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ABSTRACT

Wage Dispersion and Firm Productivity in Different Working Environments*

This paper investigates the impact of wage dispersion on firm productivity in different working environments. More precisely, it examines the interaction with: i) the skills of the workforce, using a more appropriate indicator than the standard distinction between white- and blue collar workers, and ii) the uncertainty of the firm economic environment, which has, to our knowledge, never been explored on an empirical basis. Using detailed LEED for Belgium, we find a hump-shaped relationship between (conditional) wage dispersion and firm productivity. This result suggests that up to (beyond) a certain level of wage dispersion, the incentive effects of "tournaments" dominate (are dominated by) "fairness" considerations. Findings also show that the intensity of the relationship is stronger for highly skilled workers and in more stable environments. This might be explained by the fact that monitoring costs and production-effort elasticity are greater for highly skilled workers and that in the presence of high uncertainty workers have less control over their effort-output relation and associate higher uncertainty with more unfair environments.

JEL Classification: J31, J24, M52

Keywords: wage dispersion, labour productivity, working environments, personnel economics, linked employer-employee data

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1. Introduction

The potential influence of pay systems on workers' productivity is a key issue addressed by personnel economics. In this context, relative wages are often considered to play a determinant role. Assuming that workers compare their wages with those of their co-workers when determining their level of effort, wage dispersion should influence this level and hence average firm performance. However, there is no clear theoretical consensus on the characteristics of this relationship. First, the "tournament model" proposed by Lazear and Rosen (1981) stresses that a more differentiated wage structure stimulates workers' effort, through the incentive resulting from awarding the largest prize to the most productive worker. Their approach further suggests that the higher the pay spread, the higher the workers' optimal level of effort. In contrast, other theories argue that wage compression, i.e. a lower dispersion, reinforces workers' productivity by either improving labour relations (Akerlof and Yellen, 1988), sustaining and stimulating cohesiveness among the workforce (Levine, 1991) or preventing workers from engaging in costly rent-seeking activities instead of productive work (Milgrom and Roberts, 1990).

Given the importance of this issue, a growing empirical literature is devoted to analysing the relationship between wage dispersion and firm performance (e.g. Eriksson, 1999; Winter-Ebmer and Zweimüller, 1999; Hibbs and Locking, 2000; Lallemand *et al.*, 2007; Martins, 2008). Yet the precise impact of wage dispersion on firm performance still remains unclear as both positive and negative impacts are suggested. Moreover, studies considering that this relationship might be influenced by specific working environments are not numerous, even though, as indicated by Pfeffer and Langton (1993), "one of the more useful avenues for research on pay systems may be precisely this task of determining not which pay scheme is best but, rather, under what conditions salary dispersion has positive effects and under what conditions it has negative effects" (p. 383).

Therefore, the aim of this paper is to analyse the sign and magnitude of the impact of wage dispersion on firm productivity in the Belgian private sector and to examine whether this relationship varies across different working environments. On the one hand, we investigate the role played by the skills of the workforce, using a more appropriate indicator than the standard distinction between white- and blue-collar workers. To do so, we combine information on levels of education and occupations. On the other, we analyse the interaction with the uncertainty of the firm economic environment. This has, to our knowledge, never been explored before on an empirical basis.

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In order to achieve these objectives, we use a large and detailed matched employer-employee data set for the year 2003 and compute a conditional wage dispersion indicator, as suggested by Winter-Ebmer and Zweimüller (1999). We test for a possible hump-shaped relationship between wage dispersion and firm productivity and address the potential simultaneity problem between these variables.

The remainder of this paper is organised as follows. Section 2 reviews the literature regarding the impact of wage dispersion on firm performance. We describe our methodology in section 3 and present the data set in section 4. Section 5 is devoted to a presentation and discussion of the impact of wage dispersion on firm performance and to potential differences of this impact in different working environments. Section 6 draws some conclusions.

2. Review of the literature

2.1 Wage dispersion and firm performance

From a theoretical point of view, Akerlof and Yellen (1988) are among the first to stress that a compressed wage distribution improves labour relations and thus firm performance by stimulating the average worker's effort. They develop a model where workers' effort does not only depend on the wage level but also on the degree of wage dispersion within the firm. Later, Akerlof and Yellen (1990) develop the notion of fairness through their "fair wage-effort" hypothesis which shows that a worker will reduce his effort if his actual wage falls short of the wage he considers fair. The authors further point out that a wage is regarded as fair if the pay spread is lower than the performance differential. Levine (1991) states that wage compression, within a firm where teamwork is essential, increases the firm's total productivity by stimulating cohesiveness. Hibbs and Locking (2000) provide a firm-level production function in which firms should establish a wage distribution that is more compressed than the variation in workers' productivity. Milgrom (1988) and Milgrom and Roberts (1990) postulate that wage compression should reduce workers' incentives to: i) withhold information from management in order to increase their influence, ii) engage in costly rent-seeking activities instead of productive work, and iii) take personal interest decisions, which may not be profitable for the organisation.

In contrast to previous "fairness" theories, Lazear and Rosen (1981) develop the "tournament" model which emphasises a positive impact of wage dispersion on firm performance. According to the authors, firms should establish a performance-based pay system where the largest prize is awarded to the most productive worker. Considering two identical risk-neutral workers and a risk-neutral firm with a compensation scheme such that the most productive worker receives a high wage (W_H) and the least productive one a low wage (W_L), their model leads to the conclusion that, *ceteris paribus*, workers' optimal level of effort: i) increases with the prize dispersion ($W_H - W_L$), and ii) decreases with the random component of output (e.g. luck). Subsequently, McLaughlin (1988) generalises this model for *n* players stressing that there should be a positive correlation between the prize spread and the number of contestants as the probability of winning the prize decreases with the number of contestants.

However, Lazear (1989, 1995) later develops the "hawks and doves" theory where a higher wage dispersion generates more competition between workers which may, in turn, negatively affect firm performance. This is particularly the case when some workers, the "hawks", are non-cooperative or adopt sabotage activities which reduce the probability that less aggressive workers, the "doves", will win the prize. The author therefore stresses that a compressed wage structure is more productive when the positive impact of an output-based pay system on firm performance is offset by a lower level of work cohesion due to the sabotage behaviour of "hawks".

Empirical studies confirm the ambiguous results to be expected from previous theoretical considerations. A first strand of the literature provides evidence in favour of the "fairness" theories. This is the case, for instance, of the study by Cowherd and Levine (1992) examining business units in North America and Europe, the one by Pfeffer and Langton (1993) on academic departments' performance in the UK and several studies essentially concentrated on US professional team sports[1].

Another strand of the empirical literature supports the "tournament" theory. For instance, using US and Swedish data respectively, Main *et al.* (1993) and Eriksson (1999) report a positive impact of top executive pay dispersion on firm performance[2]. Moreover, Lallemand *et al.* (2007) find that wage dispersion has a positive impact on the performance of large Belgian firms in 1995. Also noteworthy is that the study of Hibbs and Locking (2000), examining the effects of changes in the overall wage dispersion on the productive efficiency of Swedish industries and plants, does not confirm that wage levelling enhances productivity.

Besides, some authors find mixed results. Frick *et al.* (2003) measure the impact of wage inequalities on performance across different sports leagues. Their results support "fairness" arguments for some leagues and "tournament" theory for others. Winter-Ebmer and Zweimüller (1999) and Bingley and Eriksson (2001) report a hump-shaped relationship between wage dispersion and firm productivity, in Austria and Denmark respectively, this finding therefore being consistent to some extent with both the "fairness" and the "tournament" theories. Braakmann (2008) also identifies a hump-shaped relationship in Germany, albeit very weak. Finally, Martins (2008) finds a positive influence of wage dispersion on the performance of Portuguese firms only when fixed effects are not included. In contrast, fixed effects estimations reveal a strong negative impact of wage dispersion on firm performance.

2.2 Working environments

Few papers go a step further by investigating the impact of wage dispersion on firm performance across several working environments. Pfeffer and Langton (1993) point out that the magnitude of the negative impact of wage dispersion on academic departments' performance depends on a person's position in the salary structure and factors such as information, commitment, consensus and the level of certainty in the evaluation process. Beaumont and Harris (2003) show that the impact of pay inequality on UK firm performance depends on the sector considered and on differences in firms' size and ownership. Using data from the UK, Belfield and Marsden (2003) find that the extent to which the use of performance-related pay increases performance depends on the structure of firm monitoring environments. Jirjahn and Kraft (2007) show that wage dispersion only has a significant positive impact on the productivity of German firms when interaction effects with both the type of incentive scheme employed and the industrial relations regime are taken into account.

Existing studies thus clearly indicate that the relationship between wage dispersion and firm performance should be investigated in interaction with the characteristics of the working environment. In this paper, we will focus on the role played by i) the skills of the workforce and ii) the uncertainty of the firm economic environment.

2.2.1 Skills of the workforce. From a theoretical perspective, Lazear's model (1989, 1995) of "hawks and doves" suggests that it is profitable for a firm to adjust its compensation scheme to the characteristics of the workforce. The author stresses that a more compressed wage structure is preferable at the top level of the firm, where "hawks" are more present. Milgrom (1988) and Milgrom and Roberts (1990) also argue that lower levels of wage dispersion are more appropriate for white-collar workers because it is more costly to monitor their actions in order to prevent them from taking personal interest decisions as wage dispersion increases. In contrast, Prendergast (2002) suggests that it is more important to tie wages to firm performance for complex positions (occupied by highly skilled workers) as they are harder to monitor. The point is that pay-for-performance mechanisms would induce highly skilled workers to act in the optimal way. As a result, the relation between wage dispersion and firm productivity would be stronger among highly skilled workers. Moreover, Foss and Laursen (2005) postulate that managers can better apprehend tasks in industries that are low-knowledge intensive, which have on average a low-skilled workforce, and therefore have less need to use pay-for-performance mechanisms to increase productivity, as the asymmetrical information is reduced. According to Barth *et al.* (2008), highly skilled workers should also be more extensively paid according to performance because they can increase their productivity more easily than less-skilled workers.

Empirical evidence regarding the effect of the composition of the workforce on the relationship between wage dispersion and productivity again presents mixed results. On the one hand, the turning point of the hump-shaped relationship between wage dispersion and firm performance found by Winter-Ebmer and Zweimüller (1999) is encountered at a higher level of wage dispersion for blue-collar workers than for white-collar workers. On the other hand, the study by Bingley and Eriksson (2001) on the Danish private sector also reports a hump-shaped relationship but for white-collar staff only, no impact being found for blue-collar staff. Grund and Westergaard-Nielsen (2008), also analysing the Danish private sector, come to the same conclusion when they use the OLS technique while no relation is found when they include fixed effects. Heyman (2005) also finds a positive impact of wage dispersion on profits for both managers and white-collar workers in Sweden. But on the other hand, Lallemand *et al.* (2007) find that the positive impact of wage dispersion on firm performance is stronger among blue-collar staff.

2.2.2 Uncertainty of the firm economic environment. The "tournament" model leads to the conclusion that there should be larger wage spreads when risk is more significant, in order to offset the reduction in effort induced by the higher prevalence of the luck factor (Lazear, 1995). This reduction in the level of effort comes from the fact that workers will not compete hard to win the prize as luck is an important factor and they therefore have less influence over their output.

Prendergast (2002) also argues that pay-for-performance mechanisms will be more widely used in the presence of high uncertainty by introducing the notion of delegation: "uncertain environments result in the delegation of responsibilities, which in turn generates incentive pay based on output" (p. 1072). This is because in riskier environments, the principal is less able to figure out how the agent should optimally behave. In consequence, "input monitoring will be used in stable settings, but less so in more uncertain environments, where workers will be offered more discretion but will have their actions constrained by tying pay to performance" (Prendergast, 2002, p. 1074).

Both authors thus suggest a positive relation between uncertainty and wage dispersion. But this does not mean that the analysed relationship, i.e. the impact of wage dispersion on firm productivity, should be stronger in the case of high uncertainty. On the contrary, the “tournament” model leads to the conclusion that workers will not compete hard to win the prize if uncertainty is high. So, from this point of view, the impact of wage dispersion on firm performance should be weaker in the presence of higher uncertainty.

“Fairness” considerations also tend to support this weaker relation. Indeed, according to Pfeffer and Langton (1993), wage inequality will be perceived as more fair if rewards are allocated on a fair basis, that is to say if they “are based on criteria that are normatively valued” (p. 385). From this argument, we may assume that the impact of wage dispersion on firm performance is weaker in the presence of high uncertainty, as in this case workers have less control over their effort-output relation and therefore consider pay-for-performance as more unfair. So both arguments suggest that a weaker relation between wage dispersion and productivity should appear in the case of higher uncertainty.

3. Methodology

Two types of wage dispersion indicators can be found in the literature: unconditional indicators, where wage dispersion is measured between heterogeneous workers, and conditional indicators, where wage dispersion is measured between workers with similar observable characteristics. A conditional indicator appears more appropriate to examine theories such as “tournaments” or “fairness” since they refer to wage differentials between similar workers. We thus examine the impact of wage dispersion on firm productivity using a conditional indicator for wage dispersion.

To compute our conditional wage inequality indicator, we follow the Winter-Ebmer and Zweimüller (1999) methodology which rests upon a two-step estimation procedure. In the first step, we estimate by OLS the following wage equation for each firm separately:

$$\ln w_{ij} = \alpha_0 + \mathbf{y_{ij}}\, \boldsymbol{\alpha_1} + \varepsilon_{ij} \qquad (1)$$

where w_{ij} is the gross hourly wage of worker i in firm j, $\mathbf{y_{ij}}$ is the vector of individual characteristics including age, age squared, sex, education (2 dummies) and occupation (1 dummy), and ε_{ij} is the error term.

The standard deviations of the residuals of these regressions run firm by firm, σ_j, are then used as a conditional measure of wage dispersion in the second step, which consists in estimating the following firm-level performance equation:

$$\ln va\_work_j = \beta_0 + \beta_1 \sigma_j (+ \beta_2 \sigma_j^2) + \mathbf{x_j} \boldsymbol{\beta_3} + \mathbf{z_j} \boldsymbol{\beta_4} + \nu_j \qquad (2)$$

where va_work_j is the performance of firm j, measured by the average value added per worker; σ_j is the conditional wage dispersion indicator, in level (and in most specifications also in quadratic form in order to test for a hump-shaped relationship); $\mathbf{x_j}$ contains aggregated characteristics of workers in firm j, i.e. the share of the workforce that: i) has at most attended lower secondary school, ii) has more than 10 years of tenure and iii) is younger than 25 and older than 50 years, respectively, the share of women and the share of blue-collar workers; $\mathbf{z_j}$ includes firm characteristics, i.e. the sectoral affiliation (7 dummies), the size of the firm (number of workers) and the level of wage bargaining (2 dummies); and ν_j is the error term.

In order to investigate whether the relationship between wage dispersion and firm productivity depends on working environments and first on the skill level of the workforce, we improve the usual distinction between white- and blue-collar workers which might not be the most appropriate, as some blue-collar staff occupy jobs requiring more skills than those brought to bear by white-collar staff. We therefore measure the level of workforce skills by combining information on the workers' level of education and occupation, assuming that highly skilled workers have a higher level of education than their low-skilled counterparts and thus also occupy jobs requiring more skills. For this purpose, we generate several classes for the educational level and for the abilities required by occupation. On the one hand, the "low educational level" includes workers who have attained lower secondary qualifications at most; the "intermediate educational level" groups together workers who have achieved upper secondary qualifications; and the "high educational level" is constituted by workers who have achieved at least a higher non academic qualification. On the other hand, the "low ability occupation" includes workers whose occupations fall into groups 7 to 9 from the International Standard Classification of Occupations (craft and related trades workers; plant and machine operators and assemblers; and elementary occupations); the "intermediate ability occupation" comprises workers belonging to groups 4 and 5 (clerks; and service workers and shop and market sales workers); and the "high ability occupation" is constituted by groups 1 to 3 (legislators, senior officials and managers; professionals; and technicians and associate professionals)[3]. We then consider that the workforce of a firm is highly (low-) skilled if the firm presents both a proportion of highly (low-) educated workers and a proportion of high- (low-) ability occupations larger than their respective medians on the whole sample.

In order to analyse the role played by the uncertainty of the firm economic environment, we use the following two indicators: mean rates of bankruptcy at the NACE 3 digits level from 1997 to 2003 and the coefficient of variation of the net operating surplus at the NACE 2 digits level from 1997 to 2003. We then estimate equation (2) separately for: i) firms belonging to sectors whose bankruptcy rate is lower *vs.* higher than the median rate of the whole sample, and ii) firms in sectors whose coefficient of variation of the net operating surplus is below *vs.* above the median value of the whole sample.

Finally, one problem to control for is the potential simultaneity between firm productivity and wage dispersion. Indeed, it may be argued that highly productive firms may pay larger wages to their most productive workers, which in turn leads to more wage dispersion. We address this issue by estimating equation (2) with the log of value added per worker of 2004 instead of that of 2003, assuming that the value added of 2004 does not influence the wage structure of 2003.

4. Data set

Our sample is constituted from a matching of two large-scale data sets, both conducted by Statistics Belgium. The first is the 2003 "Structure of Earnings Survey" (SES). It covers all Belgian firms employing at least 10 workers and with economic activities within sections C to K of the NACE Rev.1 nomenclature. This survey contains a wealth of information, provided by the management of the firms, on the characteristics of both individual employees (e.g. age, education, gross earnings, paid hours, sex, occupation) and firms (e.g. sector of activity, number of workers, level of collective wage bargaining). Gross hourly wages are calculated by dividing gross earnings (including overtime earnings and premiums for shift work, night work and/or weekend work) in the reference period (October 2003) by the corresponding number of total paid hours (including overtime).

The SES provides no financial information. This is why we combine it with the 2003 "Structure of Business Survey" (SBS) which is a firm-level survey with a different coverage than the SES in that it does not cover the whole financial sector (NACE J) but only Other Financial Intermediation (NACE 652) and the Activities Auxiliary to Financial Intermediation (NACE 67). The SBS contains firm-level information on financial variables such as sales, value added, gross output, gross operating surplus and value of purchased goods and services.

Both datasets have been matched by Statistics Belgium using the firm social security number as identifier.

The computation of our conditional wage dispersion indicator requires a large number of individual observations per firm. We therefore restrict our sample to firms employing at least 200 workers, which guarantees a minimum of 10 observations per firm. We then consider the regular labour force and thus eliminate apprentices, workers younger than 18, older than 65 or being paid a gross hourly wage of less than 6 euros[4]. We also exclude firms that present negative value added and workers or firms for which data are missing. Our definitive sample is representative of all firms employing at least 200 workers within sections C to K of the NACE Rev. 1 nomenclature, with the exception of electricity, gas and water supply (NACE E) and large parts of the financial sector (NACE J). It covers 20,574 workers from 649 firms in 2003.

[Take in Table 1]

Table 1 shows descriptive statistics for the main variables. It indicates that we are looking at large firms of 408 workers on average with a mean gross hourly wage of 14.83 euros and a conditional hourly wage dispersion of 0.16 euro. In contrast, the average unconditional hourly wage dispersion amounts to 4.61 euros, which thus emphasises that considerable heterogeneity is encompassed by our conditional indicator. We also observe that the annual value-added per worker amounts to 75,919 euros, the mean age of workers is about 38 years, approximately 31% of the workers are women, 50% are blue-collar and 37% have a low level of education (i.e. lower secondary school at most). Firms are essentially concentrated in the manufacturing sector (49%), wholesale and retail trade, repair of motor vehicles, motorcycles and personal and household goods (18%) and in real estate, renting and business activities (13%). Finally, let us note that the average number of observations per firm is around 32, with a minimum of 10 and a maximum of 282.

5. Results

5.1. Wage dispersion and firm performance: general specification

We first estimate equation (2) using standard OLS technique. The results presented in Table 2[5] reveal the existence of a positive and significant relationship between wage dispersion and firm performance, measured by value-added per worker. Indeed, the point estimate amounts to 1.4 and yields an elasticity of 0.22 at sample mean. This result therefore suggests that, on average, a rise of 10% in wage dispersion increases firm productivity by 2.2%.

[Take in Table 2]

Our methodological option in order to control for the potential simultaneity between wage dispersion and firm productivity confirms this result. The same robustness check has been applied to all the results presented below and, on the whole, it confirms them (see Appendix II).

This positive influence of wage dispersion on firm productivity thus tends to support the "tournament" model. We can however assume that the relationship could in fact be hump-shaped. Indeed, an overly small wage dispersion level might negatively affect firm performance due to a lack of incentives and in this case raising wage dispersion should increase firm performance. However, excessive wage dispersion might also be harmful for productivity because of fairness effects. We have therefore tested for a hump-shaped relationship by adding our wage dispersion indicator in quadratic form to equation (2). The findings reported in the third column of Table 2 show that the coefficient of wage dispersion in level is again positive and significant and that our wage dispersion indicator in quadratic form presents a significant negative coefficient. So evidence appears in favour of a hump-shaped relationship between wage dispersion and productivity for large Belgian firms. Our results therefore tend to support both the "tournament" and "fairness" theories. Indeed, they indicate that up to (beyond) a certain level of wage dispersion, the incentive effects of "tournaments" dominate (are dominated by) "fairness" considerations.

The results in Table 2 also allow us to estimate that productivity is greatest when the conditional wage dispersion indicator amounts to 0.34 euro. Beyond this value, increasing wage dispersion would then decrease firm performance. Comparing this turning point with descriptive statistics suggests that wage dispersion in the Belgian private sector is suboptimal from a productivity point of view. Indeed, the optimal value for wage dispersion is found to be more than twice as high as the one observed in our sample.

5.2. Wage dispersion and firm performance in different working environments

5.2.1 Skills of the workforce. Various above-mentioned theories suggest that the relationship between wage dispersion and firm productivity depends on the composition of the workforce. Table 3 presents the impact of wage dispersion on firm productivity depending on whether the workforce is highly or low-skilled.

[Take in Table 3]

Results first highlight again the existence of a significant hump-shaped relationship between wage dispersion and firm productivity, whatever the skill level of the workforce. They also emphasise significant (at the one percent level) differences in the magnitude of the coefficients of wage dispersion between the different levels of workforce skill. Indeed, the magnitude of the coefficients of the wage dispersion variables in level and in quadratic form is larger for firms with a highly skilled workforce, that is to say for firms with a small proportion of low-skilled workers and for firms with a large proportion of highly skilled workers. We estimate from Table 3 that value added per worker is greatest when the conditional hourly wage dispersion amounts to 0.22 euro within firms with a large proportion of low-skilled workers and 0.33 euro within firms with a large proportion of highly skilled workers, against sample mean values of 0.13 and 0.20 euro respectively.

So, the effect of pay dispersion on firm productivity is stronger for highly skilled workers than for their low-skilled counterparts. This result thus tends to support Prendergast's (2002) and Barth *et al.*'s (2008) arguments. Overall, a broader wage dispersion, suggestive of larger pay-for-performance mechanisms, should have a greater impact on firm performance among highly skilled workers due to their higher monitoring costs and productivity-effort elasticity.

5.2.2 Uncertainty of the firm economic environment. In order to estimate the impact of wage dispersion on firm performance depending on whether the environment presents a high degree of uncertainty or not, we estimate equation (2) according to whether or not the mean rate of bankruptcy and the coefficient of variation of net operating surplus (taken separately) are larger than their respective medians on the whole sample.

[Take in Table 4]

The results, presented in Table 4, reveal a significantly (at the one percent level) greater impact of wage dispersion on firm productivity when the environment is less uncertain, whatever the indicator of uncertainty considered. As expected from a theoretical point of view, pay-for-performance mechanisms seem to influence workers' effort less in the presence of high uncertainty as in this case workers should have less control over their effort-output relation and associate higher uncertainty with more unfair environments. The impact of wage dispersion on firm performance nevertheless remains positive in uncertain environments. The turning point of the relationship between wage dispersion and firm performance arrives significantly (at the one percent level) later in presence of less uncertainty, though the difference is relatively small. Indeed, if we focus on the coefficient of variation of net operating surplus[6], productivity is greatest when the conditional hourly wage dispersion amounts to 0.32 euro in the presence of high uncertainty and to 0.35 euro when uncertainty is low, against sample mean values of 0.16 euro for both.

6. Conclusion

The objective of this paper is twofold. Firstly, we analyse the sign and magnitude of the impact of wage dispersion on firm productivity in the Belgian private sector. There is in fact no consensus regarding this important question in the theoretical and empirical literature. Secondly, we examine whether the relationship between wage dispersion and firm productivity varies across different working environments. Indeed, while Pfeffer and Langton (1993, p.383) point out that "one of the more useful avenues for research on pay systems may be precisely this task of determining not which pay scheme is best but, rather, under what conditions salary dispersion has positive effects and under what conditions it has negative effects", studies on this issue are scarce. On the one hand, we investigate the role played by the skill levels of the workforce, using a more appropriate indicator than the standard distinction between white- and blue-collar workers. To do so, we combine information on levels of education and occupations. On the other, we analyse the interaction with the uncertainty of the firm economic environment. This has, to our knowledge, never been explored before on an empirical basis.

Our methodology is consistent with that of Winter-Ebmer and Zweimüller (1999) which consists in a two-step estimation procedure. In the first step, we compute a conditional wage dispersion indicator by taking the standard errors of wage regressions run for each firm separately. In the second step, we estimate a firm-level productivity equation in which the conditional wage dispersion indicator is the main explanatory variable. The productivity of a firm is measured by the value added per worker. We also test for a possible hump-shaped relationship between wage dispersion and firm productivity and address the potential problem of simultaneity between these two variables.

Our empirical analysis is based on a detailed matched employer-employee data set derived from the combination of the 2003 Structure of Earnings Survey and the 2003 Structure of Business Survey. It is representative of all firms employing at least 200 workers within sections C to K of the NACE Rev. 1 nomenclature, with the exception of the electricity, gas and water supply sector (NACE E) and large parts of the financial sector (NACE J). It covers 20,574 workers from 649 firms in 2003.

Our results show the existence of a significant hump-shaped relationship between wage dispersion and firm productivity for investigated working environments. They support both the "tournament" and "fairness" theories and confirm the following intuition: up to (beyond) a certain level of wage dispersion, the incentive effects of "tournaments" dominate (are dominated by) "fairness" considerations.

Moreover, we find that the intensity of this relationship is stronger for highly skilled workers. This might be explained by the fact that monitoring costs and production-effort elasticity are greater for those workers. Wage dispersion would thus have a larger positive impact on the productivity of highly skilled workers because i) it ensures that they act in the optimal way without forcing the firm to pay higher monitoring costs and ii) they can increase their level of output more easily than their low-skilled counterparts as their output is more sensitive to their effort.

The intensity of the relationship between wage dispersion and firm productivity is also found to be stronger within firms operating in a more stable environment. This could be due to the fact that pay-for-performance mechanisms influence workers' effort less in the presence of higher uncertainty as in this case workers have less control over their effort-output relation and associate higher uncertainty with more unfair environments. A related explanation, based on 'tournaments' considerations, may be that workers will not compete hard to win a prize when uncertainty is greater.

Finally, a comparison of the estimated turning points of the relation and descriptive statistics from our sample suggests that roughly doubling the currently observed wage dispersion would optimise productivity among firms, whatever the environment.

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Notes

[1] For professional baseball teams, see Bloom (1999), Depken (2000), Harder (1992) or Richards and Guell (1998). For hockey teams, see Gomez (2002).

[2] In contrast, analysing managers of large US firms, Leonard (1990) finds no significant relationship between the standard deviation of pay and firm performance.

[3] The sixth group of the ISCO classification, i.e. "skilled agricultural, forestry and fishery workers", is not included in our data set given that it covers sections C to K of the NACE nomenclature.

[4] It is worth mentioning that including these categories of workers would most likely not change our results, as they represent only 0.2 % of the total number of workers.

[5] Detailed results, including control variables, are presented in Appendix I.

[6] Given that the regression coefficient associated to the squared wage dispersion variable is not significant for firms belonging to sectors whose mean rates of bankruptcy are larger than the median rate in the whole sample.

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References

Akerlof, G. A. and Yellen, J. L. (1988), "Fairness and Unemployment", *American Economic Review, Papers and Proceedings*, Vol. 78 No. 2, pp. 44-49.

Akerlof, G. A. and Yellen, J. L. (1990), "The Fair Wage-Effort Hypothesis and Unemployment", *Quarterly Journal of Economics*, Vol. 105 No. 2, pp. 255-283.

Barth, E., Bratsberg, B., Haegeland, T. and Raaum, O. (2008), "Who Pays for Performance", *International Journal of Manpower*, Vol. 29 No. 1, pp. 8-29.

Beaumont, P. B. and Harris, R. I. D. (2003), "Internal Wage Structure and Organizational Performance", *British Journal of Industrial Relations*, Vol. 41 No. 1, pp. 53-70.

Belfield, R. and Marsden, D. (2003), "Performance Pay, Monitoring Environments, and Establishment Performance", *International Journal of Manpower*, Vol. 24 No. 4, pp. 452-471.

Bingley, P. and Eriksson, T. (2001), "Pay Spread and Skewness, Employee Effort and Firm Productivity", Working Paper 01-2, Department of Economics, Aarhus School of Business, University of Aarhus, Denmark.

Bloom, M. (1999), "The Performance Effects of Pay Dispersion on Individuals and Organizations", *Academy of Management Journal*, Vol. 42 No. 1, pp. 25-40.

Braakmann, N. (2008), "Intra-Firm Wage Inequality and Firm Performance – First Evidence from German Linked Employer-Employee-Data", Working paper 77, Working Paper Series in Economics, University of Lüneburg, Germany.

Cowherd, D. M. and Levine, D. I. (1992), "Product Quality and Pay Equity between Lower-level Employees and Top Management: An Investigation of Distributive Justice Theory", *Administrative Science Quarterly*, Vol. 37, pp. 302-320.

Depken, C. A. (2000), "Wage Disparity and Team Productivity. Evidence from Major League Baseball", *Economics Letters*, Vol. 67 No. 1, pp. 87-92.

Eriksson, T. (1999), "Executive Compensation and Tournament Theory: Empirical Tests on Danish Data", *Journal of Labor Economics*, Vol. 17 No. 2, pp. 262-280.

Foss, N. J. and Laursen K. (2005), "Performance Pay, Delegation and Multitasking under Uncertainty and Innovativeness: An Empirical Investigation", *Journal of Economic Behavior & Organization*, Vol. 58 No. 2, pp. 246-276.

Frick, B., Prinz, J. and Winkelmann, K. (2003), "Pay Inequalities and Team Performance: Empirical Evidence from the North American Major Leagues", *International Journal of Manpower*, Vol. 24 No.4, pp. 472-488.

Gomez, R. (2002), "Salary Compression and Team Performance: Evidence from the National Hockey League", *Zeitschrift für Betriebswirtschaft*, Vol. 4, pp. 203-220.

Grund, C. and Westergaard-Nielsen, N. (2008), "The Dispersion of Employees' Wage Increases and Firm Performance", *Industrial and Labor Relations Review*, Vol. 61 No. 4, pp. 485-501.

Harder, J. W. (1992), "Play for Pay: Effects of Inequity in a Pay-for-Performance Context", *Administrative Science Quarterly*, Vol. 37, pp. 321-335.

Heyman, F. (2005), "Pay Inequality and Firm Performance: Evidence from Matched Employer-employee Data", *Applied Economics*, Vol. 37 No. 11, pp. 1313-1327.

Hibbs, D. A. Jr. and Locking, H. (2000), "Wage Dispersion and Productive Efficiency: Evidence for Sweden", *Journal of Labor Economics*, Vol. 18 No. 4, pp. 755-782.

Jirjahn, U. and Kraft, K. (2007), "Intra-firm Wage Dispersion and Firm Performance – Is There a Uniform Relationship?", *Kyklos*, Vol. 60 No. 2, pp. 231-253.

Lallemand, T., Plasman, R. and Rycx, F. (2007), "Wage Structure and Firm Productivity in Belgium", Working paper 12978, National Bureau of Economic Research, Cambridge.

Lazear, E. P. (1989), "Pay Equality and Industrial Politics", *Journal of Political Economy*, Vol. 97 No. 3, pp. 561-580.

Lazear, E. P. (1995), *Personnel Economics*, MIT Press, Cambridge (Mass.).

Lazear, E. P. and Rosen, S. (1981), "Rank-Order Tournaments as Optimum Labor Contracts", *Journal of Political Economy*, Vol. 89 No. 5, pp. 841-864.

Leonard, J. (1990), "Executive Pay and Firm Performance", *Industrial and Labor Relations Review*, Vol. 43 No. 3, pp. 13-29.

Levine, D. I. (1991), "Cohesiveness, Productivity and Wage Dispersion", *Journal of Economic Behavior and Organization*, Vol. 15 No. 2, pp. 237-255.

Main, B., G., O'Reilly, C., A. and Wade, J. (1993), "Top Executive Pay: Tournament or Teamwork?", *Journal of Labor Economics*, Vol. 11 No. 4, pp. 606-628.

Martins, P. S. (2008), "Dispersion in Wage Premiums and Firm Performance", *Economics Letters*, Vol. 101 No.1, pp. 63-65.

McLaughlin, K. J. (1988), "Aspects of Tournaments Models: A Survey", *Journal of Labor Economics*, Vol. 15, pp. 403-430.

Milgrom, P. (1988), "Employment Contracts, Influence Activities and Efficient Organisation Design", *Journal of Political Economy*, Vol. 96 No. 1, pp. 42-60.

.

Milgrom, P. and Roberts, J. (1990), "The Efficiency of Equity in Organisational Decision Processes", *American Economic Review, Papers and Proceedings*, Vol. 80 No. 2, pp. 154-159.

Pfeffer, J. and Langton, N. (1993), "The Effect of Wage Dispersion on Satisfaction, Productivity, and Working Collaboratively: Evidence from College and University Faculty", *Administrative Science Quarterly*, Vol. 38, pp. 382-407.

Prendergast, C. (2002), "The Tenuous Trade-off between Risk and Incentives", *Journal of Political Economy*, Vol. 110 No. 5, pp. 1071-1102.

Richards, D. G. and Guell, R. C. (1998), "Baseball Success and the Structure of Salaries", *Applied Economics Letters*, Vol. 5 No. 5, pp. 291-296.

White, H. (1980), "A heteroscedasticity-consistent covariance matrix estimator and a direct test for heteroscedasticity", *Econometrica*, Vol. 48 No. 4, pp. 817-838.

Winter-Ebmer, R. and Zweimüller, J. (1999), "Intra-Firm Wage Dispersion and Firm Performance", *Kyklos*, Vol. 52 No. 4, pp. 555-572.

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Table 1: Descriptive statistics of selected variables

Variables:	Mean	Std. Dev.
Annual value added per employee (€)	75,918.95	63,280.85
Gross hourly wage (€)	14.83	3.76
Gross monthly wage (€)	2,311.34	758.46
Intra-firm wage dispersion (€):		
Conditional wage dispersion[1]	0.16	0.07
Unconditional wage dispersion[2]	4.61	3.14
Age (years)	38.17	3.78
Females (%)	31.32	26.33
Education (%):		
No degree, primary/lower secondary	36.54	32.03
General upper secondary, technical/artistic/prof. upper secondary	38.76	26.99
Higher non university, university and post graduate	24.7	25.8
Blue-collar workers[3] (%)	50.3	35.92
Size of firm (number of workers)	407.92	394.09
Sector (%):		
Mining and quarrying (C)	0.59	
Manufacturing (D)	48.84	
Construction (F)	6.52	
Wholesale and retail trade, repair of motor vehicles, motorcycles and personal and household goods (G)	17.96	
Hotels and restaurants (H)	2.24	
Transport, storage and communication (I)	9.4	
Financial intermediation (J)	1.2	
Real estate, renting and business activities (K)	13.26	
Number of observations (sampled workers) per firm	31.67	17.48
Number of workers	20,574	
Number of firms	649	

[1] Hourly residual wage dispersion after controlling for human capital variables and workers' characteristics in the wage equation following the Winter-Ebmer and Zweimüller (1999) methodology (i.e. standard errors of wage regressions run for each firm separately). [2] Standard deviation of gross hourly wages within each firm. [3] The distinction between blue- and white-collar workers is based on the International Standard Classification of Occupations (ISCO-88). Workers belonging to groups 1 to 5 are considered to be white-collar workers (1: Legislators, senior officials and managers; 2: Professionals; 3: Technicians and associate professionals; 4: Clerks; 5: Service workers and shop and market sales workers) and those from groups 7 to 9 are considered to be blue-collar workers (7: Craft and related trades workers; 8: Plant and machine operators and assemblers; 9: Elementary occupations).

Table 2: Wage dispersion and firm productivity

Dependent variable:	Value added per worker (ln)	
Intercept	11.64**	11.5**
	(0.23)	(0.23)
Conditional wage dispersion[1]	1.4**	3.36**
	(0.29)	(0.74)
Squared conditional wage dispersion		-4.96**
		(1.8)
Worker characteristics[2]	Yes	Yes
Firm characteristics[3]	Yes	Yes
Adjusted R^2	0.47	0.48
F-stat	35.48**	34.44**
Number of firms	649	649

Notes: **/*/° significant at the 1, 5 and 10% level, respectively. White (1980) heteroscedasticity consistent standard errors are shown in brackets. [1] Hourly residual wage dispersion after controlling for human capital variables and workers' characteristics in the wage equation following the Winter-Ebmer and Zweimüller (1999) methodology (i.e. standard errors of wage regressions run for each firm separately). [2] Share of the workforce that: i) has at most attended lower secondary school, ii) has more than 10 years of tenure and iii) is younger than 25 and older than 50 years, respectively. The share of women and the share of blue-collar workers are also included. [3] Sectoral affiliation (7 dummies), number of workers and level of wage bargaining (2 dummies).

Table 3: Wage dispersion and firm productivity by workforce skill level

Dependent variable:	Value added per worker (ln)			
	Large proportion[1] of low-skilled workers	Small proportion[2] of low-skilled workers	Large proportion[3] of highly skilled workers	Small proportion[4] of highly skilled workers
Intercept	11.03**	11.06**	10.5**	11.2**
	(0.36)	(0.51)	(0.49)	(0.23)
Conditional wage dispersion [5]	2.72**	5.41**	5.43**	1.95**
	(0.92)	(1.85)	(1.87)	(0.74)
Squared conditional wage dispersion	-6.17*	-8.35*	-8.12*	-4.73**
	(2.66)	(3.52)	(3.74)	(1.67)
Worker characteristics[6]	Yes	Yes	Yes	Yes
Firm characteristics[7]	Yes	Yes	Yes	Yes
Adjusted R^2	0.55	0.35	0.31	0.57
F-stat	30.04**	9.71**	8.26**	28.24**
Number of firms	218	222	261	262

Notes: **/*/° significant at the 1, 5 and 10% level, respectively. White (1980) heteroscedasticity consistent standard errors are shown in brackets. [1] Proportion of poorly educated workers and proportion of low-ability occupations larger than their medians (respectively 0.281 and 0.625). [2] Proportion of poorly educated workers and proportion of low-ability occupations smaller than their respective medians. [3] Proportion of highly educated workers and proportion of high-ability occupations larger than their median, respectively 0.176 and 0.145. [4] Proportion of highly educated workers and proportion of high-ability occupations smaller than their respective medians. [5] Hourly residual wage dispersion after controlling for human capital variables and workers' characteristics in the wage equation following the Winter-Ebmer and Zweimüller (1999) methodology (i.e. standard errors of wage regressions run for each firm separately). [6] Share of the workforce that: i) has at most attended lower secondary school, ii) has more than 10 years of tenure and iii) is younger than 25 and older than 50 years, respectively. The share of women and the share of blue-collar workers are also included. [7] Sectoral affiliation (7 dummies), number of workers and level of wage bargaining (2 dummies).

Table 4: Wage dispersion and firm productivity by degree of uncertainty

Dependent variable:	Value added per worker (ln)			
	Mean rate of bankruptcy		CV of net operating surplus	
	High uncertainty[1]	Low uncertainty[2]	High uncertainty[3]	Low uncertainty[4]
Intercept	11.39**	11.4**	11.34**	11.39**
	(0.3)	(0.36)	(0.3)	(0.33)
Conditional wage dispersion[5]	1.51°	4.78**	2.43*	3.83**
	(0.86)	(1.18)	(0.96)	(1.11)
Squared conditional wage dispersion	-1.64	-7.2*	-3.85°	-5.45°
	(2.02)	(3.2)	(2.19)	(2.89)
Worker characteristics[6]	Yes	Yes	Yes	Yes
Firm characteristics[7]	Yes	Yes	Yes	Yes
Adjusted R^2	0.54	0.45	0.35	0.62
F-stat	37.34**	13.32**	12.45**	43.62**
Number of firms	313	336	365	284

Notes: **/*/° significant at the 1, 5 and 10% level, respectively. White (1980) heteroscedasticity consistent standard errors are shown in brackets. [1] Mean rate of bankruptcy larger than its median (0.013). [2] Mean rate of bankruptcy smaller than its median. [3] Coefficient of variation (CV) of net operating surplus larger than its median (0.193). [4] CV of net operating surplus smaller than its median. [5] Hourly residual wage dispersion after controlling for human capital variables and workers' characteristics in the wage equation following the Winter-Ebmer and Zweimüller (1999) methodology (i.e. standard errors of wage regressions run for each firm separately). [6] Share of the workforce that: i) has at most attended lower secondary school, ii) has more than 10 years of tenure and iii) is younger than 25 and older than 50 years, respectively. The share of women and the share of blue-collar workers are also included. [7] Sectoral affiliation (7 dummies), number of workers and level of wage bargaining (2 dummies).

Appendix I

Wage dispersion and firm productivity: detailed regression results

Dependent variable:	Value added per worker (ln)	
Intercept	11.64**	11.5**
	(0.23)	(0.23)
Conditional wage dispersion[1]	1.4**	3.36**
	(0.29)	(0.74)
Squared conditional wage dispersion		-4.96**
		(1.8)
No degree, primary/lower secondary	-0.37**	-0.37**
	(0.06)	(0.06)
More than 10 years of tenure	-0.02	-0.01
	(0.1)	(0.1)
Young (< 25 years)	-1.24**	-1.2**
	(0.28)	(0.27)
Old (> 50 years)	-0.48*	-0.44*
	(0.22)	(0.21)
Women	-0.55**	-0.54**
	(0.09)	(0.08)
Blue-collar workers	-0.46**	-0.44**
	(0.08)	(0.08)
Mining and quarrying (C)	0.37	0.36
	(0.25)	(0.26)
Manufacturing (D)	Reference Category	Reference category
Construction (F)	-0.26**	-0.25**
	(0.05)	(0.05)
Wholesale and retail trade, repair of motor vehicles, motorcycles and personal and household goods (G)	-0.24** (0.07)	-0.22** (0.07)
Hotels and restaurants (H)	-0.64**	-0.59**
	(0.12)	(0.11)
Transport, storage and communication (I)	-0.22**	-0.22**
	(0.07)	(0.07)
Financial intermediation (J)	0.43	0.44
	(0.27)	(0.27)
Real estate, renting and business activities (K)	-0.49**	-0.46**
	(0.07)	(0.07)
Firm size (number of workers)	0.01	0.003
	(0.04)	(0.04)
Firm-level collective agreement for blue-collar workers	0.04	0.03
	(0.05)	(0.05)
Firm-level collective agreement for white-collar workers	-0.06	-0.06
	(0.05)	(0.05)
Adjusted R^2	0.47	0.48
F-stat	35.48**	34.44**
Number of firms	649	649

Notes: **/*/° significant at the 1, 5 and 10% level, respectively. White (1980) heteroscedasticity consistent standard errors are shown in brackets. [1] Hourly residual wage dispersion after controlling for human capital variables and workers' characteristics in the wage equation following the Winter-Ebmer and Zweimüller (1999) methodology (i.e. standard errors of wage regressions run for each firm separately).

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Appendix II

II. 1. Wage dispersion and (one year lead) firm productivity

Dependent variable:	Value added per worker (ln) of 2004	
Intercept	11.5**	11.38**
	(0.28)	(0.28)
Conditional wage dispersion[1]	1.52**	3.36**
	(0.31)	(0.76)
Squared conditional wage dispersion		-4.64*
		(1.89)
Worker characteristics[2]	Yes	Yes
Firm characteristics[3]	Yes	Yes
Adjusted R^2	0.41	0.41
F-stat	30.54**	29.67**
Number of firms	649	649

Notes: **/*/° significant at the 1, 5 and 10% level, respectively. White (1980) heteroscedasticity consistent standard errors are shown in brackets. [1] Hourly residual wage dispersion after controlling for human capital variables and workers' characteristics in the wage equation following the Winter-Ebmer and Zweimüller (1999) methodology (i.e. standard errors of wage regressions run for each firm separately). [2] Share of the workforce that: i) has at most attended lower secondary school, ii) has more than 10 years of tenure and iii) is younger than 25 and older than 50 years, respectively. The share of women and the share of blue-collar workers are also included. [3] Sectoral affiliation (7 dummies), number of workers and level of wage bargaining (2 dummies).

II.2. Wage dispersion and (one year lead) firm productivity by workforce skill level

Dependent variable:	Value added per worker (ln) of 2004			
	Large proportion[1] of low-skilled workers	Small proportion[2] of low-skilled workers	Large proportion[3] of highly skilled workers	Small proportion[4] of highly skilled workers
Intercept	10.72**	11.26**	10.37**	11**
	(0.46)	(0.55)	(0.62)	(0.31)
Conditional wage dispersion [5]	3.62**	5.77**	4.94*	1.81*
	(1.19)	(2.13)	(2.34)	(0.82)
Squared conditional wage dispersion	-8.44*	-8.32*	-6.71	-4.26*
	(3.55)	(4.05)	(4.64)	(1.9)
Worker characteristics[6]	Yes	Yes	Yes	Yes
Firm characteristics[7]	Yes	Yes	Yes	Yes
Adjusted R^2	0.4	0.34	0.22	0.48
F-stat	17.45**	18.32**	7.55**	16.89**
Number of firms	218	222	261	262

Notes: **/*/° significant at the 1, 5 and 10% level, respectively. White (1980) heteroscedasticity consistent standard errors are shown in brackets. [1] Proportion of poorly educated workers and proportion of low-ability occupations larger than their medians, respectively 0.281 and 0.625. [2] Proportion of poorly educated workers and proportion of low-ability occupations smaller than their respective medians. [3] Proportion of highly educated workers and proportion of high-ability occupations larger than their median, respectively 0.176 and 0.145. [4] Proportion of highly educated workers and proportion of high-ability occupations smaller than their respective medians. [5] Hourly residual wage dispersion after controlling for human capital variables and workers' characteristics in the wage equation following the Winter-Ebmer and Zweimüller (1999) methodology (i.e. standard errors of wage regressions run for each firm separately). [6] Share of the workforce that: i) has at most attended lower secondary school, ii) has more than 10 years of tenure and iii) is younger than 25 and older than 50 years, respectively. The share of women and the share of blue-collar workers are also included. [7] Sectoral affiliation (7 dummies), number of workers and level of wage bargaining (2 dummies).

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II.3. Wage dispersion and (one year lead) firm productivity by degree of uncertainty

Dependent variable:	Value added per worker (ln) of 2004			
	Mean rate of bankruptcy		CV of net operating surplus	
	High uncertainty[1]	Low uncertainty[2]	High uncertainty[3]	Low uncertainty[4]
Intercept	11.44**	11.16**	11.45**	11.05**
	(0.32)	(0.51)	(0.33)	(0.49)
Conditional wage dispersion [5]	1.74*	4.71**	2.52**	3.5**
	(0.86)	(1.3)	(0.97)	(1.2)
Squared conditional wage dispersion	-1.94	-6.32°	-3.59	-4.67
	(1.99)	(3.49)	(2.26)	(3)
Worker characteristics[6]	Yes	Yes	Yes	Yes
Firm characteristics[7]	Yes	Yes	Yes	Yes
Adjusted R^2	0.52	0.37	0.33	0.51
F-stat	33.06**	12.6**	10.06**	34.16**
Number of firms	313	336	365	284

Notes: **/*/° significant at the 1, 5 and 10% level, respectively. White (1980) heteroscedasticity consistent standard errors are shown in brackets. [1] Mean rate of bankruptcy larger than its median (0.013). [2] Mean rate of bankruptcy smaller than its median. [3] CV of net operating surplus larger than its median (0.193). [4] CV of net operating surplus smaller than its median. [5] Hourly residual wage dispersion after controlling for human capital variables and workers' characteristics in the wage equation following the Winter-Ebmer and Zweimüller (1999) methodology (i.e. standard errors of wage regressions run for each firm separately). [6] Share of the workforce that: i) has at most attended lower secondary school, ii) has more than 10 years of tenure and iii) is younger than 25 and older than 50 years, respectively. The share of women and the share of blue-collar workers are also included. [7] Sectoral affiliation (7 dummies), number of workers and level of wage bargaining (2 dummies).