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# Wage Differentiation and Unemployment in the Districts of the Czech Republic

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# Wage Differentiation and Unemployment in the Districts of the Czech Republic

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**Abstract:**

This paper concerns the labour market differences among the 77 districts of the Czech Republic. There was a remarkable trend of increasing regional labour market differentiation in the 1990's, however, the patterns of differentiation have stabilised since then. The first part of the paper aims to describe the regional differentiation in wages and unemployment on the descriptive method basis. The other part of the study attempts to explain the differences in wages by an econometric model. We focus on the effect of unemployment rate, representing an exogenous factor of the region itself. The model's specification arises out of the general concept of wage differentiation and the concept of the wage curve. According to our analysis there were several factors of influence on the regional wage differentiation in 2001: educational structure of the population, employment structure of the regional economy, degree of economic concentration, and district rate of unemployment. The coefficient of the unemployment elasticity of wages equals  $-0.08$ , which can be considered as evidence of the existence of the wage curve in the districts of the Czech Republic. Moreover, the relationship is stronger in the low-unemployment districts.

**Keywords:** regional disparities, wages, unemployment, wage curve.

**JEL:** E24, J31, J64, R23.

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## **1. Introduction**

Recent developments of the Czech labour market have been rather favourable. Unemployment has followed a decreasing trend and the long-term unemployment also declined. Nevertheless, this development was attributable to the fading economic upswing mainly. Structural and institutional problems of the Czech labour market still remain a hot issue, especially in context of recent debates on the euro adoption. Besides relatively high long-term unemployment with a significant structural component and inappropriate institutional framework, regional disparities and low spatial flexibility of the labour force can be considered a substantial problem.

Overall regional differentiation has been dynamically increasing in the Czech Republic already since the beginning of the transformation process.<sup>1</sup> The basic pattern of “new” regional differentiation was realized already by the end of 1990s and regional disparities roughly stabilised at the turn of the millennium (Blažek, Csank, 2007). The existing regional differences tend to prevail in time due to inefficient functioning of the migration as an equilibrating mechanism (Čermák 2001, Hampl 2001).

This article attempts to describe and explain the developments of the regional labour market disparities since the beginning of the transformation period in 1990. The average regional NUTS-4 level data for 77 districts of the Czech Republic in years 1991-2007 was employed. The source of data was predominantly the Czech Statistical Office (CZSO) and the Ministry of

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<sup>1</sup> Hampl (2001) considers the rise of regional disparities not only a result, but also a necessary precondition of the socio-economic transformation.

Labour and Social Affairs (MLSA). Firstly, we present a descriptive analysis of the regional differences in wage levels and unemployment and estimate the mismatch between the distribution of unemployment and vacancies among the Czech districts, reflecting the structural unemployment.

Consequently, the study offers an econometric analysis of the regional wage differentiation in the Czech Republic. Cross-sectional regression analysis of regional data in 2001 was conducted. The wage differentiation in the Czech Republic has been well-described on the individual level, accounting for individual or firms characteristics (see for instance Flek and Večerník, 1998; Večerník, 2001; Gottvald, 2002). Hence, we focus on the importance of differences in the regional unemployment rates in determining the average wage levels of regions in context of the wage curve concept, as it was originally formulated by Blanchflower and Oswald (1994). In this framework, regional unemployment rate represents a specific factor of region, reflecting for the particular characteristics of regions that might to a certain extent affect the wage level.

The paper is organized as follows: The next section provides an overview of the development of the regional disparities in average wage levels, unemployment and vacancies in the CR and puts it into a broader economic and social context. Section 3 discusses the determinants of the regional wage differentiation and the wage curve concept and presents a framework for further empirical model. Section 4 then gives the analysis of the regional wage differentiation, depicts the methodology, data and results of the model. The aim is to reveal whether there exists a wage curve in the Czech districts. The main results and discussion are summarized in Section 5.

## **2. Development of the regional labour market disparities in the CR**

### *2.1. Average Wages in the Districts*

Average nominal wage in the Czech Republic recorded quite a straightforward development – it has been increasing since the early 1990s and the pace of growth hasn't changed much.<sup>2</sup> The situation is depicted in Figure 1 and Table 1. Clearly, the growth of the total republic

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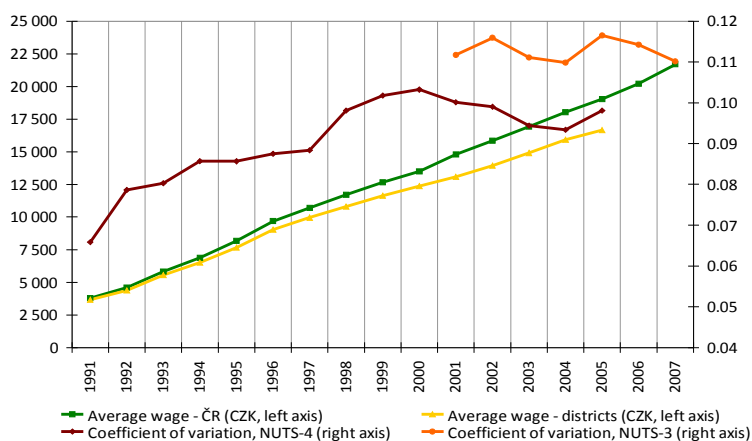
<sup>2</sup> It is impossible to examine regional real wages, as price indices are not monitored on the regional level. Therefore, we use data on nominal wages only. The data for 77 districts of the CR (NUTS-4 level) is available until 2005 only. Since 2006, NUTS-3 level data (14 territories) represents the lowest level of disaggregation.

average was sharper than the growth of the districts average (green and yellow line in the figure, respectively), as the yellow line is flatter. The difference between the average wage in the CR and the district average wage is mostly given by a very high wage level in bigger urban districts, mostly Prague, continuously moving away from the other districts. The growing difference between the district and republic averages points to the deepening of the regional disparities.

Indeed, the smooth, almost linear growth of the average wage in examined period was accompanied by a sharp increase of the regional wage disparities. Coefficient of variation almost doubled during 1990s and peaked in 2000. There was a soft decline afterwards, and the district wage variability stabilized around 9-10% since 2001 according to the NUTS-4 level data series ending in 2005 (red line in Figure 1). Generally, more aggregated NUTS-3 level data exhibits a higher degree of variability, but the trends are similar. As indicate the NUTS-3 level data series (orange line), regional variability measured by the variation coefficient decreased moderately in 2006 and 2007.

The growing differentiation is also indicated by the data on variation ratio that experienced a substantial growth trend until 2000 and a slight fall thereafter. On the other hand, decile ratio did not change much in the whole period considered, which means that the main movements took place on the extreme positions, mostly in maximum value represented by Prague. The span in the values increases and the distribution of average wages becomes flatter. The median value was lower than average in the whole period, thus more than 50% of the districts lies below the average. Moreover, this difference increases in time, which also points to the growing disparities. However, the regional differences in wages in the Czech Republic still can not be considered large, compared to the other labour market indicators, as we will show below.

## Average wage in the CR and its regional variation, 1991-2007



Source: Czech Statistical Office, own calculations

**Table 1. Variability of average regional wages**

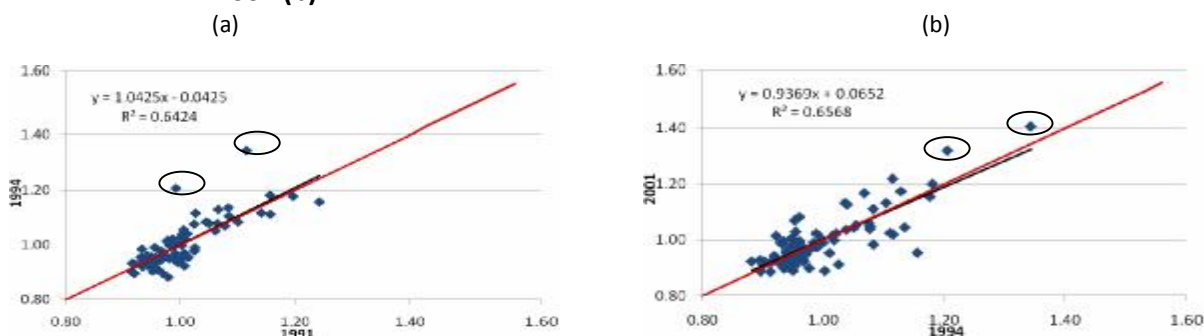
	1991	1992	1993	1995	1997	1999	2000	2001	2003	2005
Average	3 668	4 374	5 551	7 661	9 954	11 625	12 360	13 082	14 905	16 648
Coefficient of variation	0.066	0.079	0.080	0.086	0.088	0.102	0.103	0.100	0.094	0.098
Variation ratio	1.358	1.398	1.477	1.538	1.593	1.736	1.792	1.675	1.624	1.641
Decile ratio	1.159	1.209	1.209	1.211	1.217	1.196	1.222	1.248	1.244	1.235
Median	3 621	4 274	5 439	7 462	9 669	11 326	12 076	12 874	14 509	16 057
Average/median	1.013	1.023	1.021	1.027	1.029	1.026	1.024	1.016	1.027	1.037

Source: Czech Statistical Office, own calculations

At the beginning of the transformation period, the highest average wages were concentrated into heavy industrial regions in the northern part of the republic. As we already showed on the aggregate level, the major changes in the pattern of regional wage differences took place already in early 1990s. Figure 2 outlines the particular movements in relative individual district positions in 1990s. Each dot represents the relative wage position of the particular district and is calculated as a share of the average wage in the district on the overall average across all the 77 districts. A value higher than one means that the regional wage level lies above the overall average in a given year and vice versa. The regions which experienced a relative improvement of their wage position lie above the diagonal (red line), while the districts which worsened their relative position between examined years are to be found below the diagonal. By a graphical analysis we can distinguish two particular periods, when the patterns of regional wage differentiation were formed: 1991-1994 and 1994-2001 (Figure 2, panel (a) and (b), respectively); these periods correspond with the development of the coefficient of variation.



**Figure 1. Changes in relative individual district positions, 1991-1994 (a) and 1994-2001 (b)**

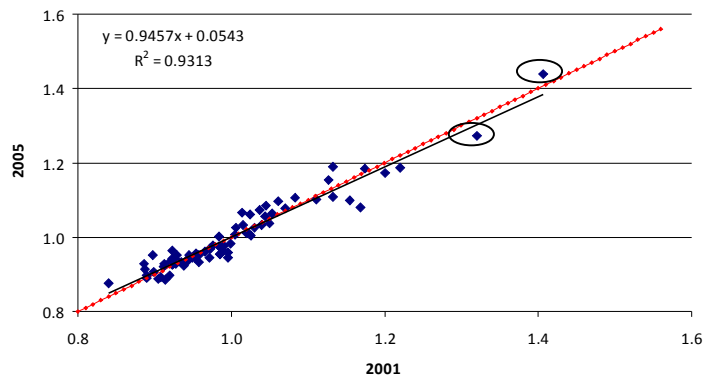


Source: Czech Statistical Office, own calculations

Clearly, the changes that took place until 1994 meant mainly a widening of the overall differences and beginning of the movement of Prague and Mladá Boleslav (two marked districts in panel (a)) away from the other districts. Generally, some districts improved and some worsened their position and the relative magnitude of movements in average cancelled out, as the regression line (black) overlaps the diagonal. The movements in relative wage positions that took place between 1994 and 2001 could be marked as a very weak convergence as the slope of the regression line decreased below one. The movements on the highest positions of the wage scale represent an exception that biases the results. The two marked districts on panel (b) (again represent Prague and Mladá Boleslav) continued in increasing their distance from the other regions.

There were no major shifts in relative wage positions of districts since 2001, the patterns of regional differentiation stabilised. The data for years 2001 and 2005 plotted in Figure 3 shows that the dots roughly overlap with the diagonal. The over-average wage growth in Prague continued, as it was increasing its distance from the other districts. The rapid wage growth in Mladá Boleslav decelerated in this period. Nevertheless, the two districts got to the top of the regional wage chart: the average annual wage growth between 1991 and 2005 was 2 percentage points higher than in all other regions.

**Figure 2. Changes in relative individual district positions, 2001-2005**



Source: Czech Statistical Office, own calculations

Recently, higher regional wages are connected with big cities influential in a larger region, or profiting from a favourable geographical location (mostly in sense of close proximity or good infrastructural connection to Prague), with a concentration of tertiary sector activities. On the other hand, declining districts are typically rather rural, suffer unfavourable economic structure, geographical location, and underdeveloped transport infrastructure. Generally, Bohemian regions exhibit higher wage level than the Moravian (with an exception of big cities and districts in northern Moravia, which maintain still relatively high wages).<sup>3</sup>

## 2.2. Regional Unemployment

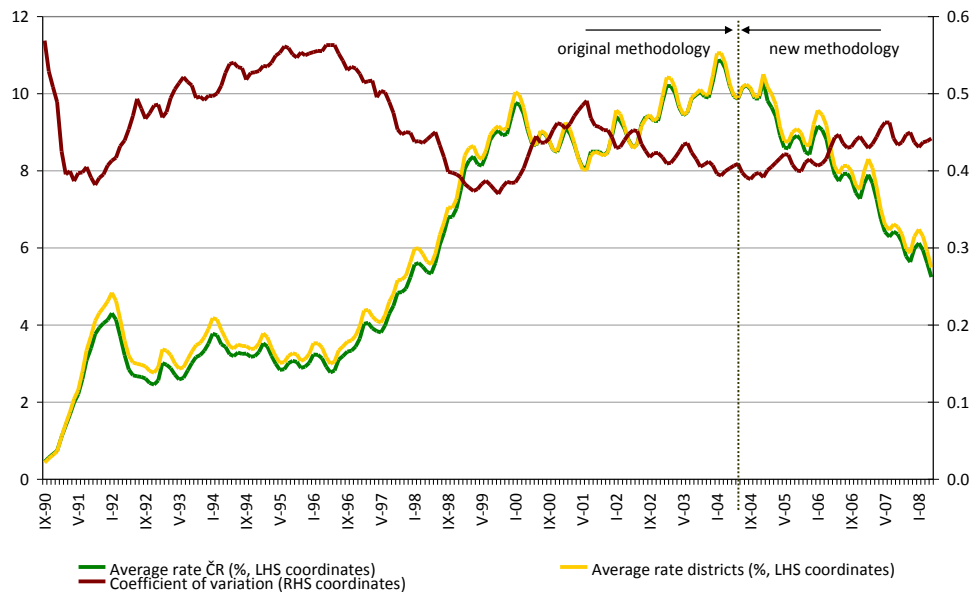
The development of the regional unemployment was not as straightforward as it was in case of wages. The analysis of the time trend is also complicated by the change of the methodology of reporting the unemployment by the MLSA in July 2004, which practically meant a decrease of the figures by 1 percentage point in an average (usually larger decrease for higher rates of unemployment). Comparability of the data is thus partly limited.

Figure 4 depicts the situation in the examined period. Unemployment was very low in the first half of 1990s and went up rapidly from 1997. The average district rate of unemployment stood only at 3.3% in 1991-1996 and it rapidly increased in 1997-2004 to 8.4%, i.e. more than twofold level. The peak was attained in 2004 when the average district unemployment rate exceeded 10% and there was registered a substantial decline thereafter to less than 7%

<sup>3</sup> The urbanised districts of northern Moravia and Bohemia still sustain a rather high wage level as heritage of the previous regime. During communist era, heavy industry was largely concentrated here and employees were paid higher wages. The wage level still stayed very high, despite the restructuring processes that started in 1990s.

in 2007. The difference between the overall average of the whole republic and the district average is again given by the low unemployment in the largest urban districts (Prague), although the discrepancy is not as large as in case of wages.

**Figure 3. Unemployment in the CR and variation among districts, 1990-2008**



Source: Czech Statistical Office, Ministry of Labour and Social Affairs, own calculations

Despite the low unemployment of the beginning of 1990s, there was already present a substantial degree of the regional differentiation. The development of the average rate of unemployment and its coefficient of regional variation has roughly followed the mirror reflection path. Thus, coefficient of variation reached the highest levels in 1990s, gradually decreasing with the increasing average rate of unemployment thereafter. The regional variation stabilised around 0.4-0.5 since year 2000.<sup>4</sup>

The most significant changes in the pattern of regional differentiation in this area again took place already in the beginning of 1990s, and the regional disparities have stabilised since 1998. However, this stabilisation represents a rather high degree of regional differentiation,

<sup>4</sup> We might speculate about the effect of the overall economic growth on the variability of regional unemployment. However, the pattern of this potential relation was not very clear in the Czech Republic so far. Correlation between the regional variation and economic growth is insignificant, amounts to -0.16 only and doesn't increase much even when accounting for the lagged values. This result might be connected to the transitional processes related to the transformation and convergence of the economy.

both compared to other labour market indicators<sup>5</sup> and in an international comparison. According to the Eurostat, dispersion of regional unemployment rates on NUTS-3 level was 49.6% in the Czech Republic in 2007, while it was significantly less in all the other countries with data available (Slovakia 43.4%, Hungary 35.8%, and Poland 23.6%).

The movements in the pattern of geographical dispersion of unemployment were influenced by several factors. The most important was the initial position of a district (specific conditions of the region, economic and structural characteristics) and also the level of restructuring and transformation of the economy. In the initial period, high levels of unemployment were concentrated in rural districts with low population density and urbanisation, specialized in agriculture (south Bohemia and Moravia and rural districts of Moravia).

Gradually the pattern has changed and in the final phase of the development, there can be identified two broad regions suffering from a relatively high unemployment – northern Bohemia and northern Moravia (now urban districts as well). These regions are specific by their specialisation in heavy industry, seriously hit by the restructuring. The distinctive attributes connected with higher unemployment further represent deficient infrastructure and lower level of urbanisation: some rural agricultural regions also exhibit a higher unemployment (southern Moravia mainly). Again, the location of a district with respect to the economical centre of the republic plays the key role here.

On the other hand, there are districts that have recorded persistently low unemployment rates. The lowest levels are concentrated exclusively in Bohemia and concern Prague, Mladá Boleslav and some regions in their surroundings. Furthermore, some districts in southern and western Bohemia and southern Moravia close to the German and Austrian borders exhibit very low unemployment, pointing to an important role of commuting to the developed neighbouring countries.

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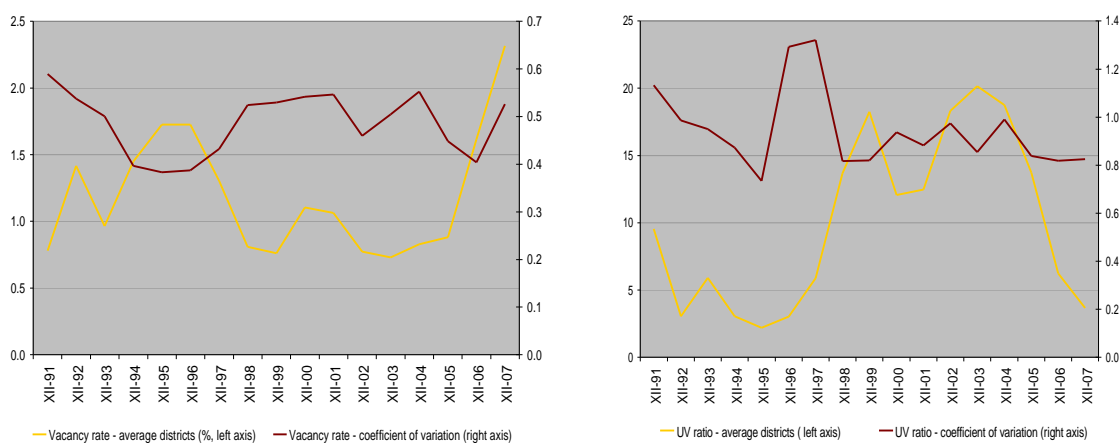
<sup>5</sup> Regional disparities in the economic activity, representing the labour supply, are also very low in the Czech Republic, as was in case of wages. The regional variation coefficient of economic activity has stabilised around 5-6% already since 1994. Also, there can be found a significant negative correlation between the level of economic activity and unemployment in regions in 2007, indicating a potential presence of a de-motivating effect of high unemployment on labour market participation.

### 2.3. Vacancies and the regional mismatch

As follows from what has already been written, a significant part of the unemployment in the Czech districts comprises the structural component. This is confirmed by the figures on regional vacancies. Examining the data, there is a clear mismatch between the presence of unemployment and supply of vacancies. There is evident a persistent trend of lower supply of vacancies in the high-unemployment regions compared to the low-unemployment regions. In 20 districts suffering from the highest unemployment between 2004-2007, the vacancy rate tends to be only on the half of the level prevailing in 20 districts with the lowest unemployment (0.95% and 1.97% were the respective average vacancy rates in 2004-2007). The vacancy rate exhibits a similar level of variability as the unemployment rate – coefficient of variation fluctuated around 0.4-0.5 and its development was mirrorlike in the examined period. Figure 5 describes the situation in this respect.

The disparity between unemployment and supply of vacancies practically means that there are more unemployed people falling on one vacancy in the depressed regions (UV ratio). The UV ratio in 20 worst-performing regions concerning the unemployment rate amounted to 20.4 in the average in 2004-2007, while it was 4.2 in the best unemployment-performing regions only, the difference thus being fivefold. The UV ratio exhibits a very strong variability among districts, coefficient of variation fluctuated between 0.8-1.3 in the examined period (Figure 5).

**Figure 4. Vacancy rate and UV ratio in the districts of the CR, 1991 - 2007**



Source: Czech Statistical Office, Ministry of Labour and Social Affairs, own calculations

Note: Data concern December 31<sup>st</sup> of the given year. The averages represent the average rate for the districts. Vacancy rate reports the number of vacancies per 100 economically active people. UV ratio states the number of unemployed per one vacancy.

The structural mismatch between the distribution of vacancies and unemployment among districts can be evaluated by the mismatch index<sup>6</sup> (see Jackman, Roper 1987). This index represents the number of unemployed as a share of total labour force (in %), which is situated in a “wrong” region, with a limited supply of vacancies. By moving these unemployed into a “good” region we would attain a structural balance, resulting in a similar UV ratio in all the regions. As Table 2 shows, the mismatch index exhibited an increasing trend in the examined period, peaking between 2000 and 2004, when it almost doubled compared to the early 1990s, and slightly declined thereafter.

**Table 2. Mismatch index in the districts of the CR, 1991 - 2007**

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Mismatch index (%)	0.99	0.85	1.08	1.04	0.93	1.03	1.24	1.48	1.75	1.91	1.88	1.94	1.95	1.98	1.76	1.68	1.50

Source: Czech Statistical Office, Ministry of Labour and Social Affairs, own calculations

Note: Data concern December 31<sup>st</sup> of the given year.

### 3. Regional wage disparities and unemployment in the economic research

There are many factors influencing the regional labour market differentiation. Generally, the patterns of regional disparities might to some extent follow the overall economic development of the whole country, although the relationship is not straightforward. Hůlka (2007) indicates that regional disparities tend to rise during the onset of economic expansion and the divergence decelerates with the running expansion. However, no clear result was proved during the recession. Furthermore, there are many region-specific factors affecting the differentiation.

<sup>6</sup> Index is calculated according to the following formula:

$$\frac{1}{2} \sum_{i=1}^{77} s_i |(u_i - v_i) - (u - v)|$$

where  $s_i$  is a share of the labour force in the given region,  $u_i$  represents the unemployment rate in the district,  $u$  is the overall unemployment in the CR,  $v_i$  is the vacancy rate in particular district and  $v$  is the total vacancy rate in the CR. Certain advantage of the index is that it is adjusted for the influences of the business cycle and doesn't change with the variation in the total unemployment or supply of vacancies. This allows for structural imbalances comparisons between the periods with different level of unemployment (see Jackman, Roper 1987).

In this study, we focus on explanation of the wage differentiation only and try to reveal the interrelation between the regional wage level and unemployment.<sup>7</sup> There are several types of factors determining the particular wage level in a region. We distinguish the following three groups of determinants: individual factors (demographic, social and economic characteristics of the regional population), characteristics of the regional businesses and economy (sector structure, productivity, level of concentration, ownership and size of businesses, collective bargaining over wages), and specific regional factors.

On the individual level, personal characteristics of the inhabitants and economic structure of businesses in the region where people work play the key role.<sup>8</sup> According to the concepts of wage differentiation based on the human capital theory (coming out mostly from Mincer, 1970), age, gender, educational level, and experience of the employed people in the region influence the wage level. Moreover, characteristics of the individual businesses such as sector classification, ownership and size can also affect the wage in the region (on the aggregate regional level, mostly structural characteristics of the economy such as sector structure, level of specialization and concentration are concerned). However, in this paper we are not concerned with the individual wages' determination. We focus on the determinants of the wage differentiation on the regional level and, in this sense, on the effect of the regional factors mainly.

Specific regional factors account for a significant part of the variability in wages among districts.<sup>9</sup> The theory of the wage curve (Blanchflower, Oswald, 1994) focuses on the regional determinants affecting wages. These determinants comprise the specific conditions of each

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<sup>7</sup> For more details on the determinants of regional differentiation of unemployment in the Czech Republic see for instance Fialová (2007).

<sup>8</sup> For the sake of simplicity we assume that regional labour markets mostly correspond with the borders of administrative districts.

<sup>9</sup> In sense of specific regional determinants affecting the wage level, foreign direct investment (FDI) inflow to the region might be considered an important positive factor. According to the CZSO data (CZSO, 2007), foreign and internationally owned companies pay significantly higher wages than the domestic companies. Moreover, there might also exist positive spillovers, promoting the economic performance of other businesses in the region and influencing the wages in other companies, too. According to the Czech National Bank's data on regional FDI, highest inflows were concentrated to Prague (amounted for 53% of total stock of FDI in the CR in 2006), followed by surrounding Central Bohemian region (11% of total FDI stock in 2006). The situation of the remaining regions is very different and incomparable to the central Bohemia. In average, the share of other NUTS-3 regions is 3%. With a few exceptions the regions with higher FDI stock typically exhibit higher wage level. Correlation between FDI stock and wage level in the districts (NUTS-4 level) is positive and significant, equals to 0.3. However, the determinants of FDI are very complex and the inflow also highly reflects the specific regional conditions (FDI is mostly attracted into urbanized areas with developed infrastructure, favourable location, educated labour force etc.). Thus, this might be considered another overall expression of regional factors (besides unemployment) that influence wages in regions.

single district (exogenous factors such as location, urbanisation, infrastructure, conditions for commuting, attraction for tourism etc.) and their expression is represented by the regional unemployment rate.<sup>10</sup> This empirical relationship runs from regional unemployment to wages: higher unemployment in a district influences its wage level negatively. The relationship is basically empirical: the authors speak of it as a statistical regularity or empirical “law” of economics. The authors specify the expression of their model as follows:

$$\ln W_{irt} = \alpha \ln U_{rt} + \beta X_{irt} + d_r + f_t + e_{irt} \quad (1)$$

where  $W_{irt}$  represents the wage of  $i$ -th individual in region  $r$  and time period  $t$ ,  $U_{rt}$  stands for the rate of unemployment in region  $r$  and time period  $t$ ,  $X_{irt}$  asserts the vector of  $i$ -th individuals characteristics (gender, age, education etc.),  $d_r$  and  $f_t$  represent region- and time-specific dummies and  $e_{irt}$  are normally distributed residuals.

Based on the results of econometric analyses of the individual data from fifteen developed countries the authors assess the coefficient of the unemployment elasticity of wages (representing the curvature of the wage curve) equal to -0.1. The authors also point to a possibility of aggregation of the individuals within each region and analysis of the aggregated data instead of the originally used individual-level data (see Card, 1995). According to the authors, such specification of the wage curve equation should provide us with the same coefficient estimations; the only difference might be found in the sample errors. We follow up this approach in the next section.

The empirical relationship represented by the wage curve is in contrast with the traditional labour market theories based on the assumption of perfectly competitive markets and also with the theory of compensating wage differentials, as these concepts predict a positive relationship between unemployment and wages. On the other hand, the existence of the wage curve might be theoretically based on the concepts coming out from the assumptions of imperfect competition. In the framework of trade unions’ bargaining over wages, we can identify the effect of higher unemployment on decreasing bargaining power of employees resulting in lower overall wage level (depending on the scope of collective bargaining coverage). An adverse effect of higher unemployment on lowering the wage level might be theoretically also based in the efficiency wages framework (Shapiro, Stiglitz, 1984). As the

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<sup>10</sup> Huber and Wörgötter (1999) believe that exogenous regional factors have been contributing to over 60% of the regional disparities in unemployment in the Czech Republic.



unemployment rises, its role as a motivation device becomes larger, and, consequently, firms can *ceteris paribus* afford to pay lower wages while sustaining the same level of workers' motivation not to shirk.

There exist several empirical studies examining the relationship described by the wage curve in the Czech environment. Blanchflower (2001) published results of research concerning the Central and Eastern European countries. In his analysis of the Czech Republic the author employs the individual ISSP data for years 1992 and 1994-97, covering about 3000 respondents. However, the data was divided into eight regional groups only. After controlling for demographic characteristics of the individuals, he acquires the coefficient of unemployment elasticity of wages significant and equal to  $-0.021$  only. However, the estimate becomes insignificant when including yearly dummies.

On the other hand, Huitfeld (2001) confirmed the existence of the wage curve in the Czech Republic by the analysis of aggregated district-level data in period 1992-1998. The negative relationship between the average wage and unemployment in regions proved to be low (elasticity reached  $-0.016$ ) but significant and increased after regional dummies were included ( $-0.042$ ). Interesting results were, however, attained after including the unemployment rates for neighbouring districts into the wage equation (as the regional labour markets do not need to correspond with the borders of administrative districts). The coefficient of elasticity went up to  $-0.086$  then. Still, the elasticity is lower than the 10% claimed by Blanchflower and Oswald for the case of Western European countries.

The most convincing results offer Galuščák and München (2003). The authors again present an analysis of district-level data on average wages in the Czech Republic. The authors show a significant negative relation between the regional unemployment and wages. The link is even stronger when the districts that registered the most pronounced rise in unemployment between 1996 and 2001 are excluded from the analysis. According to their results in the Czech Republic, the wage curve exists in low-unemployment districts, low share of public sector employment and for short-term unemployed. The coefficient of unemployment elasticity of wages is significant and amounts to values around  $-0.08$ , which is a result comparable to those acquired by analyses of some Western European countries.

In our further analysis, we turn to explanation of average wage variability among the Czech districts with a focus on the linkage to the regional unemployment reflecting the specific factors of regions in the context of the wage curve framework.

#### **4. Empirical analysis of the wage differentiation and unemployment in the CR**

To identify the effect of regional unemployment on wages we employ the regression analysis of cross-sectional data on 77 Czech districts in year 2001.<sup>11</sup> To control for other factors determining the regional wage level, we cover several other variables. As was already mentioned, apart from the regional unemployment, we identify two groups of factors: characteristics of the regional population and of the regional economy and businesses.<sup>12</sup>

We account for the age structure of the regional economically active population in districts by adding the variable stating the share of young people aged 15-29 among the economically active, *AGE15-29*. Higher proportion of young people might pull the wage level down as on the individual level, typically, wage is an increasing function of age and experience. The same logic applies for variable *FEM*, stating the proportion of females in the economically active population. Variably *TERT\_EDU* reflects the educational structure of the regional population, stating the share of inhabitants older than fifteen years who attained a tertiary educational degree. Therefore, the expected effect on wages is positive. We also account for the employment structure of the population: the variable *EMPL* states the proportion of economically active inhabitants with employment status “employed” We expect a negative effect for this variable.

As for the structure of businesses, we cover the proportion of big firms in the region – the variable *B500* asserts the share of firms (with headquarters located in the region) having more than five hundred employees. We expect a positive effect on wages. The structure of the employment and economy of the region is given by variable *I\_SECTOR*, which states the share of employment in the primary sector of the economy. The expected outcome is negative as this sector typically pays the lowest wages. We also account for the level of

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<sup>11</sup> Prague is considered a single district for our purposes. Year 2001 was selected because of availability of the regional population characteristics data from the census.

<sup>12</sup> The assumptions about the expected effect of particular variables formulated below stem from the results of existing research as was already quoted.

regional economy concentration using the Herfindahl index of economic diversification – variable *HERF*.<sup>13</sup> A higher concentration of the regional economy reflects a higher degree of specialization that might result in higher wages. Lastly in this group, we use the share of the public sector employment in the district. *PUB\_SECT*, to approximate the effect of the institutional sector – we expect a negative effect in this case.<sup>14</sup> The very last variable covered in our analysis is the regional rate of unemployment, *UNEMPL*. As was discussed in the previous section, the expected effect of district rate of unemployment is negative.

We analyse a log-linear regression equation, the expression of which largely arises from the aggregated form of the wage curve equation.<sup>15</sup> The equation takes the following form:

$$LN\_WAGE_r = \alpha + \beta LN\_UNEMPL_r + \gamma X_{irt} + e_r, \quad (2)$$

where  $LN\_WAGE_r$  represents the logarithm of average wage in the district,  $LN\_UNEMPL_r$  stands for the logarithm of the district unemployment rate,  $X_r$  represents the matrix of characteristics of the regional population and firms, and, finally,  $\epsilon_r$  are normally distributed residuals with zero mean and constant variance.<sup>16</sup>

In line with the existing research on the topic, variables *UNEMPL* and *WAGE* are represented in logs.<sup>17</sup> As the data reflect the information regarding units of different size, presence of heteroskedasticity is highly probable and consequently was proved by the conducted White test. Therefore, we use the robust estimates of variance of the regression coefficients. The residual analyses indicated normally distributed residuals with zero mean. Therefore, our regression analysis will offer consistent and efficient estimates.

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<sup>13</sup> The index is calculated according to the following formula:  $H = \sum_{i=1}^n \left( \frac{w_i}{w} \right)^2$ ,

where  $w_i$  stands for number of firms in particular sector in the region,  $w$  stands for total number of firms in the region, and  $n$  is the number of sectors. The index reaches its minimum value  $1/n$  in case of fully even distribution of firms across the sectors. On the other hand, the index reaches its maximum value  $1$  in case of full concentration of firms into a single sector. For more details see Scarpetta (1995), who presents an analogy of the index for concentration of employment across the sectors.

<sup>14</sup> Due to a lack of data we could not cover the variable reflecting the productivity of firms, which is one of the key factors influencing the wages paid by firms.

<sup>15</sup> This is mainly due to the nature of data available. However, the results should not differ from those obtained on the individual level.

<sup>16</sup> One of the potential deficiencies of such formulation of the model might stem from the fact that we do not account for not-working people and thus the variable *WAGE* might be biased. This problem is then solved by applying the structural Tobit model on an individual level, that takes into account also participation decision of the individuals. However, such a method can not be applied on the aggregated level. For details on this method see for instance Wooldridge (2002).

<sup>17</sup> The expression of variables as logs allows us to interpret the regression coefficients as elasticities.

Our model analyzes the determinants of the regional wage differentiation with the accent on the role of the unemployment rate. The deeper estimation power of our results is partly limited by the data available – our results shed some light on the differentiation on the aggregate regional level only. They have a limited explanation power on the individual level to assess the scope, to which the wage of individuals is determined by their individual characteristics and what the effect of the region is. Therefore, individual data analysis stays open to our future research.

Table 3 presents the least-squares method estimates of the regression coefficients. Model (1) runs the regression on all the above-listed variables. However, half of them proved to be insignificant and, therefore, were stepwise omitted from the model. After each elimination, the suitability of the reduced model was checked by the F-test for sub-model testing. Consequently, by the elimination of insignificant variables we obtained the final reduced form model (model (2) in Table 3), covering significant variables only.

**Table 3. Regression estimation results**

	model (1) <i>all districts</i>	model (2) <i>all districts</i>	model (3) <i>low-unemployment districts only</i>
<b>Constant</b>	10.8496 *** (0.9405)	9.3915 *** (0.1361)	9.6773 *** (0.0712)
<b>AGE15-29</b>	0.0009 (0.0144)		
<b>FEM</b>	-0.0203 (0.0200)		
<b>TERT_EDU</b>	0.0112 * (0.0064)	0.0103 ** (0.0041)	0.0145 *** (0.0033)
<b>I_SECTOR</b>	-0.0067 ** (0.0030)	-0.0075 *** (0.0023)	-0.0100 *** (0.0023)
<b>EMPL</b>	-0.0079 (0.0049)		
<b>B500</b>	0.7691 (0.6020)		
<b>HERF</b>	1.3307 * (0.6721)	1.2361 * (0.6380)	
<b>PUB_SECT</b>	-0.0061 (0.0078)		
<b>UNEMPL</b>	-0.0663 ** (0.0266)	-0.0834 *** (0.0208)	-0.1225 *** (0.0258)
<b>N (districts)</b>	77	77	53
<b>R<sup>2</sup></b>	0.6127	0.5884	0.7057

Note: Dependent variable LN\_WAGE; coefficients marked\*\*\* significant 1%, \*\* significant 5%, \* significant 10%. Least squares estimation method, robust standard errors in parentheses. Model (3) covers 53 low-unemployment districts selected by the cluster analysis (cut value: 10.242%, average rate of unemployment in this group: 6.77%).

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

Our results indicate four factors that proved to be significant in determining the average district wage level: educational structure of the population, employment structure of the regional economy, concentration of the economy, and the district rate of unemployment. While a more widespread tertiary education and a higher concentration of the economy push the wage level up, large share of employment in the primary sector works in the opposite direction and pulls the wage level down. These results are intuitive and correspond with the economic theory and existing research on wage differentiation.

The district rate of unemployment proved to have a significant negative effect on the average district wage level. The coefficient of unemployment elasticity of wages reaches -0.08, which is a result corresponding with the wage curve concept. This basically means that a rise in the rate of unemployment by 1% leads to a fall in the regional wage level by 0.08%. The wage level in the districts thus adjusts to changes in the external environment and the

external factor of region does matter. Our estimations are generally in accordance with the previous results reported by Blanchflower and Oswald (1994) indicating the existence of wage curves in the Western European countries. Our estimation of size of the unemployment elasticity of wages for the case of the Czech Republic confirms the estimates made by Galuščák and Münich (2003).

We can expect this relationship to be even stronger in low-unemployment districts. As was already mentioned, many of the districts recently suffering from high unemployment are the highly heavy-industrialized regions supported by the communist regime, characteristic by a high wage level (northern part of the republic). During the transformation, many of these industries declined in the restructuring processes and unemployment went up, while the wage level sustained relatively high. These high wages are inflexible and do not react much to changes in the external environment. Generous social system and a larger proportion of long-term unemployment accompanied by a decline of human capital of the unemployed might also contribute to this rigidity. In this case unemployment does not influence the wage level as strongly.

To analyze the effect of unemployment on wages with the high-unemployment districts excluded, we clustered the districts into two groups. The cut-value of the unemployment rate was determined at 10.2% in 2001. The low-unemployment group comprises 53 regions and the high-unemployment group remaining 24 districts. We ran the same regressions on the two separate groups. The effect of unemployment proved insignificant in case of the high-unemployment group. Thus, the flexibility of wages towards the changes in the external environment is very low in this group and increasing unemployment does not cause the wage level to fall.

On the other hand, the relationship between unemployment and wages proved highly significant in the low-unemployment group. The results are stated in Table 3, column Model (3). The coefficient of the unemployment elasticity of wages reached -0.12. Thus, the average wage level is more sensitive to developments in unemployment if the unemployment is rather low. This confirms our hypothesis and the previous results about the existence of the wage curve in the Czech districts.

## 5. Conclusions

There was a remarkable trend of increasing regional labour market differentiation in the 1990's and the differences among the regions stabilized after 2001. The disparities among the regions are still rather small as far as the average wage levels are concerned. The coefficient of variation of regional wages hovered around 9-10% since 2001. On the other hand, regional disparities in unemployment are rather large even in the international perspective. The variation of the district rates of unemployment was around 40-50% since 2000.

A significant proportion of the unemployment in the Czech districts has a structural character. The large regional disparities are accompanied by a substantial mismatch between the unemployment and vacancies, as more vacancies are generally supplied in low-unemployment regions. The regional variability of vacancy rate is comparable to that of the unemployment rate. Consequently, due to the existing mismatch, the variability of the UV ratio is even larger. The mismatch index exhibited an increasing trend in 1990s, peaked between 2000 and 2004, when it almost doubled compared to the early 1990s, and slightly declined thereafter. It is apparent that the attempts to diminish the regional and structural disparities on the Czech labour market (through active labour market policies, educational programmes, financial flows from the EU structural funds etc.) haven't had any strong effect so far. Migration, as a potential equilibrating mechanism, has not played an important role so far.

In our analyses we focused on explanation of the regional wage differentiation by the external factor of region, which reflects the specific district characteristics and is represented by the unemployment rate. Our results indicate that there were several factors of influence on the regional wage differentiation in 2001: educational structure of the population, employment structure of the regional economy, degree of economic concentration, and the district rate of unemployment. Our analyses confirm that, while controlling for various characteristics of inhabitants and economy of the districts, the rate of unemployment had a negative impact on the regional wages in 2001.

The coefficient of the unemployment elasticity of wages equals -0.08, which can be considered an evidence of the existence of the wage curve in the districts of the Czech Republic. There was even a stronger adverse relationship between the wages and

unemployment registered in the districts exhibiting low unemployment level in 2001. We conclude that the specific regional factors significantly influence the wage level in the districts via the rate of unemployment. Hence, the policies aimed at influencing the labour market developments should focus not only directly on the labour market (minimum wage, employment policies etc.) but also on the regional development in general.



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