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Working papers

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Working Papers
Institute of Statistics and Demography
Warsaw School of Economics

Nr.45, rok 2015

The impact of the minimum wage on job separations and working hours among young people in Poland

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Abstract

The aim of this paper is to investigate the impact of the minimum wage on the risk of job separation and changes in working hours among young people in Poland. To this end, we use longitudinal data from the Labour Force Survey 2003-2011 and a difference-in-differences matching estimator based on the changes in the individual position in the wage distribution. Specifically, we test the impact of the minimum wage by distinguishing between individuals who experienced a transition to the below-the-minimum-wage regime. Our results indicate that when the minimum wage was increased, employment levels, but not the number of hours of worked, declined among young people. We also found that the number of hours worked actually increased among those young people who remained employed after the minimum wage was raised. However, these effects of a hike in the minimum wage were found to have differed across various groups of workers, with men, students, and individuals who were working under a fixed-term contract being most likely to have either lost a job or increased their working longer hours.

Keywords: minimum wage, youth unemployment, difference-in-differences matching

JEL: J21, J24, J63

CONTENTS

- I. MOTIVATION 4**
- II. LITERATURE REVIEW 7**
 - THEORETICAL MODELS 7*
 - EMPIRICAL LITERATURE 8*
- III. CONTEXT..... 11**
- IV. DATA AND METHODS 14**
 - ANALYTICAL STRATEGY 14*
 - DATA 17*
- V. EMPIRICAL RESULTS..... 20**
 - THE IMPACT OF THE MINIMUM WAGE ON JOB SEPARATIONS 20*
 - HETEROGENEOUS EFFECTS..... 21*
- VI. DISCUSSION OF KEY FINDINGS..... 23**
- ACKNOWLEDGEMENTS 25**
- ANNEX 25**
 - TABLE A1. THE PROFILE OF WORKERS AT RISK (ESTIMATED COEFFICIENTS OF LOGIT MODELS OF THE PROBABILITY OF EARNING A WAGE BELOW THE MINIMUM WAGE. 25*
 - TABLE A2. THE ASSESSMENT OF QUALITY OF MATCHING(BALANCING TEST FOR COVARIATES) 27*
- REFERENCES 28**

I. MOTIVATION

The minimum wage is regarded as a key labour market institution that may affect labour supply at both the intensive and the extensive margins. Its impact is believed to be particularly strong among young workers, who lack experience and seniority and are therefore more likely to earn wages at levels close to the minimum wage. In many countries, the labour supply of young workers may be more sensitive to the changes in the minimum wage levels, partly because young people have the opportunity to prolong their education as an alternative to employment (Pastore, 2012; Petrongolo & San Segundo, 2002). In an attempt to raise employment rates and improve conditions for youth labour market integration, some governments have lowered the basic minimum wage level or have introduced subminimum wages, which target workers below certain ages (Dickens, Riley, & Wilkinson, 2014). These measures have often been criticised by proponents of minimum wage restrictions, who tend to argue that the official mandates prevent the segmentation of the labour market, and are effective policy tools for fighting poverty (Lemos, 2009).

However, the available empirical studies provide no clear consensus on the overall effects of such minimum wage reforms. These conflicting results may be attributable in part to the complex mechanisms through which the minimum wage operates on the labour market. According to the neo-classical models, a minimum wage may impose labour market costs which are higher than the individual productivity of the workers who are at the bottom of the wage distribution. Thus, those workers may lose their jobs. However, the basic neo-classical models involve a number of assumptions that may be unrealistic in practice. For example, these models fail to allow for the possibility that employers may respond to a minimum wage increase by reducing the number of hours worked rather than the number of workers. The effects of minimum wage regulations may be ambiguous if we consider hours of work as the units of labour resources used by employers (Strobl & Walsh, 2011). Meanwhile, some employers may respond to a minimum wage hike by reducing their workforce and simultaneously increasing the number of working hours for those left behind, especially if doing so does not affect the

individual productivity of workers and/or overtime premia. This strategy may be pursued because of a desire to take maximum advantage of fixed employment costs, and especially of the opportunity to add hours for part-time workers without paying overtime (Boeri & Van Ours, 2008). On the supply side, a higher minimum wage will shift the balance between substitution and income effects among some workers who are inactive, and will thus increase labour market participation at both the intensive and the extensive margins. The overall impact of these effects will depend on the interaction of these economic forces with other elements of the labour market's institutional setting.

In our study, we examine the effects of minimum wage levels on both the employment opportunities and the hours of work among young people using microdata from the Polish Labour Force Survey 2003-2011, which is the source of official statistics on the labour market situation in Poland. We have chosen 2003 as the starting date because this is the year when a new law on the minimum wage went into effect in Poland. The law fundamentally changed the rules on how the minimum wage is set and permitted to increase. This survey has a panel component, and we take advantage of this longitudinal dimension in order to assess whether changes in regulations have a causal effect on youth labour market opportunities. We employ an estimator that combines the difference-in-differences technique with propensity score matching based on the changes in the position in the wage distribution of each individual. Specifically, we test the impact of the minimum wage by distinguishing individuals who experience a transition to the below-the-minimum-wage regime. Combining propensity score matching with the difference-in-differences technique enables us to identify any temporarily-invariant unobserved factors that may bias the results (Blundell & Dias, 2002; Heckman, Ichimura, & Todd, 1997, 1998; Smith & Todd, 2005). At the same time, difference-in-differences matching is superior to a standard difference-in-differences estimator, as it does not impose linear functional form restrictions in the conditional expectation of the outcome variable, and it reweights the observations according to the weighting function of the matching estimator (Smith & Todd, 2005).

The country for which we examine the effects of the minimum wage on youth labour market opportunities is interesting for a number of reasons. First, relative to other European countries, Poland has exceptionally high levels of unemployment and low levels of job stability among young people (Scarpetta, Sonnet, & Manfredi, 2010). Second, while the literature on the consequences of the minimum wage is voluminous, it has focused mainly on Anglo-Saxon countries, where the effects of minimum wage increases are often limited because the minimum wage in these countries tends to be low. Meanwhile, we have limited evidence for changes in the minimum wage in other developed countries with different institutional settings; or for countries in which an increase in the minimum wage is consequential because the minimum wage is binding for a relatively large proportion of the labour force. At the same time, it is well known that minimum wage policies interact strongly with several other labour market institutions, particularly payroll taxes and collective bargaining. A study for Poland may fill this gap, because in recent decades minimum wage levels in Poland have been set at higher levels than in the Anglo-Saxon countries, and underwent several substantial changes over the 2003-2011 period. The most recent reforms have been especially controversial, as the negotiations between the social partners reached no consensus and led the government to gradually raise the minimum wage from 35.7% of the national average wage in 2005 to 41.1% in 2009. Moreover, in Poland payroll taxes are high at the bottom of the wage distribution and the collective bargaining system is weak, and is thus unable to influence labour market outcomes (Gardawski, Mrozowicki, & Czarzasty, 2012; Magda, Marsden, & Moriconi, 2012; Meardi & Trappmann, 2013). Finally, it makes sense to conduct an in-depth analysis of a change in minimum wage regulations in a country which has the second-highest proportion of working poor in Europe (EUROFUND, 2010), and in which over one-fifth of employees can be classified as low-paid workers (Magda, 2010), and where a large proportion of the working-age population are unemployed.

The structure of this paper is as follows. In the next section, we discuss the predictions of theoretical models and the results from the relevant empirical studies on the impact of the

minimum wage on employment and hours of work. In Section 3, we describe in detail the evolution of the minimum wage in Poland. In Section 4, we present the data and methods used to assess its impact on job separations and hours of work. In Section 5, we present our results. In Section 6 we discuss our conclusions based on these findings.

II. LITERATURE REVIEW

THEORETICAL MODELS

According to the neo-classical models, a minimum wage distorts labour market equilibrium. An increase in the minimum wage makes it more costly for companies to employ workers who are at the bottom of the wage distribution. As long as workers are offered wages based on their marginal productivity, workers whose total labour costs are lower than the new minimum wage should no longer be employed unless their marginal revenue product increases. When the minimum wage is raised, employers may lay off workers whose marginal revenue product is lower than the new minimum wage.

However, as labour market imperfections come into play, the actual response to a reform of the minimum wage by employers may not follow this model. In principle, the choices made by firms about the number of workers they employ and the hours each employee works depend on a number of factors, such as the technology and schedule of production, the fixed costs, and the regulations regarding the number of hours worked (e.g., overtime premia). Thus, employers may choose to reduce the number of hours worked instead of (or in addition to) laying off workers, or they may reduce the number of workers they employ while increasing the number of hours worked among the remaining employees (Michl, 2000; Strobl & Walsh, 2011).

Particularly in the short run, it may be easier for firms to change the distribution or number of hours worked than the number of people they employ, especially if hiring and firing workers takes time and entails high procedural and severance costs (Stewart & Swaffield, 2008). Moreover, the impact of a minimum wage increase will also depend on the firms' monopsony

power (Flinn, 2006) and the extent of labour market dualism, especially the size of the informal sector (Boeri & Van Ours, 2008).

The models that account for labour market imperfections predict that a minimum wage will have a positive effect on the labour supply. Depending on the size of the substitution and income effects, a higher minimum wage may provide incentives for work and actually increase both wages and employment (Aaronson & French, 2007; Boeri & Van Ours, 2008; Dickens, Machin, & Manning, 1999). First, a higher hourly wage can change individual preferences with regard to consumption and leisure, acting as an incentive to work more hours given the higher cost of leisure. This effect will be stronger for workers with lower total incomes, particularly those who had been working relatively few hours. Second, a higher minimum wage will raise the attractiveness of work compared to alternative forms of income (such as social assistance benefits). Again, this will act as an incentive to work for people who are either outside of the labour market or have been working relatively few hours. A similar prediction may be derived from efficiency wage models (Rebitzer & Taylor, 1995).

Finally, the overall impact on employment of changes in the minimum wage will vary based on the institutional setting of the labour market (see Neumark and Wascher 2004 for a review). A number of factors may shape the responses of employers and employees to changes in the minimum wage, including the bargaining power of unions and of collective bargaining systems, the structure of payroll taxes, and the (above-mentioned) generosity of the existing social safety net (Bassanini & Duval, 2006, 2009). Thus, the effect of the minimum wage on employment and on the number of hours worked has yet to be determined empirically, as the evidence for certain countries may not be applicable to economies with different institutional settings.

EMPIRICAL LITERATURE

Most of the existing empirical research has examined the impact of minimum wages on employment by measuring the response of the employment stock in a cross-sectional setting,

whereas relatively few studies have adopted a dynamic design which can be used to assess the effects of minimum wage increases on job flows. Looking at employment stock at a specific point in time may conceal the mechanisms of the effects of the minimum wage. According to the theories outlined in the previous section, a reform of the minimum wage may trigger job cuts, but because it can also create incentives for paid work among groups of workers who had been disconnected from the labour market, it can trigger an increase in job accessions. As a result, the net effect of an increase in the minimum wage on the stock of employees may be undistinguishable from zero, while effects which are significant from a dynamic point of view remain hidden.

One of the studies which took a dynamic approach was carried out by Portugal and Cardoso (2006). They found that teen job separations fell substantially after a minimum wage increase, and that job accessions also decreased. Thus, the overall impact on teen employment of an increase in the minimum wage was shown to be negative. While these authors used data on gross flows, other studies have employed micro-level data which make it easier to define the category of workers who were affected by a minimum wage change, and a control group who were unaffected by this policy. Yuen (2003) used panel data from the Canadian Labour Force Survey to find that among all low-paid workers, the effect of a minimum wage increase was actually close to zero, but that certain low-wage workers with long low-wage employment histories faced strong disemployment effects (this effect was shown to have been especially strong among the young people in this group). The negative effects of the minimum wage have been documented by (Brochu & Green, 2013) as well. Also using the Canadian Labour Force Survey, they compared job separations among workers with a tenure of less than one year and those with more experience. They found that layoffs among new hires declined in the year after a minimum wage increase, and that a reduction in dismissals was accompanied by a decrease in hiring rates. Based on panel data from the Canadian Survey of Labour and Income Dynamics, Campolieti, Fang, and Gunderson (2005) also found a substantial increase in the number of transitions from employment to non-employment among low-wage youths. Similar conclusions

were reached by Neumark, Schweitzer, and Wascher (2004), who used panel data from the US Current Population Survey to find that the employment chances of low-wage workers fell considerably when the minimum wage was increased. Abowd, Kramarz, Margolis, and Philippon (2000) analysed longitudinal data for the US and France. Their results showed that exits from employment were not very sensitive to changes in the minimum wage rate in the US, but that there was a strong negative effect in France (confirming the above-mentioned impact of the overall institutional setting). Entry into employment was not very sensitive to changes in the minimum wage rate in either country, according to their findings. Skedinger (2006) showed that in the Swedish hotel and restaurant industry, job separations tended to increase when the minimum wage was raised.

While the effects of the minimum wage on employment have been extensively discussed in the literature, relatively few studies have focused on the effects of the minimum wage on working hours. The effect of the minimum wage on the labour supply at the intensive margin has been examined by Neumark and Wascher (2000). Their analysis of data on payroll hours in the restaurant sector in the US showed that the minimum wage had a negative effect. A similar conclusion was reached by Couch and Wittenburg (2001). Based on data from the US Current Population Survey, they found that among teenagers who remained employed after the minimum wage was raised, the number of hours worked declined. A negative effect of the minimum wage on the number of hours worked was also shown by Stewart and Swaffield (2008) for British men, but Connolly and Gregory (2002) found no such effect for women.

These findings are in sharp contrast to the results of Hyslop and Stillman (2007). They found that following reforms in New Zealand which effectively raised the minimum wage for young people, the number of hours worked by teenagers increased. Their results also indicated, however, that changes in minimum wage regulations led to a decline in educational enrolment and an increase in unemployment and benefit receipt rates. This suggests that while the minimum wage reform increased incentives for paid work among teenagers, there was no

corresponding expansion in job opportunities. Similarly, an analysis by Zavodny (2000) of data from the US Current Population Survey showed that raising the minimum wage led to a decrease in teen employment, but did not have an adverse effect on hours of work.

The overview of the literature presented above indicates that previous research has mainly focused on the experiences of Anglo-Saxon countries, especially the US; whereas relatively few studies have investigated the effects of the minimum wage in the countries of continental Europe. This is unfortunate because Anglo-Saxon countries tend to have a low minimum wage and a specific set of institutions. Thus, conclusions based on analyses of data from those countries may not be easily generalisable to the countries of continental Europe, where the context may be very different (Abowd et al., 2000).

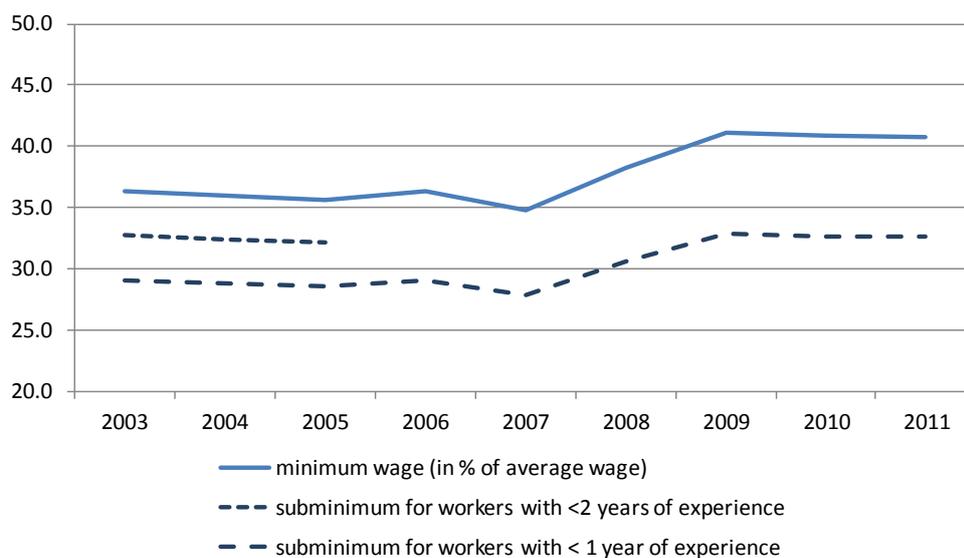
III. CONTEXT

Following the transition to a market economy, the minimum wage in Poland was set by the minister responsible for Labour and Social Affairs. Up to 2002, the minimum wage kept growing in real terms, but fell in relative terms (compared to the national average wage). In 2003, legislation was introduced which changed the mechanisms for setting the minimum wage, and foresaw a greater role for social partners. Under this new law, the minimum wage is set annually by the Tripartite Commission for Social and Economic Affairs, which includes representatives of the government, employees, and employers. The minimum wage level proposed by the government in a given year may not be lower than that of the previous year, and must be based on the national Consumer Price Index forecast, as well as (since 2005) two-thirds of the projected real GDP growth (provided the minimum wage is lower than 50% of the average wage, which so far has always been the case). If the Tripartite Commission cannot reach a consensus on the minimum wage level (which has been the case virtually every year), the government has the power to make the decision unilaterally. But in this situation, the minimum wage may not be lower than the level put forward in the government's original proposal.

The general level of the minimum wage ranged between 35% and 42% of the average wage over the whole period we analysed, 2003-2011 (compare Figure 1). The 2007-2009 period saw the largest changes, as the minimum wage was raised from 35% to 41% of the average wage; i.e., by more than 26% in real terms. Moreover, as Poland was one of the few European countries which raised the minimum wage incrementally even during the economic crisis of 2010-2012, the growth in the real minimum wage during that period was higher than the increase in the average wage.

Until the introduction of the new law in 2003, young workers were subject to the same minimum wage regulations as older and more experienced workers. But in response to concerns about the potential constraints on young workers' labour market chances (and the extremely high youth unemployment rates at that time, exceeding 40%), a subminimum amounting to 80% of the standard minimum wage was introduced as part of the new law. The subminimum was binding based on work experience: i.e., employers were allowed to pay a lower minimum wage to individuals with less than one year of total service.¹ Additionally, another subminimum for workers with more than one year but less than two years of experience was introduced for three years (2003-2005). It was set at the level of 90% of the general minimum wage, but was withdrawn in 2006. However, the 80% subminimum for labour market entrants is still in force.

¹ This work experience is measured in the social security register as the time spent in paid registered dependent employment.

Figure 1 Changes in the minimum wage level in Poland (% of average wage), 2003-2011.

Source: *Polish Journal of Laws*

The minimum wage level in Poland is moderate relative to the levels in other OECD countries: e.g., it is 48% of the average wage in Slovenia and 32% of the average wage in US (Eurostat, 2012). Because Poland has a high proportion of low-wage workers (15%-25% of all employees, if measured at the cut-off point of 60% and two-thirds of median earnings, respectively (Magda, 2010)) and relatively high unemployment rates (ranging from 7% to over 20% in the analysed period)—and because unemployment mainly affects unskilled, low-productivity workers—we can assume that changes in the minimum wage in Poland have an impact on a large number of labour market participants.

The issue of the minimum wage is being hotly debated in Poland, especially as unemployment levels have been high and increasing since the onset of the global economic crisis in 2008. The advocates of further increases emphasise that a low minimum wage contributes to rising wage dispersion and high levels of in-work poverty. The opponents disagree, arguing that a high minimum wage constitutes an obstacle to employment as the low-skilled are pushed out of jobs (and/or are prevented from finding work), and is thus associated with declining total

income and rising poverty rates. The OECD (2012) has recently recommended that Poland refrains from further minimum wage increases.

The potential impact of the minimum wage depends to large degree on the extent to which employers comply with the minimum wage regulations. In Poland there are two institutions which directly or indirectly ensure enforcement of minimum wage mandates. First, employers need to make social insurance contributions on a monthly basis, and the level of these contributions is defined as a proportion of the gross wage. The National Social Insurance administration can check whether a given employer's social insurance contributions are lower than the minimum wage would require. Second, employers are subject to checks by the Labour Inspectorate, an agency which regularly reviews working conditions at enterprises located in Poland.

IV. DATA AND METHODS

ANALYTICAL STRATEGY

Using a method which combines propensity score matching (PSM) with a difference-in-differences approach, we estimate the differentials in the labour market outcomes of workers before and after the implementation of the reforms that changed minimum wage levels in Poland.

The standard PSM involves an adoption of the potential outcome approach, also known as the Roy-Rubin model (Roy, 1951; Rubin, 1974). According to this model, after a reform of the minimum wage, employees face two potential states: a state in which the individual wage exceeds the new minimum wage level ($D_i = 0$), or a state in which the individual wage is lower than the new minimum wage level ($D_i = 1$). In each of these two potential states, workers may achieve different potential labour market outcomes (Y_i^0, Y_i^1) . The individual causal effect $\Delta_i = (Y_i^1 - Y_i^0)$ is then defined as the difference between the two potential outcomes for each

individual. However, due to the fundamental problem of causal inference, individuals can only be observed in one state at one point in time, and information about their other potential outcomes remains unobserved. As the individual causal effect cannot be estimated, we estimate average causal effects instead. The key parameter of interest is the average treatment effect on the treated $ATT = E(Y_i^1 - Y_i^0 | D_i = 1)$, which measures the effect of the minimum wage, focusing on workers whose wages did not exceed the minimum wage level that was binding after the reform.

The standard PSM approach estimates the missing counterfactual outcome $E(Y_i^0 | D_i = 1)$ under the conditional independence assumption $Y_i^0, Y_i^1 \perp D_i | X$. It postulates that conditional on a set of control variables X , all of the outcome-relevant differences between workers under differential minimum wage regimes are negligible. To reduce the high dimensionality of the vector X , the one-dimensional propensity score $P(D_i = 1 | X)$ is used. It represents the probability of being affected by the reform of the minimum wage; i.e., of finding oneself in a situation in which the wage offered by the employer in the period before the reform no longer exceeds the new minimum wage level, conditional on the control variables (Rosenbaum & Rubin 1985). The intuition behind the propensity score is that individuals with a similar propensity for being affected by the reform of the minimum wage can be compared. Different matching algorithms are used to form the comparison group, such as nearest neighbour matching, radius matching, and kernel matching (Caliendo & Kopeinig, 2008; Smith & Todd, 2005). In this application, the nearest neighbour matching algorithm has been used because it has the best balancing properties.

If there are unobserved factors which have strong simultaneous effects on the assignment into treatment and the outcome variable, the results from the standard PSM might be biased. However, by taking advantage of the longitudinal dimension of the dataset at hand, we can solve this problem using difference-in-differences matching (Heckman et al., 1997, 1998; Smith & Todd, 2005).

Difference-in-differences matching can be applied when individuals are observed over time with at least one observation before and another after the reform of the minimum wage. Difference-in-differences matching relies on a comparison of the changes in the employment outcomes of individuals who received the treatment with the most comparable individuals (in terms of propensity scores) who did not receive the treatment, across the observation period. Following the ideas of the potential outcome approach, the analysis examines whether the treated individuals experienced greater changes in their risk of job separation and in their hours of work than they would have if their wages had not fallen below the new minimum wage. Formally, the average treatment on the treated (ATT) is defined as:

$$\Delta^{MDID} = \sum_{i \in T} \left[(Y_{it}^1 - Y_{it}^0) - \sum_{j \in C} w_j (Y_{jt}^0 - Y_{jt}^0) \right] = \Delta^{ATT}$$

(10)

Identification relies on the assumption that $(Y_{it}^0 - Y_{it}^0) \perp T | X$; i.e., that the average outcome change without treatment is identical for both the treatment and control groups, conditional on the observed control variables.

The advantage of combining PSM with the difference-in-difference estimator lies in the opportunity to differentiate out time-fixed unobservables (Blundell & Dias, 2002; Heckman et al., 1997, 1998; Smith & Todd, 2005). Hence, unlike standard PSM, which controls only for the observed differences in the “treated” and “control” group, difference-in-differences matching corrects for any temporarily-invariant unobserved factors that may bias the results. In the context of our study, such unobserved differences may, for example, result from the limited bargaining power of employees in some local labour markets where employers enjoy monopsony. At the same time, difference-in-differences matching is superior to a standard difference-in-differences estimator, as it does not impose linear functional form restrictions in the conditional expectation of the outcome variable, and it reweights the observations according to the weighting function of the matching estimator (Smith & Todd, 2005).

DATA

We use data from the Labour Force Surveys (LFS) carried out in 2003-2011 by the Polish Statistical Office under the auspices of Eurostat, as well as administrative data on statutory minimum wages. The survey takes the form of a rotational panel, whereby individuals participate in interviews for two consecutive quarters, then have a 12-month break, and then are interviewed again in two consecutive quarters. Hence, it is possible to construct a year-to-year panel dataset with two observations per individual and seven changes in the statutory minimum wage level.

We wanted to concentrate on younger workers, as they are the group who are most sensitive to minimum wage regulations. Thus, we restricted our sample to dependent employees aged 18-29. The lower boundary of the age restriction was set because the Labour Law Act stipulates that employees under age 18 are subject to special regulations regarding the type of work they are permitted to do, their employment conditions, and their wages². We also excluded the self-employed and helping family members who were not affected by minimum wage regulations. In addition, we dropped all of the observations in which the value of any of the variables used in the subsequent analysis was missing, particularly cases in which a participant did not respond in the second wave (although the attrition rates in the LFS are relatively low, or less than 10% in the majority of panels; they exceeded 20% in two of them: 2004-05 and 2005-06. (Magda 2010)). As a result, the sample size used in the analysis of job separations amounted to 22,357 individuals. In the analysis of the hours of work, we considered 17,509 individuals who remained employed after minimum wage increases.

We analysed two key labour market outcomes: the risk of job separation and the risk of an increase or a decrease in the number of hours worked. The risk of job separation was defined as being employed in the first wave of a panel and making the transition out of dependent

² For example, young employees are not permitted to take jobs or perform tasks which are hazardous to health or are likely to cause accidents.

employment one year later. For workers who did not experience job separations, we analysed the probability of experiencing a reduction or an increase in working time.

The Labour Force Surveys provide very rich information about employee characteristics which may influence the probability of being affected by a change in the level of the minimum wage, as well as by job separation or a change in the number of hours of work. We can therefore control for individual labour market characteristics such as gender, marital status, age, educational attainment, the type of employment contract (i.e., whether the employment is permanent or fixed, and full time or part time), and the category of occupation at the ISCO-1 level. We also included a dummy for students, who are more likely to work part time and switch to full-time jobs. We also included firm-level characteristics such as the firm's size and its public/private affiliation, and period-specific fixed effects. Additionally, we made sure that the comparisons involved individuals with similar places of residence (based on size and region at the NUTS-2 level). This is important because different local markets may have very different employment situations. Table 1 presents the structure of our sample.

Table 1: Sample Composition

		non- treated	treated	total sample
gender	women	40%	60%	42%
	men	60%	40%	58%
age	age	25.1	23.0	24.8
part time	Full-time employees	94%	87%	93%
	Part-time employees	6%	13%	7%
marital status	single			
	married	37%	20%	35%
	widowed/separated	1%	1%	1%
education	tertiary	23%	13%	22%
	secondary	44%	49%	45%
	basic vocational	26%	23%	26%
	primary education	6%	15%	7%
	students	21%	37%	22%
size of place of residence	100K + residents	24%	15%	23%
	50K - 100K residents	7%	8%	7%
	20K-50K residents	12%	11%	12%
	10K-20K residents	8%	8%	8%
	5-10K residents	4%	4%	4%
	below 5K residents	3%	4%	3%
	rural area	43%	50%	43%
	employment type	Fixed-term	47%	74%
	permanent	53%	26%	50%
sector	public sector	21%	27%	22%
	private sector	79%	73%	78%
occupations	Managers	3%	0%	3%
	Professionals	12%	3%	11%
	Technicians, associate professionals	12%	10%	12%
	Clerical support workers	11%	19%	12%
	Service and sales workers	18%	29%	19%
	Skilled agricultural, forestry, and fishery workers	0%	1%	0%
	Craft and related trades workers	23%	21%	23%
	Plant and machine operators, and assemblers	13%	6%	12%
	Elementary occupations	8%	11%	8%
	firm size	small (<50)	38%	52%
	medium (50-249)	36%	33%	35%
	large (250+)	26%	15%	25%
sample size	N	20041	2316	22357

Source: Polish Labour Force Survey

In order to identify the employees affected by the reforms of the minimum wages, we linked microdata from the Labour Force Surveys with statutory data on the minimum wage levels collected from the official announcements of the changes in regulations on the minimum wage (announcements of the Council of Prime Minister in the Journal of Laws). We took advantage of the availability of information on the length of work experience among workers, and assigned information on their eligibility for subminimum wages.

V. EMPIRICAL RESULTS

THE IMPACT OF THE MINIMUM WAGE ON JOB SEPARATIONS

We matched employees according to the probability of receiving a wage near the threshold of the minimum wage, and compared the effects on this group of workers of the changes in minimum wage regulations with the effects on the group of workers whose wages exceeded the minimum wage both before and after the changes in the regulations. In Table 2, we present the results of our analysis of the risk of job separation and of the probability of having the number of working hours increased or decreased in response to the higher minimum wage. Our findings showed that if an individual's wage became lower than the official minimum wage following a change in the regulations, the chances that the individual would remain employed decreased by 11.5 percentage points. While we found that changes in the cost of labour led to substantial adjustments of labour inputs in terms of the number of workers, our results also showed that the response of employment at the intensive margin was limited. The probability of a decrease in the number of working hours among employees who did not experience job separation declined 1.8 percentage points. At the same time, we also observed an increase in the probability of working longer hours of 2.7 percentage points. It therefore seems to be the case that employers partially compensated for job cuts by increasing the working hours of the workers who remained employed. A higher minimum wage may have also provided incentives for employees to increase their labour supply and work longer hours.

Table 2. The effect of the minimum wage on the probability of remaining employed, and of limiting or increasing the number of working hours among young workers.

	Remaining employed	Limiting working hours	Increasing working hours	Overall effect on hours of
Effect size	-0.149***	-0.018***	0.023***	0.730***
Std. err.	0.008	0.008	0.008	0.195

*Means and Standard Errors are estimated by linear regression, Clustered Std. Errors, *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$*

HETEROGENEOUS EFFECTS

We examined the potential heterogeneity of the effects of the minimum wage across groups with varying labour supply elasticity to employment (dis)incentives. Specifically, we provided estimates across gender, educational enrolment status, and employment contract types. We expected to find that the reaction to the increase in the minimum wage would have been stronger among women and students, who have alternatives to paid work in the form of family duties or prolonging education³. But as women and students might be less flexible in terms of working longer hours, we also anticipated that the substitution effect of an increased minimum wage might have been weaker in this group. We could also argue that employees with fixed-term contracts may be more likely to experience a job loss following changes in the minimum wage because they are easier to dismiss. At the same time, the substitution effect could be stronger in this group. Moreover, given the lower levels of employment protection and the reduced bargaining power of workers with fixed-term contracts, they might have been more likely to have adjusted their hours of work to meet their employer's needs. It is even more difficult to predict the response of part-time employees to minimum wage changes: while part-time workers should be more likely to lose their jobs than full-time employees because the cost of dismissing them is lower, employing people on a part-time basis is less expensive than employing people full time. As for those workers who remain in employment, part-timers should be more flexible in adjusting to (and potentially increasing) their working hours, partly because of their assumed preference for higher consumption over leisure. In addition, the costs

³ Additionally, because employers pay lower payroll taxes for students, the overall cost of a minimum wage increase affects students much less than other employees.

associated with adjusting working hours may be lower among part-time than among full-time workers.

Regarding gender differences, we observed that the effect of the minimum wage on the probability of remaining employed was similar among women and men, but that the impact of the minimum wage on adjustments of hours of work was weaker among women. Students were somewhat less likely to have lost their jobs as a result of an increase in the minimum wage. We found that students did not increase their hours of work after a minimum wage hike, which may be because they had a limited amount of time to work. Our results showed that workers with fixed-term contracts were much more sensitive to the changes in the level of the minimum wage. Indeed, the estimated effect of this policy was found to have been three times stronger in this group than it was among permanent workers. As expected, we found that employees with fixed-term contracts were much more likely to have worked longer hours after a change in the minimum wage. Part-time workers turned out to have been less likely to have lost their jobs following a minimum wage hike, which suggests that employers were more prone to cutting full-time employees. But we were surprised to find that unlike their part-time counterparts, full-time workers who remained employed were unlikely to have had their working hours cut. This suggests that demand-side factors (cost-related) turned out to be stronger than supply-side reactions, and that employers preferred cutting jobs to adjusting working hours.

Table 3. The effect of the minimum wage on the probability of remaining employed or of having the number of working hours limited or increased among young workers across social groups.

	Remaining employed		Limiting working hours		Increasing working hours		Overall effect on hours of work	
	Effect size	Std. err.	Effect size	Std. err.	Effect size	Std. err.	Effect size	Std. err.
Gender								
Men	-0.149***	0.013	-0.028***	0.012	0.060***	0.013	1.412***	0.305
women	-0.146***	0.011	-0.003	0.011	-0.009	0.010	-0.014	0.215
Education enrolment								
students	-0.197***	0.017	-0.020	0.015	0.065***	0.017	1.152***	0.359
non-students	-0.117***	0.009	-0.018*	0.009	0.000	0.008	0.320	0.201
Employment contract								
fixed term	-0.167***	0.011	-0.031***	0.01	0.021**	0.011	0.638***	0.232
permanent	-0.059***	0.011	0.000	0.013	0.008	0.011	0.236	0.286
Working time								
part time	-0.128***	0.029	0.072***	0.024	0.007	0.038	-0.101	0.811
full time	-0.145***	0.009	-0.023***	0.008	0.007	0.007	0.360*	0.171

Means and standard errors are estimated by linear regression; Clustered Std. Errors, *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

In a series of additional analyses, we compared the results from alternative matching algorithms (which, however, provided worse matching results), and we checked the effects in a sample restricted to low-wage workers (following the suggestions of Zavodny (2000) and Yuen (2003)) and in a sample of prime-age workers. Our results were robust with respect to changes in matching procedure and sample restrictions. Among prime-age workers, the disemployment effects were weaker but still significant; however, we observed no effects of the minimum wage changes on the number of hours worked.

VI. DISCUSSION OF KEY FINDINGS

The effects of the minimum wage continue to be hotly debated in both academic and policy-making circles. Opponents argue that the minimum wage destroys existing jobs and prevents employers from hiring new workers, while proponents emphasise the need to protect employees from poverty and avoid double standards on the labour market. These concerns are particularly relevant in a country where a substantial proportion of the workforce have relatively low incomes. The main objective of this paper has been to examine the mechanism of the impact of changes in the minimum wage on the probability of remaining employed and on

the number of hours of work in the Polish labour market. To this end, we used difference-in-differences matching and microdata from the Labour Force Surveys.

We found that the minimum wage had a large impact on job separations. Workers whose earnings fell below the minimum wage level were much more likely to have lost their jobs than their counterparts with similar observed and unobserved characteristics whose earnings remained above the minimum wage level after the minimum wage level was increased. We also observed an increased propensity to work long hours among those young people who remained employed after a minimum wage hike. The latter finding suggests that Polish employers may find it easier and more efficient from an economic point of view to increase employees' working hours than to reduce their workforce (Stewart & Swaffield, 2008). This tendency could be also related to the supply side and the work incentives generated by the minimum wage. These effects may be of particular importance in Poland, where the labour supply of young people is affected by the incomes of their parents with whom they tend to share households (Haan & Myck, 2012). A higher minimum wage may have shifted the balance between the attractiveness of work and non-work. It should, however, be stressed that this small positive impact of the minimum wage is offset by a strong negative effect on job stability.

The impact of the minimum wage is not universal, and depends on a range of factors related to both individual characteristics as well as the institutional setting, such as the degree of employment protection and the levels of payroll taxes associated with different kinds of employment contracts. We have identified the groups of workers who are particularly sensitive to these effects of minimum wage legislation. Men, students, and workers with fixed-term contracts are more likely other groups of young workers to either lose their jobs after a minimum wage hike or to increase their hours.

In sum, while previous research carried out in Anglo-Saxon countries often found no or very limited effects of the minimum wage (Neumark & Wascher, 2004), our findings suggest that in the Polish context, this labour market institution has a substantial impact on the employment

of young people. At the same time, our results suggest that the influence of the minimum wage may be quite complex, and that the overall effect depends on the magnitude of both the reductions of the workforce carried out by employers and the increased incentives to work among employees.

ACKNOWLEDGEMENTS

This research was supported by a grant from the CERGE-EI Foundation under a program of the Global Development Network. All opinions expressed are those of the author(s) and have not been endorsed by CERGE-EI or the GDN.

ANNEX

Table A1. *The profile of workers at risk (estimated coefficients of logit models of the probability of earning a wage below the minimum wage).*

		Coefficient	Std. Err.	p-value
gender	women	0.881	0.058	0.00
age	age	-0.935	0.127	0.00
	age sq.	0.017	0.003	0.00
marital status	married	-0.298	0.065	0.00
	widowed	-0.587	0.901	0.51
	separated	0.071	0.238	0.77
education	tertiary	-0.173	0.085	0.04
	basic vocational	0.161	0.067	0.02
	primary education	0.835	0.089	0.00
	student	0.268	0.058	0.00
employment type	fixed term contract	0.716	0.055	0.00
	public sector	0.847	0.066	0.00
firm size	small firm	0.373	0.058	0.00
	big firm	-0.301	0.072	0.00
size of place of residence	100k + residents	-0.390	0.072	0.00
	50k - 100k residents	0.039	0.093	0.67
	20k-50k residents	0.041	0.079	0.60
	10k-20k residents	0.017	0.093	0.86
	5-10k residents	-0.042	0.124	0.74
	2-5k residents	0.131	0.144	0.37
	<2k residents	0.121	0.397	0.76
regions	Dolnośląskie	-0.045	0.118	0.70
	Kujawsko-pomorskie	0.153	0.123	0.21

	Lubelskie	0.417	0.115	0.00
	Lubuskie	0.164	0.124	0.19
	Łódzkie	0.085	0.111	0.44
	Małopolskie	-0.248	0.134	0.06
	Mazowieckie	-0.456	0.125	0.00
	Opolskie	0.156	0.133	0.24
	Podkarpackie	0.377	0.116	0.00
	Podlaskie	0.467	0.125	0.00
	Pomorskie	-0.361	0.131	0.01
	Śląskie	0.124	0.118	0.29
	Świętokrzyskie	0.356	0.130	0.01
	Warmińsko-mazurskie	-0.300	0.124	0.02
	Wielkopolskie	-0.160	0.144	0.27
period	years 2005-2007	-0.089	0.058	0.13
	year 2008	0.216	0.075	0.00
	year 2009	0.097	0.082	0.24
occupation	managers	-1.624	0.365	0.00
	professionals	-1.421	0.141	0.00
	technicians, associate professionals	-0.479	0.094	0.00
	service and sales workers	-0.110	0.082	0.18
	skilled agricultural, forestry and fishery workers	0.534	0.274	0.05
	craft and related trades workers	-0.106	0.095	0.27
	plant and machine operators, and assemblers	-0.469	0.117	0.00
	elementary occupations	-0.123	0.104	0.24
	constant	9.329	1.515	0.00

Reference values: men, single, secondary education, on permanent contracts in the private sector, living in rural areas in Zachodniopomorskie region, employed as Clerical support workers in 2003-2005 period.

Table A2. *The assessment of quality of matching(balancing test for covariates)*

Variable		Treated	Controls	% bias reduction
gender	women	0.58982	0.5814	1.7
age	age	23.321	23.315	0.2
	age sq.	554.45	553.73	0.5
marital status	married	0.22712	0.22203	1.1
	widowed	0.00049	0.0002	1
	separated	0.01028	0.00813	2.2
education	tertiary	0.11503	0.10827	1.8
	basic vocational	0.25746	0.26725	-2.2
	primary education	0.13607	0.1258	3.5
	student	0.32501	0.32031	1.1
employment type	fixed term contract	0.68918	0.68311	1.3
	public sector	0.23544	0.22663	2.1
firm size	small firm	0.51689	0.51855	-0.3
	big firm	0.14586	0.14782	-0.5
size of place of residence	100k + residents	0.15467	0.17425	-5
	50k - 100k residents	0.0744	0.07773	-1.2
	20k-50k residents	0.11992	0.11356	2
	10k-20k residents	0.07636	0.07274	1.3
	5-10k residents	0.0372	0.03279	2.3
	2-5k residents	0.03035	0.0324	-1.3
	<2k residents	0.00392	0.00303	1.5
regions	Dolnośląskie	0.06265	0.05815	1.8
	Kujawsko-pomorskie	0.06804	0.06735	0.3
	Lubelskie	0.07783	0.08429	-2.6
	Lubuskie	0.05678	0.05795	-0.5
	Łódzkie	0.09887	0.09613	1
	Małopolskie	0.04014	0.03857	0.7
	Mazowieckie	0.05188	0.05512	-1.3
	Opolskie	0.04846	0.04464	1.9
	Podkarpackie	0.07097	0.07078	0.1
	Podlaskie	0.06021	0.06471	-2
	Pomorskie	0.03818	0.03691	0.6
	Śląskie	0.05188	0.04699	2.3
	Świętokrzyskie	0.05188	0.04699	2.3
	Warmińsko-mazurskie	0.06461	0.0742	-3.9
	Wielkopolskie	0.03377	0.02996	2
period	years 2005-2007	0.37004	0.36016	2
	year 2008	0.24327	0.25874	-4.3
	year 2009	0.12482	0.12863	-1.2
occupation	managers	0.00294	0.0046	-1.3
	professionals	0.03622	0.03475	0.6

technicians, associate professionals	0.08664	0.0746	3.9
service and sales workers	0.29564	0.29819	-0.6
skilled agricultural, forestry and fishery workers	0.00979	0.01194	-2.7
craft and related trades workers	0.21488	0.20519	2.3
plant and machine operators, and assemblers	0.06706	0.07528	-2.8
elementary occupations	0.12188	0.14302	-7.2

Note: The differences between the treated and control covariate means are not significant, at the 0.01 level.

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