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Wage Inequality and Establishment Heterogeneity

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Abstract

We analyze wage dispersion within and across establishments in Korea between 2007 and 2013. We find that foreign owned establishments and those operating in global markets have higher within establishment wage dispersion. The effect is over and above the establishment size effect. Furthermore, wages are higher in larger establishments and internationally oriented ones. Our findings are consistent with theories explaining management pay and the scope of control. Our results also provide evidence that can explain the rise in wage inequality due to the emergence of ‘super star’ firms and global supply chains.

Keywords: wage inequality, managerial talent, globalization

JEL Classification Numbers: F16, J31

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1 Introduction

In recent years, there has been a fast growing literature documenting the increase in income inequality across the world (e.g. Atkinson, Piketty, and Saez (2011)). An important concern largely ignored by most trade economists is that the gains of globalization have not benefited all in the same way. For instance, Autor, Dorn, and Hanson (2013) document how import competition from China has contributed to almost 3 million jobs lost in U.S. manufacturing between 2000 and 2010. Goos, Manning, and Salomons (2009) show how offshoring has contributed to increased polarization in the U.K.. With the emergence of ‘super star’ firms¹ operating along global supply chains, increased scale economies related to international trade have likely resulted in increased profits of multinational firms with limited pass-through into prices and wages (e.g. Goldberg and Pavcnik (2016)). This is in line with recent evidence showing the increased market power in U.S. listed firms during the last 4 decades (De Loecker and Eeckhout (2017)).

This paper analyzes the role of establishment heterogeneity in rising wage inequality. In particular, there are large differences between establishments in terms of their size and hence profitability even within narrowly defined sectors. Establishments also differ in terms of their participation to international trade or international production networks. We use a new and hitherto unexploited establishment level data set of Korean firms with detailed information on different occupational hierarchies and their wages to analyze how establishment size and exposure to international trade may have contributed to wage dispersion within and across establishments.

Wage policies that pay out high wages to CEOs have been argued to contribute to growing earnings inequality. However, as argued by Mueller, Ouimet, and Simintzi (2017a,b), the rise of CEO pay over the last decades alone cannot explain the increased aggregate wage inequality; CEO pay typically lies well above the 90th percentile, whereas the aggregate rise in inequality is often measured as the 90/10 log wage inequality. Therefore, if wage inequality between different occupations within the firm has also increased,² then this may be an important factor explaining overall wage inequality in a country. The theoretical literature explaining variation in CEO pay may well be extended as is done by Mueller, Ouimet, and Simintzi (2017a,b) to the dispersion in wages between occupations within firms. Gabaix

¹Autor, Dorn, Katz, Patterson, and Van Reenen (2017) offer a number of explanations for the rise of ‘super star’ firms such as the rise of software platforms and the internet, the global supply chains and network effects favoring firms that are better in adapting and exploiting new modes of (international) production and organization.

²Autor and Dorn (2013) for the U.S., Goos, Manning, and Salomons (2009) for the U.K., and Breemersch, Damijan, and Konings (2017) for various OECD countries show that wage polarization across various occupations seems to be a widespread stylized fact of the last few decades.

and Landier (2008) show that CEO pay depends on the size of its firm, which captures the amount of resources under his control. More talented CEOs are matched with larger firms, resulting in a positive relationship between firm size and CEO pay (Terviö (2008)). Hence, if more talented managers are matched with larger firms, we should expect to see a positive relationship between firm size and not only CEO pay, but also with pay of other managers along the hierarchy of the firm.

If the wage dispersion increases with the firm size, then the emergence of ‘super star firms’ that dominate the market in terms of output, employment and exports can only have contributed to the increased wage dispersion.³ De Loecker and Eeckhout (2017) show that market power in the U.S. has been rising over the last four decades due to the increasingly growing role of large and dominant firms, resulting in increasing dispersion in profits and a decline in the labor share in the U.S.. Budd, Konings, and Slaughter (2005) have shown that international rent-sharing between affiliate and parent profits of multinational enterprises can indeed contribute to the rising wage inequality, and as production has become increasingly international over the last decades, this channel has become more important as a driver of observed wage inequality. Similarly we can expect that as the scope of the firm has been growing within the global economy and with increasing technological challenges, the wage dispersion within and across firms has also increased.

In this paper we first document within establishment wage dispersion that cuts across different hierarchies. we then analyze to what extent the wage dispersion within and across establishments is explained by establishment size and its global nature, both capturing the scope of control required by not only the CEO but also lower management functions. To this end, we consider two proxies that measure the global nature of the establishment; the export intensity and the fraction of foreign owned shareholders.

2 Data

The data used in the analysis is the Workplace Panel Survey by Korea Labor Institute. It is establishment level biennial survey from 2007 to 2013. The population of all establishments with 30 or more employees in Korea is partitioned into 240 strata based on industry classification, establishment

³For instance, firm size distributions in terms of sales, employment, exports and imports, follow a power law. Take exports as an example, in most countries 90 percent of exports is concentrated in the top 10 percent of exporting firms and the largest exporters tend to be the largest imports (Amiti, Itskhoki, and Konings (2014)).

size, and region.⁴ Then, the establishments in this survey are selected based on the stratified random sampling, giving larger sampling fraction to larger establishments.⁵

Within each establishment we have wage information on three categories of workers; new recruit, section chief, and department head.⁶ By definition, more managerial talent is required to department heads than section chiefs, who in turn are expected to have more managerial talent than new recruits. While the data report only on three broad hierarchies within the establishment, the information on compensation that workers receive includes both basic employee pay and bonuses, which is potentially an important aspect of the package that especially managers receive. Closely related to our approach is the work of Mueller, Ouimet, and Simintzi (2017a,b). They use U.K. firm level data with information on more hierarchal levels within the firm, but only with basic pay. We calculate three wage ratios, r_{12} , r_{13} , and r_{23} , where r_{ij} represents the wage ratio of the j -th rank to the i -th rank, and the j -th rank is higher than the i -th rank. For example,

$$r_{12} = \frac{\text{Average Wage for Section Chief}}{\text{Average Wage for New Recruit}}.$$

An important feature of the data is that it contains information on the global nature of the establishment. In particular, we know the fraction of exports in total sales, which allows us to distinguish between exporters versus domestic oriented establishments. Typically, exporters are more productive (e.g. Bernard, Van Beveren, and Vandebussche (2014)) and the scope of control in them is larger as they serve various export markets, which would be reflected in the compensation packages. In addition, we have firm level information on the ownership share of foreign investors. This allows us to distinguish between multinational firms and domestic ones. As multinational enterprises are typically larger, more profitable, active in many international markets and tend to have better management practices (e.g. Bloom, Sadun, and Van Reenen (2012)), we expect that the compensation packages for different hierarchies would be adjusted accordingly.

Finally, the data provides operational and financial information on various indicators such as sales, total assets, profits, and employment.⁷ In our analysis we only consider establishments that report

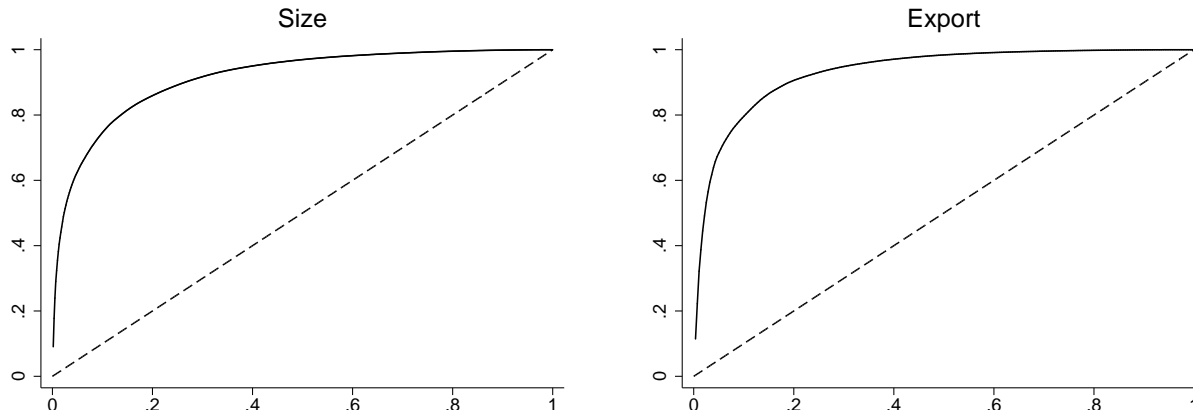
⁴The population excludes establishments in agriculture, fisheries, mining industries, whose combined share of GDP is 2 percent.

⁵For example, only 11.7 percent of establishments with 30-99 employees in the construction sector are selected, whereas the sampling fraction goes up to 71.4 percent for establishments with 500 or more employees in the same sector.

⁶For section chief and department head, it is the average first year wage for the major type of job in the establishment. For example, if the major activity is manufacturing, then the average first year wage of section chiefs and department heads only in that occupation is reported.

⁷Some information is only available at the firm level, while other information at the establishment level. Details are

Figure 1: Skewed size and export distribution in 2007.



Note: The left (right, respectively) panel plots Lorenz curve using total asset (export, respectively) of establishments in 2007. Establishments with no export are excluded in the right panel.

information on establishment level compensation for all three levels of hierarchies. This resulted in removing 20 percent of our observations, leaving a sample of 5,654 observations on 2,166 establishments (see data appendix for details). About half of them belong to the manufacturing sector, with the rest spread across construction, retail, transport and business services.

Table 1 presents descriptive statistics for the key variables of the analysis. There exists substantial wage dispersion in the average establishment; relative to the wage of a new recruit, which is on average 24 thousand USD a year, the department head earns 90 percent more. A section chief earns on average 50 percent more than a new recruit, and the department head earns 30 percent more on average than a section chief. Comparing the average and median of the size measures reveals that the distribution of establishment size is right skewed and there is a lot of heterogeneity in terms of size. This is also shown in the left panel of Figure 1 where we plot the Lorenz curve of total assets. Only 20 percent of the establishments account for about 80 percent of all total assets in the sample. This indicates the presence of a few dominant establishments with a large fringe of small ones. If ‘super star’ firms play a role in increased wage inequality we would expect that wage dispersion in these dominant and large establishments would be higher.

Note also that on average 12 percent of sales are exports. But if we focus only on exporters, this number increases to 34 percent. The average foreigners’ ownership share in the sample is 5 percent,

provided in the data appendix.

but when we consider multinationals only, the average increases to 40 percent.⁸ When we plot the distribution of exports in Figure 1 it is clear that exports is also concentrated in a few top exporters, adding to increased heterogeneity between establishments. We explore how this heterogeneity may have contributed to increased wage dispersion in the next sections.

3 Wage Inequality and Establishment Heterogeneity

Larger wage dispersion at larger and more internationalized establishments

We start the empirical analysis with examining whether the wages for employees of different ranks are more dispersed in larger and more internationalized establishments. We focus on two key drivers of wage dispersion within establishments. As has been shown in the literature on CEO compensation and more generally by Mueller, Ouimet, and Simintzi (2017b), the larger the scope of control of managers, the higher the required compensation. Most papers have measured the scope of control by firm size only. However, since firm size typically refers to employment or total assets in one particular country, it does not capture other important dimensions of the scope of the firm. In particular, firm size might poorly capture the scope of control managers are required to deal with when its main markets are foreign or when it is part of a multinational group. There may even be firms that have a relatively small activity in a particular country, while most of its activities are taking place abroad. We therefore measure the scope of control of management in the establishment by its export orientation and multinational nature in addition to its size.

We seek to estimate the following empirical relation of wage dispersion within the establishment:

$$\ln r_{it} = \alpha + \beta \ln Size_{it} + \gamma_1 1[EX < 50]_{it} + \gamma_2 1[EX \geq 50]_{it} + \mathbf{x}_{it}\delta + \varepsilon_{it}, \quad (1)$$

where subscripts i and t represent establishment and year, respectively. We use the log of the three wage ratios ($r12$, $r13$, and $r23$) as the dependent variable one by one. $\ln Size$ is the log of the establishment size measured by its total asset. A binary variable $1[EX < 50]$ ($1[EX \geq 50]$, respectively) is equal to 1 if the proportion of the export in total sales of the establishment is between 0 and 50 percent (50 percent or more, respectively), and zero otherwise. The vector \mathbf{x} includes a full set of controls for year and sector.

We first estimate model (1) without the two indicators of export orientation. From the first three

⁸The correlation coefficient of foreign market share and foreigners' ownership share is 0.22.

columns of Table 2, we see that wage dispersion is larger in larger establishments. For instance, the pay associated with the section chief increases by 0.013 percent relative to the pay associated with the new recruit when the establishment size increases by one percent. For the department head the pay increases by 0.022 percent compared to the new recruit. Hence, increase in establishment size has a larger impact on wage ratio r_{13} than on wage ratio r_{12} . With only three hierarchal levels available in our sample data we cannot explore further differences, but the pattern we find is consistent with Mueller, Ouimet, and Simintzi (2017b) that analyze U.K. data on more levels of hierarchies.⁹

We next analyze whether there is an effect over and above the size effect, which can be attributed to the international orientation of the establishment. The results are reported in columns (4) - (6) of Table 2, where we add the two indicators of export orientation. We find evidence that more export intensive establishments exhibit higher wage inequality, especially between the department head and other two lower ranks. The wage ratio between the department head and section chief (new recruit, respectively) in an establishment with heavy export, that is, the proportion of the export is at least 50 percent, is 3.1 percent (3.8 percent, respectively) higher than in an establishment with no export.

Instead of the export proportion, we use the foreigners' ownership share as an alternative measure of internationalization of the establishment in model (1): a dummy variable $1[FS < 50]$ ($1[FS \geq 50]$, respectively) is equal to 1 if the foreigners' ownership share of the firm is between 0 and 50 percent (greater than or equal to 50 percent, respectively), and zero otherwise. Estimation results presented in the last three columns of Table 2 show that the higher the foreigners' ownership share, the higher the relative wage for department head. However, the evidence is not statistically significant.

Higher wage at larger and more internationalized establishments

While the size and international orientation of the establishment seem to have a positive impact on within establishment wage dispersion, a related issue is whether larger and more internationally oriented establishments also pay higher wages. In other words, establishment heterogeneity not only contributes to within establishment wage dispersion, but it may also explain wage dispersion across establishments. If more internationally oriented establishments require more talented workers given the larger scope of control, typical efficiency wage considerations could result in higher starting wages in the first place. Or if multinational enterprises and international active establishments engage in more

⁹They analyze 9 different levels and find for instance that one percent increase in firm size is associated with 3.8 percent increase in the pay ratio between the lowest rank and rank 6. This goes up to 17.9 percent for the pay ratio between the highest and lowest levels in the firm.

rent sharing, given their higher profits on average, we would expect higher initial wages (e.g. Budd, Konings, and Slaughter (2005)). We examine this by analyzing the wage of new recruits. We use the same specification as in (1), but use as the dependent variable, the log wage of the new recruit.

In Table 3 we note that the average wage for new recruits is higher in larger establishments; one percent increase in establishment size increases the wage of new recruits by 0.055 percent. If we take the establishment at the 75th percentile of the distribution of the total assets (55 million dollars) and compare it to the establishment at the 25th percentile of the distribution (5.5 million dollars), this estimate implies that the wage of the new recruit would be 49.5 percent higher in the former. Also, the results in columns (2) and (3) of Table 3 suggest that the wage for new recruits is higher in exporting establishments and especially in multinational enterprises. For example, an establishment whose foreigners' ownership share is 50 percent or more pays 11.7 percent higher wage to its new recruits than an establishment without any foreign ownership.

These results suggest that an important source of the observed wage inequality can be explained by the observed heterogeneity between establishments in terms of size and international orientation. Given the highly skewed size distribution that can be observed in most economies and the emergence of so called 'super star' firms in the last couple of decades, size seems an important source that can explain the rise in wage inequality and polarization. Furthermore, the increasing globalization and dominance of internationally oriented firms seem to have added to this general trend of wage inequality and polarization. This effect is over and above the pure size effect.

Robustness

We carry out a number of robustness checks. First, we examine how the growth and internationalization of an establishment is associated with its wage dispersion and wage for new recruits. For this purpose, we replace the sector fixed effect with the establishment fixed effect in model (1). Also, in the model we use the export proportion itself rather than splitting it into the two dummies ($1[EX < 50]_{it}$ and $1[EX \geq 50]_{it}$) expecting that it would capture the globalization of the establishment better.¹⁰ Within estimators in Table 4 show that the relative wage for higher ranks increases as the establishment grows. Also, the more the establishment exports and the higher the foreigners' ownership share, the larger its wage dispersion is. For example, when the export proportion grows from zero to 50 percent, the wage ratio between the department head and new recruit increases by 3.5 percent. According

¹⁰Our results are qualitatively the same, when we use the two indicators instead.

to the estimation results reported in Table 5, the wage for the new recruits does not change in response to the growth of the establishment. Also, its connection to the internationalization of the establishment is not statistically strong.

Next, instead of the total asset we use other measures of the establishment size one by one in model (1): sales and number of employees. Estimation results in Tables 6 and 7, where the establishment size is measured by sales of the establishment, are qualitatively the same as previous findings: establishments with larger size, more export, and higher foreigners' ownership share are more likely to have larger wage dispersion as well as paying higher wages to employees. We find similar results when number of employees is used instead as the proxy for the establishment size as is reported in Tables 8 and 9.

Lastly, to check whether our results are driven by the outliers we drop observations that belong to the lower and upper 5 percentile in terms of the establishment size. The results reported in Tables 10 and 11 are similar to those without dropping outliers.

4 Conclusion

This paper has looked at the role of establishment heterogeneity as a new channel for explaining wage inequality and polarization in the labor market, using a new data set of Korean establishments. We find that a typical department head would earn almost twice as much as a new recruit and one third more than a section chief. This within establishment wage inequality increases with its size, resulting in higher wage dispersion in larger establishments. We also find a positive impact of internationalization on wage inequality. In particular, export intensive establishments and establishments that are part of a multinational tend to have higher wage dispersion amongst different hierarchies within the establishment.

Furthermore, heterogeneity between establishments also explains observed wage differences across establishments. Larger establishments and multinationals pay more than domestic and small ones. The rise of so called 'super star' firms that are often operating along complex global supply chains, taking an increasingly dominant role in the market, suggests that the gains from globalization do not seem to benefit all workers equally.

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Table 1: Descriptive statistics

Variables	Avg.	Med.	Std. Dev.	Min.	Max.	Obs.
<i>Wage</i>						
r12	1.5	1.4	0.4	0.4	13.8	5,654
r13	1.9	1.9	0.7	0.4	19.5	5,654
r23	1.3	1.3	0.3	0.9	12.6	5,654
Wage of new recruits	24.4	23.7	6.1	4.7	109.9	5,654
<i>Size</i>						
Total asset	203	134	2,810	0	131,879	2,598
Sales	274	24	2,807	0	144,996	3,549
Number of employees	340	16	722	3	15,250	5,654
<i>Internationalization</i>						
Export proportion (%)	12.5	0	23.2	0	100	5,654
Foreigners' ownership share (%)	5.5	0	19.1	0	100	5,654

Note: Wage of new recruits (total asset and sales, respectively) measured in real 2015 Korean won converted to thousands (millions, respectively) of US dollars.

Table 2: Larger wage dispersion at larger and more internationalized establishments

Wage Ratio	r12	r13	r23	r12	r13	r23	r12	r13	r23
ln Size	0.013 (0.002)***	0.022 (0.003)***	0.009 (0.002)***	0.013 (0.003)***	0.021 (0.003)***	0.008 (0.002)***	0.013 (0.003)***	0.022 (0.003)***	0.009 (0.002)***
Export proportion (%)									
1[$EX < 50$]				-0.008 (0.009)	0.012 (0.011)	0.020 (0.007)***			
1[$EX \geq 50$]				0.007 (0.013)	0.038 (0.014)***	0.031 (0.010)***			
Foreigners' ownership (%)									
1[$FS < 50$]							-0.003 (0.014)	0.001 (0.017)	0.004 (0.011)
1[$FS \geq 50$]							-0.002 (0.020)	0.010 (0.023)	0.012 (0.015)
Constant	0.347 (0.013)***	0.579 (0.015)***	0.231 (0.008)***	0.349 (0.013)***	0.570 (0.015)***	0.221 (0.008)***	0.347 (0.013)***	0.578 (0.015)***	0.231 (0.008)***
Fixed effects									
Sector	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,598	2,598	2,598	2,598	2,598	2,598	2,598	2,598	2,598
R-squared	0.120	0.127	0.054	0.121	0.129	0.061	0.120	0.127	0.054

Note: The table presents estimation results of the model (1) where the log of the wage ratio is the dependent variable and the establishment size is measured by total asset. Robust standard errors (clustered by establishment) are in parentheses. The notation *** indicates significance at 1% level, ** at 5% level, * at 10% level.

Table 3: Higher wage at larger and more internationalized establishments

Variables	(1)		(2)		(3)	
	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
In Size	0.055	(0.003)***	0.054	(0.004)***	0.053	(0.004)***
Export proportion (%)						
1[$EX < 50$]			0.036	(0.010)***		
1[$EX \geq 50$]			0.018	(0.013)		
Foreigners' ownership (%)						
1[$FS < 50$]					0.042	(0.016)**
1[$FS \geq 50$]					0.117	(0.018)***
Constant	2.978	(0.014)***	2.964	(0.015)***	2.975	(0.014)***
Fixed effects						
Sector		Yes		Yes		Yes
Year		Yes		Yes		Yes
Observations		2,598		2,598		2,598
R-squared		0.236		0.240		0.246

Note: The table presents estimation results of the model (1) where the log of the average wage for the new recruits is the dependent variable and the establishment size is measured by total asset. Robust standard errors (clustered by establishment) are in parentheses. The notation *** indicates significance at 1% level, ** at 5% level, * at 10% level.

Table 4: Wage dispersion and the growth and internalization of an establishment

Wage Ratio	r12	r13	r23	r12	r13	r23	r12	r13	r23
ln Size	0.011 (0.013)	0.040 (0.014)***	0.029 (0.007)***	0.011 (0.013)	0.040 (0.014)***	0.029 (0.007)***	0.011 (0.013)	0.040 (0.014)***	0.030 (0.007)***
Export proportion (%)				0.043 (0.036)	0.069 (0.038)*	0.026 (0.022)			
Foreigners' ownership (%)							-0.054 (0.050)	0.004 (0.059)	0.059 (0.034)*
Constant	0.379 (0.036)***	0.549 (0.038)***	0.170 (0.019)***	0.374 (0.036)***	0.541 (0.038)***	0.167 (0.019)***	0.383 (0.036)***	0.549 (0.038)***	0.166 (0.019)***
Fixed effects									
Establishment	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,598	2,598	2,598	2,598	2,598	2,598	2,598	2,598	2,598
R-squared	0.035	0.044	0.017	0.036	0.046	0.018	0.036	0.044	0.019

Note: The table presents estimation results of the model (1) where the log of the wage ratio is the dependent variable and the establishment size is measured by total asset. Establishment fixed effects are used instead of the sector fixed effects. Robust standard errors (clustered by establishment) are in parentheses. The notation *** indicates significance at 1% level, ** at 5% level, * at 10% level.

Table 5: Wage for new recruits and the growth and internalization of an establishment

Variables	(1)		(2)		(3)	
	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
ln Size	-0.002	(0.010)	-0.002	(0.010)	-0.001	(0.010)
Export proportion (%)			-0.003	(0.034)		
Foreigners' ownership (%)					0.070	(0.048)
Constant	3.113	(0.027)***	3.114	(0.027)***	3.109	(0.027)***
Fixed effects						
Establishment		Yes		Yes		Yes
Year		Yes		Yes		Yes
Observations		2,598		2,598		2,598
R-squared		0.002		0.002		0.004

Note: The table presents estimation results of the model (1) where the log of the average wage for the new recruits is the dependent variable and the establishment size is measured by total asset. Establishment fixed effects are used instead of the sector fixed effects. Robust standard errors (clustered by establishment) are in parentheses. The notation *** indicates significance at 1% level, ** at 5% level, * at 10% level.

Table 6: Larger wage dispersion at larger and more internationalized establishments using sales as the measure of establishment size

Wage Ratio	r12	r13	r23	r12	r13	r23	r12	r13	r23
ln Size	0.013 (0.002)***	0.018 (0.002)***	0.006 (0.001)***	0.013 (0.002)***	0.018 (0.002)***	0.005 (0.001)***	0.012 (0.002)***	0.018 (0.002)***	0.005 (0.001)***
Export proportion (%)									
1[$EX < 50$]				-0.010 (0.008)	0.008 (0.009)	0.019 (0.006)***			
1[$EX \geq 50$]				-0.002 (0.010)	0.021 (0.012)*	0.024 (0.008)***			
Foreigners' ownership (%)									
1[$FS < 50$]							-0.002 (0.011)	0.000 (0.012)	0.002 (0.008)
1[$FS \geq 50$]							0.028 (0.018)	0.051 (0.022)**	0.024 (0.013)*
Constant	0.342 (0.012)***	0.581 (0.014)***	0.240 (0.007)***	0.346 (0.012)***	0.576 (0.014)***	0.230 (0.008)***	0.341 (0.012)***	0.581 (0.014)***	0.239 (0.007)***
Fixed effects									
Sector	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,549	3,549	3,549	3,549	3,549	3,549	3,549	3,549	3,549
R-squared	0.098	0.101	0.044	0.099	0.102	0.048	0.099	0.103	0.045

Note: The table presents estimation results of the model (1) where the log of the wage ratio is the dependent variable and the establishment size is measured by sales. Robust standard errors (clustered by establishment) are in parentheses. The notation *** indicates significance at 1% level, ** at 5% level, * at 10% level.

Table 7: Higher wage at larger and more internationalized establishments using sales as the measurement of establishment size

Variables	(1)		(2)		(3)	
	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
In Size	0.064	(0.003)***	0.062	(0.003)***	0.060	(0.003)***
Export proportion (%)						
1[$EX < 50$]			0.052	(0.009)***		
1[$EX \geq 50$]			0.037	(0.012)***		
Foreigners' ownership (%)						
1[$FS < 50$]					0.066	(0.013)***
1[$FS \geq 50$]					0.098	(0.020)***
Constant	2.938	(0.013)***	2.915	(0.014)***	2.937	(0.013)***
Fixed effects						
Sector		Yes		Yes		Yes
Year		Yes		Yes		Yes
Observations		3,549		3,549		3,549
R-squared		0.291		0.298		0.301

Note: The table presents estimation results of the model (1) where the log of the average wage for the new recruits is the dependent variable and the establishment size is measured by sales. Robust standard errors (clustered by establishment) are in parentheses. The notation *** indicates significance at 1% level, ** at 5% level, * at 10% level.

Table 8: Larger wage dispersion at larger and more internationalized establishments using number of employees as the measure of establishment size

Wage Ratio	r12	r13	r23	r12	r13	r23	r12	r13	r23
ln Size	0.018 (0.003)***	0.022 (0.003)***	0.004 (0.002)**	0.018 (0.003)***	0.021 (0.003)***	0.002 (0.002)	0.017 (0.003)***	0.020 (0.003)***	0.002 (0.002)
Export proportion (%)									
1[$EX < 50$]				-0.007 (0.006)	0.007 (0.008)	0.014 (0.005)***			
1[$EX \geq 50$]				0.003 (0.009)	0.026 (0.010)**	0.023 (0.006)***			
Foreigners' ownership (%)									
1[$FS < 50$]							0.008 (0.009)	0.020 (0.010)**	0.012 (0.006)*
1[$FS \geq 50$]							0.011 (0.014)	0.040 (0.018)**	0.029 (0.011)***
Constant	0.303 (0.016)***	0.541 (0.019)***	0.238 (0.010)***	0.304 (0.016)***	0.538 (0.018)***	0.234 (0.010)***	0.304 (0.016)***	0.546 (0.019)***	0.241 (0.010)***
Fixed effects									
Sector	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,654	5,654	5,654	5,654	5,654	5,654	5,654	5,654	5,654
R-squared	0.103	0.092	0.035	0.103	0.092	0.038	0.103	0.093	0.037

Note: The table presents estimation results of the model (1) where the log of the wage ratio is the dependent variable and the establishment size is measured by number of employees. Robust standard errors (clustered by establishment) are in parentheses. The notation *** indicates significance at 1% level, ** at 5% level, * at 10% level.

Table 9: Higher wage at larger and more internationalized establishments
using number of employees as the measurement of establishment size

Variables	(1)		(2)		(3)	
	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
In Size	0.089	(0.003)***	0.084	(0.003)***	0.081	(0.003)***
Export proportion (%)						
1[$EX < 50$]			0.059	(0.008)***		
1[$EX \geq 50$]			0.056	(0.011)***		
Foreigners' ownership (%)						
1[$FS < 50$]					0.094	(0.012)***
1[$FS \geq 50$]					0.102	(0.016)***
Constant	2.760	(0.018)***	2.743	(0.018)***	2.778	(0.018)***
Fixed effects						
Sector		Yes		Yes		Yes
Year		Yes		Yes		Yes
Observations		5,654		5,654		5,654
R-squared		0.266		0.274		0.280

Note: The table presents estimation results of the model (1) where the log of the average wage for the new recruits is the dependent variable and the establishment size is measured by number of employees. Robust standard errors (clustered by establishment) are in parentheses. The notation *** indicates significance at 1% level, ** at 5% level, * at 10% level.

Table 10: Larger wage dispersion at larger and more internationalized establishments dropping outliers

Wage Ratio	r12	r13	r23	r12	r13	r23	r12	r13	r23
ln Size	0.015 (0.004)***	0.026 (0.004)***	0.011 (0.002)***	0.015 (0.004)***	0.024 (0.004)***	0.009 (0.002)***	0.015 (0.004)***	0.025 (0.004)***	0.010 (0.002)***
Export proportion (%)									
1[$EX < 50$]				-0.008 (0.010)	0.013 (0.012)	0.021 (0.007)***			
1[$EX \geq 50$]				0.003 (0.014)	0.037 (0.015)**	0.034 (0.010)***			
Foreigners' ownership (%)									
1[$FS < 50$]							-0.007 (0.016)	-0.004 (0.019)	0.003 (0.012)
1[$FS \geq 50$]							0.003 (0.023)	0.025 (0.025)	0.022 (0.015)
Constant	0.347 (0.016)***	0.575 (0.018)***	0.228 (0.010)***	0.350 (0.016)***	0.567 (0.018)***	0.217 (0.010)***	0.347 (0.016)***	0.575 (0.018)***	0.228 (0.010)***
Fixed effects									
Sector	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,339	2,339	2,339	2,339	2,339	2,339	2,339	2,339	2,339
R-squared	0.128	0.127	0.048	0.128	0.129	0.056	0.128	0.127	0.049

Note: The table presents estimation results of the model (1) where the log of the wage ratio is the dependent variable and the establishment size is measured by total asset. Observations that belong to the lower and upper 5 percentile in terms of the total asset are dropped. Robust standard errors (clustered by establishment) are in parentheses. The notation *** indicates significance at 1% level, ** at 5% level, * at 10% level.

Table 11: Higher wage at larger and more internationalized establishments dropping outliers

Variables	(1)		(2)		(3)	
	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
In Size	0.062	(0.004)***	0.060	(0.004)***	0.059	(0.004)***
Export proportion (%)						
1[$EX < 50$]			0.033	(0.010)***		
1[$EX \geq 50$]			0.008	(0.013)		
Foreigners' ownership (%)						
1[$FS < 50$]					0.037	(0.017)**
1[$FS \geq 50$]					0.113	(0.018)***
Constant	2.945	(0.015)***	2.933	(0.016)***	2.944	(0.015)***
Fixed effects						
Sector		Yes		Yes		Yes
Year		Yes		Yes		Yes
Observations		2339		2339		2339
R-squared		0.196		0.200		0.207

Note: The table presents estimation results of the model (1) where the log of the average wage for the new recruits is the dependent variable and the establishment size is measured by total asset. Observations that belong to the lower and upper 5 percentile in terms of the total asset are dropped. Robust standard errors (clustered by establishment) are in parentheses. The notation *** indicates significance at 1% level, ** at 5% level, * at 10% level.

Data Appendix

Whereas the number of employees is establishment level and available for all establishments in the data, total asset and sales are firm level and missing for some observations (1,544 for asset and 1,386 for sales out of 7,017 observations). For single establishment firms, they can be considered as establishment level.¹¹ For establishments that belong to multiple establishment firms, we compute the establishment level sales as the product of firm level sales and the proportion of the establishment sales in total sales of the firm. This can be done only for 1,001 observations of those establishments that report their sales proportions in the survey.

We drop the following observations from the analysis: (1) 788 observations in electricity/gas, financial, public sectors as their wages are firm level, not establishment level, (2) 549 observations with missing wage information, and (4) 26 observations whose reported asset or sales is zero. After removing them, we have 5,654 observations from 2,116 establishments available for the analysis. While 48.7 percent of the establishments in the sample data belong to manufacturing sector, examples of other sectors include transportation (9.3 percent), retailing (7 percent), and construction (5.8 percent).

¹¹63 percent of the 2,438 establishments in the data are single establishments.