Intra-firm Wage Dispersion and Firm Performance: A Review and Empirical Tests on Belgian Data[1]

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Abstract

The objective of this paper is twofold. First, we survey the theoretical and empirical literature regarding the impact of intra-firm wage dispersion on firm performance. Next, we examine the nature of this relationship in the Belgian private sector, using a unique combination of two large-scale data sets (i.e. the 1995 'Structure of Earnings Survey' and 'Structure of Business Survey'). We measure firm performance both in financial and productivity terms. Moreover, three unconditional indicators are used to estimate intra-firm wage dispersion. Empirical results support the existence of a significant and positive relationship between wage inequality and firm performance, even when controlling for the composition of the workforce and firm characteristics. These findings are more in line with the 'tournament' models (Lazear and Rosen, 1981) than with the 'fairness, morale and cohesiveness' models (Akerlof and Yellen, 1990; Levine, 1991). Results also suggest that the magnitude of the elasticity between wage dispersion and firm performance depends upon the sectoral affiliation of the firm and the composition of the workforce.

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JEL-Classification: J24, J31, J41.

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1. INTRODUCTION

Relative wages are often considered as a key determinant of the workers' effort. Indeed, since workers often compare their wages with those of their co-workers, it is argued that the intra-firm wage dispersion has an impact on the individual worker's productivity and thus on the average firm performance. However, there is no consensus regarding the precise impact of intra-firm wage dispersion on firm performance. On the one hand, the single-period rank-order version of the 'tournament' models (e.g. Lazear and Rosen, 1981) stresses the positive influence of wage inequality within a firm on the worker's effort. This model suggests the firms should implement a differentiated prize structure and award the largest prize to the most productive worker. On the other hand, other theories argue for some wage compression within a firm by emphasising the importance of fairness and cooperation among the workforce (e.g. Akerlof and Yellen, 1990; Levine, 1991). Empirical studies, focusing on the relationship between wage disparities and firm performance, are not very numerous and their results vary significantly. Due to a lack of appropriate data, these studies often rely on economy-wide inequality indicators or use 'noisy' proxies of firm performance. Moreover, they are generally restricted to a specific segment of the labour force (e.g. the top-management level) or a particular sector of the economy (e.g. the manufacturing sector, academic departments, professional team sports). In sum, the available evidence does not appear to be very compelling yet (Frick *et al.*, 2003).

The aim of this paper is twofold. First, we survey the theoretical and empirical literature regarding the impact of intra-firm wage dispersion on firm performance. Next, we examine the nature of this relationship in the Belgian private sector, using a unique combination of two large-scale data sets (i.e. the 1995 'Structure of Earnings Survey' and 'Structure of Business Survey'). The latter offers various advantages. Firstly, it contains precise information on individual gross hourly wages, including bonuses. Secondly, it has a large coverage. Indeed, it is representative of all firms employing at least 20 workers within the private sector, with the exception of the financial sector. Finally, it provides reliable information on firm performance. The latter is measured both in financial (operating surplus per worker) and productivity terms (turnover and value added per worker). Moreover, three unconditional indicators are used to estimate the intra-firm wage dispersion (i.e. the standard deviation, the coefficient of variation and the max-min ratio of the log hourly wages within the firm). This

methodology has been chosen so as to retain information on small firms. To the best of our knowledge, this paper is the first to investigate the impact of intra-firm wage dispersion on firm performance in the Belgian economy and one of the few covering (almost) the whole private sector. The results presented in this paper support the existence of a significant and positive relationship between wage inequality and firm performance. To put it differently, our findings are more in line with the basic version of the 'tournament' models (Lazear and Rosen, 1981) than with the 'fairness, morale and cohesiveness' models. Further results suggest that the relationship between wage dispersion and firm performance depends upon the sectoral affiliation of the firm and the composition of the workforce.

The remainder of this paper is organised as follows. Section 2 surveys the literature regarding the impact of wage inequality on firm performance, both from a theoretical and empirical perspective. Section 3 tests the nature of this relationship in the Belgian private sector and Section 4 concludes.

2. WAGE DISPERSION AND FIRM PERFORMANCE

2.1. A THEORETICAL PERSPECTIVE

A first interpretation of the relationship between within-firm wage dispersion and firm performance has been provided by Akerlof and Yellen (1988). On the basis of the effort version of the 'efficiency wage' theory (Solow, 1979), the authors argue that, in a firm where the workers' characteristics are not totally observable and where the monitoring of their actions is not perfect, employers have to find well-suited incentives to maximise the workers' effort. According to Akerlof and Yellen (1988), the effort function of a worker can be written as follows: $e = e(\sigma^2(w))$, where e denotes the level of effort and $\sigma^2(w)$ the variance of wages within the firm. This expression shows that the worker's effort does not only depend on the wage level but also on the degree of salary dispersion within the firm. Using this expression, the authors argue that a compressed wage distribution improves labour relations and stimulates the average workers' effort. To put it differently, firms should achieve a greater output per worker if their wage dispersion is low.

Later, Akerlof and Yellen (1990) developed the 'fair wage-effort' hypothesis. This hypothesis clarifies their previous reasoning by developing in greater detail the notion of fairness and

introducing the concept of relative wages.[1] The basic idea is that workers often compare their wages either internally (i.e. with workers within the same firm) or externally (i.e. with workers in other firms or industries). Therefore, Akerlof and Yellen (1990) consider the following worker's effort function: $e = \min\left[\left(w / \hat{w}\right), 1\right]$, with w the actual wage, $\hat{w}$ the fair wage and e equal to one if the level of effort is normal. This expression shows that workers reduce their effort if their actual wage falls short of the wage they regard as fair. According to the authors, a wage is generally considered as fair if the pay spread is lower than the performance differential. This means that a worker would act so as to preserve a certain equilibrium between the subjective value of input and the subjective value of return. Levine (1991) put forward this argument by stressing that pay compression, within a firm where teamwork among employees is essential (i.e. participatory firms), sustains and stimulates cohesiveness, which increases the firm's total productivity.

The above notions of fairness, morale and cohesiveness led Hibbs and Locking (2000) to define the following firm-level production function: $Q = Ef\left[\sigma^2(w)\right]F(L,...)$, with Q the real value added, Ef(.) the labour effectiveness depending on the within-firm wage dispersion, F a standard production function and L the labour inputs to production. This expression shows that the performance of a firm depends positively upon the efficiency of labour, which is negatively correlated with the intra-firm wage dispersion (i.e. Ef'<0, Ef''>0). As a result, this model of 'fairness, morale and cohesiveness' suggests that firms have a strong incentive to implement a wage distribution that is more compressed than the variation in workers' productivities.

A complementary theory promoting wage compression to increase firm performance has been developed by Milgrom (1988), and Milgrom and Roberts (1990). The authors emphasize that (white-collar) workers have incentives to: i) withhold information from managers in order to increase their influence and, ii) engage in costly rent-seeking activities instead of productive work. They also argue that the implementation of some wage equity can reduce the potential tendency of workers to take personal interest decisions, which may not be profitable for the organisation as a whole. Moreover, they stress that it is more costly to monitor the actions of

[1] The 'fair wage-effort' hypothesis is based on the social exchange theory in sociology (e.g. Blau, 1955; Homans 1961) and on the equity theory in psychology (e.g. Adams, 1963). Both theories show the existence of a relationship between effort and fairness.

white-collar workers. Therefore, lower levels of wage dispersion would be even more important for the latter.

In contrast to the previous literature, the 'relative compensation' or 'tournament' model, developed by Lazear and Rosen (1981), points to the benefits of a more dispersed wage structure, deriving from a performance-based pay system. The single-period rank-order version of the tournament model suggests that managers should introduce a large spread in the rewards of workers in order to stimulate their effort. In other words, firms should establish a prize structure and award the largest prize to the most productive worker.[2] The intuition of this model is as follows.[3] Consider two identical risk-neutral workers j and k and a risk-neutral firm, with a compensation scheme such that the most productive worker receives a high wage (W_H) and the less productive a low wage (W_L). Let us also assume that the player's output level is given by (1):

$$q_i = e_i + \varepsilon_i , \quad i = j, k \tag{1}$$

with q_i and e_i respectively the player's output and effort level, and ε_i a random component (e.g. luck). Finally, suppose that the expected utility of the jth player is given by (2):

$$P(W_H - C(e_j)) + (1 - P)(W_L - C(e_j)) = P(W_H - W_L) + W_L - C(e_j) \tag{2}$$

where P is the probability of winning the game and C(.) is a cost function, with C'>0 and C''<0. In this framework, the probability for the player j to win the game is as follows:

$$\begin{aligned} prob(q_j > q_k) &= prob((\varepsilon_k - \varepsilon_j) < (e_j - e_k)) \\ &= prob((e_j - e_k) > \zeta) \\ &= G(e_j - e_k), \end{aligned} \tag{3}$$

where $\zeta = (\varepsilon_k - \varepsilon_j)$, $\zeta \sim g(\zeta)$ with zero mean, and G is the cumulative density function of ζ. A worker maximizes his expected utility by choosing the effort level at which the marginal cost of effort is equal to its marginal benefit. Therefore, worker i's optimal effort choice is defined by (4):

$$(W_H - W_L)\, \partial P/\partial e_i - \partial C/\partial e_i = 0 \tag{4}$$

If both players are maximising (3), we find that:

$$\begin{aligned} \partial P/\partial e_j &= \partial G(e_j - e_k)/\partial e_j \\ &= g(e_j - e_k), \end{aligned}$$

[2] There is some ambiguity in the literature about the definition of a prize. It can be seen either as a promotion (i.e. to get a task with higher responsibilities and to rise in the firm hierarchy) or as a bonus.

[3] For a more detailed description of the model see Gibbons and Waldman (1999) or Eriksson (1999).

which after substitution in (4) gives player j's best reaction function:

$$(W_H\text{-}W_L)\, g(e_j - e_k) = \partial C/\partial e_j \quad (5)$$

Given the assumption of identical workers, we know that both players will choose the same level of effort. In symmetric Nash equilibrium, $e_j = e_k$ and the outcome of the game is random, i.e. P = 0,5. Therefore, expression (5) can be rewritten as follows:

$$(W_H\text{-}W_L)\, g(0) = \partial C/\partial e_j \quad (6)$$

Two lessons can be drawn from equation (6). Firstly, we find that *ceteris paribus* the level of effort is increasing with the prize dispersion ($W_H - W_L$). Secondly, expression (6) shows that, for a given wage spread ($W_H - W_L$), a higher density at the expectation of the random components of the output, the more it pays to exert effort. This theory has been generalized by McLaughlin (1988) for *n* players. The author shows that the number of players matters and that the probability to win a game decreases with the number of contestants. Consequently, to stimulate the workers' effort, there should be a positive correlation between the prize spread and the number of contestants.

Lazear (1989, 1995) argues, however, that high within-firm wage dispersion generates more competition between the workers which may negatively affect firm performance. Indeed, considering an organisation in which several workers are non-cooperative or have a sabotage behaviour ('hawks') and others who are less aggressive ('doves'), the author shows that wage compression is crucial for firm performance.[4] The point is that the non-cooperative activities adopted by 'hawks' reduce the total effort level of the workers. In other words, the positive impact of an output-based pay system on firm performance may be offset by a lower level of work cohesion due to the sabotage behaviour of 'hawks'. As a result, it appears profitable for a firm to: i) adequately sort out workers before hiring them and, ii) adjust the compensation scheme to the hierarchical level.

A further strand of the literature, developed by Frey (1997) and Frey and Osterloh (1997), focuses on the interplay between wage dispersion and intrinsic motivation.[5] This literature shows that the implementation of explicit incentive contracts (e.g. performance-based pay

[4] According to Lazear (1989, 1995), 'hawks' are often found at the top level of the organisation, i.e. mainly among white-collar workers. His arguments are thus in line with those of Milgrom (1988) and Milgrom and Roberts (1990). The counter-productive effect should be greatest within the higher echelons of the hierarchy.

[5] It derives from the psychological literature which suggests that intrinsic motivation is the main driving force of workers' effort.

systems) can crowd out the intrinsic motivation of the workers by generating excessive external monitoring (in particular, for workers who need autonomy in their job and who have high responsibilities). However, it can also enhance intrinsic motivation by supporting the workers' own motivation, self-esteem and feeling of competence. In sum, this literature emphasizes the importance of a correct match between the compensation scheme and the monitoring environment within a firm (Belfield and Marsden, 2003).

2.2. AN EMPIRICAL PERSPECTIVE

Empirical studies examining the relationship between wage disparities and firm performance are not very numerous and their results vary markedly. Due to a lack of appropriate data, these studies often rely on economy-wide inequality indicators or use 'noisy' proxies of firm performance. Moreover, they are generally restricted to a specific segment of the labour force (e.g. the top-management level) or a particular sector of the economy (e.g. the manufacturing sector, academic departments, professional team sports). In what follows, we review the main features of these studies.[6]

i) Wage compression for firm performance

A first strand of the empirical literature provides evidence in favour of the 'fairness, morale and cohesiveness' theory, developed by Akerlof and Yellen (1990) and Levine (1991).

Cowherd and Levine (1992) examine the relationship between interclass pay equity and the performance of business units, by integrating the body of equity, relative deprivation and quality management theories.[7] Their study is based on data collected from 102 business units with more than 59 employees, in North America (72%) and Europe (28%). The performance of a business unit is measured by the quality of its production.[8] According to the authors,

[6] For a summary see Appendix 1.

[7] Interclass pay equity is measured by the pay relation of hourly paid employees to top-three levels of management, controlling for the business size effect. A business unit is defined as any autonomous organisational unit that has top management with decision-making authority in areas like manufacturing and sales.

[8] The latter is measured by customers in relative terms, i.e. in comparison with the product quality of the main competitors of each business unit.

product quality is a good indicator of firm performance since it is: i) difficult for managers to control, and ii) a function of the willingness of lower-level employees to contribute more than can formally be asked from them. Their empirical findings show the existence of a substantial positive relationship between interclass pay equity and product quality. The authors attribute this result to the impact of pay equity on three aspects of lower-level employee motivation, i.e. commitment to managerial goals, effort and cooperation.

Pfeffer and Langton (1993) analyse how within-academic departments wage dispersion and pay schemes affect the individual's satisfaction, research performance and cooperation, using a large sample of college and university faculty in the UK.[9] Their data set contains information on *circa* 17,000 college and university professors from 600 academic departments located in some 300 institutions.[10] Salary dispersion is measured by an unconditional indicator, i.e. the coefficient of variation (the standard deviation divided by the mean) in salaries within a given academic department. Controlling for numerous predictors, the authors observe statistically and substantively significant negative effects of pay dispersion. To put it differently, they find that, on average, people are less satisfied, do less collaborate on research, and have a lower productivity when the pay distribution is more dispersed. Moreover, results show that the extent to which wage dispersion produces adverse effects depends upon one's position in the salary structure and factors such as information, commitment, consensus and the level of certainty in the evaluation process.

A number of studies, essentially concentrated on the US, have been devoted to the interaction between salary dispersion and performance in the team sports industry. Using mainly unconditional measures of wage inequality (e.g. the Gini-index), these studies generally conclude that pay compression is beneficial for team performance (e.g. the win-loss percentage).[11] The study of Frick *et al.* (2003) is the first to attempt to measure the impact of pay inequalities on the performance of professional team sports across different leagues. Their approach enables to implicitly control for the influence of different institutional regimes and

[9] The data come from the Carnegie Commission's 1969 survey of college and university faculty.

[10] The authors confined their attention to respondents in departments with a size of 20 or larger that had a response rate to the questionnaire greater than 50%.

[11] For professional baseball teams, see Bloom (1999), DeBrock *et al.* (2001), Depken (2000), Harder (1992) or Richards and Guell (1998). For soccer and hockey teams, see respectively Lehmann and Wacker (2000) and Gomez (2002).

production technologies. Using panel data from the four major North American sports leagues (i.e. baseball, basketball, football and hockey), their study supports neither the 'fairness, morale and cohesiveness' hypotheses nor the 'tournament' theories. Indeed, findings vary substantially between the four leagues. According to their estimates, a higher degree of intra-team wage dispersion is beneficial to the performance of professional basketball and hockey teams.[12] However, the reverse relationship is found for football and baseball teams, i.e. a team is more successful if its pay distribution is more compressed. The authors attribute the diversity in their results to the different degrees of 'cooperation requirements' in the four leagues.

ii) Wage dispersion for firm performance

Another strand of the empirical literature offers evidence in favour of the 'tournament' theory, developed by Lazear and Rosen (1981).

Winter-Ebmer and Zweimüller (1999) investigate the impact of intra-firm wage dispersion on firm performance using panel data covering the whole Austrian workforce for the period 1975-91.[13] They measure within-firm wage inequality by the standard errors of firm-level wage equations. This conditional indicator controls for the composition of the workforce within each firm.[14] Unfortunately, the authors did not observe the financial performance of the firms. As a result, they have constructed their own performance indicator, i.e. standardised wages. Of course, this instrument is not perfectly adequate. Be it as it may, controlling for several predictors, their findings suggest the existence of a positive and hump-shaped relationship between intra-firm wage dispersion and firm performance, for both blue- and white-collar workers. Yet, the overall pattern appears more monotonic for blue-collar workers. These findings are in line with the hypothesis that too little wage inequality negatively affects firm performance due to a lack of incentives. However, they also suggest that excessive wage dispersion can be harmful for productivity because of fairness effects. According to the authors, the contrasting results for blue- and white-collar workers appear to

[12] For hockey teams, the coefficient is positive but not significantly different from zero.

[13] Their sample is restricted to firms with more than 20 employees and with at least 4 data points.

[14] The data report monthly earnings that are top coded. The explanatory variables in the tobit wage regressions, ran separately for each firm, include age, age squared and dummies for sex, blue-collar, foreigner and two tenure dummies. Information on education levels is not available.

be consistent both with theories of intrinsic motivation and rent-seeking, and with the prevalence of piece rates in blue-collar jobs.

Hibbs and Locking (2000) examine the effects of changes in the overall wage dispersion, during the periods 1964-93 and 1972-93, on the productive efficiency of Swedish industries and plants. To do so, they firstly decompose the total variance in individual wages *within* and *between* plants (and industries). Next, they integrate the squared coefficients of variation of these components at the plant (or industry) level, in an Akerlof and Yellen's (1990) type of production function. The dependent variable in this equation, i.e. their performance indicator, is the log of real value added at the plant (or industry) level.[15] Their empirical findings do not confirm that wage levelling within plants and industries enhance productivity. Therefore, they do not support the 'fairness, morale and cohesiveness' theories.

Bingley and Eriksson (2001) analyse the impact of pay spread and skewness on two performance indicators, i.e. firm productivity and employee effort. Their study uses longitudinal matched employer-employee data comprising information on Danish medium- and large private sector firms during the period 1992-95. It is the first to address potential simultaneity problems using information from the income tax system. Firm productivity and employee effort are estimated by the total factor productivity and the sickness absence, respectively. Differences in firm productivity effects between the occupational groups and types of firms give support to the theories of fairness, tournaments and tastes for skewness. In contrast, individual effort effects only back up the tournament theory.

Finally, a number of papers present evidence on the interaction between the pay structure of top executives and firm performance. Focusing on managers in large US firms, Leonard (1990) finds no significant relationship between the standard deviation of pay and firm performance, i.e. the return on investment. In contrast, using respectively US and Swedish data, Main *et al.* (1993) and Eriksson (1999) report a positive impact of top executive pay dispersion on firm performance. The latter is measured by returns on assets and the

[15] Their production function is as follows: $\ln[Q] = \ln[Ef(\sigma^2(w))\ F(.)]$, where $Ef(\sigma^2(w))) = Ef(CV^2(W),CV^2(B))$. In this expression, Q represent the real value added, Ef(.) the labour effectiveness depending on $\sigma^2(w)$ (i.e. the total variation in individual wages), and F(.) a standard production function (e.g. Cobb-Douglas, CES or Translog). $CV^2(W)$ and $CV^2(B)$ stand respectively for the within and between components of the total variance of individual wages (squared coefficient of variation) among workers assortment by plants (or industries).

profits/sales ratio, respectively. The paper of Heyman (2002) is the first to explicitly control for firm differences in human capital when testing several predictions from the tournament theory for white-collar workers and in particular managers.[16] On the basis of a large matched employer-employee data set for the Swedish economy in 1991 and 1995, the author finds a positive effect of wage dispersion on profits.

3. AN EMPIRICAL ANALYSIS FOR THE BELGIAN PRIVATE SECTOR

3.1. METHODOLOGY AND INDICATORS

In this section, we estimate the impact of intra-firm wage dispersion on firm performance in the Belgian private sector. Our methodology rests upon the estimation of the following semi-logarithmic firm-performance equation:

$$\ln P_j = \alpha + \beta\sigma_j + \gamma X_j + \eta Z_j + \upsilon_j \quad (7)$$

where j is the firm index; ln Pj is the (Naperian) log of the firm performance indicator; σ_j stands for intra-firm wage dispersion; Xj contains aggregated characteristics of workers; Zj includes employer characteristics; α is the intercept; β, γ and η are the parameters to be estimated and υ_j is an error term.

The performance of a firm (Pj) is defined both in financial and productivity terms. The financial performance of a firm is measured by the gross operating surplus per worker. This surplus is a good proxy of the firm's per capita profits. It is obtained by subtracting total personnel expenditures from value added at factor costs. Firm productivity is measured by the value added and the turnover per worker, respectively. The value added at factor costs is equal to the gross operating income (plus subsidies, minus indirect taxes). The turnover corresponds to the amount of sales of goods and services assessed at market prices. The main explanatory variable σ_j, i.e. intra-firm wage dispersion, is estimated by three unconditional indicators. These are the standard deviation, the coefficient of variation and the max-min ratio of individual gross hourly wages within each firm. Our firm-performance equation contains numerous control variables for the composition of the workforce (Xj) as well as for the firm characteristics (Zj). These control variables include the share of the workforce that: i) have at most attended lower secondary school, ii) have more than 10 years of tenure and iii) are

[16] His conditional indicator of wage dispersion is the same as in Winter-Ebmer and Zweimüller (1999).

younger than 25 and older than 50 years, respectively. The share of women, the share of blue-collar workers, the share of the workers that supervise their co-workers, the sectoral affiliation (7 dummies), the size of the firm (the number of workers), and the level of wage bargaining (2 dummies) are also included.

3.2. DATA

Our analysis is based upon a unique combination of two large-scale data sets. The first, carried out by Statistics Belgium, is the 1995 '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.[17] The survey contains a wealth of information, provided by the management of the firms, both on the characteristics of the latter (e.g. sector of activity, size of the firm, level of wage bargaining) and on the individual workers (e.g. age, education, gross hourly wages, gender, occupation).[18] Unfortunately, it provides no financial information. Therefore, the SES has been merged with the 1995 'Structure of Business Survey' (SBS). It is a firm-level survey, conducted by Statistics Belgium, with a different coverage than the SES in that it includes neither the financial sector (Nace J) nor the firms with less then 20 employees. The SBS provides firm-level information on financial variables such as sales, value added, production value, gross operating surplus and value of purchased goods and services. The final sample, combining both data sets, covers 34,969 individuals working for 1,498 firms. It is representative of all firms employing at least 20 workers within sections C to K of the Nace Rev.1 nomenclature, with the exception of the financial sector.

Table 1 sets out the means (standard deviations) of selected variables.[19] We find that, on average, firms' profits per employee amount to approximately 21,000 EUR and that the estimated intra-firm wage dispersion is lowest when measured by the standard deviation. Also

[17] The following sectors are therefore not part of the sample: (i) agriculture, hunting and forestry, (ii) fisheries, (iii) public administration, (iv) education, (v) health and social action, (vi) collective, social and personal services, (vii) domestic services, and (viii) extra-territorial bodies.

[18] The SES is a stratified sample. The stratification criteria refer respectively to the region, the principal economic activity (NACE-groups) and the size of the firm. The sample size in each stratum depends on the size of the firm. Sampling percentages of firms equal respectively 10, 50 and 100% when the number of workers is lower than 50, between 50 and 99, and above 100. Within a firm, sampling percentages of employees also depend on size. Sampling percentages of employees reach respectively 100, 20 and 10% when the number of workers is lower than 50, between 50 and 99, and above 100. The result of these stratification criteria is that the number of data points depends upon firm size. As a result, our wage inequality indicators may be slightly biased. For an extended description of the SES see Demunter (2000).

[19] See Appendix 2 for a more detailed description.

noteworthy is that, on average, within each firm, approximately 31% of the workers are women, 45% are blue-collar, 32% have a low level of education, and 79% are between 25 and 50 years old. Finally, Table 1 shows that, on average, firms employ 281 workers and are essentially concentrated in the manufacturing sector (41%); the wholesale and retail trade, repair of motor vehicles sector (31%); and real estate, renting and business activities (13%).

Table 1: Means and Standard Deviations of Selected variables[+]

Variables	Mean	SD
Profits per employee[1] (in thousands of EUR)	21.2	1,376.0
Turnover per employee (in thousands of EUR)	273.0	20,295.2
Value added per employee at factor costs (in thousands of EUR)	61.4	1,785.2
Standard deviation of wages[2]	0.24	0.13
Coefficient of variation of wages[2]	0.28	0.16
Max-Min ratio of wages[2]	2.81	1.68
Share of the workforce:		
Age < 25 years	12.1	13.1
Age > 50 years	9.2	9.9
Female	30.8	26.5
Low educated (no degree, primary or lower secondary)	32.1	32.2
Blue-collar	45.0	35.7
Size of the firm (number of workers)	281.4	887.7
Sector:		
Mining and quarrying (C)	0.3	
Manufacturing (D)	41.1	
Electricity, gas and water supply (E)	0.1	
Construction (F)	5.5	
Wholesale and retail trade; repair of motor vehicles (G)	31.1	
Hotels and restaurants (H)	2.9	
Transport, storage and communication (I)	6.2	
Retail estate, renting and business activities (K)	12.8	
Number of employees	34,969	
Number of firms	1,498	

[+] The descriptive statistics refer to the weighted sample.
[1] Approximated by the firm annual gross operating surplus per worker.
[2] Individual gross hourly wages include overtime paid, premiums for shift work, night work and/or weekend work and bonuses, i.e. irregular payments which do not occur during each pay period, such as pay for holiday, 13th month and profit sharing.

3.3. BASIC SPECIFICATION RESULTS AND DISCUSSION

Table 2 reports our estimates of the effect of wage dispersion on firm performance.[20] These estimates are obtained by applying OLS, with White (1980) heteroscedasticity consistent standard errors, to equation (7). Findings emphasize the existence of a positive and significant (at least at the 5% level) relationship between intra-firm wage dispersion and firm performance, independently of the indicators considered. The intensity of this relationship is

[20] Detailed results are shown in the Appendices 3 and 4.

strongest when the dependent variable is defined in financial terms (i.e. profits per capita) and when the pay dispersion is estimated by the standard deviation. Overall, the point estimates range between 1.87 and 0.05, which yields an elasticity of between 0.45 and 0.13 at sample means. These results suggest that, on average, a rise of 10% in wage inequality increases firm performance by between 4.5 and 1.3%.

To test for the existence of a hump-shaped relationship, within-firm wage inequality indicators have been added in quadratic form to our regression model. Results from this specification are only significant (at the 5% level) when we consider the max-min ratio of wages and the value added per employee. In this case, the relationship is concave and the turning point is equal to around 19. To put it differently, the impact of wage dispersion on firm performance becomes negative when the max-min ratio of wages is close to its maximum. Unfortunately, due to a strong multicollinearity problem (deriving from the high correlation between the indicators in level and squared), we are not able to determine whether this non-linear relationship holds when the intra-firm wage dispersion is measured by the standard deviation or the coefficient of variation of wages.[21]

How are we to interpret these results ? The positive impact of wage dispersion on firm performance tends to support the single-period rank-order version of the 'tournament' models (Lazear and Rosen, 1981). Indeed, the latter demonstrates that if the workforce is relatively homogenous, wage differentials stimulate the workers' effort and their productivity. To put it differently, this model suggests that firms should establish a prize structure and award the largest prize to the most productive workers. Lazear's model (1989, 1995) of 'hawks' and 'doves' suggests, in addition, that it is profitable for a firm to: i) adequately sort out workers at the hiring stage, and ii) adjust the compensation scheme to the characteristics of the workforce (i.e. the hierarchical level). This model shows that if the majority of the workforce adopts a sabotage or non-cooperative behaviour, a more compressed wage structure should be preferred.

[21] Results are available on request.

Table 2: Firm Performance Regressions

Dependent variable:	Profits per employee[1] (ln)			Turnover per employee (ln)			Value added per employee (ln)		
Intercept	6.58**	6.70**	6.79**	9.80**	9.87**	9.91**	7.66**	7.73**	7.75**
	(23.41)	(24.98)	(24.43)	(52.08)	(64,62)	(54.35)	(69.28)	(72.34)	(70.06)
Standard deviation of wages[2]	1.87**			1.12**			1.03**		
	(3.34)			(3,62)			(5.08)		
Coefficient of variation of wages[2]		1.18**			0.72**			0.64**	
		(3.22)			(3.06)			(4.65)	
Max-min ratio of wages[2]			0.07*			0.05*			0.05**
			(2.08)			(2.48)			(3.77)
Worker characteristics[3]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm characteristics[4]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.18	0.18	0.17	0.35	0.35	0.35	0.36	0.35	0.35
F-stat	155.13**	151.93**	148.88**	239.87**	237.03**	232.75**	454.18**	445.72**	436.21**
Number of employees	34,969	34,969	34,969	34,969	34,969	34,969	34,969	34,969	34,969
Number of firms	1,498	1,498	1,498	1,498	1,498	1,498	1,498	1,498	1,498

Notes: **/*/° indicate significance at the 1, 5 and 10% level, respectively. t-statistics are between brackets. Regressions have been estimated by OLS with White (1980) heteroscedasticity consistent standard errors.

[1] Approximated by the firm annual gross operating surplus per worker.

[2] Individual gross hourly wages include overtime paid, premiums for shift work, night work and/or weekend work and bonuses, i.e. irregular payments which do not occur during each pay period, such as pay for holiday, 13th month and profit sharing.

[3] Share of workers that : i) have attended at most lower secondary school, ii) have more than 10 years of tenure, iii) are female, iv) are blue-collar, v) supervise the work of their co-workers, and vi) are younger than 25 and older than 50 years, respectively.

[4] Sectoral affiliation (7 dummies), size of the firm (number of workers), and level of wage bargaining (2 dummies).

According to this theory, our sample is essentially composed of 'doves'. To put it in another way, it is because the majority of the workforce adopts a cooperative behaviour that firms can achieve a higher performance by implementing a more dispersed wage structure.[22]

Finally, let us note that our findings offer no support to the 'fairness, morale and cohesiveness' theories (Akerlof and Yellen, 1990; Levine, 1991). Indeed, the latter suggest that wage dispersion has a detrimental effect on firm performance.

3.4. ROBUSTNESS CHECKS

In this section, we check the robustness of our previous findings by running separate performance regressions for different sub-samples of firms. In particular, we investigate whether the relationship between intra-firm wage dispersion and firm performance depends upon the following elements: firm size (i.e. number of employees below *or* above 100), level of wage bargaining (i.e. only national and/or sectoral collective agreement *versus* firm level collective agreement)[23], monitoring environment (i.e. fraction of the workforce supervising their co-workers above *or* below 20%), sectoral affiliation (service *versus* manufacturing industry)[24] and composition of the workforce (i.e. majority of blue *or* white-collar workers). For the sake of clarity, in what follows, we solely report the results of our regressions where firm performance is measured by the value added per employee.[25]

Tables 3 and 4 show that the elasticity between intra-firm wage dispersion and firm performance remains positive and significant (at the 5% level), independently of the size of the firm, the level of wage bargaining, the monitoring environment, the sectoral affiliation and the composition of the workforce.

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[22] Be that as it may, the quadratic relationship between the max-min ratio of wages and the value added per employee suggests that wage dispersion has a positive impact on firm performance up to a certain point. Beyond this point, the sabotage behaviour of certain workers within the firm may explain why the relationship between wage dispersion and firm performance becomes negative.

[23] The heart of the wage bargaining lies at the sectoral level in Belgium. However, in certain cases, sectoral agreements are renegotiated (improved) within individual firms.

[24] Manufacturing sector: manufacturing (Nace D), electricity, gas and water supply (Nace E), construction (Nace F). Service sector: wholesale and retail trade; repair of motor vehicles (Nace G), hotels and restaurants (Nace H), transport, storage and communication (Nace I), retail estate, renting and business activities (Nace K).

[25] Our findings based on the level of profit or turnover per employee are less robust but they tend in the same direction. These findings are available on request.

Table 3: Performance Regressions by firm size, bargaining regime and monitoring environment

Dependent variable:	Value added per employee (ln)					
	<= 100 workers			**>100 workers**		
Intercept	7.70**	7.78**	7.73**	7.64**	7.68**	7.75**
	(53.19)	(55.99)	(54.7)	(48.15)	(50.6)	(49.71)
Standard deviation of wages[2]	0.94**			1.07**		
	(3.62)			(3.85)		
Coefficient of variation of wages[2]		0.49**			0.79**	
		(2.64)			(4.57)	
Max-min ratio of wages[2]			0.07**			0.04**
			(3.84)			(2.96)
Worker characteristics[3]	Yes	Yes	Yes	Yes	Yes	Yes
Firm characteristics[4]	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.36	0.35	0.36	0.39	0.39	0.38
F-stat	17.35**	16.51**	18.36**	262.07**	268.31**	259.63**
Number of firms	648	648	648	850	850	850
	Firm CA[5]			**Only national and/or sectoral CA[5]**		
Intercept	7.36**	7.37**	7.44**	7.78**	7.87**	7.83**
	(37.5)	(39.07)	(37.92)	(54.21)	(57.41)	(57.02)
Standard deviation of wages[2]	0.67*			0.88**		
	(2.3)			(3.6)		
Coefficient of variation of wages[2]		0.54**			0.46**	
		(2.81)			(2.78)	
Max-min ratio of wages[2]			0.02			0.05**
			(0.84)			(3.75)
Worker characteristics[3]	Yes	Yes	Yes	Yes	Yes	Yes
Firm characteristics[4]	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.47	0.48	0.46	0.33	0.32	0.33
F-stat	35.67**	36.13**	24.42**	212.45**	205.79**	210.37**
Number of firms	538	538	538	832	832	832
	Low monitoring (<=20%)			**High monitoring (>20%)**		
Intercept	7.62**	7.71**	7.71**	7.80**	7.85**	7.89**
	(58.64)	(61.21)	(60.49)	(38.77)	(39.71)	(39.49)
Standard deviation of wages[2]	1.04**			0.72*		
	(4.24)			(2.26)		
Coefficient of variation of wages[2]		0.62**			0.44*	
		(3.34)			(2.31)	
Max-min ratio of wages[2]			0.05**			0.02*
			(3.88)			(1.78)
Worker characteristics[3]	Yes	Yes	Yes	Yes	Yes	Yes
Firm characteristics[4]	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.37	0.36	0.36	0.37	0.37	0.37
F-stat	29.58**	28.58**	26.98**	157.02**	154.58**	156.01**
Number of firms	995	995	995	503	503	503

Notes: **/*/° indicate significance at the 1, 5 and 10% level, respectively. t-statistics are between brackets. Regressions have been estimated by OLS with White (1980) heteroscedasticity consistent standard errors.
[2, 3, 4] see notes in Table 2. [5] CA stands for collective agreement on wages.

Table 4: Performance Regressions by sectoral affiliation and workforce composition

Dependent variable:	Value added per employee (ln)					
	Manufacturing sector			**Service sector**		
Intercept	8.11**	8.13**	8.11**	7.7**	7.82**	7.88**
	(31.56)	(31.97)	(32.68)	(49.7)	(52.12)	(50.65)
Standard deviation of wages[2]	0.36°			1.3**		
	(1.76)			(4.62)		
Coefficient of variation of wages[2]		0.27°			0.73**	
		(1.86)			(3.75)	
Max-min ratio of wages[2]			0.05**			0.04**
			(3.26)			(2.94)
Worker characteristics[3]	Yes	Yes	Yes	Yes	Yes	Yes
Firm characteristics[4]	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.24	0.24	0.24	0.47	0.46	0.45
F-stat	496.99**	495.71**	510.86**	35.3**	33.21**	30.10**
Number of firms	976	976	976	522	522	522
	Majority of white-collar workers			**Majority of blue-collar workers**		
Intercept	7.65**	7.72**	7.79**	7.48**	7.51**	7.49**
	(50.22)	(50.03)	(50.17)	(43.9)	(46.25)	(47.04)
Standard deviation of wages[2]	1.23**			0.44°		
	(4.88)			(1.81)		
Coefficient of variation of wages[2]		0.71**			0.30°	
		(4.15)			(1.65)	
Max-min ratio of wages[2]			0.04**			0.04*
			(3.37)			(2.23)
Worker characteristics[3]	Yes	Yes	Yes	Yes	Yes	Yes
Firm characteristics[4]	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.44	0.43	0.42	0.30	0.30	0.30
F-stat	194.47**	188.23**	176.01**	22.72**	22.48**	22.96**
Number of firms	733	733	733	765	765	765

Notes: **/*/° indicate significance at the 1, 5 and 10% level, respectively. t-statistics are between brackets. Regressions have been estimated by OLS with White (1980) heteroscedasticity consistent standard errors.
[2, 3, 4] see notes in Table 2.

Simple t-tests, reported in Table 5, indicate that the size of the firm, the level of wage bargaining and the monitoring environment have no significant impact on the magnitude of the elasticity between wage dispersion and firm performance. Yet, the elasticity appears to be significantly larger[26] in the service sector and within firms essentially composed by white-collar workers. Table 4 suggests, indeed, that at sample means, following a 10% rise in wage inequality, the value added per employee increases by:

- between 1.3 to 2.3 points of percentage more in the service sector,
- between 1.1 and 1.7 points of percentage more in firms mainly composed by white-collar workers.

[26] Except for the max-min ratio of wages.

Table 5: t-Tests for the Equality of Regression Coefficients

	Firm size	Bargaining regime	Monitoring environment	Workforce composition	Sectoral affiliation
Standard deviation of wages	0.37	0.56	0.81	2.28*	2.70**
Coefficient of variation of wages	1.19	0.30	0.67	1.65°	1.87°
Max-min ratio of wages	1.01	1.25	0.94	0.23	0.16

Notes: **/*/° indicate that the t-test is significant at the 1, 5 and 10% level, respectively.

How can we interpret these results? The higher elasticity within the service sector tends to support the hypothesis that remunerating individuals on the basis of their output is more profitable in the service sector. To put it differently, employers in the service industry would have more incentives to implement pay-for-performance systems in order to stimulate the workers' effort and to retain top performers. Our findings may also suggest that collaboration among the workforce is more important in the manufacturing sector. Therefore, lower levels of wage dispersion may be optimal in this industry (Levine, 1991). The higher elasticity between wage dispersion and performance within firms essentially composed by white-collar workers might be interpreted on the basis of the theory developed by Frey and Osterloh (1990). According to this theory, the implementation of explicit incentive contracts can crowd out the intrinsic motivation of the workers by generating excessive external monitoring. However, it can also enhance intrinsic motivation by supporting the workers' own motivation, self-esteem and feeling of competence. Our findings tend to suggest that, on average, the latter effect dominates for all workers, although it appears to be larger for white-collar workers.

4. CONCLUSION

The objective of this paper is twofold. First, we survey the theoretical and empirical literature regarding the impact of intra-firm wage dispersion on firm performance. Next, we examine the nature of this relationship in the Belgian private sector, using a unique combination of two large-scale data sets (i.e. the 1995 'Structure of Earnings Survey' and 'Structure of Business Survey'). The latter contains a wealth of information both on the characteristics of the firms (e.g. number of workers, level of wage bargaining, gross operating income, value added) and on the individual workers (e.g. age, education, occupation, gender, hourly wages, bonuses). We measure firm performance both in financial and productivity terms. Moreover, three unconditional indicators are used to estimate intra-firm wage dispersion. Empirical results support the existence of a significant and positive relationship between wage inequality and

firm performance, even when controlling for the composition of the workforce and firm characteristics. These findings are more in line with the 'tournament' models (Lazear and Rosen, 1981) than with the 'fairness, morale and cohesiveness' models (Akerlof and Yellen, 1990; Levine, 1991). Results also suggest that the magnitude of the elasticity between wage dispersion and firm performance depends upon the sectoral affiliation of the firm and the composition of the workforce.

Future research should rely on matched employer-employee panel data so as to control for the non observed characteristics of the workers and/or firms. Unfortunately, at the moment such data set does not exist for Belgium. It would also be interesting to use a conditional indicator for intra-firm wage dispersion (e.g. Winter-Ebmer and Zweimüller, 1999). However, this option requires a large number of observations per firm.

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Appendix 1 : Intra-firm Wage Dispersion and Firm Performance – Some Empirical Results

Study	Country	Data / Coverage	Wage Dispersion	Firm Performance	Methodology	Results
Cowherd and Levine (1992)	North America and Europe	OASIS program: 102 business units >= 59 workers	Semi-unconditional: pay of employees relative to top 3 management level	Product quality	Cross-section (OLS)	Negative relationship between wage spread and firm performance → fairness and cooperation theory + relative deprivation theories
DeBrock *et al.* (2001)	US	Professional baseball teams, 1985-98	Several unconditional measures and standard error of earnings regression	Win-loss percentage by team	Cross-section (OLS) and fixed-effects	Negative impact of wage dispersion on team performance → fairness theory
Eriksson (1999)	Denmark	2,600 managers from 210 Danish firms, 1992-95	Unconditional: coefficient of variation	Profits/sales ratio	Cross-section (OLS) and fixed-effects	Weak positive relationship between these variables among executives → tournament theory
Frick *et al.* (2003)	US	Professional baseball, basketball, football and hockey teams, data for min. 7 years in each league	Unconditional: GINI index of wage inequality	Win-loss percentage by team	Cross-section (OLS), fixed-effects or random-effects	Ambiguous result. For basketball and hockey teams, a higher degree of wage dispersion is beneficial for team performance but the reverse is found for football and baseball teams.
Gomez (2002)	US	Professional hockey teams, 1993-98	Unconditional: GINI coefficient	Win-loss percentage by team and season-ending point totals	Cross-section (OLS) and fixed-effects	Negative relationship between these variables → fairness theory
Harder (1992)	US	Professional baseball teams, data for 4 seasons (1976, 1977, 1987, 1988) Professional basketball (1987)	Two separate continuous measures of inequity (% overrewarded and % underrewarded players)	Technical measures for baseball (e.g. 'runs created', 'total average') and for basketball (e.g. points scored)	Cross-section (OLS) and lagged dependent values as explanatory variables	Negative relationship between these variables for basketball, results less clear for baseball → partial support of pay equity theory (underreward leads to selfish behaviour, overreward to cooperative behaviour)

Appendix 1 (*cont.*) : Intra-firm Wage Dispersion and Firm Performance – Some Empirical Results

Study	Country	Data / Coverage	Wage Dispersion	Firm Performance	Methodology	Results
Heyman (2002)	Sweden	Panel data for white-collar workers and around 10,000 managers in 1991 and 1995	Conditional: standard error of wage regression	Profits	Cross-section (OLS) and fixed-effects (lagged value of wage spread as instrumental variable)	Positive relationship between these variables among white-collar workers and managers → tournament theory
Hibbs and Locking (1995)	Sweden	Aggregated individual wage data, 1974-93	Unconditional: squared coefficient of variation	Real value added	Cross-section (OLS) and instrumental variable (lagged value of output)	Positive relationship between these indicators → tournament theory
Leonard (1990)	US	439 large corporations, 1981-85	Unconditional: standard deviation of pay	Return on investment	Cross-section (OLS) and fixed-effects	No significant relationship between these indicators for top executives
Main *et al.* (1993)	US	Executives in 210 firms, 1980-84	Unconditional: coefficient of variation	Return on assets	Cross-section (OLS)	Positive relationship between these indicators for executives → tournament theory
Pfeffer and Langton (1993)	UK	17,000 college and university professors from 600 academic departments	Unconditional: coefficient of variation	Workers' satisfaction, productivity, and cooperation	Cross-section (OLS)	Negative relationship between wage spread and (1) satisfaction, (2) productivity, (3) cooperation → fairness and cooperation theory
Richards and Guell (1998)	US	Professional baseball teams, 3 seasons (1992, 1993, 1995)	Unconditional: variance of team salaries	Win-loss percentage by team	Cross-section (OLS) and fixed-effects	Negative effect of wage spread on the win percentage but not on the probability to win a title → partial support of fairness theory
Winter-Ebmer and Zweimüller (1999)	Austria	Panel of Austrian firms (>= 20 workers with at least 4 data points), 1975-91	Conditional: standard error of wage regression	Standardized wage for white-and blue-collar workers	Cross-section (OLS) and fixed-effects	Positive relationship between these variables. Stronger for blue-collar workers → results more in line with tournament theory

Appendix 2: Means and Standard Deviations of Variables[+]

	Mean	SD
I. Firm performance:		
Profits per employee (in thousands of EUR)	21.2	1,376.0
Approximated by the firm annual gross operating surplus per worker. The gross operating surplus corresponds to the difference between the value added at factor costs and the total personnel expenditures.		
Value added per employee at factor costs (in thousands of EUR)	61.4	1,785.2
Approximated by the firm annual gross operating income per worker (plus subsidies, minus indirect taxes).		
Turnover per employee (in thousands of EUR)	273.0	20,295.2
Total amount of sales of goods and services assessed at market prices.		
II. Intra-firm wage dispersion:		
Standard deviation of wages[1]	0.24	0.13
Coefficient of variation of wages[1]	0.28	0.16
Max-Min ratio of wages[1]	2.81	1.68
III. Control variables:		
a) Share of the workforce:		
Age < 25 years	12.1	13.1
Age > 50 years	9.2	9.9
Female	30.8	26.5
Low educated (no degree, primary or lower secondary)	32.1	32.2
Blue-collar	45.0	35.7
Tenure > 10 years	29.9	24.4
Supervising their co-workers	16.2	15.4
b) Firm characteristics:		
Size (number of workers)	281.4	887.7
Level of wage bargaining:		
CA only at national and/or sectoral level²	64.9	
CA at the company level²	26.5	
Other	8.6	
Sector:		
Mining and quarrying (C)	0.3	
Manufacturing (D)	41.1	
Electricity, gas and water supply (E)	0.1	
Construction (F)	5.5	
Wholesale and retail trade; repair of motor vehicles (G)	31.1	
Hotels and restaurants (H)	2.9	
Transport, storage and communication (I)	6.2	
Retail estate, renting and business activities (K)	12.8	
Number of employees	34,969	
Number of firms	1,498	

[+] The descriptive statistics refer to the weighted sample

[1] Individual gross hourly wages include overtime paid, premiums for shift work, night work and/or weekend work and bonuses, i.e. irregular payments which do not occur during each pay period, such as pay for holiday, 13th month and profit sharing.

[2] CA stands for collective labour agreement.

Appendix 3: Firm Performance Regressions

Dependent variable:	Profits per employee[1] (ln)			Turnover per employee (ln)			Value added per employee (ln)		
Intercept	6.577**	6.700**	6.792**	9.803**	9.870**	9.913**	7.662**	7.733**	7.753**
	(23.41)	(24.98)	(24.43)	(52.08)	(64.62)	(54.35)	(69.28)	(72.34)	(70.06)
Standard deviation of wages[2]	1.865**			1.118**			1.030**		
	(3.34)			(3.62)			(5.08)		
Coefficient of variation of wages[2]		1.181**			0.719**			0.640**	
		(3.22)			(3.06)			(4.65)	
Max-min ratio of wages[2]			0.072*			0.049*			0.048**
			(2.08)			(2.48)			(3.77)
% women	-0.011**	-0.012**	-0.012**	-0.007**	-0.007**	-0.007**	-0.006**	-0.006**	-0.006**
	(-6.25)	(-6.30)	(-6.20)	(-5.39)	(-5.42)	(-5.39)	(-9.1)	(-9.12)	(-8.84)
% blue-collar	-0.003	-0.003°	-0.004*	-0.006**	-0.007**	-0.007**	-0.003**	-0.004**	-0.004**
	(-1.36)	(-1.83)	(-2.26)	(-4.28)	(-4.58)	(-4.86)	(-3.99)	(-4.69)	(-5.06)
% low-educated	-0.002	-0.002	-0.003	0.000	0.000	0.000	-0.002**	-0.002**	-0.002**
	(-1.36)	(-1.41)	(-1.69)	(-0.09)	(-0.14)	(-0.36)	(-3.09)	(-3.12)	(-3.42)
% age < 25 years	-0.009°	-0.009°	-0.008°	-0.009**	-0.009**	-0.009**	-0.008**	-0.008**	-0.004**
	(-1.94)	(-1.82)	(-1.77)	(-3.16)	(-3.04)	(-2.98)	(-4.78)	(-4.58)	(-4.44)
% age > 50 years	-0.012*	-0.011*	-0.010°	-0.002	-0.001	0.000	-0.004*	-0.003°	-0.003°°
	(-2.25)	(-2.01)	(-1.82)	(-0.43)	(-0.23)	(-0.08)	(-2.05)	(-1.71)	(-1.52)
% tenure > 10 years	-0.006**	-0.006**	-0.006**	-0.002°°	-0.002°°	-0.002°°	-0.002°°	-0.002°	-0.001°
	(-2.69)	(2.71)	(-2.75)	(-1.46)	(-1.51)	(-1.52)	(-1.47)	(-1.72)	(-1.74)
% monitoring	0.000	0.001	0.002	-0.001	-0.001	0.000	-0.001°°	0.000	0.001
	(-0.01)	(0.22)	(0.68)	(-0.65)	(-0.45)	(-0.06)	(-1.6)	(0.58)	(1.08)
ln(firm size)	0.003	0.004	0.013	-0.002	-0.001	0.003	0.050**	0.050**	0.05**
	(0.07)	(0.09)	(0.27)	(-0.06)	(-0.05)	(0.09)	(2.81)	(2.83)	(2.97)
Level of wage bargaining (2 dummies)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry (7 dummies)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.18	0.18	0.17	0.35	0.35	0.35	0.36	0.35	0.35
F-stat	155.13**	151.93**	148,88**	239.87**	237.03**	232.75**	454.18**	445.72**	436.21**
Number of employees	34,969	34,969	34,969	34,969	34,969	34,969	34,969	34,969	34,969
Number of firms	1,498	1,498	1,498	1,498	1,498	1,498	1,498	1,498	1,498

Notes: **/*/°/°° indicate significance at the 1, 5, 10 and 15% level, respectively. t-statistics are between brackets. Regressions have been estimated by OLS with White (1980) heteroscedasticity consistent standard errors. [1] Approximated by the firm annual gross operating surplus per worker. [2] Individual gross hourly wages include overtime paid, premiums for shift work, night work and/or weekend work and bonuses, i.e. irregular payments which do not occur during each pay period, such as pay for holiday, 13th month and profit sharing.

Appendix 4: Elasticities Between Wage Inequality and Firm Performance[1]

Wage inequality indicator:	*Firm performance indicator:*		
	Profits per employee[2]	Turnover per employee	Value added per employee
Standard deviation of wages[3]	0.452	0.273	0.247
Coefficient of variation of wages[3]	0.327	0.199	0.179
Max-min ratio of wages[3]	0.202	0.138	0.135

[1] The elasticities reported in this table are computed at sample means on the basis of the estimates of Appendix 3.
[2] Approximated by the firm annual gross operating surplus per worker. [3] Individual gross hourly wages include overtime paid, premiums for shift work, night work and/or weekend work and bonuses, i.e. irregular payments which do not occur during each pay period, such as pay for holiday, 13th month and profit.