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Indirect Exports and Wholesalers: Evidence from interfirm transaction network data*

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Abstract

A substantial fraction of international trade is facilitated by wholesalers, which enable manufacturers to indirectly export their products to foreign markets. Using large-scale Japanese interfirm transaction network data, this paper unveils the features of both indirect and direct exporters. We first build a simple Melitz-type model of trade in which firms can also export indirectly via intermediaries. The model predicts sorting of firms to direct, indirect, and non-exporters along the size dimension. This pattern is confirmed in the data as the distributions of sales, in-degree (the number of suppliers), out-degree (the number of customers), and labor productivity are ordered for direct, indirect, and non-exporters in terms of first order stochastic dominance. We then perform multinomial logit analysis for the three modes of export. Consistent with the model, the estimated intercept is lower and slope of sales is steeper for direct exporting. We also find that in-degree raises the probability of direct exporting, implying a cost sharing mechanism of firms with more suppliers. Out-degree raises the probability of exporting in general (both indirect and direct). This implies a higher product appeal and broader demand base for firms which have more customers in the domestic market. Industry heterogeneity in the propensity of indirect and direct exporting is also analyzed.

Keywords: Indirect export, Wholesale, Network, Mode of export, Firm heterogeneity
JEL classification: F12, F14, L14, L25

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1 Introduction

An important fraction of international trade is facilitated by wholesalers. In 2014, wholesalers account for 24% of exporting firms and 25% of total export value in Japan.[1] They act as international intermediaries enabling manufacturers to indirectly export their products to foreign markets. Despite their importance in value-added exports, little empirical evidence has been documented on the determinants of the mode of exports and characteristics of indirect exporters. Using large-scale interfirm transaction network data in Japan, this paper identifies indirect exporters who supply their products to international wholesalers, and unveils the features of both indirect and direct exporters.

We base our empirical analyses on a simple Melitz-type trade model (Ahn et al., 2011), in which each firm chooses its export status from three alternatives: direct export, indirect export through wholesalers, and no export. As in standard trade models, direct exporting requires both fixed cost and iceberg trade cost. Examples of fixed costs would include the costs for marketing research, developing distribution channels in foreign countries, or preparing documents for customs, and those of the iceberg trade cost include tariffs and transportation costs. In the model, indirect trade is assumed to require lower fixed cost than direct trade due to the cost sharing with other firms through a wholesaler but to incur higher marginal cost because of the double marginalization by wholesalers. As a result, direct exporting is consider suitable for more productive firms since their foreign sales will be larger, and so is their net export profit compared to indirect exporting. The model implies sorting of firm productivity into different export status; the most productive firms export directly, the next group only export indirectly through wholesalers, and the least productive firms do not export.

For empirical analyses, we use transaction network data of Japanese firms compiled by the Tokyo Shoko Research Ltd. (TSR). The dataset contains information on domestic customers and suppliers of each firm, and thus allows us to observe whether or not a manufacturer sells its products to exporting wholesalers. Also, each firm reports whether it exports to foreign markets. We use these information to identify each manufacturer's export status.

In our empirical implementation, we first focus on testing the implication of the above model. We perform multinomial logit analyses on the above three export statuses using sales and sales per employee as measures of firm productivity. Following the model, we expect that large fixed trade costs make direct exporting most unlikely for any firms after controlling for firm characteristics and that a larger firm size increases the likelihood of exporting at a

[1] These figures are calculated by authors using the data from Basic Survey of Japanese Business Structure and Activities, or called Kikatsu.

greater rate for direct export than for indirect export. Our empirical results are consistent with the conjecture of the model.

We find that after controlling for firm characteristics including a firm productivity measure, indirect export is relatively more likely than direct export, both with and without industry fixed effects. We also find that, the marginal effect of firm size on a firm's export probability is lower for indirect export than direct export. For larger firms, relative to dealing only with a domestic market, exporting seems to become more attractive but more so for direct-trade. This is consistent with a view that the indirect export through wholesalers incurs an additional marginal costs due to double marginalization. We also perform our analyses for each of 24 manufacturing industries separately and found the same tendency.

As compared to manufacturers that export, non-exporters are smaller. Our domestic transaction data, however, show that many of them sell their products to manufacturers that export. It is possible that manufacturing exporters play a role similar to wholesalers, because their goods incorporate many goods produced by small non-exporting manufacturers or as addressed in Bernard et al. (2014), they perform carry-along trade. In that sense, it is possible that small upstream non-exporters still benefit from their downstream customers' access to foreign markets. Therefore, it is possible that export-costs of exporting manufacturers are shared by these non-exporters.

While understanding the microstructure of such sharing is beyond the scope of this paper, as a first step toward testing whether there is any evidence, we include the number of domestic suppliers of each manufacturer in our multinomial logit analyses on export-status. We find that, among exporters with the same level of productivity based on our measures, those with more domestic suppliers are more likely to directly export. It is possible that they somehow charge a part of export-costs to these suppliers.

Other researchers also find that wholesalers play an important role especially for medium size firms as they would otherwise transact only domestically along with less productive firms (Ahn et al. 2011, Akerman 2014, Bernard et al. 2010). Using a World Bank survey, Ahn et al. (2011) and Bernard et al. (2014) find that less productive and smaller firms tend to rely on wholesalers, suggesting an existence of fixed export costs that cannot be overcome by unproductive or small firms. Using customs data on exports, Ahn et al. (2011) and Crozet et al. (2013) also find that, among exporters, as compared with manufacturers, wholesalers deal with markets that are more difficult to penetrate such as small countries and countries with high trade costs. Their findings support the view that, with existence of fixed trade costs, transacting with many partners and processing a large trade volume in total make wholesalers efficient product distributors. On a theoretical side, Antras and Costinot (2010,

2011) develop a model of trade with intermediation, and study implications from different types of economic integrations.

This paper is organized as follows. The next section presents a theoretical framework on which we base our empirical analyses, which allows firms to export indirectly via wholesalers. Section 3 describes our data in detail along with summary statistics and some figures. Section 4 performs empirical analysis using a multinomial logit model. We also investigate industry heterogeneity in the propensity of both modes of export. Section 5 concludes.

2 Model

To guide the empirical analyses, we use a simpler version of the theoretical framework in Ahn et al. (2011), which is based on Melitz (2003). In the model, two modes of exporting (direct and indirect exporting via intermediaries) are available for manufacturers. Direct exporting requires a fixed cost and a variable iceberg trade cost. Indirect exporting via wholesalers requires a smaller fixed cost due to cost sharing, but higher marginal cost due to an additional intermediary markup. Direct exporting is suitable for more productive firms since their foreign sales will be larger, and so is their net export profit compared to indirect exporting. The model implies sorting of firm productivity into different export status; the most productive firms export directly, the next group only export indirectly through wholesalers, and the least productive firms do not export. In later sections, we test this implication and examine what factors determine the mode of export. To focus on this sorting pattern, we only consider a partial equilibrium where firms in home country take foreign variables as given, and there is no entry or exit of firms in home.

2.1 Setup

There are two countries, home and foreign. All foreign variables are denoted by an asterisk, and we will describe the home economy below. Home has a population L, who supplies labor inelastically. There is a continuum of firms who produce differentiated products in both countries. The mass of firms is assumed to be fixed, so no entry into the domestic market is allowed, and firms do not exit. Home is a small open economy whose penetration into the foreign market doesn't affect their price index, and home firms take foreign variables as given.

Preferences are characterized by a CES utility function

$$U \equiv \left(\int_{\Omega} q(\omega)^{\frac{\sigma-1}{\sigma}} d\omega \right)^{\frac{\sigma}{\sigma-1}}$$

where $q(\omega)$ is the consumption of a variety ω and Ω is the set of available varieties in the home country. The elasticity of substitution across varieties $\sigma$is assumed be larger than one and identical in both countries.

The demand function for a variety ω is given by

$$q(\omega) = \left(\frac{p(\omega)}{P} \right)^{-\sigma} \frac{Y}{P}$$

where Y is the home total expenditure, $p(\omega)$ is the price of the variety ω faced by home consumers, and the ideal price index is given by $P = \left(\int_{\Omega} p(\omega)^{1-\sigma} d\omega \right)^{\frac{1}{1-\sigma}}$.

2.2 Production and Exporting

Labor is the only input in the economy. Producers are heterogeneous in their productivity ϕ. In this model, productivity ϕ is the sufficient statistic for a variety ω. Production technology is linear in labor input exhibiting constant returns to scale. The wage rate w is common for all firms, so the marginal cost of firm ϕ is given by $\frac{w}{\phi}$. Firms' entry and exit decisions are abstracted for the domestic market. The mass of firms is fixed at one, and firms do not die. There is no fixed cost for producing in the domestic market, so all firms make positive sales and profit in the domestic market. Besides the domestic sales, firms can also export to the foreign market. As described below, there are two modes of exporting: direct and indirect. Hence, firms choose their export status from three options including not to export.

In order to directly export to the foreign country, firms must pay an iceberg trade cost τ and a fixed cost f^D. The price firm ϕ charges in the foreign market is

$$p^D(\phi) = \left(\frac{\sigma}{\sigma - 1} \right) \frac{w\tau}{\phi}$$

where D indicates direct export. From the CES demand function, direct export profit net of the fixed cost is

$$\pi^D(\phi) = \frac{\mu}{\sigma} \left[\left(\frac{\sigma - 1}{\sigma} \right) \frac{\phi P^*}{w\tau} \right]^{\sigma-1} Y^* - f^D \tag{1}$$

The above equation gives the following expression for the zero-profit cutoff productivity

$$\bar{\phi}^D = \lambda \left(\frac{f^D}{Y^*} \right)^{\frac{1}{\sigma-1}} \frac{w\tau}{P^*} \tag{2}$$

where $\lambda = \left(\frac{\sigma}{\mu}\right)^{\frac{1}{\sigma-1}} \left(\frac{\sigma}{\sigma-1}\right)$. The cutoff productivity is increasing in trade costs and decreasing in the foreign market size and price.

There is an alternative way to export manufactured goods: indirect export via international wholesalers. Wholesale industry is perfectly competitive, and homogeneous wholesalers can export goods on behalf of manufacturers. To use this intermediary service, a firm must pay a fixed cost f^I which is assume to be nonnegative, but smaller than f^D. Additionally, a firm must pay an intermediary margin $\kappa > 1$ which is multiplicative to the marginal cost. Then, firm ϕ's profit from indirect exporting is

$$\pi^I(\phi) = \frac{\mu}{\sigma} \left[\left(\frac{\sigma - 1}{\sigma} \right) \frac{\phi P^*}{w\kappa\tau} \right]^{\sigma-1} Y^* - f^I \tag{3}$$

Like ϕ^D, we can characterize the zero-profit cutoff for indirect exporting

$$\bar{\phi}^I = \lambda \left(\frac{f^I}{Y^*} \right)^{\frac{1}{\sigma-1}} \frac{w\kappa\tau}{P^*} \tag{4}$$

Firm ϕ's discrete choice problem is

$$\max_{\{D,I,N\}} \left\{ \pi^D(\phi), \pi^I(\phi), 0 \right\}$$

where the last option is not to export. Because of the fixed costs, the net export profits can be negative for both modes of export. In that case, the firm does not export and sell only in the domestic market.

2.3 Sorting of Export Status

Comparing equations (1) and (3), we can see that the function $\pi^I(\phi)$ has a higher intercept but a flatter curve with respect to productivity ϕ. This curve can be obtained by tilting the direct export profit curve $\pi^D(\phi)$ clockwise.[2] Due to the monotonicity, those two curves

[2]In general, these curves are convex and not straight lines. For the expositional purpose, we draw straight lines, which happen when $\sigma = 2$, to see the argument clearly. The main implications of the model don't

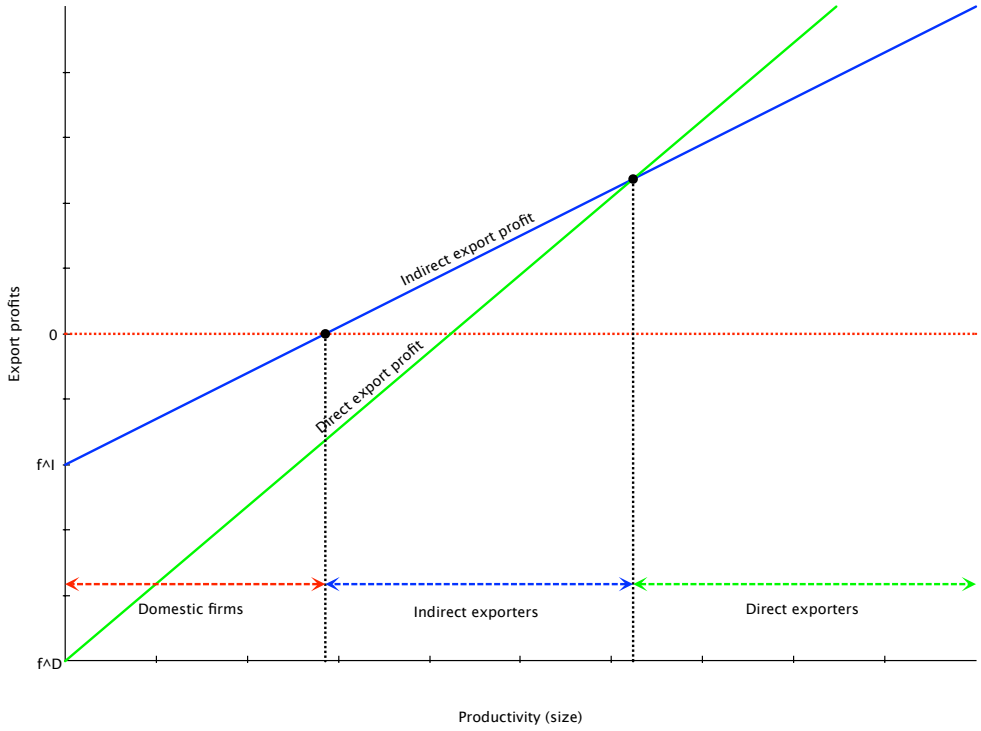

Figure 1: Export profits and firm sorting

intersect only once. Thus, we can also characterize the firm whose net profits from direct and indirect export are the same. Denote this firm by ϕ^{DI}. We obtain

$$\phi^{DI} = \lambda \left(\frac{f^D - f^I}{\left(1 - \kappa^{1-\sigma}\right) Y^*} \right)^{\frac{1}{\sigma-1}} \frac{w\tau}{P^*}$$

Firms with $\phi > \phi^{DI}$ strictly prefers direct export and firms with $\phi < \phi^{DI}$ strictly prefers indirect export conditional on positive profits. A firm never uses both types of export modes. The sorting pattern of firm productivity into three types of export status is illustrated in Figure 1. The most productive firms in $[\phi^{DI}, \infty)$ directly export, firms in the intermediate productivity range $\left[\bar{\phi}^I, \phi^{DI}\right]$ indirectly export, and the least productive firms in $\left[0, \bar{\phi}^I\right]$ do not export. Without any parameter restrictions, it is possible that the intersection of $\pi^I(\phi)$ and $\pi^D(\phi)$ occurs below the zero-profit line implying that $\pi\left(\phi^{DI}\right) < 0$. In this case, there will be no indirect exporters. Firms in $\left[0, \bar{\phi}^D\right]$ do not export, and firms in $[\bar{\phi}^D, \infty)$ directly export. As will be shown later, indirect exporters exist in all manufacturing sectors. Ahn et al. (2011) also report that indirect exporting is observed in almost all destinations based on

change in the general case.

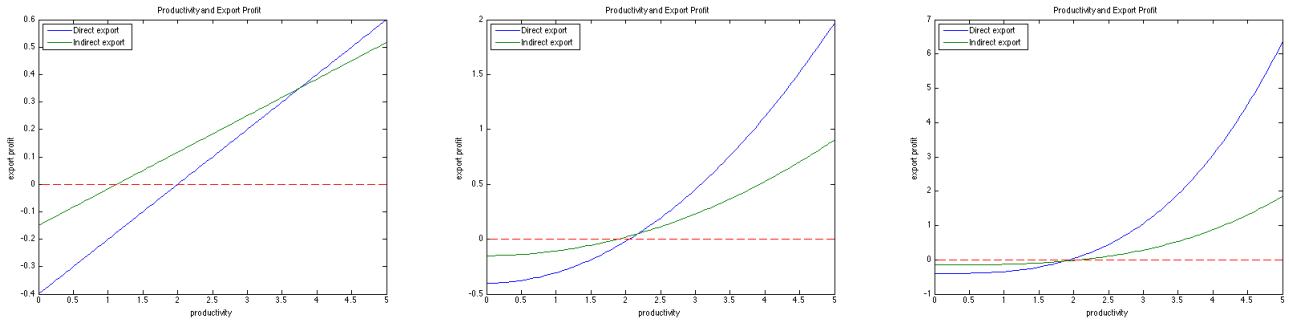

Figure 2: Export profits and different elasticities of substitution ($\sigma = 2, 3, 4$)

the World Bank's Enterprise Survey Data. Therefore we discard this possibility and focus on the case where $\pi\left(\phi^{DI}\right) > 0$ so that the range of indirect exporters does not vanish. This means that the fixed cost for indirect export cannot be too large, or the intermediary margin κ cannot be too high.

From Figure 1 and expressions for $\bar{\phi}^I$ and ϕ^{DI}, it is straightforward to see some comparative statics. If the fixed cost of indirect exporting f^I increases, $\bar{\phi}^I$ rises and ϕ^{DI} falls implying that the intermediate range of productivities for indirect exporters shrinks. Graphically, this can be seen by shifting down the curve of indirect export profit. A higher intermediary markup κ also generates the same comparative statics. In this case, the slope of the indirect export profit becomes flatter. When the fixed cost of direct exporting increases, ϕ^{DI} rises leading to more indirect exporters and less direct exporters. The range of domestic firms do not change since $\bar{\phi}^I$ does not depend on f^D. The comparative statics of changing $\sigma$is not straightforward since this alters the curvature of the export profit functions. Figure 2 depicts the export profits for different values of σ holding all other parameters identical. This parameter controls the slope and curvature of the profit functions. As σ increases (the varieties become less differentiated), the region of productivities for indirect exporters shrinks. Eventually, it will vanish at some threshold σ. In this numerical example, $\pi\left(\phi^{DI}\right) < 0$ if $\sigma = 4$, so there is no indirect exporters. As goods become more homogeneous, a small difference in ϕ creates a big difference in export profit since the price elasticity is high. In this case, losing an additional margin via intermediaries is a severe disadvantage. The difference in the fixed costs $f^D - f^I$ can be recovered very quickly as ϕ increases.

3 Data

We use the firm-level data compiled by Tokyo Shoko Research Ltd. (henceforth, TSR), which is a private credit reporting company. TSR collects information on firms' performance and financial statements to asses their credit scores. Firms provide the information in the course of obtaining credit reports on potential suppliers and customers or when attempting to qualify as a supplier. The data provided to us by RIETI was compiled in 2014 covering more than 1.2 million firms. The TSR dataset includes both private and publicly listed firms from all sectors. For each firm, we have information on sales, profits, employment, the number of establishments, year it was founded, headquarters address, and industry in the 4-digit Japanese Standard Industrial Classification (JSIC). The data also reports whether a firm exports or imports some goods. We use this information to identify direct exporters.

A unique feature of the TSR dataset is its interfirm transaction network data. Each firm in the dataset provides a list of its most important suppliers and customers up to 24 partners. Based on this information, we can construct a firm-to-firm transaction network data. This is a directed graph since we observe the directions of each link.[3] Combining self- and other-reported links, we identify as many suppliers and customers as possible to grasp a more complete view of the transaction network. If a firm has many suppliers, the upper bound of self-reported suppliers is 24. However, many of the suppliers may report the firm as one of their customers. If we combine these other-reported links, we can capture the network quite well. Indeed, some firms have thousands of suppliers and customers. For more detailed explanations and analyses of the TSR network data, please see Bernard et al. (2014).

3.1 Manufacturing Firms and Exporting

In this paper, we restrict our attention to manufacturing firms. We define indirect exporters as manufacturing firms who supply their products to exporting wholesalers to keep track of the indirect shipment of the products. Because manufacturing and wholesale sectors account for more than 80 percent of the number of exporters in the TSR population, we capture the majority of exporters.

Manufacturing firms are identified from their 2-digit JSIC code being between 09 and 32. There are three types of export status: direct exporters, indirect exporters and non-exporters (domestic firms). Direct exporters are manufacturers who report exporting to TSR. Indirect exporters are defined as manufacturers who do not export by themselves but supply

[3]Following the network terminology, we use terms "transaction relationship" and "link" interchangeably.

	Number of firms (share)	Mean sales	Median sales	Sales share	Employment (share)
Domestic	91363 (76%)	12.09	11.99	22%	2425321 (37%)
Indirect	22368 (19%)	13.13	13.02	22%	1469724 (23%)
Direct	6820 (6%)	14.57	14.36	56%	2585678 (40%)
All	120551 (100%)	12.43	12.25	100%	6480723 (100%)

Table 1: Summary statistics of manufacturing firms
The mean and median sales are in log of sales (thousand yen)

their product to at least one exporting wholesaler. Exporting (or international) wholesalers are identified by the 2-digit JSIC code between 50 and 55, and their active export status. There are manufacturers who export by themselves and also supply products to international wholesalers. We count them as direct exporters since they were able to overcome the fixed cost of direct exporting, which is the interest of out study. All other manufacturers are defined as domestic firms. They do not export nor have a link to exporting wholesalers.[4]

We drop firms whose most recent fiscal closing date is older than January 2012 and whose fiscal term is not 12 months. Also, firms whose sales information is not available or either in-degree (the number of suppliers in the TSR data) or out-degree (the number of customers) is zero are not included in our sample.[5] This gives us the basic sample of 120,551 manufacturing firms.

3.2 Descriptive Statistics

The summary statistics of the three types of exporters are shown in Table 1. From the first column, we see that the majority of manufacturing firms are domestic firms. Only 6% of manufacturers export directly. Indirect exporters have a larger share of 19%. The second and third column give the mean and median of log sales for each group. Consistent with the model, we confirm a clear sorting pattern of firm size in terms of sales. The median sales of domestic, indirect, and direct exporters are 1.61 million, 4.51 million, and 17.23 million US

[4]In the TSR data, there are cases where we cannot distinguish whether a firm does not export or it does export but do not report to TSR. This implies that there might be exporting firms in our sample of domestic firms. If this reporting pattern has any systematic correlation with firm size, then the measurement error may cause a sample bias in our empirical analysis. To address this issue, we compare the TSR sample with the data from the Basic Survey of Japanese Business Structure and Activities (BSJBSA), which surveys Japanese firms with 50 or more employees and whose capital is over 30 million yen. The data contain firms' financial statements, export amounts and other information. We adjusted the selection criteria for both samples (TSR and BSJBSA) and ran probit regressions of export status on log sales and other control variables. The estimated slope coefficients were similar in both samples, hence we conclude that there is no systematic bias of export status in the TSR sample.

[5]Including these firms does not change any of the qualitative implications of our estimates.

dollars respectively if we use the exchange rate of 100 yen = 1 USD. Roughly speaking, the median indirect exporter is three times larger than the median domestic firm, and the median direct exporter is four times larger than the median indirect exporter. The size differences can also be seen in the last two columns of Table 1, which present the share of total sales and employment of each export type. Direct exporters are only 6% in terms of the number of firms, but account for 56 % and 40 % of total sales and employment respectively.

Note that, like exporting manufacturers, exporting wholesalers typically sell their products in domestic market as well. Because the TSR data do not provide us with the information on products that are exported, when we identify a manufacturing firm that sells its product to a exporting wholesaler, we cannot tell whether the product is actually exported. In this sense, we overestimate the number of indirect exporters. We proceed with our analysis assuming that such a tendency is not correlated with our key variables, especially firm size.

The sorting of firm size is not generated by a small fraction of firms at the lower or upper tail. Figure 3 displays the empirical cumulative distribution function (CDF) of log sales by export status. Direct exporters are larger than indirect exporters, and indirect exporters are larger than domestic firms in the sense of first-order stochastic dominance (FOSD). At any sales percentile, a direct exporter is larger than an indirect exporter, who is larger than a domestic firm. This empirical regularity is very robust since it holds in any subdivided industries. We classify firms into one of 24 industries based on their 2-digit JSIC code. Figure 9 in Appendix shows the empirical CDFs of three export types by industry. The same sorting pattern in terms of FOSD can be confirmed in all industries. In some industries, the difference between the CDFs of direct and indirect exporters or indirect exporters and domestic firms is not very large (e.g. 10 Beverages and Tobacco, 12 Lumber and Wood or 20 Leather Product). Nevertheless, the sorting of size distributions still occurs.

In this paper, we incorporate three other firm characteristics: employment, in-degree (number of suppliers), and out-degree (number of customers). In the empirical analysis, employment is used to calculate labor productivity, which is defined as sales per employee. Since estimating firm-level total factor productivity from cross-sectional data is notoriously difficult, and we do not have other data of inputs, we use sales per employee as another measure of firm productivity. In-degree and out-degree are used as covariates in the multinomial logit model in Section 4. The descriptive statistics of these variables are summarized in Table 7 in Appendix. The same sorting pattern can be found in all variables. The median number of employees for domestic firms, indirect and direct exporters are 10, 20, 60, respectively. Also, the median in-degree and out-degree are 3, 6, 13, and 4, 8, 13, respectively. Exporters employ more labor and have more suppliers and customers. This is intuitive since these variables

	Sales	Employment	Labor Productivity	In-degree	Out-degree
Sales	1.000				
Employment	0.881	1.000			
Labor Productivity	0.651	0.215	1.000		
In-degree	0.750	0.710	0.409	1.000	
Out-degree	0.643	0.598	0.368	0.723	1.000

Table 2: Correlation matrix of firm variables (all in logs)

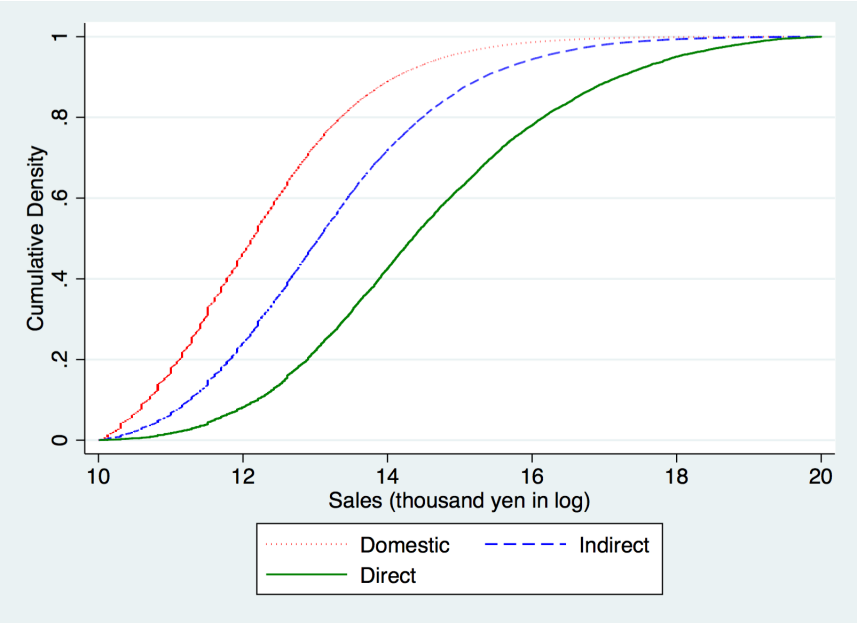

Figure 3: Empirical CDF of log sales by export status

are positively correlated with sales as shown in Table 2. Employment is strongly correlated with sales as the correlation coefficient is 0.881. In-degree and out-degree are also positively correlated with sales but the correlation is stronger for out-degree. It is informative to see the positive correlation between sales and labor productivity. Larger firms employ more labor but their labor productivity are also higher. This sorting of size distribution in terms of FOSD holds for these variables as well as illustrated in Figure 4.

Another way to see the relationship between size and export status is to compute the share of each type of exporters by sales percentile group. Figure 5 plots the share of domestic firms, indirect and direct exporters by sales decile group. The share of indirect and direct exporters increases as sales decile becomes larger. In the bottom decile, more than 90% of firms are domestic firms, and there are few direct exporters. In the top decile, more than 50% of firms

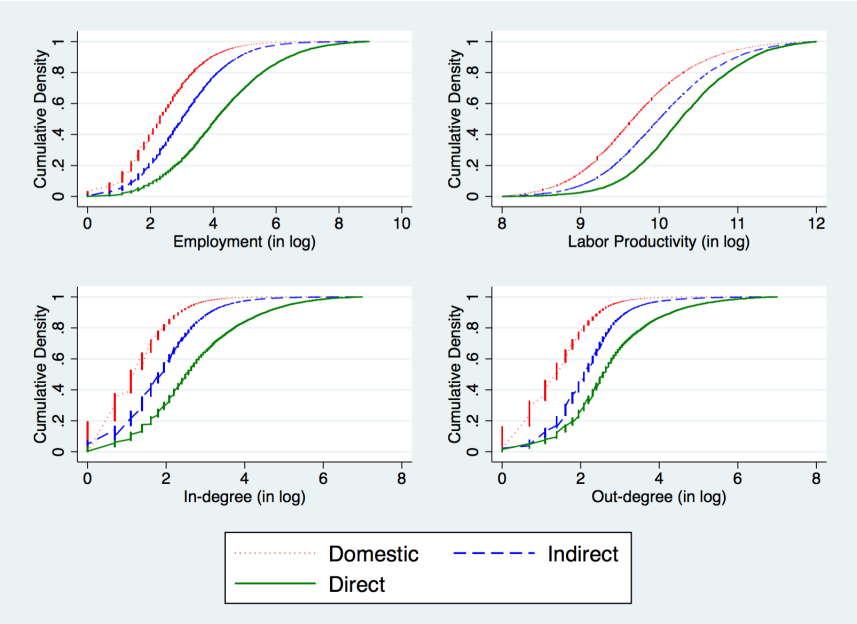

Figure 4: Empirical CDF of other variables by export status

are exporters. The share of exporters in sales deciles by industry can be found in Figure 10 in Appendix. In general, the same pattern holds as more firms export in larger sales decile groups. We can also see the industry heterogeneity in export intensity. For instance, chemical product, iron and steel, and many machinery sectors tend to have more exporters.

4 Empirical Analysis

4.1 Multinomial Logit Model for the Choice of Export Status

In the model described in Section 2, there are clear cutoffs in productivity that separate domestic firms and indirect exporters, and indirect and direct exporters. In reality, the cutoffs are not clear and the size distributions of domestic, indirect and direct exporters overlap each other. We incorporate a stochastic component to the export profits (or to the export fixed costs) in the firms' discrete choice problem, and examine their mode of export by a multinomial logit model. The multinomial logit model is used because its estimated coefficients of intercept and slope correspond to the export fixed cost and variable cost in the model enabling us to interpret the results in a transparent manner. Through this analysis, we aim to elucidate how firm's sales and other variables affect the probability of each export mode.

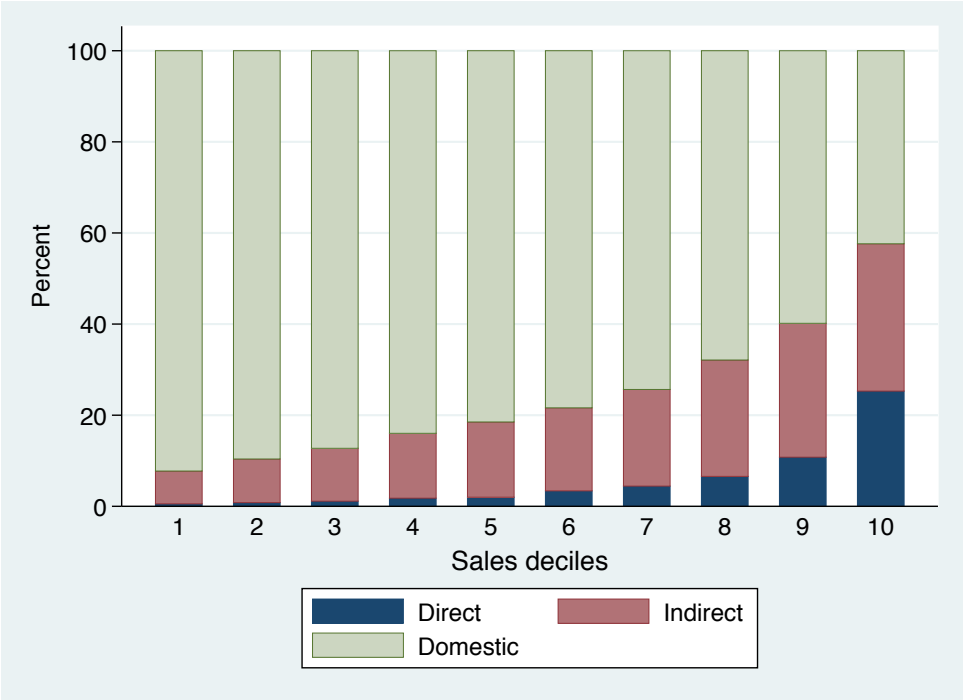

Figure 5: Share of exporters in sales decile groups

Let Y_i be the choice of firm i's export mode including not to export (domestic). Based on a multinomial logit model, the probabilities of indirect and direct exporting are written as follows

$$\Pr\left[Y_i = Indirect\right] = \frac{\exp\left(\beta_I' X_i\right)}{1 + \exp\left(\beta_I' X_i\right) + \exp\left(\beta_D' X_i\right)}$$

$$\Pr\left[Y_i = Direct\right] = \frac{\exp\left(\beta_D' X_i\right)}{1 + \exp\left(\beta_I' X_i\right) + \exp\left(\beta_D' X_i\right)}$$

where X_i is a vector of firm i's characteristics including one, and β_I and β_D are the vectors of coefficients for indirect and direct exporting respectively. The choice of being a domestic firm is used as a reference level. The dot product of β and X_i is called a score, and the probability of each choice is the share of its exponentiated score.

We first consider sales, in-degree, and out-degree as covariates, and estimate the above model by maximum likelihood estimation. The results are presented in Table 3. The upper panel displays the baseline results without fixed effects and the lower panel shows the results with 2-digit JSIC dummies and 47 prefecture dummies of the firms' headquarters address. The estimated coefficients are all significant at 1% level. The specification (1) of the baseline

	(1)		(2)		(3)		(4)	
export type	indirect	direct	indirect	direct	indirect	direct	indirect	direct
log sales	0.404***	0.805***	0.190***	0.452***	0.133***	0.536***	0.104***	0.403***
	(0.00484)	(0.00773)	(0.00715)	(0.0135)	(0.00626)	(0.0101)	(0.00754)	(0.0138)
log in-degree			0.486***	0.729***			0.102***	0.361***
			(0.0122)	(0.0223)			(0.0138)	(0.0253)
log out-degree					0.781***	0.781***	0.739***	0.647***
					(0.0112)	(0.0174)	(0.0125)	(0.0196)
intercept	-6.488***	-13.22***	-4.536***	-9.883***	-4.420***	-11.16***	-4.131***	-9.806***
	(0.0626)	(0.109)	(0.0782)	(0.149)	(0.0699)	(0.121)	(0.0812)	(0.153)
Observations	120,551		120,551		120,551		120,551	
2-digit JSIC FE	No		No		No		No	
Prefecture FE	No		No		No		No	
Pseudo R-squared	0.104		0.118		0.142		0.144	

(a) baseline results

	(1)		(2)		(3)		(4)	
export type	indirect	direct	indirect	direct	indirect	direct	indirect	direct
log sales	0.408***	0.826***	0.147***	0.441***	0.110***	0.530***	0.0539***	0.386***
	(0.00512)	(0.00859)	(0.00751)	(0.0146)	(0.00661)	(0.0111)	(0.00794)	(0.0149)
log in-degree			0.593***	0.793***			0.186***	0.398***
			(0.0129)	(0.0236)			(0.0145)	(0.0269)
log out-degree					0.867***	0.871***	0.791***	0.715***
					(0.0120)	(0.0193)	(0.0133)	(0.0219)
intercept	-6.477***	-15.21***	-4.081***	-11.52***	-4.056***	-12.83***	-3.519***	-11.35***
	(0.0767)	(0.158)	(0.0910)	(0.193)	(0.0846)	(0.168)	(0.0945)	(0.196)
Observations	120,549		120,549		120,549		120,549	
2-digit JSIC FE	Yes		Yes		Yes		Yes	
Prefecture FE	Yes		Yes		Yes		Yes	
Pseudo R-squared	0.157		0.175		0.199		0.201	

(b) industry and prefecture fixed effects

Table 3: Multinomial logit model with sales

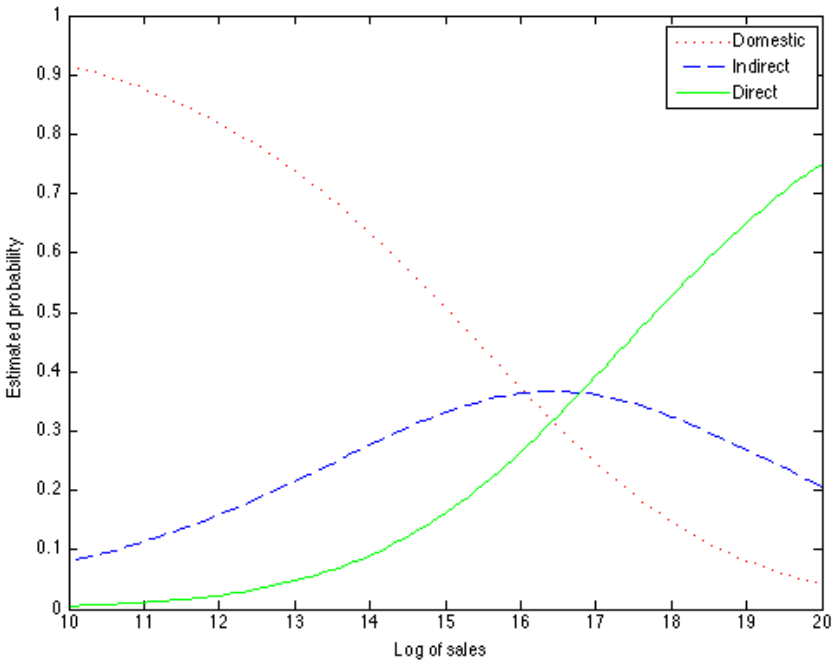

Figure 6: Estimated probabilities of export status with the baseline results

results is the simplest form where the only independent variable is log sales. The slopes of indirect and direct exports are 0.404 and 0.805 while the intercepts are -6.488 and -13.22 respectively. The results are consistent with the model that predicts a lower intercept but a steeper slope of sales for direct exporting. When a firm's sales is small, the probability of being a domestic firm is high. The score of indirect exporting is higher than that of direct exporting since the indirect curve starts from a higher intercept. As sales increases, the gap between the lines of indirect and direct exporting shrinks due to the higher slope of direct exporting. Eventually, these two lines intersect when the log sales is $16.79 \approx 195$ million USD. In the theoretical model, this is the sales of a firm ϕ^{DI}. If sales increases even more, the direct exporting becomes dominant. Figure 6 plots the estimated probabilities of each choice against log of sales. We can see that the probability of not to export (domestic) monotonically decreases and the probability of direct exporting monotonically increases with sales. The probability of indirect exporting exhibits an inverted-U shape. When sales becomes very large, the probability of direct exporting starts dominating the probability of indirect exporting.

In specification (2), we estimate the effect of in-degree along with sales. The coefficient of log in-degree is positive and significant for both indirect and direct exports, but it is higher

for direct exporting. Firms who have more suppliers tend to export directly after controlling their sales size. Including in-degree dampens the slopes of log sales for both indirect and direct equations but does not change qualitative feature of lower intercept and higher slope of sales for direct export. Specification (3) considers the effect of out-degree. Like specification (2), the coefficient of out-degree is positive for both indirect and direct exporting, and the slopes of log sales become smaller for both equations. Interestingly, there is no difference in the coefficient of out-degree for both equations, which implies that out-degree raises the probability of exporting in general. Firms with more customers tend to export both indirectly and directly. In specification (4), we analyze the effects of sales, in-degree and out-degree simultaneously. The results are similar with those in the previous specifications. All slope coefficients are positive and significant for both equations. The slopes of sales and in-degree are higher for direct exporting whereas the slope of out-degree is smaller.

In the bottom panel of Table 3, we perform the same analysis, controlling industry and prefecture fixed effects. There might be industry heterogeneity in the propensity of indirect and direct exporting due to differences in distribution networks, tariff rates, degree of product differentiation, and so forth. Also, a firm's geographical location may affect its mode of export due to various reasons (e.g. distance to the closest port, transportation infrastructure, etc). Even after controlling these industry and prefecture fixed effects, none of the qualitative properties change as we can see in the lower panel of Table 3. With any specifications, the intercept is lower and slope of log sales is higher for direct exporting. In the last specification of the bottom panel, the slope ratios (direct/indirect) for sales, in-degree and out-degree are 7.16 (=0.386/0.0539), 2.14 (=0.398/0.186), and 0.90 (=0.715/0.791) respectively. Larger sales and higher in-degree are associated with a higher propensity of direct exporting, but this relative effect is stronger for sales. Firms with more customers tend to export in general, and the positive effect is slightly stronger for indirect exporting.

A possible explanation for the differential effect of in-degree is a cost sharing of the export fixed cost. If a manufacturer has many suppliers, it might be able to divide the fixed cost of direct exporting and charge an additional margin to each supplier in the form of less payment. Also, more suppliers might be associated with more bargaining power of the manufacturer, which lowers the marginal cost and increases the incentive for direct exporting. The relatively similar coefficients of out-degree for indirect and direct exports can be explained the demand side. More customers may be associated with a higher product appeal and a broader demand base. If domestic and foreign markets have the same preference structures, there will be more demand for this product from abroad, and the firm tends to export both indirectly and directly.

We also run the same multinomial logit analyses with labor productivity (sales per worker) instead of sales. The model in Section 2 gives predictions of the mode of export in terms of productivity. Although there is a one-to-one relationship between productivity and sales in the model due to the CES demand and monopolistic competition, it is important to confirm the predictions in terms of productivity in empirical analysis as well. Remember that the sorting of export status holds for labor productivity as well from Figure 4. Table 4 presents the estimated results. As before, the top panel shows the baseline results without fixed effects and the bottom panel shows the results with industry and prefecture fixed effects. Qualitative results are the same as in the models with sales. In any specification, the intercept is lower and slope of labor productivity is steeper for direct exporting. The effects of in-degree and out-degree are not altered as well. In the last regression of the lower panel, we can see the same implications such as higher slopes of labor productivity and in-degree but a lower slope of out-degree for direct exporting.

4.2 Industry Heterogeneity

It is informative to investigate industry heterogeneity in the shares of indirect and direct exporters since the fixed and variable costs of both types of exports may be affected by industry-level variables such as tariff rates, degree of product differentiation, average weight of the product, upstreamness in a supply chain, or the market structure of the wholesalers in the industry. Table 8 in Appendix summarizes the share of indirect and direct exporters, and average size in terms of sales for 24 manufacturing industries. The sum of the third and fourth columns gives the share of total (both indirect and direct) exporters in the industry. Chemical product has the highest share of exporters (46%) followed by ICT equipment (37%) and business machinery (36%). On the other hand, the share of exporters in printing industry is only 8%. Thus, there is a large difference in the share of exporters by industry. Figure 7 displays the scatter plot of the ratio of indirect to direct exporters against the total exporters share. We see a clear negative correlation between these two statistics. An industry that exports more has relatively more direct exporters compared to indirect exporters. Industries that have higher share of direct exporters (and hence higher share of total exporters) are business machinery, electronic parts, ICT equipment, production machinery, or chemical product. These industries are characterized by their highly processed products, which imply higher degree of product differentiation and higher value added per unit. Industries that have smaller share of direct exporters are lumber and wood, furniture, food, and printing. These industries typically locate in the upstream of supply chains, and their products are

	(1)		(2)		(3)		(4)	
export type	indirect	direct	indirect	direct	indirect	direct	indirect	direct
log labor productivity	0.541***	0.916***	0.260***	0.314***	0.234***	0.444***	0.202***	0.272***
	(0.00945)	(0.0148)	(0.0104)	(0.0188)	(0.0106)	(0.0180)	(0.0108)	(0.0193)
log in-degree			0.644***	1.262***			0.159***	0.804***
			(0.00887)	(0.0143)			(0.0117)	(0.0198)
log out-degree					0.854***	1.299***	0.752***	0.696***
					(0.00942)	(0.0146)	(0.0123)	(0.0201)
intercept	-6.748***	-11.75***	-4.951***	-8.080***	-5.185***	-9.576***	-4.926***	-8.152***
	(0.0945)	(0.152)	(0.0995)	(0.181)	(0.102)	(0.176)	(0.103)	(0.186)
Observations	120,291		120,291		120,291		120,291	
2-digit JSIC FE	No		No		No		No	
Prefecture FE	No		No		No		No	
Pseudo R-squared	0.038		0.113		0.130		0.141	

(a) baseline results

	(1)		(2)		(3)		(4)	
export type	indirect	direct	indirect	direct	indirect	direct	indirect	direct
log labor productivity	0.483***	0.932***	0.159***	0.286***	0.155***	0.463***	0.107***	0.264***
	(0.01000)	(0.0168)	(0.0111)	(0.0208)	(0.0113)	(0.0201)	(0.0116)	(0.0213)
log in-degree			0.726***	1.309***			0.213***	0.811***
			(0.00941)	(0.0153)			(0.0124)	(0.0214)
log out-degree					0.937***	1.393***	0.799***	0.769***
					(0.0100)	(0.0161)	(0.0130)	(0.0222)
intercept	-6.095***	-13.55***	-4.027***	-9.512***	-4.339***	-11.42***	-3.980***	-9.748***
	(0.109)	(0.203)	(0.115)	(0.230)	(0.118)	(0.228)	(0.120)	(0.236)
Observations	120,291		120,291		120,291		120,291	
2-digit JSIC FE	Yes		Yes		Yes		Yes	
Prefecture FE	Yes		Yes		Yes		Yes	
Pseudo R-squared	0.094		0.170		0.188		0.198	

(b) industry and prefecture fixed effects

Table 4: Multinomial logit model with labor productivity

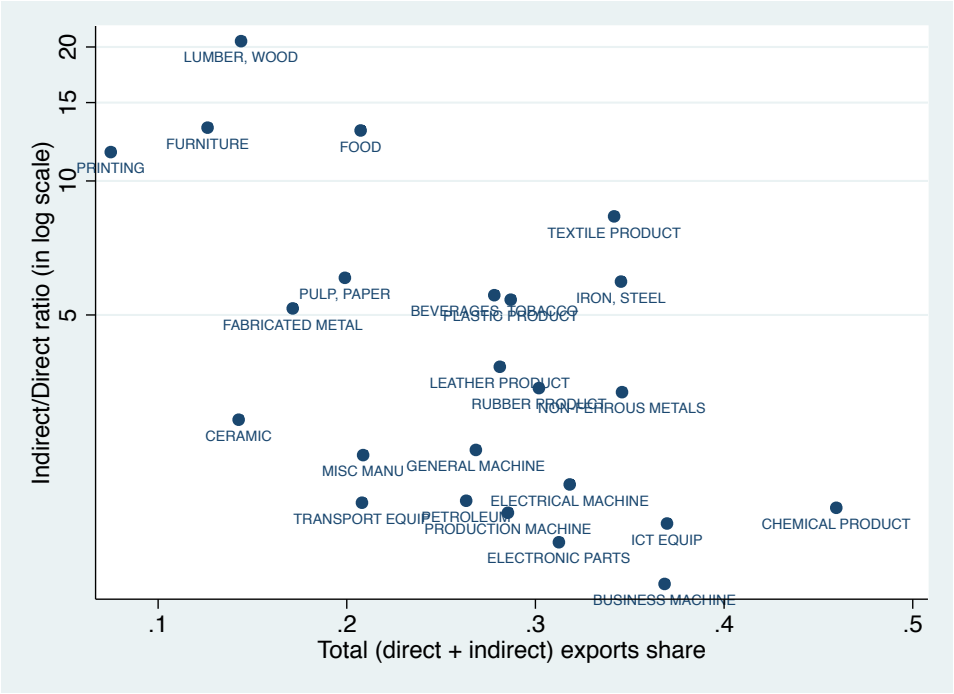

Figure 7: Ratio of indirect/direct exporters and the share of exporters by industry

less processed compared to machinery industries.[6]

From Table 3, we know that industry fixed effects do not absorb the variations of log sales, in-degree and out-degree. Yet, each industry may have different intercepts and slopes of sales. To examine the differential effects of size on the choice of export mode by industry, we estimate the multinomial logit model with only log sales (this corresponds to specification (1)) for each industry. Figure 8 plots the estimated intercepts for indirect and direct exporting (top) and slopes of log sales (bottom). All coefficients are significant at 1% level. 45-degree lines are drawn in both plots to see the relative size of the coefficients. The upper plot indicates that there is a strong positive correlation between the intercepts of indirect and direct exporting with a correlation coefficient 0.666, but the intercept of direct export is lower than that of indirect export in all industries (they all lie below the 45-degree line). These coefficients correspond to the fixed costs of export in the model. Chemical product

[6]Investigating the source of industry heterogeneity in the shares of indirect and direct exporters is an important agenda for future research. For instance, industries can be categorized according to the classifications developed in Rauch (1999). He divided traded commodities into three groups: those traded on organized exchanges, those possessing reference prices, and other commodities. Wholesalers may be able to facilitate more trade in industries whose main commodities are traded on organized exchanges. We can also compute the upstreamness of industries using the method described in Antras et al. (2012) and see its correlation with the shares of indirect and direct exporters.

and electronic machinery industries have smaller fixed costs for both indirect and direct exporting whereas lumber and wood or iron and steel have higher fixed costs in both export modes. There is also a positive correlation between the slope coefficients as shown in the bottom plot. The correlation coefficient is 0.547, a little weaker than the correlation of intercepts. As predicted, all dots lie above the 45-degree line indicating that the estimated slope of direct exporting is larger in all industries. It is interesting to see that the slopes of electronic machinery and chemical product industries are smaller for both indirect and direct exports, yet they have higher shares of exporters. From this analysis, we can tell that they have larger export intensity because of lower fixed costs of exporting, not because their size distributions are larger. The opposite is true for iron and steel industry, which is characterized by larger fixed costs, but steeper slopes of sales for both indirect and direct exporting. The larger fixed costs may reflect the heavy industry nature of iron and steel. A firm must be very large in order to export in this industry. Nevertheless, from Figure 7, we can see that iron and steel industry has larger share of exporters. This implies that the average size of firms in this industry is larger, which can be confirmed in Table 8.

4.3 Logit Model for Wholesalers' Export Decision

In the above analysis, we focused on manufacturers' export decisions. Because wholesalers facilitate indirect trade, it is important to investigate what factors affect their export decision. When a wholesaler decides to export, it opens the gateway for foreign markets for its suppliers as well. In this subsection, we examine wholesalers' export decision by a simple logit model. Wholesaling firms are identified by their 2-digit JSIC code being between 50 and 55, and extracted from the 2014 TSR data. Other criteria are the same as in Section 3. This gives the total sample of 97,404 wholesalers, and the summary statistics are shown in Table 5. Out of the 97404 wholesalers, 5253 firms export to foreign markets. The share of exporters is 5%, which is similar to the 6% share of direct exporters among manufacturing firms. Like manufacturers, exporting wholesalers are larger and account for higher shares in terms of total sales and employment.

To see what factors are associated with wholesalers' export status, we perform simple logit analyses with sales, in-degree and out-degree (all in log). Table 6 presents the results of the logit analysis. The last four columns include 3-digit JSIC (20 industries) and 47 prefecture fixed effects. The 3-digit JSIC code indicates the focus of a wholesaler such as food, textile, metals, and so forth, since many wholesalers have different specialities in terms of product scope. As in the case of manufacturers, the estimated coefficient of log sales is

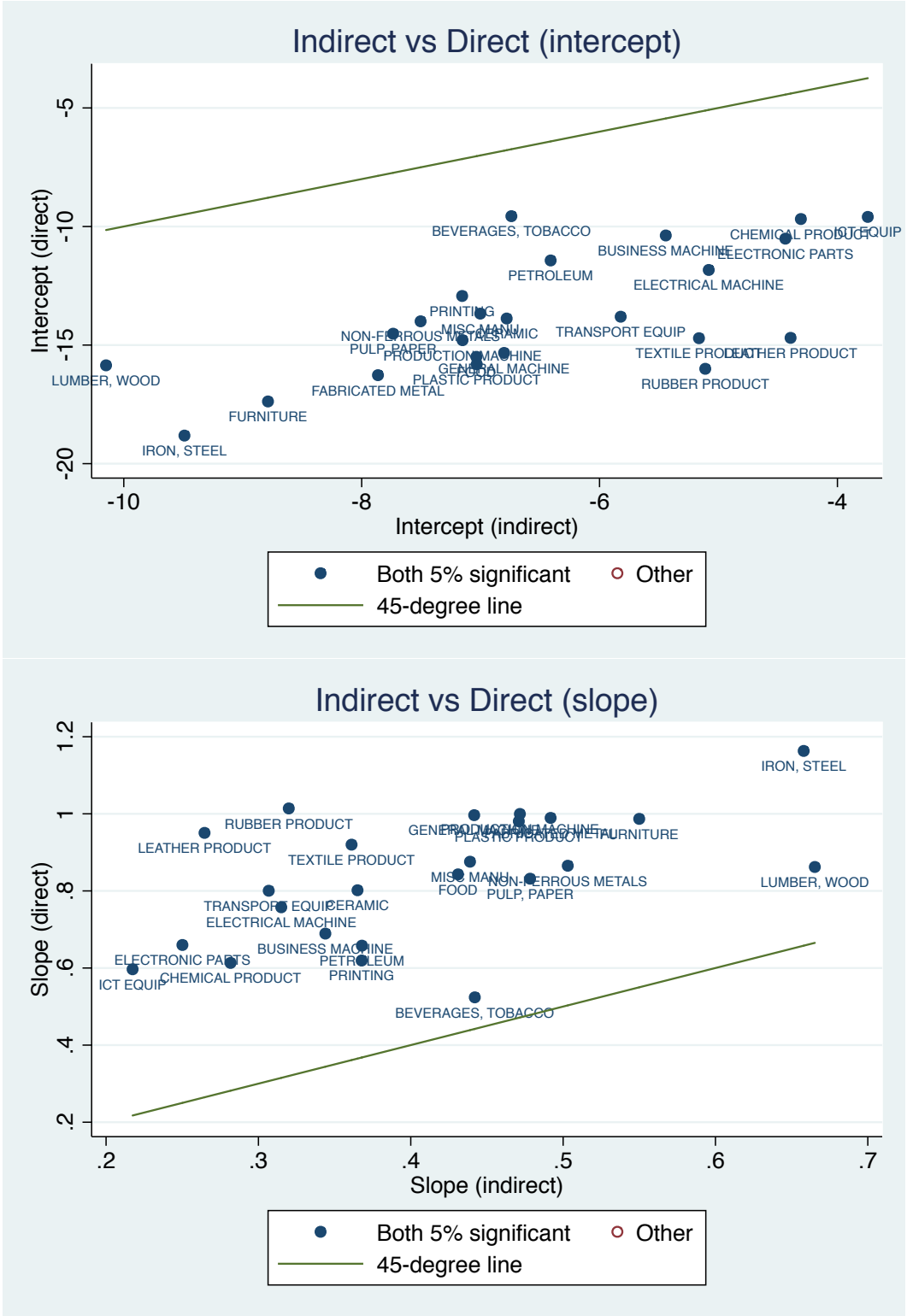

Figure 8: Coefficients of intercept and log sales (slope) by industry

	Number of firms (share)	Mean sales	Median sales	Sales share	Employment (share)
Domestic	92151 (95%)	12.61	12.47	64%	1919443 (85%)
Exporting	5253 (5%)	14.07	13.87	36%	345625 (15%)
All	97404	12.69	12.54	100%	2265068

Table 5: Summary statistics of wholesaling firms
The mean and median sales are in log of sales (thousand yen)

positive and the intercept is negative in all specifications implying that only larger wholesalers export. The coefficient of log in-degree changes if fixed effects are included implying that between-industry-prefecture variations of in-degree are larger. In columns (6) and (8), this coefficient is positive and significant. Wholesalers who have more suppliers tend to export after controlling the size and industry and prefecture averages.

This result suggests an amplifying effect of wholesalers' export status on indirect exporting. Since exporting wholesalers tend to have more suppliers, the leverage of indirect exporting via international wholesalers is higher. Contrary to the results from manufacturers' export status, the estimated coefficient of log out-degree is negative and significant in all specifications. This implies that wholesalers who have more customers in the domestic market are less prone to export. A possible explanation is higher substitutability between domestic and foreign customers for wholesalers. Another explanation might be a cost advantage by focusing on particular manufacturing industries or products. Many wholesalers have particular focus in terms of industry. This specialization may limit the product scope leading to less customers, but lower the fixed cost of exporting. This also relates to the role of exporting manufacturers as wholesalers in so-called carry-along trade. As documented in Bernard et al. (2014), many manufacturers export products which they do not produce but purchased from their suppliers. Thus, some manufacturers act as international wholesalers and facilitates indirect exports. Although this is not the focus of our research, the empirical results suggest the opposite effects of out-degree on the propensity of exporting for manufacturers and wholesalers. This difference should be further investigated to understand the selection mechanism for exporting for manufacturers and wholesalers, and to asses any policy implications on carry-along trade.

5 Conclusion

This paper unveils the properties of direct and indirect exporters in relation to domestic firms, and examines what factors are associated with firms' choice of export mode. It is impor-

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	export	export	export	export	export	export	export	export
log sales	0.440***	0.480***	0.538***	0.532***	0.398***	0.363***	0.458***	0.416***
	(0.00764)	(0.0108)	(0.0107)	(0.0116)	(0.00839)	(0.0120)	(0.0121)	(0.0132)
log in-degree		-0.0992***		0.0272		0.0836***		0.178***
		(0.0183)		(0.0212)		(0.0204)		(0.0228)
log out-degree			-0.190***	-0.200***			-0.116***	-0.180***
			(0.0144)	(0.0165)			(0.0168)	(0.0187)
intercept	-8.706***	-9.081***	-9.637***	-9.587***	-5.824***	-5.464***	-6.430***	-6.002***
	(0.107)	(0.128)	(0.129)	(0.135)	(0.133)	(0.159)	(0.160)	(0.169)
Observations	97,404	97,404	97,404	97,404	97,402	97,402	97,402	97,402
3-digit JSIC FE	No	No	No	No	Yes	Yes	Yes	Yes
prefecture FE	No	No	No	No	Yes	Yes	Yes	Yes
Pseudo R-squared	0.0804	0.0811	0.0846	0.0847	0.225	0.225	0.226	0.227

Table 6: Logit model for wholesalers' export decision

tant to study the features of indirect exporters, manufacturers who export via international wholesalers, since a substantial fraction of international trade is facilitated by intermediaries. They are the "true" value-added exporters, who cannot be captured in a standard trade statistics. Using Japanese large-scale interfirm transaction network data, we identify those indirect exporters in manufacturing sector. As predicted by a simple Melitz type trade model with indirect export alternative (Ahn et al., 2011), we confirm a strong sorting pattern of any measures of size and productivity by export status (domestic, indirect and direct). The distributions of sales, employment, labor productivity, in-degree, and out-degree by three export status are ordered in the sense of FOSD. Also, the shares of indirect and direct exporters are higher in larger sales deciles. These empirical regularities are very robust as we can see the same pattern in all subdivided industries. The multinomial logit analysis for firms' choice of export mode gives strong evidence of larger fixed cost but lower variable cost of direct exporting compared to the alternative of indirect exporting via intermediaries. We also find that in-degree raises the probability of direct exporting implying a cost sharing mechanism of firms with more suppliers. Out-degree raises the probability of both indirect and direct exporting. This implies a higher product appeal and broader demand base for firms who have more customers in the domestic market. There is a large industry heterogeneity in the shares of indirect and direct exporters. Industries of highly processed products or high degree of product differentiation such as chemical product and electronic machinery have smaller fixed costs but larger variable costs of exporting. Compared to the industries located upstream in supply chains, these industries have larger shares of exporters, and disproportionately larger shares of direct exporters. These results may give rise to new policy implications of export

promotion. For some industries, an effective way to increase export volume can be to subsidize international wholesalers or to provide a better matching mechanism which connects those potential indirect exporters and exporting wholesalers.

References

Ahn, JaeBin, Amit K. Khandelwal, and Shang-Jin Wei (2011) "The Role of Intermediaries in Facilitating Trade," *Journal of International Economics*, Vol. 84, No. 1, pp. 73–85.

Antras, Pol, Davin Chor, Thibault Fally, and Russell Hillberry (2012) "Measuring the Upstreamness of Production and Trade Flows," *American Economic Review Papers and Proceedings*, Vol. 94, No. 4, pp. 841–859.

Antras, Pol and Arnaud Costinot (2010) "Intermediation and Economic Integration," *American Economic Review*, Vol. 100, No. 2, pp. 424–428.

——— (2011) "Intermediated Trade," *Quarterly Journal of Economics*, Vol. 126, No. 3, pp. 1319–1374.

Bernard, Andrew B., Emily J. Blanchard, Ilke Van Beveren, and Hylke Vandenbussche (2014a) "Carry-Along Trade," *NBER Working Paper 18246*.

Bernard, Andrew B., Marco Grazzi, and Chiara Tomasi (2012) "Intermediaries in International Trade: Direct versus indirect modes of export."

Bernard, Andrew B., J. B. Jensen, Stephen J. Redding, and Peter K. Schott (2010) "Wholesalers and Retailers in US Trade," *American Economic Review*, Vol. 100, No. 2, pp. 408–413.

Bernard, Andrew B., Andreas Moxnes, and Yukiko U. Saito (2014b) "Geography and Firm Performance in the Japanese Production Network," *RIETI Discussion Paper Series 14-E-034*.

Crozet, Matthieu, Guy Lalanne, and Sandra Poncet (2013) "Wholesalers in International Trade," *European Economic Review*, Vol. 58, pp. 1–17.

Melitz, Marc J. (2003) "The Impact of Trade on Intra-industry Reallocations and Aggregate Industry Productivity," *Econometrica*, Vol. 71, No. 6, pp. 1695–1725.

Rauch, James E. (1999) "Networks versus Markets in International Trade," *Journal of International Economics*, Vol. 48, pp. 7–35.

Appendix

		mean	median	25 percentile	75 percentile	standard deviation
Sales (in log)	Domestic	12.09	11.99	11.08	13.01	1.52
	Indirect	13.13	13.02	11.98	14.15	1.68
	Direct	14.57	14.36	13.13	15.81	2.04
	All	12.43	12.25	11.29	13.40	1.72
Employment (in log)	Domestic	2.41	2.30	1.61	3.18	1.20
	Indirect	3.09	3.00	2.20	3.91	1.33
	Direct	4.23	4.09	3.09	5.28	1.67
	All	2.64	2.48	1.61	3.40	1.34
In-degree	Domestic	5.22	3	2	6	8.00
	Indirect	12.26	6	3	12	37.33
	Direct	50.73	13	6	32	194.44
	All	9.10	4	2	8	50.57
Out-degree	Domestic	6.09	4	2	7	13.85
	Indirect	15.46	8	5	14	98.26
	Direct	42.97	13	7	28	161.60
	All	9.92	5	2	9	59.10
Labor Productivity (in log)	Domestic	9.70	9.66	9.21	10.17	0.81
	Indirect	10.05	10.01	9.53	10.52	0.81
	Direct	10.34	10.28	9.87	10.78	0.75
	All	9.80	9.76	9.27	10.30	0.83

Table 7: Statistics for other variables

name	# of firms	share of direct	share of indirect	indirect/direct	mean of log sales
FOOD	12409	0.01	0.19	12.98	12.75
BEVERAGES, TOBACCO	2491	0.04	0.24	5.54	12.51
TEXTILE PRODUCT	7778	0.04	0.31	8.33	12.11
LUMBER, WOOD	3452	0.01	0.14	20.61	12.01
FURNITURE	2583	0.01	0.12	13.17	11.90
PULP, PAPER	3618	0.03	0.17	6.06	12.64
PRINTING	6901	0.01	0.07	11.61	12.05
CHEMICAL PRODUCT	4072	0.16	0.30	1.84	13.38
PETROLEUM	376	0.09	0.17	1.91	13.45
PLASTIC PRODUCT	6636	0.04	0.24	5.41	12.49
RUBBER PRODUCT	1451	0.07	0.23	3.42	12.56
LEATHER PRODUCT	875	0.06	0.22	3.82	12.14
CERAMIC	5641	0.04	0.11	2.91	12.63
IRON, STEEL	2412	0.05	0.30	5.94	13.08
NON-FERROUS METALS	1749	0.08	0.27	3.35	13.05
FABRICATED METAL	16602	0.03	0.14	5.17	12.14
GENERAL MACHINE	5819	0.08	0.19	2.49	12.29
PRODUCTION MACHINE	12003	0.10	0.18	1.80	12.23
BUSINESS MACHINE	2703	0.16	0.20	1.24	12.65
ELECTRONIC PARTS	2970	0.12	0.19	1.54	12.64
ELECTRICAL MACHINE	6166	0.10	0.21	2.08	12.49
ICT EQUIP	1336	0.14	0.23	1.70	12.85
TRANSPORT EQUIP	4393	0.07	0.14	1.89	13.11
MISC MANU	6115	0.06	0.15	2.42	11.94

Table 8: Industry statistics

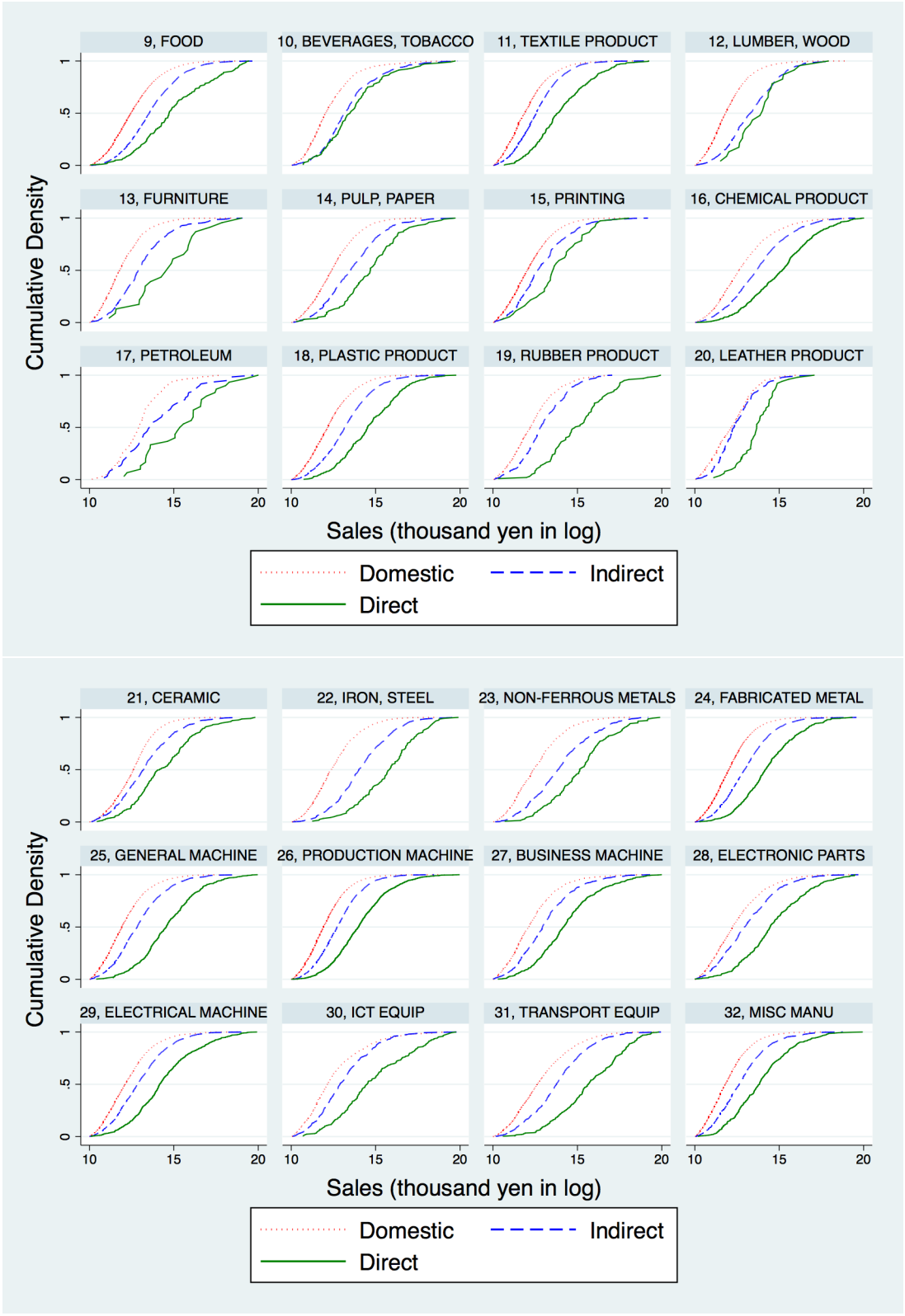

Figure 9: Empirical CDF of log sales by industry

Figure 10: Share of exporters in sales decile groups by industry