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WAKASUGI Ryuhei
RIETI

Hongyong ZHANG
Kyoto University

RIETI
Research Institute of Economy, Trade & Industry, IAA

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WAKASUGI Ryuhei [**]

RIETI, Kyoto University and Yokohama National University

and

Hongyong ZHANG[***]

Kyoto University

Abstract

The standard model in the literature indicates that heterogeneity in productivity and fixed costs is the key in determining firms' internationalization. However, few studies have considered the effect of ownership structure on firms' exporting and foreign direct investment (FDI). This study examines how differences in productivity and ownership structure affect the exporting and FDI of Chinese firms with different types of ownership: privately owned firms, state-owned enterprises (SOE), and foreign affiliates. Using our original dataset of Chinese firms, our statistical estimations yield several new findings. We find that privately-held and SOE firms must be highly productive to engage successfully in both exporting and FDI, whereas foreign-owned firms need relatively little productivity to be successful exporters and foreign direct investors. We also find that the interaction between the mode of ownership and experience with exporting and FDI has heterogeneous effects on expanding FDI. For privately-owned and state-owned Chinese firms, experience with exporting and FDI has a stronger effect on expanding FDI than on foreign-owned firms.

Keywords: Productivity; Ownership; Export; FDI; Privately owned firms; State-owned enterprises; Foreign-owned firms

JEL Classification: F1, F23, L6

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[**] Ryuhei Wakasugi is program director of RIETI and professor at the Institute of Economic Research, Kyoto University and the Center for Economic Growth Strategy, Yokohama National University.

[***] Hongyong Zhang is a graduate student at the Graduate School of Economics, Kyoto University.

1. Introduction

Chinese firms have been increasing exports and foreign direct investment (FDI) rapidly since China joined the World Trade Organization in 2001.[1] The internationalization of Chinese firms has attracted significant research interest in firm heterogeneity and internationalization. Substantial theoretical and empirical evidence concludes unanimously that exporters are more productive than non-exporters and that FDI firms are the most productive. (Bernard and Jensen (1999) and Bernard et al. (2007) for the study of the United States; Mayer and Ottaviano (2007) for the study of European firms; Tomiura (2007) and Wakasugi et al. (2008) for the study of Japan; Aw et al. (2008) for the study of Taiwan; Clerides et al. (1998) for the study of Columbia, Mexico, and Morocco). The dominant explanation of this productivity premium is that exporting and FDI entail fixed costs, so more-productive firms become exporters and the most productive firms become direct investors (Melitz (2003); Helpman et al. (2004); Helpman (2006)).

Further studies examine firms' choices of multiple FDI destinations. Analyzing data for Taiwanese electronics firms with a Multinomial Logit Model, Aw and Lee (2008) demonstrated that firms with FDI in the United States are more productive than those with FDI in China and that firms with FDI in both countries are the most productive.[2] On the basis of a three-country model, Grossman et al. (2006) showed that the higher a firm's productivity, the greater is its number of FDI destinations. Using data from US multinational firms, Yeaple (2008) demonstrated empirically that the most productive firms invest directly in the most countries and establish the most foreign subsidiaries. These studies have provided bases for explaining what factors affect Chinese firms' decisions to export and invest directly abroad. Much of China's exporting has come from foreign

[1] In 2000s, Chinese exports have increased about 60% annually, outstripping the United States in 2007 and Germany in 2009 to become the world's largest exporting country. Data from UNCTAD indicate that the FDI of Chinese firms in terms of stock increased 25% annually from 2000 to 2010, far exceeding the 11.4% average annual growth rate in that period. Refer UNCTAD, FDI/TNC database.

[2] In empirical studies of Japanese firms, Wakasugi et al. (2008) and Wakasugi and Tanaka (2012) showed that the relationship between productivity and the choice of internationalization is influenced by firms' productivity and market conditions. They assert that the productivity of firms internationalizing in both North America and Europe exceeds that of firms internationalizing in only North America or Europe, even though both regions have similar income levels.

affiliates and processing exporters—which are less productive than non-exporters—because they enjoy lower fixed export costs (Manova and Zhang (2008); Lu et al. (2010)).

The rise in Chinese exports and FDI has come not only from privately owned firms but also from state-owned enterprises and Chinese firms affiliated with foreign firms. It is anticipated that fixed costs for domestic production, exporting, and FDI will differ among firms having different ownership structures. Despite rising numbers of state-owned and foreign-owned Chinese exporters and foreign direct investors, nearly all existing studies of Chinese firms focus on the internationalization of privately owned domestic firms, or at least they do not explicitly or sufficiently examine the effect of different ownership structures on firms' exporting and FDI. This paper fills that void in the literature by empirically investigating the effect of heterogeneity in productivity and ownership on the export and FDI behavior of Chinese firms by using our original dataset of Chinese firms. Our dataset is constructed by matching two firm-level datasets: the *Chinese Annual Survey of Industrial Firms* (CASIF)[3] by the National Bureau of Statistics and the *List of FDI Firms and Organizations* reported by the Ministry of Commerce.[4]

In CASIF, Chinese firms are decomposed into four groups by ownership: Chinese privately owned, state-owned, Hong Kong–Macao–Taiwan (HMT) owned, and non-HMT foreign owned. By decomposing internationalized firms according to ownership, we show that the relationship between productivity and modes of ownership and internationalization is the opposite of—or at least different from—the unanimous findings of literature that neglects differences in ownership. We find that state-owned firms must be highly productive to engage in exporting and FDI, whereas low-productivity foreign-owned firms can internationalize successfully. Moreover, experience as an exporter affirmatively affects firms' decisions to become foreign direct investors, particularly the decisions of Chinese privately owned and state-owned firms. We conclude that export experience is more

[3] NBS annually releases industry-level aggregated data in the *China Statistical Yearbook*. The CASIF survey includes all industrial firms with sales exceeding 5 million RMB regardless of ownership structure (privately owned, state-owned, and foreign-owned).

[4] The list covers all permitted FDI firms in the manufacturing, mining, and service sectors, but no firms in the financial sector, with the name, FDI destinations, and purpose of FDI, from 1982 to 2012. In September 2012, 22,438 foreign subsidiaries and branches are listed.

effective for privately owned and state-owned Chinese firms to expand FDI destinations than for foreign-owned firms.

This paper proceeds as follows. Section 2 describes statistical data and productivity premium of Chinese exporters and FDI firms with different ownership structures. Section 3 presents empirical findings. Section 4 concludes the study.

2. Productivity and Ownership

2.1 Data and Descriptive Statistics

This study focuses on exporting and FDI choices of Chinese firms, taking into account both their heterogeneity in productivity and different ownership structures. Data for Chinese firms' business activities are from *The Chinese Annual Survey of Industrial Firms* (CASIF survey) conducted annually by the National Bureau of Statistics (NBS). The CASIF survey covers all industrial firms with sales exceeding 5 million RMB (above-scale firms).[5] We use the CASIF survey for 2007, which includes 336,769 manufacturers covering more than 90% of China's total industrial production and exports.[6]

CASIF classifies Chinese firms by ownership into foreign affiliates and non-foreign firms. NBS defines foreign affiliates as Chinese firms for which foreign firms hold 25% or more of their equity shares. Compelling reasons argue for separating foreign affiliates from Chinese firms. Foreign affiliates have a knowledge base regarding exporting and FDI and global networks through their parent firms outside China, but they have little knowledge and few networks supporting domestic Chinese production and sales. Fixed costs for domestic production, export, and FDI differ between foreign affiliates and domestic firms. Foreign affiliates are classified into two types: those owned by firms in Hong Kong, Macao,

[5] Iindustries in the CASIF survey include manufacturing, mining, and public utilities (gas, water service, electric power). The CASIF survey contains more than 100 variables, including firm data (ownership, location, telephone number), firm activities (production, sales, number of employees, value of intermediate inputs, export value), and financial data (tangible fixed assets, debt, gross profit, tax payment, wages).

[6] For issues concerning construction of the dataset, refer to Brandt et al. (2011). Although we concentrate our analysis of manufacturing firms, we exclude the cigarette industry, which is a regulatory industry, and the recycling industry, which neither participates in export nor FDI. Then, we scrubbed the data to omit blank items and abnormal values from the samples, following the precedent by Brandt et al. (2011), as follows: we excluded from the sample firms having fewer than eight employees and firms for which tangible fixed assets, value-added, and sales do not show positive values.

and Taiwan and those owned by foreign firms outside these three locations. Mainland China shares a distinctive economic and political proximity with Hong Kong, Macao, and Taiwan, and non-foreign firms include privately owned and state-owned Chinese firms. We classify Chinese firms into four categories: Chinese privately owned firms (private firms); state-owned firms (SOE firms); foreign affiliates owned by firms in Hong Kong, Macao, and Taiwan (HMT firms); and foreign affiliates owned by multinational firms outside Hong Kong, Macao, and Taiwan (NHMT firms).

Although the CASIF survey covers firms' production and export, it does not cover FDI. To our knowledge, firm-level statistics for Chinese outward FDI have not been disclosed. In this paper, we refer to the *List of FDI Firms and Organizations* issued by the Chinese Ministry of Commerce, which reports the names of FDI firms and their investment destinations. From the list, we identify Chinese firms that conduct outward FDI,[7] and match the individual names of FDI firms from the *List of FDI Firms and Organizations* with the Chinese firm's data from the CASIF survey.[8] We exclude the following FDI firms in constructing our dataset: (i) those investing only in overseas offices with no actual business operations in the host countries, (ii) those located only in tax haven countries,[9] and (iii) those located only in Hong Kong and Macao. As tax havens, Hong Kong and Macao are not necessarily final destinations for FDI; much FDI there is designated for reinvestment elsewhere. Concerning FDI of Chinese firms in particular, firms engaging even in round-trip FDI via subsidiaries in tax haven locations may receive preferential treatment.[10] Their FDI is regarded as disguised FDI. Considerable FDI of this type still takes place, although the benefit of round-trip FDI in China is disappearing because laws granting preferential

[7] The list includes the names of the firms, FDI destinations, names of affiliated firms, and the years they initiated FDI, but excludes much information pertaining to firms' business activities, such as the capital stock of FDI, sales of foreign affiliates, and number of employees of foreign affiliates.

[8] For greater accuracy when matching each firm's name from the CASIF survey with its name from the *List of FDI Firms and Organizations*, we used not only the names and identification numbers of Chinese firms in the CASIF survey but also their addresses, names of their representatives, industry classifications, and other information from the firms' websites.

[9] We regard Andorra, Aruba, Bahamas, Bahrain, Belize, Bermuda, British Virgin Islands, Cayman Islands, Cook Islands, Dominica, Gibraltar, Grenada, Liechtenstein, the Marshall Islands, Monaco, Netherlands Antilles, Panama, Samoa, San Marino, and Vanuatu as tax heavens.

[10] Refer to Huang (2003).

tax treatment to foreign firms have been amended.[11] Hong Kong is a special destination for Chinese firms. Many Chinese firms regard Hong Kong as their bridgehead for overseas expansion, for collecting information in foreign markets, as a base for overseas selling, and as a base for financing via the Hong Kong Stock Exchange. Taking into account that firms engaged in FDI in tax haven countries, Hong Kong, and Macao differ from FDI firms in other countries, we exclude from our FDI dataset outward FDI of Chinese firms to those locations. We categorize Chinese firms as non-internationalized firms, exporter-only firms (firms that export but do not conduct FDI), and FDI firms (firms that invest directly in at least one foreign country regardless of whether they export.

Table 1 tabulates the number of Chinese manufacturers by mode of internationalization and ownership in 2007. Although the number of Chinese FDI firms has increased rapidly, it remains small compared to the number of exporters. In 2007 and 2010, respectively, only 790 and 2,223 manufacturers were categorized as FDI firms. In 2007, 25% of Chinese firms were exporters, while only 0.3% engaged in FDI. Although foreign-owned firms comprised 60% of all exporters, private or SOE firms comprised less than 20%.

Table 1

2.2 Productivity Premium: A Non-parametric Approach

We graphically compare the productivity premium of exporters and FDI firms with that of non-internationalized firms. We calculate total factor productivity (TFP) by the method of Caves et al. (1982) instead of using estimations by Olly and Pakes (1996) and Levinsohn and Petrin (2003), drawing data from the CASIF survey in 2007. The method of Caves at al. (1982) offers the advantage of escaping the problem of common shares of capital and labor

[11] After implementation of the New China Corporate Law, enforced on January 1, 2008, the corporate income tax (25%) is, in principle, applied to non-foreign-owned and foreign-owned firms.

across firms, even when using two-digit industry classifications. Appendix 1 describes the calculation of TFP for Chinese firms.[12]

Figure 1 presents probability density function (p.d.f.) of TFP for three types of firms: non-internationalized firms, exporters, and FDI firms. The horizontal axis expresses TFP in logarithm, and the vertical axis presents firms' probability density. We find no difference in the p.d.f between non-internationalized firms and exporters, but find higher productivity for FDI firms than others. The figure presents the rightward shift of FDI firm's probability density compared to exporters and non-internationalized firms.[13]

Figure 1

We test whether the p.d.f. differs significantly among non-internationalized firms, exporters, and FDI firms by using the Kolmogorov–Smirnov test (K–S test). Following Delgado et al. (2002), we assume that $G_1(\theta)$ and $G_2(\theta)$ denote the cumulative distribution functions (CDFs) of productivity θ for two comparison groups and that the stochastic dominance of $G_1(\theta)$ relative to $G_2(\theta)$ is defined by $G_1(\theta) - G_2(\theta) < 0$ for all values of productivity θ.

First, we test the hypothesis that the CDFs differ for two comparison groups $G_1(\theta)$ and $G_2(\theta)$. The null and alternative hypotheses are expressed as

$$\begin{aligned} &\mathrm{H}_0 : G_1(\theta) - G_2(\theta) = 0 \quad \text{for all } \theta \\ &\mathrm{H}_1 : G_1(\theta) - G_2(\theta) \neq 0 \quad \text{for some } \theta \end{aligned} \tag{1}$$

The K–S test statistic for the two-sided test is given as follows:

[12] We also calculated labor productivity, defined as the ratio of value added to the number of employees. The estimated results using labor productivity are similar to those based on TFP.

[13] We also depicted the case for excluding foreign-owned firms. The shape is similar to the case of all firms.

(2) $$KS_1 = \sqrt{\frac{mn}{N}} \max_{1 \le i < N} \left| G_{1,m}(\theta_i) - G_{2,n}(\theta_i) \right|$$

where m and n are the sample sizes of the distributions $G_1(\theta)$ and $G_2(\theta)$, respectively, and $N = m + n$.

Next, we test whether one group stochastically dominates the other. The null and alternative hypotheses are expressed as follows:

(3) $$\begin{aligned} &\mathrm{H}_0 : G_1(\theta) - G_2(\theta) \le 0 \quad \text{for all } \theta \\ &\mathrm{H}_1 : G_1(\theta) - G_2(\theta) > 0 \quad \text{for some } \theta \end{aligned}$$

The K–S test statistic for the one-sided test is given by

(4) $$KS_2 = \sqrt{\frac{mn}{N}} \max_{1 \le i < N} \left\{ G_{1,m}(\theta_i) - G_{2,n}(\theta_i) \right\}$$

If the null hypothesis for the two-sided test is rejected and that for the one-sided test is not rejected, we judge that $G_1(\theta)$ is stochastically dominant over $G_2(\theta)$. Graphically, $G_1(\theta)$ lies entirely to the right of $G_2(\theta)$. We conduct two tests on the 2007 data.

Table 2 shows the results of the K–S test in three cases: non-internationalized firms vs. exporters, non-internationalized firms vs. FDI firms, and exporters vs. FDI firms. The upper part of Table 2 presents the K–S test of all firms. In all three cases, the low P-value indicates rejection of the null hypothesis for the two-sided test that the two distributions do not differ. However, the high P-value indicates the null hypothesis for the one-sided test is not rejected for non-internationalized firms vs. FDI firms and for exporters vs. FDI firms. The low P-value for the one-sided test of non-internationalized firms vs. exporters expresses rejection. These results support statistically that the p.d.f. of FDI firms' TFP exceeds TFPs for non-internationalized firms and exporters, but the p.d.f. of TFP for non-

internationalized firms and exporters do not differ, as Figure 1 shows graphically. Presented in the lower part of Table 2, the results of the K–S tests for non-foreign-owned firms do not differ from those for all firms.

Table 2

2.3 Empirical Analysis

Statistical evidence in the previous section indicates that the productivity of exporters is not higher than that of non-internationalized firms, while the productivity of FDI firms exceeds that of non-internationalized firms and exporters. Given earlier unanimous theoretical and empirical evidence that exporters are more productive than non-exporters and FDI firms are the most productive, this puzzle needs to be investigated. This section empirically investigates why the p.d.f. of TFP for Chinese exporters is so low, while that for FDI firms is high.

Following Bernard and Jensen (1999, 2007), we examine what productivity premium is required for Chinese firms to engage in exporting and FDI. But differently from Bernard and Jensen (1999, 2007), we estimate productivity premium as a variable dependent on not only the explanatory variables of three modes of internationalization but also the variables of four ownership categories. We control for firm size, industry-specific, and location-specific factors in the following equation by using ordinary least squares:

$$\begin{aligned} \ln Y_{foir} = {} & \alpha + \beta Exporter_{foir} + \gamma FDI_{foir} + \sum_{o=2}^{4} \theta_o Ownership_{foir} \\ & + \sum_{o=1}^{4} \delta_o Exporter_{foir} \cdot Ownership_{foir} + \sum_{o=1}^{4} \lambda_o FDI_{foir} \cdot Ownership_{foir} , \\ & + \kappa \ln Z_{foir} + \eta_i + \nu_r + \varepsilon_{foir} \end{aligned} \tag{5}$$

where Y_{foir} is the TFP of firm f in ownership category o, industry i, and region r. $Exporter_{foir}$ is a dummy variable indicating whether firm f is an exporter. FDI_{foir} is a dummy indicating whether firm f is an FDI firm; $Ownership_{foir}$ denotes a set of dummy

variables indicating the type of ownership for firm f (private firm o = 1, SOE o = 2, HMT firm o = 3, NHMT firm o = 4). Z_i is a variable to control for firm size defined by number of employees; η_i and ν_r are two-digit industry and region dummies, respectively; ε_{foir} is the error term. We use the method of Caves et al. (1982) to calculate TFP. The sample size used for the estimation is 305,064 in 2007.

Table 3

Table 3 reports regression results for eq. (5). As shown in Column (1), among private firms, SOE firms, HMT firms, and NHMT firms, NHMT firms display the highest average productivity regardless of the mode of internationalization. HMT and private firms are not distinctive in productivity, and the productivity of SOE firms is the lowest. This implies that the productivity cutoff for domestic production in China is the lowest for SOE and the highest for NHMT. Column (3) presents the same ranking of average productivity as Column (1) among private firms, SOE, HMT, and NHMT. The lowest productivity for SOE implies that SOE enjoys some advantage that compensates for its low productivity.

As Column (2) shows, the average productivity of exporters is not higher than that for non-internationalized firms, while average productivity of FDI firms exceeds that of non-internationalized firms and exporters. This means that on average, even low-productivity firms can export, but only productive firms can engage in FDI. However, if we disaggregate Chinese exporters into four groups according to ownership, a different productivity ranking emerges. Column (3) shows that the productivity of HMT exporters is the lowest, followed by NHMT exporters, while the productivity of SOE exporters is the highest, followed by private exporters. This indicates why the p.d.f for exporters and that for non-internationalized firms are not distinctive in the graphical analysis and K–S tests: HMT and NHMT firms have accumulated export knowledge and global networks. Many HMT and NHMT firms are engaged in the processing trade with their parent firms.[14] These

[14] This result is consistent with previous studies by Ma et al. (2011).

factors reduce firm-specific fixed costs for HMT and NHMT exporters and reduce the productivity cutoff for their exporting. The estimated results indicate that even low-productivity HMT and NHMT firms export, while only highly productive SOE firms can export. In fact, more than 60% of HMT and NHMT firms are exporters, whereas less than 20% of private firms and SOE are exporters.

As Column (3) also shows, the productivity cutoff for each type of FDI firm is higher than that for non-internationalized firms. In particular, the productivity of SOE-type FDI firms is the highest, followed by private firms, and the productivity for FDI of HMT and NHMT firms is lower than that of private firms. This indicates that only highly productive SOE firms can conduct FDI, while even low-productivity HMT and NHMT firms can engage in FDI. The network of HMT and NHMT firms with their parent firms and their previous experience with FDI reduce firm-specific fixed costs for FDI. The estimated results conclude that private firms and SOE firms require higher productivity to be both exporters and foreign direct investors, while HMT and NHMT firms can engage in exporting and FDI despite their relatively low productivity.

Existing literature indicates that foreign affiliates exporting their entire production are less productive than those that sell in China and export output (Lu et al., 2010). By decomposing the ownership of firms, our study examines the productivity required for domestic production, exporting, and FDI among firms with different ownership. Differences in ownership give rise to differences in firm-specific fixed costs for exporting and FDI. The empirical analysis in this section shows that, compared to non-foreign ownership, foreign-owned Chinese firms confront a lower productivity premium for exporting and FDI but a higher premium when selling their production in China. To our knowledge, our study is the first to report that foreign ownership lowers the productivity required for exporting and FDI from China and raises the productivity required for selling in China, and that the reverse holds for non-foreign, privately owned, and SOE firms.

3. Productivity and Ownership on Extensive Margin of FDI

3.1 Pecking Order of FDI Destinations

Firms initiate FDI in countries where its cost is low and expand to countries where its cost is higher. This implies that firms conduct FDI in more countries as they become more productive. Yeaple (2009) theoretically presented that the pecking order of firms' productivity coincides with their ranking in number of FDI destinations. To investigate empirically whether the theoretical prediction applies to FDI by Chinese firms, we categorize Chinese firms into four groups: non-FDI firms, firms with FDI in one country, firms with FDI in two countries, and firms with FDI in three or more countries. We then compare productivity among the four. Table 4 shows descriptive statistics for the number of firms in each group and their average TFP. Table 4 indicates that the larger the number of FDI destinations, the higher the average TFP.

Table 4

Existing studies clarify that the profit of FDI firms is determined not only by productivity but also by firm-specific fixed costs for FDI (Helpman et al., 2004; Yeaple, 2008; Lu et al., 2010). The previous section indicated that differing modes of ownership occasion differing fixed costs for FDI, but it did not investigate whether ownership affects conducting FDI. This section statistically tests whether the extensive margin of FDI (the number of FDI destinations) is determined not only by productivity but also by firm-specific factors, including ownership.

Because the dependent variable is an ordinal, not a cardinal, number, we empirically estimate the following logistic function using the Ordered Logit Model:

$$(6) \qquad \log\left[\frac{Prob(Y_f = j \mid X)}{1 - Prob(Y_f = j \mid X)}\right] = g(X), \quad j = 0, 1, 2, 3,$$

where j is the number of FDI destinations,

(7) $$Prob(Y_f = j \mid X) = \frac{e^{g(X)}}{1+e^{g(X)}}, \text{ and}$$

(8) $$\begin{aligned} g(X) = {} & \alpha_0 + \alpha \ln TFP_f + \sum_{o=2}^{4} \beta_o Ownership_{fo} + \delta Exporter_{fo} \\ & + \sum_{o=1}^{4} \delta_o Exporter_{fo} \cdot Ownership_{fo} + \gamma FDI_{fo} + \sum_{o=1}^{4} \gamma_o FDI_{fo} \cdot Ownership_{fo} \\ & + \lambda_1 \ln(K/L)_f + \lambda_2 \ln(R\&D)_f + \lambda_3 \ln(Age_f) + \eta_i + \nu_r + \varepsilon_{fo} \end{aligned}$$

where $Ownership_{fo}$ denotes a set of dummy variables indicating mode of ownership of firm f (private firm o = 1, SOE o = 2, HMT firm o = 3, NHMT firm o = 4). $Exporter_{fo}$ is a dummy variable indicating whether firm f is an exporter. FDI_{fo} is a dummy variable indicating whether firm f is an FDI firm; exporter K/L_f is the capital–labor ratio indicating the capital intensity of firm f; $R\&D_f$ is the ratio of R&D expenditures to total sales indicating the R&D intensity of firm f; Age_f indicates how long firm f has been operating; η_i and ν_r are two-digit industry and region dummies, respectively; and ε_{foir} is the error term. For the estimation, we use our count data of Chinese FDI firms.

We note the simultaneous bias in the estimation of productivity and the order of FDI destinations because both the explanatory variables (firm productivity) and the dependent variables (cardinal and ordinal numbers of FDI destinations) are determined simultaneously. To avoid simultaneous bias, we use the number of FDI destinations and the classification of FDI firms grouped from data in 2010 instead of 2007. Three years' lag for the explanatory variables mitigates the statistical problem of simultaneity.

Table 5

Regression results for eq. (6), subject to eqs. (7) and (8), are reported in Table 5. The results in Columns (1)–(3) are summarized as follows:

(i) TFP presents a significantly positive effect on the number of FDI destinations. This indicates that the higher the firm's productivity, the larger is its number of FDI destinations.
(ii) After controlling for a firm's productivity, the coefficients of HMT and NHMT are significantly positive in Columns (1) and (3). Foreign-owned firms (HMT and NHMT) tend to expand FDI destinations compared to non-foreign-owned firms.
(iii) The coefficient of exporters is significantly positive for the increase in FDI destinations under the benchmark of private non-exporters in Column (2). Export experience normally accumulates knowledge and intangible assets useful for FDI, and then possibly lowers the fixed costs for FDI and increases the number of FDI destinations.
(iv) In Column (3), the interaction between non-foreign ownership (private firms and SOE) and export experience has a stronger effect on the extensive margin of FDI than does foreign ownership (HMT and NHMT). The effect of interaction between export experience and foreign ownership on the increase in FDI destinations is relatively weak.
(v) The coefficient for interaction between FDI experience in 2007 and ownership is significantly positive in all cases. This implies that FDI experience increases the stock of knowledge and intangible assets that reduce fixed cost for FDI and are effective in expanding FDI destinations in any case.
(vi) The coefficients for capital-labor ratio, R&D intensity, and operating period are significantly positive for increasing the number of FDI destinations.

The estimated results indicate not only that high productivity raises the number of FDI destinations, but also that the interaction between ownership and export and FDI experience has different effects. The interaction between exporting experience and Chinese private and state ownership increases the number of FDI destinations more effectively than the interaction between exporting and foreign ownership. The interaction of FDI experience has a positive effect on expanding FDI destinations, which is almost equivalent for all types of ownership.

3.2 Robustness Check

To check the robustness of results in the previous section, we investigate what effect firms' ownership and experience with export and FDI have on the order of number of additional FDI destinations between 2007 and 2010. We categorize firms into four groups by the increasing number of FDI destinations between 2007 and 2010, instead of the number of FDI destinations in 2007, and estimate their rank order on the Ordered Logit Model of eqs. (6)–(8). For brevity, we report only the estimated results shown in Table 6.

Table 6

TFP presents a significantly positive effect on increasing the number of FDI destinations. Although the coefficient of exporters is significantly positive, the interactive effect between export experience and foreign ownership (HMT and NHMT exporters) is relatively weak in increasing the number of FDI destinations compared to the interaction between non-foreign ownership (private and SOE exporters). Having had FDI experience in 2007 tends to increase the number of firms' FDI destinations regardless of ownership. The coefficients of capital–labor ratio, R&D intensity, and the operating period are significantly positive for increasing the number of FDI destinations.

The estimated results shown in Table 6 are consistent with our main results in Table 5, indicating that high productivity boosts the number of FDI destinations. Export and FDI experience increase the number of FDI destinations, and for non-foreign-owned firms, the effect of export and FDI experience is stronger than that for foreign-owned firms. Our main results in Table 5 remain robust for the increase in FDI destinations between 2007 and 2010.

4. Conclusion

This study has empirically investigated how differing productivity and ownership structures affect the exporting and FDI of Chinese companies. After categorizing Chinese firms as privately owned; SOE; foreign-owned by companies in Hong Kong, Macao, and Taiwan (HMT firms); and firms owned by non-HMT companies, we demonstrated that privately owned and SOE Chinese firms must be highly productive in order to engage in exporting

and FDI, whereas foreign-owned firms require relatively low productivity to do so. To our knowledge, this is the first study to report those findings.

We surmised that different ownership structures cause differences in accumulation of knowledge, networks, and other intangible assets useful for export and FDI, and that accumulation of advantages lowers or raises fixed costs for their internationalization. We found that experience as an exporter and foreign direct investor influences Chinese firms to undertake FDI. In particular, the interaction between private and state ownership and experience in exporting and FDI is strong compared to the interactive effect between foreign ownership and experience with internationalization. In addition, by incorporating the pecking order of productivity according to the number of FDI destinations (Yeaple, 2008), we conclude that export experience is more significant in expanding FDI destinations for privately owned and SOE Chinese firms than that for foreign-owned firms.

The standard model in the literature indicates that heterogeneity in productivity and fixed costs is the key in determining firms' internationalization. However, few studies (Lu et al., 2010; Ma et. al., 2011; Manova, 2008) have considered the effect of ownership structure on Chinese firms' exporting and FDI. This study has expanded the literature of firm heterogeneity and internationalization by examining how differences in productivity and ownership structure affect the exporting and FDI of Chinese firms.

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Appendix 1. Calculation of TFP

TFP is calculated by the following equation.

$$\ln TFP_i = (\ln VA_i - \overline{\ln VA_i}) - \tilde{S}_i(\ln L_i - \overline{\ln L_i}) - (1-\tilde{S}_i)(\ln K_i - \overline{\ln K_i}), \quad \text{(A1)}$$

where $\ln VA_i$, $\ln L_i$, and $\ln K_i$ are the value added, number of employees, and capital stock, respectively, of firm i. $\overline{\ln VA}$, $\overline{\ln L}$, and $\overline{\ln K}$ are the average value added, average number of employees, and average tangible capital assets of firms fitting a two-digit industry classification. All are expressed as logarithms. The share of labor, $\tilde{S}_i$, is defined by $\tilde{S}_i = (s_i + \bar{s}_i)/2$, where s_i is given by the ratio of total payroll (salary and bonuses) to the summation of the total payroll and return on capital stock. $\bar{s}_i$ is given by the average labor share for the industry of firm i. The return on capital stock is calculated by multiplying the interest rate and capital stock. Then, $(1-\tilde{S}_i)$ expresses the share of capital.[15] In calculating TFP, all nominal values for value added and payroll are changed to real value by denominating according to the product deflators at the two-digit industry level. Capital stock is changed to a real term using the deflator of equipment investment. All deflators are from the *China Statistical Yearbook, 2008*.

[15] According to industrial statistics, industry's average share of labor reached only about 34% in 2007. On the other hand, National Income Accounts in China reports that the average share of the work force in all industries is about 55%.[15] The difference between two figures suggests that the value added might be overestimated. By multiplying a certain number on the payroll in each firm, Brandt et al. (2011) attempted to inflate the total payroll so as to equalize the adjusted share to National Income Accounts in China. For the share of labor, we used the ratio of total payroll (sum of salary and bonuses) to the sum of total payroll and return on capital.

Table 1. Export and FDI of Chinese Firms by Ownership (2007)

Internationalization modes		Total	Ownership			
			Private	SOE	HMT	NHMT
	Total	305067	234315	6046	30899	33807
		(1.000)	(1.000)	(1.000)	(1.000)	(1.000)
	Non-internationalized firms	227230	197098	4968	12183	12981
		(0.745)	(0.841)	(0.822)	(0.394)	(0.384)
2007	Exporters	77047	36684	1052	18643	20668
		(0.253)	(0.157)	(0.174)	(0.603)	(0.611)
	FDI firms	790	533	26	73	158
		(0.003)	(0.002)	(0.004)	(0.002)	(0.005)
2010	FDI firms	2223	1479	62	260	422

Note: The number in parentheses is the share of each internationalization mode for each ownership.

Table 2. Kolmogorov-Smirnov Test of Probability Density between Non-internationalized Firms, Exporters and FDI Firms

	lnTFP	
All firms	Two-sided *Ho*: equality	One-sided *Ho*: $G_1(\theta) < G_2(\theta)$
Non-internationalized firms vs. Exporters	0.1532	-0.1532
	[0.000]	[0.000]
Non-internationalized firms vs. FDI firms	0.0617	-0.0028
	[0.004]	[0.988]
Exporters vs. FDI firms	0.2110	-0.0007
	[0.000]	[0.999]
Firms exluding foreign owned firms		
Non-internationalized firms vs. Exporters	0.1364	-0.1364
	[0.000]	[0.000]
Non-internationalized firms vs. FDI firms	0.0857	-0.0020
	[0.000]	[0.995]
Exporters vs. FDI firms	0.2190	-0.0006
	[0.000]	[1.000]

Note: Asymptotic *p*-values in brackets.

Table 3. Productivity Premium for Export and FDI by Ownership (2007)

	Log TFP		
	(1)	(2)	(3)
C	2.039 *	2.057 *	2.041 *
	[0.075]	[0.075]	[0.075]
SOE	−0.274 *		−0.341 *
	[0.023]		[0.024]
HMT_firm	−0.018		0.093 *
	[0.017]		[0.013]
NHMT_firm	0.177 *		0.232 *
	[0.018]		[0.020]
Exporter		0.023	
		[0.015]	
Private firm*Exporter			0.034 *
			[0.012]
SOE*Exporter			0.400 *
			[0.047]
HMT*Exporter			−0.178 *
			[0.025]
NHMT*Exporter			−0.080 *
			[0.018]
FDI firm		0.510 *	
		[0.038]	
Private firm*FDI firm			0.512 *
			[0.044]
SOE*FDI firm			1.337 *
			[0.219]
HMT*FDI firm			0.359 *
			[0.114]
NHMT*FDI firm			0.294 *
			[0.077]
lnlabor	−0.154 *	−0.156 *	−0.156 *
	[0.007]	[0.007]	[0.007]
Industry dummy	Yes	Yes	Yes
Region dummy	Yes	Yes	Yes
N	305067	305067	305067
adj. R-sq	0.253	0.249	0.254

Note: Industry and region dummies are suppressed.
Standard errors clustered at the industry-region level are shown in the brackets.
* indicates significance at the 1% level.

Table 4. Productivity of FDI Firms by Category of FDI Destinations

Category by number of FDI destinations	Number of firms	lnTFP
0	304,277	−0.061
1	692	0.159
2	58	0.417
More than 3	40	0.639

Table 5. Estimated Results

	Order of FDI destinations in 2010		
	(1)	(2)	(3)
lnTFP	0.272 *	0.286 *	0.285 *
	[0.023]	[0.027]	[0.027]
SOE firm	0.096		−0.250
	[0.139]		[0.361]
HMT firm	0.345 *		0.689 *
	[0.072]		[0.161]
NHMT firm	0.519 *		0.819 *
	[0.059]		[0.136]
Exporter		1.723 *	
		[0.060]	
Private firm*Exporter			2.046 *
			[0.071]
SOE firm*Exporter			2.563 *
			[0.404]
HMT firm*Exporter			0.958 *
			[0.175]
NHMT firm*Exporter			0.706 *
			[0.144]
FDI firm in 2007		7.690 *	
		[0.093]	
Private firm*FDI firm in 2007			7.722 *
			[0.105]
SOE firm*FDI firm in 2007			8.342 *
			[0.511]
HMT firm*FDI firm in 2007			7.251 *
			[0.263]
NHMT firm*FDI firm in 2007			7.268 *
			[0.198]
ln(K/L)	0.273 *	0.222 *	0.228 *
	[0.019]	[0.022]	[0.022]
R&D intensity	0.039 *	0.038 *	0.037 *
	[0.004]	[0.005]	[0.005]
ln(Age)	0.502 *	0.186 *	0.163 *
	[0.030]	[0.035]	[0.035]
Industry dummy	Yes	Yes	Yes
Region dummy	Yes	Yes	Yes
N	305067	305067	305067
pseudo R-sq	0.058	0.322	0.326
Log likely	−13721.1	−9868	−9817.3
Chi-squared	1677.2	9383.5	9485

Note: Constants, industry and region dummies are suppressed.
* indicates significance at the 1%.

Table 6. Estimated Results for Robustness Check

	Increase of FDI destinations from 2007 to 2010		
	(1)	(2)	(3)
lnTFP	0.295 *	0.307 *	0.307 *
	[0.027]	[0.028]	[0.029]
SOE firm	0.295		−0.255
	[0.163]		[0.362]
HMT firm	0.420 *		0.690 *
	[0.083]		[0.162]
NHMT firm	0.498 *		0.803 *
	[0.071]		[0.136]
Exporter in 2007		1.718 *	
		[0.061]	
Private firm*Exporter			2.037 *
			[0.072]
SOE firm*Exporter			2.527 *
			[0.404]
HMT firm*Exporter			0.961 *
			[0.175]
NHMT firm*Exporter			0.710 *
			[0.144]
FDI firm in 2007		4.113 *	
		[0.111]	
Private firm*FDI firm in 2007			4.149 *
			[0.134]
SOE firm*FDI firm in 2007			5.259 *
			[0.560]
HMT firm*FDI firm in 2007			3.531 *
			[0.367]
NHMT firm*FDI firm in 2007			3.641 *
			[0.251]
ln(K/L)	0.272 *	0.243 *	0.248 *
	[0.022]	[0.023]	[0.023]
R&D intensity	0.038 *	0.039 *	0.038 *
	[0.005]	[0.005]	[0.005]
ln(Age)	0.395 *	0.206 *	0.175 *
	[0.036]	[0.036]	[0.037]
Industry dummy	Yes	Yes	Yes
Region dummy	Yes	Yes	Yes
N	305067	305067	305067
pseudo R-sq	0.053	0.116	0.120
Log likely	−10213.7	−9540.9	−9492.2
Chi-squared	1152.4	2497.9	2595.4

Note: Constants, industry and region dummies are suppressed.
* indicates significance at the 1%..

Figure 1. Probability Density Function of Chinese Firms