

Firms and wage inequality in Central and Eastern Europe*

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Abstract

The recent studies show an increasing importance of firms in shaping wage inequality in advanced economies. We use a large linked employer-employee dataset to analyse the wage inequality patterns in Central and Eastern European countries between 2002 and 2014. We find that the levels of wage inequality have converged among the CEE countries, and the largest changes occurred between 2006 and 2014. We show that most of the overall inequality arises between and not within firms. We estimate Recentered Influence Function (RIF) regression to investigate the determinants of the wage dispersion. We find that firm characteristics such as sector, share of tertiary educated workers, and share of old workers significantly contribute to wage inequality.

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1 Introduction

Increasing income inequality is in the centre of public debates in all countries, and many of the questions asked relate to the role of changes in wage dispersion as one of the driving forces of income differentials. This paper contributes to this literature by investigating the wage inequality patterns in Central and Eastern European countries in the 2000s, under-researched in the existing strands of literature. We paid a particular attention to the role firms played in changing the wage distribution.

The existing studies mostly looked at the US and countries from Western Europe (see Lazear and Shaw (2009) for a review), the region of Central and Eastern Europe is an interesting and under-researched case to look at, when it comes to wage inequality. Until the launch of the economic transition, the Socialist model of administrative wage setting artificially maintained a compressed wage distribution, and ensured full employment in the economy. The launch of transition was associated with a trend towards greater income inequality, especially in the early phase (Rutkowski, 2001; Zaidi, 2009). Little is known about wage inequality developments in CEE countries in the aftermath of their EU Accession (2004) or during and after the Great Recession in late 2000s. This is the period we cover with our study.

The paper has three main objectives. First, we investigate changes in the wage dispersion in CEE countries between 2002 and 2014. Second, we analyse the role of establishments in determining wage inequality, and examine how much of this inequality – at the macro level - is due to wage differentials arising between firms, and how much due to the within-firm wage inequality. Third, we want to investigate the potential micro level factors associated with higher or lower levels of wage inequality, in particular the drivers of the observed evolution of wage inequality during the period of 2002-2014. We use four consecutive waves for years 2002, 2006, 2010 and 2014 from the European Structure of Earnings Survey (ESES), a unique cross sectional linked employer-employee data set. The highly detailed information at the level of the individual allows us to compute precise measures of wage inequality, distinguishing between the within-firm component and the between-firm component. It also enables us to conduct a detailed comparative analysis of the developments of wage inequality for these countries during the 2000s.

We find that between the early 2000s and mid 2010s the levels of wage inequality have converged among the CEE countries. Wage inequality decreased in most parts of the region (in particular in the Baltic states and Romania, where it was highest) and increased (slightly) only in the Czech Republic, where it remains at the lowest level in the region. We further established that wage inequality is higher between-firms than within-firms in almost all CEE countries. Furthermore, differences in the level of wage inequality between firms stand behind the differences in the level of overall wage inequality among the CEE countries. We also identified the most important microeconomic factors associated with wage dispersion in the region - these include workers' age, education and occupation, and their firm's characteristics. We show that firms' sectoral affiliation and employment structure with respect to age and education are strongly linked to the overall levels of wage inequality in particular countries.

2 Literature review

We contribute to selected strands of the literature on the wage and income inequality. The first strand analyses the determinants and the evolution in wage inequality. This literature has grown considerably in the recent decades, focussing on the US and Western European economies, but without dealing explicitly with CEE countries. The most recent works (see e.g. Autor, Katz, and Kearney (2008); Lemieux (2006)) investigate the individual determinants of the increasing inequality in individual earnings in the US. They show that the steady rise in inequality that took place in the US starting from the 1970s is highly heterogeneous across education, age, and type of occupation. Another striking feature of this trend is that earnings increased more at higher percentiles of the earnings distribution, even for the same level of skill. This observation implies that one should consider the role of non-individual determinants of wage inequality. Building upon the early literature on inter-industry wage differentials (see e.g. Groschen (1991)), some studies highlight the importance of establishment characteristics, particularly those factors associated with their pay policies. While Lazear and Shaw (2009) claim that within firm variation explains around 60 – 80% of the observed individual wage variation, based on European and US data, they also find evidence of differences in wages between firms growing in time. Card, Heining, and Kline (2013) suggest that increasing firm level heterogeneity explains a large share of the rise in inequality experienced in West Germany between 1985 and 2009. Barth et al. (2016) show that the increased variance of average earnings across the establishments can be held responsible for the rise in US wage inequality during 1970-2000. Handwerker and Spletzer (2016) show that this growing contribution of establishment effects in the widening distribution of wages is only partially explained by the changing distribution of occupations among workplaces. Establishment effects matters, as employers are differently affected by the various factors shaping changes in the wage distribution, such as the skill biased technological change or changes in labour market institutions while workers sort among employers. These studies of determinants of changes in wage inequality and of the role of establishments in increased wage inequality focus on Western countries, mostly the US, the UK and Germany. Much less is known about developments of wage inequality in countries from Central and Eastern Europe, and its drivers. In a recent work, Kelly et al. (2017) show that differences in wages across firms explain more than half of wage inequality in Bulgaria, Estonia, and Latvia, while differences in educational attainment or occupations across workers explain only a third or less. The authors claim these differences across firms are driven by differences in the rate of adoption of digital technologies.

What can explain the between-firm wage inequality? Firms may be segregated with respect to skills they require. Or it may be that firms that pay high-level efficiency wages (in exchange for skills or low turnover) are increasingly diverging from those that are pushed to low-level market clearing wages in lower-skilled or highly competitive industries (Lazear and Shaw, 2009). Between firm wage dispersion could also be due to outsourcing, if firms higher in the value chain are more likely to outsource low skilled jobs.

3 Data

We use repeated cross-sectional data from the European Structure of Earnings Survey (ESES) for the years 2002, 2006, 2010 and 2014. The ESES is a large matched employer–employee dataset provided by Eurostat. It includes information on earnings, personnel, jobs, and firm characteristics in the manufacturing,

construction, and services (market and non-market) sectors. We use data for the following nine CEE countries: Czech Republic, Estonia, Hungary, Lithuania, Latvia, Poland, Romania, Slovakia, and Bulgaria. We additionally draw on the ESES Survey in the Netherlands, Norway, Sweden and Portugal, to provide a comparison for some of our results with those of Western European countries.

While the ESES data are characterized by a high degree of cross-country comparability, we had to carry out a number of cleaning steps to guarantee the full cross-country harmonization of the national samples and our analyses. In particular we dropped observations which referred to workers in the smallest firms (below 10 workers), because they were available for some of the countries only. We dropped observations from the top and the bottom 0.1% of the hourly wage distribution to avoid outliers. In the 2002 wave of the survey, it was optional to include observations from non-market services sector. Without these observations, we are not able to obtain comparable datasets for all countries for 2002 (because data for Estonia, Latvia, Hungary, Norway, Portugal, Sweden is incomplete). Therefore, we analyse the 2002 data only for countries with datasets that included all sectors and provide some of the analyses for the 2006 - 2014 period only. The size of samples ranges from 26 thousand observations in Lithuania in 2010 to over 2 million observations in the Czech Republic in 2014. Summary statistics across countries and years are presented in Table 1.

Table 1. Summary statistics

(a) Number of observations

year	Bulgaria	Czechia	Estonia	Hungary	Lithuania	Latvia	Poland	Romania	Slovakia
2002	151 384	1 030 676			136 775		630 357	229 879	418 835
2006	163 139	1 942 065	115 725	732 662	115 776	272 333	640 788	247 843	671 927
2010	175 925	1 952 429	109 081	782 600	26 135	199 266	669 313	263 523	769 327
2014	168 661	2 173 899	113 044	826 436	31 541	154 561	709 230	271 121	881 738

(b) Number of firms

year	Bulgaria	Czechia	Estonia	Hungary	Lithuania	Latvia	Poland	Romania	Slovakia
2002	2 454	2 289			5 923		13 403	8 870	1 391
2006	4 596	11 673	2 636	14 012	5 316	7 641	13 979	10 778	2 971
2010	5 187	11 193	2 502	13 681	1 364	5 261	14 423	12 161	4 739
2014	4 904	12 159	2 348	12 847	1 648	3 694	14 608	12 075	5 700

(c) Mean of hourly earnings (EUR)

year	Bulgaria	Czechia	Estonia	Hungary	Lithuania	Latvia	Poland	Romania	Slovakia
2002	0.79	2.78			1.85		3.38	1.03	1.92
2006	1.12	4.19	3.57	3.54	2.80	2.67	4.12	1.84	3.08
2010	2.04	5.38	4.90	4.32	3.84	3.95	5.18	2.52	4.70
2014	2.35	5.30	5.80	4.47	4.22	4.45	5.63	2.76	5.30

Data: European Structure of Earnings Survey

Panel C in Table 1 summarizes the distribution and changes in average hourly gross wages in CEE countries between 2002 and 2014. Wages are the lowest in the late EU entrants, Romania and Bulgaria; and are on average twice as high in the Czech Republic, Estonia, Slovakia and Poland, where they exceeded 5 EUR per hour in 2014. All CEE countries recorded substantial increases in average earnings in the analysed period, both between 2002 and 2006, 2006 and 2010 and after 2010. One must note, however, that in most countries (in particular those outside the Euro zone or currency board systems) these increases reflect not

only changes in the real wages, but also the strengthening of currencies.

Our baseline measure of wages is log hourly gross wage, expressed in euro. It includes earnings, earnings related to overtime, special payments for shift work, social-security contributions and taxes. It does not include annual bonuses and allowances not paid at each period. We use the variance of log hourly wages as our measure of wage inequality. This is a common statistical measure of dispersion, and in contrast to other popular measures of inequality such as the Gini coefficient and the 90-10 wage gap, the variance is additively decomposable into the between-firm and the within-firm components. We use log wages, as the variance of log wages is a mean independent measure, unlike the variance of wages (Atkinson, 1970). We verify the robustness of our results using the Gini coefficient and the Atkinson coefficient for the analysis of the overall wage inequality (see Table A.1 and A.2 in the Appendix).

4 Methodological approach

Our analysis is carried out in two main steps. First, we analyse levels and changes in wage inequality in each country over time, and we determine the contribution of the within- and the between-firm component. In the second step, we investigate the determinants of the levels and changes in wage inequality over time.

We start the first part of our analysis by calculating the variance of log wages for each country and each year. We normalize wages for each year and country, such that $\hat{w}_{it} = 100 * \frac{w_{it}}{\bar{w}_t}$, where w_{it} denotes individual log hourly wage and \bar{w}_t is average hourly wage in a given year t .

We analyse to what extent the level of overall wage inequality and its changes are determined by the within- and the between-firm inequality, following the methodology applied by Lazear and Shaw (2009) and Barth et al. (2016). We decompose the overall variance of normalized log wages ($Var(\hat{w}_{it})$) into the within-firm component ($Var(within)$), and the between-firm component ($Var(between)$). Thus, the variance decomposition of normalized log wages, $Var(\hat{w}_{it}) = Var(within) + Var(between)$, is given by the following equation:

$$Var(\hat{w}_{it}) = \frac{1}{N_t} \sum_i (\hat{w}_{it} - \hat{w}_t)^2 = \frac{1}{N_t} \sum_j \sum_{i \in j} (\hat{w}_{it} - \hat{w}_{jt})^2 + \frac{1}{N_t} \sum_j N_{jt} (\hat{w}_{jt} - \hat{w}_t)^2 \quad (1)$$

where \hat{w}_t is the average normalized log wage in year t in a given country, \hat{w}_{jt} denotes average normalized log wage for workers in firm j in year t , N_t is the number of all workers in year t and N_{jt} is the number of workers in firm j .

We repeat the above analysis, but looking at *residual* wage inequality, that is the wage inequality that remains once observable workers' characteristics are accounted for. We estimate a standard Mincerian wage equation of the following form:

$$\hat{w}_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 X_{jt} + \epsilon_{it} \quad (2)$$

where X_{it} is a set of individual characteristics such as age, gender, education, occupation, type of contract,

and X_{jt} is a set of firm characteristics such as sector, form of economic and financial control of the enterprise, and peer effects (share of female workers, share of workers with tertiary education, share of workers aged 50 years or more and share of workers who were employed by the firm not earlier than 2 years prior to the survey, see, e.g., Card and De La Rica (2006)).

The above exercises are useful to give a broad picture of the aggregate trends in the wage dispersion but give little insight into the determinants of these trends. An established literature analyses the determinants of the wage inequality, and tries to distinguish the individual determinants from the job and firm characteristics (see e.g. Barth et al. (2016); Handwerker and Spletter, 2015). Thus, in the second step, we estimate the variance of wages as a function of worker and firm characteristics (the same characteristics as in the Mincerian equation above). We run the recentered influence function regression, which calculates the partial effect of a small change in the distribution of covariates on the distributional statistic of interest (Firpo, Fortin, and Lemieux, 2018). In our case, we estimate the impact of mentioned variables on the variance of normalized log wages. First, we calculate the recentered influence function value for each observation according to the following formula

$$RIF(\hat{w}_{it}) = (\hat{w}_{it} - \hat{w}_t)^2 \quad (3)$$

Next, we estimate the following model for each country and each year:

$$RIF(\hat{w}_{it}) = \beta_0 + \beta_1 X_{it} + \beta_2 X_{jt} + \epsilon_{it} \quad (4)$$

and the notation is the same as in Equation (2). We obtain the estimated partial effects of small changes in the distribution of selected variables on the variance of normalized log wages for each country and for each year. Thus, we can observe differences in the magnitude of effects over time. Furthermore, we are interested in the determinants of changes in inequality between 2006 and 2014 - the period of the largest changes in wage inequality in CEE countries. Therefore, we use the standard Blinder-Oaxaca method to decompose the changes in the variance of log wages into changes in endowments, coefficients from the RIF regression $\beta_0, \beta_1, \beta_2$ and interactions. The decomposition is given by the following equation

$$\begin{aligned} Var(w_{i,\hat{2014}}) - Var(w_{i,\hat{2006}}) &= \beta_{2006}(\bar{X}_{2014} - \bar{X}_{2006}) \\ &\quad + (\beta_{2014} - \beta_{2006})\bar{X}_{2006} \\ &\quad + (\bar{X}_{2014} - \bar{X}_{2006}) * (\beta_{2014} - \beta_{2006}) \end{aligned} \quad (5)$$

The first term reflects changes in the variance driven by changes in the set of covariates ($\bar{X}_{2014} - \bar{X}_{2006}$) given that the coefficients would remain at the 2006 level. The second term captures the change in the coefficients ($\beta_{2014} - \beta_{2006}$) given that the covariates would remain at the 2006 level. The third part is the residual; i.e., an interaction term accounting for the fact that differences in endowments and coefficients existed simultaneously in 2006 and 2014.

5 Results

Table 2. Variance of ln wages

year	Bulgaria	Czechia	Estonia	Hungary	Lithuania	Latvia	Poland	Romania	Slovakia
2002	0.34	0.19			0.37		0.34	0.42	0.25
2006	0.33	0.21	0.28	0.29	0.36	0.46	0.36	0.42	0.24
2010	0.33	0.23	0.28	0.30	0.31	0.34	0.31	0.38	0.23
2014	0.33	0.23	0.27	0.28	0.27	0.31	0.32	0.36	0.23

5.1 Overall wage dispersion and its changes

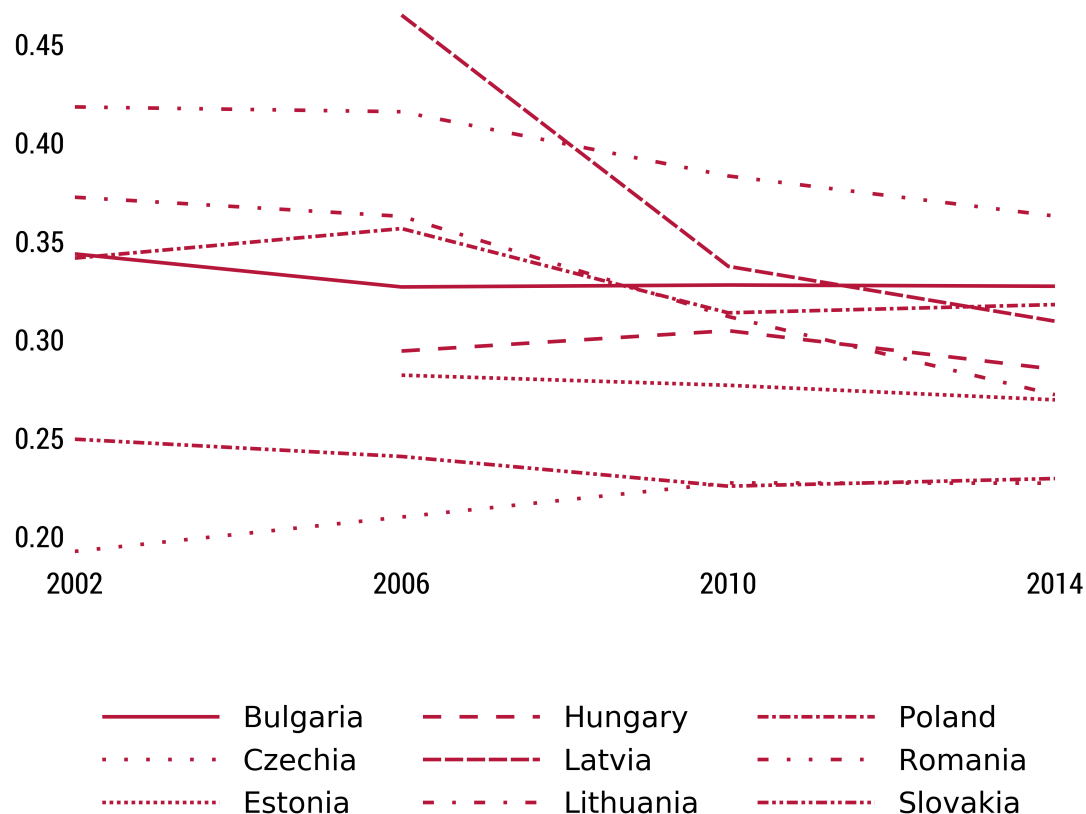
The level of the wage dispersion varies quite substantially among the CEE countries (Table 2). In 2014, the lowest level of the wage inequality was observed in the Czech Republic and Slovakia (where the variance of log wages amounted to 0.23), while the highest level was observed in Romania (0.36). Comparing the CEE to more advanced European countries (Table A.7), the level of wage inequality in the Czech Republic and Slovakia was similar to the level observed in the Netherlands, and the high variance of wages in Romania corresponded to the level of wage inequality observed in Portugal (where wages were the most dispersed among EU countries if measured with the D9/D1 decile dispersion (Eurostat, 2014)). The average level of the variance of log wages observed in the CEE was around three times higher than in the two Scandinavian countries we observe (Norway and Sweden). All in all, wages appear to be on average more unequal in the CEE countries than in the old EU member states, which is confirmed also by the Eurostat D9/D1 dispersion statistics. Moreover, in all CEE countries, wage inequality was the highest in the market services sector (Table A.4 in the Appendix), but there were no other common patterns with respect to other sectors. The Czech Republic's and Slovakia's non-market services had distinguishably lower levels of wage inequality (compared to construction, manufacturing and market services). This stands in contrast to e.g. Hungary and Romania, where wage inequality in the sector of non-market services was higher than among manufacturing or construction workers.

There were substantial changes in the level of wage disparities in CEE countries between early and mid 2000s and 2014 (Table 2). These included a slight increase in the level of wage inequality in the country with their lowest starting level - the Czech Republic - where the variance of log wages increased from 0.19 in 2002 to 0.23 in 2014. At the same time, the high-inequality countries experienced a considerable decrease in the levels of wage dispersion. In particular, the variance of log wages decreased the most in Latvia (from 0.46 in 2006 to 0.31 in 2014), Romania (0.42 to 0.36) and Lithuania (0.37 in 2002 to 0.27 in 2014). The data suggests that the strongest decrease in wage inequality took place after 2006 (between 2006 and 2010 in particular), pointing to the likely role of the post-crisis adjustments. In the 2002-2006 subperiod (marked by the EU entry by 7 of the 9 CEE countries we analyse), there were hardly any changes in the overall wage dispersion. All in all, the differences in the level of wage dispersion among the CEE countries have narrowed considerably in 2000s and early 2010s (see Figure 1).

5.2 The role of between- and within-firm wage differentials

The overall wage dispersion at a country level arises from dispersion in average wages between firms and from the wage inequality that exist within firms. Thus, we can decompose the overall wage inequality into two components: the within- and the between-firm wage inequality, as discussed in the methodological section. Tables 3 and 4 summarize the results of such an exercise.

Figure 1. Overall variance of log wages: 2002-2014



Source: Own calculations based on European Structure of Earnings Survey

CEE countries differed mostly with respect to the between-firm wage inequality and this component ex-

Table 3. Contribution of the within component to level and change in variance of log wages

	Level 2006 (percent)	Change 2006-2014 (percent)
Estonia	60	68
Czechia	55	16
Slovakia	50	20
Lithuania	49	29
Hungary	48	35
Latvia	47	46
Poland	44	35
Romania	36	56
Bulgaria	29	51

Note: the first column shows the contribution of the within-firm component to the level of the variance of log wages in 2006 ($\frac{Var(w_{i,2006}^{within})}{Var(w_{i,2006})}$). The unreported between component is 100% minus the reported within component. The second column shows the contribution of the within component to the change of the variance ($\frac{|\Delta Var(w_{i,2006}^{within})|}{(|\Delta Var(w_{i,2006}^{within})| + |\Delta Var(w_{i,2006}^{between})|)}$)

Data: European Structure of Earnings Survey

Table 4. Variance decomposition**(a) Within-firm variance of ln wages**

year	Bulgaria	Czechia	Estonia	Hungary	Lithuania	Latvia	Poland	Romania	Slovakia
2002	0.10	0.11			0.18		0.15	0.16	0.12
2006	0.09	0.12	0.17	0.14	0.18	0.22	0.16	0.15	0.12
2010	0.10	0.11	0.15	0.14	0.18	0.16	0.15	0.14	0.11
2014	0.11	0.11	0.14	0.14	0.15	0.14	0.14	0.12	0.12

(b) Between-firm variance of ln wages

year	Bulgaria	Czechia	Estonia	Hungary	Lithuania	Latvia	Poland	Romania	Slovakia
2002	0.24	0.09			0.19		0.19	0.26	0.13
2006	0.23	0.09	0.11	0.15	0.19	0.25	0.20	0.26	0.12
2010	0.22	0.12	0.13	0.16	0.14	0.18	0.17	0.24	0.11
2014	0.22	0.11	0.12	0.15	0.12	0.16	0.18	0.24	0.11

Data: European Structure of Earnings Survey

plained most of the existing differences in the levels of the total wage inequality between countries. In 2014, the within-firm wage inequality varied from 0.11 in the Czech Republic to 0.14 in Estonia, Hungary, Latvia and Poland. The between-firm wage inequality amounted to 0.11 in the Czech Republic and Slovakia, and to 0.24 in Romania. Thus, the between firm wage inequality was the main factor differentiating the levels of total wage inequality among the CEE countries. High inequality countries (Romania, Bulgaria) had much higher levels of the between-firm wage inequality, compared to the low wage inequality countries (the Czech Republic, Slovakia), while their levels of within-firm wage inequality were more similar. The shares of the within-firm wage inequality in total wage inequality varied from 33% in Bulgaria to 55% in Lithuania. These patterns appear similar to the ones observed in the four Western European countries we analyze: among the Netherlands, Norway, Portugal and Sweden the levels of the between-firm wage inequality varied more than the levels of variance of wages within firms.

The between-firm wage inequality was both higher and more dispersed among CEE countries also in the early- and mid-2000s. In 2002, the within-firm wage inequality varied from 0.11 in the Czech Republic to 0.18 in Lithuania (among the countries with 2002 data available), while the variance of wages between firms amounted from a low of 0.09 in the Czech Republic to 0.26 in Romania. Thus, also in the early 2000s the between-firm wage inequality accounted for the majority of the total wage inequality in all CEE countries but Estonia and the Czech Republic. At the same time, there was no single pattern of changes over time. For instance Romania saw a larger decrease in the within-firm wage inequality, while in Lithuania the percentage decrease in the between-firm variance of wages was higher than the drop in the variance of wages within firms. However, in most cases there was a decrease both in the level of within- and between-firm wage inequality. The between-firm component was the main driver of the change in wage inequality between 2006-2014 in most CEE countries (see Table 3). In three countries, it was the within-firm component that contributed the most to the change in overall wage inequality (Estonia, Romania and Bulgaria).

Overall, the between-firm of wages explained on average 53 - 54% of the total variance of wages in the CEE countries in the early 2000s and mid-2010s. The between-firm wage inequality tends to be higher (in absolute levels and as shares of the total wage inequality) in countries with higher levels of the overall variance of wages. Interestingly, this is also the case of Western European countries (see Table A.7 in the Appendix, Card, Heining, and Kline (2013) for Germany and Barth et al. (2016) for the US). In Bulgaria, the between-firm wage inequality explained around 2/3 of the total wage disparities, a similar share as in

Table 5. Residual variance decomposition**(a) Total residual variance of ln wages**

year	Bulgaria	Czechia	Estonia	Hungary	Lithuania	Latvia	Poland	Romania	Slovakia
2002	0.20	0.10			0.23		0.17	0.22	0.14
2006	0.19	0.11	0.15	0.16	0.23	0.32	0.16	0.23	0.13
2010	0.18	0.12	0.13	0.15	0.16	0.21	0.15	0.21	0.12
2014	0.18	0.11	0.15	0.14	0.15	0.19	0.16	0.19	0.12

(b) Within-firm residual variance of ln wages

year	Bulgaria	Czechia	Estonia	Hungary	Lithuania	Latvia	Poland	Romania	Slovakia
2002	0.08	0.08			0.13		0.09	0.10	0.10
2006	0.07	0.08	0.10	0.10	0.12	0.16	0.10	0.10	0.09
2010	0.07	0.08	0.08	0.10	0.10	0.11	0.09	0.09	0.08
2014	0.08	0.08	0.10	0.10	0.10	0.11	0.10	0.08	0.09

(c) Between-firm residual variance of ln wages

year	Bulgaria	Czechia	Estonia	Hungary	Lithuania	Latvia	Poland	Romania	Slovakia
2002	0.12	0.02			0.10		0.08	0.12	0.03
2006	0.12	0.03	0.05	0.06	0.11	0.16	0.07	0.13	0.04
2010	0.10	0.04	0.05	0.05	0.06	0.10	0.06	0.12	0.04
2014	0.10	0.03	0.05	0.04	0.06	0.08	0.06	0.11	0.03

Portugal. This component was smaller in the Netherlands (where the share of between-firm wage inequality amounted to the average level observed among the CEE countries) and the smallest in Sweden, where between-firm wage inequality accounted for only a third of the total observed wage inequality.

5.3 Residual variance

The variance of average wages between firms partly reflects the observed differences in firms' employment structure (primarily in terms of skills), and partly firm-specific wage premia (Card, Heining, and Kline, 2013). In other words, regardless of the fact that low-skilled firms will have lower average wages than firms with higher average level of human capital, some firms will pay higher wages than others for equally skilled workers. While we are unable to account directly for the latter, we aim at capturing the impact of the observable confounding factors which determine firms' average wages, such as workers' age or education, types of jobs held or firms' sectoral affiliation. We thus calculate the residual wage inequality (measured as the variance of residual wages), which reflects the differences in wages across firms which are not due to the workers' or firms' (observable) characteristics.

The levels of the residual and the absolute wage inequality were obviously different across countries (Table 5). The variance of residuals was 2-3 times lower than the variance of wages, which means that observable characteristics explained around 40-50% of the total wage inequality in CEE countries. There are also important differences with respect to the role of the within-firm and between-firm components. In particular, once individual, job and firm level characteristics are accounted for, the share of the within-firm variance is much higher. The within-firm residual wage inequality explained 42% of the total residual wage inequality in Bulgaria and Romania, 60 - 70% in most other CEE countries, to a high of 75% in Slovakia. The share of the within-firm residual wage variance was also higher in countries with lower level of the overall wage inequality, and lower in high inequality countries like Bulgaria and Romania, where the between-firm (residual) wage inequality was relatively high, in line with the patterns observed with the overall wage levels.

Table 6. Results of RIF regression: Bulgaria and Romania

	Bulgaria				Romania			
	2002	2006	2010	2014	2002	2006	2010	2014
<i>Individual effects</i>								
<i>reference: primary education</i>								
tertiary education	0.085***	0.052***	0.028***	0.014**	0.332***	0.158***	0.149***	0.151***
secondary education	-0.014***	-0.043***	-0.059***	-0.050***	-0.065***	-0.043***	-0.084***	-0.038***
<i>reference: under 30 years old</i>								
30-49 years old	0.012***	0.033***	0.086***	0.110***	0.035***	0.077***	0.094***	0.113***
50 years old or more	0.039***	0.046***	0.092***	0.117***	0.132***	0.162***	0.134***	0.145***
<i>reference: male</i>								
female	-0.094***	-0.095***	-0.092***	-0.096***	-0.070***	-0.069***	-0.057***	-0.074***
<i>reference: tenure of less than a year</i>								
tenure: 1-4 years	-0.010***	0.024***	-0.000	-0.001	0.013***	-0.002	0.015***	-0.001
tenure: 5-9 years	-0.003	0.061***	0.024***	0.020***	0.023***	0.012**	0.022***	0.012***
tenure: 10 years or more	0.018***	0.095***	0.049***	0.049***	0.017***	0.020***	0.037***	0.055***
<i>reference: ISCO 9</i>								
ISCO 1-3	0.069***	0.171***	0.136***	0.189***	0.011**	0.138***	0.002	0.084***
ISCO 4-5	-0.028***	-0.017***	-0.065***	-0.060***	-0.015***	-0.074***	-0.035***	-0.007*
ISCO 6-8	-0.062***	-0.056***	-0.099***	-0.089***	-0.113***	-0.134***	-0.150***	-0.080***
<i>reference: permanent contract</i>								
fixed contract	0.010***	0.098***	0.033***	0.062***	0.020**	0.007	0.006	-0.039***
<i>Firm effects</i>								
<i>reference: non-market services</i>								
manufacturing and construction	0.247***	0.201***	0.255***	0.196***	0.166***	0.096***	0.207***	0.182***
market services	0.235***	0.201***	0.274***	0.206***	0.284***	0.176***	0.245***	0.208***
<i>reference: private ownership of a firm</i>								
public ownership of a firm	-0.040***	-0.050***	-0.063***	-0.057***	0.014***	0.022***	0.025***	-0.020***
tenure: less than 2 years (share)	0.104***	0.005	0.084***	0.073***	0.157***	0.097***	0.023***	0.104***
age: 50 years or more (share)	-0.576***	-0.398***	-0.335***	-0.417***	-0.573***	-0.417***	-0.287***	-0.260***
tertiary education (share)	0.147***	0.249***	0.382***	0.284***	0.210***	0.161***	0.348***	0.429***
female (share)	-0.070***	-0.053***	-0.025***	-0.093***	0.060***	0.013**	-0.038***	-0.049***
constant	0.307***	0.211***	0.079***	0.173***	0.234***	0.254***	0.168***	0.023***
Observations	150,392	162,838	175,575	168,345	220,284	241,708	262,983	270,582
R-squared	0.115	0.109	0.137	0.138	0.134	0.126	0.119	0.152

Standard errors in parentheses

* p<0.1, ** p<0.05 ***p<0.01

Data: European Structure of Earnings Survey

5.4 Microeconomic determinants of wage inequality and its changes over time

There are several micro-level factors that impact the degree of wage dispersion among workers. Human capital and skills determine differences in productivity, which are reflected in wage and their heterogeneity. Job characteristics, such as type of contract held and occupation in which one works also impact wages. An increased flexibility in the use of non standard employment in the CEE (Broughton et al., 2006) and trends of job polarisation (Hardy, Keister, and Lewandowski, 2016) were likely to lead to changes in the wage distribution. There are firm-level characteristics that determine pay setting schemes e.g. its sectoral affiliation (Barth et al. (2016)). Peer effects such as share of old workers or females in an establishment may also influence the level of wages and their distribution. Using the RIF-regression approach presented in the methodology section we aim at capturing the potential contribution of a set of individual, job and firm level characteristics to the observed levels of wage inequality.

Tables 6-10 report the results of the RIF regression for every country and every year. These results allow us to compare the effects of selected characteristics on wage inequality across time and countries. The first interesting observation that stands out concerns the strong association between workers' educational attainment and total wage inequality: tertiary educated employees contribute strongly to increasing wage dispersion and this association is reinforced by tertiary-educated co-workers. In most CEE countries tertiary education is the most important single factor that affects positively the variance of wages, both at individual and firm level. Secondly, workers' age matters as well - while older workers are associated with higher wage inequality (compared to young ones), the firm-level age dimension is much more important.

Table 7. Results of RIF regression: Czechia and Slovakia

	Czechia				Slovakia			
	2002	2006	2010	2014	2002	2006	2010	2014
<i>Individual effects</i>								
<i>reference: primary education</i>								
tertiary education	0.151***	0.169***	0.177***	0.133***	0.116***	0.121***	0.093***	0.043***
secondary education	-0.051***	-0.062***	-0.065***	-0.070***	-0.073***	-0.116***	-0.098***	-0.103***
<i>reference: under 30 years old</i>								
30-49 years old	0.052***	0.092***	0.104***	0.113***	0.076***	0.089***	0.110***	0.115***
50 years old or more	0.065***	0.100***	0.114***	0.127***	0.097***	0.093***	0.124***	0.130***
<i>reference: male</i>								
female	-0.064***	-0.080***	-0.078***	-0.090***	-0.084***	-0.085***	-0.088***	-0.080***
<i>reference: tenure of less than a year</i>								
tenure: 1-4 years	-0.007***	-0.015***	-0.020***	-0.033***	0.001	0.006***	0.001	-0.016***
tenure: 5-9 years	0.001	0.007***	-0.015***	-0.036***	0.020***	0.027***	0.016***	-0.013***
tenure: 10 years or more	-0.012***	0.009***	0.011***	-0.022***	-0.012***	0.038***	0.020***	-0.004***
<i>reference: ISCO 9</i>								
ISCO 1-3	-0.043***	-0.070***	-0.078***	-0.093***	-0.058***	-0.049***	-0.024***	-0.063***
ISCO 4-5	-0.052***	-0.108***	-0.122***	-0.135***	-0.013***	-0.064***	-0.048***	-0.118***
ISCO 6-8	-0.136***	-0.207***	-0.215***	-0.237***	-0.174***	-0.179***	-0.154***	-0.178***
<i>reference: permanent contract</i>								
fixed contract	0.008***	0.009***	-0.004***	-0.027***	0.027***	-0.009***	0.019***	-0.004***
<i>Firm effects</i>								
<i>reference: non-market services</i>								
manufacturing and construction	0.093***	0.073***	0.066***	0.074***	0.085***	0.110***	0.100***	0.049***
market services	0.100***	0.120***	0.131***	0.135***	0.136***	0.127***	0.125***	0.087***
<i>reference: private ownership of a firm</i>								
public ownership of a firm	-0.061***	-0.089***	-0.088***	-0.087***	-0.094***	-0.094***	-0.091***	-0.100***
tenure: less than 2 years (share)	0.064***	0.021***	0.101***	0.062***	-0.001	-0.044***	0.023***	0.025***
age: 50 years or more (share)	-0.175***	-0.219***	-0.139***	-0.127***	-0.395***	-0.304***	-0.224***	-0.168***
tertiary education (share)	0.041***	0.043***	-0.004**	0.072***	0.173***	0.160***	0.130***	0.105***
female (share)	0.071***	0.081***	0.030***	0.040***	0.014***	-0.002	0.014***	0.019***
constant	0.205***	0.273***	0.264***	0.298***	0.333***	0.354***	0.242***	0.320***
Observations	978,101	1,938,186	1,948,513	2,169,586	391,714	670,603	767,368	875,689
R-squared	0.117	0.130	0.136	0.135	0.081	0.119	0.127	0.106

Standard errors in parentheses

* p<0.1, ** p<0.05 ***p<0.01

Data: European Structure of Earnings Survey

A high share of older employees in a worker's firm is associated with an increase in the variance of log wages. Third, higher and medium skilled occupations contribute substantially to lowering wage inequality, compared to elementary occupations. Interestingly, this result holds strongly for all countries but Bulgaria and Romania, where employees in high skilled occupations increase the overall wage inequality. Finally, sectoral affiliation also turns out to be an important determinant of wage inequality, with market services contributing the most to its level. Also in this respect Bulgaria and Romania stand out, as the estimates coefficients associated with employment in market services are particularly high.

With respect to the time dimension of our analysis, there are few noticeable changes in the magnitude of the effects over time. In most countries the positive effect of age on the variance of log wages has increased over time. This change is likely related to the ageing of the workforce and increasing employment rates among older workers (whose wages are more unequal). The correlation between type of occupation and wage inequality has strengthened in some countries (the Czech Republic, Bulgaria) but decreased in others (Estonia, Latvia). Poland, Latvia and Hungary experienced a decreasing positive effect of tertiary education on the variance of wages, while this relationship was stable in other CEE countries.

In order to better capture the determinants of changes in wage inequality over time, we decompose the above estimates a la standard Blinder-Oaxaca approach, as discussed in the methodology. It allows us to distinguish between the impact of changes in endowments (i.e. the structure of workers with respect to their and their workplaces' characteristics) and coefficients (i.e. returns to these characteristics) on the change in the variance of log wages between 2006 and 2014. The analysis is performed for each country

Table 8. Results of RIF regression: Estonia and Poland

	Estonia			Poland				
	2002	2006	2010	2014	2002	2006	2010	2014
<i>Individual effects</i>								
<i>reference: primary education</i>								
tertiary education		0.116***	0.104***	0.099***	0.302***	0.278***	0.199***	0.163***
secondary education		-0.028***	-0.038***	-0.018***	-0.020***	-0.006***	-0.018***	-0.021***
<i>reference: under 30 years old</i>								
30-49 years old		0.089***	0.104***	0.105***	0.092***	0.137***	0.134***	0.126***
50 years old or more		0.075***	0.098***	0.097***	0.153***	0.194***	0.170***	0.158***
<i>reference: male</i>								
female		-0.110***	-0.108***	-0.113***	-0.067***	-0.071***	-0.071***	-0.086***
<i>reference: tenure of less than a year</i>								
tenure: 1-4 years		0.001	-0.007*	0.001	-0.047***	-0.006**	-0.015***	-0.000
tenure: 5-9 years		0.039***	0.004	0.009**	-0.040***	-0.001	-0.009***	-0.005***
tenure: 10 years or more		0.011**	0.014***	0.000	-0.037***	-0.001	0.020***	0.045***
<i>reference: ISCO 9</i>								
ISCO 1-3		-0.184***	-0.151***	-0.097***	-0.036***	-0.064***	-0.043***	-0.026***
ISCO 4-5		-0.241***	-0.174***	-0.141***	-0.113***	-0.102***	-0.131***	-0.110***
ISCO 6-8		-0.304***	-0.252***	-0.202***	-0.125***	-0.124***	-0.124***	-0.122***
<i>reference: permanent contract</i>								
fixed contract		0.057***	0.035***	0.036***				
<i>Firm effects</i>								
<i>reference: non-market services</i>								
manufacturing and construction		0.023***	0.024***	0.012**	0.107***	0.111***	0.075***	0.059***
market services		0.065***	0.068***	0.078***	0.106***	0.123***	0.106***	0.091***
<i>reference: private ownership of a firm</i>								
public ownership of a firm		-0.070***	-0.068***	-0.037***	-0.121***	-0.103***	-0.090***	-0.069***
tenure: less than 2 years (share)		0.010	0.028***	0.031***	0.136***	0.172***	0.121***	0.122***
age: 50 years or more (share)		-0.063***	-0.115***	-0.069***	-0.226***	-0.179***	-0.158***	-0.105***
tertiary education (share)		0.074***	0.064***	0.031***	0.280***	0.201***	0.166***	0.128***
female (share)		0.036***	0.080***	0.075***	0.087***	0.111***	0.092***	0.058***
constant		0.432***	0.374***	0.299***	0.229***	0.114***	0.125***	0.129***
Observations		115,512	108,903	112,842	629,101	639,784	667,963	707,999
R-squared		0.094	0.088	0.075	0.151	0.129	0.126	0.102

Standard errors in parentheses

* p<0.1, ** p<0.05 ***p<0.01

Data: European Structure of Earnings Survey

separately. We find that in virtually all CEE countries the changes in coefficients explained most of the observed changes in inequality during the period. The only exception was the Czech Republic, where changes in endowments were more important. In other words, keeping coefficients constant, the observed change in composition of workers would lead to an increase in inequality in all countries. However in all countries (but the Czech Republic) the changes in coefficients compensated for the changes that took place in workers' endowments. That said, looking at the detailed decomposition of the observed changes in wage inequality it is yet striking to see that in most of countries the biggest change was due to the change in the slope (see Tables A.9-A.13). In fact, the change in coefficients on explanatory variables contributed to an increase rather than a decrease in inequality in Bulgaria, Estonia, Latvia, Romania and Slovakia. The opposite situation occurred in Hungary and Poland, where the positive impact of the change in the slope on variance of wages was offset by the change in coefficients on explanatory variables. All in all, this suggests that in most CEE countries the observed decrease in wage inequality was linked to factors unobserved in our data, likely institutional adjustments related to the Great Recession and its aftermath.

Table 9. Results of RIF regression: Lithuania and Latvia

	2002	Lithuania			Latvia			
	2002	2006	2010	2014	2002	2006	2010	2014
<i>Individual effects</i>								
<i>reference: primary education</i>								
tertiary education	0.163***	0.157***	0.091***	0.037***	0.109***	0.051***	0.024***	
secondary education	-0.010*	0.001	-0.047***	-0.020*	-0.033***	-0.039***	-0.032***	
<i>reference: under 30 years old</i>								
30-49 years old	0.054***	0.083***	0.111***	0.114***	0.099***	0.106***	0.118***	
50 years old or more	0.071***	0.095***	0.128***	0.133***	0.091***	0.091***	0.117***	
<i>reference: male</i>								
female	-0.093***	-0.102***	-0.102***	-0.116***	-0.108***	-0.103***	-0.087***	
<i>reference: tenure of less than a year</i>								
tenure: 1-4 years	0.012***	0.025***	-0.027***	-0.004	0.025***	0.006*	0.029***	
tenure: 5-9 years	0.042***	0.072***	-0.004	-0.014*	0.075***	0.030***	0.040***	
tenure: 10 years or more	0.043***	0.065***	0.029***	0.017**	0.063***	0.033***	0.027***	
<i>reference: ISCO 9</i>								
ISCO 1-3	-0.043***	-0.090***	-0.232***	-0.066***	-0.089***	-0.044***	-0.027***	
ISCO 4-5	-0.115***	-0.155***	-0.214***	-0.131***	-0.169***	-0.126***	-0.126***	
ISCO 6-8	-0.136***	-0.169***	-0.287***	-0.192***	-0.174***	-0.143***	-0.126***	
<i>reference: permanent contract</i>								
fixed contract	-0.033***	0.051***	0.031***	-0.012	0.194***	0.055***	0.045***	
<i>Firm effects</i>								
<i>reference: non-market services</i>								
manufacturing and construction	0.081***	0.026***	-0.024**	0.021**	0.060***	0.120***	0.105***	
market services	0.101***	0.031***	0.014	0.063***	0.105***	0.156***	0.155***	
<i>reference: private ownership of a firm</i>								
public ownership of a firm	-0.068***	-0.109***	-0.115***	-0.112***	-0.147***	-0.079***	-0.090***	
tenure: less than 2 years (share)	0.069***	0.089***	0.063***	0.004	0.089***	0.072***	0.056***	
age: 50 years or more (share)	-0.242***	-0.125***	-0.081***	-0.054***	-0.161***	-0.131***	-0.108***	
tertiary education (share)	0.348***	0.183***	0.146***	0.133***	0.327***	0.331***	0.363***	
female (share)	-0.029***	-0.007	0.028***	0.082***	0.043***	0.037***	0.005	
constant	0.312***	0.330***	0.474***	0.270***	0.383***	0.192***	0.126***	
Observations	136,513	115,577	26,093	31,504	271,872	198,862	154,293	
R-squared	0.117	0.084	0.100	0.082	0.083	0.103	0.097	

Standard errors in parentheses

* p<0.1, ** p<0.05 ***p<0.01

Data: European Structure of Earnings Survey

Table 10. Results of RIF regression: Hungary

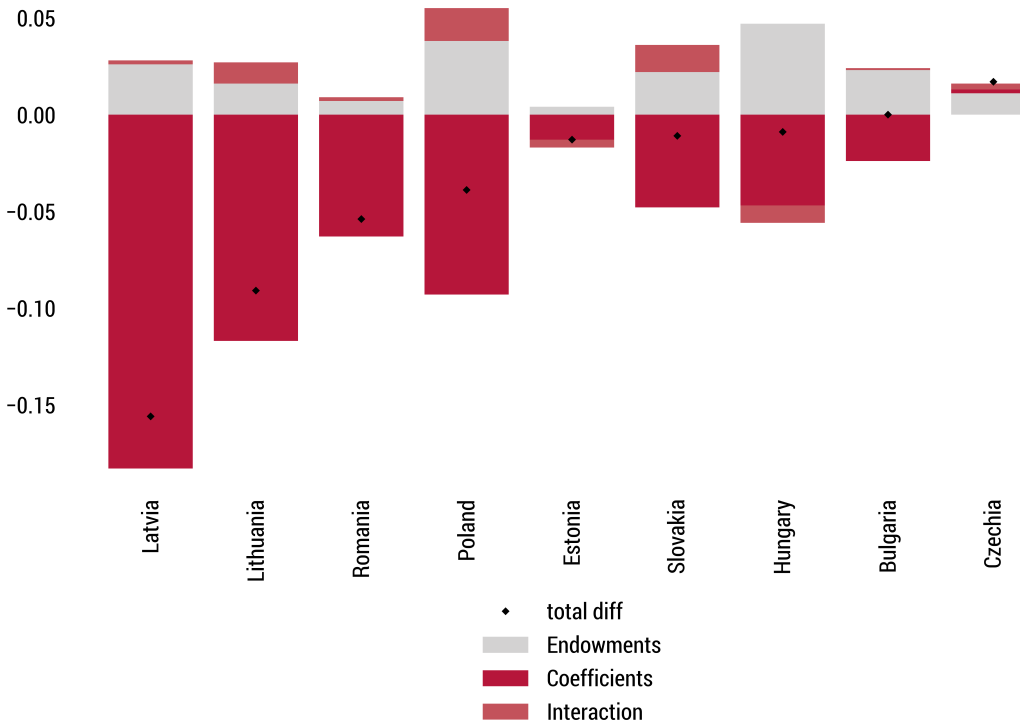
	Hungary			
	2002	2006	2010	2014
<i>Individual effects</i>				
<i>reference: primary education</i>				
tertiary education		0.265***	0.285***	0.150***
secondary education		-0.034***	-0.030***	-0.096***
<i>reference: under 30 years old</i>				
30-49 years old		0.100***	0.108***	0.116***
50 years old or more		0.141***	0.135***	0.151***
<i>reference: male</i>				
female		-0.105***	-0.105***	-0.100***
<i>reference: tenure of less than a year</i>				
tenure: 1-4 years		-0.012***	-0.049***	-0.122***
tenure: 5-9 years		0.003*	-0.038***	-0.091***
tenure: 10 years or more		-0.007***	-0.023***	-0.099***
<i>reference: ISCO 9</i>				
ISCO 1-3		-0.025***	-0.163***	-0.060***
ISCO 4-5		-0.081***	-0.216***	-0.134***
ISCO 6-8		-0.179***	-0.281***	-0.213***
<i>reference: permanent contract</i>				
fixed contract		-0.023***	-0.044***	-0.081***
<i>Firm effects</i>				
<i>reference: non-market services</i>				
manufacturing and construction		0.131***	0.158***	0.066***
market services		0.158***	0.172***	0.085***
<i>reference: private ownership of a firm</i>				
public ownership of a firm		-0.079***	-0.032***	-0.026***
tenure: less than 2 years (share)		0.097***	0.113***	0.167***
age: 50 years or more (share)		-0.202***	-0.278***	-0.267***
tertiary education (share)		0.050***	0.148***	0.073***
female (share)		-0.060***	-0.037***	-0.081***
constant		0.286***	0.337***	0.416***
Observations		731,329	781,240	824,876
R-squared		0.171	0.160	0.162

Standard errors in parentheses

* p<0.1, ** p<0.05 ***p<0.01

Data: European Structure of Earnings Survey

Figure 2. Three-component decomposition of the changes in the variance of log wages between 2006 and 2014



Source: Own calculations based on European Structure of Earnings Survey

6 Conclusions

Wage inequality has decreased in most Central and Eastern European countries between early 2000s and mid 2010s. A slight increase was observed only in the Czech Republic, which still has the lowest level of wage inequality in the region. The observed trends stood in contrast to the pattern of increasing wage inequality evidenced for many other Western countries (Autor, Katz, and Kearney, 2008; Card, Heining, and Kline, 2013). The observed decrease in wage inequality was concentrated mostly in 2006-2014, raising the question on the role of the Great Recession and the post-crisis adjustments.

In line with the ongoing debate on the role of firms in shaping wage inequality, we found that wage inequality was higher between firms than within them, and this was true both in early 2000s and in 2014. Once we account for workers' and firms' characteristics and calculate residual wage inequality, the role of the between-firm component diminishes. Among the firm characteristics that contribute the most to the level of wage inequality, three stand out. First, working in a firm operating in the market services sector contributes to higher wage inequality. Second, so does working in a firm with a high share of tertiary-educated workers, which likely proxies firms with a relatively high productivity. Third, co-workers' composition in terms of age matters as well, as working in a firm with a higher share of older workers contributes to lower wage inequality.

We also found that among the CEE countries Bulgaria and Romania are interesting cases that deserve further in-depth research investigation. These two countries have relatively high levels of wage inequality (much higher than other countries in the region), and this high level of wage inequality arises in particular in the sector of market services. They also have much higher levels and shares of between-firm wage inequality, which might suggest that Bulgarian and Romanian firms are more heterogeneous in terms of their productivity (and thus wages). Whether this could be linked to their late economic restructuring, lower level of economic development and/or later EU entry (than other countries in the region) requires further studies.

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A Annex

Table A.1. Gini coefficient

year	Bulgaria	Czechia	Estonia	Hungary	Lithuania	Latvia	Poland	Romania	Slovakia
2002	0.34	0.26			0.36		0.34	0.38	0.30
2006	0.35	0.27	0.31	0.32	0.35	0.39	0.35	0.38	0.30
2010	0.35	0.28	0.30	0.33	0.32	0.34	0.33	0.37	0.28
2014	0.36	0.28	0.30	0.32	0.30	0.33	0.34	0.37	0.29

Table A.2. Atkinson index ($\epsilon = 2$)

year	Bulgaria	Czechia	Estonia	Hungary	Lithuania	Latvia	Poland	Romania	Slovakia
2002	0.29	0.18			0.31		0.29	0.34	0.23
2006	0.28	0.19	0.25	0.26	0.30	0.37	0.30	0.34	0.22
2010	0.28	0.21	0.24	0.26	0.27	0.29	0.27	0.32	0.21
2014	0.28	0.21	0.24	0.25	0.24	0.27	0.27	0.31	0.21

Table A.3. Variance of log wages: manufacturing and construction

year	Bulgaria	Czechia	Estonia	Hungary	Lithuania	Latvia	Poland	Romania	Slovakia
2002	0.38	0.19			0.34		0.30	0.36	0.22
2006	0.31	0.18	0.25	0.31	0.35	0.45	0.31	0.33	0.23
2010	0.29	0.19	0.24	0.29	0.28	0.31	0.25	0.32	0.20
2014	0.30	0.19	0.22	0.25	0.24	0.29	0.26	0.28	0.20

Table A.4. Variance of log wages: market services

year	Bulgaria	Czechia	Estonia	Hungary	Lithuania	Latvia	Poland	Romania	Slovakia
2002	0.43	0.23			0.44		0.37	0.58	0.31
2006	0.40	0.29	0.33	0.38	0.39	0.52	0.38	0.52	0.31
2010	0.40	0.31	0.33	0.36	0.35	0.40	0.35	0.48	0.29
2014	0.40	0.31	0.32	0.33	0.32	0.38	0.36	0.46	0.28

Table A.5. Variance of log wages: non-market services

year	Bulgaria	Czechia	Estonia	Hungary	Lithuania	Latvia	Poland	Romania	Slovakia
2002	0.20	0.14			0.35		0.34	0.36	0.18
2006	0.26	0.16	0.27	0.22	0.33	0.42	0.32	0.41	0.18
2010	0.24	0.16	0.25	0.26	0.30	0.29	0.30	0.36	0.17
2014	0.24	0.17	0.25	0.27	0.25	0.26	0.29	0.35	0.19

Table A.6. Summary statistics**(a) Number of observations**

year	Netherlands	Norway	Portugal	Sweden
2002	54 139	518 027		
2006	65 068	878 523	62 438	274 537
2010	92 425	1 257 352	87 516	272 648
2014	80 371	1 346 030	60 977	253 139

(b) Number of firms

year	Netherlands	Norway	Portugal	Sweden
2002	1 550	10 179		
2006	2 070	17 642	3 346	4 733
2010	2 500	28 897	4 449	4 918
2014	2 181	31 073	2 852	3 650

(c) Mean of hourly earnings (EUR)

year	Netherlands	Norway	Portugal	Sweden
2002	15.98	22.07		
2006	15.92	23.96	7.20	15.90
2010	17.97	28.10	8.07	17.63
2014	18.83	30.96	7.70	20.49

Data: European Structure of Earnings Survey

Table A.7. Variance decomposition

(a) Variance of ln wages

year	Netherlands	Norway	Portugal	Sweden
2002	0.21			
2006	0.28	0.12	0.42	0.09
2010	0.27	0.12	0.40	0.09
2014	0.23	0.12	0.35	0.09

(b) Within-firm variance of ln wages

year	Netherlands	Norway	Portugal	Sweden
2002	0.13			
2006	0.18	0.06	0.16	0.06
2010	0.17	0.06	0.16	0.06
2014	0.11	0.06	0.14	0.06

(c) Between-firm variance of ln wages

year	Netherlands	Norway	Portugal	Sweden
2002	0.08			
2006	0.10	0.05	0.26	0.03
2010	0.10	0.05	0.24	0.03
2014	0.12	0.06	0.20	0.03

Data: European Structure of Earnings Survey

Table A.8. Contribution of the within component to variance of log wages

	Level 2006 (percent)	Change 2006-2014 (percent)
Netherlands	63	77
Norway	54	12
Sweden	66	36
Portugal	39	26

Note: the first column shows the contribution of the within-firm component to the level of the variance of log wages in 2006 ($\frac{Var(w_{i,2006}^{within})}{Var(w_{i,2006})}$). The unreported between component is 100% minus the reported within component. The second column shows the contribution of the within component to the change of the variance ($\frac{|\Delta Var(w_{i,2006}^{within})|}{(|\Delta Var(w_{i,2006}^{within})| + |\Delta Var(w_{i,2006}^{between})|)}$)

Data: European Structure of Earnings Survey

Table A.9. Blinder-Oaxaca decomposition: Bulgaria and Romania

	Bulgaria			Romania		
	Endowments	Coefficients	Interaction	Endowments	Coefficients	Interaction
<i>Individual effects</i>						
<i>reference: primary education</i>						
tertiary education	-0.001**	0.014***	-0.003***	-0.001***	0.002	-0.000
secondary education	-0.001***	0.004	0.000	0.001***	-0.003	0.000
<i>reference: under 30 years old</i>						
30-49 years old	0.003***	-0.038***	-0.002***	0.000	-0.022***	-0.000
50 years old or more	-0.005***	-0.024***	0.003***	-0.006***	0.004***	-0.001***
<i>reference: male</i>						
female	0.001***	0.001	-0.000	0.000**	0.002	-0.000
<i>reference: tenure of less than a year</i>						
tenure: 1-4 years	-0.000	0.009***	0.001***	-0.000	-0.000	-0.000
tenure: 5-9 years	-0.001***	0.009***	-0.002***	-0.001***	-0.000	0.000
tenure: 10 years or more	0.000***	0.010***	0.000***	-0.001***	-0.010***	0.001***
<i>reference: ISCO 9</i>						
ISCO 1-3	-0.010***	-0.007**	0.001**	-0.005***	0.020***	-0.003***
ISCO 4-5	0.002***	0.011***	-0.001***	0.000*	-0.013***	0.001***
ISCO 6-8	-0.005***	0.009***	0.002***	-0.007***	-0.016***	-0.005***
<i>reference: permanent contract</i>						
fixed contract	0.002***	0.003***	0.001***	0.000***	0.001***	-0.001***
<i>Firm effects</i>						
<i>reference: non-market services</i>						
manufacturing and construction	0.013***	0.002	0.000	0.014***	-0.036***	-0.006***
market services	-0.020***	-0.002	0.000	-0.016***	-0.011***	0.003***
<i>reference: private ownership of a firm</i>						
public ownership of a firm	-0.004***	0.002	0.000	-0.001***	0.013***	0.001***
tenure: less than 2 years (share)	0.004***	-0.029***	-0.004***	0.008***	-0.002	-0.001
age: 50 years or more (share)	0.017***	0.006	-0.001	0.010***	-0.041***	0.006***
tertiary education (share)	-0.021***	-0.013***	0.003***	-0.003***	-0.087***	0.002***
female (share)	0.001***	0.020***	-0.000***	0.000***	0.030***	-0.000***
constant		0.038**			0.231***	
total	-0.023***	0.024***	-0.001	-0.007***	0.063***	-0.002*
Observations		331,183			512,290	

Standard errors in parentheses. ISCO variables are based on International Standard Classification of Occupations (1-digit level).

* p<0.1, ** p<0.05, ***p<0.01

Data: European Structure of Earnings Survey

Table A.10. Blinder-Oaxaca decomposition: Czechia and Slovakia

	Czechia			Slovakia		
	Endowments	Coefficients	Interaction	Endowments	Coefficients	Interaction
<i>Individual effects</i>						
<i>reference: primary education</i>						
tertiary education	-0.005***	0.007***	-0.001***	-0.004***	0.024***	-0.007***
secondary education	-0.001***	0.006***	0.000***	-0.009***	-0.008***	-0.001***
<i>reference: under 30 years old</i>						
30-49 years old	-0.004***	-0.011***	0.001***	0.001***	-0.014***	-0.000***
50 years old or more	0.001***	-0.008***	-0.000***	-0.005***	-0.011***	0.001***
<i>reference: male</i>						
female	0.002***	0.005***	-0.000***	0.000	-0.003***	0.000
<i>reference: tenure of less than a year</i>						
tenure: 1-4 years	-0.001***	0.005***	0.001***	-0.002***	0.007***	0.002***
tenure: 5-9 years	0.000***	0.009***	-0.000***	0.001***	0.010***	-0.002***
tenure: 10 years or more	0.000***	0.010***	-0.000***	0.000***	0.014***	-0.002***
<i>reference: ISCO 9</i>						
ISCO 1-3	-0.002***	0.009***	0.000***	0.001***	0.006***	-0.000***
ISCO 4-5	0.007***	0.006***	-0.001***	0.007***	0.012***	-0.003***
ISCO 6-8	-0.008***	0.010***	0.001***	-0.011***	-0.000	-0.000
<i>reference: permanent contract</i>						
fixed contract	0.001***	0.008***	-0.001***	0.000***	-0.001**	0.000**
<i>Firm effects</i>						
<i>reference: non-market services</i>						
manufacturing and construction	0.004***	-0.000	-0.000	0.004***	0.020***	0.005***
market services	-0.004***	-0.005***	0.000***	-0.006***	0.015***	-0.003***
<i>reference: private ownership of a firm</i>						
public ownership of a firm	0.000***	-0.001	0.000	0.001***	0.002***	-0.000***
tenure: less than 2 years (share)	0.001***	-0.014***	-0.001***	0.002***	-0.021***	-0.005***
age: 50 years or more (share)	-0.001***	-0.026***	-0.001***	0.006***	-0.043***	0.005***
tertiary education (share)	-0.003***	-0.006***	0.001***	-0.009***	0.017***	-0.005***
female (share)	-0.001***	0.018***	-0.001***	-0.000	-0.010***	0.000
constant		-0.025***			0.034***	
total	-0.011***	-0.002***	-0.003***	-0.022***	0.048***	-0.014***
Observations		4,107,772			1,546,292	

Standard errors in parentheses. ISCO variables are based on International Standard Classification of Occupations (1-digit level).

* p<0.1, ** p<0.05, ***p<0.01

Data: European Structure of Earnings Survey

Table A.11. Blinder-Oaxaca decomposition: Estonia and Poland

	Estonia			Poland		
	Endowments	Coefficients	Interaction	Endowments	Coefficients	Interaction
<i>Individual effects</i>						
<i>reference: primary education</i>						
tertiary education	0.002***	0.004**	0.000**	-0.015***	0.045***	-0.011***
secondary education	0.000***	-0.007*	0.000*	-0.002***	0.008***	0.001***
<i>reference: under 30 years old</i>						
30-49 years old	0.002***	-0.007***	-0.000***	0.001***	0.007***	0.000***
50 years old or more	-0.004***	-0.008***	0.001***	-0.007***	0.010***	-0.002***
<i>reference: male</i>						
female	-0.001***	0.002	0.000	0.000***	0.007***	-0.000***
<i>reference: tenure of less than a year</i>						
tenure: 1-4 years	0.000	-0.000	-0.000	0.000	0.001	0.000
tenure: 5-9 years	-0.000	0.006***	-0.000	-0.000	0.004***	-0.000***
tenure: 10 years or more	-0.000	0.003	-0.000	-0.000***	-0.011***	0.000***
<i>reference: ISCO 9</i>						
ISCO 1-3	0.001***	-0.037***	0.001***	0.001***	-0.016***	0.001***
ISCO 4-5	0.003***	-0.023***	0.002***	0.002***	0.002**	-0.000**
ISCO 6-8	-0.007***	-0.024***	-0.004***	-0.003***	-0.000	-0.000
<i>reference: permanent contract</i>						
fixed contract	0.000***	0.001***	0.000***	0.000***	0.007***	0.000***
<i>Firm effects</i>						
<i>reference: non-market services</i>						
manufacturing and construction	0.001**	0.003	0.000	0.001***	0.019***	0.001***
market services	-0.004***	-0.005**	0.001**	-0.004***	0.012***	-0.001***
<i>reference: private ownership of a firm</i>						
public ownership of a firm	-0.001***	-0.012***	-0.001***	-0.005***	-0.011***	-0.002***
tenure: less than 2 years (share)	-0.000***	-0.008**	0.000**	0.000***	0.012***	0.000***
age: 50 years or more (share)	0.003***	0.002	-0.000	0.005***	-0.020***	0.003***
tertiary education (share)	0.002***	0.011***	0.003***	-0.012***	0.030***	-0.007***
female (share)	-0.000**	-0.022***	0.000*	-0.000***	0.025***	-0.000***
constant		0.133***			-0.038***	
total	-0.004***	0.013***	0.004***	-0.038***	0.093***	-0.017***
Observations		228,354			1,347,783	

Standard errors in parentheses. ISCO variables are based on International Standard Classification of Occupations (1-digit level).

* p<0.1, ** p<0.05, ***p<0.01

Data: European Structure of Earnings Survey

Table A.12. Blinder-Oaxaca decomposition: Lithuania and Latvia

	Lithuania			Latvia		
	Endowments	Coefficients	Interaction	Endowments	Coefficients	Interaction
<i>Individual effects</i>						
<i>reference: primary education</i>						
tertiary education	-0.005***	0.055***	-0.018***	-0.002***	0.036***	-0.007***
secondary education	-0.002*	0.010	0.002	-0.003***	-0.001	-0.000
<i>reference: under 30 years old</i>						
30-49 years old	0.009***	-0.014***	-0.002***	0.003***	-0.009***	-0.001***
50 years old or more	-0.012***	-0.014***	0.004***	-0.005***	-0.009***	0.001***
<i>reference: male</i>						
female	0.004***	0.008**	-0.000**	0.001***	-0.012***	0.000***
<i>reference: tenure of less than a year</i>						
tenure: 1-4 years	-0.000	0.008***	0.001***	0.001***	-0.001	-0.000
tenure: 5-9 years	0.000*	0.017***	-0.003***	-0.000***	0.007***	-0.000***
tenure: 10 years or more	-0.001**	0.016***	-0.004***	-0.001***	0.009***	-0.002***
<i>reference: ISCO 9</i>						
ISCO 1-3	0.002***	-0.011**	0.001**	0.001***	-0.028***	0.001***
ISCO 4-5	0.001***	-0.004**	0.000**	0.000**	-0.008***	0.000**
ISCO 6-8	-0.007***	0.006**	0.001**	-0.004***	-0.011***	-0.001***
<i>reference: permanent contract</i>						
fixed contract	0.000	0.005***	-0.002***	-0.000***	0.008***	-0.001***
<i>Firm effects</i>						
<i>reference: non-market services</i>						
manufacturing and construction	0.001**	0.002	0.000	0.004***	-0.011***	-0.002***
market services	0.001***	-0.009***	-0.001***	-0.000	-0.018***	0.000
<i>reference: private ownership of a firm</i>						
public ownership of a firm	0.010***	0.001	-0.000	0.003***	-0.027***	0.002***
tenure: less than 2 years (share)	0.000	0.031***	0.007***	0.004***	0.013***	0.002***
age: 50 years or more (share)	0.005***	-0.026***	0.007***	0.005***	-0.020***	0.002***
tertiary education (share)	-0.019***	0.023***	-0.007***	-0.031***	-0.015***	0.003***
female (share)	-0.002***	-0.048***	0.002***	-0.000	0.022***	-0.000***
constant		0.060***			0.257***	
total	-0.016***	0.117***	-0.011***	-0.026***	0.183***	-0.002**
Observations		147,081			426,165	

Standard errors in parentheses. ISCO variables are based on International Standard Classification of Occupations (1-digit level).

* p<0.1, ** p<0.05, ***p<0.01

Data: European Structure of Earnings Survey

Table A.13. Blinder-Oaxaca decomposition: Hungary

	Hungary		
	Endowments	Coefficients	Interaction
<i>Individual effects</i>			
<i>reference: primary education</i>			
tertiary education	-0.007***	0.035***	-0.005***
secondary education	-0.002***	0.036***	0.001***
<i>reference: under 30 years old</i>			
30-49 years old	-0.004***	-0.009***	0.001***
50 years old or more	0.001***	-0.003***	-0.000***
<i>reference: male</i>			
female	-0.003***	-0.003***	-0.000***
<i>reference: tenure of less than a year</i>			
tenure: 1-4 years	-0.000	0.036***	0.000
tenure: 5-9 years	-0.002***	0.017***	0.002***
tenure: 10 years or more	-0.003***	0.025***	0.003***
<i>reference: ISCO 9</i>			
ISCO 1-3	-0.000**	0.015***	0.000**
ISCO 4-5	-0.009***	0.006***	0.004***
ISCO 6-8	0.005***	0.010***	-0.001***
<i>reference: permanent contract</i>			
fixed contract	-0.002***	0.003***	0.001***
<i>Firm effects</i>			
<i>reference: non-market services</i>			
manufacturing and construction	0.001***	0.018***	0.001***
market services	-0.003***	0.023***	-0.002***
<i>reference: private ownership of a firm</i>			
public ownership of a firm	-0.001***	-0.025***	-0.002***
tenure: less than 2 years (share)	-0.012***	-0.029***	0.005***
age: 50 years or more (share)	-0.001***	0.019***	0.000***
tertiary education (share)	-0.003***	-0.007***	0.001***
female (share)	-0.001***	0.011***	0.000***
constant		-0.130***	
total	-0.047***	0.047***	0.009***
Observations		1,556,205	

Standard errors in parentheses. ISCO variables are based on International Standard Classification of Occupations (1-digit level).

* p<0.1, ** p<0.05, ***p<0.01

Data: European Structure of Earnings Survey