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Firm Size, Foreign Exposure and Inequality in Wage: A Decomposition Analysis

Satis Devkota, Kul Kapri, Mukti Upadhyay

ABSTRACT

This study uses pooled cross-section data from two large surveys of firms in Nepal to determine wage inequality. Applying an inequality decomposition procedure, the estimated wage inequality is then attributed to various factors that affect the labor demand function in the country. We find that firm size and exposure of firms to international trade are among the factors showing statistical significance in affecting wage disparity in Nepal. To the extent wage inequality can be attributed to the factors considered in this study, firm size alone accounts for 55 to 84 percent of the inequality depending on the size indicators such as employment or sales. On the other hand, foreign exposure, unlike strongly suggested in the literature, has played much less of a role.

Keywords: Wage inequality, survey data, firm size, international trade exposure, inequality decomposition

I. INTRODUCTION

A number of studies have shown that exporting firms are larger, more productive, and pay a higher wage than non-exporters. Others have found similar results for importing firms as well. Since firm size and productivity are not constant but rather have a distribution within and across industries, this implies that there will be wage inequality across firms and industries at any time in any country.

Bernard and Jensen (1995) investigated the behavior of exporting and non-exporting firms in the U.S. data before and after controlling for capital per worker, plant age, and firm size, as well as individual-specific effects regarding regions, industries, and years. With or without the controls, they found that the wage premiums are positive and statistically significant in exporting plants relative to others. Hahn (2005) produced similar results using Korean manufacturing data from 1990 to 1998. Export wage premiums were also shown to exist by Schank et al. (2007) for Germany, Frías et al. (2011) for Mexico, and Krishna et al. (2011) for Brazil.

Several authors find that importing firms also display characteristics of larger size, higher productivity and higher wages (Bernard et al., 2007; Lopez, 2005; and Seker, 2012) than is the case with non-trading firms. When firms are divided into four groups (exporters, importers, both exporters and importers, and none), a positive relationship between labor productivity and import level is found for Belgian firms (Muuls and Pisu, 2009) and for German manufacturing firms (Vogel and Wagner, 2010).

Literature shows that wages are unequal because of variations in skill, ability, experience, gender, race, and other characteristics of workers. Even after adjustments are made for these differences, firm size and productivity can be important in affecting wage rates (Akerlof, 1984; Kahn and Curme, 1987; and Donohue and Heywood, 2004). Experimental research conducted by Charness and Kuhn (2007) concludes that a phenomenon of gift exchange is prevalent and strong among workers and firms. Larger the wage (a gift to labor) received from the firm, larger is the effort (a gift to firm) workers provide in return. Alternatively, larger and more productive firms pay higher wages out of fairness consideration (Amiti and Davis, 2012), even after adjusting for skilled employment by exporting firms which in turn succeed in producing high quality products that compete in the world market. (Verhoogen, 2008).

Our paper uses firm-level data from Nepal collected by the World Bank's Enterprise Survey Unit to examine whether globally engaged firms pay higher wages and thereby contribute to wage inequality. We first estimate a wage equation at the firm level and determine the level and pattern of wage inequality. The paper then decomposes the existing inequality into the determinants of wage using linear decomposition technique developed by Wagstaff, et al. (2003). Finally, our decomposition results help us to identify the contribution of such variables as firm size and foreign exposure on inequality in the firm level wage.

II. COUNTRY BACKGROUND

Nepal is one of the poorest countries ranked 157th out of 187 countries ranked by the Human Development Report (2013), with a Human Development Index of 0.463 (UNDP, 2013). "Agriculture accounts for a third of the GDP of the country and provides employment to three out of four members of the country's labor force." (Islam, 2014). The average agricultural growth rate in Nepal declined from 3.3 percent during 1997–2001 to 2.67 percent during 2002–07 (MoF, 2014/15). The manufacturing value added has stagnated around 7 percent of GDP over ten years during 2005-14 (WDI, 2014). Growth potential of industry remains fairly strong because of the widely prevailing underemployment as well as high unemployment of labor.

Of firms in Nepal trading internationally, only 9 percent both export and import, and an additional 2 percent of firms export some of their *output* but do not import, and almost 74 percent of firms import some of their *inputs* but do not export their *output*. Overall, only 3.1 percent of the firms export their products either directly or indirectly. Among firms with five or more employees, only 3.8 percent are exporters. Among large firms[1] 28.3 percent are exporters, still a low figure by international standards. Firms are twice as likely to be exporters in the manufacturing sector as those in other sectors.

The average firm's total sales amounted to 41.5 million Nepali rupees (NRs) in 2005 prices, the lowest among the comparator countries consisting of Bhutan, Mongolia, Bangladesh and Lao PDR. Over three years before the survey (before 2009), sales grew at an average annual rate of 9 percent, lower than in Bhutan and Mongolia, and higher than in Bangladesh and Laos. The average sales per firm amounted to NRs. 60.9 million in 2009 and increased to NRs. 133 million in 2013. This represents a robust 118% increase during the four years. The average sales per worker also rose from NRs. 0.933 million in 2009 to NRs. 1.393 million in 2013.

Between 2006 and 2008, business enterprises increased employment on average by 3.9 percent per year. Annual growth in manufacturing employment was, however, only 1 percent and jobs in tourism, a major earner of foreign exchange, actually declined. Looking at labor data by firm size, large firms accounted for 84.6 percent of employment in 2013 compared to 82.3

percent in 2009. Other (micro, small, and medium) firms showed a corresponding decline from 17.7 percent in 2009 to 15.4 percent in 2013. Overall, the average employment has increased from 37.2 workers in 2009 to 49.8 workers in 2013.

Another indicator of labor market conditions, our main topic in this paper, is wage dispersion. Data show considerable wage heterogeneity across firms with a coefficient of variation for log wage at 0.07. The average real wage has increased by 6.38% per year during the period from 2009 to 2013, partly because of slightly greater representation of medium to large firms in 2013. A notable feature of the wage condition has been in the inequality between wage paid by large firms and wage paid by others. Thus, the average wage paid by large firms in 2009 was 100 percent higher than medium firms and 108 percent higher than micro and small firms. By 2013, the medium firm wages had risen faster than other wages which changed the large-to-small wage ratio to 1.99 and large-to-medium ratio to 1.58. While the gap between large and medium firms closed somewhat, the gap between medium and small firms rose from 3 percent to 36 percent.

III. DATA

We use the Enterprise Survey data for Nepal collected by the World Bank Group. The survey was conducted in the year 2009 and 2013 using stratified random sampling. Both surveys collected a wide array of qualitative and quantitative information through face-to-face interviews with firm managers and owners regarding the business environment and the productivity of their firms. The surveys covered infrastructure, trade, finance, regulations, taxes and business licensing, corruption, crime and informality, finance, innovation, labor, and perceptions about obstacles to doing business. Using data for the two years, we construct a pooled cross-sectional database of firm level characteristics for the 901 firms that were selected randomly from around the country.

The surveys provide information on such firm variables as sales, wage bill, cost of raw materials, net book value of machinery, vehicle, land and building, as well as personnel data such as the number of permanent and temporary workers, and production and non-production workers. Sales, wages and other nominal variables expressed in Nepalese Rupees (NRs) are all expressed at constant 2005 prices obtained from the Nepal Rastra Bank, the central bank of Nepal.

Our dependent variable is the natural log of wages calculated as the total wage bill divided by the number of employees for each firm.

We consider several independent variables, as suggested by the literature, to explain wages at the firm level. Total sales, sales per worker, and total employment can all affect the wage a firm pays out (Amiti and Davis, 2012; Egger and Kreickemeier, 2009). Sales and employment are alternative measures of firm size and appear in their logarithmic forms. Next, participation in international trade can also affect wages. Based on firm's participation in exports or imports, we construct a variable *fxposr*, a foreign exposure dummy which takes the value 1 if a firm is engaged in international trade and 0 if not. Besides exports and imports, the surveys also provide information on whether workers at the firm are unionized or participate in union forming activities. Our regressions also control for the age of a firm, the year of a firm's inception, and industry and region specific effects. A summary statistics of the main variables used in this study are presented in Table 1.

Table 1a: Descriptive Statistics

Variable	N	Mean	St Dev	Min	Max
lwr: Natural log of wage rate in NRs.	901	10.87	0.76	7.48	13.99
lns: Natural log of total sales in NRs.	901	15.70	2.08	11.18	22.67
lspw: Natural log of sales per worker	901	12.89	1.35	8.96	17.07
lte: Natural log of total employment	901	2.80	1.24	0.69	7.49
fed: Foreign exposure dummy	901	0.85	0.35	0.00	1.00
sopw: Share of permanent worker	901	0.88	0.20	0.05	1.00
ud: Union dummy	901	0.32	0.47	0.00	1.00
age: Age of the firm	901	15.00	10.50	1.00	66.00
age^2*:* Square of age	901	335.21	486.76	1.00	4356.0

Source: Calculated by authors

IV. METHODOLOGY

Our model estimation proceeds in several steps starting with a wage equation. This allows us to find the extent of inequality in wages across firms. The wage inequality is then decomposed into inequalities in the determinants of labor demand that yielded our wage equation in stage one.

Wage Equation

Şeker (2012) empirically shows that globally engaged firms are larger, more productive, and pay higher wages than non-traders, using a detailed firm level dataset from 43 developing countries. Following Şeker (2012), wage at the firm level is assumed to be determined by the size of the firm, its exposure to international trade, and other factors including in particular firm level characteristics. Firm specific factors provide us controls that indicate whether older firms with a higher share of *permanent workers* or firms with any *union activity* pay higher wages. Our wage equation in a linear form can thus be written as follows:

$$w_i = \beta_0 + \beta_1 firmsize_i + \beta_2 fxposr_i + \sum_{j=3}^{k} \beta_j X_{ji} + \gamma_{yr} D_{yr} + \gamma_{ind} D_{ind} + \gamma_{rgn} D_{rgn} + \varepsilon_i \qquad (1)$$

where subscript *i* indicates a firm, *w* is the wage rate, *fxposr* is foreign exposure dummy, *firmsize* is firm size given by total sales, sales per worker, or total employment. Similarly, D_{yr}, D_{ind}, and D_{rgn} are year, industry and region dummies respectively. Year effects are added to the model to capture economy-wide shocks that affect wage in the country. The industry effects and region effects are included to address time invariant factors for industries and geographic regions respectively. The residuals ε are assumed to follow a normal distribution with a zero mean and a constant variance. The definitions and descriptive statistics of other variables used in the model

are discussed in the previous section. We assume all $\beta_j > 0$ except for the coefficient of the firm's age. To avoid possible problems with multicollenearity, each measure of the size of the firm is introduced in a separate regression with and without foreign exposure dummy since firm size and international exposure are likely to be positively correlated. Regression results are shown for alternative measures of firm size in Table 2 without *fxposr,* and in Table 3 with *fxposr*.

Calculation and Decomposition of Wage Inequality

We use the concentration index to calculate the inequality in wage and other variables listed in Table 1 above.[2] This requires the ordering of firms by the wages they pay from lowest to highest and pair the resulting cumulative wage percentages with the cumulative percentages of firms. Thus, the lowest paying percentile (or any other quantile) of firms would be matched with their corresponding wage percentage in the total wage payments for all firms. The cumulative percentages of firms and of wages can be plotted, if so desired, to draw a "Lorenz Curve" of wages in order to study wage inequality across firms. These two sets of numbers also yield a wage Gini index, the subject of our focus in this paper. The procedure is then repeated to calculate concentration indexes (*CI*s) for *other variables* in equation (1). *CIs* for other variables are still based on the rank ordering of firms, and cumulative percentages of firms, just the way they are used to calculate the wage Gini. Holding the rank ordering of firms constant, the *CI* for any given variable replaces cumulative wage percentages with cumulative percentages in that given variable. To measure the *CI* for firm size, for instance, the wage percentages are replaced with sales or employment percentages because sales and employment are our indicators of firm size. Since the ordering of firms does not change when inequality for any non-wage variable is computed, such inequality is no longer called the *Gini* but rather the *CI*.

The inequality measurement sets the stage for our next step, namely the decomposition of wage inequality into factors behind the labor demand function. The wage *Gini* is given by the following equation:

$$GI_w = \frac{2}{n\mu}\sum_{i=1}^{n} w_i R_i - 1 \tag{2}$$

where μ is the mean wage, n is the number of observations in the sample and R_i is the rank of firms after they are arranged in an ascending order on the basis of their wage. The wage, w_i, in equation (2) comes from equation (1). By substituting the value of w_i from equation (1) and simplifying, we get[3].

$$GINI_{wage} = \eta_1 CI_{fxposr} + \eta_2 CI_{fsize} + \sum_{j=1}^{k} \eta_j CI_j + \eta_{yr} CI_{yr} + \eta_{ind} CI_{ind} + \eta_{rgn} CI_{rgn} + \frac{GC_\varepsilon}{\mu} \tag{3}$$

where CI_j is the concentration index that measures the inequality in j^{th} covariate in equation (1) and GC_ε is the generalized concentration index (Shorrocks, 1983) which measures the inequality in the residual term. Further, η_j is the partial elasticity of wage with respect to the j^{th} covariate in equation (1) and is given by $\eta_j = \beta_j \frac{\overline{X}_j}{\mu}$, where $\overline{X}_j$ represents the mean of j^{th} covariate in the model.

Equation (3) shows that the firm level wage inequality consists of two major components. The first is the deterministic component, equal to a weighted sum of the concentration indices

(CI$_s$) of the *K* covariates, where the weight for X_{ji} is simply the elasticity of wage with respect to j^{th} covariate (evaluated at sample means). The second is a residual component captured by the error term, and reflects the inequality in wage that cannot be explained by systematic variations in X_{ji}.

V. RESULTS AND DISCUSSION

Table 2 shows regression results for the effect of firm size and productivity on the firm level wage rate. Columns 1, 3 and 5 indicate simple correlations between the wage rate and either sales (total or per worker) or employment. The even numbered columns add other variables as described before. Results on the first two columns indicate no change on the total sales coefficient even after four more explanatory variables are added. Thus, a one percent increase in total sales is associated with a wage increase of 0.26 percent at the firm level. Does this relationship change when we replace total sales with sales per worker? Columns (3) and (4) show the results. The change in the wage is actually very marginal and is statistically insignificant. Our full specification (column 4) indicates a coefficient of 0.25 for per worker sales as compared to 0.26 for the total sales[4].

Our third variable indicating firm size is employment of workers. Columns (5) and (6) report the results. A firm that employs 1 percent more workers than another pays a 0.22 percent higher wage. Here we find a larger coefficient for the firm size relative to the coefficient we get when we include no other controls.

Secondly, compared to total sales and sales per worker, employment has a smaller effect on wages paid. Overall, a larger firm pays a higher wage than does a smaller one. Other controls for worker and firm level characteristics and year, industry, and region effects display statistically significant results. In all of the models estimated, the standard errors are clustered errors at the industry level.

Next, we introduce *Fxposr* in the regression model and report the result in Table 3. Once again, we look at simple correlation between *Fxposr*, our variable of interest, and wages, before proceeding with the estimation of our model with controls. Finally, the firm size is also brought in to get a full picture of wage determination. In particular, we test whether the firm size and international exposure still significantly affect the firm level wage jointly and severally. The results are reported in Table 3, again with standard errors clustered at the industry level.

Fxposr and log wages are significantly correlated as shown by the size and significance of the coefficient 0.355 in Table 3 column 1. But the inclusion of *Fxposr* in the model does not produce a substantial change in the coefficients of firm size we saw in Table 2. Columns (3)-(8) in Table 3 indicate that foreign exposure itself turns out to be insignificant when it appears along with sales, a proxy for firm size. Yet, the two variables together appear highly significant according to the F-test. Moreover, when labor employed is used to represent firm size, we find that a firm engaged in international trade provides about 27 percent higher wage than a typical nontrading firm. This result is consistent with the story of firms that experience greater efficiency because of their ability to withstand external competition and therefore to pay a higher wage. In the same specification with employment representing the firm size, we find that a 10 percent greater employment leads to about a 2.2 percent higher wage.

Table 2: Effect of Firm Size on Wage Rate

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Lnsales	0.261***	0.263***				
	(0.014)	(0.012)				
Ln(sales/L)			0.271***	0.250***		
			(0.027)	(0.026)		
Lnlabor					0.157*	0.226***
					(0.084)	(0.055)
PermLshr		0.810**		0.400		1.028***
		(0.303)		(0.259)		(0.365)
Union		0.219**		0.457***		0.425**
		(0.089)		(0.108)		(0.153)
Age		-0.017***		-0.009		-0.025*
		(0.005)		(0.006)		(0.014)
Age2		0.000***		0.000		0.000*
		(0.000)		(0.000)		(0.000)
Constant	6.950***	6.286***	7.383***	7.221***	10.317***	9.336***
	(0.200)	(0.261)	(0.274)	(0.230)	(0.180)	(0.239)
Year Effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry Effects	Yes	Yes	Yes	Yes	Yes	Yes
Region Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	901	901	901	901	901	901
R^2	0.354	0.392	0.324	0.350	0.174	0.241

Source: Calculated by authors, 2015

Note: All regressions are estimated by OLS and include year, industry, and region effects. Standard errors are clustered at the industry level are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table-3: Effect of Foreign Exposure and Firm Size on Wage Rate

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lnsales			0.260***	0.262***				
			(0.015)	(0.014)				
Ln(sales/L)					0.268***	0.248***		
					(0.025)	(0.026)		
Lnlabor							0.147	0.222***
							(0.087)	(0.058)
Fxposr	0.355***	0.269**	0.023	0.047	0.155**	0.095	0.277***	0.236***
	(0.076)	(0.105)	(0.079)	(0.108)	(0.064)	(0.101)	(0.094)	(0.112)
Permlbr		0.690*		0.814**		0.411		1.045***
		(0.360)		(0.311)		(0.273)		(0.371)
Union		0.586***		0.214**		0.446***		0.396***
		(0.108)		(0.087)		(0.112)		(0.135)
Age		-0.018		-0.017***		-0.009		-0.025*
		(0.012)		(0.005)		(0.006)		(0.014)
Age²		0.000		0.000***		0.000		0.000*
		(0.000)		(0.000)		(0.000)		(0.000)
Constant	10.416***	9.822***	6.943***	6.265***	7.314***	7.172***	10.152***	9.176***
	(0.045)	(0.328)	(0.200)	(0.285)	(0.254)	(0.260)	(0.158)	(0.282)
Year Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Indus. Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	901	901	901	901	901	901	901	901
R^2	0.169	0.215	0.354	0.393	0.326	0.351	0.179	0.240

Source: Calculated by Authors, 2015. *** p < 0.01, ** p < 0.05, * p < 0.1.

To conclude, firm size and wages are closely related. Smaller the size lower the wage, and larger the size higher the wage. The result is inequality in wages. This leads us to explore wage inequality further and identify factors that can account for such inequality.

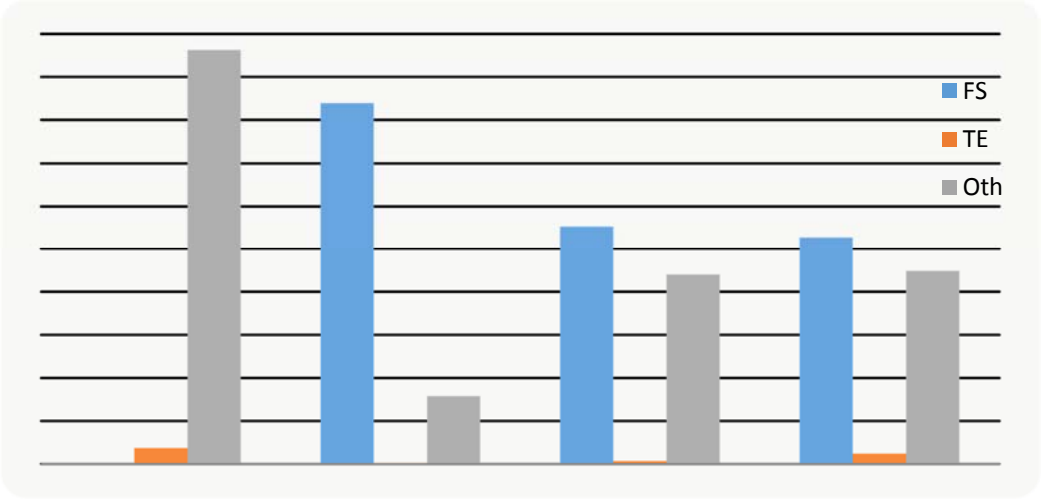
Wage Inequality

The wage inequality in Nepal (the wage *Gini*) according to equation (2) equals 0.4265, which is fairly high and is statistically significant at one percent level. However, the dependent variable in our regression model is wage in logarithms. We find inequality in log wage to be 0.047 which is highly significant indicating a tight 95 percent confidence interval, between 0.046 and 0.048.

The wage inequality is then decomposed into the determinants of wage indicated by equation (1) above. The decomposition is done for four separate cases, the results of which appear in columns (2), (4), (6) and (8) of Table 3. The results of the decomposition of the calculated wage inequality appear in Figure 1. *FS* represents firm size, *TE* represents the trade exposure, and *Oth* represents the other factors in the model. The first set of bars in Figure 1 shows the base case where the firm size is not included.

Our interest is in examining the three other cases. We find the contribution of firm size to wage inequality to be larger than the contribution of foreign (trade) exposure and other factors. Firm size, when proxied by total sales, accounts for about 84.5 percent to inequality whereas sales per worker and total employment measures of the size are found to contribute approximately 55.3 percent and 54.7 percent respectively. In all three cases the fraction of inequality accounted for by foreign exposure is small as indicated in Figure 1 by the short bar in the middle of each set. Factors other than the firm size play a much bigger role in wage inequality. Even though a large fraction of firms in Nepal engages more or less in international trade, the relationship between trade and wage inequality seems to be marginal. In all of the models reported in Table 2 and 3 above, $\bar{R}^2 \leq 0.40$ which makes the contribution of other non-model terms on wage inequality more substantial.

Figure 1: Decomposition of Firm Level Wage Inequality



As shown, firm size plays a significant role in wage inequality in Nepal. However, high wages paid by larger firms are not the root of this wage inequality. These higher wages by larger firms are a result of rising efficiency while small firm wage growth remains sluggish. The problems of inadequate intersectoral migration of labor and high incidence of poverty are partly explained by the productivity in the manufacturing and service sectors that, while gradually rising, remains low in Nepal. Future reductions in wage inequality might be achieved through changes in policy, especially the implementation of a minimum wage to raise incomes of low-skill workers in small firms.

VI. CONCLUSION

Firm size and, to a lesser extent, exposure of firms to international trade significantly affect the firm level wage in Nepal. Firm size accounts for 54.7 to 84.5 percent of wage inequality depending on the firm size indicators such as employment or sales. Foreign exposure plays much less of a role in inequality. Trade exposure of the country is dominated by firms' imports rather than their export competitiveness. It will be important to see what aspects of public policy in other developing countries have succeeded in nurturing domestic firms before the firms gain enough efficiency to be able to compete in export markets. Indeed, higher productivity in smaller firms can be instrumental in raising wages and lower wage inequality. Even within the context of this study, further exploration into other factors such as unionization or a lack thereof could possibly be an interesting area of research. Given a greater role of public sector employment in Nepal, and developing countries more generally, a distinction between public and private sector wage practices and their interrelationships could be another fruitful area of research.

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Notes

1 Based on Nepal Enterprise Survey, we consider firms that employ at least 100 workers as large, firms with 20-99 employees as medium, 5-19 workers as small and less than 5 workers as micro. However, for analysis in this paper, we consider all firms with at most 19 employees as small.

2 The concentration index (*CI*) uses a measure of income, in our case the wage paid by a firm, to rank economic agents (firms) in a study of inequality. For instance, *CI* for education (or health) ranks individuals in order of their incomes rather than their level of educational attainment (or health status), and then matches thus derived cumulative income percentages against cumulative education attainment percentages. For an example of *CI* in education, see Devkota and Upadhyay (forthcoming) and in health, see Kakwani et al. (1997).

3 Detailed solution is available from authors upon request.

4 The difference is not significant at less than 5% and 10% significant level.

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Appendix 1: Variable Means by Number of Firms and Firm Size

Firm Size	No. of firms	Log wage	Log sales	Log sales/L	Log L (emp.)	Foreign exposure	Share perm L	Union	Age	Age sq.
Large	77	11.355	19.569	14.174	5.422	0.987	0.932	0.935	22.766	650.948
Medium	284	10.949	16.529	12.935	3.594	0.813	0.879	0.588	17.764	412.595
Small	540	10.766	14.710	12.698	2.012	0.854	0.884	0.104	12.439	249.483

Source: Calculated by authors.