Export Destination, Skill Utilization and Skill Premium in Chinese Manufacturing Sector*

Bilal M. Khan† Junjie Xia‡

Abstract

This paper analyzes the link between export destination, skill utilization and skill premium. We propose a mechanism behind these links: the difference in quality valuation of the product across exporting destinations and the distribution of level of skill among the skilled workers in the labor market. We test this theory using cross-section of more than 160,000 single product Chinese Manufacturing firms survey data, of which nearly 22,000 are exporting to more than 200 countries across the world. Contrary to the earlier literature, we explicitly use education as a measure of skill. We find that firms exporting to high income countries tend to charge a higher price, pay higher average wages to employees, hire more skilled workers as defined by education level, and pay higher skill premium as compared to firms exporting to middle or low income countries or selling domestically. As in similar recent studies, we did not find exporting per se to significantly impact the proportion of skilled workers or the skill premium in the firm.

JEL Classification: F14, F16, J24, L60, O14, O19

Keywords: Trade, Exports, Export destinations, Skill premium, Firm heterogeneity, wages, Inequality

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†University of Southern California

‡University of Southern California

Introduction

Much of the traditional literature in International Trade has been focused on the exporting behavior of the firm. Yet there has not been much of consensus in the literature on whether more productive firms self-select into exporting activity (Bernard and Jensen 1995; Clerides, Lach, and Tybout 1998) or on whether the exporting activity helps to improve the productivity of the firms by using more efficient technologies for production or hire more skilled workers (Bustos 2011; Matsuyama 2007). Some of the more recent literature, however, e.g. Bastos and Silva (2010), Verhoogen (2008) and Manova & Zhang (2012) suggest that characteristics of the exporting destination country such as income, distance, transportation costs etc. might contribute to the determination of firm behavior and choice of production techniques. Serti and Tomasi (2008) have analyzed the role of international trade in explaining the intra-industry heterogeneity in the Italian manufacturing firms involved in exporting or importing activities. They have shown that the firms that involve both importing and exporting activities outperform the firms that involve only one of these activities in terms of productivity, size, capital intensity and skill intensity. Brambila et al. (2012) and Brambila & Porto (2016) have established a causal link between the export destination and the proportion of skilled workers in the firm whereas Frazer (2013) has established a similar link between the importing source and skill utilization at the firm level.

In this paper, we elaborate upon the theoretical literature on the role of export destinations and skill utilization and also empirically establish a link between the export destination and the skill premium being awarded at the firm level using Chinese manufacturing firms data. Building on the work of Brambila et al. (2012), we explore whether the provision of higher quality goods requires only more intensive use of skilled workers or it also requires higher quality of skilled workers. To test our hypothesis, we use a cross-section of annual Chinese manufacturing firms data for 2004. It has detailed information on the individual firms including sales, exports, number of workers, wage bill, capital ownership etc. We match that data with the monthly customs data with information on every export or import transaction by these firms. We also use the firm level data on the distribution of workers by education level for these manufacturing firms. After carefully matching these datasets, we find a statistically significant relationship between export destination, skill utilization and skill premium at the firm level. The availability of the data on the distribution of education among

the workers helps us to cleanly define the measure for skills in the firm and to analyze its relation to export destination.

The remainder of the paper is organized as follows. The next section will discuss the recent literature in international trade that is relevant to our paper. Section 3 will discuss the basic economic intuition for this paper and develops a model to describe a link between export destination and the skill premium in the firm setting. In section 4, we would discuss the data and section 5 would outline the empirical strategy employed to test the results of the model.

Relevant Literature

Using cross-sectional data for 60 countries, Hallak (2006) showed that the consumers in the richer countries demand higher quality products. Building on this idea introduced by Hallak (2006), Verhoogen (2008) developed a model linking trade and wage inequality in developing countries. In that model with heterogeneous plants and quality differentiation, more productive plants were able to produce better quality products and to export them to richer countries. In order to produce higher quality products, firms were deemed able to attract better quality labor by paying them higher wages. Using panel data for manufacturing plants in Mexico, he showed that this quality upgrading leads to higher wage inequality in exporting firms and non-exporting firms within the industry. Subsequently, however, Matsuyama (2007) found another channel for the effect of export activity on the proportion of skilled workers in the firm, namely a ”skill biased globalization” in which exporting requires tasks that are more skill intensive in nature. These tasks require workers who are more familiar with the international business practices and can communicate with the foreign customers in their language and be careful with respect to the intricacies of the foreign cultures. All these activities require proportionally more skilled workers than the firm that is selling domestically.

Building on Verhoogen (2008) and Matsuyama (2007), Brambilla et al. (2012) explored the link between the export destination of the firms and the proportion of skilled workers hired by the firm. Their intuition is that consumers in higher income countries demand higher quality products as they value high quality products more than the consumers in low income countries (whose marginal valuation on income is relatively low). To produce higher quality products, firm need to

hire skilled workers in higher proportion. Using panel data for manufacturing firms in Argentina, they have found that the exporting to higher income countries matter, but exporting per se does not. Firms that tend to export more to high income countries use more skills and as a result pay higher average wages compared to the firms that export to middle-income or low-income countries. They have used average wage per worker and the proportion of non-production workers as a measure of skill intensity for the firms.

In still another paper, Brambilla & Porto (2016) have established a link between the income level of the export destination and the level of average wages in the exporting country across the world. They have found robust evidence, worldwide, that the industries exporting their product to high income destination pay higher wages to their workers. Using an instrumental variable approach, they have shown a causal link for this phenomenon. They have shown that the consumers in high income destination demand higher quality products and that the provision of higher quality is costly and requires more intensive use of higher waged skilled labor. Hence, the production of higher quality products at the industry level creates a wage premium. They have used the data for 82 countries from 1990-2000. They have dis-aggregated the data into 28 manufacturing sectors.

Similar to Brambila et al. (2012), Frazer(2013) explored the link between imports, import destination and the skill utilization for firms in Rwanda. He found that the importers, in general, and in particular, the ones importing materials from richer countries, pay higher wages (and consequentially, utilize more skills). Nevertheless, all of the above mentioned papers relating to skill utilization used only crude proxies for such skill. For example, Brambila et al. (2012) and Frazer (2013) used above average wages or the share of non-production workers proxies for higher utilization of skills in the firm. In contrast to these papers, our paper explicitly uses education as a measure for level of skill.

Theory

In this section, we develop partial equilibrium model analyzing the link between export destination and the level of the skill premium. On the demand side, we assume that the products are differentiated horizontally as well as vertically. The preferences are non-homothetic in order to capture the idea that consumers in high income countries value high quality goods more than consumers in

low income countries. For simplicity, we assume a representative consumer for each country and adopt the multi-nomial logit model as introduced by Verhoogen (2008). Customers in high income countries have lower marginal utility of income and are willing to pay higher prices for the same quality good as compared to their counterparts in low income countries. consumer i in country c has the following utility in consuming product j of quality θ, a price p and a random deviation following type-I extreme value distribution, ϵ_{ij}^c as

$$\mathrm{U}_{ij}^c = \theta_j^c - \alpha^c p_{ij}^c + \epsilon_{ij}^c$$

Using these assumptions, we obtain the following demand function for the product j

$$x_j^c(p_j^c, \theta_j^c) = \frac{M^c}{W^c} e^{(\theta_j^c - \alpha^c p_j^c)}$$

where M^c is the number of consumers in country c and W^c is an index that summarizes the characteristics of all products available in country c (i.e. $W^c = \Sigma_{z \epsilon Z^c} e^{(\theta_z^c - \alpha^c p_z^c)}$) where Z^c defines the set of available products.

Implicitly, we notice that the $\frac{e^{(\theta_j^c - \alpha^c p_j^c)}}{W^c}$ is the probability of choosing the product j of quality θ by a representative consumer in country c and we multiply it with the number of consumers in country c to find out the expected demand for firm j product. α^c measures the marginal utility of income, and as per Verhoogen (2008), $\frac{1}{\alpha^c}$ measures the quality valuation in country c. α^c will determine the relationship between θ and p in the consumer's utility function. The higher the level of per capita income in country c, the lower will be the marginal valuation of income and hence, consumers will be willing to pay more for the same quality product as compared to the consumers in lower income countries.

On the supply side, there are J monopolistically competitive firms in the source country. Each firm produces a differentiated product and can export it to multiple destinations or sell it domestically. The firm can also choose a different quality of it's product for different exporting destinations, based on the quality valuation in destination countries. We assume that output of the product can be produced by using labor only. The firm j, in the source country, can produce the variety of the quality for it's product as follows:

$$\theta_j = (\frac{b_j}{a_j + b_j})(\frac{A}{1 + e^{-s_j}})$$

Here a_j and b_j are the number of unskilled and skilled workers in each firm j respectively. In the above production of quality θ, notice that in order to produce higher quality, the firm needs, not only, more skilled workers but also, skilled workers of higher quality i.e. the workers are heterogeneous in their level of skill as introduced by Yeaple (2005). We assume that all unskilled workers in the economy are identical and receives a wage of $\$1$ whereas s_j is the level of skill of the skilled workers over the entire range $(-\infty, \infty)$. For current purposes, we can assume the level of skill is uniformly distributed among the skilled workers. The higher is the value of s_j, higher is the quality of the skilled worker. For $s\ \epsilon(-\infty, \infty), \theta$ takes the value between 0 and A where A is the maximum quality of the product.

Now, since the skilled workers vary by quality, we also define the compensation of the skilled workers as function of s_j. The skilled worker's wage of quality s_j is given by $(1 + \frac{K}{1+e^{-s_j}})$ i.e. $\frac{K}{1+e^{-s_j}}$ is the premium that the skilled worker of quality s_j gets over and above the unskilled worker.

Given the above assumptions, a monopolistically competitive firm, producing product j of quality θ and selling it to consumers in country c at a price p, would maximize the profit as:

$$Max_{p_j^c, s_j, b_j} \qquad \pi_j^c = [p_j^c - a_j - b_j(1 + \tfrac{K}{1+e^{-s_j}})]x_j^c(p_j^c, \theta_j^c) - F^c$$

or

$$Max_{p_j^c, s, b_j} \qquad \pi_j^c = [p_j^c - a_j - b_j(1 + \tfrac{K}{1+e^{-s_j}})]e^{(\theta_j^c - \alpha^c p_j^c)}\tfrac{M^c}{W^c} - F^c$$

For the firm j in the source country, M^c and W^c will be exogenous. F^c is the fixed cost of exporting to country c. It can be thought of as transportation costs, or other regulatory costs involved in exporting to country c.

The first order conditions for the above maximization problem would be:

$$p_j^c : \qquad e^{(\theta_j^c - \alpha^c p_j^c)}(1 - \alpha^c p_j^c + \alpha^c a_j + \alpha^c b_j(1 + \frac{K}{1 + e^{-s_j}})) = 0 \tag{1}$$

$$b_j : \frac{e^{(\theta_j^c - \alpha^c p_j^c)}}{1 + e^{-s_j}}[\frac{A a_j p_j^c}{(a_j + b_j)^2} - \frac{A a_j^2}{(a_j + b_j)^2} - (1 + K + e^{-s_j}) - \frac{A a_j b_j (1 + K + e^{-s_j})}{(a_j + b_j)^2)(1 + e^{-s_j})}] = 0 \tag{2}$$

$$s_j : \frac{e^{(\theta_j^c - \alpha^c p_j^c)} e^{-s_j}}{(1+e^{-s_j})^2} [\frac{p_j^c A b_j}{(a_j+b_j)} - \frac{A a_j b_j}{(a_j+b_j)} - b_j K - \frac{A b_j^2 (1+K+e^{-s_j})}{(a_j+b_j)(1+e^{-s_j})}] = 0 \tag{3}$$

Now, from FOC of the price, we would have

$$p_j^c = a_j + b_j (\frac{1+K+e^{-s_j}}{1+e^{-s_j}}) + \frac{1}{\alpha^c} \tag{4}$$

First we put this equation of price into the FOC for s_j, we would get

$$[(a_j + b_j(\frac{1+K+e^{-s_j}}{1+e^{-s_j}}) + \frac{1}{\alpha^c})\frac{A b_j}{(a_j+b_j)} - \frac{A a_j b_j}{(a_j+b_j)} - b_j K - \frac{A b_j^2 (1+K+e^{-s_j})}{(a_j+b_j)(1+e^{-s_j})}] = 0$$

(5)

After simplifying, we obtain

$$b_j^* = \frac{A}{\alpha^c K} - a_j$$

Propostion 1: *Firms, that export more to high income countries, will hire more skilled (educated) workers in comparison to the firms that export to middle or low income countries.*

Similarly, now we put the value of p_j^c and above found b_j into the FOC for b_j, we would have

$$[(a_j + b_j(\frac{1+K+e^{-s_j}}{1+e^{-s_j}}) + \frac{1}{\alpha^c})\frac{A a_j}{(a_j+b_j)^2} - \frac{A a_j^2}{(a_j+b_j)^2} - (1+K+e^{-s_j}) - \frac{A a_j b_j (1+K+e^{-s_j})}{(a_j+b_j)^2)(1+e^{-s_j})}] = 0$$

(6)

After simplifying, we obtain

$$1 + K + e^{-s_j} = \frac{a_j \alpha^c K^2}{A}$$

Propostion 2: *Firms, that export more to high income countries, will hire better quality skilled (educated) workers in comparison to the firms that export to low or middle income countries.*

From the above, it is clear that α^c is inversely related with the level of skill s_j of the skilled worker. Now replacing $1 + e^{-s_j}$ and b_j into the first order condition for the price, we would get

$$p_j^c = a_j + (\frac{A}{\alpha^c K} - a_j)(1 + \frac{K}{(\frac{a_j \alpha^c K^2}{A} - K)}) + \frac{1}{\alpha^c}$$

Propostion 3: *Firms, that export more to high income countries, will charge higher price to customers in high income countries as compared to the customers in low or middle income countries.*

From the above, one can see that the firms that are exporting to high income countries will be charging a higher price within the same product category as the consumers in high income countries would demand higher quality of the product. In addition, our model also shows that firms exporting larger proportions of exports to high income countries would proportionally hire more skilled workers and also ones of better quality. Given the wage schedule defined above, it would lead to higher average wage in the firm.

Data

For this paper we use balance sheet data for Chinese Manufacturing firms from the Annual Survey of Industrial Firms (ASIF) conducted by China's National Bureau of Statistics(NBS) for 2004. ASIF cover all firms with sales above 5 million RMB [§] during the survey year. There are multi-product as well as single product firms in this data. The survey reports information on the firm name, firm id, total sales, total capital, total fixed assets, total employment, total wage bill, total exports, number of computers, firm subsidy, firm ownership etc. In addition to ASIF, for trade-related data, we use the comprehensive data-set provided by the General Administration of the Chinese Customs, known as Chinese Customs Trade Statistics (CCTS) for 2004. CCTS reports the firm name, firm id, value of all firm-level exports and imports and export or import destination at the monthly level. We first aggregate the CCTS to the annual level and then match it with ASIF for 2004.

In addition, for 2004, ASIF also reports data about the distribution of number of employees by level of education. For example, in firm x, we know how many workers are with middle school, high school, technical diplomas, bachelors and postgraduate degrees. Contrary to Brambilla et al.

[§]In 2004, 1 USD was equivalent to 8.27 RMB

(2012), we use these education levels to split the workers into skilled and unskilled workers. We have defined the workers to have less than high school education to be unskilled workers and those with more than or equal to high school be considered as skilled.

We matched these 3 data-sets using firm ids and firm names. ASIF also reports the top 3 products of the manufacturing firms. We drop all the firms that have more than one major product as in case of multi-product firms, we cannot identify how much of the labor is assigned to what product in the firm. After dropping multi-product firms from the data, we are still left with nearly 22,000 exporting firms and nearly 140,000 non-exporting firms. These firms are distributed over 524 industries at 4 digit level and across 399 cities in China. Among the left-over firms, 471 industries and 311 cities have atleast one exporting firm.

We split the countries into high income, middle income and low income countries using 2004 income per capita range as listed by World Bank. Countries having per capita income to be higher than $9000 in 2004 are considered to be the high income countries.

Empirical Results

We start by reporting the summary statistics for the Chinese manufacturing sector in 2004 in Table 1. We notice that, on average, exporting firms are larger by both sales and employment, pay higher average wages and are more capital intensive as compared to the non-exporting firms. As the data is about the manufacturing firms in China, we notice that more than half of the workers are unskilled as defined by level of education. For the exporting firms, nearly two-thirds of the exports are directed towards the high income countries. In addition, nearly a quarter of the firms are pure exporters i.e. with their entire output sold abroad. However, we notice that in contrast to some of the earlier literature referred to above, in aggregate data, there is not much difference between exporting and non-exporting firms in terms of proportion of workers with high school or above education.

In order to perform the empirical analysis, we start by trying to ascertain the validity of our hypothesis that firms export the better quality products to higher income countries. Since all the firms in this analysis are single product firms, we will use the price charged as a proxy for the quality of the product. We use the CCTS data for 2004. As noted above, CCTS reports the price

Table 1: Summary Statistics for Chinese Manufacturing Firms in 2004

	All	Exporting	Non-exporting
No. of Firms	162,867	21,977	140886
Skilled workers	0.435	0.42	0.437
Workers with high school degree	0.32	0.307	0.325
Workers with diploma	0.08	0.076	0.08
Workers with Bachelors degree	0.0295	0.035	0.028
Workers with Masters degree	0.0025	0.003	0.0024
Capital per worker (RMB)	65522	75260	63990
Average wage (RMB)	9446	10601	9278
Employees per firm	249	555	202
Fully State-owned	0.1	0.03	0.12
Mean sales (Million RMB)	46.6	104.85	37.53
Export to sales ratio		0.64	
Proportion of export to HI countries		0.68	
Average number of exporting destinations		21	
Pure Exporter		4949	

and quantity for the exported (or imported) goods as well as the export (or import) destination for the exporting firms at monthly level. We convert this monthly data to annual data by calculating the average price being charged by a firm for each destination.

$$Log(Price)_{ij} = \beta_0 + \beta_1 HI\ \ Dummy_i + \beta_2 MI\ \ Dummy_i + \beta_3 log(Quantity)_{ij} + \beta_4 Distance_i + \phi_j + \nu_{ij}$$

We start in column 1 of Table 2 by regressing logarithm of price against a dummy for High Income countries as well as Middle Income countries. Here, $Log(Price)_{ij}$ is the logarithm of average price charged by firm j to customers in Country i. ϕ_j is the dummy for firm j to control for firm fixed effects. We notice that the firm charges, on average, 5.4 percent more for a product exported to high income countries than to one exported to low income country in 2004 and charge 1.95 percent more for a product exported to middle income countries than to low income country. Once we add the logarithm of quantity exported, as in column 2 of this table, the price premium falls down to about 2.8 percent for high income country and 1 percent for middle income country. However, coefficient for the Middle Income country dummy is no longer significant when we add the $Log(Quantity)_{ij}$ to the analysis as in column 2. We also notice from column (2), a negative relationship between price and quantity. On average, if the firm exports 1 percent more quantity, price of that export goes down by about 0.25 percent. While there could be several explanations for this, it could be because of firms offering bulk discount to the consumers in exporting destination.

For the above two regressions, we are using Firm fixed effects. The finding that the higher the income of the country, higher is the price being charged by the firm for the same category of the product is in line with the earlier literature. Manova and Zhang (2012) have shown that firms vary the quality of their product across destinations by varying the quality of the input used in the production process. They have shown that the firms, within the same product line, charge varying prices for their exports by export destination. Across destinations, within a firm-product, firms set higher prices in richer countries. Görg et al.(2010) have analyzed the relationship between gravity variables and f.o.b. export unit values using Hungarian firm-product destination data. They also found a positive and significant relationship between the export unit values and the GDP per capita of the destination. Manova and Zhang (2012) have shown that firms charge higher prices in export destinations which are bilaterally more distant countries. It might be possible that the firm is charging a higher price to high income countries just because they are more distant than the middle or low income countries. In order to find distance between China and exporting destination, we use the database for bilateral distances between countries prepared by Mayer and Zignago (2011). In column (3) of Table 2, we add the distance in kilometers as a control variable. We also found positive and significant relationship between bilateral distance and price charged by the firm. Nevertheless, even after controlling for distance, the coefficient for high income country dummy still remains positive and significant. Another possibility for firm charging varying prices for same product across export destinations could be the variation in the import tariffs across destination. However, Baumellassa et al. (2009) have shown that the average tariff for manufactured products was much less in 2004 for high income countries as compared to middle of low income countries. It would imply that for the same quality products, firm should charge higher prices to customers in middle and low income countries as compared to the customers in high income countries.

Table 2

Now that we have established that the firms export higher quality products to the High Income countries using price as a proxy for quality, we can proceed to examining the impact of export destination on the labor hired by the firms. From the model, it was seen that the firms, exporting higher proportion of their exports to high income countries, would be expected to hire proportionally more skilled(or educated) workers. To test this prediction, Table 3 presents results obtained

from a regression similar to that in Brambilla et al. (2012). The estimating equation we have, with skilled workers defined as ones with high school or more education, is

$$SKILL_{jkl} = \beta_0 + \beta_1 HI_{jkl} + \beta_2 EXP_{jkl} + X'_{jkl}.\beta_{\mathbf{3}} + \theta_{kl} + \epsilon_{jkl}$$

where $SKILL_{jkl}$ is defined as proportion of skilled workers in firm j operating in 4 digit industry code k and city l, HI_{jkl} is defined as the proportion of exports that goes to the High Income countries, EXP_{jkl} is ratio of exports to sales. X_{jkl} is a vector of firm specific variables that can possibly affect the proportion of skilled workers. In addition, θ_{kl} is dummy to control for the industry-city fixed effects. That creates more than 30,000 cells for industry-city fixed effect. We also cluster the errors at 4 digit industry-city level.

Table 3

From column (1) of Table 3, it can be seen that exports to high income country positively and significantly affects the proportion of skilled workers. However, contrary to the existing literature, the coefficient for export intensity is negative and significant. Nevertheless, using the same firm level data for 2004, Zhang (2010) has found that the similar results for the relationship between export intensity and the proportion of skilled workers in the firm i.e. exporters tend to hire more un-skilled workers as compared to the non-exporters among the Chinese manufacturers. We will see later, that once we control for pure exporter dummy, this effect does not remain significant any more. Zhang (2010) did not control for the pure exporter dummy.

In order to check the robustness of our results, in column (2) and (3) we add more variables that can affect the employment of skilled workers in the firm. In column (2), we add age of firm, age squared, capital per worker and a dummy for State owned firm. In column (3), in addition to the above, X would include pure exporter (PE) dummy, processing and assembly trade (PAT) dummy and feed processing trade (FPT) dummy. We assume that the firms that are existing for longer period of time have better understanding of the labor market as well as the market for it's product. Though, apriori, we do not expect any sign for the coefficient of age. In addition, we are controlling for Capital intensity of the firm (Cap) defined as the logarithm of capital per worker in the firm. Our expectation is that the more capital intensive is the firm, firm would hire more skilled workers to operate the expensive machines and the results in column (2) and (3) supports this. We find the

similar results as above i.e. positive and significant effect of high income exporting destination and negative and significant effect of exporting activity on proportion of skilled workers. In addition, we find negative relationship between the age of the firm and proportion of skilled workers in the firm, though, the coefficient is small.

In order to address this negative impact of exporting behavior on the proportion of skilled workers, we need to be careful in interpreting these results for China. Dai et al(2011), have shown that the firms which are involved in the processing trade in China are also comparatively less productive. Processing trade firms import nearly all of the inputs from abroad, assemble it in Chinese Export Processing zones and then ship all of their output to the rest of the world. In order to distinguish these types of firms, we will use two types of processing trade dummies i.e. PAT controls for whether the firm is involved in processing and assembly trade and FPT for Feed and Processing trade. In addition, we will also use a pure exporting firm dummy (PE) for the firms which ship all of their output abroad and do not sell anything in China. The intuition is that the processing trade firms will be exporting all of their output to the foreign firms for which they are processing the exports. Since usually these processing trade firms are established by foreign firms to take advantage of cheap labor in China. In addition, building on Melitz's (2003) framework, Lu et al. (2012) identified the condition for the existence of pure exporters and showed their productivity levels to be above the productivity of the non-exporters but less than the productivity of the firms which sell both in the domestic and the foreign market. It might also be that the firms with high export to sales ratios, might make less use of skilled workers in the firm. Once we account for the pure exporter effect, we notice that the coefficient of the export intensity hover around zero and is no longer significant. Note that Brambila et al.(2012), also did not find a significant effect of exporting behavior on the proportion of skilled workers in the firm. As in Lu et al. (2014) and Dai et al. (2011), we also find significant negative coefficient for pure exporter dummy. Indeed, a firm which is a pure exporter and not exporting to a high income country, on average, tends to hire 4.5 percent less skilled workers as compared to a firm selling all or part of it's output in the domestic market.

Our results suggest that firms which export only to the High Income countries hire 4.5 percent more skilled workers as compared to the firms that export to middle or low income countries or sell only in the domestic market once we control for the Pure Exporter dummy. Brambilla et al.

(2012) found it to be about 5 percent, when they employed a simple OLS regression and used share of non-production workers as a measure for skill for Argentinian Manufacturing firms.

Next we proceed to estimate the impact of export destination on the skill premium in the firm. We first run the regression using the definition of skilled workers as used above. Later, we split the skilled workers into five categories defined by their education level. Then, we explore the impact of export destination on extra premium for each category of education for skilled workers.

To test our main hypothesis of the paper, we run the following regression to estimate the impact of export destination on the skill premium in the firm.

$$Average\ wage_{jkl} = \beta_0 + \beta_1 SKILL_{jkl} + \beta_2 HI_{jkl} + \beta_3 HI_{jkl} * SKILL_{jkl} + \beta_4 EXP_{jkl} + X'.\beta_5 + \theta_{jkl} + \eta_{jkl}$$

where $Average\ wage_{jkl}$ is the logarithm of the average wage for firm j operating in 4 digit industry k and city l. $HI_{jkl} * SKILL_{jkl}$ is an interaction between the proportion of skilled workers in the firm and the proportion of the exports going to the High Income countries. X_{jkl} is the same vector of variables as above and η_{jkl} is the error term. β_3 represents our estimate of the additional premium being awarded to the skilled workers as a result of exporting to high income destinations. As above, we find a significant negative impact of export intensity on the average wage as well.

Table 4

From the first column, we notice that a firm which hires only skilled workers i.e. workers with education of high school and above, pays 27 percent more than a firm which hires only unskilled workers. In addition, there is also a premium for exporting to high income countries. We notice that, assuming everything else to be the same, a firm which exports all of the output to the high income country, pays, on average, 6 percent more compared to the firm which sells the output to middle or low income countries or sell only in the domestic market. We also notice that, once we control for high income destination, we find no significant impact of exporting activity on the average wage in the firm but do find a positive and significant coefficient for the interaction term $HI_{jkl} * SKILL_{jkl}$. Even after controlling for the skilled (or educated) workers in the firm, we find that there is an extra premium for skilled workers. Notice that firms which only employ skilled workers and export all the output to high income countries pay 26.6 percent more to the workers compared to firms which also employ only skilled workers but do not export any output to high income countries.

Next, in column (2) we add more controls (i.e. $AGE, AGE^2, Cap, State\ Ownership$) as above. Using the data about US firms, Ouimet and Zarustkie (2014) had found a positive and significant relationship between the age of the firm and age of the employee. They found that young firms disproportionately hire more young workers and these results hold even when they controlled for industry or geographical location of the firm. Here, we use the age of the firm as a proxy for the average age of the employees to control for the experience of the workers since there is no data available for the age of the employees in the firm. In column (3), we would also add PE, PAT and FPT to control for the pure exporter dummy as well as two types of processing trade firm dummy.

After controlling for these extra measures, the premium for skill, high income export destination as well as the skill premium for the high income export destination falls a little but still remains positive and significant. We also find a positive and significant relationship between the age of the firm and the average wage being awarded by the firm. These results show that our findings are robust to the addition of these extra controls.

Next, in Table 5 we proceed to dis-aggregate the skilled workers into their education groups and analyze the impact of export destination on skill premium for each category. In this case, labeling each different category of education as a different level of skill. HS refers to high school, $Diploma$ refers 2 year technical degree which is ranked higher than high school but less than 4 year college degree, BS refers to 4 year college degree and MS refers to 2 year Masters degree.

Table 5

We notice that every educational category has an extra premium over and above the unskilled workers. It can be seen that the highest premium is for a college degree. It is positive and significant. Ge and Yang (2012) also found the premium for a college degree to have been the highest and continuously rising over time. For our cross-sectional analysis, we also found the highest premium be for the college degree in the firm. We also notice that every education category of high school and above also gets an extra premium if the firm is exporting more to a high income destination. Notice that the premium for high income export destination is largest for the college degree.

In addition, we notice that the State ownership dummy has also positive and significant affect on proportion of skilled workers as well as average wage. It seems like the state owned firms hire

higher proportion of skilled workers and also pay higher wages on average. We also find significant negative effect on the average wage of the pure exporter dummy. However, we found significantly positive coefficient for labor intensity.

The above results supports our theoretical results where we found the inverse relationship between marginal utility of income and the price charged by the firm, proportion of skilled workers as well as skill premium being awarded by the firm.

Income Inequality and Trade

Another strand of International Trade literature has focused on the impact of trade activities on the income inequality of the developing countries and have found conflicting evidence in this regard. Conventional wisdom dictates that the trade liberalization activities would help the less skilled workers in the developing economy because the developing country has abundant supply of less skilled workers. Though after analyzing many studies related to developing countries, Goldberg and Pavcnik (2007) could not find support for this conventional wisdom. Rather, in many of these studies related to developing economies, they found that the higher skilled workers benefit more than the unskilled workers as a result of trade liberalization which leads to worsening of income inequality in these countries. Amriti and Cameron (2012) have analyzed the impact of import tariffs on the Indonesian labor market. They found that the reduction in import tariffs leads to reduction in skill premium for the firms that import intermediate inputs. They did not find any significant effect of reducing import tariffs on final goods on skill premium within firms. They suggest that their result differs from the earlier studies as their study is the first one to separate out the effects of input tariffs and output tariffs whereas earlier studies used to focus on reducing final goods tariffs and changing trade shares.

As China has achieved spectacular growth after opening up her economy, there has been many studies exploring the impact of opening up the economy on income inequality in China. Wei and Wu (2001) have empirically analyzed the relationship between openness and rural-urban income inequality in Chinese cities and their adjacent rural areas during between 1988 and 1993. They defined openness as the ratio of exports to GDP. Using distance to major seaports as an instrument for openness, they found negative correlation between rural-urban inequality and openness to trade.

On the contrary, Dayal-Gulati and Hussain (2002) found the inter-provincial inequality in income to worsen between 1978 and 1997 as a result of FDI inflows and technology transfer. They noticed that the relatively rich coastal and North-eastern region, despite having relatively expensive labor, were able to attract higher FDI inflows compared to inland regions. As a result, these regions converge to higher level of income as compared to inland provinces, atleast in short run. They cited more developed infrastructure as major reason for higher FDI inflows in these regions.

Fleisher et al. (2010) have analyzed the impact of regional differences in physical, human, and infrastructure capital as well as differences in FDI flows on regional growth patterns in China. They have shown that FDI had a much larger effect on TFP growth before 1994. After that, they found the impact of human, physical and infrastructure capital to be more significant on TFP growth as compared to the FDI inflows. They found that while infrastructure investments generate higher returns in more developed coastal and north-eastern regions than in interior, investing in human capital generates slightly higher or comparable returns in interior regions. They propose investment in human capital in less-developed areas, on efficiency grounds, to reduce the inter-regional income inequality in China.

Using Chinese Urban Household Survey data from 1988 to 2008, Han et al. (2012) analyze the impact of globalization on wage inequality. They explore the impact of two major trade liberalization shocks in China i.e. Deng Xiaoping's Southern Tour in 1992 and China's accession to the World Trade Organization in 2001. Using distance of the region from the coast as a measure of exposure to globalization, they found that the areas more exposed to globalization experienced larger increase in wage inequality as compared to less exposed regions. They have also shown that both shocks contributed to the within region inequality by raising the returns to education i.e. returns to high school after 1992 and returns to college after 2001.

Similar to Han et al. (2012), our results also show that the highest premium is for college graduates as compared to high school graduates. Han et al. (2014) found the coefficient for the college premium to be about 0.66 which is not much different from our results as they also included Masters degree holders in college graduates. In addition, we also show that the firms which export bigger proportion of their exports to the high income destination pay an extra premium to these more educated workers which in turn, further increases the wage inequality in the region. We did not find any significant impact of the exporting behavior of the firm on the average wages in the

firm. These results indicate that much of the income inequality that is attributed to the exporting behavior is coming from exporting to high income countries as the workers that are involved in exports to high income countries tend to get higher average wages.

Figure 1

In addition to the above analysis, we also provide the results for table 4 by running quantile regressions for average wage.* We note varying skill premium for high school and above education on different percentile of average wage. We notice that there is no premium for lowest decile and it rises up to 35 percent for the top decile. In addition, we also find varying return to the High Income export destination for these skilled (or educated) workers. It can be seen that the extra premium for exporting to high income countries range between 11 percent at the lowest decile to 32 percent for the top decile for these skilled workers. These results further confirm that the firms exporting better quality products hire better quality skilled (or educated) workers and also rewards them by paying higher wages.

Table 6

Conclusion

In this paper, we have extended the recent literature analyzing the impact of export destination on the firm activity in several ways. First, we have developed a theoretical model linking the export destination to the level of skill (or education) premium being awarded at the firm level. The model implies that firms exporting to high income destinations should pay higher wages to their skilled (or more educated) workers. Second, we empirically test this theory using this huge cross-section of manufacturing firms. We have found significant and positive effect of export destination on proportion of skilled workers in the firm and the skill premium being offered by the firm. As such, it is the first paper to establish a link between export destination and the skill premium at the firm level. Third, in keeping with the recent literature, we find no significant impact of exporting activity on either the proportion of skilled workers or the skill premium. Fourth, we have clearly

*Due to the computing limitations, we have used two digit industry fixed effects rather than 4 digit industry code and city fixed effects for this quantile based regression

defined the skill level by education at the firm level while much of the work uses the average wage or the share of non-production workers as proxy of skills due to the lack of data on the educational distribution in the firm in the recent trade literature[†]. Finally, in contrast to most other empirical studies that focus on Latin American countries , the present study focuses on China which has recently become the world largest exporter.

[†]This statement is true to the best of our knowledge.

Table 2. Relationship between Price of the product and Export Destination

VARIABLES	(1) Log Price	(2) Log Price	(3) Log Price
HI Dummy	0.0543***	0.0278***	0.0221***
	(0.00890)	(0.00798)	(0.00801)
MI Dummy	0.0195**	0.0108	-0.000979
	(0.00902)	(0.00809)	(0.00820)
Log Quantity		-0.255***	-0.256***
		(0.00124)	(0.00124)
Distance(km)			4.89e-06***
			(5.72e-07)
Constant	1.314***	3.320***	3.294***
	(0.00807)	(0.0121)	(0.0125)
Observations	200,988	200,988	200,988
R-squared	0.806	0.844	0.845
Firm Fixed Effects	Yes	Yes	Yes

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Notes: Dependant variable is the logarithm of the price of the product being charged by the firm for each destination. HI Dummy and MI Dummy are dummy variables for High Income country and Middle Income country dummy respectively. Log Quantity is the logarithm of the quantity being exported for each transaction. We have controlled for Firm Fixed effects for this regression and standard errors are robust.

Table 3. Relationship between proportion of skilled workers and Export destination

VARIABLES	(1) SKILL	(2) SKILL	(3) SKILL
HI	0.0651***	0.0453***	0.0453***
	(0.00608)	(0.00543)	(0.00537)
EXP	-0.0259***	-0.0178***	-0.00370
	(0.00662)	(0.00606)	(0.00627)
AGE		-0.00363***	-0.00364***
		(0.000246)	(0.000246)
AGE^2		4.79e-05***	4.79e-05***
		(5.39e-06)	(5.39e-06)
Cap		0.0679***	0.0678***
		(0.00118)	(0.00117)
State Ownership		0.0859***	0.0859***
		(0.00420)	(0.00420)
PE			-0.0233***
			(0.00596)
PAT			-0.0231**
			(0.00995)
FPT			-0.0113
			(0.00782)
Constant	0.425***	0.107***	0.107***
	(0.000604)	(0.00564)	(0.00562)
Observations	155,155	155,129	155,129
R-squared	0.432	0.470	0.470
Industry-City Fixed Effects	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes: Here Proportion of Skilled workers (SKILL) in a firm are regressed against the proportion of exports to High Income countries (HI), Export to Sales ratio (EXP), Age of the firm, Logarithm of capital per worker (Cap), State Ownership Dummy, Pure Exporter (PE) dummy, Feed and Processing Trade (FPT) dummy, Processing and Assembly Trade (PAT) dummy. Skilled worker has been defined as the one with high school and above level of education. We have controlled for Industry-City fixed effects and standard errors have been clustered at Industry-City level. There are 524 four-digit industries and 399 cities in the data.

Table 4. Relationship between Average wage and Export destination using broader measure of Skill

VARIABLES	(1) Average wage	(2) Average wage	(3) Average wage
SKILL	0.271***	0.195***	0.194***
	(0.00912)	(0.00860)	(0.00859)
HI	0.0608***	0.0493***	0.0452***
	(0.0153)	(0.0149)	(0.0148)
EXP	-0.0201	-0.0161	0.00508
	(0.0129)	(0.0125)	(0.0132)
HI*SKILL	0.266***	0.231***	0.230***
	(0.0264)	(0.0251)	(0.0248)
AGE		0.00137***	0.00134***
		(0.000420)	(0.000420)
AGE^2		-1.91e-05**	-1.87e-05**
		(8.01e-06)	(8.01e-06)
Cap		0.0933***	0.0932***
		(0.00289)	(0.00289)
State Ownership		0.0322***	0.0323***
		(0.0107)	(0.0107)
PE			-0.0455***
			(0.0125)
PAT			0.0233
			(0.0233)
FPT			-0.00304
			(0.0127)
Constant	1.898***	1.464***	1.465***
	(0.00400)	(0.0145)	(0.0145)
Observations	155,155	155,129	155,129
R-squared	0.491	0.505	0.505
Industry-City Fixed Effects	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes: Here, Logarithm of average wage (Average wage) in the firm is regressed against proportion of Skilled workers (SKILL), the proportion of exports to High Income countries (HI), Export to Sales ratio (EXP), interaction of HI and SKILL (HI*SKILL), Age of the firm, Logarithm of capital per worker (Cap), State Ownership Dummy, Pure Exporter (PE) dummy, Feed and Processing Trade (FPT) dummy, Processing and Assembly Trade (PAT) dummy. Skilled worker has been defined as the one with high school and above level of education. HI*SKILL captures the premium for skilled (or educated) workers for exporting to high income countries. We have controlled for Industry-City fixed effects and standard errors have been clustered at Industry-City level. There are 524 four-digit industries and 399 cities in the data.

Table 5. Relationship between Average wage and Export destination using disaggregated measure of Skill

VARIABLES	(1) Average wage	(2) Average wage	(3) Average wage
HI	0.0560***	0.0473***	0.0405***
	(0.0150)	(0.0148)	(0.0146)
MS	0.798***	0.669***	0.670***
	(0.181)	(0.177)	(0.177)
BS	1.096***	0.907***	0.908***
	(0.0491)	(0.0478)	(0.0478)
Diploma	0.559***	0.432***	0.432***
	(0.0269)	(0.0264)	(0.0263)
HS	0.110***	0.0781***	0.0781***
	(0.00949)	(0.00928)	(0.00928)
HI*MS	1.109*	1.003	1.011
	(0.646)	(0.647)	(0.638)
HI*BS	1.206***	1.103***	1.103***
	(0.170)	(0.164)	(0.164)
HI*Diploma	0.351***	0.331***	0.333***
	(0.0979)	(0.0940)	(0.0939)
HI*HS	0.0877***	0.0687**	0.0643**
	(0.0305)	(0.0294)	(0.0293)
EXP	-0.00430	-0.00294	0.0138
	(0.0125)	(0.0122)	(0.0130)
AGE		0.00201***	0.00196***
		(0.000415)	(0.000415)
AGE^2		-2.43e-05***	-2.35e-05***
		(7.97e-06)	(7.96e-06)
Cap		0.0774***	0.0773***
		(0.00286)	(0.00285)
State Ownership		0.0234**	0.0235**
		(0.0105)	(0.0105)
PE			-0.0456***
			(0.0123)
PAT			0.0386*
			(0.0233)
FPT			0.0190
			(0.0123)
Constant	1.904***	1.537***	1.538***
	(0.00378)	(0.0141)	(0.0141)
Observations	155,155	155,129	155,129
R-squared	0.505	0.514	0.514
Industry-City Fixed Effects	Yes	Yes	Yes

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Notes: Here, Logarithm of average wage (Average wage) in the firm is regressed against dis-aggregated measure of education(or skill) i.e. High school (HS), technical diploma (Diploma), Bachelor's degree (BS) or Masters degree (MS), the proportion of exports to High Income countries (HI), Export to Sales ratio (EXP), interaction of HI and Y (HI*Y) where Y can be HS, Diploma, BS or MS, Age of the firm, Logarithm of capital per worker (Cap), State Ownership Dummy, Pure Exporter (PE) dummy, Feed and Processing Trade (FPT) dummy, Processing and Assembly Trade (PAT) dummy. HI*Y captures the additional premium for educated (high school, diploma, Bachelor's or Masters) workers as a result of exporting to high income countries. We have controlled for Industry-City fixed effects and standard errors have been clustered at Industry-City level. There are 524 four-digit industries and 399 cities in the data.

Quantile Regression between Average Wage and Export Destination

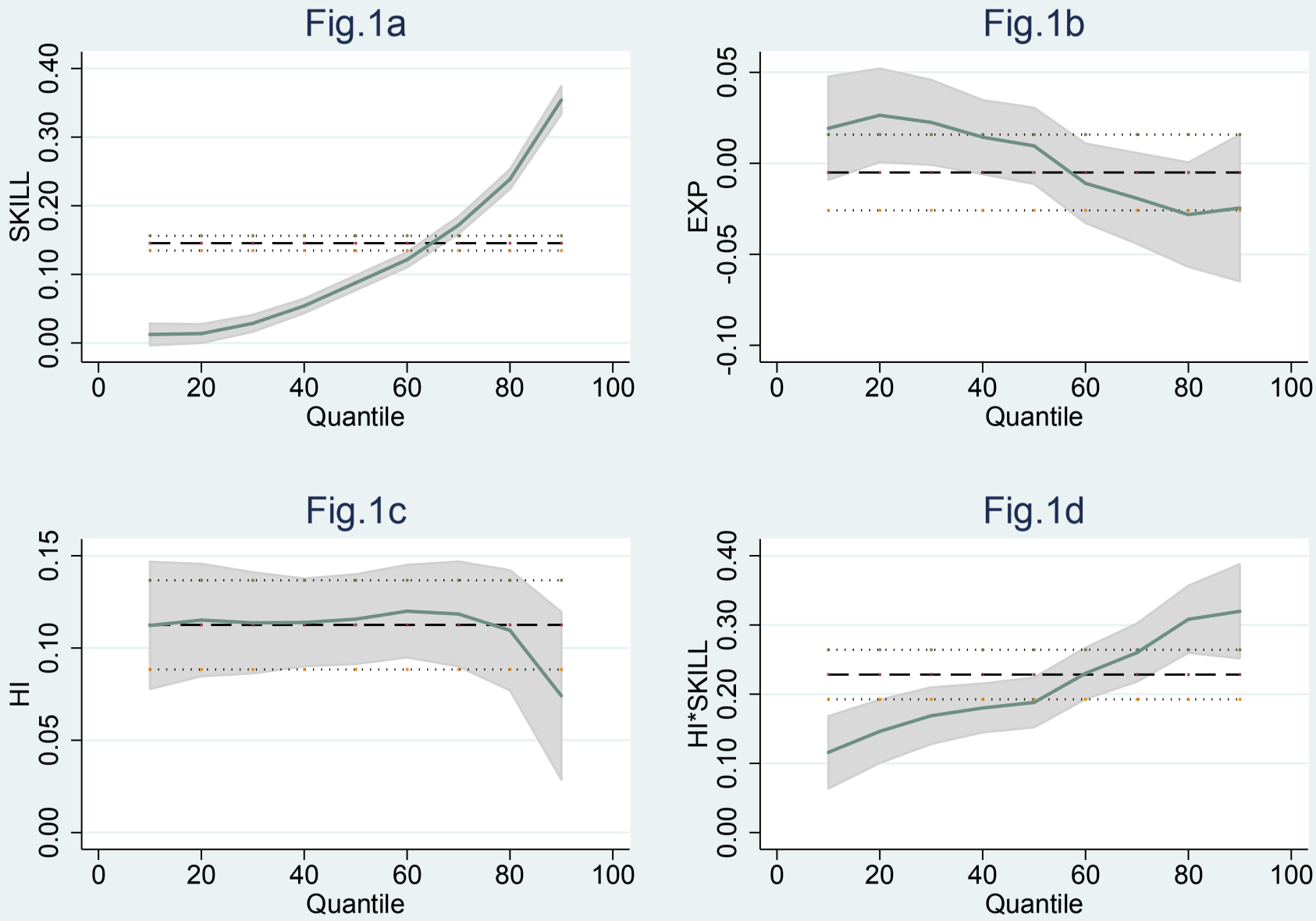
VARIABLES	(1) 10%	(2) 25%	(3) 50%	(4) 75%	(5) 90%
SKILL	0.0124*	0.0179***	0.0876***	0.199***	0.354***
	(0.00732)	(0.00627)	(0.00564)	(0.00709)	(0.0109)
HI	0.112***	0.123***	0.116***	0.113***	0.0741***
	(0.0164)	(0.0141)	(0.0119)	(0.0133)	(0.0195)
EXP	0.0193	0.0199	0.00962	-0.0237*	-0.0245
	(0.0141)	(0.0122)	(0.0105)	(0.0126)	(0.0158)
HI*SKILL	0.116***	0.154***	0.188***	0.290***	0.320***
	(0.0277)	(0.0233)	(0.0209)	(0.0249)	(0.0360)
AGE	0.00925***	0.00599***	0.00151***	0.000511	-0.000587
	(0.000602)	(0.000486)	(0.000424)	(0.000487)	(0.000636)
AGE^2	-0.000245***	-0.000148***	-4.56e-05***	-2.11e-05*	-8.59e-06
	(1.57e-05)	(1.22e-05)	(1.08e-05)	(1.18e-05)	(1.35e-05)
Cap	0.0988***	0.134***	0.158***	0.184***	0.209***
	(0.00190)	(0.00162)	(0.00146)	(0.00178)	(0.00266)
State Ownership	-0.166***	-0.0790***	0.0221***	0.0986***	0.131***
	(0.00968)	(0.00713)	(0.00701)	(0.00805)	(0.00997)
PE	-0.0671***	-0.0632***	-0.0449***	-0.0236**	-0.00462
	(0.0139)	(0.0117)	(0.0107)	(0.0112)	(0.0152)
PAT	0.0350**	0.0406**	0.0414**	0.0599**	0.0860***
	(0.0163)	(0.0177)	(0.0163)	(0.0272)	(0.0166)
FPT	0.0106	0.00957	0.0131	0.00320	0.00539
	(0.0167)	(0.0114)	(0.0101)	(0.0108)	(0.0156)
Constant	1.078***	1.115***	1.205***	1.248***	1.295***
	(0.0224)	(0.0177)	(0.0156)	(0.0162)	(0.0256)
Observations	162,541	162,541	162,541	162,541	162,541

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Notes: This table reports the quantile regression results for each decile of Logarithm of average wage against proportion of skilled workers (SKILL), Export to Sales ratio (EXP), proportion of export to High Income countries (HI) and interaction of HI and SKILL (HI*SKILL), Age of the firm, Logarithm of capital per worker (Cap), State Ownership Dummy, Pure Exporter (PE) dummy, Feed and Processing Trade (FPT) dummy, Processing and Assembly Trade (PAT) dummy. Here, we have controlled for Industry Fixed effects at two digit level due to the computational limitation and standard errors are robust.

Figure 1. Relationship between average wage and the skill premium at different deciles of average wage



Notes: This figure corresponds to Table 6 and traces out the impact of proportion of skilled workers (SKILL), Export to Sales ratio (EXP), proportion of export to High Income countries (HI) and interaction of HI and SKILL (HI*SKILL) on each decile of logarithm of average wage using the quantile regression. Here, we have controlled for Industry Fixed effects at two digit level due to the computational limitation.

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