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Dispersion in Wage Premiums and Firm Performance

by

Pedro Martins

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Pedro S. Martins†

Queen Mary, University of London & CEG-IST, Lisbon & IZA, Bonn

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Abstract

Using matched employer-employee panel data, we estimate measures of pay dispersion per firm-year that take into account both firm *and* worker unobserved heterogeneity. Unlike research that controls only for differences in observables, we find that within-firm pay inequality is significantly associated to lower firm performance.

Keywords: Wage policies, Worker heterogeneity, Fairness.

JEL Codes: M52, J31, D24.

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†Email: p.martins@qmul.ac.uk. Web: http://www.qmul.ac.uk/~bsw019. Address: School of Business and Management, Queen Mary, University of London, Mile End Road, London E1 4NS, United Kingdom. Phone: +44/0 2078827472. Fax: +44/0 2078823615.

1 Introduction

There are two main contrasting theories about the role of wage dispersion in terms of firm performance. On the one hand, fairness and equity considerations (Akerlof & Yellen 1990, Fehr & Schmidt 1999) suggest that pay dispersion is detrimental to firm performance; on the other hand, 'tournament' theories (Lazear & Rosen 1981) indicate that sharp differences in pay create stronger incentives and, to that extent, may improve firm performance.

Given the importance of the topic and the ambiguity in the theoretical predictions, there has been considerable empirical research on this matter (Eriksson 1999, Winter-Ebmer & Zweimuller 1999, Hibbs & Locking 2000, Lallemand et al. 2007). However, due to data limitations, all these empirical papers have been based on measures of pay dispersion that control only for observable differences across workers. The implicit assumption made in those papers is therefore that wage residuals that arise after controlling for human capital (gender, schooling, age, etc) and firm characteristics variables are good proxies for the dispersion of pay determined by firm wage policieis.

However, it is well known that, particularly since the seminal contribution of Abowd et al. (1999), worker heterogeneity can exceed considerably the differences across individuals in terms of the observable variables mentioned above. In other words, unobservable differences (e.g. ability, school quality) can play a large role in explaining wage dispersion as high levels of wage dispersion can simply mean large differences in worker observables. Moreover, when firms reward such worker characteristics that are unobservable for the econometrician (but known by the employer), one cannot interpret such rewards as a 'wage policy' related to fairness or tournaments - instead, those payments simply correspond to the standard remuneration of productive characteristics that occurs in competitive labour markets.

This paper examines this issue by relating firm performance to measures of pay dispersion that take into account worker unobserved heterogeneity. Using matched employer-employee data (described in the next section) and the methods of Abowd et al. (2002) and Ouazad (2006), we are able to calculate worker and firm fixed (wage) effects. As far as we know, we are the first to subtract those unobservable effects (not only the effects of observables) from workers' total pay. We are therefore left with a more rigorous measure of wage premiums, which we use to compute wage dispersion per firm-year, and assess its relationship with firm performance.

2 Data

'Quadros de Pessoal' (QP) is a particularly rich annual census of all firms that operate in Portugal and that employ at least one worker. Under the regulations of this census, administered by the Ministry of Employment, each firm is legally required to provide extensive information about itself and also about each one of its workers that are employed at the census reference month. Crucially for our purposes, the list of variables available in the data includes unique identifiers for each firm and for each employee, which allow us to follow workers over time, even if they move between firms.

Moreover, the list of firm-level variables is also very detailed (it includes the economic sector/industry (five digits), region (four digits), number of employees, firm age, type of ownership, sales, and equity). Worker-level information is also comprehensive (including schooling, age, gender, tenure, occupation (five digits), wages, hours worked, etc). The benchmark measure of pay adopted in this study is based on the sum of the five types of pay available in the data (base wages, tenure-related payments, overtime pay, 'subsidies' and 'other payments') divided by the sum of the two types of hours worked (normal hours and overtime). After deflating the variable using Portugal's CPI and converting it to 2004 euros, we obtain a measure of total real hourly pay.[1]

In the present paper, we consider a subset of the entire data set, considering only firms that are present in all years from 1991 to 2000 and that exhibit sizes not smaller than 20 employees in all years. This sample definition ensures that the size of the data is compatible with our computational constraints. We also require that information about firm sales (from which we obtain our proxy for firm performance) is available in all years from 1991 to 2000.

We obtain a data set including 4,735 different firms and 1,389,328 different workers. 87,656 workers are observed in more than one firm over the ten-year period covered. Table 1 presents some descriptive statistics.

[1]The two other nominal variables (sales and equity) are measured in thousands of 2004 euros per worker. See Martins (2007) for a more detailed description of the data set.

3 Results

In the first step of our analysis, we estimate wage equations including both worker and firm fixed effects (Abowd et al. 1999):

$$ln\ w_{it} = X'_{it}\beta + \alpha_i + \psi_{j(i,t)} + \epsilon_{it}, \tag{1}$$

in which w_{it} indicates the wage of individual i in period t, X includes worker time varying characteristics (schooling, gender, and quadratics in experience and in tenure), α_i is an indicator variable (a fixed effect) for worker i, and $\psi_{j(i,t)}$ denotes a firm fixed effect for the firm j where worker i works in period t. As discussed in the literature, these models require mobility of workers across firms, which is assumed to be exogenous, conditionally on the control variables. The estimation method used is based on Abowd et al. (2002) and the algorithm implemented in Ouazad (2006).

After estimating the model above, we use the estimates of the worker fixed effects ($\hat{\alpha}_i$) to compute the residuals of equation (1).[2] Finally, we calculate different measures of pay dispersion for each firm in each year. We consider the standard deviation and the difference between the 90th and 10th percentiles (see the last two rows of Table 1 for descriptive statistics).

In the second and final step of our analysis, we estimate 'firm performance' equations as below:

$$ln\ FirmPerf_{it} = \lambda \widehat{PayDisp}_{it} + Z'_{it}\delta + \theta_j + \tau_t + \xi_{it}, \tag{2}$$

in which $FirmPerf_{it}$ denotes a measure of firm performance (total sales per worker), $\widehat{PayDisp}_{it}$ indicates a measure of pay dispersion obtained from the results of equation (1), Z is a set of time-varying firm characteristics (worker composition - measured in terms of average gender, schooling, experience and tenure - plus firm size and the log of equity per worker), θ_j is a set of firm fixed effects, and, finally, τ_t is a set of year dummies.

In Tables 2 and 3, we report our estimates of λ, the parameter that indicates the relationship between dispersion in wage residuals and firm performance, once we control for worker (and firm) heterogeneity. Table 2 measures wage dispersion using the standard deviation of the wage premiums (in each firm and in each year) while Table 3 measures such wage disper-

[2]Incidentally, our results indicate no correlation between worker and firm fixed effects, as in other research using similar methods (Abowd et al. 2004).

sion based on the difference between the 90th and the 10th percentiles of the wage premium distribution (again, in each firm and in each year).

In the three first columns of Table 2, the results indicate a positive correlation between wage dispersion and firm performance, regardless of not controlling or controlling for worker and firm observables. However, those results are based on pooled data, and thus can be explained by unobservable differences across firms (for instance, there may be unobserved traits of firms that simultaneously increase wage dispersion and firm performance). In order to address this important concern, the last three columns replicate the models of the first three columns but now including firm fixed effects. The results for the last three columns indicate, unlike before, a negative relationship between wage premium dispersion and firm performance. For instance, a one-standard deviation increase in that measure of wage dispersion decreases performance by about 17%. Moreover, all results are corroborated from the analysis in Table 3, based on our alternative measure of wage-premium dispersion.[3]

4 Conclusions

Previous research on the relationship between the dispersion of pay within firms and firm performance has been based on measures of such dispersion that do not take into account worker unobserved heterogeneity. However, it is well known that the common controls for worker observables used in most research miss a considerable amount of heterogeneity across workers. Using a large Portuguese matched employer-employee panel data set, we instead calculate measures of pay dispersion per firm-year based on wage premiums that account for worker fixed unobserved heterogeneity. When relating dispersion in such premiums to firm performance (and after allowing for unobservable differences across firms), we find a strong negative relationship between the two variables. Overall, our results support the importance of 'fairness' (Akerlof & Yellen 1990, Fehr & Schmidt 1999) in personnel policies as a driver of firm performance.

[3]We have also found that the negative relationship between wage premium dispersion and firm performance is robust across sectors and for firms of different size. Moreover, coefficients tend to be more negative for larger firms and for firms based in the services sectors (than in manufacturing sectors) - results available upon request. Furthermore, when considering measures of wage dispersion that do not take into account worker unobserved heterogeneity, tends to be positive, although typically not significative.

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Table 1: **Descriptive statistics, firm characteristics, 1991-2000**

Variable	Obs	Mean	Std. Dev.	Min	Max
Female	46423	0.375	0.299	0	1
Schooling	46423	6.345	1.958	2	17
Experience	46423	24.414	6.098	2	77
Tenure	46423	8.99	4.986	0	68.217
Firm size	46423	131.116	513.605	20	29850
Log sales per worker	46423	3.894	1.153	-4.613	12.474
Log equity per worker	44971	1.363	1.77	-6.092	11.607
Premium (standard deviation)	46331	0.426	0.118	0.001	1.721
Premium (P90-P10)	46423	1.024	0.305	0	4.73

Notes: Source: Author's calculations based on *Quadros de Pessoal*. Variables are measured at the firm-level, for each year. Worker variables are based on averages of worker characteristics per firm-year: 'Female' is based on a dummy variable taking value one for women; 'Schooling' indicates the number of years of schooling that corresponds to the worker's diploma; 'Experience' is based on the worker's age and schooling; and 'Tenure' is measured in years.

Table 2: **Firm performance and dispersion of wage premiums** (measured by standard deviation)

	OLS-1	OLS-2	OLS-3	FE-1	FE-2	FE-3
	(1)	(2)	(3)	(4)	(5)	(6)
Premiums St. Dev.	1.541	.352	.269	-.166	-.179	-.179
	(.045)***	(.046)***	(.044)***	(.047)***	(.047)***	(.048)***
Female		-1.060	-.736		-.126	-.129
		(.017)***	(.017)***		(.060)**	(.062)**
Schooling		.191	.172		.049	.044
		(.003)***	(.003)***		(.007)***	(.007)***
Experience		.002	.006		.0002	-.003
		(.001)*	(.001)***		(.003)	(.003)
Tenure		.012	.004		.012	.011
		(.001)***	(.001)***		(.003)***	(.003)***
Firm size/1000			-.080			-.100
			(.010)***			(.026)***
Log Equity per Worker			.168			.071
			(.003)***			(.004)***
Obs.	46331	46331	44886	46331	46331	44886
R^2	.032	.192	.254	.645	.646	.64

Notes: Dependent variable: Log sales per worker. Key explanatory variable: standard deviation of wage premiums (computed after partialling out both observable and time-invariant unobserved characteristics). See the main text and Table 1 for more details. Significance levels: *: 0.10; **: 0.05; ***: 0.01.

Table 3: **Firm performance and dispersion of wage premiums** (measured by difference in percentiles)

	OLS-1	OLS-2	OLS-3	FE-1	FE-2	FE-3
	(1)	(2)	(3)	(4)	(5)	(6)
P(90)-P(10)	.574	.108	.096	-.073	-.075	-.076
	(.017)***	(.018)***	(.017)***	(.019)***	(.019)***	(.020)***
Female		-1.052	-.730		-.084	-.085
		(.017)***	(.017)***		(.058)	(.059)
Schooling		.191	.171		.042	.038
		(.003)***	(.003)***		(.007)***	(.007)***
Experience		.003	.006		-.0008	-.004
		(.001)**	(.001)***		(.002)	(.002)
Tenure		.012	.004		.012	.011
		(.001)***	(.001)***		(.003)***	(.003)***
Firm size/1000			-.079			-.102
			(.010)***			(.026)***
Log Equity per Worker			.168			.071
			(.003)***			(.004)***
Obs.	46423	46423	44971	46423	46423	44971
R^2	.031	.191	.253	.645	.646	.64

Notes: Dependent variable: Log sales per worker. Key explanatory variable: difference between 90th and 10th percentile of wage premiums (computed after partialling out both observable and time-invariant unobserved characteristics). See the main text and Table 1 for more details. Significance levels: *: 0.10; **: 0.05; ***: 0.01.