Pure Exporter: Theory and Evidence

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Abstract

This paper provides the first evidence about pure exporters (i.e., firms exporting all of their output to the foreign market) – a phenomenon overlooked and cannot be explained in the existing literature. It then offers a generalized model of Melitz (2003) for examining the existence and behavior of pure exporters. In particular, pure exporters arise when the export market is sufficiently large – a situation more likely to hold in developing countries as opposed to large developed countries; and their productivity levels are above those of non-exporters, but below those of firms having both domestic sales and export. These theoretical predictions are borne out in a data of Chinese manufacturing firms for the period of 1998-2005.

Keywords: Pure Exporter, Firm Heterogeneity, Exporting Behavior
JEL Codes: F12, F23, L22, D24

1 Introduction

In the past decade, there has been a growing literature on firm heterogeneity and exporting behavior. A dominant theoretical explanation is that more productive firms self-select to become exporters (e.g., Melitz, 2003). Specifically, in Melitz's framework, there is a fixed cost of production, and a fixed cost of exporting but no fixed cost of selling in the domestic market. As a result, in equilibrium there are only two types of firms: less productive firms sell only in the domestic market, while more productive firms have both domestic sales and export.[1]

In reality, however, there are firms exporting all of their output (called *pure exporters*). For example, McMillan and Woodruff (1999) report that in their sample of firms in Vietnam, as high as 9% of them exports all of their production. Meanwhile, from a sample of Chinese manufacturing firms for the period of 1998-2005, we find that nearly 3% firms are pure exporters. How to explain the existence of pure exporters? And what kinds of firms choose to become pure exporters? In this paper, we offer a theoretical explanation for pure exporters, and then test the theoretical predictions using a data of Chinese manufacturing firms.

In our theoretical analysis, we build upon Melitz (2003)'s framework by generalizing its key assumption about fixed cost of selling. Instead of assuming that there is no fixed cost of selling in the domestic market but a fixed cost of exporting, we assume that there is also a fixed cost for domestic sales albeit lower than that of exporting. Under this more generalized framework, we have the same results as in Melitz (2003) when the export market is not sufficiently large, that is, there are just two types of firms in equilibrium with the more productive firms having both domestic sales and export while the less productive firms selling only in the domestic market. However, when the export market is sufficiently large, there are three types of firms in equilibrium: firms having both domestic sales and export are the most productive, followed by pure exporters, and finally by firms with domestic sales only.

The intuition for our theoretical results is as follows. The three types of firms differ in the fixed costs of operations (including both production and sales): firms with both domestic sales and export have the highest fixed costs, followed by pure exporters, and finally by firms with domestic sales only. Meanwhile they also differ in the production efficiency, which is jointly determined by the unit cost of production and market size. As the unit cost of production is the same across the three types of firms (because production

[1]Existing empirical studies only include a dummy indicating whether or not a firm exports without distinguishing pure exporters from exporters that also have domestic sales (see for example, Clerides, Lach, and Tybout, 1998; Bernard and Jensen, 1999).

takes place in the same country), the variations in production efficiency come from the differences in market size, with a bigger market size leading to higher production efficiency.

It is clear that firms with both domestic sales and export have the highest production efficiency among the three. However, the ranking in production efficiency between firms with domestic sales only and firms with export only depends on the relative size of the domestic market vis-à-vis the export market. When the export market is sufficiently larger than the domestic market, firms with both domestic sales and export have the highest production efficiency, followed by pure exporters, and finally by firms with domestic sales only. Combined with the ranking in fixed costs of operations, it follows that firms having both domestic sales and export are the most productive, followed by pure exporters, and finally by firms with domestic sales only. However, when the export market is not sufficiently large, firms with domestic sales have higher production efficiency than pure exporters, and they dominate pure exporters as they also enjoy lower fixed costs of operations. Hence, in equilibrium, there are only two types of firms, with the more productive firms having both domestic sales and export while the less productive firms selling only in the domestic market.

Next, using the data set of Chinese manufacturing firms, we compare the three types of firms in terms of productivity. Preliminary statistics reported in Table 1 show that firms having both domestic sales and export always have the highest rank among the three types of firms in terms of employment, fixed assets, output, and productivity.[2] On the other hand, firms with domestic sales have the lowest ranking except in the category of fixed assets. For further empirical analysis, we regress firm productivity on a dummy variable for domestic sales only, and a dummy variable for domestic sales and export, together with a list of industry, region and year dummies. Regression results show that firms with domestic sales and export have the highest productivity, followed by pure exporters, and finally by firms with domestic sales only. These results are robust to the exclusion of outlying observations, to the inclusion of firm size, an alternative classification of Chinese domestic firms, two sub-samples, and an alternative estimation method. These empirical results are consistent with our theoretical predictions.

This paper contributes to the literature by being the first one documenting and then offering a generalized model of Melitz (2003) to explain the existence and behavior of pure exporters. In particular, pure exporters arise

[2]Here we estimate the total factor productivity using four different methodologies, that is, OLS, fixed-effect, GMM, and Levinsohn and Petrin (2003)'s. Details of these estimations are presented in Section 3.

when the export market is sufficiently large vis-a-vis the domestic market, a situation more likely to hold in developing countries than in large developed countries. This also explains why we are able to identify pure exporters that are overlooked in the existing literature, because our empirical work utilizes the data from China in contrast to most of the existing work that use data from large developed countries.

The remainder of the paper is structured as follows. A theoretical analysis of pure exporters is offered in Section 2, while empirical tests of the theoretical predictions are presented in Section 3. The paper concludes with Section 4.

2 Theoretical Analysis

In this section, we provide a generalized model of Melitz (2003) to explain the existence of pure exporters and analyze its differences from other two types of firms (firms with both domestic sales and export, and non-exporters). There are two countries (i.e., home (H) and foreign (F)), two sectors (i.e., a homogeneous good (X) produced with a constant returns to scale technology and a continuum of differentiated goods (Y) produced with an increasing returns to scale technology), and one production factor (labor).

Following the literature, we take the homogeneous good (X) as a numéraire and assume the utility function for the differentiated goods (Y) to be a constant elasticity of substitution (CES) function. Then the demand function for variety ω of the differentiated goods Y in country l can be derived as:

$$y^l(\omega) = \alpha^{\frac{-\alpha}{1-\alpha}} I^l (p^l(\omega))^{\frac{-1}{1-\alpha}} \tag{1}$$

where $l \in \{H, F\}$ is the index for the country; $y^l(\omega)$ is the consumption of variety ω of the differentiated goods Y in country l; $I^l \equiv M^l (Y^l)^{\frac{\mu-\alpha}{1-\alpha}}$ is the measure for the size of market in country l, where M^l is the number of consumers and Y^l is the index of aggregate consumption of differentiated goods in country l; and $p^l(\omega)$ is the price of variety ω in country l. The elasticity of substitution between any two differentiated goods is $\sigma \equiv 1/(1-\alpha) > 1$. The variety parameter ω is left out hereon as all the cases are symmetric.

The production of the differentiated goods (y) takes place in the home country. The unit production cost is given by c/θ, where θ is the firm-specific productivity measure drawn from a common distribution. Meanwhile, the fixed cost of production is same across all firms and given by f_p. Moreover, the transport cost of differentiated goods to the foreign market takes the form of an iceberg cost, i.e., one needs $t > 1$ units of final product in order to ship 1 unit to an abroad market.

Thus far the setup is the same as in Melitz (2003). The departure of our model from his lies in the assumption about the fixed cost of selling the differentiated goods. In Melitz (2003), it is assumed that there is zero fixed cost of selling in the home market, but a positive fixed cost of selling in the foreign market. In contrast, we assume that there is also a positive fixed cost of selling the home market (denoted by f_s^H), though it is lower than the fixed cost of selling in the foreign market (denoted by f_s^F), which is lower than the fixed cost of selling in both markets (denoted by f_s^{HF}), i.e., $0 < f_s^H < f_s^F < f_s^{HF}$.

A firm needs to decide where to sell its products. There are three possible choices: selling only in the home market (non-exporters), selling only in the foreign market (pure exporters), and selling in both home and foreign markets. For ease of exposition, we denote these three choices by $\sigma(H)$, $\sigma(F)$, and $\sigma(HF)$, respectively.

Given the above setup, we can derive the equilibrium profit function for these three choices as:

$$\begin{cases} \pi_{\sigma(H)} = \frac{(1-\alpha)I^H}{C}\Theta - (f_p + f_s^H) \\ \pi_{\sigma(F)} = \frac{(1-\alpha)\frac{I^F}{T}}{C}\Theta - (f_p + f_s^F) \\ \pi_{\sigma(HF)} = \frac{(1-\alpha)\left(I^H + \frac{I^F}{T}\right)}{C}\Theta - (f_p + f_s^{HF}) \end{cases}, \tag{2}$$

where $\Theta \equiv \theta^{\frac{\alpha}{1-\alpha}}$ is a monotonic transform of productivity θ; $C \equiv c^{\frac{\alpha}{1-\alpha}}$ is a monotonic transform of unit production cost c; $T \equiv t^{\frac{\alpha}{1-\alpha}}$ is a monotonic transform of transport cost t; and I^l is the market size in country l, $l \in \{H, F\}$.

Note that the profit function for each of these three choices is a linear function of Θ, and it just differs in the slope term (denoted by ϕ) and the intercept term (the negative of all the fixed costs, denoted by F). The comparison of the fixed costs across the three choices is straightforward, in which:

$$F_{\sigma(H)} < F_{\sigma(F)} < F_{\sigma(HF)}, \tag{3}$$

where $F_{\sigma(H)} = f_p + f_s^H$; $F_{\sigma(F)} = f_p + f_s^F$; and $F_{\sigma(HF)} = f_p + f_s^{HF}$.

The slope term (ϕ) is determined by the unit cost of production (the denominator, C) and the size of the markets (the nominator, $\sum I^l$). As the production takes place only in the home market, the three choices have the same unit cost of production, and they only differ in the size of the markets. The choice $\sigma(HF)$ involves the selling in both the home and the foreign markets, and thus it has the largest market coverage or the steepest slope term. The comparison of the slope term between the choice $\sigma(H)$ and

the choice $\sigma(F)$ hinges upon the relative size of the home market and the foreign market (adjusted by the transport cost). When the (transport-cost-adjusted) foreign market is smaller than the home market (that is, $\frac{I^F}{T} < I^H$), the slope term of the choice $\sigma(H)$ is steeper than that of the choice $\sigma(F)$. When the (transport-cost-adjusted) foreign market is larger than the home market (that is, $\frac{I^F}{T} \geq I^H$), the slope term of the choice $\sigma(F)$ is steeper than that of the choice $\sigma(H)$. So we have the following ranking of the slope term for these three choices:

$$\begin{cases} \phi_{\sigma(F)} < \phi_{\sigma(H)} < \phi_{\sigma(HF)} \text{ when } \frac{I^F}{T} < I^H \\ \phi_{\sigma(H)} < \phi_{\sigma(F)} < \phi_{\sigma(HF)} \text{ when } \frac{I^F}{T} > I^H \end{cases}, \tag{4}$$

where $\phi_{\sigma(H)} = \frac{(1-\alpha)}{C} I^H$; $\phi_{\sigma(F)} = \frac{(1-\alpha)}{C} \frac{I^F}{T}$; and $\phi_{\sigma(HF)} = \frac{(1-\alpha)}{C} \left(I^H + \frac{I^F}{T} \right)$.

With inequalities (3) and (4), it follows that the optimal choice for a firm depends on its productivity:

Proposition: *When the foreign market is not sufficiently large, in equilibrium there are only two types of firms: the more productive firms sell in both the home and foreign markets, while the less productive firms sell only in the home market (the non-exporters). When foreign markets are sufficiently large, in equilibrium there are three types of firms: the most productive firms sell in both the home and foreign markets, the least productive ones sell only in the home market (the non-exporters), and those in the middle sell only in foreign markets (the pure exporters).*

Proof: See the Appendix.

The intuition for the proposition is as follows. For the case where the foreign market is not sufficiently large, the choice of selling only in the foreign market ($\sigma(F)$) is always dominated by the choice of selling only in the home market ($\sigma(H)$). This is because the former has a higher fixed costs but a smaller market coverage than the latter. Meanwhile, compared with the choice of selling in both the home and the foreign markets ($\sigma(HF)$), $\sigma(H)$ has a lower fixed costs but a smaller market coverage. Thus, the equilibrium choice depends on firm productivity as elucidated in the literature on firm heterogeneity and exporting behavior, with the more productive firms choosing $\sigma(HF)$ while the less productive ones choosing $\sigma(H)$.

For the case where the foreign market is sufficiently large, none of these three choices is always dominated by others. As we move from the choice of selling only in the home market ($\sigma(H)$), to the choice of selling only in the

foreign market ($\sigma(F)$), and finally to the choice of selling in both the home and foreign markets ($\sigma(HF)$), the fixed costs are increasing (i.e., $F_{\sigma(H)} < F_{\sigma(F)} < F_{\sigma(HF)}$), but so are the market coverage (i.e., $\phi_{\sigma(H)} < \phi_{\sigma(F)} < \phi_{\sigma(HF)}$). The equilibrium choice depends on firm productivity, namely, the most productive firms choose $\sigma(HF)$, the least productive ones choose $\sigma(H)$, and those in the middle choose $\sigma(F)$.

It is interesting to point out why pure exporters do not exist in equilibrium under Melitz (2003)'s framework. In Melitz (2003), it is assumed that the fixed cost of selling in the home market is zero (i.e., $f_s^H = 0$). Under this assumption, the choice of selling only in the foreign market ($\sigma(F)$) is always dominated by the choice of selling in both the home and the foreign markets ($\sigma(HF)$). This is because the former has the same fixed costs as the latter (i.e., $F_{\sigma(F)} = F_{\sigma(HF)}$), but has a smaller market coverage than the latter (i.e., $\phi_{\sigma(F)} < \phi_{\sigma(HF)}$). Intuitively, as there is no extra fixed cost of selling in the home market, firms always have sales in the home market.

Under our more generalized framework (i.e., $0 < f_s^H < f_s^F$), however, pure exporters may exist in equilibrium, and the condition for its existence is that the foreign market is sufficiently larger than the home market. However, if this condition is not satisfied, the choice of selling in the foreign market (or the pure exporters) is dominated by the choice of selling only in the home market (or the non-exporters), and the equilibrium choice is between selling only in the home market ($\sigma(H)$) and selling in both the home and foreign markets ($\sigma(HF)$) just as in Melitz (2003).

3 Empirical Analysis

Our empirical analysis uses data from annual surveys of manufacturing firms conducted by the National Bureau of Statistics of China for the period of 1998 to 2005. These annual surveys covered all state-owned enterprises, and those non-state-owned enterprises with annual sales of five million Chinese currency (about US$650,000) or more. The data provides detailed information on firms' identification, operations and performance, including firm ownership, output and export, which are of special interest to this study. The number of manufacturing firms varies from over 140,000 in the late 1990s to over 243,000 in 2005. The percentage of China's total exports contributed by firms in our dataset was just below 70% in late 1990s, and was as high as 76% in 2005, indicating that our data set is highly comprehensive.

According to the classification of the National Bureau of Statistics of China, firms with more than 25% equity shares held by foreign multinationals are classified as foreign affiliates, and the rest is classified as China's

domestic firms. As the literature almost exclusively examines the exporting behavior of domestic firms, in this study we also focus on the exporting behavior of domestic firms, and hence simply refer to domestic firms as firms.[3] The number of firms in China with valid information on export, output, employment, fixed assets and intermediate inputs ranges from 112,246 in 1998 to 192,234 in 2005. As shown in Table 1, for the period of 1998-2005, 80.96% of firms only sell in the home market, 15.75% of firms have sales in both the home and foreign markets, and finally 3.29% of firms sell only in the foreign market.

To estimate total factor productivity (TFP), we first use the OLS regression method. Specifically, we use the constant value of output, deflate the fixed assets by the fixed-assets investment price index and intermediate inputs by the producer price index, and estimate for firms in each 2-digit industry and each year (see also Bernard and Jensen, 1999). The OLS estimation of TFP, however, may suffer from the simultaneity problem, specifically, input choices could be endogenously determined by unobservable productivity shocks. This may lead to an upward bias in the estimation coefficients of more variable inputs such as capital (Van Biesebroeck, 2007). We therefore use three alternative estimation methods, that is, panel fixed-effect estimation, the instrumental estimation (i.e., GMM), and semi-parametric estimation[4] (i.e., Levinsohn and Petrin (2003)'s TFP estimation method).[5] Table 2 provides the correlation among these four different measures of TFP.

Table 1 also provides some preliminary comparison of these three types of firms in terms of output, employment, fixed assets, and TFP. It is clear that firms with sales in both the home and foreign markets always have the largest output, employment and fixed assets, and the highest TFP. Meanwhile, except for fixed assets, firms with domestic sales only have smallest output and employment, and the lowest TFP. These preliminary results, in particular the TFP, are consistent with our theoretical predictions.

To further investigate the exporting behavior of firms in China, we esti-

[3] In addition, as shown in Lu, Lu, and Tao (2010), the exporting behavior of foreign affiliates is rather different and complicated, as multinationals can choose the location of production as well as the location of market.

[4] Another semi-parametric estimation method for dealing with the endogeneity problem is Olley and Pakes method (1996), which uses investment as a proxy for unobservable productivity shocks. However, there is substantial missing information on investment in our data. Therefore Olley and Pakes method is not econometrically efficient in our case.

[5] However, these three alternative estimation methods may also have their own estimation concerns, for example, the semi-parametric estimation may lead to larger biases than the OLS estimates if unobservable productivity shocks are mostly transitory and the firm fixed effects are significant. For detailed discussion on the differences among various methods for estimating TFP, please see Van Biesebroeck (2007).

mate the following equation:

$$TFP_{firt} = \alpha + \beta \cdot Home_{firt} + \gamma \cdot Home\ and\ Foreign_{firt} + \delta_i + \eta_r + \lambda_t + \varepsilon_{firt} \quad (5)$$

where TFP_{firt} is the TFP of firm f in industry i, region r and year t; $Home_{firt}$ is a dummy variable having value of one if firm f sells only in the home market, and zero otherwise; $Home\ and\ Foreign_{firt}$ is a dummy variable having value of one if firm f sells in both the home and foreign markets, and zero otherwise; δ_i, η_r and λ_t are 4-digit industry dummy, region dummy,[6] and year dummy, respectively; and ε_{firt} is the error term. To deal with the possible heteroskedasticity problem, we use the robust standard error clustered at the firm level.

Regression results for equation (5) are reported in Table 3. We use TFP estimated using Levinsohn and Petrin (2003)'e method as the dependent variable in Column (1), TFP estimated using OLS method as the dependent variable in Column (2), TFP estimated using panel fixed-effect method as the dependent variable in Column (3), and finally TFP estimated using GMM as the dependent variable in Column (4). It is clear that in all these regressions, the coefficient for $Home_{firt}$ is negative and statistically significant, whereas the coefficient for $Home\ and\ Foreign_{firt}$ is positive and statistically significant. These results suggest that firms having sales in both the home and foreign markets are the most productive, followed by firms with sales only in the foreign market, and finally, by firms with sales only in the home market.

As shown in the Proposition in Section 2, pure exporters arise only when the export market is sufficiently large vis-à-vis the domestic market, and their productivity levels lie between those of non-exporters and those of firms having both domestic sales and export. It is reasonable to argue that the condition of sufficiently large export market holds more likely for developing countries such as China as compared with large developed countries such as the United States. Indeed our identification of the existence of pure exporters among the Chinese manufacturers lends support to the above argument. Moreover, our empirical findings on the productivity ranking across the three types of firms lend further support to our theoretical predictions in the Proposition.

In the remaining part of this section, we conduct a series of robustness checks on the productivity ranking of non-exporters, pure exporters, and firms with sales in both the home and the foreign markets. As the results with each of these four measures of TFP are similar, we only report the estimation results using TFP estimated by Levinsohn and Petrin (2003)'s method as the dependent variable to save space.

[6]Region here refers to 22 provinces, 4 province-level municipalities, and 5 minority autonomous regions in China.

First, to address the concern that our results could be driven by some outlying observations, we exclude the top and bottom 1% observations in our sample and repeat the analysis. The results shown in Column 1 of Table 4 demonstrate clearly that out findings in Table 3 remain robust.

Second, to make sure that our findings are not entirely driven by firm size, we incorporate *Firm Size* (defined as the logarithm of employment) in the regression analysis. The result reported in Column 2 of Table 4 reveal that our findings remain robust to the inclusion of *Firm Size*.

Third, we use an alternative definition of domestic firms – the official ownership type reported by firms in the survey – instead of that implied by equity ownership. Specifically, there are five types of ownership: state-owned firms, collectively-owned firms, joint-stock companies, privately-owned firms, and foreign-invested firms. We treat firms with the first four types of ownership as domestic firms. As shown in Column 3 of Table 4, our findings remain robust to this alternative definition of domestic firms.

Fourth, we split the whole sample into two sub-samples to take care of the possible changes of exporting behavior over time. In particular, China entered into the WTO near the end of 2001, which might facilitate the export of China's domestic firms and enlarge the foreign market vis-à-vis the domestic market. Hence, we split the sample period into two, the pre-WTO period (1998-2001) and the post-WTO period (2002-2005), and repeat the analysis. As shown in Columns 4-5 of Table 4, the estimated coefficients for $Home_{firt}$ are negative and statistically significant for both the pre- and the post-WTO periods, though the magnitude of the coefficient drops substantially from the pre- to the post-WTO period. Intuitively, with China's entry into the WTO, entry barriers into the foreign market are lowered down (or transport cost t drops in our model), which narrows down the productivity gap between non-exporters and pure exporters. Meanwhile, the estimated coefficients for $Home\ and\ Foreign_{firt}$ are positive and statistically significant for both the pre- and the post-WTO periods, with similar magnitudes. Intuitively, the productivity gap between pure exporters and firms with sales in both the home and foreign markets is driven by the fixed cost of selling in the home market as well as the size of the home market, none of which is significantly affected by China's entry into the WTO.

Lastly, to reflect the self-selection feature of exporting behavior by firms in terms of their productivity levels as stated in the Proposition, we use an alternative estimation method, that is, multinomial logistic estimation.[7]

[7] Another two possible choices are ordered probit estimation and ordered logit estimation. The advantage of multinomial logit estimation over these two methods is that multinomial logit estimation places no order on the dependent variable that takes ordinal values.

Specifically, we construct a new variable, called $Exporting\ Status_{firt}$, which takes a value of 1 if a firm sells only in the home market, a value of 2 if it sells in both the home and foreign markets, and a value of 3 if it sells only in foreign markets. Set $Exporting\ Status_{firt} = 1$ as the base outcome and the multinomial logistic estimation generates two relative risk ratios, corresponding to the other two outcomes (that is, $Exporting\ Status_{firt} = 2$ and $Exporting\ Status_{firt} = 3$). A relative risk ratio for the explanatory variable X_k measures the change in the predicted odds favoring $Exporting\ Status_{firt} = j \in \{2, 3\}$ relative to the base outcome $Exporting\ Status_{firt} = 1$ associated with an 1-unit increase in X_k. In other words, the relative risk ratio (rrr_{j1}) for X_k takes the following form:

$$rrr_{j1} = \frac{P(ExportingStatus_{firt} = j|X_k + 1)}{P(ExportingStatus_{firt} = 1|X_k + 1)} \Big/ \frac{P(ExportingStatus_{firt} = j|X_k)}{P(ExportingStatus_{firt} = 1|X_k)}.$$

Hence, $rrr_{j1} > 1$ means that with an increase in X_k, a firm is more likely to choose outcome value j relative to the base outcome; whereas $rrr_{j1} < 1$ means that with an increase in X_k, a firm is less likely to choose outcome value j relative to the base outcome. In our regression, we take $X_k = TFP_{firt-1}$ and control for 4-digit industry dummy, region dummy and year dummy. The estimation results are reported in Table 5. As shown in Column 2, the relative risk ratio for outcome $ExportingStatus_{firt} = 3$ over basic outcome $ExportingStatus_{firt} = 1$ (rrr_{31}) is $1.392 > 1$ and statistically significant. This means that with an increase in firm productivity level in the last period, a firm is more likely to switch from selling only in the home market to selling only in foreign markets, which is consistent with the theoretical prediction in the Proposition. Given the relative risk ratio rrr_{21} in Column 1, we can calculate the relative risk ratio for outcome $ExportingStatus_{firt} = 2$ over outcome $ExportingStatus_{firt} = 3$, that is

$$rrr_{23} = rrr_{21}/rrr_{31} = 2.268 > 1.$$

This means that an increase in firm productivity level is associated with a higher probability of selling in both the home and foreign markets than selling only in foreign markets, which is again consistent with the theoretical prediction in the Proposition.

4 Conclusion

This paper studies the existence and behavior of pure exporters, which are overlooked and cannot be explained by the existing literature. Using a generalized model of Melitz (2003), we first identify the condition for the existence

of pure exporters, that is, the sufficiently large foreign market relative to the domestic market. We then show that in the presence of pure exporters, their productivity levels are above those of non-exporters, but below those of firms having both domestic sales and export. To examine the relevance of these theoretical predictions, we use a data of manufacturing firms for the period of 1998-2005 from China, for which the foreign market is arguably much larger compared with the domestic market. From this data, we find quite a substantial number of pure exporters, and their productivity ranking vis-à-vis the other two types of firms highly consistent with our theoretical predictions.

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Appendix

Proof of Proposition: Let us first consider the case that the foreign market is not sufficiently large, i.e., $\frac{I^F}{T} < I^H$. In this case, the choice $\sigma(F)$ (selling only in the foreign market or pure exporting) is dominated by the choice $\sigma(H)$ (selling only in the home market or domestic sale only), as

$$\begin{aligned}\pi_{\sigma(F)} &= \frac{(1-\alpha)\frac{I^F}{T}}{C}\Theta - (f_p + f_s^F) \\ &< \frac{(1-\alpha)I^H}{C}\Theta - (f_p + f_s^F) \\ &< \frac{(1-\alpha)I^H}{C}\Theta - (f_p + f_s^H) = \pi_{\sigma(H)}.\end{aligned}$$

The first inequality comes as $\frac{I^F}{T} < I^H$, while the second inequality is due to the assumption $0 < f_s^H < f_s^F$. Hence, in the equilibrium, there are only two available choices: $\sigma(H)$ and $\sigma(HF)$ (selling in both home and foreign markets).

Denote the cutoff point Θ_1 as $\pi_{\sigma(H)}(\Theta_1) = 0$, i.e.,

$$\Theta_1 = \frac{f_p + f_s^H}{(1-\alpha)I^H}C$$

and the cutoff point Θ_2 as $\pi_{\sigma(H)}(\Theta_2) = \pi_{\sigma(HF)}(\Theta_2)$, i.e.,

$$\Theta_2 = \frac{f_s^{HF} - f_s^H}{(1-\alpha)\frac{I^F}{T}}C$$

When $\frac{I^F}{T} < \frac{f_s^{HF} - f_s^H}{f_p + f_s^H} I^H$, we have

$$0 < \Theta_1 < \Theta_2.$$

Thus, we have a clear dichotomy that when the foreign market is not sufficiently large, more productive firms sell in both the home and the foreign markets and less productive firms sell only in the home market.

Next, let us consider the case that foreign market is sufficiently large, i.e., $\frac{I^F}{T} > I^H$. In this case, in the equilibrium, there are three available choices: $\sigma(H)$, $\sigma(F)$ and $\sigma(HF)$.

Denote the cutoff point Θ_1' as $\pi_{\sigma(H)}(\Theta_1') = 0$ i.e.,

$$\Theta_1' = \frac{f_p + f_s^H}{(1-\alpha)I^H}C$$

and the cutoff point Θ_2' as $\pi_{\sigma(H)}(\Theta_2') = \pi_{\sigma(F)}(\Theta_2')$, i.e.,

$$\Theta_2' = \frac{f_s^F - f_s^H}{(1-\alpha)\left(\frac{I^F}{T} - I^H\right)} C$$

and the cutoff point Θ_3' as $\pi_{\sigma(F)}(\Theta_3') = \pi_{\sigma(HF)}(\Theta_3')$, i.e.,

$$\Theta_3' = \frac{f_s^{HF} - f_s^F}{(1-\alpha) I^H} C.$$

When $\frac{f_p + f_s^F}{f_p + f_s^H} I^H > \frac{I^F}{T} > \frac{f_s^{HF} - f_s^H}{f_s^{HF} - f_s^F} I^H$, we have

$$0 < \Theta_1' < \Theta_2' < \Theta_3'.$$

Thus, the most productive firms sell in both the home and foreign markets, followed by those selling in the foreign market only, and then by those selling in the home market only.

Table 1, Comparison of three types of Chinese manufacturers

	Domestic Sales Only	Domestic Sales and Export	Export Only
Number of Observations	841,818	163,730	34,244
Share of Total Sample	80.96%	15.75%	3.29%
Logarithm of Employment	4.656	5.452	4.988
Logarithm of Output	9.363	10.316	9.553
Logarithm of Fixed Assets	8.158	8.925	7.487
TFP LP	3.747	4.121	3.834

Table 2, Correlations among different measures of TFP

	TFP LP	TFP OLS	TFP FE	TFP GMM
TFP LP	1.0000			
TFP OLS	0.6681	1.0000		
TFP FE	0.9118	0.9060	1.0000	
TFP GMM	0.9222	0.8907	0.9971	1.0000

Table 3, Main Results, OLS Estimates

	1	2	3	4
Dependent Variable	TFP LP	TFP OLS	TFP FE	TFP GMM
Domestic Sales Only	-0.139***	-0.014***	-0.054***	-0.044***
	[0.004]	[0.002]	[0.003]	[0.003]
Domestic Sales and Export	0.190***	0.021***	0.078***	0.096***
	[0.004]	[0.002]	[0.003]	[0.003]
Constant	-0.805***	-2.840***	-1.948***	-1.927***
	[0.033]	[0.016]	[0.021]	[0.022]
Number of Observations	1,039,792	1,039,792	1,039,792	1,039,792
R-squared	0.2033	0.1159	0.1581	0.1636
p-value for F-test	0.0000	0.0000	0.0000	0.0000

Note: Standard errors, clustered at the firm-level, are reported in the bracket. *, **, *** represent statistical significance at the 10%, 5%, and 1%, respectively.

Table 4, Robustness Checks, OLS Estimates

Dependent Variable	1	2	3	4	5
Estimation Specification	Excluding Outlying Observations	Including Firm Size as an Additional Control	TFP LP Alternative Definition of Domestic Firms	Subsample of Firms from 1998-2001	Subsample of Firms from 2002-2005
Domestic Sales Only	-0.116***	-0.014***	-0.137***	-0.172***	-0.103***
	[0.004]	[0.003]	[0.004]	[0.006]	[0.004]
Domestic Sales and Export	0.167***	0.098***	0.207***	0.202***	0.192***
	[0.004]	[0.003]	[0.004]	[0.006]	[0.004]
Constant	3.378***	-1.313***	-0.809***	-0.810***	4.147***
	[0.194]	[0.026]	[0.034]	[0.042]	[0.271]
Number of Observations	1,018,996	1,039,792	1,025,030	462,642	577,150
R-squared	0.1964	0.3533	0.2070	0.2191	0.1650
p-value for F-test	0.0000	0.0000	0.0000	0.0000	0.0000

Note: Standard errors, clustered at the firm-level, are reported in the bracket. *, **, *** represent statistical significance at the 10%, 5%, and 1%, respectively.

Table 5, Robustness Check, Multinomial Logistic Estimates

Independent Variable	1 Exporting Status=2 Lag 1-year TFP LP	2 Exporting Status=3 Lag 1-year TFP LP	Number of Observations	Pseudo R2
Relative Risk Ratio	3.157*** [0.039]	1.392*** [0.028]	631,052	0.2172

Note: Standard errors, clustered at the firm-level, are reported in the bracket. *, **, *** represent statistical significance at the 10%, 5%, and 1%, respectively.