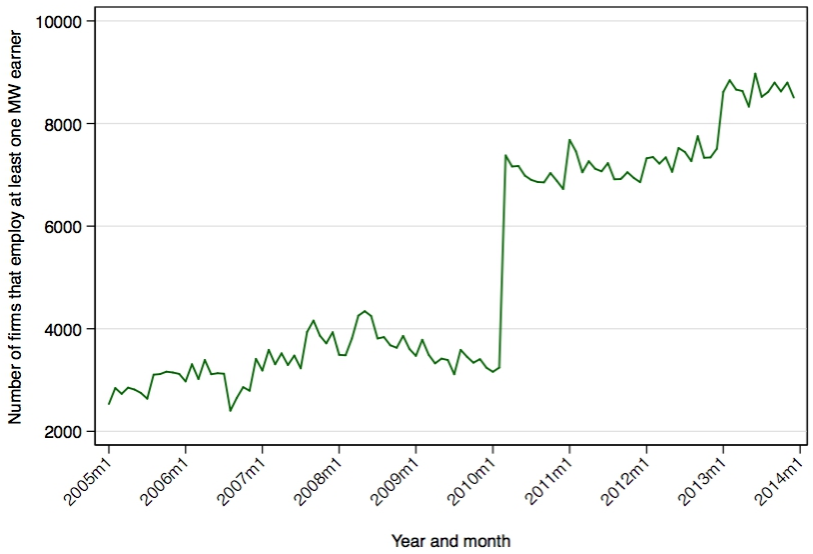
Figure 2: Number of workers in firms that receive the minimum wage, private and public sectors, January 2005-December 2013



Note: Public sector includes to the following industries: public administration and defence, compulsory social security, education, and health and social work.

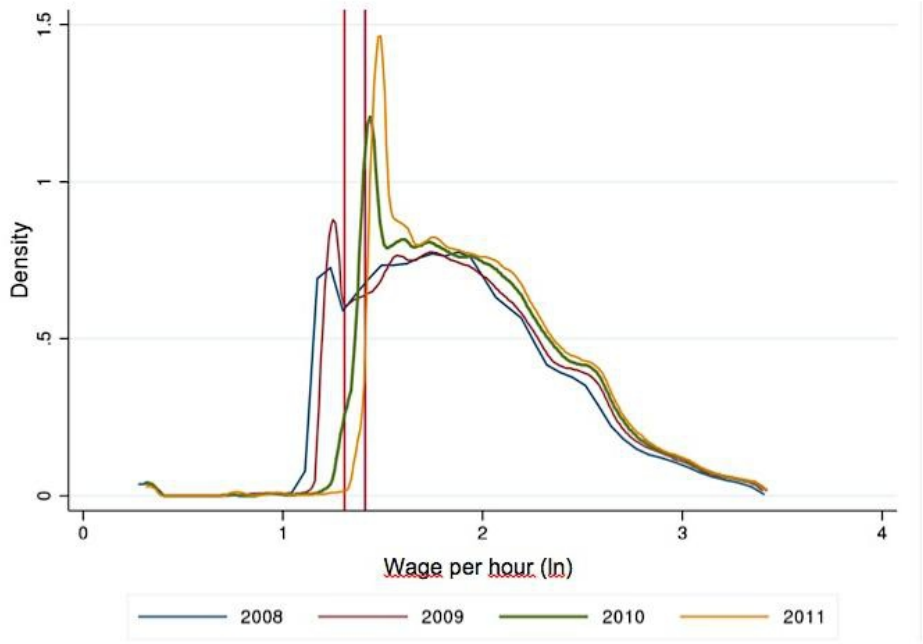
Source: SORS 2014.

Figure 3: Number of firms that employ at least one minimum wage earner, January 2005-December 2013



Source: SORS 2014.

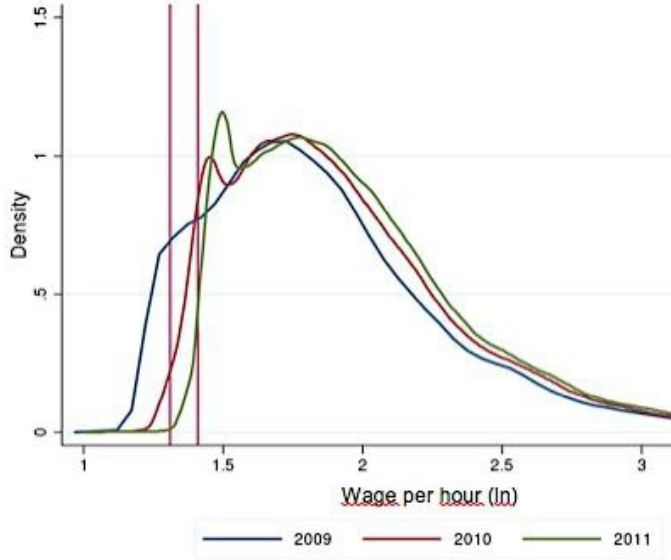
Figure 4: Wage distribution, 2009–2011



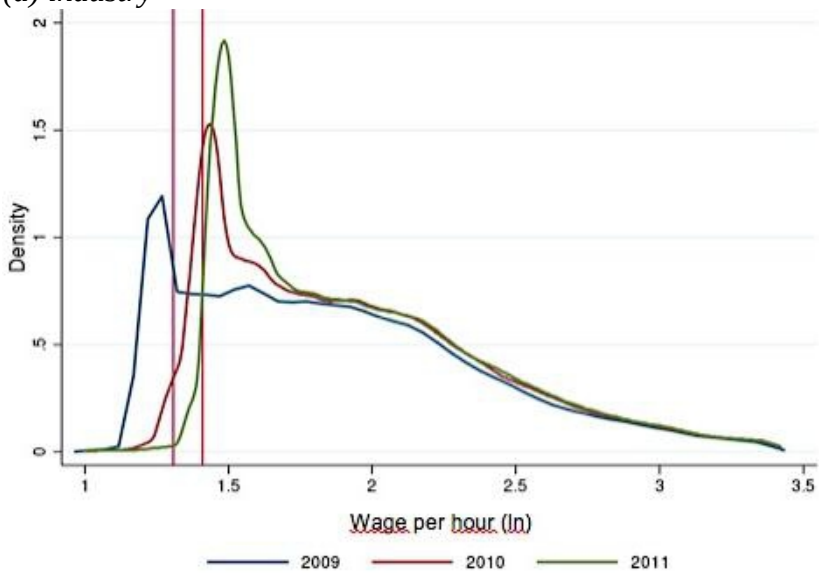
Note:

[1] First red vertical line (from left to right) denotes the reduced minimum wage rate in March 2010 for firms entitled to gradual increase of the minimum wage (i. e., 3.7 euro per hour); the second line indicates the regular minimum wage rate in March 2010 (i.e., 4,1 euro per hour).

Figure 5: Wage distribution, industry (a) and market services (b), 2009–2011



(a) industry



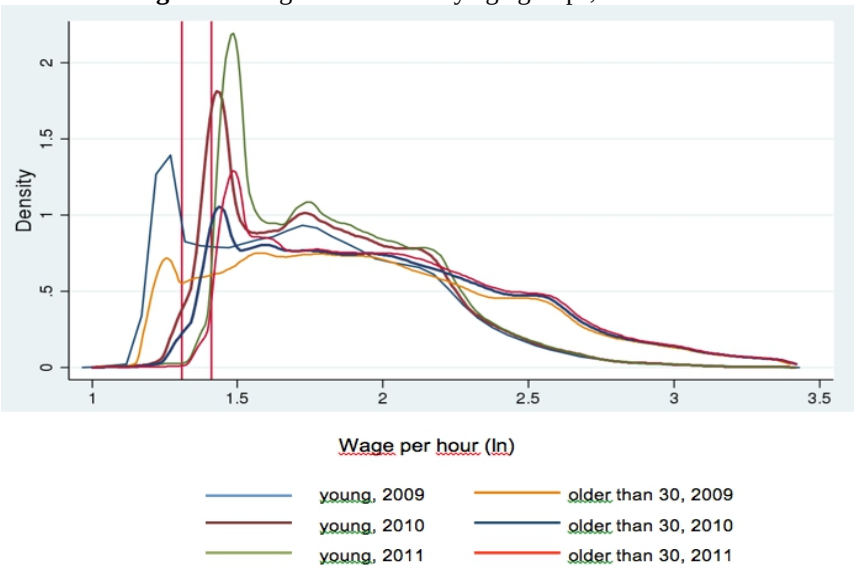
(b) market services

Notes:

[1] According to Nace Rev. 2, industrial activies include activities B–E, whereas market services activities F–N and R–S.

[2] First red vertical line (from left to right) denotes the reduced minimum wage rate in March 2010 for firms entitled to gradual increase of the minimum wage (i. e., 3.7 euro per hour); the second line indicates the regular

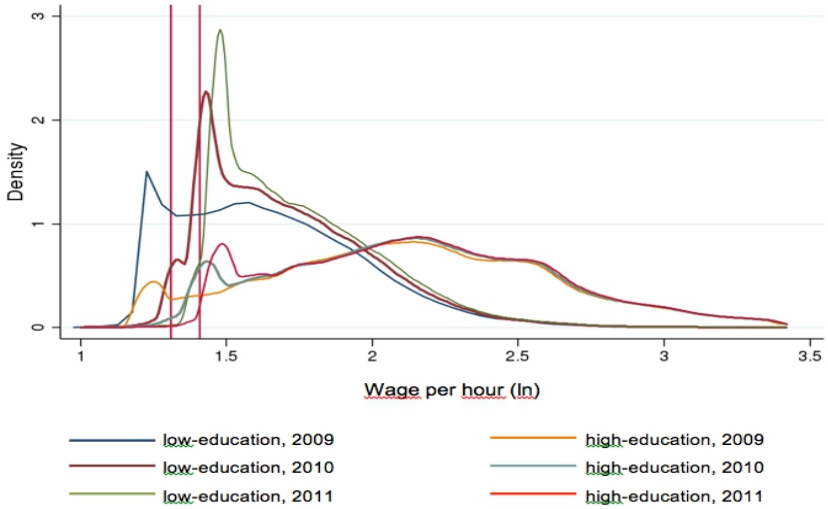
Figure 6: Wage distribution by age groups, 2009–2011



Note:

[1] First red vertical line (from left to right) denotes the reduced minimum wage rate in March 2010 for firms entitled to gradual increase of the minimum wage (i. e., 3.7 euro per hour); the second line indicates the regular minimum wage rate in March 2010 (i.e., 4,1 euro per hour).

Figure 7: Wage distribution among low- and high-education workers, 2009–2011



Note:

[1] First red vertical line (from left to right) denotes the reduced minimum wage rate in March 2010 for firms entitled to gradual increase of the minimum wage (i. e., 3.7 euro per hour); the second line indicates the regular minimum wage rate in March 2010 (i.e., 4,1 euro per hour).