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The Minimum Wage: Labor Market Consequences in the Czech Republic*

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Abstract
This paper aims to quantify the impact of the minimum wage on labor market performance in the Czech Republic. Using regional data for 1995–2004, it estimates the effect of the minimum wage adjusted for the regional wage differential on regional unemployment. Consequently, using detailed individual data from 2004/2005, we analyze the annual hikes in the minimum wage, which allow us to estimate employment probabilities for workers with a wage level at, or close to, the new minimum wage. The aim is to reveal whether the most endangered groups of workers exhibited significantly different subsequent employment probabilities. Our results reveal that the minimum wage has had a significant impact in terms of increasing regional unemployment and reducing the employment probabilities of low-paid workers.

1. Introduction

Almost all the developed countries use some form of wage legislation that prevents wages falling below a certain threshold.[1] Indeed, several conventions of the International Labor Organization recommend the minimum wage concept as an instrument of workers' protection.[2] However, the minimum wage and its economic consequences have traditionally been at the center of both academic and political discussions and the subject of many controversies.

On the one hand, proponents of the minimum wage mostly seek arguments in the social area. The main stated goals of the minimum wage are usually to reduce (or prevent) poverty, to decrease income inequality, to improve the living conditions of low-paid workers, and to make "work pay." Indeed, certain positive employment con-

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[1] The minimum wage can be either statutory, established by the government, or set as an extension of collective bargaining agreements. Many "old" European countries do not have a legally binding minimum wage, but usually there exists an effective minimum wage determined by collective bargaining (Austria, Italy, Germany, Denmark, Sweden). The Czech Republic, on the other hand, has a statutory minimum wage, similarly to other countries of Central and Eastern Europe (for more details see Eurostat, 2007).

[2] Czech Republic has ratified two out of the three conventions recommending the introduction of a minimum wage.

sequences of the minimum wage have been reported, for instance by Dickens et al. (1999), Card and Krueger (1995), and Dolado et al. (1999). Also, Lee (1999) showed a positive effect of the minimum wage in terms of decreasing income differentiation. Card (1992) and Bazen and Martin (1991) indicated a positive effect in terms of increasing the wages of young workers.

However, the potential of the minimum wage in the fight against general poverty is rather limited. Burkhauser, Couch, and Wittenburg (1996) state that it is mainly higher-income households who profit from the minimum wage. Borjas (2005) confirms this result and estimates that only 19% of the increase in incomes resulting from the growing minimum wage between 1989 and 1992 was registered in poor households. As indicated by OECD (1998) in its study on nine developed countries in 1993, the majority (60–90%) of low-paid workers paid below two thirds of the wage median lived in medium- or high-income households. On the contrary, the proportion of low-paid workers living in the poorest households was around 10% only. Thus, the minimum wage does not seem to be an efficient instrument for preventing general poverty.[3]

On the other hand, there are significant critics of the minimum wage, who stress the potential adverse impacts on the labor costs of firms and unemployment among the least productive workers (Deere, Murphy, and Welch, 1995; Neumark and Wascher, 2003; Abowd, Kramarz, and Margolis, 1999; Bazen and Martin, 1991). From a similar perspective, the OECD in its Jobs Strategy (1994) emphasizes the allocation function of wages in providing essential information regarding employment opportunities. In this sense, wage flexibility is of particular importance. However, flexibility might be reduced as soon as the minimum wage level becomes binding, resulting in negative effects on employment.

Economic theorists have not reached a broad consensus regarding the consequences of the minimum wage so far. Nevertheless, on the microeconomic level it is usually generally accepted that although it might have some positive impact on the motivation to increase productivity among low-paid workers (Stigler, 1946; Acemoglu and Pischke, 1998; Cubitt and Hargreaves-Heap, 1999; Cahuc and Michell, 1996), on shifting the employment composition toward high-wage jobs (Acemoglu, 2001), as a motivational device in the efficient wages framework (Rebitzer and Taylor, 1995; Manning, 1995), or in the case of a monopsony (Card and Krueger, 1995)[4], there exists a threshold over which the negative effects of the minimum wage tend to prevail. The minimum wage then increases unemployment and causes economic losses in terms of efficiency. The effect is considered stronger for particular groups of workers with the lowest productivity, especially the youngest and the least experienced. The situation is confirmed to some extent by the existing empirical

[3] Exact estimations for the Czech Republic are not available. For details on the effect of the minimum wage on poor households' incomes in the Czech Republic see Fialová (2007).

[4] The research of Card and Krueger, published in several studies, was based on a natural experiment and examined employment patterns in the fast-food industry given the changes in minimum wage tariffs in several states of the US. The results indicate some positive employment effect of the minimum wage in this segment. However, the approach was largely criticized by several authors, based on inappropriate methodology, misleading interpretation of data, and insufficient theoretical and empirical rationale (Neumark and Wascher, 1992; Neumark and Wascher, 2000; Dolado et al., 1996; Brown, 1999), resulting in an extensive academic debate on this topic. In the end, the controversy did not lead to any consensus.

research. For a summary of the empirical research results on this issue, see for example Brown, Gilroy, and Kohen (1982) or OECD (1998).[5]

The employment and unemployment effects of the minimum wage also depend on the structure of the labor market. In a competitive environment, a hike in the minimum wage results in employment cuts, growth of unemployment, and higher wages for those who retain their jobs.[6] On the other hand, under a monopsonistic market structure, a hike in the minimum wage need not have any disemployment effects and, up to some level, would simply raise the wage level of the employed and the stock of employment itself. However, industries with high shares of low-paid workers have traditionally been considered rather competitive (the food industry, the textile industry, the wood-processing industry, agriculture, construction, etc.; see also Stigler, 1946). Furthermore, these industries might be characterized by higher elasticity of labor demand (according to the Hicks-Marshall rules of derived demand, see Hicks, 1932) implying larger employment reductions in reaction to an increasing price of labor. Also, the growing mobility of labor makes the concept of monopsony problematic and its application to the Czech situation rather limited. The prevailing adverse effect of the minimum wage in low-wage industries was also confirmed by the research of Buchtíková (1995) – see below. Therefore, the competitive model seems more appropriate for describing the effects of the minimum wage in the Czech environment.

On the macroeconomic level, the major impact of the minimum wage can be identified in its effect on the entire relative wage distribution. By restricting the (legal) incomes of workers below the statutory tariff, the minimum wage tends to increase the proportion of workers paid exactly at, or slightly over, its level. This spike in the minimum wage level and the spillover effects on wages above the minimum has been identified by several studies (for a summary, see Neumark and Wascher, 2008, or OECD, 1998). The minimum wage compresses the wage distribution in such way and, hence, damages the relative wage status of better-paid workers. Moreover, this situation ultimately leads to losses in overall economic

[5] Apart from influencing labor market performance directly, the minimum wage might have additional indirect effects due to its interaction with other institutions and policies. A binding minimum wage might, for instance, amplify the adverse unemployment effects of labor taxation by preventing tax shifting to workers (see for instance Bassanini and Duval, 2006). The relatively high level of labor taxation in the Czech Republic (see Fialová and Schneider, 2009) might, therefore, play an important role in this respect. Furthermore, a rising minimum wage might also have substantial fiscal implications in terms of reducing tax evasion in a competitive environment characterized by underreporting of earnings by employed labor (for details see Tonin, 2007).

[6] The adverse effect of the minimum wage on employment might, however, be at least partially offset by increased employment in the grey economy (dualistic economy model). The informal sector is where workers dismissed in the formal sector go to seek employment opportunities. At the same time, increased flows of workers into the grey economy tend to reduce the wage level prevailing there. Hence, the consequences of minimum wage hikes are much more complex in such case. Still, the evidence on the impact of the minimum wage on the informal sector is rather mixed. Some studies, mostly in Brazil, found positive wage and negative employment effects in accordance with the neoclassical theory of competitive labor markets, while others found negative wage and positive employment effects in the informal sector in accordance with the dualistic economy framework (for a summary of the literature on this topic see Kristensen and Cunningham, 2006). Estimations of the impact of a rising minimum wage in the formal sector on wages and employment in the informal sector in the Czech Republic are not available. The share of the grey economy in the Czech Republic has recently been estimated very broadly at around 3–30% of GDP (Fassmann, 2007).

efficiency, and some authors also mention it as one of the causes of the European labor market hysteresis (see, for example, Krugman, 1994).

The Czech Republic introduced a minimum wage in 1991 as part of sweeping labor market reforms. The minimum wage in the Czech Republic exhibited dynamic growth as from the late-1990s, slackening somewhat after 2003. Yet the empirical evidence on the economic consequences of the minimum wage in the Czech Republic is rather limited. The first analysis was conducted by Buchtíková (1995) on the early-1990s data. The author carried out a simulation to show the effects of wage growth driven by minimum wage hikes on employment and the wage distribution in firms. The results indicate that increasing the minimum wage does not necessarily result in higher unemployment. The negative effect would be more apparent in particular industries (textiles, machinery, wood-processing, foods) and groups of workers (the young, women, part-time workers). However, the data covered state-owned enterprises only and the simulations used parameter estimates that were not based on Czech data. Hence, the interpretative power of the results is rather limited.

Gottvald, Hančlová, and Pytlikova (2002) examined the effects of the minimum wage on employment and the wage distribution in the Czech Republic in the period 1998–2002. The authors indicated a significant positive effect of the minimum wage on wages in the given period, although the magnitude of the effect diminishes as one moves up the wage scale. The effect on unemployment proved to be rather low and was not statistically significant, as in the study of Buchtíková. Nevertheless, this study can again be criticized as far as the technical correctness of the analysis is concerned. Still, similar results were reported by Eriksson and Pytlikova (2004) in their study on data for the same period. They evaluate the effect of the minimum wage on wages as positive in general, while the impact on employment is ambiguous. The employment effect was even positive in the case of large companies employing a large share of low-paid workers (the authors attribute this result to increased motivation stemming from a growing minimum wage and its distance from the subsistence minimum); on the other hand, minimum wage hikes had negative consequences in small businesses.

Therefore, based on the results of previous economic research in the Czech environment, we can expect some positive effects of the minimum wage on the wage level of workers (i.e., those who sustain their job even after a minimum wage hike) and, consequently, perhaps also on the motivation of the unemployed or inactive to find a job. However, their chance of being hired might be reduced as a result of increased costs of firms in employing low-productive workers. There is no clear consensus in the existing research regarding what the effects of the minimum wage on employment and unemployment in the Czech environment would be.[7] In this context, this paper is concerned with the impact of the minimum wage on employment and unemployment in the Czech Republic.

[7] Research has also been carried out into the effects of the minimum wage in other transition economies. Hinnosar and Rõõm (2003) examined the consequences of the minimum wage setting in Estonia and concluded that minimum wage growth in the 1990s resulted in a drop in employment among workers paid below and slightly over the new minimum wage. Kertesi and Köllõ (2003) studied the impact of the minimum wage in Hungary. Their results show that the almost 100% hike in the minimum wage tariff that took place in 2001/2 significantly increased labor costs, reduced employment in small firms, and had an adverse effect on job retention and job-finding probabilities of low-paid workers.

Table 1 Minimum Wage (MW) and Average Wage (AW) in the Czech Republic, 1991–2008, CZK

	1991	1992	1993	1994	1995	1996	1997	1998	1999
MW	2 000	2 200	2 200	2 200	2 200	2 500	2 500	2 650	3 425*
AW	3 792	4 644	6 095	7 226	8 572	10 141	11 132	12 163	13 181
MW/AW (%)	52.7	47.4	36.1	30.4	25.7	24.7	22.5	21.8	26.0
	2000	2001	2002	2003	2004	2005	2006	2007	2008
MW	4 250*	5 000	5 700	6 200	6 700	7 185	7 763*	8 000	8 000
AW	14 029	15 248	16 363	17 443	18 589	19 591	20 855	22 384	24 282
MW/AW (%)	30.3	32.8	34.8	35.5	36.0	36.7	37.2	35.7	32.9

Note: * Figure refers to annual average (minimum wage increased in January and July).
Source: Ministry of Labor and Social Affairs of the Czech Republic, Czech Statistical Office.

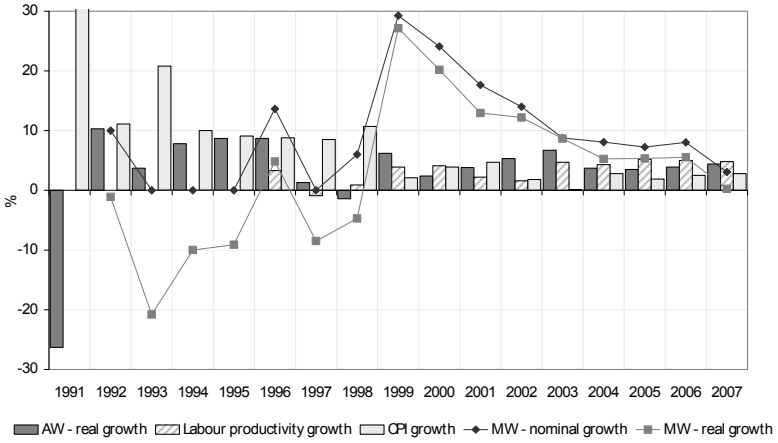
Using regional data for 1995–2004 and individual data for 2004/2005 we aim to find out whether the minimum wage did indeed influence labor market performance. More precisely, on the regional level, we estimate the effect of the minimum wage adjusted for the regional wage differential on regional unemployment. Consequently, using detailed individual data from the Statistics on Income and Living Conditions database we analyze the annual hikes in the minimum wage and categorize workers into several groups based on their wage level relative to the minimum wage. We focus on workers whose wage in period t was lower or marginally higher than the new minimum wage in period t+1, and estimate the subsequent employment probabilities in period t+1. We aim to reveal whether the most endangered groups of workers exhibited significantly different employment probabilities. Based on our results we aim to reveal whether the minimum wage has had any adverse effect on Czech labor market performance.

The paper is organized as follows. The next section provides an overview of the development of the minimum wage in the Czech Republic and puts it into a broader economic and social context. Section 3 is devoted to an analysis of the effects of the minimum wage on unemployment on the regional level. Section 4 presents an analysis of the consequences of the minimum wage on the individual level and depicts the methodology for the employment equation estimations and the model. The main results and discussion are summarized in section 5.

2. The Minimum Wage and Its Socioeconomic Consequences in the Czech Rep.

The minimum wage was introduced in the Czech Republic in 1991 together with a system of minimum wage tariffs fixing the minimum wage rates for particular occupations and strengthening the impact of the minimum wage in the economy.[8] Sub-minimum wage tariffs for the young and the disabled supplemented the system to eliminate potential negative employment effects. The basic minimum wage rate was initially set relatively high, at CZK 2,000, or 50% of the average wage. However, its nominal level was not adjusted considerably until the late 1990s. Consequently, the real value of the minimum wage fell continuously to a historical minimum in 1998, when it reached 63% of the real 1991 value. This development, together with a comparison with the average wage level and other economic variables, is summarized in *Table 1* and *Figure 1*.

Figure 1 Minimum Wage (MW) and Average Wage (AW), CPI and Labor Productivity Growth in the CR, 1991–2007, y/y %



Source: Ministry of Labour and Social Affairs of the CR, Czech Statistical Office, authors´ calculations

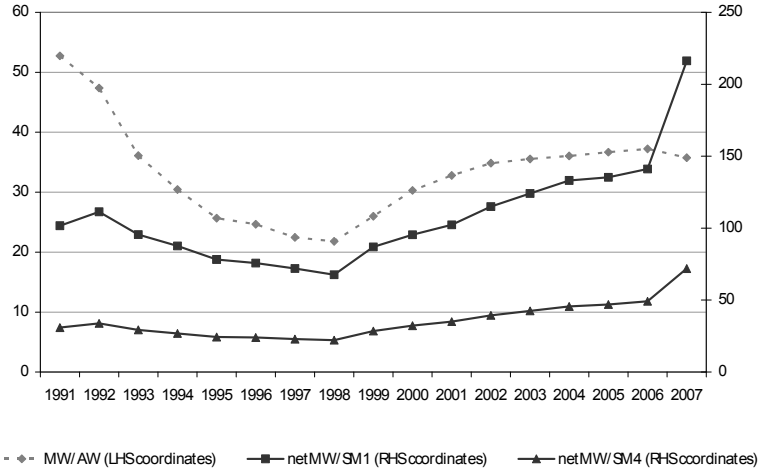
There were several reasons for this stagnation: the weak position of trade unions in the early 1990s; restrictive government income policy introduced in 1991 by a system of wage regulation; and last but not least, legal links between the minimum wage and the social system. Many social benefits were explicitly linked to the minimum wage. In this interrelated political framework, increasing the minimum wage pushed up the state's social expenditure and caused budgetary pressures, making hikes in the minimum wage politically unacceptable.

The slump in the real value of the minimum wage during the 1990s was criticized by many international organizations. The link to the social system was thus freed in 1998 and a path toward growth in the minimum wage was opened. The minimum wage started to grow substantially, increasing by 29% in 1999 and by 24% in 2000. As a result, it reached its real 1991 value in 2001. However, the pace of nominal growth gradually decelerated (hovering around 8% in the 2003–2006 period) and finally stopped in 2008 and 2009, when the minimum wage was not increased at all.

By law, the minimum wage should follow movements in prices and wages to sustain its purchasing power. The real growth of the minimum wage was negative until 1998 (with the exception of 1996), as its increments fell short of the high annual inflation (see *Figure 1*). The situation changed in 1999, when the nominal gains in the minimum wage markedly exceeded inflation, which slowed (these two figures

[8] After the collapse of the central administration of wages at the beginning of the 1990s, the system of twelve minimum wage tariffs was initially intended to be temporary and was designed to protect workers until the system of collective wage bargaining developed to take over this function. The number of tariff classes was reduced to three in 1996, fully re-introduced in 2000, and reduced to eight again in 2006 (renamed the "guaranteed wage" in the new Labor Code). The tariffs are binding on firms with no collective agreement. However, even the highest, eighth tariff amounts to less than 80% of the average wage, which makes these tariffs a completely ineffective limitation for human-capital intensive occupations. According to the OECD, collective bargaining coverage stood at only 27% in the Czech Republic in 2004. Therefore, minimum wage tariffs might represent an effective limitation for a significant proportion of firms, mainly for less skilled occupations.

Figure 2 Minimum Wage (MW) as a Share of Average Wage (AW) and Subsistence Minimum (SM) of One- and Four-Member Households in the Czech Republic, 1991–2007, %



Note: SM1 = subsistence minimum for an individual household; SM4 = subsistence minimum of a four-member household, two adults, two children.

Source: Ministry of Labor and Social Affairs of the Czech Republic, Czech Statistical Office, the authors´ calculations.

roughly equalized in 2007). It is clear that the minimum wage has not followed the movements in consumer prices and wages in the Czech Republic, despite the intended interconnection laid down by law. The data also do not show any relation to movements in the average wage or labor productivity, as the real minimum wage rose relatively faster in periods with lower productivity gains. Thus, it seems that the minimum wage developments in the examined period pursued political goals in the social area rather than developments in the real economy.

However, the absolute level of the minimum wage does not reflect its real importance and economic consequences. As for economic impact, its position in the overall wage distribution is of key importance. This relationship is indicated by the Kaitz index, stating the ratio of the statutory minimum wage to the average gross wage in the economy (see *Figure 2*).[9] This ratio was rather high when the minimum wage was first introduced: it stood at 53% of the economy-wide average in 1991. However, during the 1990s it dropped drastically to a minimum of just 22% in 1998. In 1999 it started rising again, and since 2003 the ratio has been broadly stable at around 36–37%. Moreover, according to the Czech Statistical Office (2008), the minimum wage reached more than two thirds of the value of the first wage decile in 2007. This might represent a considerable burden for employment of the least-productive and lowest-paid workers.

[9] This index might understate the overall impact of minimum wages due to progressivity of tax systems. Also, the average wage might be highly distorted by shifts in the highest level of the wage distribution, without any change in the lowest deciles most influenced by the minimum wage. Thus, the median and the net wage might be a better choice for evaluating the economic impact of the minimum wage over time or for comparison across countries (OECD, 1998). However, comparable data sources are limited.

On the other hand, the effects on the motivation of low-paid workers and of non-working persons to accept a paid job is indicated by the relation between the net minimum wage and the subsistence minimum level, as depicted in *Figure 2*. The subsistence minimum was introduced later than the minimum wage, as late as the end of 1991. The movements in these two policy instruments were completely independent until the late 1990s. The net minimum wage was below the subsistence level of a one-member household throughout the 1990s. We can hardly expect the minimum wage to meet its goals in motivating low-paid workers in an environment where social income in inactivity exceeds the potential minimum labor income. The minimum wage outpaced the subsistence minimum of a one-member household only in 2000 and has kept increasing moderately since then. There was a large upward jump of the ratio of the minimum wage to the subsistence minimum in 2007, related to social reform measures and cuts in social expenditure. Thus, the motivating role of the minimum wage might have been increased by the reforms in 2007. However, its real potential to meet its goals might be limited due to the adverse effects on the motivation of employers to hire low-productive workers for pay exceeding their productivity.

Sometimes, the minimum wage function is perceived not just on an individual level, but takes into account the welfare of whole families. According to the ILO[10] and the European Social Charter of the Council of Europe, the minimum wage should represent a level of remuneration that will provide workers and their families with a decent standard of living.[11] Such an approach, however, is not applied in the Czech Republic. The minimum wage amounted to roughly 20–30% of the subsistence level of a four-member household between 1991 and 2000 and increased slightly to 50% in 2004–2006 – see *Figure 2*. The surge toward 70% in 2007 is again attributable to the above-mentioned social reform measures. Thus, the minimum wage is based rather on the individual approach in the Czech Republic and does not reflect the family concept.

Despite the substantial increases in the minimum wage in the Czech Republic since 1999, it still remains rather low by international comparison. A statutory national minimum wage has been introduced in 20 EU member states and ranged from EUR 92 (Bulgaria) to EUR 1,570 (Luxembourg) in 2007. The Czech Republic with EUR 288 is at the low end of the scale, together with most of the other new member countries. All three remaining Visegrad countries were below the Czech level with even lower minimum wages (for details see Fialová and Schneider, 2009). The rankings do not change much after adjusting for differences in price levels, when the differentiation of countries narrows. The minimum wage expressed in PPS in the EU varied from 204 (Bulgaria) to 1,503 (Luxembourg) in 2006; the Czech minimum wage went up relatively to 465, but kept the same relative position among the countries when expressed in EUR.[12]

[10] Convention No. 131: Minimum Wage Fixing Convention.

[11] Such a concept was implemented, for instance, by the city of Baltimore, USA, in 1994. Its "living wage" ordinance requires businesses with city contracts to pay their workers a wage exceeding the national poverty level for a family of four, which lies significantly above the federal minimum wage. In many European countries, the minimum wage is roughly equal to the subsistence minimum of a four-member household (for instance France: 100%, Portugal and Ireland: more than 80% – Source: Eurostat and European Commission).

[12] However, as mentioned for example by Dolado et al. (1996), a relatively higher minimum wage level does not necessarily mean a larger economic burden. The existence of special sub-minimum wage tariffs for more threatened groups can mitigate the adverse effects of a higher minimum wage.

If we compare the real economic burden represented by the minimum wage when reflecting the different labor productivity and average wage levels across countries, the minimum wage was about 40% of the average wage in industry and services in 2006 in the Czech Republic (Eurostat, 2007). Most of the new member states attained lower shares (the lowest, at just over 30%, were recorded in the Baltic States), while most of the older members had higher values (the highest, in Ireland and Luxembourg, hovered around 50%). Consequently, the proportion of full-time workers earning the minimum wage was rather low in the Czech Republic: 2.3% in 2006, while in many countries it exceeded 8% (e.g. France, Luxembourg, Latvia, and Bulgaria). However, the proportion of women paid the minimum wage in the Czech Republic was more than double that of men (3.5% and 1.4% respectively). A larger share of women than men on the minimum wage was common in all European countries except Malta and Hungary. Comparably large differences in these two figures were recorded for instance in Luxembourg, Portugal, and the Netherlands. Therefore, women are endangered by hikes in the minimum wage generally more than men.

3. The Impact of the Minimum Wage at the Regional Level

In this paper, we focus on the potential adverse consequences of the minimum wage on labor market performance. This section estimates the potential negative impact of the minimum wage on unemployment at the regional level. We utilize the differences in average wage levels between the 77 Czech districts.[13] We might expect districts with relatively lower average wages to suffer relatively more from nation-wide setting of the minimum wage, as it would represent a larger economic burden for firms and regional economies. Thus, our assumption is that, as a result of the minimum wage affecting regional labor markets, low-wage districts will *ceteris paribus* exhibit a higher rate of unemployment than high-wage districts.

A similar relationship was reported by DiNardo, Fortin, and Lemieux (1996), who indicate more pronounced effects of the minimum wage in regions with lower average wages. Our hypothesis is consistent with the more general relationship described by the concept of the wage curve, explaining the negative relationship between regional unemployment and the wage level (first formulated by Blanchflower and Oswald, 1994). In this framework, higher unemployment in a region leads *ceteris paribus* to a lower wage level. In our case, however, the causality runs in the opposite direction. Our approach is generally consistent with the approach and results of Galuščák and Münich (2003), who confirm the existence of the wage curve in the Czech Republic in the period 1996–2001.

To estimate the burden of the minimum wage we use the ratio of the minimum wage to the gross average wage in the district in a particular year. Indeed, the first brief analysis of the regional-level data reveals a positive relationship between the ratio of the minimum wage to the average regional wage and the regional unemployment rate. Districts with a low wage level registered relatively

[13] The coefficient of variation of average wages among the 77 Czech districts (NUTS-4 level) grew substantially during the 1990s and has stabilized since 1998 at around 10% (with some volatility). However, the wage disparities between the regions are much lower than the differences in unemployment: the coefficient of variation of regional unemployment rates has been fluctuating between 40% and 50% since 2000 (source: Czech Statistical Office and Ministry of Labor and Social Affairs of the Czech Republic, the authors´ calculations); for details see Fialová (2008).

higher rates of unemployment in 2004–2005:[14] the unemployment rate was 11.1% in the ten lowest-wage districts (high minimum/average wage ratio), while it was 7.9% in the ten highest-wage districts. The correlation coefficient between unemployment and the minimum wage as a proportion of the average wage in the districts was positive and reached 0.3 in 2004–2005. However, to analyze the causal relationship between the minimum wage and unemployment, we have to use more sophisticated models, as follows in the next section.

3.1 Methodology, Data, and Description of Variables

To estimate the effect of the minimum wage on regional unemployment more consistently, we used generalized least squares regression analysis on panel data. We employ data from 77 districts of the Czech Republic (NUTS-4 level) in 1995–2004.[15] The data sources are the Czech Statistical Office[16] and the unemployment statistics of the Ministry of Labor and Social Affairs.

To reveal the effect of the minimum wage on unemployment and to control simultaneously for other factors of influence, we use the following characteristics of the districts. The average yearly unemployment rate (*U*) is the endogenous variable. Among the explanatory variables, the ratio of the nation-wide minimum wage to the average regional wage (*MWAW*) is in first place. According to our assumption stated above, we expect a positive effect of this variable on the explanatory variable.

In our analysis we are limited by the low availability of relevant data on other control variables that might also affect the overall unemployment level in the region. Some of the data was available for the period 1995–2001 only. Thus, in the initial basic analysis we only cover five independent control variables in the period 1995––2004 (model (1)).

In the basic dataset of model (1) we control for the overall situation and tightness of the regional labor market by including the vacancy rate in the region (*VACR*). The number of self-employed entrepreneurs per 1,000 inhabitants of the region (*ENT*) reflects the activity of the regional population; a higher level of self-employment might push regional unemployment down. We also control for the educational level of the population in the districts by adding a variable stating the share of the population older than 15 years that has attained a tertiary level of educational (*TERTIARY*). Regional unemployment also differs according to the urbanization of the regions, as rural regions typically exhibit fewer employment opportunities than urban districts. Thus, we also account for the urbanization of the region using the share of inhabitants living in cities (*URB*). As there are significant regional disparities in the Czech Republic and the capital Prague is the economic center of the country and the main source of economic growth, we also add a variable stating the distance of the regional capital from Prague (*DIST*).

[14] We chose the period 2004–2005 due to data limitations: the data series on wages in the districts (NUTS4) end in 2005 and, moreover, there was a break in the methodology of reporting of unemployment by the Ministry of Labor and Social Affairs from 2004 on.

[15] Our dataset is limited by the year 2004, as this is the last year when detailed regional statistics on the NUTS-4 level were reported by the Czech Statistical Office. Later on, the detailed statistics switched to the more aggregated NUTS-3 level, corresponding to the standard general European approach.

[16] mainly the publication "Districts of the Czech Republic in Year…."

In the subsequent analysis (model (2)), we narrow the time period to 1995––2001 and add two more explanatory variables to check the robustness of the previous results. This adjusted dataset also reflects the sector structure of employment by covering the share of the working labor force employed in the primary sector (*EMPA*) and the development of capital construction expenditure in the region (*CAPCON*), reflecting the trends in the economic development of the region itself.[17]

The regression equation then takes the following form:

$$\ln U_{ti} = \alpha + \beta_1 \ln MWAW_{ti} + \beta_2 \ln VACR_t + \beta_3 ENT_{ti} + \beta_4 TERTIARY_{ti} + \\ + \beta_5 URB_{ti} + \beta_6 DIST_{ti} + (\beta_7 EMPA_{ti} + \beta_8 \ln CAPCON_{ti}) + \varepsilon_{ti} \qquad (1)$$

where ε represents normally distributed residuals with zero mean and constant variance. In line with the common practice in this type of research, the dependent variable, the ratio of the minimum wage to the average regional wage, and the vacancy rate are given in logs. Capital construction expenditure is also given in log form, to eliminate a potential source of heteroskedasticity (as the data covers units of different size). Expressing the variables as logs allows us to interpret the regression coefficients as elasticities. We use the random effects regression model employing the generalized least squares procedure, because the time variability of the variables *DIST* and *TERTIARY* is zero, and in such case the fixed effects model is not applicable. As the data reflect information regarding units of different size, the presence of heteroskedasticity is highly probable. Therefore, we use robust estimates of the variance of the regression coefficients. Moreover, the residual analyses indicate autocorrelation (AR1), so we use econometric procedures that eliminate this effect. Consequently, our analysis offers consistent and efficient estimates.[18]

3.2 Results

The results of our regression models are given in *Table 2*. In the basic model covering the longer time period (model (1.a)), all six explanatory variables proved to be significant. The expected effect of the variables was confirmed, with the exception of *URB* and *ENT*, which indicated a low positive effect on unemployment. Our results suggest that the impact of self-employment might be ambiguous within the transition processes that took place in the given period. The effect of urbanization might be also more complex: high urbanization has been connected with a higher share of an expanding tertiary sector in some districts, but also with a contracting secondary sector in other districts. Thus, besides the low-unemployment districts (Prague, Brno, Plzeň, etc.), there were also highly urbanized industrial districts of northern Bohemia and northern Moravia suffering from restructuring processes and high levels of unemployment.

[17] The descriptive statistics of the variables are available from the authors upon request.

[18] Chow tests rejected the hypothesis of stability of the regression coefficients among the districts, which puts some doubt on our approach to the analysis of the data as a panel. However, the Chow test puts rather restrictive assumptions on the character of the input data and residuals (e.g. homoskedasticity of residuals; for more details see Greene, 2003), which were not fulfilled by the data used. Therefore, we accept the assumption of general homogeneity of the Czech Republic as regards the reaction of unemployment to the development of various factors of influence due to similar institutional and socio-cultural background. Consequently, we proceed to an analysis of the data as a panel.

Table 2 Regression Estimation Results – Regional Data Analysis

	Model (1.a)	Model (1.b)	Model (2.a)	Model (2.b)	Model (2.c)
Constant	-1.022***	-0.510	-1.031*	-0.328	-0.176
	(0.315)	(0.334)	(0.511)	(0.544)	(0.404)
lnMWAW	0.314***	0.724***	0.391***	0.652***	0.639***
	(0.072)	(0.082)	(0.093)	(0.107)	(0.105)
lnVACR	-0.113***	-0.209***	-0.158***	-0.256***	-0.256***
	(0.016)	(0.018)	(0.022)	(0.025)	(0.025)
ENT	0.011***		0.012***		
	(0.001)		(0.001)		
TERTIARY	-0.164***	-0.074***	-0.159***	-0.084***	-0.087***
	(0.019)	(0.016)	(0.021)	(0.019)	(0.018)
URB	0.015***		0.019***		
	(0.003)		(0.004)		
DIST	0.003***	0.002***	0.003***	0.002***	0.002***
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
EMPA			0.014*	0.005	
			(0.008)	(0.008)	
lnCAPCON			-0.088**	0.006	
			(0.037)	(0.041)	
N (districts, time):	770 (77, 10)	770 (77, 10)	539 (77, 7)	539 (77, 7)	539 (77, 7)
R^2 overall:	0.475	0.451	0.430	0.389	0.402
R^2 within:	0.758	0.525	0.764	0.445	0.441
R^2 between:	0.274	0.427	0.248	0.406	0.429

Notes: *** significant at 1% level, ** significant at 5% level, * significant at 10% level.
Random effects generalized least squares estimation method, robust standard errors in parentheses.

Source: Ministry of Labor and Social Affairs of the Czech Republic, Czech Statistical Office, the authors´ calculations.

Therefore, we exclude the variables *ENT* and *URB* due to an ambiguous relationship with regional unemployment. This step also significantly improves the explanatory power of the model in the case of inter-group variation and decreases the overall explanatory power only negligibly. The reduced form of the basic model (1.b) contains only four exogenous variables: *MWAW*, *VACR*, *TERTIARY*, and *DIST*. All these variables proved to be significant. The model explains almost 50% of the variation of unemployment in the districts over time.

Our results for model (1) indicate that the ratio of the minimum wage to the average wage in the region has a significant positive effect on regional unemployment. However, the results are sensitive to the inclusion of the variable *ENT*. The elasticity of unemployment with respect to *MWAW* is 0.3–0.7 (depending on the inclusion of *ENT* and *URB*), i.e., it is positive and lower than one. Furthermore, a higher education level of the district's population and a higher supply of vacancies decrease unemployment in the regions. On the other hand, a larger distance from Prague yields higher rates of regional unemployment.

If we add two more variables and narrow the time period (model (2.a)) we get similar results. Again, the results are sensitive to the inclusion of *ENT*, which influ-

ences the explanatory power of the model and the regression coefficients and their significance. After excluding *ENT* and *URB* (model (2.b)), *EMPA* (which in the original model (2.a) was significant only at the 10% level) and *CAPCON* become insignificant and consequently were excluded, too.

The final, reduced model (2.c) leaves us with four explanatory variables, again as in model (1.b), which are significant and show a similar effect on the endogenous variable as in the basic model (1.b). The model explains 40% of the variation of unemployment in the districts over time. *MWAW* shows a significant positive effect in all the models (2.a–c), but its magnitude slightly alters according to the control variables covered. The elasticity of regional unemployment with respect to the ratio of the minimum wage to the average wage in the region is 0.4–0.6.

Overall, our results indicate that since 1995, the increasing minimum wage expressed as a ratio to the average regional wage has had a significant upward effect on the unemployment rate in the regions. However, the elasticity estimates are not robust, are sensitive to the inclusion of particular variables, and amount to 0.3–0.7. This means that increasing the ratio of the minimum wage to the average wage in the region by 1% leads to a rise in unemployment of 0.3–0.7%.

An increase in the *MWAW* ratio occurs if the minimum wage grows faster than the average wage. In 2001, for instance, the minimum wage rate went up by 18%. Therefore, if the average wage growth in a region did not exceed this level, we can expect that the minimum wage increase led to higher unemployment in that region. Looking at the data from 2001, we find that average wage growth was indeed below minimum wage growth: wages grew by more than 10% in five districts only (Ostrava, Kutná Hora, Kladno, Jihlava, and Beroun) and by more than the 18% threshold in a single district only (Kutná Hora). Thus, in all the regions but one, we can expect an adverse effect on unemployment. We can also expect the districts where the *MWAW* ratio increased most rapidly between 1995 and 2004 to be negatively affected the most. Indeed, eight out of the ten districts which exhibited more than 55% growth in *MWAW* in the given period recorded considerably above-average levels of unemployment in 2004.[19]

Our results indicate a significant adverse effect of the minimum wage on regional unemployment. However, the aggregate district-level data reflect a large spectrum of factors and we cannot attribute a substantial part of the differences in unemployment to the effect of the minimum wage only. To estimate the labor market impact of the minimum wage more precisely, we supplement our approach with an analysis of the individual-level data.

4. The Impact of the Minimum Wage on the Individual Level

In this section, we estimate the potential negative impact of the minimum wage on employment on the individual level. Our analysis stems from an assumption based on the theory of competitive markets: if the productivity of workers remains the same, hikes in the nominal wage render workers originally paid a wage between the old and new minima currently unemployable.

[19] High unemployment levels were registered in Karviná (21.1%), Frýdek-Místek (15.2%), Sokolov (13.5%), Hodonín (15.2%), Třebíč (13.6%), Louny (16.1%), Chomutov (18.1%), and Karlovy Vary (11%). On the other hand, low, below-average unemployment was sustained in Písek (8.2%) and Tábor (6.5%). The country average was 10.2% in 2004.

We use the hike in the minimum wage from 2004 (t) to 2005 (t+1) to identify the groups of individuals most endangered by this provision. In first place are workers paid at a level right between the old and new statutory minima. Second, due to significant spill-over effects (OECD 1998), workers originally paid marginally over the new minimum might also be hit. We suppose that these two groups of individuals have significantly lower probabilities of staying employed after the hike in the minimum wage takes place. Therefore, we compare the conditional probabilities of being employed full time in period t+1 given full-time employment status in period t, $p(e_{t+1}=1|e_t=1)$ for these groups of individuals with those for individuals who were paid well above the new statutory minimum in reference period t. In our approach we use logistic regression to estimate the conditional probabilities.

In our analysis we employ a similar approach to that of Abowd et al. (1997). However, given the character of the data applied (a cross-sectional sample with partial information on two time periods) we do not employ the standard panel data analysis customarily used for minimum wage research on individual data. Therefore, we partially adjust the approach to our specific circumstances; the adjustment does not call into question the theoretical relevance.

4.1 Methodology, Data, and Variables

The household survey European Union-Statistics on Income and Living Conditions (EU-SILC) data was employed.[20] The reference period for the income variables, t, is the year 2004; the majority of the other variables relate to the current situation at the time of the survey, t+1, which means Q2 2005. The data provide us with yearly net wages; net monthly earned income was therefore constructed according to the number of months worked.

The original data set includes 10,333 individuals (8,628 aged 16 and over) in 4,351 households. In our study, only individuals 16 to 64 years old are considered. We cover only those individuals who reported full-time employment in the last four months of the reference period t and part-time employment, full-time employment, unemployment, retirement, or out of labor force status in period t+1.[21] Part-time employees in the income reference period are excluded since their monthly income is not comparable with full-time workers' wages. Furthermore, the self-employed are eliminated since their income contains irregularities which would make the analysis biased. We also exclude individuals reporting a wage below the minimum wage. In addition, we eliminate individuals who received any sickness benefits in 2004 as this biases their wage considerably.

In other words, only individuals who moved between full-time employment in period t and full-time employment, part-time employment, unemployment, retirement, and inactivity during period t+1 are included. This leaves us with 3,070 in-

[20] EU-SILC UDB 2005-version 2 of June 2007. EU-SILC is a new panel survey which replaced the ECHP survey in 2004. It is a harmonized survey compulsory for all EU member states. Information is collected at both household level (mainly information on living conditions) and individual level (e.g. individual and job characteristics, wages, income, social allowances).

[21] We limit our reference period to four months only, because covering the whole of 2004 would be too restrictive. The four-month period also excludes those employed in a probation period only (the probation period generally lasts three months in the Czech Republic).

dividuals. Individual weights were included to reflect the number of people in the whole population who are represented by the particular individual.

Logistic regression is used for the computations since the endogenous variable in the model is dichotomous. This variable is being employed full time in the current period t+1 (Q2 2005, i.e., lagged by 4 to 6 months with respect to the income reference period t) and takes the value of 1 if the individual was employed full time and 0 if she/he is a part-time employee, unemployed, retired, or out of the labor force. The logistic model takes the following for

$$\ln [p/(1-p)] = \beta_0 + \beta_i X_i, \qquad (2)$$

where p is the probability of staying employed in t+1 conditional on employment in t $p(e_{t+1}=1|e_t=1)$ and vector X_i includes all the explanatory variables. The explanatory variables included in equation (2) were the individuals' minimum wage status, age, education, sex, occupational category, and region as a proxy for general trends in the unemployment rate.[22]

The minimum wage status (*MWST_j*) is the individual's position in the wage distribution given their relation to the net minimum wage in t and t+1. *MWST_*1 represents those employees receiving a wage higher than the minimum wage in t yet not exceeding the minimum wage in t+1 ("between" employees). *MWST_*2 represents those employees who were paid marginally over the minimum wage in t+1 ("marginally over" employees). Therefore, the thresholds are represented by the net minimum wage in 2004 (CZK 5,459) and 2005 (CZK 5,819) and 1.5 times the 2005 level for the interval "marginally over". The thresholds were adjusted for individuals aged 16–21 according to their sub-minimum wage tariffs. We also adjust the intervals for errors in measurement (± 10%). The intervals are defined as follows:

– *MWST_*1 – *"between":*

CZK 4,900 (MW_t*0.9) < *monthly net wage in t* < CZK 6,400 (MW_{t+1}*1.1);

– *MWST_*2 – *"marginally over":*

CZK 6,400 (MW_{t+1}*1.1) ≤ *monthly net wage in t* < CZK 8,700 (MW_{t+1}*1.5)*;*

– *MWST_*3 – *"considerably over" (reference variable):*

CZK 8,700 (MW_{t+1}*1.5) ≤ *monthly net wage in t.*

AGEk are dummies for age, reflecting also work experience. The reference group is age 35–44. The education variable (*TER_EDUC*) corresponds to tertiary education.[23] *MALE* is a dummy variable which equals 1 when the individual is male. *ISCOl* are variables classifying occupation according to the International Standard Classification of Occupations. The reference group is *ISCO9* (elementary occupations). *REGm* are dummies for region as a proxy for unemployment rates. The regions on the NUTS-2 level were clustered into four groups given the level of unemployment to reflect the labor market situation in the region where the individuals live. The reference group is the Prague region.[24]

[22] Descriptive statistics of the variables are available from the authors upon request.

[23] The dummy on primary education was excluded due to a lack of relevant observations.

[24] REG2 consists of South-West, Central Bohemia, and North-East, REG3 consists of South-East and Central Moravia, and REG4 consists of North-West and Moravia-Silesia.

Table 3 Regression Estimation Results – Individual Data Analysis

	Coeff.	S.E.	Odds ratio
MWST_1	-1.8642***	(0.3565)	0.1550
mwst_2	-0.7724**	(0.3090)	0.4619
male	0.4318	(0.2801)	1.5400
age16_21	-0.3995	(0.6021)	0.6707
age22_25	0.2824	(0.5775)	1.3264
age26_34	-0.2547	(0.3652)	0.7752
age45_54	0.3619	(0.4081)	1.4361
age55_59	-1.2781***	(0.3896)	0.2786
age60_64	-2.1715***	(0.5138)	0.1140
ter_educ	-0.5694	(0.4587)	0.5658
ISCO0	-2.8734***	(0.8819)	0.0565
ISCO1	1.0208	(1.3588)	2.7753
ISCO23	0.4164	(0.5217)	1.5165
ISCO45	-0.1057	(0.4590)	0.8997
ISCO67	-0.1811	(0.4722)	0.8343
ISCO8	-0.6131	(0.4904)	0.5417
reg2	0.1019	(0.4421)	1.1072
reg3	0.3337	(0.4752)	1.3961
reg4	-0.2523	(0.4568)	0.7770
Constant	4.2184	(0.6373)	67.9245

Notes: *** significant at 1% level, ** significant at 5% level. Equation estimated by maximum likelihood logit. Standard errors in parentheses. Sample size: 3,070. Correctness of observation classification 97.5%.

Source: EU-SILC UDB 2005–version 2 of June 2007; the authors´ calculations.

4.2 Results

The results of the maximum likelihood logit estimation procedure are reported in *Table 3*. The results show that workers whose 2004 wage lies between the 2004 and 2005 minima or marginally over the 2005 minimum have substantially lower subsequent employment probabilities in 2005 than workers whose wage in 2004 exceeds the new 2005 minimum considerably. The differences proved to be statistically significant. Moreover, the hike in the minimum wage hits the "between" workers much harder than the workers paid "marginally over": the coefficient of the "between" workers group is much lower than that of the "marginally over" group. Furthermore, the age and occupational variables proved to be relevant in explaining conditional employment probabilities: the probability of subsequent employment falls significantly in groups aged 55–59 and 60–64 (the effect of retirement) and in ISCO group 0 – armed forces (this relates to huge withdrawals from the army and the police service in connection with the screening law and the new civil service law).

The employment probabilities resulting from the model have to be considered in relation to the relevant reference variable, which here consists of workers paid considerably more than the new minimum (more than 1.5 times the 2005 minimum wage net value). The odds ratio of the reference variable equals 1. When an indi-

vidual exhibits the minimum wage status "between" (*MWST_*1), his employment probability decreases substantially: the odds ratio amounts to a very low 0.16 (see *Table 3*). Furthermore, for workers with a minimum wage status "marginally over" the new minimum wage (*MWST_*2), the odds ratio increases slightly to 0.46 but is still well below one.

This means that if we compare two otherwise completely identical individuals, the first one paid *between* the old and new minima, and the second whose net wage exceeds the new minimum considerably, the first one will be 0.16 times as likely to remain employed after the minimum wage hike compared to the second one. The drop in the employment probability of a worker paid *marginally over* the new minimum is 0.46. The results therefore affirm our initial assumption and prove the negative effect of the minimum wage on the employment probability of low-paid workers. The strength of this effect diminishes as one moves up the wage distribution.

Despite the substantial negative effect estimated, the first of the at-risk groups is relatively small: workers in the "between" group comprise 5.2% of the sample only. On the other hand, workers in the "marginally over" group account for more – 18.5% – of the sample, and the adverse effects might be larger in scope. However, as is usually assumed in the empirical literature, the differences in the age averages of the groups are not statistically significant and so the adverse effects are not limited to young workers only.

5. Conclusions

This paper aimed to quantify the impact of the minimum wage on labor market performance in the Czech Republic. There have been substantial hikes in the minimum wage since the late 1990s. The movements in minimum wage tariffs, however, have not reflected the trends in the real economy and have mainly been a result of political measures in the social area. Despite the rapid growth, the Czech Republic remains among the more liberal countries in the EU as regards the relative importance of the minimum wage in the economic environment.

Our analyses suggest that the minimum wage does have significant adverse consequences for labor market performance. Using regional data for 1995–2004, we estimate the effect of varying the economic burden represented by the ratio of the minimum wage to the average regional wage on regional unemployment. Our results indicate that since 1995, the increasing minimum wage expressed as a share of the average regional wage has had a significant upward effect on the unemployment rate in the regions. The elasticity estimates amount to 0.3–0.7; however, they are not robust and are sensitive to the inclusion of particular variables. This means that increasing the ratio of the minimum wage to the average wage in the region by 1% leads to a rise in unemployment of 0.3–0.7%. However, when interpreting the results, the low robustness of the estimates must be taken into account.

Consequently, using detailed individual data for 2004/2005, we use the annual hikes in the statutory minimum wage to identify workers whose wage falls "between" the old and the new minimum wage level and "marginally over" the new minimum wage. We estimate the subsequent employment probabilities of these

workers compared to workers whose wage exceeds the new minimum considerably. Our results show that when a worker exhibits the minimum wage status "between" in 2004, his/her subsequent employment probability in 2005 decreases substantially: he/she is 0.16 times as likely to remain employed after the minimum wage hike compared to a worker paid considerably over the minimum. Furthermore, for workers who are "marginally over" the new minimum wage, the difference in probability increases slightly to 0.46, but is still well below one. The results therefore affirm our initial assumption and prove the negative effect of the minimum wage on the employment probability of low-paid workers. The strength of this effect diminishes as one moves up the wage distribution.

The potential of the minimum wage in fighting poverty is generally rather limited, as the empirical literature on this topic shows. Given its proven adverse effects on unemployment in regions and the employment probabilities of low-paid workers, it seems valid to claim that the minimum wage in the Czech Republic has not been a very useful or effective instrument so far. Instead, alternative measures for motivating low-paid workers (e.g. negative income tax) without adverse effects on employment should be considered together with direct provisions aimed at enhancing the human capital of the least productive workers.

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