

Increased Sorting and Wage Inequality in the Czech Republic: New Evidence Using Linked Employer-Employee Dataset

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Abstract

In this paper, we take a closer look at the evolution of firms' wage structures using a linked employer-employee dataset, which has longitudinal information for firms and covers a large fraction of the Czech labor market during the period 1998-2006, which includes the pre- and post EU accession years. We first consider the evolution of individual wage determination and find evidence of slightly increasing returns to human capital and diminishing gender inequality. We then document sharp increases in both within-firm and between-firm inequality. We investigate various hypotheses to explain these patterns: increased domestic and international competition, an increasingly decentralized wage bargaining, skill biased technological change and a changing educational composition of the workforce. We find some support for all these factors having contributed to the changes in the Czech wage structure. In particular, increased educational sorting and inflow of foreign firms are strongly associated with the observed changes in wage inequality.

Keywords: sorting, wage inequality, linked employer-employee dataset, firm panel data, Czech Republic

JEL Codes: J31, P31

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1. Introduction

In recent years, many countries have experienced a considerable increase in wage inequality. The debate regarding which factors (trade, skill biased technological change or change in wage setting institutions) were behind this phenomenon has mostly focused on the US¹, where the increase has been especially large, and has led to various new theories to explain this surge.

Yet, in many countries, wage structures have come under pressure of change for a number of reasons, such as dramatic industrial restructuring, deregulated labor markets and deeper integration of the world economy. The new member states of the European Union form a group of such countries, which has received rather little attention in research as well as in the public debate.² In order to gain EU membership, successive governments in the new member states launched significant deregulations, leading to firms facing increased competition both from abroad and from within its borders. Another important change is the move from a relatively centralized, tripartite wage bargaining system towards an increasingly decentralized wage setting. Finally, there has been a continued "marketization" of the former socialist economies also during the period that followed the first post-revolution years.

¹ See e.g. Bound and Johnson (1992), Katz and Murphy (1992) and Katz and Autor (1999) for early evidence; Acemoglu (2002), Card and DiNardo (2002) and Lemieux (2008) for recent surveys; and Lemieux (2006) and Autor et al. (2008), for new developments. See also the discussion on the UK (e.g. Machin, 1996; Faggio, Salvanes and Van Reenen, 2007; or more recently Machin and Van Reenen, 2010), Germany (Dustmann, Ludsteck and Schönberg, 2009) and Latin America (e.g. Galiani and Sanguinetti, 2003 for Argentina; Attanasio, Goldberg and Pavcnik, 2004 for Colombia; Esquivel and Rodríguez-López for Mexico).

² Most research on the consequences of the EU enlargement has focused on migration to the old member states and the consequences thereof. Considerably less work has been done on how the functioning of the new members states labour markets are influenced. Only a few papers have documented the dynamics of the labor market in the new EU member states, see e.g., Flanagan (1995); Filer, Jurajda and Planovsky (1999), Svejnar (1999); Jurajda and Terell (2003); München, Svejnar and Terrell (2005) and Keane and Prasad (2006). The great majority of previous studies have been concerned with the early transition years and consequently the evidence from late-transition and pre- and post- EU accession years is rather thin on the ground. A recent study by Jurajda (2003) looks at returns to schooling in the CR using linked employer-employee data for year 2002. The paper shows that the return to education is relatively high, close to 10%.

The aim of this paper is to document and analyze changes in the wage structure of the Czech Republic (CR), one of the ten new EU member states, that joined the European Union in May 2004, eight of which from the former so called "Soviet bloc". Our analysis is concerned with the pre- and post- EU accession years and examines a number of key explanations of the changes observed in the wage structure.

A key feature of our paper is that we focus on the role of firm characteristics in explaining wages, and how changes in the structure of firms' workforces affect wage inequality. The role of firm's characteristics is often overlooked in the literature on wage inequality, although a large literature documents the significant roles of firm size, foreign ownership, and more generally firm productivity in explaining individual wage differences. We argue that changes at the firm level are likely to have contributed to the changes in wage inequality. One particular mechanism we find to be important is the role of increased sorting: the best firms acquiring a larger proportion of the most productive workers in the economy.³

We make use of a comprehensive linked employer-employee dataset covering all workers in more than 2,000 private sector firms, i.e. an average of one million individuals each year, over the period 1998-2006.⁴ We document a sizeable increase in overall wage inequality in the CR; see Figure 1. The 90/10 percentile ratio of hourly wage increased from 3.03 in 1998 to 3.32 in 2006. The increase chiefly occurred above the median of the distribution; see Figure 2. The 90/50 percentile ratio of hourly wage increased by 4.9 per cent, while the 50/10 wage percentile ratio only increased by 2.2 per cent, and has actually been decreasing since 2003.

<Insert figures 1 and 2 around here>

³ A theoretical explanation of this evolution was suggested by Kremer and Maskin (1996): When workers with different skills are imperfect substitutes, tasks are complementary and output is more sensitive to skills in some tasks, an increase in skill dispersion causes firms to specialize in one skill level or another.

⁴ See section 3 for a detailed description of the dataset we use for this analysis.

In order to understand what is driving this increase in wage inequality, we first run standard Mincerian regressions and look at the evolution of the estimated parameters over time. We find rising returns to university education up to 2002, then slightly declining; rising returns to age, and a gradually decreasing gender wage gap. We next decompose the evolution of wage inequality into within- and between-firm wage inequality. Within-firm wage inequality is found to be strongly associated with foreign ownership and the share of individuals with a university education. Between-firm inequality (within sectors) is principally explained by differences in the variation in the share of university-educated workers within firms across industries. Our findings suggest that the changing educational composition both within and between firms is an important engine giving rise to the increased wage inequality. We show that our results can also be interpreted as evidence of increased sorting: the more productive firms are more able to attract those who recently graduated from university as they can offer higher wages and presumably also better career prospects.

Among our other findings, we find that higher domestic competition is associated with lower within-firm wage inequality, consistent with the idea that the erosion of rents reduces the ability of firms to pay higher wages. On the other hand, our results show little evidence that increased involvement in international trade (import and export) at the industry-level is associated with higher between- and within-firm wage inequality. We also examine the impact of changes in wage bargaining systems that have occurred gradually since the mid-nineties by adding dummies describing the level of bargaining (at the level of the sector or at the level of the firm). A more decentralized wage bargaining could lead to more pay differentiation between firms and hence contribute to increased wage inequality. However, we do not find evidence that firm-level bargaining is associated with increased within-firm or between-firm inequality.

The current paper also contributes to the recent literature on the role of the changing educational composition as a determinant of wage inequality (see e.g. Lemieux, 2006), but differs from previous studies as the focus here is at the firm level. Skill upgrading was a

major concern for Czech politicians during the period we study. In the beginning of the nineties, the Czech government took a number of steps to increase the number of university graduates and as a result university enrolment went up by approximately 50 per cent.⁵

Our paper also relates to some recent studies. Faggio, Salvanes and Van Reenen (2007) document the increase in wage inequality in the UK and link it to increased dispersion in productivity. They also argue that the differentiated use of IT in firms is strongly linked to that evolution. Csillag (2008) follows a similar procedure as in the current paper, but he focuses on testing alternative models of wage determination, whereas our analysis is concerned with identifying the main factors behind the rise in wage inequality.

The remainder of the paper is organized as follows. Section 2 describes the data sets used. In section 3, we discuss the various theories that could explain observed changes in the Czech wage structure. Section 4 presents our empirical methodology and results. Section 5 concludes.

2. Data

For our analysis we use a linked employer-employee dataset covering all workers from over 2,000 companies during the period 1998-2006. This was provided to us by a private consulting company on behalf of the Czech Ministry of Labor and Social Affairs.⁶ The sampling strategy used by the consultancy firm is to survey all firms with more than 250 employees every year, while a rotating random sample is adopted for smaller firms (15% of all firms between 50 and 249 employees, and 4.5% of firms between 10 and 49 employees)⁷. Table 1 provides some summary statistics of our dataset.

⁵ See Jurajda (2003) for a discussion and analysis.

⁶ See Eriksson and Pytlikova (2004) or Jurajda and Paligorova (2006) for more details.

⁷ However, as we are concerned that our results could be influenced by the sampling frame, we have also constructed a balanced panel data set consisting of the firms that are present for the entire period and test the robustness of our cross-sectional findings on it. Tables with the results from analyses conducted on the balanced panel of firms are available from the authors upon request.

<Insert Table 1 around here>

Our analyses are based on a subsample consisting of exclusively private sector firms that employ at least 10 employees. This provides us with an unbalanced panel of 2,416 firm and on average little over 1 million employee observations per year.

The data set contains information about the age, gender, education, occupation, firm tenure⁸, hourly wage, total annual compensation as well as its wage and bonus components.⁹

It is important to notice that the data are longitudinal with respect to firms but not with respect to individuals. For confidentiality reasons, it is not straightforward to follow individuals over time, as the individual identifier is not necessarily the same every year. However, the firm identifiers remain unchanged and hence, the data set is a firm panel.

The data set also provides information about firm-level variables, such as sales, profits, type of ownership, industry (3-digit NACE) and the region (NUTS3) where the firm operates. Further we received separate information about firm's wage bargaining regime for year 2006. Thus, we know whether the firm is covered by a firm-specific bargaining agreement, either at the sector or firm level, and this information is exploited in our empirical analysis. In addition, the data set has been augmented with information on sales, imports and exports at 3-digit industry (NACE) levels, provided by the Czech Statistical Office.

⁸ Tenure information is available since 2002.

⁹ The hourly wage information is of unusually high quality as it is reported by the employer and it is not associated with measurement errors arising from division of aggregate income by number of working hours. The quality of hourly wage variable is moreover increased by the fact that the same information is used within the firms to calculate the employee's vacation, absence pay and unemployment benefits.

3. Hypotheses

The CR is a relatively small EU country with little over 10 million inhabitants situated right in the middle of the EU. It resulted from the break up of Czechoslovakia on January 1st, 1993, which itself, following the Velvet Revolution, had broken free from the communist regime in November 1989. The CR rapidly adopted a series of reforms to transform the economy and was labeled as a fast reformer. Early in transition, the unemployment rate remained very low compared to other fast reformers like Poland and Hungary. However, the differences vis-à-vis other transition economies shrunk after the deep recession in 1997-98 (see Appendix A for a few economy-wide indicators). In 2007, it had a GDP per capita equal to 80% of EU average, the second highest score among the new member states, only surpassed by Slovenia. The country also became more integrated in the world economy; the share of imports and exports in GDP has grown substantially from around 50% to around 70% in less than a decade (see Appendix B for the evolution of trade).

Over the last ten years, the CR has experienced several changes that are likely to have contributed to changes in the wage structure. A potential source of pressures towards changes in the wage structure is the increased competition in product markets, above all because of privatization of former state-owned companies, but also due to growing international competition as a consequence of the Czech Republic becoming a new EU member state and the deregulation of several markets which was a crucial element of the process towards the EU membership. Increasing competition is predicted to erode firms' product market rents, which could lead to reduced wage dispersion among employers.¹⁰ As for the impact of increased competition on firms' internal wage structure, foreign competition is predicted to reduce the level of fixed pay and increases the sensitivity of

¹⁰ Syverson (2004) shows that in a market with heterogeneous firms, stronger competition will in general lead to less dispersion in productivity. He also provides some empirical evidence in support of this hypothesis.. Changes in the productivity dispersion are also likely to be associated with changes in the wage dispersion both within and between firms.

pay for performance (see e.g., Cuñat and Guadalupe, 2009). Thus the effect of foreign competition on within-firm wage inequality is expected to be positive.

A factor that has been emphasized in the international discussion about changes in wage dispersion is the phenomenon of skill-biased technological change which, it is argued, has led to an increase in returns to observable as well unobservable skills and in inter-firm wage differentials (Aghion, Howitt and Violante, 2004; Acemoglu, 2002; Lemieux, 2008). Skill-biased technological change can, in the case of the Czech Republic, have been further reinforced by a considerable initial skill mismatch before transition. One can also conceive of the introduction of market-oriented business practices or a shift to a business environment with considerably stronger competition as forms of "technological revolutions" (Caselli, 1999). If these new marketing, management and other business practices are implemented at different rates, we would expect increased differences in wages between firms and that increased wage dispersion may develop even for observationally similar employees.

One important change is the gradual shift from a centralized, tripartite wage bargaining system towards a considerably more decentralized wage setting. In particular, the wage setting process has moved to the firm level¹¹, which is likely to have changed the relative weights of employer and employee effects on the wage structure. This development has removed the constraints on firm-specific bargaining, increased local bargaining power and as a consequence we would expect to observe an increase in the variability of the firm-specific component of wages. In other words, decentralized wage setting is hypothesized to have given rise to an increase in wage dispersion between as well as within firms.

Still another explanation for increased wage inequality has recently been suggested by Lemieux (2006). He shows that part of the increase in wage inequality in the U.S. can be explained by a mechanical relationship between wage dispersion and the share of

¹¹ In 2006 almost 40% of firms in our sample of private firms have firm-level wage bargaining, while only 15% of firms have higher (that is mainly industry) level wage bargaining.

university-educated workers in the population, as education (as well as experience) is associated with higher within-group wage dispersion. A related argument was also put forward by Kremer and Maskin (1996), who argue that a change in the skill distribution is followed by increased sorting. This appears highly relevant for the CR, where there was an increase in supply of university graduates over the studied period, [see the discussion above]. In our sample, the share of workforce with university education went up from 7.4% to 10.5% in less than a decade, and the share of workers with university education within the age range 21-35 years went up from 8.22% to 11.50% (see Table 2).

<Insert Table 2 around here>

4. Results

Increased Wage Inequality

We begin by considering changes in how the labor market rewards employees' skills. For this purpose we estimate conventional Mincerian wage equations, i.e., for each year t we regress log real gross hourly earnings on i -individual's age, gender and education¹²:

$$\ln(W_{ift}) = \beta_1 + \beta_2 AGE_{it} + \beta_3 (AGE_{it})^2 + \beta_4 GENDER + \sum \beta_E EDU_{Eit} + z_{ft} + \varepsilon_{ift}$$

Education enters the equation as a set of education dummy variables with secondary education being the omitted category. We add dummies for industry, region, size and ownership of firm f as controls, z_{ft} . These equations have been estimated with and without firm effects. As mentioned previously due to data confidentiality reasons, we cannot observe the same individual over time, but the data are longitudinal with respect to firms.

¹² As from 2002 also information about firm tenure is available. We have estimated the wage equation including tenure among the regressors, but as the estimates of the other coefficients are affected only little, we do not present them here. The returns to tenure were increasing over the time period 2002-2006. The results of regressions including tenure are available from authors upon request.

The estimates of regressions with and without firm effects are displayed in *Table 3* and *Table 4* respectively. They indicate that returns to experience and university education have increased slightly, while the gender gap has narrowed by about four percentage points.¹³ The fact that the returns to education did not increase much could, as we discussed in section 3, be explained by the evolution of supply of education. We focus on this relationship in the next steps of our analysis.

<Insert Tables 3 and 4 around here>

Further, we can observe some dynamics at the lower end of the educational distribution. The gap between employees with a secondary education and workers with no or primary education is shrinking over time, which may in part be due to the substantial increases in minimum wages during the period (see Appendix A). We do not observe important differences in the explanatory power over time. Furthermore, the results in *Table 3* are quite robust to the introduction of firm fixed effects (see *Table 4*).

Increased Within- and Between-Firms Inequality

Using a standard individual wage equation approach does not dovetail obvious candidates for explaining the growth in wage inequality that has occurred. Next, we exploit the fact that our linked employer-employee data allow us to look for additional sources of the changes in inequality by decomposing wage inequality into its between-firm and within-firm components. In *Table 5*, we report these two measures computed as standard deviations. As can be seen from the table, within-firm wage inequality remained stagnant during the first half of the period after which we notice a quite sharp increase: in

¹³ The increase in returns to university education over the period 1998-2006 was rather small in comparison to earlier years as documented by Chase (1998) for years 1984 and 1993; by Filer et al. (1999) for years 1995-1997 and by Münich et al. for years 1989 and 1996. The three studies document the following increase in returns to university education: increase by approximately 84 per cent between years 1984 and 1993 (Chase, 1998); increase by approximately 17,4 per cent between years 1995-1997 (Filer et al., 1999) and increase by approximately 92 per cent between years 1989 and 1996 (Münich et al., 2005). It should be noted however that the studies by Chase (1998) and Filer et al. (1999) use slightly different educational categories.

2006 the standard deviation has reached its highest level during the period and is 50 per cent higher than its initial level. The between-firm dispersion decreased from 1998 to 2000, and then started to increase again.

<Insert Table 5 around here>

Another way of studying differences in pay levels across firms, while accounting for differences in the composition of their workforces is to look at the variance of the estimated firm effects in *Table 4*. The standard deviation of firm effects obtained after controlling for differences in human capital is shown in *Table 6*. The dispersion of firm effects exhibits first a slight decline, then as from 2002, an increase, which brings it back to the same level as in the beginning of the period. The last column in *Table 6* shows the adjusted R²s from wage regression with firm fixed effects as the only regressors. The adjusted coefficients of determination have increased by 2-3 percentage points over the period, and most of this occurred around 2002. The rise in the role of the firm fixed effects in predicting wages occurred roughly in parallel with the increase of the variance of the employer wage effects. This is consistent with increased sorting of skills between firms, on which we will provide additional evidence below.

<Insert Table 6 >

Decomposing wage inequality into its between- and within-firm components is only partially helpful as the observed pattern – increases in both – is consistent with decentralized wage setting, skill biased technological change and sorting. The decrease in between-firm differences is opposite to what is expected from increased competition in product markets. However, the increase in inequality could be the result of distinct forces pulling the wage structure in different directions: increased competition could reduce differences between firms, but these changes could be counteracted by decentralization of wage setting processes and technological change. In the next subsections we try to disentangle the impact of these different forces.

For this purpose we construct three explanatory variables to capture changes in domestic and international competition through imports and exports. Our measure of domestic competition is computed as the average profit margin at the 3-digit industry level (from our linked data set). We also compute two conventional measures of exposure to international trade: the export intensity and the import penetration ratio, both measured at the 3-digit industry level. Equipped with these additional explanatory variables, we carry out three sets of analyses aiming at understanding the changes in firm fixed effects, within-firm and between-firm wage inequality, respectively.

One of the hypotheses we want to test is whether stronger competition reduces firms' "ability to pay", resulting in a reduction in the firm-specific level component of pay. To examine this we run regressions with the estimated firm effects as dependent variable and log labor productivity, the share of workers with university level education, foreign ownership, firm size, region, industry, and year dummies as explanatory variables. A collection of estimates are displayed in Table 7.

<Insert Table 7 around here>

As can be seen from *Table 7*, the coefficients of our three measures of competition are not significantly different from zero. The firm effects appear to be related primarily to differences in labor productivity, foreign ownership and firm size. Another interesting finding is that the presence of collective agreement is associated with a higher average firm wage (column 3), although this result is not robust once we control for labor productivity (column 4).

Explaining Within- and Between-Firm Wage Inequality

We next turn to the two components that we have shown have both increased during the period: within- and between firm wage dispersion. We begin by looking at the main

factors explaining within-firm wage inequality by employing a similar specification as in *Table 7* but with within-firm wage dispersion as the dependent variable and a number of variables describing the composition of the firm's workforce as additional explanatory variables. *Table 8* shows results from analyses of within-firm (columns 1 to 4) and between-firms wage inequality (columns 5 to 7). Three different specifications are presented: without firm effects, and with industry and firm effects, respectively.

<Insert Table 8 around here>

As can be seen from *Table 8* columns 1 to 3, the firm effects account for a substantial portion of the within-firm wage inequality equation's explanatory power. Not surprisingly, entering firm effects gives rise to quite large changes in the coefficient estimates of the other explanatory variables as both these and the dependent variable are not likely to change significantly in the short run. For a given human capital composition of the workforce, larger and foreign owned firms¹⁴ have a larger pay spread.

Turning to our competition and trade variables, we find that a higher average profit margin in the industry is associated with a higher within-firm spread in wages. The effect is large and significant in all model specifications. On the other hand, export intensity and import penetration ratio do not have significant effects on within-firm wage inequality in the full model specification.

Our results regarding the effect of collective bargaining imply that there is no significant relationship with within-firm wage dispersion, suggesting that bargaining mainly affects the level but not the variance of wages.

Further we find that larger firms and foreign-owned firms are associated with larger within-firm wage inequality. Thus, the increasing number of foreign-owned firms in

¹⁴ The number of foreign-owned firms has increased dramatically over the period studied due to continued privatisation and growing inflow of FDI. From our data the share of foreign owned firms among firms in our sample increased from 10.4 per cent in 1998 to 27.3 per cent in 2006, see Appendix table C.

Czech Republic over time (see Appendix table C) can be seen as another important driver of wage inequality.

Last but not least, we find a strong positive relationship between the share of university-educated workers and within-firm wage dispersion. The estimated coefficient is large (although the share is relatively small, between 7.5% and 10.5%) and robust to all model specifications. This finding indicates that the changing composition of the workforce plays an important role in explaining changes in wage dispersion across firms. This could in turn be explained by increased sorting, as more productive firms can more easily attract new cohorts of university-educated employees. In the next subsections we explore this relationship further.

To examine the heterogeneity of between-firm wage dispersion, we look at differences across industries. For this purpose, we first compute within-industry between-firm wage dispersion as the standard deviation of the firm average wage within each 3-digit industry. Next, we run a regression where the dependent variable is between-firm wage dispersion within each 3-digit industry. Accordingly, all the explanatory variables are measured at the industry level, too. Without industry dummies (column 5), we find that higher profitability is associated with higher between-firm wage dispersion in the OLS specification, but - not surprisingly-once industry fixed effects are included, this relationship disappears.

Once again the educational composition plays an important role: the standard deviation of the share of university educated workers within an industry is positively and strongly related to between-firm wage dispersion. The effect is large and significant across all model specifications. Productivity is also strongly correlated with between-firm inequality. The effect of collective bargaining agreements however is not significant.

To sum up, only increased domestic competition appears to affect within- and between-firm wage inequality, as higher competition is associated with lower dispersion. Another

important result of our analysis is that the share of university educated is positively related to both within- and between-firm wage inequality. Productivity differences is also related to wage inequality within and between firms. Finally, foreign ownership is positively associated with within-firm wage inequality, but not with the between-firms.

Increased Sorting: The Evolution of the Share of University-Educated Workers

Our results so far are consistent with the hypothesis of increased sorting being the driving force behind increases in wage inequality. Our final empirical test relates the composition of the workforce to firm level characteristics like labor productivity and firm size. We enter firm effects to control for the fact that some firms had a higher proportion of educated workers to begin with.

<Insert Table 9 around here>

Results are shown in Table 9, from which we may observe that the share of university-educated workers is strongly and positively correlated with labor productivity and firm size, even after catering for firm effects. This lends some support to the hypothesis of increased sorting: more productive firms employ an increasing share of university-educated workers. Further support is found in Table 10 which shows that the share of university-educated workers increased from 11% to around 16% in firms in the top decile of the productivity distribution, while in the bottom decile it remained constant around 5%.

<Insert Table 10 around here>

5. Conclusion

In this paper, we have used a rich linked employer-employee dataset covering a significant proportion of Czech private sector firms and their employees to analyze the determinants of post-transition wage inequality in the Czech Republic. We find that increased foreign ownership, increased domestic competition and increased returns to education could be associated with increased wage inequality. Another important factor is the change in the educational composition and increased sorting of university-educated individuals into the more productive firms. These two factors explain a large fraction of the observed increase in within-firm as well as between-firm wage dispersion. In addition to that, we observe that the increase in the number of foreign-owned firms over time had an effect on increased wage inequality.

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Table 1: Summary statistics

	1998	1999	2000	2001	2002	2003	2004	2005	2006
Number of individuals	790,386	822,280	863,399	928,893	1,013,771	1,082,701	1,168,270	1,273,828	1,475,725
Number of firms	1,489	1,838	2,151	2,402	2,372	2,445	2,853	3,156	3,040
Average employment	531	448	401	387	427	443	410	404	485
Average hourly wages in CZK	78.64	83.33	91.24	100.18	106.30	114.75	120.30	126.01	136.58
Average yearly wages in CZK	142974.8	157736.2	169095	178599.7	187337.8	203812.2	213309.1	219120.2	215995.3

Table 2: Evolution of the share of workers with university education

	1998	1999	2000	2001	2002	2003	2004	2005	2006
% of workers with university education	7.43	7.91	8.76	8.73	8.97	9.78	10.45	10.46	10.47
% of workers. with university education in age range 21-35 years	8.22	7.69	8.43	8.12	8.59	9.81	10.71	11.07	11.50

Figure 1: Changes in real hourly wage inequality as measured by P90/P10 percentile ratio, years 1998-2006

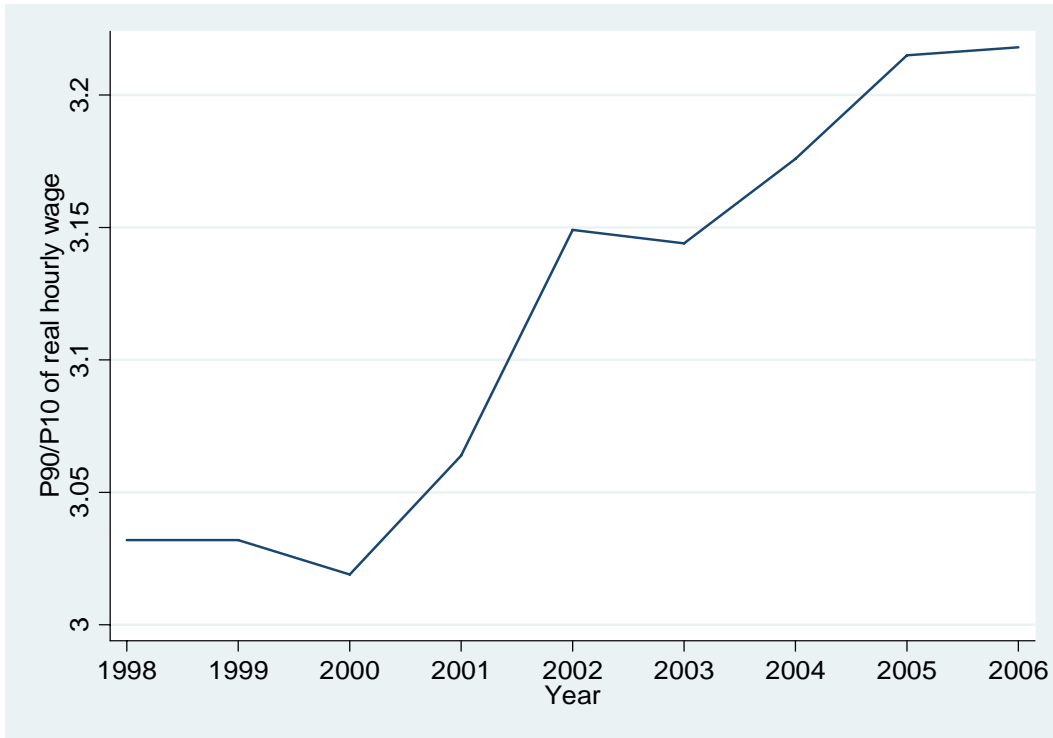


Figure 2: Changes in real hourly wage inequality as measured by P90/P50 and P50/P10 percentile ratios, years 1998-2006

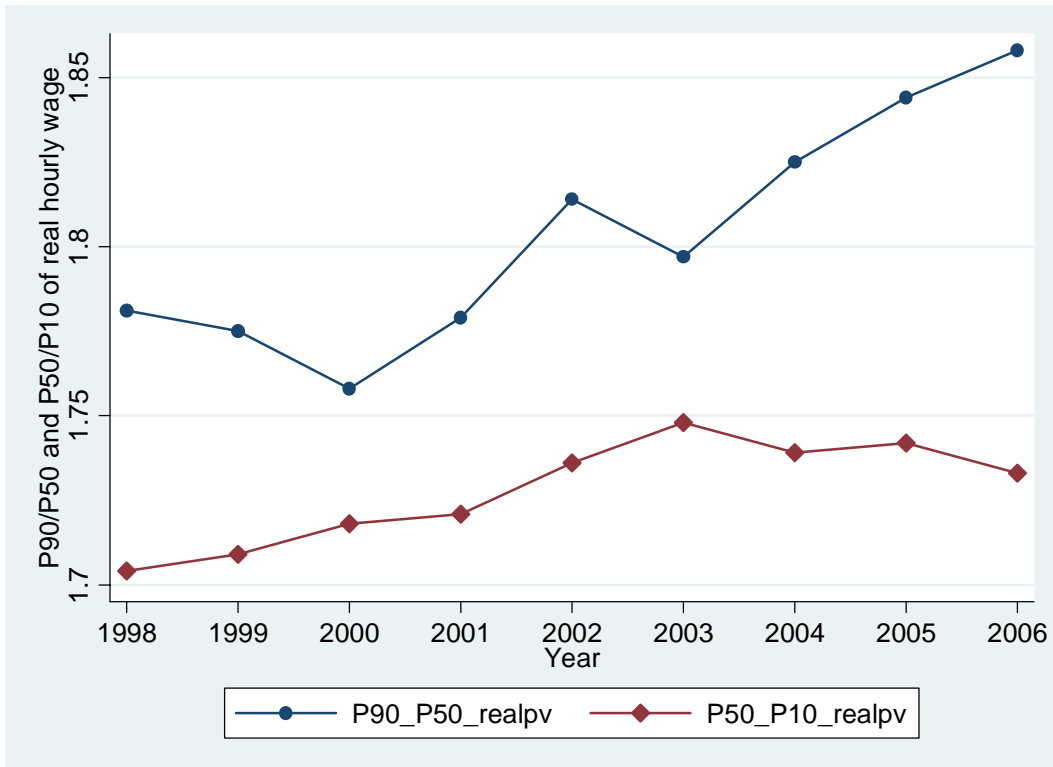


Table 3: Individual wage regressions, (1998-2006)

	1998	1999	2000	2001	2002	2003	2004	2005	2006
	<i>Dep. Var.: Log Hourly Wage</i>								
Age	0.035 [0.000]***	0.042 [0.000]***	0.039 [0.000]***	0.036 [0.000]***	0.036 [0.000]***	0.036 [0.000]***	0.038 [0.000]***	0.039 [0.000]***	0.039 [0.000]***
Age-sq/100	-0.038 [0.000]***	-0.048 [0.000]***	-0.044 [0.000]***	-0.04 [0.000]***	-0.041 [0.000]***	-0.04 [0.000]***	-0.042 [0.000]***	-0.043 [0.000]***	-0.043 [0.000]***
Female	-0.245 [0.001]***	-0.24 [0.001]***	-0.228 [0.001]***	-0.23 [0.001]***	-0.232 [0.001]***	-0.227 [0.001]***	-0.223 [0.001]***	-0.217 [0.001]***	-0.222 [0.001]***
No or primary	-0.271 [0.006]***	-0.391 [0.006]***	-0.255 [0.006]***	-0.249 [0.006]***	-0.299 [0.007]***	-0.372 [0.007]***	-0.267 [0.006]***	-0.305 [0.006]***	-0.236 [0.006]***
Lower secondary	-0.206 [0.001]***	-0.185 [0.001]***	-0.162 [0.001]***	-0.179 [0.001]***	-0.177 [0.001]***	-0.176 [0.001]***	-0.182 [0.001]***	-0.192 [0.001]***	-0.188 [0.001]***
University	0.578 [0.002]***	0.564 [0.002]***	0.591 [0.001]***	0.606 [0.001]***	0.634 [0.001]***	0.625 [0.001]***	0.607 [0.001]***	0.618 [0.001]***	0.615 [0.001]***
Foreign	0.053 [0.001]***	0.133 [0.001]***	0.095 [0.001]***	0.091 [0.001]***	0.08 [0.001]***	0.075 [0.001]***	0.119 [0.001]***	0.121 [0.001]***	0.119 [0.001]***
Firm Size	0.044 [0.000]***	0.038 [0.000]***	0.041 [0.000]***	0.034 [0.000]***	0.023 [0.000]***	0.026 [0.000]***	0.018 [0.000]***	0.02 [0.000]***	0.019 [0.000]***
Region dummies	YES								
Industry dummies	YES								
Observations	601922	687321	783587	857366	905251	977137	1111814	1214734	1253130
R-squared	0.44	0.43	0.43	0.44	0.44	0.44	0.43	0.45	0.44

Notes: 10, 5 and 1 % levels of confidence are indicated by *, ** and ***, respectively. Standard errors are in parentheses.

Table 4: Individual wage regressions - with firm fixed effect, (1998-2006)

	1998	1999	2000	2001	2002	2003	2004	2005	2006
	<i>Dep. Var.: Log Hourly Wage</i>								
Age	0.032 [0.000]***	0.039 [0.000]***	0.035 [0.000]***	0.032 [0.000]***	0.032 [0.000]***	0.032 [0.000]***	0.034 [0.000]***	0.034 [0.000]***	0.033 [0.000]***
Age-sq/100	-0.034 [0.000]***	-0.042 [0.000]***	-0.039 [0.000]***	-0.035 [0.000]***	-0.035 [0.000]***	-0.035 [0.000]***	-0.036 [0.000]***	-0.037 [0.000]***	-0.036 [0.000]***
Female	-0.209 [0.001]***	-0.205 [0.001]***	-0.192 [0.001]***	-0.194 [0.001]***	-0.185 [0.001]***	-0.185 [0.001]***	-0.184 [0.001]***	-0.18 [0.001]***	-0.182 [0.001]***
No or primary	-0.288 [0.005]***	-0.414 [0.006]***	-0.263 [0.006]***	-0.251 [0.006]***	-0.282 [0.006]***	-0.288 [0.007]***	-0.227 [0.005]***	-0.23 [0.005]***	-0.186 [0.006]***
Lower secondary	-0.182 [0.001]***	-0.176 [0.001]***	-0.16 [0.001]***	-0.158 [0.001]***	-0.156 [0.001]***	-0.155 [0.001]***	-0.159 [0.001]***	-0.162 [0.001]***	-0.152 [0.001]***
University	0.527 [0.001]***	0.506 [0.001]***	0.534 [0.001]***	0.544 [0.001]***	0.56 [0.001]***	0.545 [0.001]***	0.526 [0.001]***	0.542 [0.001]***	0.54 [0.001]***
Constant	3.602 [0.005]***	3.532 [0.004]***	3.677 [0.004]***	3.835 [0.004]***	3.883 [0.004]***	3.94 [0.004]***	3.961 [0.004]***	3.996 [0.003]***	4.092 [0.003]***
Observations	601922	687321	783587	857366	905251	977137	1111814	1214734	1253130
R-squared	0.6	0.58	0.58	0.6	0.6	0.6	0.59	0.59	0.58

Notes: 10, 5 and 1 % levels of confidence are indicated by *, ** and ***, respectively. Standard errors are in parentheses.

Table 5: the evolution of within-firm and between-firms real hourly wage inequality

	1998	1999	2000	2001	2002	2003	2004	2005	2006
Within-Firm Wage Inequality	48.38	49.24	48.91	52.33	55.84	62.29	63.14	65.26	74.35
Between- firm Wage Inequality	48.75	43.33	41.01	43.78	47.91	55.86	54.13	55.35	63.45

Note: Within-firm wage inequality is equal to the average standard deviation of real hourly wage within firms. Between- firm wage Inequality is defined as the standard deviation of the average real hourly wage between firms in our sample.

Table 6: Evolution of the standard deviation of the fixed effect

Year	Standard deviation of the fixed effect from the log real hourly wage	Adjusted R ² s from wage regressions with firm fixed effects only
1998	0.31	0.400
1999	0.289	0.392
2000	0.279	0.399
2001	0.276	0.416
2002	0.28	0.423
2003	0.291	0.432
2004	0.29	0.422
2005	0.285	0.420
2006	0.298	0.414

Note: The Adj R² from wage regressions with firm effects are run on the same number of observations as wage regressions with human capital variables shown in Table 3 in order to be comparable.

Table 7: Explaining the Firm-Fixed Effect in the Wage Regression

	(1)	(2)	(3)	(4)
	<i>Dep.Var.: Firm-Fixed Effects</i>			
Export Intensity	0.016 [0.024]	0.028 [0.021]	0.088 [0.054]	0.067 [0.045]
Import Penetratio Ratio	0.001 [0.003]	-0.002 [0.003]	-0.054 [0.047]	-0.037 [0.039]
Average Industry Profit Margin	0.075 [0.071]	0.014 [0.061]	0.069 [0.095]	-0.045 [0.079]
Log Labor Productivity	- -	0.111*** [0.003]	- -	0.133*** [0.004]
Foreign ownership	0.152*** [0.006]	0.091*** [0.006]	0.153*** [0.008]	0.079*** [0.007]
Log Size	0.022*** [0.002]	0.021*** [0.002]	0.019*** [0.003]	0.015*** [0.003]
Coll. Agreement (Y/N)	- -	- -	0.024** [0.009]	0.009 [0.007]
Constant	-0.660*** [0.178]	-1.359*** [0.155]	-0.681** [0.238]	-1.417*** [0.199]
Observations	4923	4923	3103	3103
R-squared	0.419	0.564	0.429	0.605

Notes: 10, 5 and 1 % levels of confidence are indicated by *, ** and ***, respectively. Standard errors are in parentheses. Firm fixed effects are calculated from hourly real wage regressions with HC controls. We control for year, region and industry in all regressions.

Table 8: Explaining Within- and Between-Firm Wage Inequality, 1998-2006.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>Dep.Var.:</i>	<i>Within- Firm St. Dev. of Hourly Wage</i>				<i>Between- Firm St. Dev. of Hourly Wage</i>		
Export Intensity	-0.559 [1.619]	3.489 [4.837]	0.139 [3.175]	20.459 [11.713]	-3.619 [1.913]	0.495 [2.828]	-1.210 [5.653]
Import Penetration Ratio	-0.466 [0.621]	-0.695 [0.630]	-0.084 [0.472]	-14.558 [10.327]	-1.296 [1.469]	-1.035 [1.133]	-0.555 [4.207]
Average Industry Profit Margin	87.447*** [11.749]	39.722** [14.245]	22.095* [10.984]	40.656* [20.717]	31.299*** [9.037]	-0.610 [7.879]	5.902 [10.369]
Log Labor Productivity	10.806*** [0.622]	9.760*** [0.699]	4.129*** [1.019]	12.603*** [1.052]	0.052*** [0.010]	0.060*** [0.008]	0.056*** [0.009]
Foreign	11.908*** [1.346]	10.806*** [1.372]	3.833 [2.117]	10.888*** [1.804]	2.608 [2.982]	2.890 [3.735]	3.227 [4.578]
Log Size	2.672*** [0.466]	2.990*** [0.507]	1.330 [1.712]	2.736*** [0.764]	0.971 [0.678]	2.762 [1.473]	3.403 [2.269]
Share of University Edu	113.522*** [5.730]	155.871*** [7.986]	182.552*** [15.974]	163.837*** [11.972]	239.530*** [10.127]	226.326*** [11.338]	236.157*** [14.425]
Coll. Agreement (Y/N)	- -	- -	- -	2.249 [1.967]	- -	- -	-6.003 [3.824]
Industry dummies	NO	YES	-	YES	NO	YES	YES
Firm dummies	NO	NO	YES	NO	-	-	-
Constant	-23.045** [8.014]	-25.693** [9.067]	12.443 [20.694]	-45.592 [38.442]	2.708 [4.428]	-10.241 [9.329]	-5.824 [14.415]
Observations	4938	4938	4938	3108	580	580	414
R-squared	0.288	0.341	0.685	0.330	0.611	0.810	0.822

Notes: 10, 5 and 1 % levels of confidence are indicated by *, ** and ***, respectively. Standard errors are in parentheses. In within-firm wage inequality regressions we also include the standard deviation of age, the share of the other education groups and the share of female workers as additional controls. The between-firm wage inequality regressions include year dummies and the standard deviation of the share of female workers.

Table 9: Explaining the Share of University Educated Workers

<i>Dep. Var.: Share of University-Educated Workers</i>	(1)	(2)	(2)
Log(Labor productivity)	0.027*** (0.001)	0.023*** (0.001)	0.002*** (0.001)
Log(Size)	-0.012*** (0.001)	-0.005*** (0.001)	-0.024*** (0.001)
Year dummies	YES	YES	YES
Region dummies	NO	YES	YES
Industry fixed effect	NO	YES	NO
Firm fixed effect	NO	NO	YES
Constant	-0.045*** (0.008)	-0.061*** (0.007)	0.186*** (0.012)
Adj. R ²	0.09	0.57	0.89
# obs.	12,432	12,432	12,432

Table 10: Share of university-educated workers by labor productivity decile

<i>Share of University-Educated Workers</i>	Top productivity decile	Bottom productivity decile
1998	11.05%	4.69%
1999	12.25%	5.14%
2000	11.69%	5.49%
2001	12.22%	4.72%
2002	12.40%	4.59%
2003	13.53%	4.02%
2004	14.81%	4.48%
2005	15.06%	4.23%
2006	15.63%	5.04%

Appendix A: The development of main economic and labor market indicators: 1994 – 2006

CZECH REPUBLIC	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
GDP growth at 2000 const. prices	2,2	5,9	4,0	-0,7	-0,8	1,3	3,6	2,5	1,9	3,6	4,2	6,1	6,1
Inflation rate	10,0	9,1	8,8	8,5	10,7	2,1	3,9	4,7	1,8	0,1	2,8	1,9	2,5
CPI (year2005=100)	59,1	64,5	70,2	76,2	84,4	86,2	89,4	93,6	95,4	95,5	98,1	100,0	102,5
Unemployment rate	4,3	4,0	3,9	4,8	6,5	8,7	8,8	8,1	7,3	7,8	8,3	7,9	7,1
Labor productivity growth	1,0	4,2	3,3	-0,9	0,9	3,9	4,0	2,2	1,6	4,6	4,1	4,6	4,4
The growth of gross average earnings %	18,6	18,6	18,3	9,9	9,2	8,4	6,4	8,7	7,3	6,6	6,6	5,2	6,5
The growth of real average earnings %	7,8	8,7	8,7	1,3	-1,4	6,2	2,4	3,8	5,4	6,5	3,7	3,2	3,9
Monthly MW	2.200	2.200	2.500	2.500	2.650	3.250 3.600 *	4.000 4.500 *	5.000	5.700	6.200	6.700	7185	7.580 7.955 *
Increase in MW in %	0,0	0,0	13,6	0,0	6,0	22,6 10,8 *	11,1 12,5 *	11,1	14,0	8,8	8,1	7,2	5,5 5,0 *
MW as %-age of average wage	31,4	26,5	25,4	23,1	22,5	28,1	33,1	33,8	35,9	36,6	37,1	37,8	39,4

Notes: * changes as from July 1.

Source: Czech Statistical Office and the Ministry of Labour and Social Affairs.

Appendix B: Evolution of export and import share as % of GDP

	2000	2001	2002	2003	2004	2005	2006	2007 ¹⁾
Export share as % of GDP	51.21 %	53.91 %	50.92 %	53.20 %	61.20 %	62.62 %	66.70 %	70.15 %
Import share as % of GDP	56.73 %	58.91 %	53.80 %	55.91 %	61.60 %	60.48 %	64.56 %	66.66 %

Source: Czech Statistical Office

Appendix C: Foreign and domestic firms in our sample

	1998	1999	2000	2001	2002	2003	2004	2005	2006
Foreign-owned firms	155	216	205	228	214	214	651	735	831
Domestic	1,329	1,604	1,918	2,145	2,113	2,231	2,202	2,421	2,209
Total firms	1,484	1,820	2,123	2,373	2,327	2,445	2,853	3,156	3,040