Export, Productivity Pattern, and Firm Size Distribution

Sun, Churen and Zhang, Tao

Shanghai Institute of Foreign Trade, Shanghai Institute of Foreign Trade

3 January 2012

Export, Productivity Pattern, and Firm Size Distribution*

Churen Sun†

Shanghai Institute of Foreign Trade, Shanghai, 201600

Guoqiang Tian‡

Texas A&M University, College Station, 77840

Tao Zhang§

Shanghai Institute of Foreign Trade, Shanghai, 201600

Abstract

We show in the *Chinese Annual Survey of Industrial Firms* that size distributions of non-exporters and exporters have different shapes, which can only be explained by assuming that their productivity distributions have different shapes. Empirical estimations verify this assumption. This paper also analyzes the relationship between firms' size and productivity distributions and shows that: 1) productivity and size distributions change accordingly, and 2) productivity is deterministic for size distribution.

Keywords: Heterogeneous firm, Pareto distribution, Production size, Productivity heterogeneity

JEL Subject calssification: F12

*The research is funded by the Key Research Base of Humanities and Social Science of Shanghai Municipal of Higher Education (Institute of International Business, Shanghai Institute of Foreign Trade). We thank Larry Qiu, Jiandong Ju, Bo Chen, Xiaopeng Yin, Yongbin Chen, Tao Zhang, Xiang Zuo and others for helpful discussions based on earlier versions of the paper. The usual disclaimer applies.

†Correspondence address: Rm. 701, Building 34, No.1099, Wenxiang Road, Songjiang District, Shanghai, China, 201620; Email: *sunchuren@gmail.com*.

‡Department of Economics, Texas A & M University, College Station, TX 77843, USA; Email: *gtian@tamu.edu*.

§Correspondence address: Rm. 703, Building 33, No.1099, Wenxiang Road, Songjiang District, Shanghai, China, 201620; Email: *neotaoism@yahoo.com.cn*.

1 Introduction

The past several decades has witnessed a rapid economic growth in China. Its GDP has increased by 400% since 1998 and 2007.[1] Many scholars ascribe this to the rapid growth of Chinese manufacturing industries. However, interestingly, the growth of manufacturing firms in China was not so fast as that of China's GDP. According to our statistics for 40 manufacturing industries based on the Annual Survey of Industrial Firms (**ASIF**) collected by the National Bureau of Statistics of China between 1998 and 2007, the firms' scales has increased by about 200%, which is far below that of China's GDP within these years.[2] This result holds also for the 40 individual manufacturing industries. Figure 1 shows the average scales of firms in manufacturing industry 6 to 46 except industry 37 between 1998 and 2007.

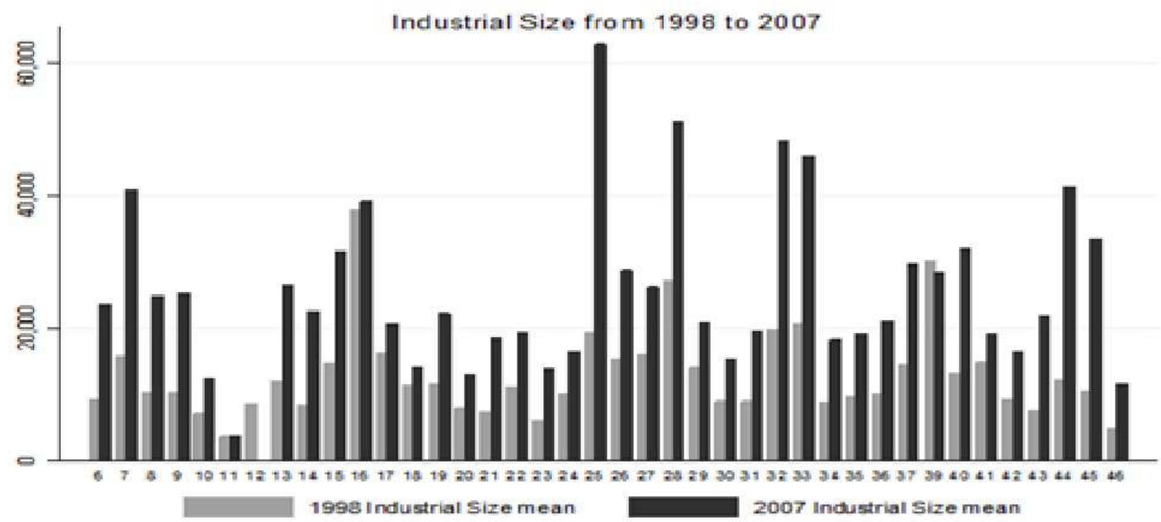


Figure 1: Average scales of manufacturing firms by industry (1998 and 2007)

We can see from Figure 1 that the growth rates of the average scales of firms in those industries except for industry 25, 44 and 45 are less than 391.91%. This implies that the growth of manufacturing industries is not only from that of average scales but also from that of numbers of firms in the industries. In fact, the firm number in the manufacturing industries increased from 165118 in 1998 to

[1] According to the data from "China Statistical Yearbook", China's GDP was 8302.48 billions yuan in 1998, and it became 25730.6 billions yuan in 2007, increasing by 391.91%.

[2] According to our statistics, the average scale of all firms in the manufacturing industries is 0.1203823 billions yuan in 1998, while it became 0.2459359 billion yuan in 2007, increasing by around 204.29%.

336768 in 2007, with a growth rate of 203.96%. The growth rate of output value of all the manufacturing industries is 416.66% between 1998 and 2007, which is very close to that of GDP. [3] As industrial firm number increased, the competition was tougher, which increased the selection effect in the industry and thus firms were forced to increase their productivity so as to survive in the market. Such mechanism further increased industrial total productivity level and led to resource reallocation across firms. It can be also seen from Figure 1 that manufacturing industries' growth rates were different, which indicates that there also existed resource reallocations across industries. The inter- and intra- industry resource reallocations changed the size distributions of Chinese manufacturing industries.

The first row of Figure 2 shows the change of (log) firm size distribution in the gross Chinese manufacturing industry between 1998 and 2007, where the horizontal and the vertical axes represent for the logarithm of firm output value and the probability density, respectively. It's seen from this figure that firm size distribution between 1998 and 2007 changed significantly. Moreover, the mean, minimal and maximal firm scales in 2007 are all larger than those in 1998, which implies that the firm sizes increased and distributed more disperser in 2007 than in 1998. This may be from the resource reallocation effect across industries and firms, and the influence of tougher competition on firms' choices of optimal scales.

As it's well known that trade is one of the three "carriages" promoting Chinese economic growth, a natural problem related to the above discussions is that whether and how firms' trade behaviors affected firm size distribution. The second and third rows of Figure 2 show the size distributions of non-exporters and exporters in 1998 and 2007, respectively, where the blue curve and the red one illustrate that the size distributions of non-exporters and exporters are significantly different. And, we can see intuitively that the size distribution of non-exporters are first-order stochastically dominated by that of exporters in both 1998 and 2007. It is also easy to see that the average scales of exporters in 1998 and 2007 are more larger than those of non-exporters, respectively.

This paper investigates: (1) whether resources allocate to more efficient firms, and (2) what's the role of export in this process and how it affects firm size distributions. The answer to these problems helps us to understand the source of Chi-

[3] This implies that the growth of manufacturing industries is synchronous to that of GDP.

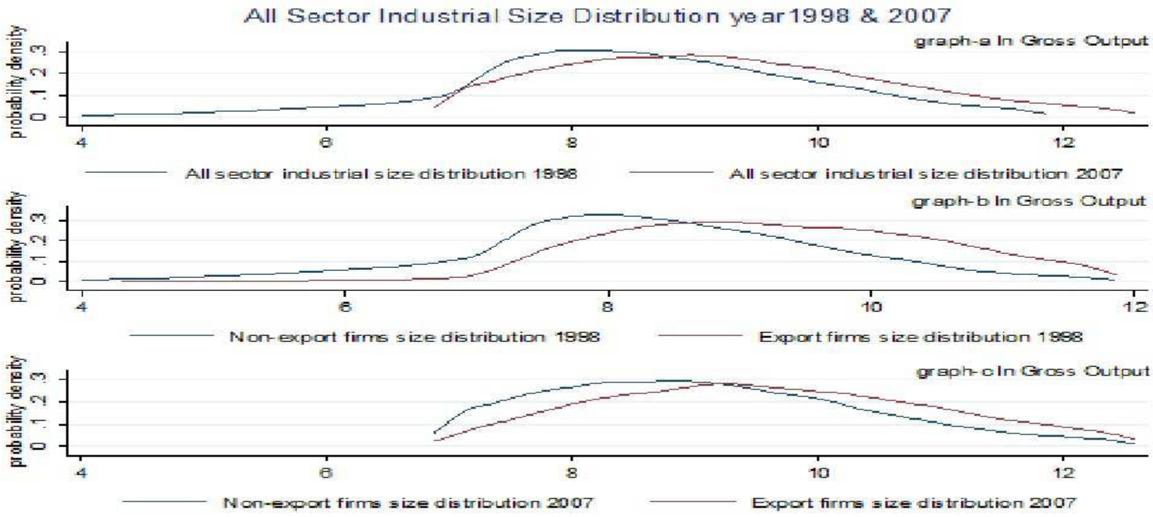


Figure 2: Changes of size distributions of firms in Chinese manufacturing industry between 1998 and 2007

nese economic growth, considering that there are many systematic distortions which may affect the efficiency of resource allocation.

Efficiently allocating resources is the kernel theme in economics. Firm size distribution, which reflects whether resources are efficiently allocated and synthesizes issues involving firms' decision making, growth, production efficiencies, strategic interactions and market selection processes, incurs many attentions. In open economy, trade liberalization increases market area and content, toughens market competition and speeds spillovers of information and technology, which has critical influences on firms' operating efficiencies and fixed production costs. Moreover, the openness to trade changes regional industry structure, and increases intra-industry division of labor and resource allocation efficiency.

As trade influences firms' productivity, and the latter affects their production decisions, which further influence sales, in short, trade must affect firms' sizes. In our points of view, resources allocated to the most efficient firms between 1998 and 2007 in Chinese manufacturing industries, though there were various systematic distortions which may influence resource allocation efficiency. While firms' exports affected industrial productivity distribution through selection, competition and technology spillover effects, which further influenced resource allocation.

Under the above train of thought, this paper revises the Melitz model proposed first in Melitz (2003) by assuming that productivity distributions of non-exporters and exporters are different while both are Pareto distributions. Under this assumption, this paper derives their size distributions, which are both Pareto distributions with different parameters. Moreover, the ratio between the shape parameters of their size distributions is equal to that corresponding to their productivity distributions. The paper estimates the productivity and size distributions of non-exporters and exporters and tests their differences for all the 40 manufacturing industries based on **ASIF**. The results show that: (1) their shape parameters are significantly different for most industries, and (2)the relationship between the ratio of their shape parameters is statistically equal to that corresponding to productivity distributions. These findings imply that trade significantly altered firms' size distributions by changing their productivity ones.

The rest of this paper is scheduled as follows. Section 2 reviews the related literatures on trade, productivity patterns and firm size distribution. Section 3 introduces the revised Melitz model and its different results from those obtained in the classic one. Section 4 introduces the estimation and test approaches applied to estimate the productivity and size distributions of non-exporters and exporters, and overviews the dataset used in this paper, its manipulations, and the productivity estimation methods. Section 5 and 6 demonstrate the estimation and test results of firms' size and productivity distributions. The relationship between the shape parameters of size and productivity distributions of non-exporters and exporters is analyzed in section 7. Section 8 concludes the paper.

2 Literature review

The research of firm size distribution originated from Viner (1932). It shows that the equilibrium firm size distribution in an industry is unique, at which industrial total cost is minimized, if the long-term industrial average cost curve is of "U" shape. This implies that firm size distribution reflects the efficiency of industrial resource allocations. However, the subsequent literatures deviated from this tradition and turned to investigate the shape of firm size distribution and its causation. Simon and Bonini (1958), Ijiri and Simon (1964) found that the upper tail of American firms follows some Pareto distribution. They also explained this phenomenon in the model of stochastic growth. Axtell (2001) showed that the sizes (measured by different indices, including employees and sales) of American firms follow approximately a Pareto distribution, whose concentration degree is about 1. Motivated by this research, many scholars investigated firm size distributions for various countries, such as Gaeo et al. (2003) for G7 countries, Fujiwara et al. (2004) for several European countries, Cirillo and Husler (2009) for Intaly and Zhang et al. (2009) for China. The above findings all indicate that firm sizes follow Pareto distributions. Furthermore, these literatures attempted to explain such phenomena from the angle of ecophysics. The underlying mechanism , summarizing up their explanations, is that there are interactions between their stochastic growth and cumulative revolving effects. Some other scholars investigated them from the angle of economics, such as Steindl (1965), Cabral and Mata (2003), Pagano and Schivardi (2003), Luttmer (2007), etc. For heterogeneous firms, Luttmer (2007) proved that the power distributions are the best to describe firms' size distributions among many other ones. Hence, models with heterogeneous firms usually assume that firms' productivity follows a power distribution (Pareto distribution) (Helpman et al. 2004; Chaney 2008; di Giovanni et al. 2011; Eaton et al. 2011;Ottaviano 2011). These researches help us understand why firms' sizes usually follow an ordered distribution.

If the results in Pagano and Schivardi (2003) and Luttmer (2007) hold, i.e., there is an interaction effect between firms' sizes and their productivity. Then according to Melitz (2003), firms' exporting behaviors affect their size distribution as stronger industrial competition caused by trade liberalization increases firms' productivity. However, this topic has received few attentions up till now. Recently, several researchers have noticed this issue and investigated the relationship between trade and firm size distribution, such as Nocke and Yeaple (2008), di Giovanni et al. (2011), etc. Nocke and Yeaple (2008) examined the influences of trade liberalization on the distribution of multi-product firms' domestic sales. In their points of view, trade liberalization affects firm size distributions through two channels: (1) resulting in reallocation of properties of products across firms, and (2) toughening competition among firms, which magnifies the cost-difference effect so that the losses of sales of high-cost firms are larger than those of low-cost ones. di Giovanni et al. (2011) investigated the impacts of openness to trade on firm size distributions and estimated the parameters of the Pareto distributions of non-exporters and exporters, respectively. It found that concentration degrees of the Pareto distributions of these two kinds of firms are different, which thus verified that openness to trade has impacts on firms' size distributions, by implicitly assuming these two kinds of firms are *ex ante* equal before openness to trade. The drawback of this literature is twofold. First, it did not test the significant differences between the concentration degrees of non-exporters and exporters' size distributions. Second, it did not state the mechanism that trade affects firm size distributions. It's finding is explained in term of the heterogeneity of exporting fixed costs of exporters, which is difficult to reflect the influences of trade on firm size distributions as firms' exporting fixed costs are unable to measure, though we can say that they are endogenously affected by exports. Moreover, this setting leads to the result that concentration degrees of exporters' size distributions are less than those of non-exporters in all the industries, which is not true for Chinese firms as to be shown in our empirical results. This implies that there shall be other sources by which trade affects firm size distributions.

In our point of view, the mechanism that trade affects firm size distribution is mainly that it affects firm productivity distributions, which further affects firm size distributions. First, the openness to trade allocates resources (such as labors, capitals and other resources) to more productive firms, so that the efficiencies of resource using are improved. Furthermore, exporters, because of exporting learning effects, improve their productivity much more than non-exporters by engaging into exporting. This leads to the change of firm size distributions. Second, by engaging into trade, firms' fixed trade costs relevant with searching, matching and communication with trade partners and fixed shipping costs are changed (Koenig 2009), which creates the heterogeneity of firms' exporting costs and makes firm size distributions changed (di Giovanni et al. 2011). Third, trade leads to stronger competition and forces low-productivity firms exit the market. Stronger competition forces firms to improve their productivity. As different firms have different reactions to this, their productivity improvements are different, which may change firm productivity distributions, which further change firm size distributions. Fourth, trade leads to agglomeration through urban economies and specialization effects, which improves their productivity as a whole. However, different firms have different productivity improvements, which further change firm productivity distributions and thus firm size distributions.

This paper derives size distributions of non-exporters and exporters in the Melitz (2003) model by assuming that their productivity distributions are different but both are of Pareto form and their exporting fixed costs are homogeneous. The theoretical results shows that the concentration degrees of the size distributions of the two types of firms shall be the same if their productivity distribution are the same. This paper then estimates size distributions of non-exporters and exporters using firm-level dataset of Chinese industrial enterprises and tests their difference. The result shows that size distributions of these two types of firms are different, which implies that their productivity distributions shall not be the same. We thus test the difference of size distributions of the two types of firms to that of their productivity distributions. The estimation results of their productivity distributions verify this conjecture. We also show that the difference in their productivity distributions can explain 89% of that in their size distributions.

3 The model

3.1 The Melitz model

In the standard Melitz (2003) model , there are two countries (the home and the foreign countries), L monopolistic competitive industries and two production factors (capital and labor). In each industry l, there is endogenously determined N_l firms, each of which produces only one differentiated variety. Consumers in both countries are homogeneous in preferences, which can be represented by the following utility function:

$$U = \prod_{l=1}^{L} \left(\int_0^{N_l} x_{li}^{\rho_l} di \right)^{\frac{\beta_l}{\rho_l}}, \tag{1}$$

where x_{li} is the consumption of variety i in industry l, $\rho_l = \frac{\sigma_l - 1}{\sigma_l}$, σ_l is the substitution elasticity between varieties in industry l and β_l is the share of expenditure on varieties in industry l, where $\sum_{l=1}^{L} \beta_l = 1$. Suppose the total expenditure in the home country is Y. Then the demand for variety i in industry l is

$$x_{li} = \frac{p_{li}^{-\sigma_l}}{P_l^{\sigma_l - 1}} \beta_l Y, \tag{2}$$

where $P_l = \left(\int_0^{N_l} p_{li}^{\sigma_l - 1} di \right)^{\frac{1}{\sigma_l - 1}}$ is the price index in industry l.

In each industry l, a firm must pay a fixed entry cost F_l to enter the market, and then it observes its productivity θ, which is *ex ante* (before the firm pays F_l) random with the cumulative distribution function $G_l(\theta)$. After knowing its productivity θ, the firm decides whether or not to produce its variety in each period. In the former case is incurred another fixed production cost f_l. If the firm decides to produce its variety, its production technology is $x = \theta K^{\alpha_l} L^{1-\alpha_l}$, where K and L are, respectively, the capital and the labor inputs and α_l is the capital-output elasticity of capital in industry l, which is assumed to be constant across all firms in the same industry. Substituting (2) into the firm's profit function and solving the firm's profit maximization problem, we can write the firm's maximized profit as follows:

$$\pi_l(\theta) \quad = \quad (1-\rho_l)D_l(\theta) - f_l, \tag{3}$$

where $D_l(\theta) = M_l\Theta$ is the firm's domestic sale, $M_l = \rho_l^{\sigma_l-1} A_l^{-\sigma_l} \omega_l^{1-\sigma_l}$ measures the market capacity of the home country, $\Theta = \theta^{\sigma_l-1}$ measures the firm's productivity level, $A_l = \frac{\beta_l Y}{P_l^{\sigma_l-1}}$ and $\omega_l = \left(\frac{r}{\alpha_l}\right)^{\alpha_l}\left(\frac{w}{1-\alpha_l}\right)^{1-\alpha_l}$ is the unit production cost in industry l, where r and w are the prices of capital and labor in the home country, respectively. The firm is indifferent from entering into or exit the industry if its profit $\pi_l(\theta) = 0$, from which we can get the domestic sale cut-off $\underline{D}_l = \sigma_l f_l$ and the productivity cut-off $\underline{\theta}_l = \left(\frac{\sigma_l f_l}{M_l}\right)^{\frac{1}{\sigma_l-1}}$ in industry l. If a firm's productivity is below $\underline{\theta}_l$, then it will exit the market. Otherwise it will stays in the market.

The firm with productivity θ in industry l may or may not export to the market. It must pay a fixed exporting cost $\kappa_l(\theta)$ if it wants to enter into the foreign market, where $\kappa_l(\theta)$ may be homogeneous or heterogeneous. Suppose the iceberg transportation cost exporting to the foreign country is $\tau_l > 1$ while that selling in the home country is 1. Then the firm's foreign sale is $X_l(\theta) = M_l^*\Theta$, where $M_l^* = \rho_l^{\sigma_l-1}(A_l^*)^{-\sigma_l}(\omega_l^*)^{1-\sigma_l}\tau_l^{\sigma_l-1}$, $A_l^* = \frac{\beta_l Y^*}{(P_l^*)^{\sigma_l-1}}$ and $\omega_l = \left(\frac{r^*}{\alpha_l}\right)^{\alpha_l}\left(\frac{w^*}{1-\alpha_l}\right)^{1-\alpha_l}$, where the variables with "*" are those in the foreign country. Moreover, the firm's profit by exporting is

$$\pi_{Xl}(\theta) \quad = \quad (1-\rho_l)X_l(\theta) - \kappa_l(\theta). \tag{4}$$

The firm is indifferent from exporting or not if $\pi_{Xl} = 0$, from which we can get the exporting sale cut-off $\underline{X}_l = \sigma_l\kappa_l(\theta)$ and the exporting productivity cut-off $\underline{\theta}_{Xl} = \left(\frac{\sigma_l\kappa_l(\theta)}{M_l^*}\right)^{\frac{1}{\sigma_l-1}}$.

3.2 Firm size distributions in the closed economy and in the open economy

Following Helpman et al. (2004), Antras and Helpman (2004), Antras and Helpman (2006), di Giovanni et al. (2011), Ottaviano (2011) and many other literatures, we assume that industrial productivity distribution function $G_l(\theta)$ is of the following form:

$$G_l(\theta) = \begin{cases} 1-\left(\frac{b_l}{\theta}\right)^{k_l} & \theta \geq b_l, \\ 0 & \theta < b_l, \end{cases} \tag{5}$$

where $k_l, b_l > 0$ are industry-specific parameters and k_l is called the concentration degree of $G_l(\theta)$, which measures the concentration degree of firms' productivity in industry l. Then in the closed economy, we have

$$\Pr(D_l(\theta) \geq s) = \begin{cases} C_l s^{-\zeta_l} & s \geq \underline{D}_l, \\ 0 & s \leq \underline{D}_l, \end{cases} \tag{6}$$

where $C_l = \left(M_l^{\frac{1}{\sigma_l - 1}} b_l\right)^{k_l}$ and $\zeta_l = \frac{k_l}{\sigma_l - 1}$. (6) implies that the firm's domestic sale follows a power law with concentration degree ζ_l, where ζ_l may change with industries. If we use a firm's sale to represent its size, then (6) implies that the size of a firm selling only domestically (domestic firm) follows a power distribution.

The situation is different in the open economy. Under the assumption of homogeneous exporting cost (i.e., $\kappa_l(\theta) = \kappa_l$) in the same industry, it's easy to prove that each firm's exporting sale also follows a power distribution. Specifically, we have

$$\Pr(X_l(\theta) \geq s) = \begin{cases} C_l^* s^{-\zeta_l} & s \geq \underline{X}_l, \\ 0 & s \leq \underline{X}_l, \end{cases} \tag{7}$$

where $C_l^* = \left((M_l^*)^{\frac{1}{\sigma_l - 1}} b_l\right)^{k_l}$ and $\zeta_l = \frac{k_l}{\sigma_l - 1}$. This implies that the concentration degrees of distributions of each firm's domestic and exporting sale are equal under the assumption of homogeneous exporting cost within the same industry. As the firm's total sale is

$$S_l(\theta) = \begin{cases} 0 & \theta < \underline{\theta}_l, \\ D_l(\theta) & \underline{\theta}_l \leq \theta < \underline{\theta}_{Xl}, \\ D_l(\theta) + X_l(\theta) & \theta \geq \underline{\theta}_{Xl}, \end{cases} \tag{8}$$

we conclude the following result.

Proposition 1 *Suppose firms' exporting costs and their productivity distributions in an industry are homogeneous. Then the sizes of both non-exporters and exporters (measured by total sale) in the industry follow power distributions with the same concentration degree.*

However, as to be shown in the sequel, our empirical results show that the concentration degrees of size distribution of non-exporters and exporters for most industries are not the same, which implies that the results given in Proposition 1 does not hold. The possible rationales are as follows. First, firms' exporting fixed costs are heterogeneous in the same industry (di Giovanni et al. 2011). In this sense, di Giovanni et al. (2011) proved that the concentration degree of the size distribution of exporters is less than that of non-exporters. However, this explanation owns the following drawbacks: (1) Its result does not hold robustly with data. In Chinese firms, the concentration degree of the size distribution of exporters may be larger or less than that of non-exporters. (2) It's impossible (at least very difficult) to observe and measure each firm's exporting fixed cost and thus it's impossible to verify *ex ante* whether or not its heterogeneity. In di Giovanni et al. (2011), the heterogeneity of firms' exporting fixed costs is measured by the difference between the size distributions of non-exporters and exporters. This methodology falls into the following circular causation – the difference between the size distributions of the two types of firms is due to heterogeneity exporting fixed costs, which is in turn measured by the former. Therefore, a better scheme is still called to explain the difference between the size distributions of the two types of firms. Second, firms of different status quo are faced with different exogenous shocks. Few empirical results and theoretical models have been done in this explanation. Third, productivity distributions of the two types of firms are different. Though there are few literatures having been developed in this explanation, it has its explanative conveniences and methodological reasonableness. On the one hand, firms' engaging into exporting may change their productivity distribution in the following ways: (1) As shown in many literatures (Kox and Rojas-Romagosa 2010; Eaton et al. 2010; Leocker 2010; etc.), a firm can improve its productivity through learning by exporting. (2) Exporters are more active in improving their productivity facing with stronger competition (Wang and Zhu 2010; etc.). (3) Exporting spillovers and other externalities improve exporters' productivity (Koenig 2009; Lovely et al. 2005; Van Biesebroeck 2005; etc.). On the other hand, firms' productivity is observable and can be measured *ex ante* in many ways and thus we can test whether or not the productivity distributions of the two types of firms are different, which overcomes the circular causation of the method assuming heterogeneous exporting fixed costs among firms. Under the assumption that the productivity distributions of the two types of firms are different, we can derive their different size distributions accordingly. Combining both perspectives and analyzing their relationship help us reviewing whether or not and how much the difference between their productivity distributions can explain that between their size distributions.

Suppose the productivity distribution of exporters is as follow:

$$G'_l(\theta) = \begin{cases} 1 - \left(\frac{b'_l}{\theta}\right)^{k'_l} & \theta \geq b'_l, \\ 0 & \theta < b'_l, \end{cases} \tag{9}$$

where $k'_l, b'_l > 0$ are industry-specific parameters and k'_l is called the concentration degree of $G'_l(\theta)$, which measures the concentration degree of the exporters' productivity in industry l. Then the size distribution of the exporters in industry l is of following:

$$\mathsf{Pr}(S_{Xl}(\theta) \geq s) = \begin{cases} C'_l s^{-\zeta'_l} & s \geq \underline{X}_l, \\ 0 & s \leq \underline{X}_l, \end{cases} \tag{10}$$

where $C'_l = \left(M_l^{\frac{1}{\sigma_l - 1}} b'_l\right)^{k'_l}$ and $\zeta'_l = \frac{k'_l}{\sigma_l - 1}$. If $b_l < b'_l$, $k'_l < k_l$, i.e., the exporters' size distribution has a higher productivity bound and a lower concentration degree, then $\zeta'_l < \zeta_l$. That is, the concentration degree of the exporters is less than that of the non-exporters. [4] Vice versa. Therefore, we have the following intuition:

Proposition 2 *Suppose firms' exporting fixed costs are equal and the productiv-*

[4] This relationship does not hold between C_l and C'_l.

ity distributions of non-exporters and exporters are different, whose distribution functions are given by (5) and (9), respectively. Then their size distributions are both power distributions. The concentration degree of exporters' size distribution is less than that of non-exporters if $k_l' < k_l$ *and vice versa.*

As the *ex ante* productivity distribution of firms in the same industry when there's no trade, trade does not influence the shape of industrial firm size distribution if it does not affect productivity distribution according to Proposition 2. This implies that trade must affect the shape of firm size distribution if it literally influenced that of firm productivity distribution. In this sense, Proposition 2 implies that trade alters the shape of firm size distribution through influencing firm productivity distribution. As there are other factors affecting firm size distribution, such as differences of income distributions (Alfaro et al. 2008), heterogeneity in exporting fixed costs (di Giovanni et al. 2011), etc., Proposition 2 does not sufficiently hold in practice. However, if firm productivity distribution is the unique factor determining the shape of firm size distribution, then we can conclude the following result according to the relationship among ζ_l', k_l', ζ_l and k_l.

Proposition 3 *Under the assumptions given in Proposition 2, there holds*

$$\frac{\zeta_l'}{\zeta_l} = \frac{k_l'}{k_l}, \forall l. \tag{11}$$

Suppose we can test that the shapes of productivity and size distributions of non-exporters and exporters are different, respectively, and their shape parameters (concentration degrees) satisfy the relationship given in (11), then we can conclude that trade also alters the shape of firm size distribution (concentration degree) through affecting that of firm productivity distribution. If there are other factors deterministically affecting the shape of firm size distribution, then this proposition shall not hold.

We will verify Proposition 1 and Proposition 2 in the next sections. To do this, we first estimate firm productivity and size distributions of non-exporters and exporters, and then test the differences in their shape parameters. Based on the validity test of 2, we will test Proposition 3 accordingly. Our econometric results verify our predictions that trade does alter the shape of firm size distribution through influencing that of firm productivity distribution.

4 Empirical analysis

4.1 Estimation of the size distributions of non-exporters and exporters

We first illustrate the estimation approach for the size distribution of non-exporters in industry l, where a firm's size is measured by its sale. Let $D_l = (D_{l1}, \cdots, D_{lM_l})^T$ be the vector of domestic sales of the M_l firms in industry l. Note that the distribution of D_{li} without international trade is Pareto with cumulative distribution function $\Phi(D) = 1 - C_l D^{-\zeta_l}$ according to (6), where $\zeta_l = \frac{(1-\rho_l)k_l}{\rho_l}$. Then we can estimate ζ_l as follows. First we sort the vector $D_l^t = (D_{l1}^t, \cdots, D_{lM_l^t}^t)$ in year t in descending order to yield the new vector $\tilde{D}_l^t = (\tilde{D}_{l1}^t, \cdots, \tilde{D}_{lM_l^t}^t)^T$, where D_{lk}^t is the domestic sale of firm k in industry l. Denote the number of firms whose sales are larger than D_{lk}^t by N_{lk}^t. Then we can apply $\frac{N_{lk}^t}{M_l^t}$ to approximate $1 - \Phi(\tilde{D}_{lk}^t)$. We thus have

$$\ln \frac{N_{lk}^t}{M_l^t} = \chi_l - \zeta_l \ln \tilde{D}_{lk}^t, \tag{12}$$

where $\chi_l = \ln C_l$, i.e, $C_l = e^{\chi_l}$.

For estimation of the distribution of foreign sales of exporting firms, we let the vector of their foreign sales in year t in industry l be $X_l^{Xt} = (X_{l1}^{Xt}, \cdots, X_{lK_l^t}^{Xt})^T$, where K_l^t is the number of incumbent exporters in year t in industry l and X_{lk}^{Xt} is the sale of exporter k. Note that X_{lk}^{Xt} follows the Pareto distribution with cumulative distribution function $\Psi(X) = 1 - C_l^* X^{-\zeta_l}$ from (7), where $C_l^* = ((M_l^*)^{\frac{1-\rho_l}{\rho_l}} b_l)^{k_l}$. Let the vector sorted in decending order from X_l^{Xt} be $\tilde{X}_l^{Xt} = (\tilde{X}_{l1}^{Xt}, \cdots, \tilde{X}_{lK_l}^{Xt})^T$. Then, in a similar way, we know that we can estimate C_l^* and ζ_l by regressing the following equation:

$$\ln \frac{N_{lk}^t}{K_l^t} = \psi_l - \zeta_l \ln \tilde{X}_{lk}^{Xt}, \tag{13}$$

where N_{lk}^t is the number of firms whose sales are larger than $\tilde{X}_{lk}^{Xt}$ and $\psi_l = \ln C_l^*$ or $C_l^* = e^{\psi_l}$.

Note that (12) and (13) are different only in the intercepts. Therefore, we can regress them simultaneously for each industry, controlling the time fixed effects.

4.2 Testing that trade affects firm productivity and size distributions

After we get the concentration degrees $\hat{k}_l$ and $\hat{k}'_l$ of firm productivity distributions of non-exporters and exporters and those ζ_l and ζ'_l related to firm size distributions, we shall test whether there holds $\hat{k}_l > \hat{k}'_l$.

To illustrate the principle, let's consider the following two regression equations:

$$Y_1 = \alpha_1 + \beta_1 X_1 + \varepsilon_1, Y_2 = \alpha_2 + \beta_2 X + \varepsilon_2, \tag{14}$$

where $\varepsilon_1 \sim N(0, \Sigma_1), \varepsilon_2 \sim N(0, \Sigma_2)$, $\varepsilon_1 \sim N(0, \Sigma_1), \varepsilon_2 \sim N(0, \Sigma_2)$. To test the null hypothesis $H_0 : \beta_1 > \beta_2$. We can first estimate the following equation:

$$\begin{pmatrix} Y_1 \\ Y_2 \end{pmatrix} = \begin{bmatrix} I_1 & 0 & X_1 & 0 \\ 0 & I_2 & 0 & X_2 \end{bmatrix} \gamma + \varepsilon,$$

where $\gamma = (\alpha_1, \alpha_2, \beta_1, \beta_2)^T$. Let the estimation value be $\hat{\gamma} = (\hat{\alpha}_1, \hat{\alpha}_2, \hat{\beta}_1, \hat{\beta}_2)^T$. Then we can test H_0 by the t-statistics $t = \frac{\hat{\beta}}{s_{\hat{\beta}}}$, where

$$\hat{\beta} = \hat{\beta}_1 - \hat{\beta}_2, s_{\hat{\beta}} = \sqrt{e^T (X^T X)^{-1} X^T \hat{\Sigma} X (X^T X)^{-1} e}, \hat{\Sigma} = \begin{pmatrix} \hat{\Sigma}_1 & 0 \\ 0 & \hat{\Sigma}_2 \end{pmatrix},$$

where $e = (0, 0, 1, -1)^T$, $\hat{\Sigma}_1, \hat{\Sigma}_2$ are the estimation values of Σ_1, Σ, respectively, t follows a t-distribution with freedom $n_1 + n_2 - 2$, where n_1 and n_2 are observations of the above two regression equations. Let the quantile of this t-distribution given the significance level τ be t_τ. Then we accept H_0 if $t > t_\tau$. Otherwise H_0 is rejected.

4.3 Dataset and Coverage

This paper employs plant-level data from the *Annual Survey of Industrial Firms* (**ASIF**) cross-sectional data collected by China National Bureau of Statistics between 1998 and 2007. The dataset contains all detailed information for all state-owned and non-state firms above designated scale (5 million Yuan) in (1) mining, (2) manufacturing and (3) production and distribution of electricity, gas and water sector with all 40 industries (see the appendix of industrial categories). The number of firms covered by this dataset is 161,000 in 1998 and 336,768 in 2007, respectively. The industry section of *China Statistic Yearbook* and reports in *China Markets Yearbook* are complied based on this dataset (Lin et. al., 2009; Lu and Tao, 2009; Brandt et. al., 2011). The stretch of this dataset includes the WTO entry year 2001, and new industrial information calculation in year 2004, which is sensitive to the impact and fluctuations of structural change.

The **ASIF** dataset provide us a unique opportunity to observe Chinese enterprises performance with large and comprehensive sample and the time span also enables us to avoid some radical economic policy changes in the early and middle 1990s (structural change, SOE reform, etc.). China undertook a series of economic policy reform since 1978, and such structural adjustments stabilized in the later years. Especially in the late 1990s, more and more domestic firms and plants are emerging and competing with their foreign rivals for the unconditional governmental fiscal loans, abolishing industrial licensing, equal foreign direct investment opportunities, cutting import duties, deregulating capital markets and reducing tax rates. Therefore, the time period of this dataset with relatively stable price indices and deflators for all variables is suitable to explore the firm performance with specific effects.

4.4 Data Treatment

Some noteworthy drawbacks in the **ASIF** dataset need further discussions. We believe these characteristics are partial reasons causing the estimates' standard errors relatively large and less convergent in our later empirical tests. The first is that the number of manufacturing firms covered in the sample period increased dramatically since 2004, an industry census year, in which was a comprehensive survey coverage, which may explain the jump in the number of firms from 2003 to 2004 (Lu and Tao, 2009). The second is that the **ASIF** does not cover small non-state-owned firms with annual sales less than five million Yuan, which could cause the sample estimation upward biased. The third and most challenging problem is that ASIF does not provide organization relation information among multi-plant firms. We could only recognize each sample as individual plant and ignore the situation that firms having more than one plants in different regions. The disaggregate composition of plant TFP could not reflect some multi-plant firms real performance.

Like most large survey datasets, the **ASIF** dataset contains some statistically conflicting or extreme data. Considering the research needs, we implement some necessary treatments. (1) according to Jefferson et al. (2008), we delete those observations with missing value in major financial items (gross assets, net sum of fixed capital value, sales, gross output) and employment less of 10 persons; (2) according to Cai and Liu(2009) and general accounting principles of industrial establishment, we delete firms with less gross assets than gross current assets, less gross asset than net fixed capital, missing or wrong firm id (which is uniquely designed for each individual firm), inappropriate establishment year (establishment year earlier than 1840 or later than 2007); (3) Apart from above treatment, we are faced with the critical problem of endogeneity issue of firm behavior. Previous studies using **ASIF** dataset all include observations with negative or zero investment and middle input values. We are arguing that if researchers need to explore firms' endogenous behavior by estimating their self-adjustments in capital and labor investment and yearly middle inputs from year to year, zero investment or middle inputs is intolerable. Since we assume that firms are aware of their productivity changes as well as the profitability, there is less solid ground to assume that their decisions are static upon each year's productivity shock. Though Levinsohn-Petrin (2003) proposed method on firm-level productivity estimation requiring only the middle input information, we still need to observe firm dynamics of market entry-exit in each year. We use Olley-Pakes (1996) method to tackle this problem. Such trade-off leads large quantity of data loss in our actual empirical test (OLS, Fixed Effect, Olley-Pakes(1996) and Levinsohn-Petrin(2003) methods accordingly), while on the other hand, it enables us to compare different methods within the same sample coverage. The purpose of applying these estimation methods is to obtain consistent and robust results for accounting firm level capital stock and productivity estimation. Hence, we dropped firms with negative and zero investment and middle input. Finally, we have 407,919 observations in 10 years.

One other problem to use this dataset is to identify and match firms in different years. Some firms may experience restructuring, merging or reallocation in different locations, instead of using the official firm ID given by the survey, here we assigned a unique numerical ID to each firm and matched those IDs using the combination of official firm ID, firm names, founding year, geographic code and address, respectively. In addition, to avoid some extreme sample variations, we trim firms in the categories of top 1 % and bottom 1 % gross output.

For the computation of total factor productivity, gross production value, net sales of the plants, investment, middle inputs and all other monetary variables were deflated using price deflators (1978 as the benchmark year).

5 Estimations of productivity distributions of non-exporters and exporters and their tests

According to the theoretical prediction given in section 2.2, if non-exporting and exporting firms have the same productivity distribution, the shape parameters of their size distributions shall be identical. While taking above discussion into account, we also know that the productivity distributions of both types of firms could be different since changes of market environment and size changes directly lead to the changes of productivity distributions of exporting firms and the non-exporting ones upon trade liberalization. In this section, we estimate all firms' productivity, and test both types of firms' productivity distributions respectively.

5.1 Firm-level productivity estimation

The firm-level productivity estimation has different theoretical foundations in terms of aggregation and disaggregation. Since firms simultaneously self-adjust their production input portfolios, operation state (entry-exit market) according to in-time performance (Marschak and Andrews, 1994), there is endogeneity issue to tackle with: simultaneity and selection bias. For robust concern, the firm-level estimates of TFP are computed using the Ordinary Least Squares (OLS), Fixed Effects (FE), Olley-Pakes(1996) (OP) and Levinsohn-Petrin (2003) (LP) methods respectively, which are applied to capture consistent and robust results for accounting firm level productivity distributions.

Primarily, we apply Cobb-Douglas production function to estimate firm production function. As the foundation of later econometric treatments, the OLS method entails estimating output as a function of the inputs and then subtracting the estimated output from actual output to capture productivity as the residual. Firms production function is:

$$y_{it} = \beta_{il} l_{it} + \beta_{ik} k_{it} + \beta_{im} m_{im} + \theta_{it} + u_{it}$$

where y_{it} is the logarithm of firm value-added output, i is the index of the firm, l_{it}, k_{it} and m_{it} are logarithm of firm employment, fixed capital and middle inputs in year t. θ_{it} is the productivity known to the firm, but unobserved by the econometrician. u_{it} refers to all other disturbances such as measurement error, omitted variables, functional form discrepancies and any other shocks affecting output that are unknown to the firm when making input decisions. The basic computation methodology used for measuring firm TFP is as follows:

$$\ln TFP_{it} = y_{it} - \hat{\beta}_{il} l_{il} - \hat{\beta}_{ik} k_{ik} - \hat{\beta}_{im} m_{im}$$

Firms' inputs are based on their optimizing behavior on the input quantity l_{it} and k_{it} that may be endogenous in the estimation equation, and the productivity could be contemporaneously and serially correlated with inputs, which would cause the OLS estimates biased and inconsistent.[5] Contemporaneous correlation will occur if the firm hires more workers based on its current productivity in anticipation of future profitability. Serial correlation between productivity and hiring decisions will lead to an upward bias in the coefficient, in the case of a single-input production process, but the direction of bias is less obvious in a multivariate setting.

Regarding to the selection bias, it is observable that firms stay in the market in each year. A firm's decision to stay in the market is contingent upon its productivity and expected future profitability. If there is a positive correlation between greater capital stocks and future profitability, then firms with higher capital stock, at any productivity level, will have a higher survival rate in the market. The expectation of productivity, contingent upon firm's survival, would then be decreasing in capital. The OLS estimates of the production would thus lead to a negative bias in the capital coefficient.

If there is a sufficient reason to believe the production decisions of firms are observable, productivity varies across firms and is consistent in time changes, under the panel data model setting, the fixed effect panel data model can partially resolve the endogeneity bias of individual firms .[6] The FE model can be specified

[5]In this case, contemporaneous correlation will occur if the firm hires more workers based on its current productivity in anticipation of future profitability. Serial correlation between productivity and hiring decisions will lead the OLS estimation of a production function to estimates of the coefficients of exogenous inputs that are biased upwards.

[6]According to the theoretical model introduced in section 2.2, it is implied that firms size and productivity distribution have the property of consistent cross time among heterogeneous firms.

as following:

$$y_{it} = \beta_{il} l_{it} + \beta_{ik} k_{it} + \beta_{im} m_{im} + \varpi_{it} + \theta_{it} + u_{it}$$

where ϖ_{it} is the set of individual dummy variables of firms, which is supposed to condition the existence of endogeneity of firms individual effect with consistent estimation results.

Since the firm's asymmetry knowledge of their productivity is unavailable to the econometrician, individual fixed effect model only considers the cross-time individual changes with strict assumptions on constant ϖ_{it} , Olley and Pakes (1996) (O-P for short) developed a consistent semi-parameter approach to deal with this problem. In dealing with the simultaneous issue, they assumed that firms make their investment decisions and realize conditional profits on the current productivity, in which current anticipating level of investment is taken as the proxy variable to unobservable productivity shock: incumbent firms decide at the beginning of each year whether to continue participating in the market or not. If a firm survives, it receives a liquidation value of Φ dollars; otherwise, it chooses variable inputs with anticipating level of investment I_{it}. The O-P approach consists of two steps: estimating firm's anticipation of future production by current investment, and estimating the polynomial correlation between investments and capital inputs. The O-P production function is:

$$y_{it} = \beta_{it} l_{it} + \gamma k_{it} + h_{it} \left(i_{it}, k_{it} \right) + e_{it}$$

where $\beta_{it} l_{it}$ is the labor contribution in output, and the capital contribution is defined as:

$$\phi_{it} = \gamma k_{it} + h_{it} \left(i_{it}, k_{it} \right)$$

where ϕ_{it} is the polynomial of logarithm of investment and capital stock, whose estimated form is $\tilde{\phi}_{it}$. Therefore, the production function can be rewritten as:

$$y_{it} = \beta_{it} l_{it} + \phi_{it} + e_{it}$$

From the above equation, we can obtain the consistent parameter estimation of labor l_{it}. Taken the estimated labor estimation, the estimation function of the fitted polynomial of investment and capital stock $\tilde{\phi}_{it}$, $V_{it} = y_{it} - \hat{\beta}_{it} l_{it}$, is:

$$V_{it} = \gamma k_{it} + g \left(\phi_{it-1} - \gamma k_{it-1} \right) + \mu_{it} + e_{it}$$

where $g(\cdot)$ is the function consisting of ϕ_{it-1} and k_{it-1}. To ensure that the estimated parameter of capital stock is consistent, the nonlinear OLS is applied to the above equation. Hence, we have the logarithm productivityfrom the residual of the above equation .[7]

Instead of using investment value as the proxy to proximate the unobserved productivity shock in Olley and Pakes(1996) approach, Levinsohn and Petrin(2003) (L-P for short) developed an alternative proxy choice in dealing with firm-level productivity estimation .[8] The L-P approach argued that the investment indicator varied dramatically in firms' decisions to maximize the expected value of net future profits (there are substantial adjustment costs), in which such proxy could not smoothly demonstrate the productivity shock, and thus jeopardize the consistent estimation condition. Especially for developing countries, most firms report their middle inputs value as necessary means of representing their production input expectation. Levinsohn and Petrin (2003) applies middle inputs as the proxy variable to deal with the simultaneous issue. It is notable that Olley-Pakes(1996) and Levinsohn-Petrin(2003) approach has different treatments in capital stock estimation. The former regards the current fixed capital plus previous year's investment as the proxy of current year's capital stock, the latter replaces it by the current investment (middle input) plus current fixed capital.

5.2 Industrial productivity description

Applying above mentioned estimation approaches, we estimate firms' productivity in 37 industries productivity, which is consistent with our theoretical prediction. Though the four estimation approaches yield different results, the general patterns and trends among them are quite similar and robust. In this paper, our focus is not comparing the merit of each estimation approach but whether the productivity among exporting and non-exporting firms are significantly different or not (**proposition 1**). We also compute the coefficients of variation of both types of firms by industry. There are apparent average productivity disparities among them as well as their distribution patterns. Similar to some Chinese empirical findings (Li, 2010), we find that some exporting firms' average productivity is less than that of domestic ones, and all exporting firms variation coefficients are less

[7] To save the discussion, the selection bias adjustment measures of O-P approach (firms entry-exit market survivor probability model) was listed with detail in appendix.

[8] The L-P approach is comparatively similar with O-P approach. Please refer the detailed description of L-P model in Levinsohn and Petrin (2003).

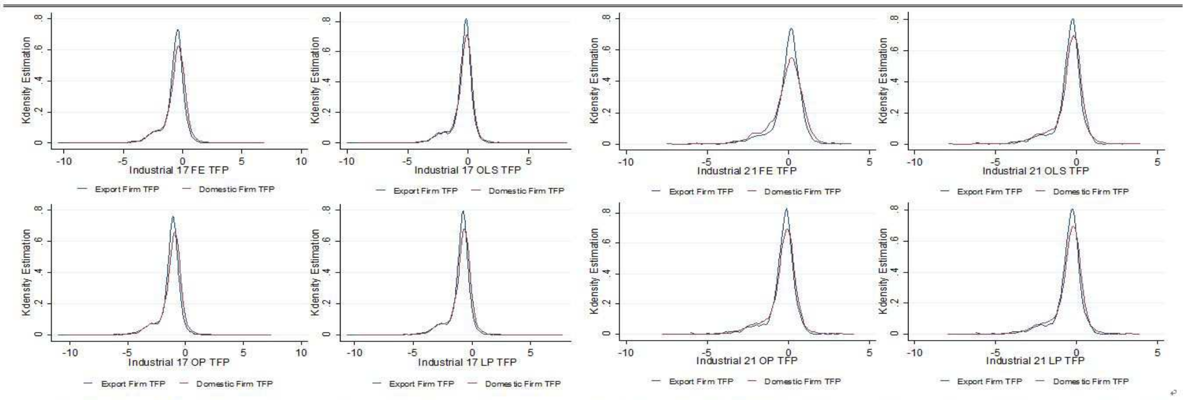
than that of non-exporting firms in all industries. Here we choose two representative industries as the demonstrative examples which are regarded as one of the most labor intensive and export-oriented industries in China (industry 17, textile industry is extensive distributed all over China; industry 21, furniture industry has the most productivity disparities among all industries; both industries are not the largest or the most dominant industries in various senses, nevertheless, they have different characteristics in terms of home-market effects and export-oriented market demands) . The labor intensive textile industry consists mostly of state-owned or collective enterprises, which are large in employment and taxation proportion. While on the contrary, the furniture industry has a large number of out-souring and original equipment manufacturer (OEM) firms. Caused by existing regional protectionism (taxation and subsidy preferential policies), the market segmentation itself significantly distorted local factor endowments, resource allocation efficiency as well as firm input-output decision making. Comparing with large firms, small firms are more sensitive to market segmentation and entry barriers. Such status quo faced by incumbents and emerging firms are deterministic for intra-regional competition in China: large and government-led firms are more keen on domestic market competition while the middle and small firms who are naked of preferential policy protections are more keen on only exporting so as to avoid high domestic market entry costs.

Table 1 Mean productivity and coefficients of variation of non-exporters and exporters in industry 17 and 21 under different productivity estimation approaches

	OLS		Fixed-effect		Olley-Pakes		LP	
Ind	Exporter	Non-exporter	Exporter	Non-exporter	Exporter	Non-exporter	Exporter	Non-exporter
17	-0.49	-0.44	-0.73	-0.63	-1.35	-1.22	1.04	-0.93
	-1.94	-2.26	-1.33	-1.61	-0.72	-0.83	0.93	-1.07
21	-0.52	-0.47	-0.07	-0.09	-0.39	-0.35	0.55	-0.50
	-1.81	-2.09	-14.12	-12.03	-2.45	-2.78	1.73	-1.98

Note: In the above table, for each industry, the first and the second row represent for the mean productivity and the coefficient of variation of exporters and non-exporters, respectively, for each productivity estimation approach.

The classical Melitz model implies that the productivity distributions of non-exporters and exporters have the same shape parameter. The following figure demonstrates the kernel density estimations in the above representative industries [9] :



a Productivity distribution of non-exporters and exporters in industry17

b Productivity distribution of non-exporters and exporters in industry 21

Figure 3: Productivity distributions of non-exporters and exporters in industry 17 and 21, where the blue curve represents for the kernel density of exporters, and the red one is for that of non-exporters.

For both industry 17 and 21, we have the following estimation results. In general, the O-P and the L-P methods have lower productivity estimation results than the OLS and the FE methods, the former two have higher distributional kurtosis and skewness coefficients. Taking the OLS estimation results as the benchmark, other methods have less estimated logarithm productivity. Apparently, the OLS method overestimates the coefficients of exogenous inputs (labor input in particular). For both kinds of firms, the four estimation methods are all consistent with the following conclusion: the productivity distribution of the exporting firms are more concentrated than the non-exporting ones, and the exporting firms' productivity variation is much smaller.

5.3 Estimations of productivity distributions of non-exporters and exporter and their tests

We testify the influence of trade to industrial productivity distribution (table 2). Apart from industry 7, 8 and 11, table 2 shows the estimation results of shape parameters (concentration degrees) of the productivity Pareto distributions of the two types of firms among all the 37 industries. From table 2, we know that they

[9]See the appendix for the results for all industries.

are statistically different at 10 % significance (except industry 10), which indicates that trade has significantly influenced industrial productivity distribution.

Table 2 Concentration degrees of productivity distributions of non-exporters and exporters and their differences between 1998 and 2007

Ind	k_l	k_l'	t	$k_l > k_l'$	**Ind**	k_l	k_l'	t	$k_l > k_l'$
6	1.219	0.855	227.41	yes	28	0.822	0.943	-74.47	no
9	0.963	0.539	122.92	yes	29	1.126	1.037	106.75	yes
10	0.002	0.001	0.15	yes	30	1.037	1.150	-337.53	no
12	0.783	0.705	8.70	yes	31	1.087	1.026	368.03	yes
13	0.780	0.865	-334.35	no	32	0.873	0.884	-14.60	no
14	0.917	0.903	28.29	yes	33	0.852	0.893	-60.92	no
15	0.974	0.949	42.78	yes	34	0.991	1.066	-367.93	no
16	0.673	0.449	45.15	yes	35	1.056	1.109	-416.71	no
17	1.064	1.139	-651.31	no	36	0.933	1.013	-431.96	no
18	0.962	1.095	-443.79	no	37	0.945	1.045	-452.80	no
19	0.947	1.042	-142.28	no	39	1.021	1.015	6.09	yes
20	1.012	1.002	9.51	yes	40	0.927	0.977	-255.37	no
21	0.941	1.113	-118.27	no	41	0.805	0.997	-535.58	no
22	0.932	0.992	-86.48	no	42	0.802	0.992	-321.22	no
23	0.974	1.106	-174.39	no	43	0.832	1.096	-293.77	no
24	1.000	1.097	-85.13	no	44	0.861	0.913	-39.38	no
25	0.962	0.778	84.64	yes	45	0.723	0.694	5.56	yes
26	0.941	0.977	-258.54	no	46	0.714	0.439	103.75	yes
27	0.943	0.917	73.71	yes					

Note: Industry 7, 8 and 11 are ignored as there are too few firms or no exporters. Ind represents for Industry, and t is the testing t-statistics.

In summary, we conclude the mechanism of trade liberalization on industrial productivity distribution as following. Firstly, selection effect. Firms are faced with severer competition upon exports. This increases exporting firms' productivity. Secondly, learning effect. No matter in terms of learning by doing or learning by exporting, exporting firms have more opportunities to interact with more rivals as well as vertical and horizontal linkages in the production process. It is beneficial for firms to learn more advanced managerial experiences, methods, and technology to increase their productivity. Thirdly, value chain specialization. According to specialization indoctrination of Adam Smith, market size determines specialization, and the latter improves production technology. Exporting behavior enables firms to face larger markets with greater demands, which improves industrial specialization level as well as intra-industrial firms' productivity. Finally, stochastic dominance incentives of individual firms. Though there are exporting fixed costs and severer competition in foreign markets, firms realize that export itself can bring technology improvement and larger market demands that can decrease the marginal production costs, not to mention the financial constraint and other barriers firms faces in domestic markets. Hence, in reality, there are two kinds of exporting firms in China: firms of high productivity participating global market competition, and firms of low productivity crowding in foreign markets and avoiding domestically institutional distortion (the latter in many cases are OEM firms in the global value chain specialization). Exporting firms' productivity changes also will lead non-exporting firms' productivity to change accordingly. Due to the information exchange, managerial methods and experience learning and knowledge spillover, domestic firms also benefit from exporting firms.Moreover, the productivity increase of exporting firms also lead to the increase of domestic market competition, which in turn increases the non-exporting firms productivity.

6 Estimations of size distributions of non-exporter and exporters and their tests

6.1 Empirical results

According to section 3.2 and 3.3, we estimate the size distributions of non-exporters and exporters for each industry and test their differences accordingly.

Table 3 demonstrates the estimation results of the shape parameters of the Pareto size distributions of non-exporting and exporting firms' gross sales for 37 industries. It can be seen that they are significantly different for most industries at the 5 % t test significance rate. As predicted, there are 26 industries in which the concentration degrees of exporters are smaller than those of non-exporting firms. Such findings can be justified in the Melitz model: exporting firms in the same industry are highly homogenous than non-exporters because of engaging in global market competition. Notably, there are 11 industries whose concentration degrees of exporters are larger than those of non-exporters, which requires further explanations.

We believe that Chinese manufacturing firms have some special characters in the global market participation and competition, which are important issues in analyzing the influence of trade liberalization on firms' productivity and size distributions. First of all, value chain specialization. Extensive numbers of Chinese manufacturing firms participate in the global value chain specialization by outsouring and OEM. Literally, these firms are mostly labor intensive firms who are relatively low in productivity and R &D investment. Hence, they are at the low end of production and assembly chain of trading activities, which are dramatically different with other Chinese manufacturing firms who are directly participating global market competition, in which the latter kind enjoying more stronger selection effect. Secondly, factor endowment advantage. Consistent with development theories and empirical findings, Chinese export firms have cost advantages in labor and nature resources. Such comparative and absolute advantages enable local firms export certain products for a long period of time resisting outside technological shock. Thus, some exporting firms have lower productivity than non-exporting ones. Thirdly, market segmentation. Due to the market segmentation, governmental policy distortion, regional protectionism, low production inputs (low labor wage) and a large number of firms (in 11 industries) choose export their products. The direct effect is Chinese export scale is increasing year by year while the relative total revenue is decreasing. Therefore, if we do not test the heterogeneous firm model's **primary distribution assumption**, we could not provide sufficient explanation on why some industries are not applicable in Melitz's model, which were always simply explained as *Chinese Orthodox* or *Chinese Characteristics.*

In brief, we discuss the above 11 industries accordingly. Industry 12 (Wood processing) as the industry catalogue was canceled in year 2003. Industry 13 (Food processing) and 14(Food manufacturing) have most firms locating and designing for local market. Hence, the home market effect is deterministic for their productivity and size distributions. Different with industry 17 (Textile), industry 18 (Garments and other fiber products manufacturing) and 19 (Leather furs down and related products) have less industrial standardization, not fully participating in global market competition, either largely serving local market demands or as out-sourcing companies at the low-end value chain specialization. Industry 20 (Timber processing, bamboo, cane, palm fiber and straw products), 24(Cultural educational and sports goods), 41 (electronic and telecommunication equipment manufacturing) and 42(Instrumentation and culture, office machinery manufacturing) represent industries of highly heterogeneity, which are closely related to local heterogeneous market demands. Considering the above-mentioned market distortions with localized factors, the concentration degrees of size distributions of non-exporting firms are less than those of exporting ones within these industries. Naturally, industry 43(Other manufacturing) and 44(Electricity, thermal production and supply) are different with above reasons. Actually, these two industries are highly state-owned and are dependent to local market structure. With high sunk costs and governmental protection, they are mainly local industries under monopolized institutions. Such kind of institutional distortion in market resource allocation is essentially different with the assumption made in the Melitz model.

Table 3: Concentration degrees of size distributions of non-exporters and exporters and their differences between 1998 and 2007

Ind	ζ_l	ζ_l'	t	$\zeta_l > \zeta_l'$	**Ind**	ζ_l	ζ_l'	t	$\zeta_l > \zeta_l'$
6	0.676	0.621	39.85	yes	28	0.606	0.541	28.76	yes
9	0.671	0.612	21.43	yes	29	0.790	0.719	99.03	yes
10	0.732	0.625	100.16	yes	30	0.779	0.743	132.86	yes
12	0.496	0.548	-5.04	no	31	0.747	0.679	402.91	yes
13	0.637	0.653	-69.77	no	32	0.643	0.579	78.14	yes
14	0.597	0.687	-223.46	no	33	0.635	0.631	5.07	yes
15	0.588	0.579	14.49	yes	34	0.788	0.739	307.92	yes
16	0.515	0.480	4.55	yes	35	0.797	0.723	609.90	yes
17	0.760	0.693	589.71	yes	36	0.723	0.675	276.07	yes
18	0.725	0.803	-323.61	no	37	0.657	0.649	39.10	yes

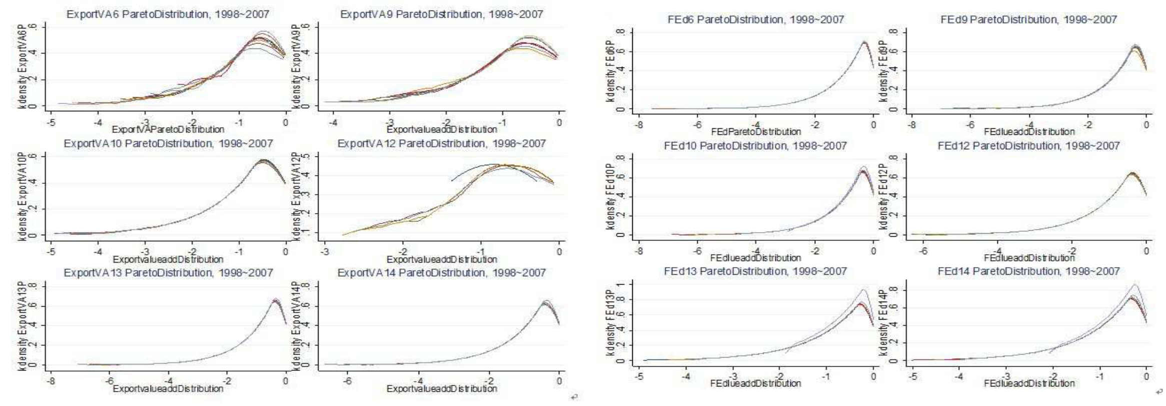
19	0.672	0.733	-111.23	no	39	0.723	0.639	99.97	yes
20	0.696	0.720	-33.80	no	40	0.714	0.675	194.06	yes
21	0.758	0.720	33.62	yes	41	0.667	0.696	-80.97	no
22	0.685	0.661	38.18	yes	42	0.676	0.724	-94.24	no
23	0.673	0.649	35.14	yes	43	0.634	0.810	-136.39	no
24	0.745	0.749	-4.08	no	44	0.608	0.611	-2.08	no
25	0.589	0.495	34.21	yes	45	0.612	0.426	21.05	yes
26	0.701	0.680	149.30	yes	46	0.676	0.411	114.86	yes
27	0.719	0.679	103.43	yes					

Note: Industry 7, 8 and 11 are ignored as there are too few firms or no exporters. Ind and t represent for Industry and t-statistics.

Table 3 demonstrates that not all industries' exporting firms have less concentration degrees in size distributions than non-export firms, especially for manufacturing firms (industry 13 to 43 in particular). To show that the concentration degrees of the two types of firms' size distributions are different, we estimated their size distribution kernel density curves (Graph 4) . From Graph 4 we can see that apart from stable power law distribution patterns among all industries, the size distributions of exporting and non-exporting firms varied dramatically over time within the same industry. Comparing with exporting firms, non-exporting firms' size distribution varied more slightly, in which some industries are nearly identical (Graph 4-b) while some exporting firms' size distributions fluctuated significantly from year 1998 to 2007 (Graph 4-a). According to the size distribution estimations of different types of firms in all industries, we can finally conclude that the size distributions of non-exporters and exporters have different concentration degrees, which is not the case in the classic Melitz model (Melitz 2003).

7 The relationship between firms' productivity distribution and their size distribution

Synthesizing the result proposed in section 6, we know that trade significantly affects firms' size distribution in Chinese manufacturing industries. This section shows that there's close relationship between firms' size distribution and their



a **Size distributions of exporters in industry 6-14** **b** **Size distribution of non-exporters in industry 6-14**

Figure 4: Size distributions of non-exporters and exporters in industry 6-14, , where the blue curve is for the kernel density of exporters, and the red one is for that of non-exporters.

productivity distribution. This explanation is much different from that proposed in di Giovanni et al. (2011), in which the difference between the size distributions of non-exporters and exporters is explained by the heterogeneity of exporting fixed costs across firms. According to their explanation, the concentration degree of size distribution of exporters must be less than that of non-exporters, which, however, is not consistent with our results shown in section 6. Furthermore, as we argued in section 2, the heterogeneity of exporting fixed costs across firms can not be tested empirically. In fact, it's measured by the difference between the concentration degrees of size distributions of non-exporters and exporters in di Giovanni et al. (2011), hence the problem of *post hoc fallacy* is induced. This section is to show that the difference between the size distributions of the two kinds of firms is correspondingly affected by their productivity distributions. Specifically, the ratio of the concentration degrees of size distributions of non-exporters and exporters is equal to that of their productivity distributions, which verifies Proposition 3 given in section 2.

Comparing Table 3 with Table 2, we can see that the sign of the difference between the concentration degrees of size distributions of non-exporters and exporters are consistent with that of their productivity distributions at a ratio 51% for all manufacturing industries. This seems that it's not sufficient to explain the difference of their size distributions by their productivity distributions. However, this simple statistical relation can not illustrate the relationship between these two kinds of distributions with stochastic disturbances in mind. Recall Proposition 3 given in section 2, we know that there holds the following expression:

$$\frac{\zeta_l'}{\zeta_l} = \varsigma \frac{\kappa_l'}{\kappa_l} + \varepsilon \tag{15}$$

where ζ_l and k_l are the concentration degrees of size and productivity distribution of non-exporters, respectively, and ζ_l' and k_l' are the corresponding parameters of exporters. Therefore, it suffices for us to test the null hypothesis $H_0 : \varsigma = 1$ and the alternative hypothesis $H_1 : \varsigma \neq 1$ for testing Proposition 2 proposed in section 2. Substituting the estimated concentration degrees of size and productivity distributions of these two kinds of firms in Table 2 and Table 3 into (15) and doing the regression, we can find the estimated parameter $\hat{\varsigma} = 1.0025$, with standard deviation being $s_{\hat{\varsigma}} = 0.08$ and goodness of fit being $R^2 = 0.99$. This result implies that we shall accept the null hypothesis H_0, i.e., there is a close relationship between firms' size and productivity distributions. Moreover, under the framework set in this paper, we can assert that trade affects firms' size distribution by influencing their productivity distribution.

The above result is easy to understand. First, given its productivity level, each firm has an optimal production scale and optimal inputs. When its productivity changes, its optimal scale shall changes. When their productivity changes, some firms own additional resources (inputs), while some are short of them. Therefore those with excrescent inputs sell their resources to those that are short of them so that each of them owns the appropriate inputs and attains its optimal production scale corresponding to its productivity. As trade has different influences on firm-s' productivity, i.e., changes their productivity distribution, their scale changes differently, which finally alters their size distribution.

8 Conclusion

The consistency between firms' size and their productivity distributions reflects whether there exists distortion in resource allocations in reality. The openness to trade helps to promote the improvement of resource allocation efficiency among firms. This further affects firms' production decisions, their market selections and market competition and finally their size distribution.

This paper shows that there are differences between size distributions of non-exporters and exporters. This result will not occur in the classic Melitz model, which assumes that the exporting fixed costs across firms are the same. The paper also suggests that the concentration degree of size distribution of exporters may be larger than, equal to, or less than that of non-exporters, which can not uniquely be explained by the heterogeneity of exporting fixed costs across exporters, as shown in di Giovanni et al. (2011). In the latter literature, the concentration degrees of size distribution of exporters are all less than those of non-exporters in all industries. We ascribe this phenomena to the differences between productivity distributions of non-exporters and exporters. Empirical analysis verifies this conjecture, which implies that trade changes firms productivity distribution. We examine the relationship between the concentration degrees of productivity and size distributions and find that they are perfectly consistence. This indirectly proves that trade changes firms' size distribution by changing their productivity distribution. This result is of sense for us to understand the effects of resource allocation and productivity improvement due to trade.

In this paper, we only show that non-exporters and exporters productivity distributions are different but do not explain why. A further problem is that how trade may change firms' productivity distribution, i.e., why non-exporters and exporters productivity distributions are different. Suppose that the productivity distributions of non-exporters and exporters are different, it's easy to imagine that there shall be productivity spillover between exporters and non-exporters. Testing this conjecture is interesting. A consequential problem is whether exporters' productivity distribution are stochastically dominant to that of non-exporters. Many literatures has investigated this problem, but testing it for Chinese firms year by year is still of sense.

References

Alfaro, Laura, Andrew Charlton, and Fabio Kanczuk, "Fir-size Distribution and Cross-country Income Differences," *NBER Working Paper No.14060*, 2008.

Antras, Pol and EIhanan Helpman, "Global Sourcing," *Journal of Political Economy*, 2004, *112* (3), 552–580.

_ and _ , "Contractual Frictions and Global Sourcing," *NBER Working Paper No.12747*, 2006.

Axtell, R. L., "Zipf distribution of U.S. firm sizes," *Science*, 2001, *293*, 1818–1820.

Biesebroeck, J. Van, "Exporting raises productivity in sub-Saharan African manufacturing firms," *Journal of International Economics*, 2005, *67(2)*, 373–391.

Cabral, L. M. B. and J. Mata, "On the Evolution of the Firm Size Distribtion: Facts and Theory," *American Economic Review*, 2003, *93* (4), 1075–1090.

Chaney, Thomas, "Distorted Gravita: The Intensive and Extensive Margins of International Trade," *American Economic Review*, 2008, *98(4)*, 1707–1721.

Cirillo, Pasquale and Jurg Husler, "On the Upper Tail of Italian Firms' Size Distribution," *Physica A*, 2009, *388*, 1546–1554.

di Giovanni, Julian, Andrei A. Levchenko, and Romain Ranciere, "Power Law in Firm Size and Openness to Trade: Measurement and Implications," *Journal of International Economics*, 2011, *forthcoming*.

Eaton, Jonathan, Marcela Eslava, C. J. Krizan, Maurice Kugler, and James Tybout, "A Search and Learning Model of Export Dynamics," *mimeo*, 2010, *98(4)*, 1707–1721.

_ , Samuel Kortum, and Sebastian Sotelo, "International Trade: Linking Micro and Macro," *mimeo*, 2011.

Fujiwara, Yoshi, Hideaki Aoyama, and Corrado Di Guilmi, "Gibrat and Pareto-Zipf Revisited with European Firms," *Physica A*, 2004, *344*, 112–116.

Gaeo, Edoardo, Mauro Gallegatib, and Antonio Palestrini, "On the size distribution of firms: additional evidence from the G7 countries," *Physica A*, 2003, *324*, 117–123.

Helpman, EIhanan, Marc J. Melitz, and Stephen R. Yeaple, "Export versus FDI with Heterogeneous Firms," *American Economic Review*, 2004, *94(1)*, 300–316.

Ijiri, Y. and H. A. Simon, "Business Firm Growth and Size," *American Economic Review*, 1964, *54* (2), 77–89.

Koenig, Pamina, "Agglomeration and the Export Decision of French Firms," *Journal of Urban Economics*, 2009, *66*, 186–195.

Kox, Henk and Hugo Rojas-Romagosa, "Exports and productivity selection effects for Dutch firms," *CPB Discussion Paper No.143*, 2010.

Leocker, Jan De., "A Note on Detecting Learning by Exporting," *mimeo*, 2010.

Lovely, M. E., S. S. Rosenthal, and S. Sharma, "Information, Agglomeration, and the Headquarters of U.S. Exporters," *Regional Science and Urban Economics*, 2005, *35(2)*, 167–191.

Luttmer, Erzog. J., "Selection, Growth, and the Size Distribution of Firms," *Quarterly Journal of Economics*, 2007, pp. 1103–1144.

Melitz, Marc J., "The Impact of Trade on Intra-industry Reallocations and Aggregate Industry Productivity," *Econometrica*, 2003, *71(6)*, 1695–1725.

Nocke, Volker and Stephen Yeaple, "Globalization and the Size Distribution of Multi- product Firms," *mimeo*, 2008.

Ottaviano, G. I. P., "Firm Heterogeneity, Endogenous Entry, and the Business Cycle," *NBER Working Paper, No. 17433*, 2011.

Pagano, Patrizio and Fabiano Schivardi, "Firm Size Distribution and Growth," *S-candish Journal of Economics*, 2003, *105(2)*, 255–274.

Simon, Herbert A. and Charles P. Bonini, "The Size Distribution of Business Firm-s," *American Economic Review*, 1958, *48* (4), 607–617.

Steindl, J., *Random Processes and the Growth of Firms*, New York: Hafner, 1965.

Viner, Jacob, "Cost Curves and Supply Curves," *Zeischrift f r Nationalok nomie*, 1932, *3*, 23–46.

Wang, Fang and Zhaoyuan Zhu, "Learning by Exporting under International Schumpeterian Competition: Evidence from Chinese Firms," *mimeo*, 2010.

Zhang, Jianhua, Qinghua Chen, and Yougui Wang, "Zipf Distribution in Top Chinese Firms and An Economic Explanation," *Physica A*, 2009, *388*, 2020–2024.

Appendix

The Olley-Pakes (1996) treatments on sample selection bias

In real survey sample estimation, it is often that some observed samples having missing values in particular years or variables. If such kind of missing value is caused by non-random factors (exit the market due to poor management or performance), the estimation of incumbent firms are upward biased. To deal with this issue, some direct treatment can be done simply by trim unbalanced panel data into balanced form which could cause some other critical issues: apart from large number of observed data was dropped for simplicity, large size firms with large capital stock are more capable in resisting crisis. They are more likely to stay in the market under the productivity shock, while firms existing market are mainly possessing less capital stock that are small in size. Such correlation between production function residuals and capital is negative, which in turn causes structural bias in empirical estimation.

Olley and Pakes (1996) proposed semi-parametric approach to solve the selection bias of firm-level survey data. They assume that incumbent firms decide at the beginning of each year whether to continue participating in the market. If the firm exits, it receives a liquidation value of $\varPhi$ dollars, if does not, it chooses variable inputs with anticipating level of investment I_{it}. Firms realize their conditional profits on the beginning years' state variables: productivity indicator or shock, ω_{it}, capital stock, K_{it} and the age of the firm, a_{it}. Therefore, the expected productivity is a function of current productivity and capital, $E\left[\omega_{i,t+1} \mid \omega_{it}, K_{it}\right]$, and the profit is a function of ω_{it} and K_{it}. By proposing the polynomial ϕ_{it} to obtain the consistent estimation of labor inputs, the survival probability can the illustrate firms' entry-exit dynamics cross time.

Firm $i's$ decision to maximize the expected discounted value of net future profits is characterized by Bellman equation:

$$
\begin{aligned}
& V_{it}(K_{it}, a_{it}, \omega_{it}) \\
& = Max\left\{\varPhi, Sup_{I_{it\geq 0}} \varPi(K_{it}, a_{it}, \omega_{it}) - C(I_{it}) + \rho E\left[V_{i,t+1}, a_{i,t+1}, \varOmega_{i,t+1} \mid J_{it}\right]\right\}
\end{aligned}
$$

where $\Pi_{it}(\cdot)$ is the profit function (current profit as a function of the state variables), $C(\cdot)$ is the cost of current investment, ρ is the discount factor, and $E[\cdot \mid J_{it}]$ is the firm's expectations operator conditional on information J_{it} at time t. The investment decision I_{it} is the function of observed production state ω_{it}, K_{it} and a_{it}, $I_{it} = I(\omega_{it}, K_{it}, a_{it})$. The state variable ω_{it} follows a first-order Markov process. The Bellman equation implies that a firm exits the market if its liquidation value, Φ exceeds its expected discounted returns. Above function depends on the defined exit and investment decision following Markov complete equilibrium strategy.

Given the survival state variable χ. Firm i decides to stay in the market $(\chi_{it} = 1)$ or exit the market $(\chi_{it} = 0)$ if its productivity is greater than or less than some threshold subject to the firm's current capital stock and age, K_{it} and a_{it}. The exit rule is:

$$\chi_{it} = \begin{cases} 1, & \text{if } \omega_{it} \geq \underline{\omega}_{it}(K_{it}, a_{it}) \\ 0, & \text{otherwise} \end{cases}$$

where firm's exit decision depends on the technology cutoff value $\underline{\omega}$. A firm will choose to stay in the market if its productivity is greater than this threshold $\underline{\omega}_{it}$ that depends on K_{it} and a_{it}. The probability of survival in period t depends on ω_{it} and $\omega_{i,t-1}$, and in turn on investment, capital and age at time $t-1$. The probability of survival by fitting a probit model of χ_{it} on $I_{i,t-1}$, $K_{i,t-1}$ and $a_{i,t-1}$ as well as on their squares and cross products:

$$\Pr(\chi_{it} = 1 \mid J_{i,t-1}) = \Pr\left(\chi_{it} = 1 \mid \omega_{i,t-1}, \hat{\omega}_{i,t}(k_{i,t+1})\right) = \phi(i_{i,t-1}, k_{i,t-1})$$

Call the predicted probabilities from this model $\hat{P}_{it}$.

In the third step, the fitted probit value is introduced into the nonlinear profit maximization equation:

$$V_{it} = \gamma k_{it} + g(\phi_{i,t-1} - \gamma k_{i,t-1}, \hat{P}_{t-1}) + \mu_{it} + \varepsilon_{it}$$

where the unknown function $g(\cdot)$ is approximated by a polynomial with $\phi_{i,t-1}$, $k_{i,t-1}$and $\hat{P}_{t-1}$. Therefore, such treatment can obtain the consistent estimator of capital across time.

Table 1: Industry codes, industry names and their abbreviations

ID	Industry name	Abbreviation
6	Extraction coal	EC
9	Extraction non-ferrous metal	ENM
10	Extraction nonmetallic ore	ENOM
13	Food processing	FP
14	Food manufacturing	FOM
15	Beverage Manufacturing	BM
16	Tobacco processing	TP
17	Textile	T
18	Garments and other Fiber Products manufacturing	GFPM
19	Leather Furs Down and Related Products	LFDRP
20	Timber Processing,Bamboo,Cane, Palm Fiber and Straw Products	TPBCPFSP
21	Furniture Manufacturing	FUM
22	Papermaking and Paper Products	PPP
23	Printing Industry and Recording Media	PRM
24	Cultural Educational and Sports Goods	CESG
25	Petroleum Refining and Cok	PRC
26	Chemical materials and chemical products	CMCP
27	Pharmaceutical manufacturing	PM
28	Chemical Fiber manufacturing	CF
29	Rubber Products	RP
30	Plastic product industry	PP
31	Nonmetal Mineral Products	NMP
32	Ferrous metal smelting and rolling processing	FMSRP
33	Non-Ferrous Metals Smelting and Rolling	NMSR

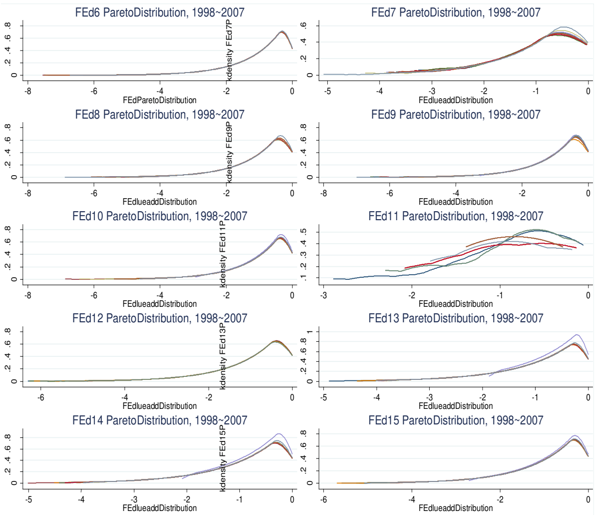
34	Metal product industry	MP
35	Machine building industry	MB
36	General Equipment manufacturing	GEM
37	Transport Equipment manufacturing	TEM
39	Arms and ammunition manufacturing	AAM
40	Electric Equipment and Machinery manufacturing	EEMM
41	Electronic and Telecommunication Equipment manufacturing	ETEM
42	Instrumentation and culture, office machinery manufacturing	ICOMM
43	Other Manufacturing	OM

Table 2: Descriptive statistics of ASIF

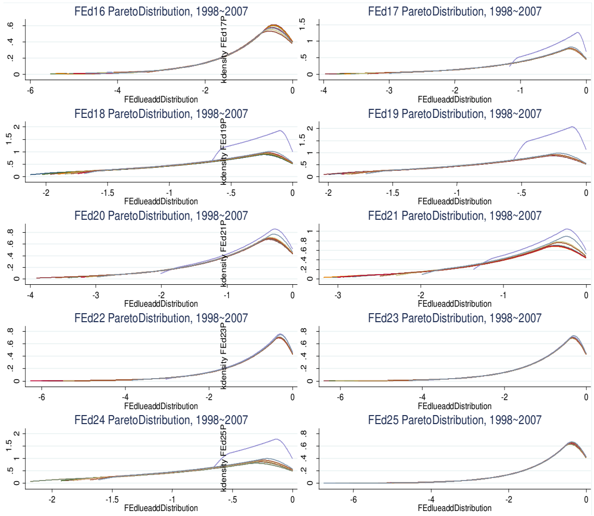
Variable		Mean	Std	Min	Max	Obs
ln Y	overall	8.83	1.44	3.68	12.58	N = 407919
	between		1.37	3.71	12.58	n = 169902
	within		0.53	3.08	13.06	T-bar = 2.40
ln V	overall	7.45	1.61	-1.54	13.28	N = 407919
	between		1.49	-1.39	13.00	n = 169902
	within		0.75	-2.16	13.02	T-bar = 2.40
ln K	overall	7.83	1.70	-1.54	14.79	N = 407919
	between		1.69	-1.54	14.41	n = 169902
	within		0.39	0.04	13.49	T-bar = 2.40
ln L	overall	5.39	1.18	2.30	10.85	N = 407919
	between		1.14	2.30	10.64	n = 169902
	within		0.28	0.86	9.00	T-bar = 2.40
ln M	overall	8.60	1.45	-1.54	13.99	N = 407919
	between		1.41	-1.54	13.99	n = 169902
	within		0.43	-1.59	14.07	T-bar = 2.40
ln X	overall	7.96	1.87	-2.09	13.82	N = 107833
	between		1.85	-1.71	13.04	n = 48133
	within		0.62	1.17	13.31	T-bar = 2.24
log I	overall	5.12	2.61	-1.54	15.20	N = 407919
	between		2.44	-1.54	15.20	n = 169902
	within		0.94	-4.77	14.45	T-bar = 2.40

Note: In the above table, Y, V, K, L, M, X, I, represent for, respectively, output, V value added, fixed asset, labor hired, intermediate input, exporting sale, and investment.

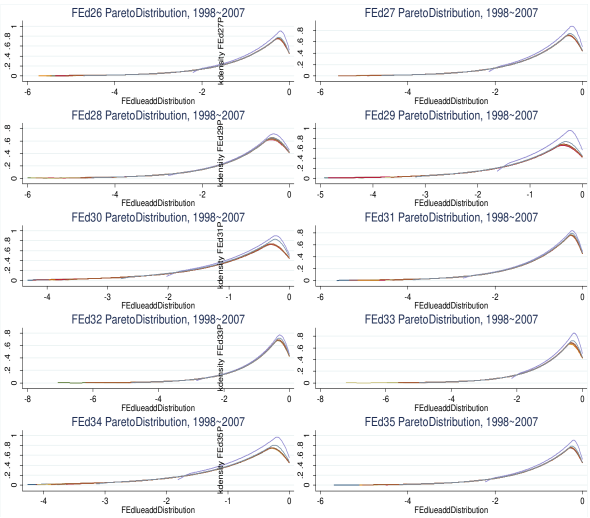
Figure 1: Kernel density Estimations of size distribution of non-exporters by industry



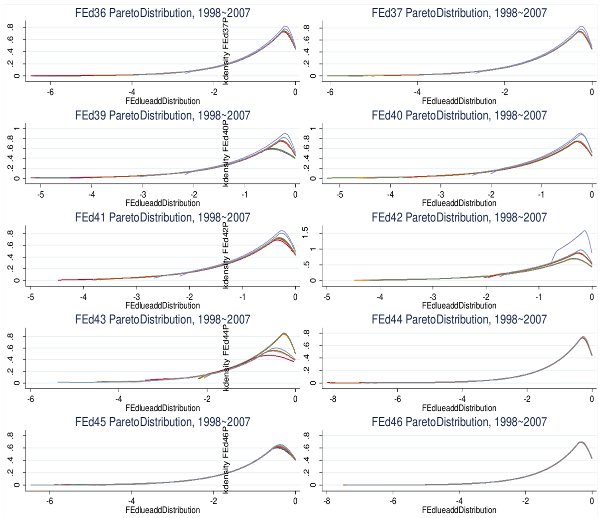
1-a Industry 6-14



1-b Industry 16-25



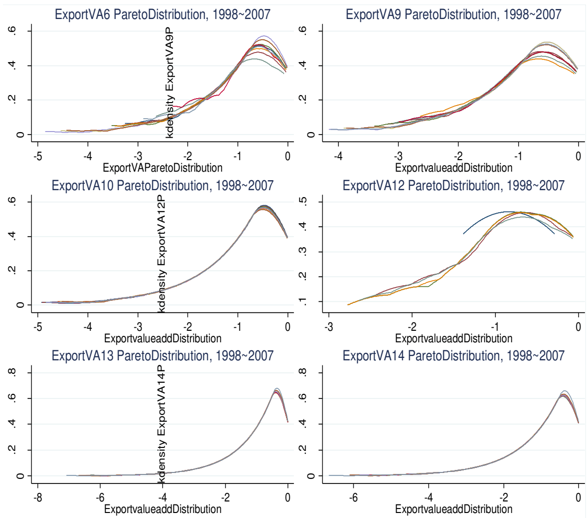
1-c Industry 26-35



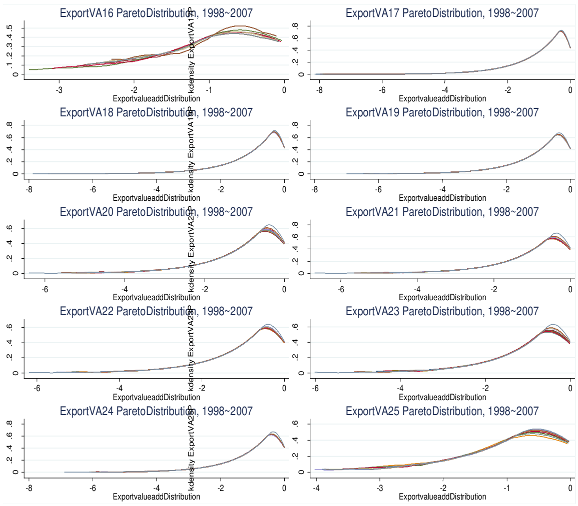
1-d Industry 36-46

Note: Industry7, 8, 11, 15, 43 and 45 are ignored as there are two few exporting firms in them.

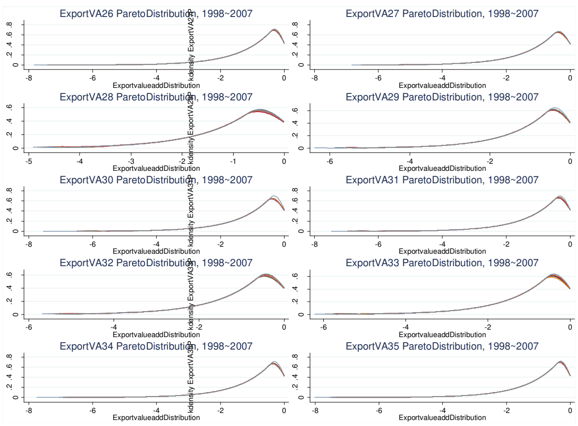
Figure 2 Kernel density Estimations of size distribution of exporters by industry



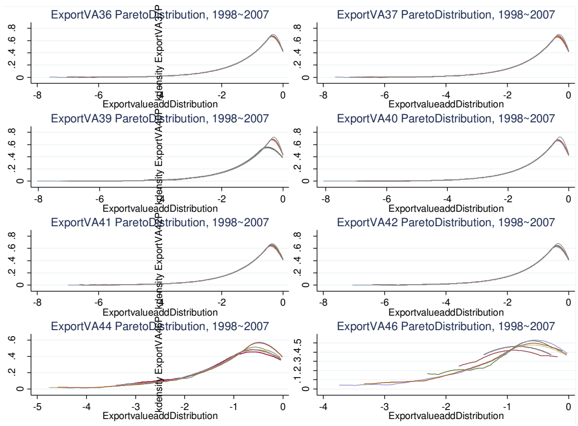
2-a Industry 6-14



2-b Industry 16-25



2-c Industry 26-35



2-d Industry 36-46

Note: Industry7, 8, 11, 15, 43 and 45 are ignored as there are two few exporting firms in them.

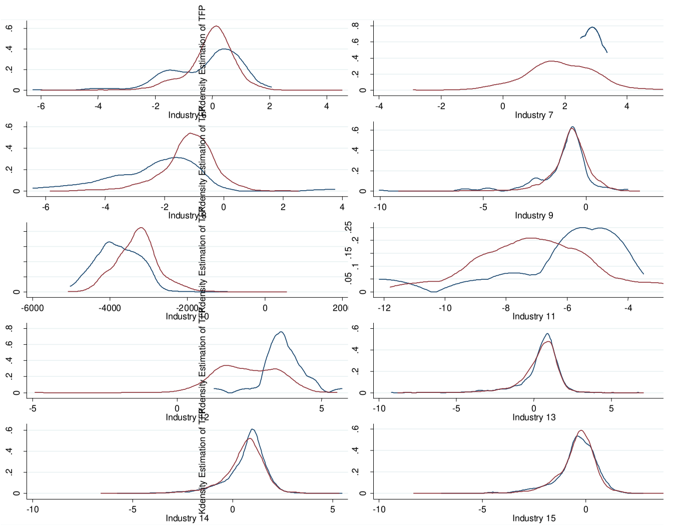
Table 3 Average productivity and coefficients of variation of non-exporters and exporters by industry under different productivity estimation approaches

	OLS		Fixed Effects		Olley-Pakes		Levinsohn-Petrin	
Industry	Exporters	Non-exporters	Exporters	Non-exporters	Exporters	Non-exporters	Exporters	Non-exporters
6	-0.66825	-0.41384	-0.23167	-0.05164	-0.10541	0.130531	0.383083	-0.13827
	-1.88149	-2.04216	-5.42186	-16.6527	-12.1917	6.488491	3.309173	-6.10267
7	0.257435	-0.41344	2.879302	1.811527	2.272036	1.191891	-0.17092	-0.47207
	1.168952	-2.2905	0.153148	0.632792	0.134018	0.825966	-1.68197	-2.00897
8	-1.55546	-0.50428	-2.32912	-1.19422	-1.32076	-0.22372	1.030188	-0.00324
	-1.18271	-1.72562	-0.74228	-0.77449	-1.36924	-3.94973	1.791091	-269.516
9	-0.73968	-0.3529	-1.13554	-0.7857	-0.45496	-0.09217	0.791212	-0.42179
	-1.91495	-2.71787	-1.24333	-1.25858	-3.13057	-10.4245	1.795208	-2.281
10	-0.08504	-0.03698	-3794.98	-3292.25	0.065491	0.095593	5650.244	-4901.76
	-11.4616	-24.8252	-0.14686	-0.16637	14.98155	9.614689	0.146873	-0.16637
11	1.302607	1.036281	-6.3522	-7.09101	0	0	-1.28811	0.715568
	0.201795	0.781664	-0.40949	-0.2791	0	0	-0.39774	1.187734
12	-0.03259	-0.23483	3.675241	2.405564	1.190532	0.62873	-1.8062	1.099477
	-21.5657	-3.46464	0.206036	0.452278	0.594495	1.35233	-0.40902	0.806991
13	-0.38317	-0.34513	0.421826	0.37503	-0.91526	-0.86977	0.490203	-0.45422
	-3.26996	-3.51322	3.00543	3.299667	-1.36892	-1.40554	2.552452	-2.67288
14	-0.63995	-0.55611	0.67307	0.589447	-0.14046	-0.1075	0.107738	-0.08183
	-1.64878	-1.82584	1.614578	1.805999	-7.56294	-9.46876	9.866629	-12.4499
15	-1.13887	-1.0305	-0.43616	-0.43292	0	0	1.389528	-1.26636
	-0.8957	-0.91977	-2.35098	-2.25768	0	0	0.729494	-0.75091
16	-1.69682	-1.5492	4.800403	4.330814	0.885544	0.7139	0.021278	0.027894
	-0.49499	-0.51982	0.338639	0.299188	1.228778	1.299582	41.68865	30.12035
17	-0.49358	-0.43963	-0.73496	-0.631	-1.35022	-1.2159	1.040541	-0.93362
	-1.94357	-2.26363	-1.32762	-1.61426	-0.71857	-0.83181	0.925103	-1.07441
18	-0.26817	-0.21909	0.901147	0.916787	-0.88975	-0.8006	0.735422	-0.65678
	-3.67398	-4.67471	1.124985	1.177074	-1.11675	-1.29708	1.34664	-1.57249
19	-0.43032	-0.29278	0.891264	0.942787	-0.29707	-0.16537	0.025853	0.089782
	-2.34299	-3.28982	1.159834	1.101497	-3.40082	-5.81966	39.18082	10.73159
20	-0.21748	-0.18809	0.205269	0.18097	-0.83539	-0.82718	0.696336	-0.67451
	-4.60093	-5.40466	4.931351	5.728398	-1.21217	-1.24845	1.448002	-1.51613
21	-0.52302	-0.47061	-0.06889	-0.08737	-0.38646	-0.3545	0.547206	-0.49714
	-1.81167	-2.09015	-14.1186	-12.028	-2.45001	-2.78273	1.73277	-1.98016
22	-0.36555	-0.34803	-0.14875	-0.14786	-0.90399	-0.84442	0.681389	-0.63785
	-2.58309	-2.67699	-6.43362	-6.47914	-1.04481	-1.11704	1.382689	-1.4668
23	-0.64217	-0.53005	1.111231	0.860757	-0.04887	-0.09456	-0.11713	0.142829
	-1.4955	-1.74829	0.910108	1.188202	-19.8882	-10.0364	-8.26286	6.541895
24	-0.14701	-0.08409	0.370507	0.390007	0.318376	0.330157	-0.29532	0.314214
	-6.23524	-10.8024	2.490621	2.358314	2.899562	2.771366	-3.12068	2.903882
25	-0.36385	-0.11877	-0.81046	-0.2908	-0.63587	-0.20987	0.236648	-0.00332
	-2.57977	-7.9851	-1.32287	-3.46793	-1.60848	-4.67801	3.978248	-285.493
26	-0.26233	-0.24206	-0.21934	-0.19409	-0.83109	-0.74812	0.256907	-0.23501
	-3.95085	-4.21673	-4.875	-5.4912	-1.25632	-1.38531	4.031364	-4.3462

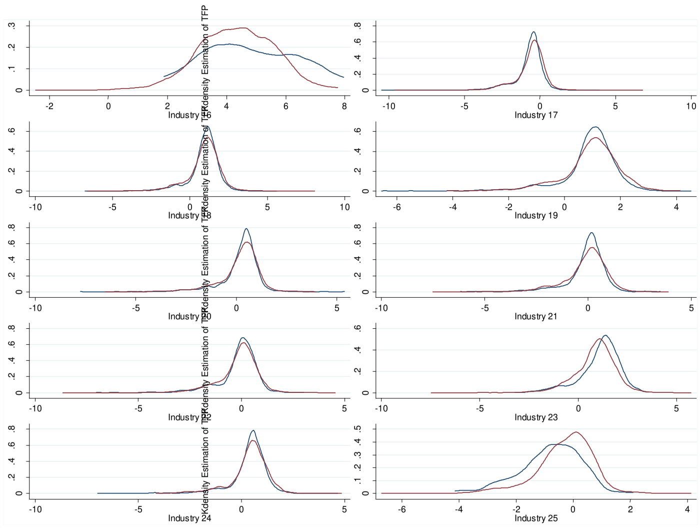
27	-0.60652	-0.41732	1.082702	1.13877	-0.84925	-0.60814	0.590816	-0.40047
	-1.72054	-2.37663	0.987176	0.907296	-1.22354	-1.64179	1.763024	-2.48019
28	0.11593	-0.05056	0.180724	0.055107	0	0	0.902299	-0.98012
	8.90677	-21.9755	5.844268	20.73029	0	0	1.144447	-1.15938
29	-0.1597	-0.10388	-0.50221	-0.38377	-0.10886	-0.06143	-0.01635	0.05022
	-6.11581	-8.76087	-1.97519	-2.44903	-8.98208	-14.8937	-59.8296	18.11793
30	-0.21758	-0.1922	0.401521	0.36578	-0.32406	-0.31482	0.213836	-0.18958
	-4.45997	-5.2416	2.429514	2.80876	-3.00715	-3.23946	4.536728	-5.31524
31	-0.15495	-0.14797	1.354076	1.196152	-0.43149	-0.42433	0.18832	-0.18685
	-6.38585	-5.81162	0.774765	0.77286	-2.29597	-2.0414	5.249099	-4.60777
32	-0.30991	-0.24727	0.213291	0.24808	-0.82886	-0.70525	0.922048	-0.78896
	-3.51597	-4.43865	5.268114	4.534194	-1.31855	-1.5623	1.187564	-1.39832
33	-0.40809	-0.34646	-0.31947	-0.21803	-1.22855	-1.04662	0.79295	-0.6769
	-2.8831	-3.25616	-3.71055	-5.28191	-0.96226	-1.09682	1.482108	-1.67385
34	-0.18436	-0.15104	0.409287	0.433938	-0.49253	-0.42108	0.120533	-0.09332
	-5.18907	-6.80179	2.420021	2.44931	-1.96309	-2.47251	7.938089	-11.0102
35	-0.35361	-0.34069	-0.17099	-0.15815	-0.70355	-0.63945	0.413431	-0.38903
	-2.66696	-2.80932	-5.65802	-6.30925	-1.33874	-1.50771	2.277967	-2.46308
36	-0.04549	-0.08539	0.329762	0.251608	-0.60337	-0.58289	0.266366	-0.27705
	-21.8874	-11.7796	3.139994	4.285329	-1.67146	-1.76034	3.734845	-3.64145
37	-0.07939	-0.08757	0.773787	0.672621	-0.12564	-0.12538	0.234135	-0.21874
	-12.8741	-11.8999	1.349119	1.599371	-8.12332	-8.31941	4.35779	-4.77309
39	-2.31672	-2.15711	-2.36764	-2.17001	-2.28802	-2.14414	2.085369	-1.96033
	-0.46071	-0.5057	-0.45915	-0.515	-0.4667	-0.50996	0.513403	-0.55719
40	-0.09926	-0.04746	-0.16436	-0.03609	-0.85219	-0.70722	0.126012	-0.07146
	-10.1663	-20.3502	-6.32773	-28.6842	-1.1888	-1.39201	8.000894	-13.5305
41	0.072068	0.137114	0.812551	0.818499	-0.07195	0.005844	0.310419	-0.19788
	13.50894	7.837333	1.286844	1.454054	-13.5185	186.9492	3.122835	-5.47354
42	0.056335	0.094384	-0.32027	-0.17921	0.14874	0.180727	0.230722	-0.17298
	17.70332	11.4502	-3.36455	-6.64926	6.709187	5.980512	4.31944	-6.27468
43	-0.08892	-0.14055	2.012441	1.839315	0.16419	0.099425	-0.08785	0.029259
	-7.63121	-6.66669	0.379085	0.562893	4.151232	9.443892	-7.74399	32.01338
44	-0.34944	-0.07073	3.46801	3.328301	2.080108	2.13834	-1.93564	2.009671
	-2.91929	-13.6205	3056055	0.34399	0.502174	0.485013	-0.53447	0.510504
45	0.243176	0.580914	0.867696	1.176135	1.780862	1.871129	-1.77162	1.825164
	4.114304	2.076781	1.186019	1.103935	0.609489	0.670127	-0.62335	0.670883
46	-0.8008	-0.49977	5.10289	5.252362	-4.38684	-4.00412	-1.57613	1.788721
	-1.70047	-1.85532	0.42561	0.278018	-0.32508	-0.29257	-1.01609	0.571763

Note: For each industry and each productivity-estimation method, the first row is the average productivity and the second one is the coefficient of variation.

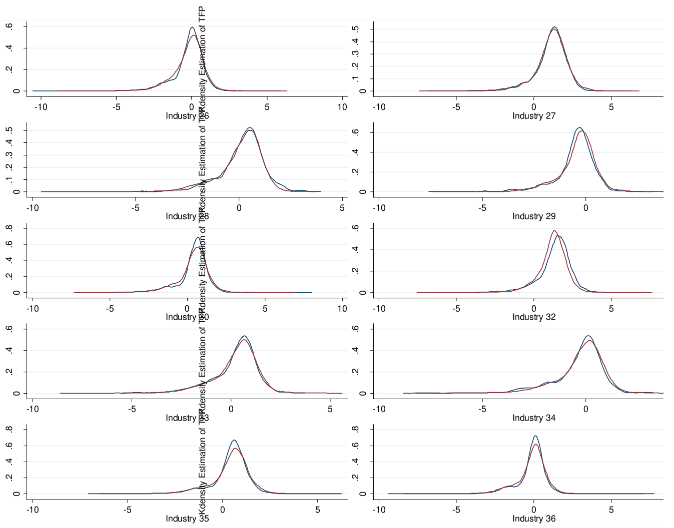
Figure 3: **Kernel density Estimations of productivity distribution by industry under the fixed-effect productivity-estimation method**



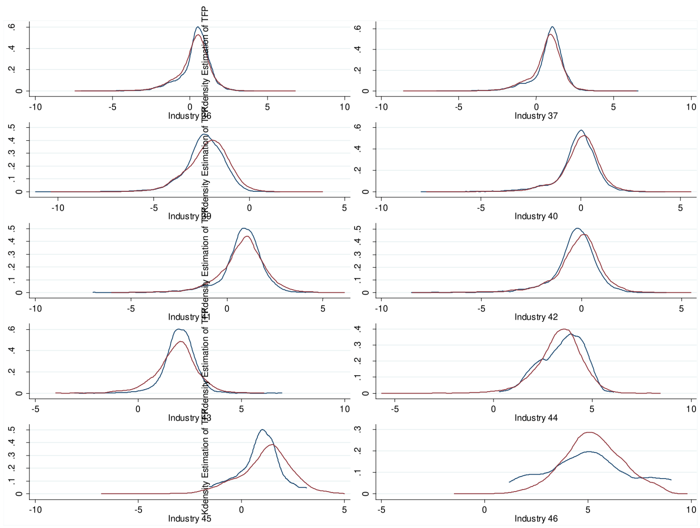
3-a Industry 6-15



3-b Industry 16-25



3-c Industry 26-35



3-d Industry 36-46

Table 4-1: Size distribution of non-exporters (Industry 6-15)

	6	9	10	12	13	14	15
lnYd	0.676	0.671	0.732	0.496	0.637	0.597	0.588
	0.003	0.007	0.006	0.007	0.003	0.003	0.004
year==1999	-0.655	-0.666	-0.578	-0.198	-0.618	-0.873	-0.510
	0.016	0.033	0.029	0.040	0.014	0.019	0.021
year==2000	-0.635	-0.560	-0.472	-0.164	-0.564	-0.752	-0.455
	0.016	0.032	0.028	0.039	0.014	0.019	0.021
year==2001	-0.576	-0.449	-0.431	-0.165	-0.513	-0.598	-0.378
	0.016	0.032	0.029	0.040	0.014	0.020	0.022
year==2002	-0.524	-0.381	-0.359	-0.147	-0.417	-0.502	-0.345
	0.016	0.045	0.031	0.041	0.015	0.020	0.023
year==2003	-0.298	-0.363	-0.242		-0.305	-0.362	-0.303
	0.016	0.033	0.031		0.016	0.021	0.023
year==2004	-0.215	-0.252	-0.301		-0.213	-0.222	-0.234
	0.016	0.035	0.032		0.015	0.021	0.023
year==2005	-0.689	-0.752	-0.964		-1.097	-0.960	-0.846
	0.016	0.039	0.033		0.019	0.023	0.026
year==2006	0.037	-0.098	-0.044		-0.085	-0.071	-0.083
	0.016	0.036	0.032		0.015	0.022	0.024
year==2007	0.081	0.119	0.068		-0.030	0.010	-0.098
	0.016	0.035	0.031		0.015	0.021	0.024
Constant	5.182	5.327	5.301	3.074	4.960	4.405	4.525
	0.028	0.066	0.054	0.064	0.026	0.032	0.037
N	8918	2901	3258	1265	15386	6773	6808

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4-2: Size distribution of non-exporters (Industry 16-25)

	16	17	18	19	20	21	22	23	24	25
lnYd	0.515	0.760	0.725	0.672	0.696	0.758	0.685	0.673	0.745	0.589
	0.014	0.003	0.005	0.007	0.005	0.008	0.003	0.004	0.010	0.007
year==1999	0.064	-0.319	-0.226	-0.571	-0.570	-0.515	-0.732	-0.608	-0.536	-0.751
	0.093	0.013	0.022	0.032	0.028	0.037	0.016	0.018	0.045	0.041
year==2000	0.095	-0.307	-0.255	-0.515	-0.384	-0.515	-0.678	-0.555	-0.440	-0.661
	0.091	0.013	0.023	0.033	0.026	0.036	0.016	0.018	0.044	0.041
year==2001	0.098	-0.263	-0.178	-0.368	-0.252	-0.486	-0.528	-0.408	-0.513	-0.575
	0.092	0.014	0.023	0.034	0.028	0.038	0.017	0.019	0.047	0.043
year==2002	0.172	-0.173	-0.143	-0.221	-0.120	-0.393	-0.463	-0.343	-0.235	-0.514
	0.092	0.014	0.023	0.037	0.029	0.037	0.017	0.020	0.046	0.042
year==2003	0.268	-0.114	-0.002	-0.167	-0.063	-0.386	-0.326	-0.208	-0.201	-0.491
	0.098	0.014	0.024	0.037	0.029	0.038	0.018	0.020	0.048	0.041
year==2004	0.247	-0.076	0.062	-0.106	-0.006	-0.271	-0.225	-0.109	-0.125	-0.295
	0.102	0.015	0.024	0.037	0.028	0.039	0.018	0.020	0.051	0.040
year==2005	-0.435	-1.266	-0.918	-0.967	-1.052	-1.374	-0.969	-0.841	-1.190	-1.001
	0.126	0.014	0.024	0.040	0.028	0.042	0.019	0.021	0.053	0.040
year==2006	0.078	0.032	0.144	-0.071	0.043	-0.095	-0.024	0.088	-0.020	-0.198
	0.116	0.013	0.023	0.036	0.027	0.040	0.018	0.020	0.048	0.037
year==2007	0.123	0.051	0.176	0.131	0.135	-0.058	0.000	0.112	0.077	-0.147
	0.132	0.013	0.023	0.036	0.027	0.038	0.018	0.020	0.046	0.037
Constant	4.090	5.823	5.282	4.990	5.094	5.578	4.997	4.783	5.298	5.071
	0.156	0.026	0.042	0.063	0.049	0.074	0.030	0.033	0.090	0.074
N	724	15902	3947	1777	3288	1638	8241	7379	964	2512

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4-3: Size distribution of non-exporters (Industry 26-35)

	26	27	28	29	30	31	32	33	34	35
lnYd	0.701	0.719	0.606	0.790	0.779	0.747	0.643	0.635	0.788	0.797
	0.002	0.004	0.009	0.006	0.003	0.002	0.004	0.004	0.003	0.002
year==1999	-0.386	-0.406	-0.194	-0.290	-0.336	-0.561	-0.595	-0.507	-0.466	-0.509
	0.012	0.020	0.052	0.026	0.015	0.012	0.022	0.025	0.013	0.011
year==2000	-0.365	-0.320	-0.102	-0.262	-0.262	-0.516	-0.569	-0.449	-0.453	-0.500
	0.012	0.019	0.052	0.026	0.015	0.012	0.023	0.024	0.013	0.011
year==2001	-0.336	-0.251	-0.014	-0.164	-0.139	-0.461	-0.473	-0.443	-0.382	-0.462
	0.012	0.020	0.053	0.028	0.016	0.012	0.024	0.025	0.013	0.011
year==2002	-0.304	-0.183	-0.070	-0.247	-0.162	-0.387	-0.427	-0.300	-0.347	-0.403
	0.012	0.020	0.053	0.028	0.016	0.012	0.024	0.028	0.014	0.012
year==2003	-0.214	-0.057	-0.044	-0.202	-0.168	-0.298	-0.384	-0.316	-0.260	-0.288
	0.012	0.020	0.054	0.029	0.016	0.012	0.025	0.025	0.014	0.012
year==2004	-0.152	0.021	0.075	-0.083	-0.070	-0.194	-0.263	-0.223	-0.107	-0.131
	0.012	0.019	0.056	0.030	0.016	0.013	0.023	0.025	0.015	0.012
year==2005	-1.134	-0.908	-1.014	-1.262	-1.223	-1.114	-1.140	-1.302	-1.286	-1.274
	0.013	0.020	0.056	0.030	0.016	0.013	0.023	0.025	0.015	0.012
year==2006	-0.022	0.091	0.088	-0.046	0.055	-0.074	-0.052	-0.111	0.042	-0.024
	0.012	0.019	0.054	0.031	0.016	0.013	0.022	0.024	0.014	0.011
year==2007	0.036	0.093	0.171	0.031	0.109	0.024	-0.004	0.002	0.097	0.045
	0.012	0.018	0.055	0.030	0.016	0.013	0.022	0.023	0.014	0.011
Constant	5.450	5.599	4.905	5.923	5.779	5.741	5.357	5.225	5.917	5.982
	0.021	0.037	0.096	0.056	0.030	0.021	0.042	0.046	0.026	0.022
N	23110	8249	1501	2486	9273	27421	6148	5269	12121	21546

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4-4: Size distribution of non-exporters (Industry 36-46)

	36	37	39	40	41	42	43	44	45	46
lnYd	0.723	0.657	0.723	0.714	0.667	0.676	0.634	0.608	0.612	0.676
	0.003	0.002	0.003	0.003	0.004	0.005	0.008	0.002	0.007	0.002
year==1999	-0.561	-0.510	0.372	-0.395	-0.271	-0.603	-0.882	-0.872	-0.680	-0.844
	0.013	0.013	0.055	0.015	0.022	0.029	0.047	0.015	0.045	0.015
year==2000	-0.520	-0.442	0.454	-0.360	-0.195	-0.553	-0.787	-0.821	-0.515	-0.759
	0.013	0.013	0.053	0.015	0.022	0.028	0.047	0.014	0.040	0.015
year==2001	-0.440	-0.393	0.424	-0.263	-0.116	-0.433	-0.767	-0.730	-0.413	-0.675
	0.013	0.013	0.058	0.015	0.022	0.028	0.047	0.014	0.041	0.015
year==2002	-0.400	-0.354	0.627	-0.225	-0.048	-0.440	-0.690	-0.660	-0.351	-0.616
	0.013	0.014	0.053	0.015	0.022	0.028	0.048	0.014	0.039	0.015
year==2003	-0.257	-0.256	-0.134	-0.153	0.019	-0.363	-0.730	-0.570	-0.271	-0.515
	0.014	0.014	0.012	0.015	0.022	0.028	0.049	0.014	0.039	0.015
year==2004	-0.113	-0.137	-1.220	-0.016	-0.218	-0.231	-0.479	-0.485	-0.181	-0.413
	0.014	0.014	0.013	0.019	0.027	0.035	0.115	0.014	0.038	0.015
year==2005	-1.133	-1.040	-0.020	-0.941	-0.941	-0.937	-0.973	-0.941	-0.636	-0.914
	0.014	0.014	0.012	0.019	0.026	0.037	0.076	0.015	0.038	0.016
year==2006	-0.014	-0.078	0.044	-0.008	-0.055	0.092	-0.073	-0.186	-0.065	-0.207
	0.014	0.013	0.012	0.019	0.025	0.035	0.079	0.015	0.036	0.016
year==2007	0.068	-0.030	0.000	0.088	0.054	0.107	-0.143	-0.104	0.098	-0.103
	0.014	0.014	0.000	0.019	0.025	0.034	0.072	0.015	0.036	0.016
Constant	5.399	5.029	5.586	5.428	4.850	4.914	4.915	4.948	4.798	4.763
	0.723	0.657	0.723	0.714	0.667	0.676	0.634	0.608	0.612	0.676
N	14811	15977	8970	11798	5675	2910	1530	17723	1608	8156

$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table 5-1: Size distribution of exporters (Industry 6-15)

	6	9	10	12	13	14	15
lnYd	0.621	0.612	0.625	0.548	0.653	0.687	0.579
	0.019	0.028	0.012	0.096	0.005	0.007	0.010
year==1999	-0.776	0.487	-0.242	0.119	-0.157	-0.304	-0.156
	0.153	0.150	0.065	0.371	0.029	0.035	0.055
year==2000	-0.516	0.519	-0.208	-0.233	-0.176	-0.179	-0.137
	0.148	0.141	0.065	0.260	0.029	0.035	0.055
year==2001	-0.340	0.399	-0.007	-0.113	-0.113	-0.245	-0.025
	0.144	0.130	0.066	0.238	0.029	0.036	0.056
year==2002	-0.256	0.752	-0.065	-0.252	-0.094	-0.211	0.028
	0.145	0.173	0.070	0.241	0.031	0.037	0.057
year==2003	-0.035	0.811	0.008	0.000	-0.023	-0.086	0.017
	0.176	0.147	0.066	0.000	0.031	0.036	0.058
year==2004	-0.177	0.880	-0.030	0.000	0.050	0.015	-0.162
	0.195	0.153	0.068	0.000	0.030	0.035	0.056
year==2005	-1.817	-0.609	-0.793	0.000	-1.161	-1.120	-0.860
	0.133	0.107	0.068	0.000	0.031	0.036	0.059
year==2006	-0.831	0.368	0.128	0.000	-0.016	0.020	-0.009
	0.128	0.111	0.071	0.000	0.027	0.032	0.054
year==2007	-0.827	0.418	0.166	0.000	0.063	0.109	0.157
	0.130	0.113	0.072	0.000	0.027	0.033	0.055
Constant	5.955	4.705	4.951	5.144	5.244	5.586	4.703
	0.233	0.265	0.119	1.042	0.054	0.068	0.100
N	235	177	585	31	3530	2037	1150

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5-2: Size distribution of exporters (Industry 16-25)

	16	17	18	19	20	21	22	23	24	25
lnYd	0.480	0.693	0.803	0.733	0.720	0.720	0.661	0.649	0.749	0.495
	0.037	0.003	0.003	0.005	0.008	0.009	0.010	0.011	0.006	0.026
year==1999	-0.117	-0.062	-0.121	-0.312	-0.274	-0.400	-0.268	-0.236	-0.334	-0.512
	0.204	0.016	0.015	0.025	0.038	0.049	0.058	0.060	0.028	0.148
year==2000	-0.065	-0.013	-0.040	-0.330	-0.062	-0.304	-0.375	-0.342	-0.337	-0.392
	0.197	0.017	0.016	0.026	0.047	0.048	0.062	0.064	0.028	0.159
year==2001	-0.159	0.127	0.075	-0.252	-0.215	-0.330	-0.008	0.018	-0.284	-0.208
	0.174	0.017	0.016	0.026	0.042	0.047	0.068	0.070	0.028	0.158
year==2002	0.159	0.111	0.050	-0.195	-0.322	-0.267	-0.029	-0.002	-0.225	-0.055
	0.204	0.018	0.016	0.027	0.043	0.048	0.067	0.069	0.030	0.171
year==2003	0.314	0.121	0.081	-0.065	-0.147	-0.234	-0.020	0.007	-0.094	-0.148
	0.224	0.018	0.016	0.027	0.041	0.047	0.074	0.075	0.030	0.154
year==2004	0.276	0.184	0.208	-0.085	-0.083	-0.024	0.127	0.151	0.017	0.060
	0.186	0.018	0.016	0.026	0.037	0.045	0.063	0.065	0.029	0.146
year==2005	-0.613	-1.048	-1.117	-1.380	-1.145	-1.268	-0.871	-0.828	-1.309	-0.838
	0.218	0.018	0.018	0.029	0.040	0.045	0.049	0.053	0.033	0.137
year==2006	0.212	0.176	0.187	0.077	0.084	0.034	0.046	0.071	0.021	-0.177
	0.212	0.017	0.016	0.026	0.033	0.038	0.048	0.051	0.027	0.138
year==2007	0.061	0.223	0.270	0.039	0.062	0.087	0.147	0.170	0.023	-0.088
	0.223	0.017	0.016	0.025	0.033	0.036	0.046	0.049	0.028	0.135
Constant	4.293	5.596	6.190	5.880	5.498	5.761	5.310	5.165	5.880	4.521
	0.416	0.033	0.032	0.051	0.072	0.085	0.097	0.111	0.057	0.304
N	77	14037	7906	3200	1094	1178	867	657	2271	189

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5-3: Size distribution of exporters (Industry 26-35)

	26	27	28	29	30	31	32	33	34	35
lnYd	0.680	0.679	0.541	0.719	0.743	0.679	0.579	0.631	0.739	0.723
	0.004	0.007	0.017	0.009	0.005	0.005	0.013	0.010	0.004	0.004
year==1999	-0.258	-0.128	-0.406	-0.023	-0.142	-0.074	-0.647	-0.309	-0.331	-0.339
	0.024	0.037	0.095	0.038	0.027	0.028	0.071	0.057	0.018	0.019
year==2000	-0.208	-0.121	-0.374	-0.007	-0.112	-0.024	-0.640	-0.307	-0.220	-0.293
	0.024	0.037	0.092	0.040	0.027	0.029	0.071	0.057	0.019	0.019
year==2001	-0.117	-0.030	-0.139	-0.034	-0.095	0.062	-0.390	-0.181	-0.270	-0.228
	0.024	0.038	0.098	0.041	0.027	0.029	0.074	0.055	0.019	0.020
year==2002	-0.085	0.035	-0.308	0.062	-0.122	0.059	-0.278	-0.013	-0.213	-0.186
	0.024	0.038	0.096	0.043	0.028	0.030	0.076	0.066	0.020	0.020
year==2003	-0.029	0.075	-0.146	0.055	0.038	0.082	-0.247	-0.153	-0.158	-0.108
	0.024	0.038	0.097	0.043	0.027	0.030	0.076	0.053	0.019	0.020
year==2004	0.034	0.081	0.130	0.098	0.090	0.124	-0.256	-0.098	-0.090	0.023
	0.024	0.038	0.105	0.043	0.028	0.029	0.072	0.053	0.020	0.020
year==2005	-1.082	-1.025	-0.859	-1.049	-1.201	-0.894	-1.066	-1.160	-1.205	-1.107
	0.024	0.038	0.099	0.043	0.027	0.028	0.068	0.053	0.021	0.020
year==2006	0.107	0.093	0.083	0.120	0.141	0.165	-0.116	-0.051	0.011	0.075
	0.023	0.036	0.099	0.041	0.026	0.027	0.068	0.051	0.019	0.019
year==2007	0.190	0.131	0.171	0.154	0.177	0.217	-0.113	0.064	0.114	0.154
	0.023	0.036	0.100	0.042	0.024	0.027	0.066	0.052	0.019	0.019
Constant	5.767	5.811	4.814	5.913	5.910	5.371	5.298	5.651	5.913	5.963
	0.046	0.077	0.193	0.086	0.053	0.051	0.145	0.114	0.038	0.038
N	7869	3222	532	1567	3333	4273	1014	1563	5559	9037

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5-4: Size distribution of exporters (Industry 36-46)

	36	37	39	40	41	42	43	44	45	46
lnYd	0.675	0.649	0.639	0.675	0.696	0.724	0.810	0.611	0.426	0.411
	0.004	0.005	0.006	0.005	0.006	0.006	0.008	0.027	0.070	0.018
year==1999	-0.246	-0.286	0.241	-0.212	-0.015	0.019	-1.504	-0.112	-1.058	-0.227
	0.023	0.030	0.079	0.024	0.028	0.028	0.187	0.190	0.435	0.243
year==2000	-0.230	-0.221	0.421	-0.163	0.023	0.047	-1.376	-0.400	0.008	-1.030
	0.024	0.030	0.076	0.024	0.028	0.029	0.186	0.175	0.492	0.225
year==2001	-0.127	-0.175	0.536	-0.112	0.144	0.192	-1.342	0.027	-0.523	-1.086
	0.024	0.029	0.071	0.024	0.028	0.029	0.187	0.185	0.369	0.206
year==2002	-0.026	-0.191	0.651	-0.074	0.185	0.169	-1.393	0.338	-1.132	0.287
	0.025	0.031	0.084	0.024	0.029	0.029	0.187	0.185	0.440	0.244
year==2003	-0.001	-0.031	0.062	0.001	0.281	0.237	-1.303	0.821	-0.306	-0.362
	0.025	0.029	0.024	0.024	0.029	0.030	0.187	0.204	0.365	0.244
year==2004	0.165	0.030	-1.008	0.076	0.025	-0.019	1.779	0.977	-0.329	0.275
	0.024	0.029	0.024	0.026	0.034	0.026	0.415	0.194	0.346	0.244
year==2005	-0.890	-0.973	0.133	-0.934	-0.928	-1.166	-2.335	-0.754	-1.790	-1.986
	0.024	0.028	0.023	0.027	0.034	0.029	0.415	0.141	0.394	0.191
year==2006	0.079	0.060	0.170	0.053	0.048	0.136	0.642	0.197	-0.792	-1.309
	0.023	0.027	0.022	0.024	0.032	0.025	0.321	0.139	0.327	0.187
year==2007	0.138	0.111	0.000	0.141	0.127	0.238	0.622	0.237	-0.663	-1.252
	0.023	0.025	0.000	0.023	0.031	0.026	0.414	0.142	0.352	0.187
Constant	5.480	5.537	5.299	5.671	5.549	5.512	7.400	5.251	4.853	3.781
	0.045	0.057	0.056	0.048	0.058	0.052	0.201	0.293	0.897	0.252
N	5564	5051	4210	6101	3385	2754	1838	250	35	68

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6-1: Productivity distribution of non-exporters (Industry 6-15)

	6	9	10	12	13	14	15
lnYd	1.219	0.963	0.002	0.783	0.780	0.917	0.974
	0.008	0.013	0.000	0.012	0.005	0.007	0.008
year==1999	-0.231	-0.454	0.552	-0.208	-0.489	-0.663	-0.568
	0.023	0.040	0.029	0.042	0.017	0.025	0.027
year==2000	-0.319	-0.475	0.472	-0.269	-0.424	-0.547	-0.496
	0.022	0.039	0.029	0.041	0.018	0.025	0.027
year==2001	-0.478	-0.416	0.430	-0.226	-0.390	-0.551	-0.455
	0.023	0.039	0.030	0.043	0.018	0.026	0.027
year==2002	-0.412	-0.469	0.351	-0.214	-0.348	-0.475	-0.416
	0.023	0.056	0.031	0.044	0.019	0.027	0.029
year==2003	-0.277	-0.528	0.288		-0.263	-0.319	-0.369
	0.024	0.041	0.032		0.020	0.028	0.029
year==2004	-0.279	-0.458	0.298		-0.168	-0.228	-0.276
	0.023	0.043	0.032		0.020	0.028	0.030
year==2005	-2.249	-2.330	0.275		-2.532	-2.252	-2.211
	0.027	0.056	0.032		0.028	0.035	0.037
year==2006	0.035	-0.251	0.058		-0.082	-0.141	-0.138
	0.023	0.044	0.032		0.019	0.029	0.031
year==2007	0.034	-0.130	-0.063		-0.030	-0.005	-0.077
	0.023	0.043	0.032		0.019	0.028	0.030
Constant	-0.655	-1.283	-6.673	1.092	-0.349	0.002	-0.970
	0.015	0.025	0.051	0.045	0.012	0.018	0.018
N	8918	2901	3258	1265	15386	6773	6808

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6-2: Productivity distribution of non-exporters (Industry 16-25)

	16	17	18	19	20	21	22	23	24	25
lnYd	0.673	1.064	0.962	0.947	1.012	0.941	0.932	0.974	1.000	0.962
	0.012	0.005	0.009	0.014	0.012	0.016	0.006	0.007	0.022	0.012
year==1999	0.223	-0.620	-0.552	-0.515	-0.505	-0.670	-0.278	-0.842	-0.313	-0.460
	0.070	0.017	0.031	0.043	0.039	0.052	0.021	0.024	0.063	0.043
year==2000	0.235	-0.542	-0.502	-0.587	-0.498	-0.464	-0.231	-0.792	-0.132	-0.535
	0.068	0.017	0.032	0.044	0.036	0.051	0.021	0.024	0.062	0.043
year==2001	0.237	-0.454	-0.440	-0.330	-0.450	-0.437	-0.115	-0.671	-0.141	-0.503
	0.069	0.018	0.032	0.046	0.039	0.053	0.022	0.025	0.066	0.045
year==2002	0.160	-0.392	-0.406	-0.330	-0.372	-0.444	-0.032	-0.584	0.042	-0.374
	0.069	0.018	0.032	0.050	0.040	0.051	0.022	0.025	0.066	0.044
year==2003	0.343	-0.336	-0.278	-0.257	-0.308	-0.429	0.082	-0.465	0.027	-0.445
	0.074	0.018	0.033	0.049	0.039	0.054	0.023	0.026	0.068	0.043
year==2004	0.218	-0.267	-0.222	-0.259	-0.313	-0.309	0.234	-0.307	0.118	-0.203
	0.076	0.019	0.033	0.049	0.038	0.054	0.023	0.026	0.072	0.042
year==2005	-1.205	-2.654	-2.317	-2.327	-2.489	-2.352	-1.445	-2.061	-1.950	-1.872
	0.097	0.022	0.039	0.062	0.047	0.067	0.025	0.030	0.084	0.047
year==2006	-0.030	-0.148	-0.046	-0.201	-0.121	-0.230	0.438	-0.093	0.038	-0.091
	0.087	0.017	0.032	0.048	0.037	0.056	0.024	0.026	0.069	0.039
year==2007	0.047	-0.105	-0.010	-0.044	-0.141	-0.050	0.472	-0.058	0.073	-0.121
	0.099	0.017	0.031	0.048	0.037	0.053	0.024	0.026	0.066	0.039
Constant	1.816	-1.163	0.310	0.316	-0.350	-0.592	-0.178	0.410	-0.404	-0.841
	0.076	0.010	0.021	0.032	0.021	0.030	0.012	0.018	0.038	0.025
N	724	15902	3947	1777	3288	1638	8241	7379	964	2512

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6-3: Productivity distribution of non-exporters (Industry 26-35)

	26	27	28	29	30	31	32	33	34	35
lnYd	0.941	0.943	0.822	1.126	1.037	1.087	0.873	0.852	0.991	1.056
	0.004	0.006	0.017	0.014	0.007	0.004	0.008	0.008	0.006	0.005
year==1999	-0.635	-0.422	-0.639	-0.844	-0.615	-0.772	-0.273	-0.369	-0.407	-0.470
	0.016	0.023	0.066	0.039	0.021	0.016	0.028	0.032	0.018	0.015
year==2000	-0.579	-0.337	-0.475	-0.901	-0.511	-0.684	-0.282	-0.292	-0.412	-0.500
	0.016	0.023	0.064	0.039	0.022	0.016	0.028	0.031	0.018	0.015
year==2001	-0.566	-0.255	-0.410	-0.763	-0.381	-0.628	-0.172	-0.335	-0.371	-0.469
	0.016	0.023	0.066	0.041	0.022	0.016	0.030	0.032	0.019	0.016
year==2002	-0.465	-0.192	-0.336	-0.615	-0.320	-0.569	-0.133	-0.301	-0.299	-0.431
	0.016	0.023	0.066	0.041	0.022	0.016	0.030	0.036	0.020	0.016
year==2003	-0.409	-0.117	-0.407	-0.533	-0.283	-0.479	-0.191	-0.248	-0.270	-0.361
	0.016	0.023	0.067	0.042	0.022	0.016	0.031	0.033	0.020	0.016
year==2004	-0.266	-0.084	-0.222	-0.493	-0.206	-0.328	-0.046	-0.191	-0.177	-0.255
	0.016	0.023	0.069	0.043	0.022	0.016	0.029	0.032	0.021	0.016
year==2005	-2.182	-1.854	-2.163	-2.611	-2.460	-2.248	-1.904	-2.063	-2.386	-2.333
	0.019	0.026	0.080	0.052	0.027	0.019	0.032	0.036	0.024	0.018
year==2006	-0.123	-0.011	-0.196	-0.396	-0.137	-0.234	-0.038	-0.145	-0.096	-0.130
	0.016	0.022	0.067	0.044	0.022	0.017	0.028	0.030	0.020	0.015
year==2007	-0.110	-0.057	-0.100	-0.231	-0.052	-0.138	-0.003	0.014	-0.030	-0.064
	0.016	0.022	0.068	0.043	0.022	0.017	0.027	0.030	0.019	0.015
Constant	-0.686	0.362	-0.436	-0.710	-0.168	0.881	-0.478	-0.824	-0.158	-0.687
	0.011	0.016	0.047	0.025	0.013	0.014	0.018	0.017	0.012	0.010
N	23110	8249	1501	2486	9273	27421	6148	5269	12121	21546

$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table 6-4: Productivity distribution of non-exporters (Industry 36-46)

	36	37	39	40	41	42	43	44	45	46
lnYd	0.933	0.945	1.021	0.927	0.805	0.802	0.832	0.861	0.723	0.714
	0.005	0.005	0.006	0.005	0.006	0.009	0.013	0.004	0.011	0.003
year==1999	-0.623	-0.503	1.368	0.110	0.029	0.244	-0.700	-0.317	-0.266	-0.790
	0.017	0.018	0.075	0.019	0.026	0.038	0.058	0.015	0.056	0.018
year==2000	-0.609	-0.510	0.926	0.059	0.019	0.181	-0.647	-0.350	-0.292	-0.709
	0.018	0.018	0.071	0.019	0.026	0.037	0.058	0.015	0.050	0.018
year==2001	-0.568	-0.471	0.541	0.029	0.032	0.187	-0.600	-0.318	-0.389	-0.653
	0.018	0.018	0.078	0.020	0.026	0.037	0.059	0.015	0.051	0.018
year==2002	-0.497	-0.407	0.493	0.017	0.107	0.150	-0.579	-0.326	-0.252	-0.618
	0.018	0.018	0.072	0.020	0.027	0.037	0.060	0.015	0.049	0.018
year==2003	-0.398	-0.297	0.932	0.023	0.099	0.094	-0.561	-0.307	-0.315	-0.540
	0.019	0.018	0.018	0.020	0.026	0.037	0.060	0.015	0.049	0.018
year==2004	-0.336	-0.238	-1.436	0.145	-0.103	0.154	-0.046	-0.240	-0.359	-0.439
	0.019	0.018	0.018	0.025	0.031	0.047	0.142	0.015	0.048	0.018
year==2005	-2.208	-2.183	0.464	-1.916	-1.649	-1.983	-1.905	-1.847	-1.704	-1.972
	0.022	0.021	0.016	0.027	0.032	0.053	0.099	0.017	0.054	0.020
year==2006	-0.138	-0.141	0.237	0.102	-0.047	0.079	0.053	-0.190	-0.158	-0.251
	0.019	0.018	0.016	0.024	0.030	0.046	0.098	0.015	0.046	0.018
year==2007	-0.057	-0.067	0.000	0.064	-0.021	0.066	-0.028	-0.097	-0.047	-0.153
	0.019	0.018	0.000	0.024	0.029	0.045	0.090	0.015	0.045	0.019
Constant	-0.245	0.095	-3.229	-0.968	-0.231	-1.144	1.127	2.240	0.210	3.375
	0.012	0.012	0.017	0.014	0.019	0.026	0.059	0.017	0.032	0.023
N	14811	15977	8970	11798	5675	2910	1530	17723	1608	8156

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7-1: Productivity distribution of non-exporters (Industry 6-15)

	6	9	10	12	13	14	15
lnYd	0.855	0.539	0.001	0.705	0.865	0.903	0.949
	0.047	0.041	0.000	0.097	0.010	0.015	0.018
year==1999	0.224	-0.337	0.151	0.599	-0.282	-0.421	-0.440
	0.237	0.210	0.064	0.319	0.040	0.052	0.062
year==2000	0.162	-0.124	0.150	-0.113	-0.214	-0.404	-0.256
	0.230	0.194	0.064	0.222	0.039	0.052	0.061
year==2001	-0.269	-0.187	-0.088	-0.001	-0.178	-0.331	-0.329
	0.225	0.180	0.065	0.205	0.039	0.053	0.062
year==2002	0.273	0.140	-0.048	0.079	-0.126	-0.275	-0.231
	0.228	0.238	0.069	0.206	0.041	0.055	0.063
year==2003	0.492	-0.107	-0.087		-0.087	-0.256	-0.104
	0.276	0.201	0.065		0.041	0.054	0.064
year==2004	0.447	-0.111	-0.044		-0.018	-0.186	-0.222
	0.304	0.208	0.067		0.040	0.052	0.063
year==2005	-1.696	-1.413	0.151		-2.752	-2.256	-2.179
	0.211	0.179	0.065		0.052	0.064	0.076
year==2006	0.476	0.003	-0.122		-0.075	-0.026	-0.135
	0.201	0.153	0.070		0.036	0.048	0.060
year==2007	0.230	-0.066	-0.153		0.000	-0.010	-0.047
	0.201	0.155	0.071		0.037	0.048	0.061
Constant	-0.819	-1.167	-6.588	1.843	-0.290	-0.010	-1.027
	0.182	0.104	0.112	0.385	0.025	0.033	0.038
N	235	177	585	31	3530	2037	1150

$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table 7-2: Productivity distribution of non-exporters (Industry 16-25)

	16	17	18	19	20	21	22	23	24	25
lnYd	0.449	1.139	1.095	1.042	1.002	1.113	0.992	1.106	1.097	0.778
	0.023	0.007	0.008	0.013	0.023	0.022	0.018	0.024	0.017	0.034
year==1999	0.088	-0.582	-0.580	-0.217	-0.468	-0.397	0.007	-0.706	-0.209	-0.962
	0.145	0.020	0.025	0.038	0.070	0.070	0.066	0.073	0.046	0.133
year==2000	0.526	-0.470	-0.502	-0.252	-0.267	-0.416	0.087	-0.618	-0.215	-0.566
	0.143	0.020	0.025	0.038	0.085	0.069	0.071	0.077	0.047	0.139
year==2001	0.224	-0.360	-0.367	-0.116	-0.278	-0.291	0.302	-0.380	-0.187	-0.560
	0.125	0.021	0.025	0.039	0.076	0.067	0.079	0.083	0.047	0.138
year==2002	0.669	-0.353	-0.348	-0.058	-0.364	-0.168	0.427	-0.239	-0.111	-0.861
	0.149	0.021	0.026	0.040	0.077	0.069	0.078	0.082	0.049	0.153
year==2003	0.663	-0.250	-0.304	0.010	-0.388	-0.100	0.336	-0.343	-0.044	-0.440
	0.162	0.021	0.026	0.041	0.074	0.067	0.085	0.090	0.049	0.135
year==2004	0.552	-0.165	-0.176	-0.035	-0.269	-0.225	0.571	-0.078	0.006	-0.343
	0.135	0.021	0.026	0.040	0.066	0.064	0.074	0.077	0.049	0.127
year==2005	-0.748	-2.784	-2.962	-2.695	-2.584	-2.833	-1.651	-2.553	-2.622	-1.400
	0.156	0.027	0.035	0.052	0.091	0.081	0.063	0.082	0.066	0.127
year==2006	0.253	-0.069	-0.057	-0.010	-0.135	-0.110	0.433	-0.228	0.031	-0.073
	0.151	0.021	0.025	0.039	0.060	0.054	0.056	0.061	0.046	0.119
year==2007	0.037	-0.080	-0.017	-0.002	0.050	-0.009	0.635	-0.003	0.034	-0.112
	0.159	0.021	0.025	0.038	0.059	0.051	0.054	0.058	0.047	0.116
Constant	1.150	-1.331	0.447	0.227	-0.404	-0.719	-0.081	0.732	-0.333	-0.982
	0.140	0.014	0.019	0.028	0.035	0.026	0.027	0.048	0.028	0.081
N	77	14037	7906	3200	1094	1178	867	657	2271	189

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7-3: Productivity distribution of non-exporters (Industry 26-35)

	26	27	28	29	30	31	32	33	34	35
lnYd	0.977	0.917	0.943	1.037	1.150	1.026	0.884	0.893	1.066	1.109
	0.008	0.011	0.023	0.020	0.013	0.010	0.020	0.016	0.010	0.008
year==1999	-0.613	-0.436	-0.652	-0.700	-0.364	-0.397	-0.284	-0.262	-0.374	-0.403
	0.029	0.041	0.079	0.055	0.037	0.034	0.070	0.059	0.028	0.025
year==2000	-0.516	-0.302	-0.713	-0.682	-0.340	-0.358	-0.260	-0.213	-0.322	-0.396
	0.028	0.040	0.078	0.058	0.037	0.034	0.071	0.059	0.029	0.026
year==2001	-0.500	-0.261	-0.546	-0.549	-0.349	-0.308	-0.317	-0.234	-0.348	-0.323
	0.029	0.041	0.083	0.058	0.038	0.035	0.075	0.057	0.029	0.026
year==2002	-0.404	-0.239	-0.616	-0.357	-0.281	-0.305	-0.250	-0.194	-0.247	-0.278
	0.029	0.042	0.080	0.060	0.039	0.035	0.077	0.069	0.030	0.027
year==2003	-0.376	-0.238	-0.362	-0.401	-0.099	-0.190	-0.188	-0.133	-0.226	-0.247
	0.029	0.042	0.081	0.061	0.038	0.035	0.077	0.055	0.030	0.027
year==2004	-0.298	-0.128	-0.175	-0.234	-0.090	-0.166	-0.099	-0.150	-0.165	-0.159
	0.029	0.041	0.088	0.061	0.039	0.035	0.073	0.055	0.031	0.026
year==2005	-2.497	-2.008	-2.302	-2.652	-2.834	-2.367	-2.040	-2.282	-2.611	-2.564
	0.035	0.046	0.097	0.077	0.048	0.039	0.080	0.065	0.039	0.032
year==2006	-0.144	-0.028	-0.204	-0.256	-0.084	-0.007	0.012	-0.019	-0.125	-0.131
	0.028	0.039	0.083	0.058	0.036	0.032	0.069	0.053	0.030	0.025
year==2007	-0.108	-0.066	-0.207	-0.218	-0.046	0.090	0.014	-0.034	-0.088	-0.069
	0.028	0.039	0.083	0.059	0.034	0.032	0.067	0.054	0.029	0.025
Constant	-0.686	0.363	-0.184	-0.944	-0.153	0.763	-0.404	-0.878	-0.169	-0.747
	0.019	0.030	0.056	0.033	0.020	0.028	0.046	0.034	0.018	0.017
N	7869	3222	532	1567	3333	4273	1014	1563	5559	9037

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7-4: Productivity distribution of non-exporters (Industry 36-46)

	36	37	39	40	41	42	43	44	45	46
lnYd	1.013	1.045	1.015	0.977	0.997	0.992	1.096	0.913	0.694	0.439
	0.009	0.010	0.011	0.008	0.010	0.012	0.015	0.041	0.068	0.024
year==1999	-0.603	-0.477	1.257	0.320	0.436	0.669	-1.504	0.018	-0.220	-0.449
	0.029	0.033	0.092	0.027	0.033	0.042	0.250	0.192	0.277	0.294
year==2000	-0.471	-0.439	0.974	0.234	0.326	0.618	-1.441	-0.164	0.741	-1.139
	0.030	0.033	0.088	0.027	0.033	0.043	0.250	0.177	0.340	0.273
year==2001	-0.405	-0.313	1.003	0.293	0.405	0.587	-1.482	0.138	-0.434	-1.186
	0.030	0.032	0.083	0.027	0.033	0.043	0.250	0.188	0.253	0.250
year==2002	-0.347	-0.268	0.596	0.241	0.358	0.566	-1.438	0.177	-0.413	0.194
	0.031	0.034	0.098	0.027	0.034	0.043	0.250	0.188	0.279	0.293
year==2003	-0.289	-0.160	1.100	0.218	0.382	0.429	-1.381	0.224	-0.195	-0.460
	0.032	0.032	0.030	0.028	0.034	0.044	0.250	0.204	0.252	0.294
year==2004	-0.278	-0.124	-1.488	0.315	0.194	0.402	0.309	0.547	0.133	-0.013
	0.031	0.032	0.031	0.030	0.040	0.038	0.555	0.194	0.242	0.293
year==2005	-2.435	-2.543	0.542	-2.160	-2.092	-2.009	-2.151	-1.728	-1.431	-2.683
	0.037	0.039	0.027	0.034	0.044	0.047	0.556	0.158	0.244	0.247
year==2006	-0.165	-0.086	0.300	0.181	0.129	0.249	0.779	-0.253	-0.161	-1.460
	0.029	0.030	0.025	0.027	0.038	0.037	0.430	0.140	0.222	0.227
year==2007	-0.075	-0.023	0.000	0.141	0.077	0.111	0.271	-0.298	0.135	-1.521
	0.029	0.028	0.000	0.026	0.036	0.038	0.555	0.143	0.242	0.228
Constant	-0.186	0.224	-3.485	-1.167	-0.266	-1.432	2.662	2.737	0.387	3.107
	0.019	0.021	0.030	0.013	0.022	0.022	0.252	0.203	0.208	0.281
N	5564	5051	4210	6101	3385	2754	1838	250	35	68

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$