HIAS-E-7

Outward FDI and domestic input distortions: Evidence from Chinese firms

Cheng Chen
School of Economics and Finance, University of Hong Kong
Wei Tian
School of International Trade and Economics, University of International Business and Economics, Beijing, China
Miaojie Yu
Economic Research (CCER), National School of Development, Peking University, Beijing 100871, China
Hitotsubashi Institute for Advanced Study, 2-1, Naka, Kunitachi 186 - 8601, Japan

1 September 2015

Hitotsubashi Institute for Advanced Study, Hitotsubashi University
2-1, Naka, Kunitachi, Tokyo 186-8601 Japan
tel:+81 42 580 8604 http://hias.ad.hit-u.ac.jp/

HIAS discussion papers can be downloaded without charge from:
http://hdl.handle.net/10086/27202
https://ideas.repec.org/s/hit/hiasdp.html

Outward FDI and Domestic Input Distortions: Evidence from Chinese Firms*

Cheng Chen† Wei Tian‡ Miaojie Yu§¶

Setptember 1, 2015

Abstract

This paper studies how discriminations against private enterprises (i.e., non-state-owned enterprises or non-SOEs) in the domestic market affect firms' investment and production strategies abroad. We first document three puzzling empirical findings using data on Chinese multinational corporations (MNCs). First, private MNCs are *less* productive than state-owned MNCs. Second, SOEs are *less* likely to undertake FDI. Third, relative size of state-owned MNCs (compared with non-exporting or non-multinational firms) is *larger* than that of private MNCs. A theoretical model is built to rationalize these facts. The key economic force is that distortions in the domestic input market incentivize private firms to invest and produce abroad, which results in less tougher self-selection into FDI for those firms (i.e., selection reversal). Compared with state-owned MNCs, private MNCs allocate output disproportionately more in the foreign market, and their size increases disproportionately when they become MNCs. All such theoretical predictions are supported by the data on Chinese MNCs. **JEL**: F13, O11, P51

Keywords: Outward FDI, Multinational Firms, Institutional Distortion, State-owned Enterprises

*We thank Pol Antràs, Taiji Furusawa, Marc Melitz, Stephen Terry..... for their insightful comments. We thank seminar participants at Histotsubashi.....for their very helpful suggestions and comments. Cheng Chen thanks IED of Boston University for their hospitality when the paper is written. Wei Tian and Miaojie Yu thank Histotsubashi Institute of Advanced Studies for their hospitality when the paper is written. However, all errors are ours.

†School of Economics and Finance, University of Hong Kong. Email: ccfour@hku.hk

‡School of International Trade and Economics, University of International Business and Economics, Beijing, China. Email: wei.tian08@gmail.com.

§China Center for Economic Research (CCER), National School of Development, Peking University, Beijing 100871, China. Email: mjyu@nsd.pku.edu.cn.

¶Hitotsubashi Institute for Advanced Study, Hitotsubashi University, 2-1, Naka, Kunitachi 186-8601 Japan.

1 Introduction

Foreign direct investment (FDI) and the emergence of multinational corporations (MNCs) are dominant features of the world economy nowadays.[1] In 2013, world FDI inflows reached the level of 1.47 trillion US dollars, and global FDI stock was roughly 26 trillion US dollars, surpassing GDP of any country in the world (UNCTAD World Investment Report 2015). Moreover, almost all firms listed in Fortune 500 are MNCs, and MNCs are by far the largest firms in the global economy. Therefore, understanding the behavior of MNCs and patterns of FDI is important, if we want to analyze aggregate productivity and resource allocation of the modern economy.

The sharp increase in outward FDI from developing countries in the past decade is phenomenal, and this is especially true for China. UNCTAD World Investment Report 2015 shows that outward FDI flows from developing economies has already accounted for more than one third of overall FDI flows, up from 13% in 2007. Furthermore, despite that global FDI flows plummeted by 16% in 2014, MNCs from developing economies invested almost 468 billion US dollars abroad in 2014, a 23% increase from the previous year.[2] As the largest developing country in the world, China has seen an astonishing increase in its outward FDI flows in the past decade. In 2012, China's outward FDI reached the level of 6.5% of the world's total FDI flows, which made China the third largest home country of FDI outflows globally. In addition, there are more than 15 thousand Chinese MNCs (parent firms) now, which is comparable to the number of MNCs of any developed economy in the world. Moreover, outward FDI flows from China have increased by 37.8 times in the past ten years, while GDP and trade volume of China have increased by less than fourfold during the same period. Finally, outward FDI flows from China were 140 billion US dollars in 2014, surpassing the inward FDI flows to China which were 119 billion US dollars in the same year. In total, behavior of Chinese MNCs and patterns of outward FDI flows from

[1] MNCs refer to firms that own or control production of goods or services in countries other than their home country. FDI includes mergers and acquisitions (M&A), building new facilities, reinvesting profits earned from overseas operations and intra company loans.

[2] The UNCTAD World Investment Report also demonstrates that FDI stock from developing economies to other developing economies grew by two-thirds from 1.7 trillion US dollars in 2009 to 2.9 trillion US dollars in 2013. It also reports that transition economies now represent 9 of the 20 largest investor economies globally.

China are needed to be explored, given their significant impact on the world economy.

In this paper, we investigate investment strategies of Chinese MNCs and patterns of China's outward FDI through the lens of domestic input-market distortions, as it has been documented that discriminations against private firms are a fundamental issue for Chinese economy. For instance, state-owned enterprises (SOEs) enjoy preferential access to financing from state-owned banks, although they are less efficient than private firms (Dollar and Wei, 2007; Song, Storesletten and Zilibotti, 2011; Khandelwal, Schott and Wei, 2013; Manova et al., 2015). Moreover, Bai, Krishna and Ma (2013), Bai, Hsieh and Song (2015) and Khandelwal, Schott and Wei (2013) document that private firms are treated unequally by the Chinese government in the exporting market, at least before 2001 when China joined WTO. These unequal treatments come from excessive (exporting) quotas granted to SOEs and tougher requirements for exporting that private firms face. In addition, according to a report from the World Bank, SOEs also have priority in market for land acquisition and are less constrained by environmental regulations. In short, it is natural to link the behavior of Chinese MNCs to domestic distortions in China.

To our best knowledge, there is no existing work studying how home institutional distortion affects patterns of outward FDI in the literature. The reason is that developed economies had been home countries of outward FDI for many decades, and their economies are much less likely to be subject to distortions compared with developing economies. On the contrary, various distortions are fundamental features of developing countries. For instance, size-dependent policies and red tapes have been shown to generate substantial impact on firm growth and resource allocation in India (Hsieh and Klenow, 2009 and 2012; Garicano, Lelarge and Van Reenen, 2013). State-controlled firms in Russia and SOEs in China are more favored than individual and private firms (Huang , 2003 and 2008; Brandt, Tombe and Zhu, 2013) in their domestic markets. Brazil's economy is plagued with problems of difficult business registration, inefficient judicial systems and rigid labor markets.[3] Moreover, there is already anecdotal evidence documenting how firms

[3]Doing business index for Brazil can be found at `http://www.doingbusiness.org/data/exploreeconomies/brazil`. As the index shows, Brazil is ranked extremely low in terms of starting businesses, dealing with construction permits and enforcing contracts.

circumvent these distortions by investing abroad. For instance, the key to the success of Hainan airline (the fourth largest airline in China and a private firm) is to expand internationally and acquire foreign assets even at the early stage of its development.[4] In total, distortions in the domestic market do seem to impact firms' decisions on going aborad in developing countries.

We first document three sets of stylized facts to motivate our theory. First, although non-exporting private firms are more productive than non-exporting SOEs on average, private FDI firms (i.e., MNCs) are actually *less productive* than state-owned FDI firms on average. Second, compared with private firms, the fraction of firms that undertake outward FDI is smaller among SOEs. Finally, relative size of FDI firms (i.e., average size of FDI firms divided by average size of non-exporting firms) is *smaller* among private firms than among SOEs. All these findings seem to be counter-intuitive. First, SOEs are much bigger than private firms, and bigger firms are more likely to invest abroad. Furthermore, it has been documented that they receive substantial support from the Chinese government for investing abroad. Thus, why are there so few of them which actually invested aborad in the data? Second, it has been documented that SOEs are less productive than private firms in China (e.g., Brandt, Van Biesebroeck and Zhang (2012), Khandelwal, Schott and Wei (2013)). Our data also shows that this pattern holds when we look at non-exporting and exporting (but non-FDI) firms. Why does this pattern is reversed when we focus on FDI firms? Third, if SOEs were more likely to invest abroad, relative size premium of them should be smaller than that of private firms, since the selection into FDI is less stringent for SOEs. However, why does the data present the opposite pattern? In short, a theory is needed to rationalize these findings.

In order to rationalize the above puzzling findings, we set up a model in order to highlight two

[4] In China, commercial aviation industry had been heavily regulated for many years. As a result, private firms could not enter this market, although SOEs could. In order to circumvent this distortion, Hainan airline undertook FDI and served the international market first. Interesting, after the airline grew big enough and had the strength to compete against state-owned airlines (e.g., Air China), it went back to expand in the domestic market substantially. Readers who are interested in studying anecdotal evidence of this can find it at `http://www.washingtonpost.com/business/for-hainan-airlines-chen-feng-rise-of-resort-in-china-provides-lift-for-a-new-sky-empire/2014/05/22/d4bb7508-d9fb-11e3-b745-87d39690c5c0_story.html`.

economic forces generated by the existence of distortions: institutional arbitrage and selection reversal. We assume that private firms are discriminated either in the input factor market at home.[5] As a result, there are relative *higher* incentives for them to invest abroad, since they can circumvent domestic institutional distortions by doing this, which is termed as institutional arbitrage in the paper. Institutional arbitrage explains the first stylized pattern documented above. Second, absent domestic distortion, there should be no difference in selection into the FDI market, since both SOEs and private firms face the same foreign market environment when undertaking FDI. Under the existence of domestic distortions, selection in the domestic market is tougher from private firms. However, since they receive extra benefit from investing abroad (i.e., alleviation of distortion), they have higher incentives to undertake FDI, which leads to less tougher selection into FDI. We call this selection reversal. This reversal rationalizes why private FDI firms are less productive than state-owned FDI firms and why relative size premium of FDI firms is smaller among private firms than among SOEs. In summary, a model with the existence of distortion in the domestic market naturally rationalizes all the above puzzling empirical findings.

Our model follows Helpman, Melitz and Yeaple (2004)'s (henceforth, HMY (2004)) industry equilibrium model with heterogeneous films. The key feature is that when private firms *produce* in the domestic market, they suffer from higher input prices compared with SOEs. However, when they undertake FDI and produce abroad, this distortion ceases to exist. As a result, private firms have one extra benefit of undertaking FDI. That is, they can alleviate distortion they suffer from the domestic market.[6] Therefore, compared with SOEs, private firms are more likely to undertake FDI, and they have disproportionately more FDI firms compared with SOEs. Following this line, the model yields two more empirical predictions. First, when private firms undertake FDI, they produce and sell *disproportionately more* in the foreign market. We call

[5] Our model's main predictions still hold well when extending our analysis to the distortions in output market, which can be found from Appendix B.

[6] This is not true for exporting, since exporting firms are still plagued with distortion in the domestic factor market.

this global reallocation of market shares, which is due to the asymmetry of distortions across borders. Second, conditional on other firm-level characteristics, (overall) firm size of private firm grow more than that of SOEs when both of them undertake FDI. This is again due to the existence of the extra benefit obtained from investing abroad for private firms. In the end, we implement further empirical analysis to show that all our theoreticaal predictions receive support from Chinese firm-level data.

Although we focus on how a particular type of institutional distortion affects economic outcomes, the insights of this paper are general. For instance, it was reported that a rising number of talented and wealthy French people went aborad due to the increasing tax rates in France.[7] This serves as a perfect example for institutional arbitrage which is the key idea of the current paper. Furthermore, tax-evasion motives for the location choice of MNCs is another example of institutional arbitrage and has found many real world examples.[8] Finally, in India, red tapes have forced many talented entrepreneurs to move out of India and start their businesses aborad.[9] In total, agents, firms and entrepreneurs can move across countries and regions to circumvent distortions they face. This key idea of this paper is not confined to the case of discriminations against private firms in China.

This article aims to speak to the literature on FDI and MNCs. For the research on vertical FDI, Helpman (1984) insightfully points out how the difference in factor prices across countries affects patterns of vertical FDI. Antràs (2003, 2005) and Antràs and Helpman (2004) emphasize the importance of contractual frictions for shaping the pattern of FDI and outsourcing in various industries (e.g., capital-intensive v.s. labor intensive). For research on vertical FDI, Markusen (1984) postulates the concentration-proximity tradeoff which receives empirical support from Brainard (1997). More recently, HMY (2004) develop a model of trade and FDI with heterogeneous firms. They show that the least productive firms sell in the domestic market only;

[7] See `http://www.france24.com/en/20150808-france-wealthy-flee-high-taxes-les-echos-figures`.

[8] Many American firms moved aborad in order to evade high tax rates in the US. For details, see `http://www.wsj.com/articles/SB10000872396390444230504577615232602107536`.

[9] Readers interested in studying anecdotal evidence of this can find it at `http://www.thehindu.com/news/national/red-tape-forces-top-indian-entrepreneurs-to-shift-overseas/article7367731.ece`.

firms with medium levels of productivity serve the domestic market and export; and the most productive firms sell domestically and undertake FDI. Our paper contributes to this literature by pointing out another motive for firms to do FDI and showing how this affects patterns of FDI both theoretically and empirically.

This paper is also related to the literature that substantiates the existence of resource misallocation in developing economies. Hsieh and Klenow (2009)'s pioneering work documents that compared with the U.S., there is substantial misallocation of resources across firms in China and India. Restuccia and Rogerson (2008) show how size-dependent taxes can generate quantitatively important impact on aggregate productivity. Following their work, scholars started to uncover how various types of distortions affect aggregate productivity and welfare. Midrigan and Xu (2014) and Moll (2012) study aggregate impact financial frictions on the economy. Guner, Ventura and Xu (2008) and Garicano, Lelarge and Van Reenen (2013) explore impact of size-dependent policies on aggregate productivity and firm size distribution.[10] Our work contributes to this research area by showing a linkage between domestic distortion and firms' behavior in the global market. Moreover, we provide direct evidence to support our theoretical results.

The third related strand of the literature is the research on distortions in China and FDI decisions of Chinese firms. Bai, Hsieh and Song (2015) find that a key feature of Chinese economy is crony capitalism meaning that each local government supports businesses related to itself. Brandt, Tombe and Zhu (2013) substantiate the existence of distortions between private firms and SOEs in China. Furthermore, they document how misallocation between SOEs and private firms had changed between 1980s and 2000s. Moreover, distortions related to foreign transactions also exist in Chinese economy. For instance, Khandelwal, Schott and Wei (2013) document that private firms in the textile industry had to obtain licenses in order to export, while SOEs didn't. Recent work on China's outward FDI, such as Huang and Wang (2011), examines the industrial characteristics and heterogenous motivation of FDI but abstract away

[10] For a synthesis of work on misallocation and distortion, see Restuccia and Rogerson (2013). Review of Economic Dynamics published a special issue focusing on aggregate impact of distortions and misallocation in 2013 which can be found at `http://www.economicdynamics.org/RED-misallocation.htm`.

the role of firm activity. In echoing this, Kolstad and Wilg (2012) find that Chinese outward FDI is attracted to three destinations: countries with lower institutional quality, countries that are rich in natural resources, and large markets. More recently, using the same data set, Tian and Yu (2015) document the sorting pattern of Chinese FDI firms among production FDI and non-production FDI, but abstract away from the key difference between state-owned FDI firms and private FDI firms. Compared with the existing work, the key innovation of our work is to link firm's decisions on outward FDI to distortions in the home country, and this linkage deserves more attention in future research.

2 Data and Stylized Facts

2.1 Data

Our first data set is a production data set of Chinese manufacturing firms from 2000 to 2008, which comes from the annual survey of industrial firms (ASIF) complied by the National Bureau of Statistics of China. All SOEs and non-SOEs (i.e., private firms) with annual sales of five million RMB (or equivalently, about $830,000) or more are included in the data set. This data set contains more than 100 variables such as the number of employees, value of capital stock, total sales, and export value. Firms included into this data set contribute to 95 percent of China's total sales in all manufacturing sectors. This data set is particularly useful for us to identify the ownership type of the firm (i.e., SOE or not) and other key firm-level characteristics such as firm size and TFP.

The key interest of our paper is to explore how distortion in the input market (between SOEs and non-SOEs) affects Chinese firms' outward FDI decisions. We pay particular attention to identifying which firm is an SOE. As discussed in Yu (2015), the official definition of the SOE reported in China City Statistical Yearbook (2006) includes domestic SOEs (code in the firm data set: 110), state-owned joint venture enterprises (141), state-owned and collective joint venture enterprises (143), but excludes state-owned limited corporations (151). Appendix Table

1 provides summary statistics for the SOE dummy used in this paper.

We use two data sets that report information on Chinese firms' outward FDI decisions in this paper.[11] The first data set is a nationwide data set of firm-level outward FDI from 1980 to 2012, and the second one is an outward FDI data set of firms from Zhejiang province during 2006-2008. In terms of the time span and regional coverage, the former one has the advantage. However, the nationwide data set does not have information on firms' investment amount in foreign countries. Such information, however, is available in Zhejiang province's FDI data set (i.e., the second data set). Nevertheless, both data sets provide information on the initial year when the firm engages in outward FDI in a foreign country, the type of the investment (wholesale or production FDI), and destination countries for the investment.

Following Tian and Yu (2015), we merge the two FDI data sets with the firm-level production data set by using Chinese name of the firm. If a firm has the same Chinese firm in the three or two data sets in a particular year,[12] it is considered as an identical firm.

Table 1 shows information on FDI in our matched data sets. Rows (1) and (2) report the number of manufacturing firms and the number of FDI starting firms (including firms doing services) by year. Rows (3) and (4) report the number of (matched) FDI manufacturing firms and the number of (matched) state-owned FDI manufacturing firms.[13] Row (5) shows the FDI share by dividing the number of FDI starting firms by the number of manufacturing firms. Clearly, FDI is indeed a rare event—the share of it is less than 1 percent each year. The last row calculates the share of SOEs among FDI manufacturing firms, which is obtained by dividing the number in row (4) by that in row (3). The overall patterns is that the share of state-owned multinational firms becomes smaller over the year.

[11] See Tian and Yu (2015) for more details.

[12] For firms from Zhejiang Province, we use all the three date sets. The data set of FDI from Zhejiang province is excluded from using, when firms are from provinces other than Zhejiang.

[13] The number of FDI manufacturing firms in row (3) reports not only FDI manufacturing firms that had foreign investment in a given year, but also firms that had foreign investment before (i.e., FDI continuing firms). Therefore, although the number reported in Row 2 includes both manufacturing and non-manufacturing FDI firms that had foreign investment in a given year and a given country (i.e., starters), it is possible that there are fewer FDI starters than *matched* FDI manufacturing firms. This is the case for 2007 and 2008.

[Insert Table 1 Here]

We first estimate firm TFP using the augmented Olley-Pakes (1996) approach as in Yu (2015). First, we estimate the production function for exporting firms and non-exporting firms in each industry separately.[14] Second, we include dummy variables for SOEs and years after China's entering WTO in the inversion step of our productivity estimation.

2.2 Stylized Facts

The main purpose of this subsection is to document three stylized facts using Chinese multinational data. As our interest is to explore how resource misallocation (across firm type) at home affects Chinese firms' outward FDI behavior, we compare multinational MNCs with private MNCs when stating these stylized patterns.

2.2.1 Stylized Fact One: Productivity Premium for State-Owned MNCs

Table 2 reports differences in firm productivity between SOEs and private firms. Simple t-tests in columns (1) and (3) clearly show that, among non-FDI firms and non-exporting firms, private firms are more productive than SOEs. In order to confirm this finding, we perform the nearest-neighbor matching, which is one type of the propensity score matching (PSM), by choosing firm sales and the number of employees as covariates.[15] Columns (2) and (4) present the estimates for average treatment for the treated (ATT) for private firms. Again, the coefficients of the productivity difference between SOEs and private firms are highly significant, suggesting that non-FDI (and non-exporting) SOEs are less productive than non-FDI (and non-exporting) private firms. In total, the above findings for non-FDI firms are consistent with other studies

[14] We choose to do so, since firms doing processing trade may use different technologies compared to other firms (Feenstra and Hanson, 2005), and processing trade accounted for around a half of China's foreign trade before 2008. As a robustness check, we also pool exporters and non-exporters together and re-estimate the production function by including a dummy variable for the exporting status in the inversion step of the productivity estimation. Results generated by this alternative method do not change our subsequent empirical findings qualitatively.

[15] To avoid the case in which multiple observations have the same propensity score, we perform a random sorting before matching.

such as Hsieh and Klenow (2009).

[Insert Table 2 Here]

On the contrary, when focusing on FDI firms, we find *selection reversal*. That is, private MNCs (i.e., Chinese *private* parent firms) are on average *less productive* than state-owned MNCs (i.e., state-owned parent firms), which is shown by column (5) of Table 2. To confirm this finding, we focus on the productivity difference between private and state-owned MNCs that are engaged in both FDI *and* exporting as well.[16] Column (6) reveals the same pattern as before. Namely, private FDI firms are less productive than state-owned FDI firms on average in China.

2.2.2 Stylized Fact Two: Smaller Fraction of State-Owned MNCs

Our second stylized fact is presented in column (9) of Table 2, which shows that the fraction of FDI firms is bigger among private firms than among SOEs. On the one hand, this finding is puzzling, since SOEs are bigger firms which should be more likely to invest abroad. Furthermore, the Chinese government supports its SOEs' investing abroad for many years, known as the "Going Out" strategy. On the other hand, such an observation echoes with our first finding. Namely, as state-owned FDI firms are more productive than private FDI firms, the fraction of SOEs engaged in doing FDI should be smaller (i.e., tougher selection).

2.2.3 Stylized Fact Three: Bigger Size Premium for State-Owned MNCs

Our last stylize fact is related to the size premium of state-owned MNCs. First, we observe that firm size (i.e., log employment and sales) of state-owned non-FDI firms is bigger than that of private non-FDI firms, as shown by columns (1) to (2) of Table 3. Next, this property also holds for state-owned FDI firms and private FDI firms, as shown by columns (3) to (6) of Table 3. Furthermore, all these differences are statistically significant. For FDI firms, We examine the

[16] If foreign countries impose high tariffs on Chinese products, some FDI parent firms may set up foreign affiliates as a substitute for exporting. In reality, some Chinese MNCs engage in both outward FDI and exporting. This is especially true for firms that undertake distribution FDI (Tian and Yu, 2015).

size difference more carefully by grouping them into two categories: (i) FDI non-exporting firms (as shown in columns (3) and (4)); (ii) FDI exporting firms (as shown in columns (5) and (6)). Different from the case of productivity comparison, we see that, private FDI firms are smaller than state-owned multinational firms for such two types of firms.[17] In short, SOEs are bigger than private firms irrespective of their FDI and exporting status.

[Insert Table 3 Here]

Importantly, size premium for state-owned MNCs holds in the relative sense as well. Specifically, Table 4 shows that the ratio of average log employment of (the domestic part of) MNCs to that of non-exporting firms is bigger among SOEs than among private firms.[18] To sum up, our third stylized fact states that both absolute and relative size (compared with non-exporting firms) of private MNCs are smaller than that of state-owned MNCs.

[Insert Table 4 Here]

Thus far, we have established three interesting empirical findings. First, we observe productivity premium for state-owned MNCs in the sense that private MNCs are less productive than state-owned FDI firms, although private non-FDI firms are more productive than state-owned non-FDI firms. Second, we find that a smaller proportion of SOEs undertake FDI, despite that they are much bigger than private firms. Finally, we document that both the absolute size and the relative size of state-owned FDI firms are bigger than private FDI firms. I.e., there

[17] The bottom module of Appendix Table 2 examines the absolute size difference by year for such two types of firms. As shown by the table, state-owned FDI firms are larger than private FDI firms each year. In addition, the last column of Table 3 shows that domestic sales of private FDI firms is also smaller than that of state-owned FDI firms.

[18] The first module of Table 4 reports the result from the comparison between the relative size of state-owned FDI firms (compared with non-exporting firms) and that of private FDI firms. The relative size is measured by l_o^j/l_d^j where l_o^j and l_d^j are log employment of FDI firms and that of non-exporting firms for firm type j (i.e., private or state-owned). The year-average ratio in first column shows that the relative size of private FDI firms is significantly smaller than that of SOEs. As few SOEs were engaged in outward FDI before 2004 (see Table 1), we report the year-average ratio up to a particular year for the rest part of Table 4. All columns suggest higher relative size premium for state-owned MNCs. Furthermore, the difference in the relative size (between private firms and SOEs) is more pronounced after 2004.

is size premium for state-owned FDI firms. In what follows, we present a theoretical model to rationalize all these findings. Furthermore, the model yields several extra empirical predictions which are going to be shown to be consistent with the data.

3 Model

In the theoretical part of the paper, we modify the standard FDI model proposed by HMY (2004) to rationalize the empirical findings documented above. We study how discrimination against private firms in input-factor markets affects the sorting pattern of MNCs and size-premium of them. At the same time, we also investigate how the difference in foreign investment costs impacts investment behavior of private MNCs and state-owned MNCs differently.

3.1 Setup

There is one industry populated by firms that produce differentiated products under conditions of monopolistic competition à la Dixit and Stiglitz (1977). Each variety is indexed by ω, and Ω is the set of all varieties. Consumers derive utility from consuming these differentiated goods according to

$$U = \Big[\int_{\omega \in \Omega} q(\omega)^{\frac{\sigma-1}{\sigma}} d\omega \Big]^{\frac{\sigma}{\sigma-1}}, \tag{1}$$

where $q(\omega)$ is the consumption of variety ω, and σ is the constant elasticity of substitution (CES) between differentiated goods.

Entrepreneurs can enter the industry by paying a fixed cost, f_e. After paying the entry cost, the entrepreneur receives a random draw of (labor) productivity, φ, for her firm. The cumulative density function (CDF) of this draw is assumed to be $F(\varphi)$. Once the entrepreneur observes the productivity draw, she decides whether or not to stay in the market as there is a fixed cost to produce, f_D, as well. In equilibrium, entrepreneurs in the monopolistically competitive sector earn an expected payoff that is equal to zero due to free entry.

Labor is the only factor that is used in production. Productivity draw of φ means that the firm has to use q/φ units of labor to produce q unit of output. Since there are only two asymmetric countries in the model, we use w_H and w_F to denote the equilibrium wage in the home country and in the foreign country respectively.

After entering and choosing to stay in the domestic market, each entrepreneur also chooses whether to serve in the foreign market (or equivalently, the rest of the world). There are two ways to serve the foreign market, the first of which is through exporting. Exporting entails a variable trade cost, $\tau(\geq 1)$, and a fixed exporting cost, f_X. The second way is to set up a plant in the foreign country and produce there directly. The cost of doing this is a fixed cost denoted by f_I.[19] In short, we consider horizontal FDI here as in HMY (2004).

The key innovation of the model is to introduce a wedge between the input price paid by SOEs and by private enterprises when they prod, beared by the private firm is $c(> 1)$ times as high as that by the SOE.[20]

Based on equation (1), we derive the demand function for variety ω as

$$q(\omega) = \frac{p(\omega)^{-\sigma}}{P_H^{1-\sigma}} E, \tag{2}$$

where E is the total income of the economy and P is the idea price index of the differentiated goods and defined as $P \equiv \left[\int_{\Omega(\omega)\in\Omega} p^{1-\sigma}(\omega) M dF(\omega)\right]^{\frac{1}{1-\sigma}}$ where M is the total mass of varieties

[19] Qualitative results of the model would be the same, if we assumed that private firms pay higher fixed production cost (and fixed exporting cost), but *not* higher fixed cost of undertaking outward FDI. Higher fixed production cost and exporting cost lead to tougher selection in the domestic market and in the exporting market for private firms. This is exactly the impact of discrimination against private firms generated by our model. Furthermore, since the fixed FDI cost is not higher for private firms, these firms have higher incentives to set up plants abroad and produce there. This is another key result of our model. Some evidence shows that the fixed FDI cost is actually higher for Chinese SOEs sometime (i.e., the banning of Chinese SOEs' entering the US market). Finally, it may be argued that the fixed entry cost, f_e is higher for private firms. However, this argument does not seem to square well with the data. A higher entry cost implies a lower exit cutoff and lower average productivity for private firms (compared with SOEs) due to free entry, which is against the finding form the data.

[20] Alternatively, we can also assume the existence of this wedge in the product market. For this scenario, difference in revenue taxes is a straightforward example. An extreme case of this type of discrimination is to ban the entry of private firms like what had happened in the commercial aviation industry in China. This case can be treated as a case in which the tax rate on revenue is one hundred percent for private firms. The analysis is relegated to Appendix B.

in equilibrium. The resulting revenue function is

$$q^{\frac{\sigma-1}{\sigma}} E^{\frac{1}{\sigma}} P^{\beta}, \tag{3}$$

where $\beta \equiv \frac{\sigma-1}{\sigma}$. To simplify the notation, we define the aggregate market condition as $C_i \equiv E_i^{\frac{1}{\sigma}} P_i^{\beta}$, $\forall i \in \{H, F\}$, where H and F represent Home and Foreign respectively.

3.2 Domestic Production, Exporting and FDI

Following HMY (2004), we assume that the cost function features constant returns to scale and is country-specific. Specifically, for a private firm that does not undertake FDI, its cost function is

$$\frac{(q_H + I_{\{q_E>0\}} q_E) w_H}{\varphi}, \tag{4}$$

where $I_{\{q_E>0\}}$ is an indicator function for exporting. As a result, operating profit and final profit for a private firm that does not export is

$$\pi_{PD}(\varphi) = \frac{1}{\sigma}\Big(\frac{\beta\varphi}{c w_H}\Big)^{\sigma-1} D_H \tag{5}$$

and

$$\Pi_{PD}(\varphi) = \frac{1}{\sigma}\Big(\frac{\beta\varphi}{c w_H}\Big)^{\sigma-1} D_H - f_D, \tag{6}$$

where

$$D_H \equiv P_H^{\sigma-1} E_H.$$

For an SOE, they are

$$\pi_{SD}(\varphi) = \frac{1}{\sigma}\Big(\frac{\beta\varphi}{w_H}\Big)^{\sigma-1} D_H \tag{7}$$

and

$$\Pi_{SD}(\varphi) = \frac{1}{\sigma}\Big(\frac{\beta\varphi}{w_H}\Big)^{\sigma-1} D_H - f_D. \tag{8}$$

If the firm is productive enough, choosing to serve the foreign market is optimal. For an exporting private firm, profit earned from exporting is

$$\frac{1}{\sigma}\Big(\frac{\beta\varphi}{\tau c w_H}\Big)^{\sigma-1} D_F - f_X,$$

and profit earned from outward FDI is

$$\frac{1}{\sigma}\Big(\frac{\beta\varphi}{w_F}\Big)^{\sigma-1} D_F - f_I.$$

Note that if the private firm *produces* in the foreign market, it does not face any distortion in input markets. Therefore, the cutoff for private firms' doing FDI is

$$\bar{\varphi}_{PO} = \left[\frac{\sigma(f_I - f_X)/D_F}{\frac{\beta^{\sigma-1}}{w_F^{\sigma-1}} - \frac{\beta^{\sigma-1}}{(\tau c w_H)^{\sigma-1}}}\right]^{\frac{1}{\sigma-1}}, \tag{9}$$

while the cutoffs for exporting and survival are

$$\bar{\varphi}_{PX} = \frac{\tau c w_H (\sigma f_X / D_F)^{\frac{1}{\sigma-1}}}{\beta}; \tag{10}$$

and

$$\bar{\varphi}_{PD} = \frac{c w_H (\sigma f_D / D_H)^{\frac{1}{\sigma-1}}}{\beta} \tag{11}$$

respectively. For SOEs, the three cutoffs are

$$\bar{\varphi}_{SO} = \left[\frac{\sigma(f_I - f_X)/D_F}{\frac{\beta^{\sigma-1}}{w_F^{\sigma-1}} - \frac{\beta^{\sigma-1}}{(\tau w_H)^{\sigma-1}}}\right]^{\frac{1}{\sigma-1}}, \tag{12}$$

$$\bar{\varphi}_{SX} = \frac{\tau w_H (\sigma f_X / D_F)^{\frac{1}{\sigma-1}}}{\beta}, \tag{13}$$

and

$$\bar{\varphi}_{SD} = \frac{w_H(\sigma f_D / D_H)^{\frac{1}{\sigma-1}}}{\beta} \tag{14}$$

respectively. Note that we need higher enough trade costs and FDI costs (i.e., $f_I >> f_X >> f_D$ and $\tau c w_H > w_F$) to ensure the sorting pattern of domestic, exporting and FDI firms (i.e., $\bar{\varphi}_{iO} > \bar{\varphi}_{iX} > \bar{\varphi}_{iD}$) where $i \in \{P, S\}$. It is obviously true that

$$\frac{\bar{\varphi}_{PX}}{\bar{\varphi}_{PD}} = \frac{\bar{\varphi}_{SX}}{\bar{\varphi}_{SD}},$$

$$\bar{\varphi}_{PD} = c\bar{\varphi}_{SD} > \bar{\varphi}_{SD},$$

and

$$\bar{\varphi}_{PO} < \bar{\varphi}_{SO}.$$

3.3 Sorting Pattern of FDI firms and Size-Premium of MNCs

In this subsection, we focus on how domestic distortion affects the sorting pattern of multinational firms and the size premium of them. We summarize our results on the sorting pattern of exporting firms and FDI firms using the following proposition.

Proposition 1 ***Sorting Pattern among Private Firms and SOEs****:*

1. *The exit cutoff and the exporting cutoff are higher for private firms than for SOEs. However, the cutoff for becoming an MNC is lower for private firms than for SOEs (i.e., selection reversal).*

2. *Assume that the initial productivity draw follows a Pareto distribution with the same shape parameter k for private firms and SOEs. Then, the fraction of MNCs is bigger among private firms than among SOEs. Average productivity of non-exporting (and all) private firms is bigger than that of non-exporting (and all) SOEs. However, average productivity of*

private FDI firms is smaller than that of state-owned FDI firms (i.e., productivity premium for state-owned FDI firms).

3. *Conditional on the initial productivity draw, private firms are more likely to become FDI firms.*

Proof. Part one comes from the above discussion. Under the Pareto assumption, the fraction of MNCs among SOEs is

$$\left(\frac{\bar{\varphi}_{SD}}{\bar{\varphi}_{SO}}\right)^k,$$

while it is

$$\left(\frac{\bar{\varphi}_{PD}}{\bar{\varphi}_{PO}}\right)^k$$

for private firms. The share of MNCs is higher among private firms than among SOEs, since

$$\bar{\varphi}_{SD} < \bar{\varphi}_{PD}$$

and

$$\bar{\varphi}_{SO} > \bar{\varphi}_{PO}.$$

In addition, under the Pareto assumption, average productivity of firms with productivity draws above φ_0 only depends on φ_0 and increases in it. Therefore, average productivity of private FDI firms is smaller than that of state-owned FDI firms, and average productivity of active private firms is bigger than that of active state-owned firms. Furthermore, since

$$\frac{\bar{\varphi}_{PX}}{\bar{\varphi}_{PD}} = \frac{\bar{\varphi}_{SX}}{\bar{\varphi}_{SD}}$$

and

$$\bar{\varphi}_{PD} > \bar{\varphi}_{SD},$$

average productivity of private non-exporting firms is bigger than that of state-owned exporting firms. This completes the proof for part two. Part three is true, since $\bar{\varphi}_{SO} > \bar{\varphi}_{PO}$ again. ■

The intuition for the above result is as follows. First, since there is discrimination against private firms in home country, it is more difficult for private firms to survive and export in the home country. As a result, the exit cutoff and the exporting cutoff are bigger for private firms. Absent the choice of exporting, the FDI cutoff would be the same for SOEs and private firms, as they face the same market environment in the foreign country. However, since the firm at the FDI cutoff compares profit earned from exporting with that earned from doing FDI, there is a bigger incentive for the marginal private firm to invest and produce abroad compared with the marginal SOE.[21] As a result, the FDI cutoff is smaller for private firms than for SOEs. This selection reversal leads to productivity premium for state-owned MNCs. Note that the selection reversal holds irrespective of the distribution of the initial productivity draw. In addition, productivity premium for state-owned MNCs exists, even if the Parato distribution has different values for the minimum productivity draw across the two types of firms.

The above theoretical results rationalize the first two stylized facts documented in last section. As Table 5 will show, compared with private firms, SOEs are *less likely* to undertake FDI. As Table 2 reports, the fraction of FDI firms is smaller among SOEs. Moreover, Table 2 shows that although non-exporting private firms are more productive than non-exporting SOEs on average, private FDI firms are actually *less productive* than state-owned FDI firms on average.

For future use, we derive operating profit for the exporting SOE and the multinational SOE as:

$$\pi_{SX}(\varphi) = \frac{1}{\sigma}\Big(\frac{\beta\varphi}{w_H}\Big)^{\sigma-1} D_H + \frac{1}{\sigma}\Big(\frac{\beta\varphi}{\tau w_H}\Big)^{\sigma-1} D_F \tag{15}$$

and

$$\pi_{SO}(\varphi) = \frac{1}{\sigma}\Big(\frac{\beta\varphi}{w_H}\Big)^{\sigma-1} D_H + \frac{1}{\sigma}\Big(\frac{\beta\varphi}{w_F}\Big)^{\sigma-1} D_F. \tag{16}$$

[21] Remember that exporting does not eliminate the distortion private firms face in the domestic market.

For private firms, they are

$$\pi_{PX}(\varphi) = \frac{1}{\sigma}\Big(\frac{\beta\varphi}{cw_H}\Big)^{\sigma-1} D_H + \frac{1}{\sigma}\Big(\frac{\beta\varphi}{\tau cw_H}\Big)^{\sigma-1} D_F \tag{17}$$

and

$$\pi_{PO}(\varphi) = \frac{1}{\sigma}\Big(\frac{\beta\varphi}{cw_H}\Big)^{\sigma-1} D_H + \frac{1}{\sigma}\Big(\frac{\beta\varphi}{w_F}\Big)^{\sigma-1} D_F \tag{18}$$

respectively. The next proposition discusses how absolute size premium varies with the enterprise type.

Proposition 2 ***Absolute Size Premium for State-owned MNCs****: Suppose the initial productivity draw follows a Pareto distribution with the same shape parameter k for private firms and SOEs.*

1. *Average domestic sales (and employment) of private NNCs (i.e., firm size of the domestic part of an FDI firm) are smaller than average domestic sales (and employment) of state-owned MNCs.*

2. *Average overall firm size (i.e., sales and employment) of private exporting (and multinational) firms is smaller than that of exporting (and multinational) SOEs.*

Proof. First, since φ follows a Pareto distribution with the same parameter, we only need to compare firm size of the marginal SOE (i.e., at the FDI cutoff) and the marginal private firm in order to show the difference in average domestic firm size. For the marginal SOE that has the draw of $\bar{\varphi}_{SO}$ and the marginal private firm that has the draw of $\bar{\varphi}_{PO}$, domestic sales are

$$S(\bar{\varphi}_{SO})_{dom} = \sigma f_D \left(\frac{\bar{\varphi}_{SO}}{\bar{\varphi}_{SD}}\right)^{\sigma-1}$$

and

$$S(\bar{\varphi}_{PO})_{dom} = \sigma f_D \left(\frac{\bar{\varphi}_{PO}}{\bar{\varphi}_{PD}}\right)^{\sigma-1},$$

since

$$S(\bar{\varphi}_{PD})_{dom} = S(\bar{\varphi}_{SD})_{dom} = \sigma f_D.$$

As

$$\frac{\bar{\varphi}_{PO}}{\bar{\varphi}_{PD}} < \frac{\bar{\varphi}_{SO}}{\bar{\varphi}_{SD}},$$

we must have

$$S(\bar{\varphi}_{SO}) > S(\bar{\varphi}_{PO}).$$

Therefore, average domestic sales of private multinational firms is smaller than that of multinational SOEs.

Second, for all firms, β fraction of revenue is paid to inputs, and the input price private firms pay is higher than what SOEs pay. Therefore, average employment or capital stock (depending on which input the firm uses) of private FDI firms is also smaller than that of state-owned FDI firms. Moreover, the difference in average employment between private FDI firms and state-owned FDI firms is bigger than that in average sales, since private firms pay higher input price which reduces their demand for inputs, *even conditioning on sales*.

Third, since private firms and SOEs face the same market condition and pay the same input price when producing abroad (i.e., FDI), and $\bar{\varphi}_{SO} > \bar{\varphi}_{PO}$, we must have

$$S(\bar{\varphi}_{SO})_{for} > S(\bar{\varphi}_{PO})_{for},$$

where $S(.)_{for}$ refers to foreign sales. Since φ follows a Pareto distribution with the same shape parameter (for private firms and SOEs), average foreign sales and employment of private FDI firms are smaller than average foreign sales and employment of state-owned FDI firms. As total sales (and employment) equal the sum of domestic sales and foreign sales (and employment), average overall firm size of private multinational firms is smaller than that of and multinational SOEs.

Finally, since $\frac{\bar{\varphi}_{PX}}{\bar{\varphi}_{PD}} = \frac{\bar{\varphi}_{SX}}{\bar{\varphi}_{SD}}$ and $S(\bar{\varphi}_{SD})_{dom} = S(\bar{\varphi}_{PD})_{dom}$, the marginal exporting SOE and the marginal private exporting firm have the same domestic sales. Moreover, total sales of a private firm with the productivity draw of $\bar{\varphi}_{PX}$ are

$$S(\bar{\varphi}_{PD})_{dom}\left(\frac{\bar{\varphi}_{PX}}{\bar{\varphi}_{PD}}\right)^{\sigma-1}\left(1+\frac{D_F}{\tau^{\sigma-1}D_H}\right),$$

while total sales are

$$S(\bar{\varphi}_{SD})_{dom}\left(\frac{\bar{\varphi}_{SX}}{\bar{\varphi}_{SD}}\right)^{\sigma-1}\left(1+\frac{D_F}{\tau^{\sigma-1}D_H}\right)$$

for an SOE with the productivity draw of $\bar{\varphi}_{SX}$. Therefore, they also have the same overall sales. Moreover, since $\frac{\bar{\varphi}_{PO}}{\bar{\varphi}_{PX}} < \frac{\bar{\varphi}_{SO}}{\bar{\varphi}_{SX}}$ and the productivity draw follows a Pareto distribution with the same shape parameter, average sales of private exporting firms is smaller than that of exporting SOEs. Since private firms pay higher input cost, average employment of private exporting firms is smaller than that of exporting SOEs as well. ■

The above results receive strong empirical support from Table 3, since average firm size (i.e., log sales and log employment) of private exporting and FDI firms is much smaller than that of state-owned exporting and FDI firms. This is especially true when we focus on domestic sales of FDI firms.

The size premium for state-owned MNCs also holds in the relative sense which is summarized by the following proposition.

Proposition 3 ***Relative Size Premium for State-owned MNCs****: Suppose the initial productivity draw follows a Pareto distribution with the same shape parameter k for private firms and SOEs.*

1. *Relative (domestic) employment of private exporting firms (i.e., compared with private non-exporting firms) is smaller than that of state-owned exporting firms.*

2. *Relative domestic and global employment of private multinational firms (i.e., compared*

with private non-exporting firms) is smaller than that of state-owned multinational firms as well.

Proof. The key observation is that average sales of non-exporting SOEs equals that of private non-exporting firms. To see this, first note that the marginal SOE (i.e., at the exit cutoff) and the marginal private firm have the same (domestic) sales:

$$S(\bar{\varphi}_{SD})_{dom} = S(\bar{\varphi}_{PD})_{dom} = \sigma f_D.$$

Furthermore, since the draw of φ follows the Pareto distribution and

$$\frac{\bar{\varphi}_{PX}}{\bar{\varphi}_{PD}} = \frac{\bar{\varphi}_{SX}}{\bar{\varphi}_{SD}},$$

average sales of non-exporting SOEs equals average sales of private non-exporting firms. As average sales of exporting SOEs is higher, the ratio of average sales of exporters to that of non-exporters is higher for SOEs than for private firms. Furthermore, among private firms or SOEs, exporting and non-exporting firms pay the same factor price and have the same share of revenue (i.e., β) that is paid to employees. Therefore, the ratio of average (domestic) employment of exporters to that of non-exporters is also higher for SOEs than for private firms.

Next, we discuss how the relative size premium of FDI firms varies across the type of ownership. First, as shown by Proposition 2, average domestic sales of private FDI firms is smaller than that of state-owned FDI firms. Therefore, the ratio of average sales of FDI firms' domestic subsidiaries to that of non-exporting firms is also higher for SOEs than for private firms. Second, domestic subsidiaries of private FDI firms' face the same factor price as private non-exporting firms. Thus, the ratio of average domestic employment is the same as the ratio of average domestic sales (of private FDI firms' to that of private non-exporting firms). Similarly, domestic subsidiaries of state-owned FDI firms face the same factor price as non-exporting SOEs. Therefore, the ratio of average domestic employment is the same as the ratio of average domestic

sales (of state-owned FDI firms' to that of non-exporting SOEs). Therefore, the ratio of average domestic employment of FDI firms to that of non-exporting firms is higher for SOEs than for private firms.

Finally, Proposition 2 also shows that average foreign employment of multinational private firms is smaller than that of multinational SOEs. Therefore, the ratio of average foreign employment of MNCs to that of non-exporting firms is smaller for private firms. In total, we have the result that relative global employment of private MNCs is smaller than that of state-owned multinational firms. ■

The above results receive strong statistical support from Table 4. As the table shows, relative size premium of private multinational firms is smaller than that of state-owned multinational firms. In addition, relative size premium of private exporting firms is also smaller than that of state-owned exporting firms.

3.4 Investment Costs, Distortion and Allocation of Sales across Borders

The following proposition discusses how FDI firms allocate their products across borders and how this differ across state-owned multinational firms and private multinational firms. Furthermore, it shows how overall firm size changes when the firm starts to undertake FDI and how it differs across SOEs and private firms.

Proposition 4 ***Global Allocation of Sales****:*

1. *Conditional on the productivity draw of φ and other firm-level characteristics, the ratio of foreign sales to domestic sales is higher for private FDI firms than for state-owned FDI firms.*

2. *Suppose there is a reduction in the fixed FDI cost. Conditional on the initial productivity draw and other firm-level characteristics, the increase in overall firm size (after the reduction in the fixed FDI cost) is larger for the new multinational private firm than for the new multinational SOE.*

3. *Suppose the initial productivity draw follows a Pareto distribution with the same shape parameter k for private firms and SOEs. Furthermore, assume that we are in a world with multiples sectors each of which is small relative to the whole economy. When the distortion deteriorates at one sector (i.e, c increases), the ratio of relative (domestic) size of state-owned MNCs (compared with non-exporting SOEs) to that of private MNCs increases in that sector. In addition, the log difference between these two relative sizes also increases in that sector, when the distortion deteriorates.*

Proof. Comparing equation (16) with equation (18), we know that given φ the ratio of foreign sales to domestic sales is higher for private FDI firms (than for state-owned FDI firms). This proves the first part of this proposition.

For the second part of the proposition, there are three cases to consider. The first case is the case in which both firms are non-exporters before the reduction in f_I. Equations (5), (7), (16) and (18) together imply that

$$\frac{\pi_{PO}(\varphi)}{\pi_{PD}(\varphi)} > \frac{\pi_{SO}(\varphi)}{\pi_{SD}(\varphi)},$$

which proves the second part of this proposition for the first case (remember overall sales are proportional to the operating profit). The next case is the case in which both firms are exporters before the reduction of f_I. In this case, equations (15)-(18) also imply that

$$\frac{\pi_{PO}(\varphi)}{\pi_{PX}(\varphi)} > \frac{\pi_{SO}(\varphi)}{\pi_{SX}(\varphi)}.$$

Therefore, after the two firms undertake FDI, the increase in overall firm size is bigger for the new private FDI firm than for the new state-owned FDI firm.

The final case to consider is the case in which the SOE is an exporter and the private firm is a non-exporter before the reduction of the fixed FDI cost. In this case, we still have

$$\frac{\pi_{PO}(\varphi)}{\pi_{PD}(\varphi)} > \frac{\pi_{PO}(\varphi)}{\pi_{PX}(\varphi)} > \frac{\pi_{SO}(\varphi)}{\pi_{SX}(\varphi)},$$

since $\pi_{PX}(\varphi) > \pi_{PD}(\varphi)$. Therefore, after the two firms undertake FDI, conditioning on φ, the increase in overall firm size is bigger for the new private FDI firm than for the new state-owned FDI firm as well. In total, the second part of this proposition is true for all possible cases.

We discuss the third part of this proposition now. First note that since each sector is small relative to the economy, any change in c at the sectoral level does not affect equilibrium wages (i.e., w_H and w_F). Next, note that relative size of private FDI firms is

$$\frac{Ave(empl)_{PO,dom}}{Ave(empl)_{PD,dom}} = \frac{Ave(Sales)_{PO,dom}}{Ave(Sales)_{PD,dom}} = \left(\frac{\bar{\varphi}_{PO}}{\bar{\varphi}_{PD}}\right)^{\sigma-1} \frac{1}{1-\left(\frac{\bar{\varphi}_{PD}}{\bar{\varphi}_{PX}}\right)^{k-(\sigma-1)}},$$

where *dom* refers to employment and sales for domestic output. Similarly, relative size of state-owned FDI firms is

$$\frac{Ave(empl)_{SO,dom}}{Ave(empl)_{SD,dom}} = \frac{Ave(Sales)_{SO,dom}}{Ave(Sales)_{SD,dom}} = \left(\frac{\bar{\varphi}_{SO}}{\bar{\varphi}_{SD}}\right)^{\sigma-1} \frac{1}{1-\left(\frac{\bar{\varphi}_{SD}}{\bar{\varphi}_{SX}}\right)^{k-(\sigma-1)}}.$$

Note that

$$\frac{\bar{\varphi}_{PX}}{\bar{\varphi}_{PD}} = \frac{\bar{\varphi}_{SX}}{\bar{\varphi}_{SD}}.$$

Therefore, the ratio of relative (domestic) size of state-owned FDI firms to that of private FDI firms can be expressed as

$$\frac{Ave(empl)_{SO,dom}/Ave(empl)_{SD,dom}}{Ave(empl)_{PO,dom}/Ave(empl)_{PD,dom}} = \frac{\left(\frac{\bar{\varphi}_{SO}}{\bar{\varphi}_{SD}}\right)^{\sigma-1}}{\left(\frac{\bar{\varphi}_{PO}}{\bar{\varphi}_{PD}}\right)^{\sigma-1}} = \frac{(\tau w_H c)^{\sigma-1} - w_f^{\sigma-1}}{(\tau w_H)^{\sigma-1} - w_f^{\sigma-1}},$$

which increases in c, conditioning on w_H and w_F.

Finally, we know the ratio of the two relative sizes increases after c increases. This directly leads to the result that

$$\ln\left[\frac{Ave(empl)_{SO,dom}}{Ave(empl)_{SD,dom}}\right] - \ln\left[\frac{Ave(empl)_{PO,dom}}{Ave(empl)_{PD,dom}}\right] = \ln\left[\frac{Ave(empl)_{SO,dom}/Ave(empl)_{SD,dom}}{Ave(empl)_{PO,dom}/Ave(empl)_{PD,dom}}\right]$$

increases with c, since $\frac{Ave(empl)_{SO,dom}/Ave(empl)_{SD,dom}}{Ave(empl)_{PO,dom}/Ave(empl)_{PD,dom}}$ is bigger than zero and increases with c. ■

The intuition for the above proposition is straightforward. Since there is an extra benefit for private firms to invest abroad, the increase in overall firm size is bigger for them as well. When private firms become MNCs, they produce and sell disproportionately more in the foreign market owing to the non-existence of distortions in that market. This effect is another key result of our theoretical framework for which we will provide empirical support in next section.

Proposition 4 receives empirical support from Tables 7-9 which will be discussed more carefully in the next section. In summary, for the decision on FDI, distortions in factor markets generate two economic forces that have not been explored in the literature. First, institutional arbitrage generates additional incentives for firms that are unfavored in the domestic market to invest aborad. As a result, there is less tougher selection in the FDI market for this type of firms. In our story, these unfavored firms are private firms in China. Second, when these firms undertake FDI, they produce and sell products disproportionately more in the foreign market due to the non-existence of institutional distortion. In Appendix 6.2, we show that all the above theoretical predictions continue to hold, even if we assume a cost function that features decreasing returns to scale.

4 Empirical Evidence

Our theoretical model states four propositions. Some of them are already shown to be consistent with the stylized facts presented in Section 2, while others are still waiting for further empirical

examination. This is the purpose of this section.

4.1 FDI Decision and Firm Ownership

Proposition 1 has three predictions, and the first two have been shown to be consistent with empirical results of Table 2-4. Therefore, only the last needs further empirical examination.

Estimation in Table 5 starts from a linear probability model (LPM) in which the regressand is an outward FDI indicator which equals one if a firm engages in FDI and zero otherwise. To explore whether SOEs are less likely to engage in FDI, we include an SOE indicator in the estimation. Furthermore, we control for several key firm characteristics such firm size (i.e., log employment), firm-level TFP, and the exporting status. In addition, we control for year-specific fixed effects and industry-specific fixed effects for all regressions other than the one reported in column (1).

As discussed in Tian and Yu (2015), our nationwide FDI data are pooled cross-sectional data, as we only know the first year when firms begin to undertake FDI in a given country (i.e., no information on whether firms continue to do FDI in a given country and whether they exit from FDI after entry). Therefore, estimation in Table 5 and other tables only includes non-FDI firms and FDI starters. The SOE indicator is shown to be negative and statistically significant in column 2, suggesting that SOEs are indeed less likely to engage in outward FDI. Since the magnitude of the SOE indicator is too small, we suspect that it is due to the well-known pitfall of LPM. I.e., the predicted probability of the LPM model could be great than one or less than zero. To overcome such drawback, we thus perform Probit estimation in column (3) and Logit estimates in column (4) which yield the same qualitative finding as before. That is, compared to private firms, SOEs are less likely to engage in outward FDI.

However, there are two important caveats for the Probit (and Logit) estimates. First, as shown in Table 1, there were only less than one percent of manufacturing firms that undertook FDI each year until 2008. Within FDI firms, a small fraction of them are SOEs. Thus, becoming a state-owned MNC is a rare event whose distribution exhibits faster convergence toward the

probability that SOEs engage in foreign investment. However, standard Logit or Probit estimates are assumed to be symmetric to the original point. We thus run the complementary log-log regression in column (5), which allows a faster convergence toward the rare events. Second, as highlighted by King and Zeng (2001, 2002), the standard binary nonlinear models, such as Logit and Probit models, would underestimate the probability of rare events. To address this concern, they recommend using the rare-event Logit approach which corrects for possible downward bias.[22] The last column of Table 5 reports the Logit estimates with rare-event corrections. The key coefficient in front of the SOE indicator is much larger than its counterparts in columns (4)-(5) in absolute value. Equally importantly, the coefficient is still negative and statistically significant, confirming that SOEs are less likely to engage in outward FDI. In total, estimation results from Table 5 are consistent with part three of Proposition 1.

[Insert Table 5 Here]

4.2 Input Market Distortions

Our theoretical model is built on the assumption that private firms face discrimination on input factor markets. Compared to SOEs, private firms have to bear higher input costs in the domestic market. Although such an assumption seems to be widely accepted, we provide direct evidence for it in this subsection.

Previous work suggests that Chinese SOEs access to working capital by paying a lower interest rate (Feenstra et al, 2014). Similarly, SOEs also acquire land at a lower market price, which is especially true in manufacturing sectors (Tian et al., 2015). To see whether such conjectures are supported by the data, we first construct a measure for firm-level interest rate by dividing firm's interest expenses by its current liability (in each year), both of which are obtained from the ASIF data set. We then regress this measure on the SOE indicator in columns (1)-(3)

[22] Note that the rare-events estimation bias can be corrected as follows. We first estimate the finite sample bias of the coefficients, $bias(\hat{\boldsymbol{\beta}})$, to obtain the bias-corrected estimates $\hat{\boldsymbol{\beta}} - bias(\hat{\boldsymbol{\beta}})$, where $\hat{\boldsymbol{\beta}}$ denotes the coefficients obtained from the conventional logistic estimates.

of Table 6. Our underlying assumption is that SOEs can access to external working capital at a lower cost than private firms. If so, it should be observed that the SOE indicator has a negatively significant coefficient.

This outcome is exactly what we observe in Table 6. The estimates in column (1) abstract away other control variables, whereas those in column (2) include both year-specific and industry-specific fixed effects. In addition to various fixed effects, column (3) also controls for other key firm-characteristics such as firm TFP and log employment of the firm. It turns out that the key coefficient, the SOE indicator, is always negative and statistically significant, suggesting that SOEs pay lower interest rates and hence bear lower capital costs than private firms.

Columns (4)-(6) check whether SOEs acquire land at lower costs. An empirical challenge is that data on each firm's cost of acquiring land are unavailable. Instead, we are able to access prices of land sales (conversion) at the prefectural city level by year.[23] We thus construct a variable of the SOE intensity which is defined as the number of SOEs divided by the number of total manufacturing firms within each prefectural city. If our hypothesis is supported by data, the city with a higher SOE intensity is expected to have a lower average price of land. Estimation in columns (4)-(6) regresses city-average land price on the SOE intensity and finds such a support.[24] Specifically, the coefficient in front of the SOE intensity is negatively significant. Column (4) only controls for year-specific fixed effects whereas column (5) controls for both year-specific and industry-specific fixed effects. In addition, it is possible that aggregate demand for land acquisition in each city affects the land price in the city, column (6) thus also controls for cities' total sales as well as city-specific, year-specific and industry-specific fixed effects. In all cases, the coefficient in front of the SOE intensity is negatively statistically significant, suggesting that SOEs pay lower land prices on average and hence bear lower land costs than private firms.

[23] Data are from *China's Land and Resources Statistical Yearbook* (various years). As in Tian et al. (2015), we only use data on land sales that are sold or granted by market channels including agreement, auction, bidding, and listing. We exclude land transfer to SOEs through direct government leasing and allocation. Thus, our coefficients in the estimates of Table 6 shall be understood as the lower bound of the measured distortion.

[24] Note that cities with zero SOEs or all SOEs are dropped from the sample.

[Insert Table 6 Here]

4.3 Firm Size and Investment Liberalization

We now provide empirical support for Proposition 4. The first prediction of Proposition 4 states that the ratio of foreign sales to domestic sales is higher for private MNCs than for state-owned MNCs. We are not able to directly test this theoretical prediction due to data limitation. To circumvent such a problem, we proxy foreign sales and domestic sales using the amount of foreign investment and the value of parent firm's total capital stock.[25] As the nationwide FDI data set does not provide information on FDI volume, only data for MNCs from Zhejiang province are used for Table 7. Accordingly, the number of observations decrease a lot in all estimations. Column (1) of Table 7 regresses the ratio of foreign investment to parent firm's capital stock on the SOE indicator. It shows that the SOE indicator has a negative and statistically significant coefficient, which is consistent with our prediction. As a robustness check, column (2) includes firm TFP and the number of days of import document preparation which is a proxy for the fixed exporting cost.[26] In addition, column (3) controls for both year-specific fixed effects and industry-specific fixed effects. In both regressions, the SOE indicator is negatively significant, which re-confirms our finding in column (1).

[Insert Table 7 Here]

Furthermore, the second prediction of Proposition 4 implies that, in response to investment liberalization (i.e., a reduction in the fixed FDI cost) in FDI destination countries, the increase in overall firm size is bigger for new private MNCs than for new state-owned MNCs. We implement empirical analysis to show support for this prediction. First, firm sales and log employment are usually used to measure firm size. However, as data on sales of foreign affiliates are unavailable, we use the sum of parent firm's fixed capital stock and the value of its FDI as an alternative

[25] We recover information of firm's capital stock following the approach introduced by Brandt et al. (2012).

[26] Data on days of import document preparation in the destination country are obtained from *Doing Business* Projects complied by the World Bank (various years).

measure for the overall firm size. Second, we use log licence costs to measure the fixed investment cost in the destination country.[27] Finally, the sample in Table 8 (except for column (4)) only covers MNCs from Zhejiang province due to data limitation.

To conduct the empirical analysis, we include an interaction term between the log of licence cost and the SOE indicator into the regression. If the theoretical predictions gain support from the data, the coefficient in front of log licence costs is expected to be negatively significant, while the coefficient for its interaction term with the SOE indicator is expected to be positively significant.[28] The simple OLS estimates in column (1) and the fixed-effects estimates in column (2) confirm the above theoretical predictions. As our model implicitly assumes a substitution between exporting and FDI, we thus drop distribution FDI (i.e., keeping production FDI only) and rerun the regression (Tian and Yu, 2015). Estimation results are reported in column (3) and support our theoretical predictions again. Finally, columns (4)-(6) focus on Chinese parent firms only and use log employment as the regressand. Estimation results reported in columns (4)-(6) are qualitatively the same as the results in columns (1)-(3).

[Insert Table 8 Here]

4.4 Size premium of SOEs

Proposition 3 predicts that relative size premium of state-owned MNCs is larger than that of private MNCs. Furthermore, the third prediction of Proposition 4 states that the difference in the relative size premium (between state-owned MNCs and private MNCs) increases when distortions deteriorate at the sectoral level. In what follows, we provide empirical evidence for this. Specifically, we start with the following empirical specification:

$$(l^o_{jt}/l^d_{jt}) = \alpha_0 + \alpha_1 SOEInt_{jt} + \alpha_2 r_{jt} + \eta_t + \lambda_j + \varepsilon_{jt} \tag{19}$$

[27] licence costs measure the average cost of getting a business licence in an economy and is reported by the *Doing Business* project (2009) which is compiled by the World Bank.

[28] These results indicate that a decline in the fixed investment costs at the destination country leads to a larger firm size, and this effect is more pronounced for private MNCs than for state-owned MNCs.

where l^o_{jt} and l^d_{jt} represent log employment of FDI firms and that of non-exporting firms in industry j. As a result, the regressand in (19) measures relative size of multinational firms at the industry level. $SOEInt_{jt}$ denotes the SOE intensity in industry j at year t (as defined before). r_{jt} is average interest rate paid by firms in industry j at year t (as defined before). Finally, the error term is decomposed into three components: (1) year-specific fixed effects η_t which re used to control for industry-invariant factors such as the exchange rate of Chinese RMB; (2) industry-specific fixed effects which are used to control for time-invariant factors (that affect firms' incentives to invest abroad) such as the comparative advantage, and (3) an idiosyncratic term ε_{it} with a normal distribution which is used to control for other unspecified factors. If proposition 3 is supported by data, we should observe a positive coefficient in front of $SOEInt_{jt}$. Namely, the higher the industrial SOE intensity, the larger is the relative FDI size premium. The fixed-effects estimates in column (1) of Table 9 clearly suggest that industries with higher SOE intensities have bigger FDI size premium.

Similarly, if firms in an industry pay lower prices for acquiring capital (i.e., a lower average interest rate), they should have more profits which would in turn affect the FDI size premium at the industry level. Column (2) regresses the relative size of multinational firms on the industrial interest rate and finds that a lower industrial interest rate is associated with a bigger relative size of FDI firms at the industry level. Column (3) includes both the industrial interest rate and the SOE intensity as the regressors and find similar results.

One of the key ideas of the present paper is that distortions in input factor markets lead to the relative size premium for state-owned MNCs. Thus, it is important and interesting to explore how the difference in interest rates paid by SOEs and private firms (measuring the level of the distortion), $r^{SOE}_{jt} - r^{PRIVATE}_{jt}$, affects the difference in the relative size premium of FDI firms (i.e., $(l^o/l^d)^{SOE}_{jt} - (l^o/l^d)^{PRIVATE}_{jt}$). Part 3 of Proposition 4 suggests that the difference in the relative size of MNCs between SOEs and private firms increases, when the distortion (i.e., c) deteriorates. If such a theoretical prediction is supported by the data, a smaller difference in the interest rates should lead to a smaller difference in relative size of MNCs (between SOEs

and private firms). We thus run the following regression in columns (4)-(8) of Table 9:

$$(l^o/l^d)_{jt}^{SOE} - (l^o/l^d)_{jt}^{PRIVATE} = \gamma_0 + \gamma_1(r_{jt}^{SOE} - r_{jt}^{PRIVATE}) + \epsilon_{jt}. \tag{20}$$

Industries used for the estimation in columns (4) and (5) are defined at the 2-digit China industrial classification (CIC) level. We provide robustness checks in column (6) by defining industries at the 4-digit CIC level. Note that not every 4-digit CIC industry has both types of FDI firms (i.e., state-owned and private), and 2-digit CIC industries are more likely to have both types of FDI firms. As a result, the number of (non-missing) dependent variables does not increase that much when we move from 2-digit CIC industries to 4-digit CIC industries. The estimates since column (5) also control for industrial relative TFP.[29] The coefficient of $\hat{\gamma}_1$ is negatively significant in estimates in columns (4)-(6), suggesting that the difference in the relative interest rates (between the low rates paid by SOEs and the high rates bear by private firms) is *negatively* associated with the difference in the relative size between state-owned MNCs and private MNCs. Such findings are essentially consistent with our theoretical predictions.

To be more precise and exactly matching to our theoretical framework, column (7) regresses the ratio of FDI relative size $((l^o/l^d)_{jt}^{SOE}/(l^o/l^d)_{jt}^{PRIVATE})$ on the ratio in industrial interest rates $(r_{jt}^{SOE}/r_{jt}^{PRIVATE})$. The corresponding coefficient of the industrial interest rates is still negative, though insignificant, in column (7) with 2-digit CIC industrial fixed effects. However, such a key coefficient turns to be negative and significant once we control for both year-specific and 4-digit CIC industry-specific fixed effects in the last column of Table 9.

We now turn to discuss the economic magnitude of one of key coefficients: $\hat{\gamma}_1$. The average of the interest rate differential across industries is around 21%.[30] The average measured interest rates for SOEs firms is 3% whereas that for private firms is 24% in our sample. One reason that

[29] Arkolakis (2010) argues that firm productivity cannot be compared across industries directly. Therefore, we scale the estimated TFP into the range from zero to one by each 2-digit CIC industry, and normalize the highest estimated TFP of firms in each industry to one in order to obtain firm-level relative TFP in each industry. Then, we calculate the average relative TFP at the industry level and use it as the industrial relative TFP.

[30] Correspondingly, the ratio in interest rate between SOEs and privates is 0.72.

private firms bear such high capital costs is due to the inclusion of borrowing from the informal financial institutions (e.g., credit cooperatives, rotating savings, and credit associations etc.) in which the *de-facto* interest rate is much higher than the *de-jury* interest rate listed by the commercial banks in China.[31] The difference in the relative size between state-owned MNCs and private MNCs is 0.09. Thus, as shown in column (6) of Table 9, the contribution of the interest rates differential to the difference in the relative size is 10.5% which is obtained from $(-0.044) \times (-0.21)/0.09$. Therefore, if there were no domestic distortions in the capital market, the difference in the relative size between state-owned MNCs and private MNCs would fall by around 10 percent. The caveat here is that the overall contribution of domestic distortions to the difference in the relative size of state-owned and private MNCs should be much higher than such a crude accounting as we do not take the distortions in the land acquisition and other input factors into account.

[Insert Table 9 Here]

5 Concluding Remarks

In this paper, we utilize data on Chinese MNCs to study how distortions (i.e., discrimination against private firms) in the domestic market affect firms' FDI decisions. We first document three puzzling stylized facts. First, private MNCs are *less* productive than state-owned FDI firms, although private non-FDI firms are more productive than state-owned non-FDI firms. Second, SOEs are *less* likely to undertake FDI, even though they are bigger and receive various supports from the government for investing abroad. Third, relative size of state-owned FDI firms (compared with non-exporting firms) is *larger* than that of private FDI firms. We then build up a model to rationalize these findings and highlight a key channel through which distortions affect firm's FDI decisions. Distortions in the domestic market incentivize private firms to invest

[31] Note that the measured interest rates are measured by firm's interest expenses divided by its current liability which include money borrowed from both formal and informal financial institutions.

and produce abroad, which results in less tougher selection into the FDI market for them. In addition, compared with state-owned MNCs, private MNCs allocate output disproportionately more in the foreign market, and their size increases disproportionately when they become MNCs. All the empirical predictions of the model receive support from the data.

We believe that this paper is a start of our series of research on how outward FDI and MNCs from developing economies behave differently compared with those from developed economies. At the micro-level, how these differences impact firm productivity and firm-level R&D is worth exploring in the near future. At the macro-level, how these differences affect misallocation, aggregate TFP and welfare is also worth investigating. At the same time, more and more data on MNCs of developing economies are becoming available now. Our current paper points out one important aspect of these firms' investment behavior.

References

[1] Antràs, Pol (2003), "Firms, Contracts, and Trade Structure," *Quarterly Journal of Economics* 118(4), pp. 1375-1418.

[2] Antràs, Pol (2005), "Incomplete Contracts and the Product Cycle," *American Economic Review* 95(4), pp. 1054-1073.

[3] Antràs, Pol and Elhanan, Helpman (2004), "Global Sourcing," *Journal of Political Economy* 112(3), pp. 552-580.

[4] Arkolakis, Costas (2010), "Market Penetration Costs and the New Consumers Margin in International Trade," *Journal of Political Economy*, 118(6), pp. 1151-1199.

[5] Bai, C. E., Hsieh, C. T., and Song, Z. M. (2014), "Crony Capitalism with Chinese Characteristics," Unpublished manuscript, University of Chicago.

[6] Bai, Xue, Kala Krishna, and Hong Ma (2013),"How You Export Matters: Export Mode, Learning and Productivity in China," Unpublished manuscript, Penn State University.

[7] Brainard, S. L. (1997), "An Empirical Assessment of the Proximity-Concentration Trade-off Between Multinational Sales and Trade," *American Economic Review* 87(4), pp. 520-544.

[8] Brandt, L., J. Van Biesebroeck, and Y. Zhang, (2012), "Creative Accounting or Creative Destruction? Firm-level Productivity Growth in Chinese Manufacturing," *Journal of Development Economics* 97(2), pp. 339-351.

[9] Brandt, L., Tombe, T., and Zhu, X. (2013), "Factor Market Distortions across Time, Space and Sectors in China," *Review of Economic Dynamics* 16(1), pp. 39-58.

[10] Chen, Wenjie and Heiwai Tang (2014), "The Dragon is Flying West: Micro-Level Evidence of Chinese Outward Direct Investment," *Asian Development Review* 31(2), pp. 109-140.

[11] Guner, N., G. Ventura, and Daniel Yi Xu (2008), "Macroeconomic Implications of Size-dependent Policies," *Review of Economic Dynamics* 11(4), pp. 721-44.

[12] Garicano, L., C. Lelarge, and J. Van Reenen, (2013), "Firm size distortions and the productivity distribution: Evidence from France," Working Paper No. 18841, National Bureau of Economic Research.

[13] Feenstra, Robert, Zhiyuan Li, and Miaojie Yu (2014), "Exports and Credit Constraints under Incomplete Information: Theory and Evidence from China," *Review of Economics and Statistics*, 96(4), pp. 729-744.

[14] Helpman, Elhanan, Marc J. Melitz and Steven R. Yeaple (2004), "Export vs. FDI," *American Economic Review* 94(1), pp. 300-316.

[15] Hsieh, Chang-Tai and Peter Klenow (2009), "Misallocation and Manufacturing TFP in China and India," *Quarterly Journal of Economic* 124(4), pp. 1403-1448.

[16] Huang, Yasheng (2003), "Selling China: Foreign Direct Investment During the Reform Era," Penguin Group.

[17] Huang, Yasheng (2008), "Capitalism with Chinese Characteristics: Entrepreneurship and the State," (Vol. 1) Cambridge: Cambridge University Press.

[18] Huang, Yiping and Bijun Wang (2011), "Chinese Outward Direct Investment: Is There a China Model?" *China and World Economy* 19(4), pp. 1-21.

[19] King, Gary and Langche Zeng (2001), "Logistic Regression in Rare Events Data," *Political Analysis* 9(2), pp. 137-163.

[20] King, Gary and Langche Zeng (2002), "Estimating Absolute, Relative, and Attributable Risks in Case-control Studies," *Statistics in Medicine* 21, pp. 1409-1427.

[21] Kolstad Ivar and Arne Wilg (2012), "What determines Chinese FDI?" *Journal of World Business* 47(1), pp. 26-34.

[22] Khandelwal, Amit K., Peter K. Schott, and Shang-Jin Wei (2013), "Trade Liberalization and Embedded Institutional Reform: Evidence from Chinese Exporters," *American Economic Review* 103(6), pp. 2169-2195.

[23] Markusen, James R. (1984), "Multinationals, Multi-Plant Economies, and the Gains from Trade," *Journal of International Economics* 16(3), pp. 205-226.

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

[25] Midrigan, Virgiliu, and Daniel Y. Xu (2014), "Finance and Misallocation: Evidence from Plant-Level Data," American Economic Review 104(2), pp. 422-458.

[26] Moll, Bejamin (2012), "Productivity Losses from Financial Frictions: Can Self-financing Undo Capital Misallocation?" Unpublished manuscript, Princeton University.

[27] Olley, Steven and Ariel Pakes (1996), "The Dynamics of Productivity in the Telecommunications Equipment Industry," *Econometrica* 64(6), pp. 1263-1297.

[28] Restuccia, Daniel and Richard Rogerson (2008), "Policy Distortions and Aggregate Productivity with Heterogeneous Establishments," *Review of Economic Dynamics* 11(4), pp. 707-720.

[29] Restuccia, Daniel and Richard Rogerson (2008), "Misallocation and Productivity," *Review of Economic Dynamics* 16, pp. 1-10.

[30] Rosen H. Daniel and Thilo Hanemann (2009), "China's Changing Outbound Foreign Direct Investment Profile: Drivers and Policy Implication," Peterson Institute of International Economics, Policy Brief, PB09-14.

[31] Tian, Wei, Liugang Sheng, and Hongyan Zhao (2015), "State Capitalism: A New Perspective of Land Sale in China," *Pacific Economic Review*, forthcoming.

[32] Tian, Wei and Miaojie Yu (2015), "Distribution Outward FDI and Productivity Heterogeneity: Evidence from Chinese Firms," Unpublished manuscript, Peking University.

[33] UNCTAD (2015), World Investment Report–Reforming International Investment Governance.

[34] Yu, Miaojie (2015), "Processing Trade, Tariff Reductions, and Firm Productivity: Evidence from Chinese Firms," *Economic Journal*, 125 (June), pp. 943-988.

Table 1: FDI Share in Chinese Manufacturing Firms (2000-08)

Firm type	2000	2001	2002	2003	2004	2005	2006	2007	2008
(1) Mfg. firms	84,974	100,091	110,522	129,720	200,989	198,285	248,601	258,246	222,312
(2) FDI starting firms	197	340	444	587	972	984	1,081	1,140	1,018
(3) FDI mfg. firms	14	17	20	30	103	431	761	1,168	1,183
(4) SOE FDI mfg. firms	3	3	3	4	4	18	22	29	18
(5) FDI share (%)	0.23	0.34	0.40	0.45	0.48	0.49	0.43	0.44	0.46
(6) SOE FDI share (%)	21.4	17.6	15.0	13.3	3.8	4.17	2.89	2.48	1.52

Notes: Data on FDI starting firms are obtained from Ministry of Commerce of China and authors' calculations. FDI share in row (5) is obtained by dividing the number of FDI starting firms by the number of manufacturing firms (i.e., (5)=(2)/(1)). SOE FDI share in row (6) is obtained by dividing the number of SOE FDI mfg. firms by the number of FDI mfg. firms (i.e., (6)=(4)/(3)). FDI starting firms refer to firm-destination country pairs. I.e., if firm F invests in countries B and C, there will be two FDI starting firms recorded by the Ministry of Commerce: firm F-A and firm F-B. FDI mfg. firms refer to (Chinese) parent firms only (not firm-destination country pairs). In the previous example, there will be only one FDI firm counted in row (3): firm F.

Table 2: Selection Reversal: State-owned FDI Firms Are More Productive than Private FDI Firms

Category	Non-FDI firms				FDI firms		# of	# of	Fraction of
	domestic only		domestic+export		all firms	with exports	FDI firms	All firms	FDI firms
PSM Matching	unmatched	matched	unmatched	matched	unmatched	unmatched			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(i) Private firms	3.63	3.54	3.62	3.58	4.28	4.28	3,626	1,100,212	0.33%
(ii) SOE	2.99	2.99	3.05	3.05	4.48	4.76	104	40,612	0.25%
Difference=(i)-(ii)	0.63***	0.55***	0.57***	0.53***	-0.20*	-0.48***			
	(93.60)	(41.34)	(95.76)	(46.73)	(-1.67)	(-3.30)			

Notes: Columns (1) and (2) show that private firms have higher TFP than SOEs among non-FDI firms with only domestic sales. Columns (3) and (4) show that private firms have higher TFP than SOE for non-FDI firms with both domestic sales and exports. Columns (5) and (6) show that, on average, private FDI firms are *less* productive than state-owned FDI firms. This is consistent with part 1 of Proposition 1. Column (9) reports the fraction of FDI firms which is obtained by dividing column (8) by column (7). Clearly, the share of FDI firms is smaller among SOEs than among private firms, which is consistent with part 2 of Proposition 1. Firm size (i.e., log employment) and sales are used as covariates to obtain the propensity score. Number in parenthesis are t-value. ***(**,*) denotes the significance at 1(5, 10)%, respectively.

Table 3: Absolute Size Premium for SOEs

Category	Non-FDI exporting firms		FDI non-exporting firms		FDI firms		Domestic sales
Variable	Lnl	Sales	Lnl	Sales	Lnl	Sales	of FDI firms
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(i) Private firms	5.19	60,703	4.73	181,713	5.77	3,110,883	1,874,675
(ii) SOE	6.88	130,238	6.55	549,485	8.29	11,130,681	10,347,231
Difference=(i)-(ii)	-1.69***	-69,535***	-1.82***	-367,772**	-2.52***	-8,019,798***	-8,472,556***
	(-140.8)	(-26.71)	(-7.85)	(-2.26)	(-14.14)	(-5.49)	(-8.48)
			Regressions				
SOE Indicator	1.566***	1.491***	1.795***	1.701***	2.400***	2.841***	3.727***
	(79.35)	(70.83)	(4.78)	(4.07)	(7.68)	(8.14)	(6.84)
Firm TFP	0.068***	0.550***	0.180***	0.683***	0.345***	0.807***	0.938***
	(21.56)	(163.30)	(4.41)	(15.03)	(7.61)	(15.95)	(11.51)
Year-specific Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-specific Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	323,397	323,397	1,375	1,375	2,352	2,352	2,058
R-squared	0.07	0.21	0.15	0.33	0.16	0.31	0.21

Notes: Columns (1)-(6) of the upper module show that private firms have lower sales and employment than SOEs for non-FDI exporting firms, FDI non-exporting firms, and FDI firms, respectively. Column (7) of the upper module shows that domestic sales of private FDI firms is smaller than its counterpart of state-owned FDI firms. The lower module regress firm size (in log employment) and firm sales on SOEs indicator while controlling for firm TFP, year-specific fixed effects, and firm-specific fixed effects. All regressions shows that SOEs are bigger than private firms among non-FDI exporting firms, non-exporting FDI firms, and FDI firms respectively. Such results are consistent with predictions of Proposition 2. Numbers in parentheses are t-values. ***(**, *) denotes significance at the 1% (5%, 10%) level.

Table 4: Relative Size Premium for SOEs

Year coverage	Avg.	$\leq$ 2001	$\leq$ 2002	$\leq$ 2003	$\leq$ 2004	$\leq$ 2005	$\leq$ 2006	$\leq$ 2007	$\leq$ 2008
relative size of FDI firms to non-exporting firms (l_o/l_d)									
(1) Private Firms	4.50	4.59	4.59	4.56	4.54	4.53	4.52	4.51	4.50
(2) SOE	5.48	5.65	5.64	5.58	5.55	5.53	5.51	5.49	5.48
Size Difference=(1)-(2)	-0.97***	-1.06***	-1.05***	-1.02***	-1.01***	-1.00***	-0.99***	-0.98***	-0.98***
	(-488.1)	(-234.0)	(-283.5)	(-329.0)	(-374.1)	(-400.1)	(-430.4)	(-445.5)	(-466.6)
relative size of exporting firms to non-exporting firms (l_e/l_d)									
(3) Private Firms	4.70	4.83	4.83	4.79	4.76	4.74	4.73	4.71	4.71
(4) SOE	5.79	5.98	5.96	5.90	5.86	5.85	5.82	5.80	5.79
Size Difference=(3)-(4)	-1.08***	-1.15***	-1.13***	-1.11***	-1.10***	-1.09***	-1.09***	-1.09***	-1.08***
	(-432.0)	(-200.2)	(-239.4)	(-289.4)	(-300.9)	(-365.1)	(-395.9)	(-425.8)	(-441.7)

Notes: This table reports the difference in relative firm size between private FDI firms and state-owned FDI firms. Firm size is measured by log employment. The top module shows that relative size of FDI firms to non-exporting firms is smaller for private firms than that for SOEs. The bottom module shows that relative size of exporting firms to non-exporting firms is smaller for private firms than for SOEs as well. These findings are consistent with predictions of Proposition 3 that relative size premium of FDI firms and exporting firms is smaller for private firms than for SOEs. Numbers in parentheses are t-values. ***(**, *) denotes significance at the 1% (5%, 10%) level.

Table 5: Private Firms Are more likely to Undertake FDI (2000-08)

Regressand: FDI Indicator	LPM	LPM	Probit	Logit	Complementary Log-Log	Rare Event Logit
Variable:	(1)	(2)	(3)	(4)	(5)	(6)
SOE Indicator	-0.002**	-0.003**	-0.268***	-0.703***	-0.628**	-0.975***
	(-2.09)	(-2.56)	(-2.66)	(-2.71)	(-2.56)	(-9.50)
Firm TFP	0.001***	0.001***	0.043**	0.140**	0.146**	0.493***
	(3.96)	(3.31)	(2.25)	(2.16)	(2.15)	(28.22)
Log Firm Labor	0.003***	0.003***	0.232***	0.606***	0.566***	0.535***
	(6.52)	(5.34)	(12.11)	(10.69)	(8.90)	(36.78)
Export Indicator	0.004***	0.006***	0.426***	1.150***	1.156***	1.154***
	(7.45)	(12.60)	(8.49)	(6.07)	(6.13)	(27.01)
Foreign Firms Dropped	No	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	No	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	No	Yes	Yes	Yes	Yes	Yes
Number of Observations	1,140,824	899,910	898,800	898,800	898,800	899,910

Notes: The regressand is the FDI indicator. All columns except column (1) include both industry dummies at the 2-digit level and year dummies. Column (1) includes foreign-invested firms, whereas all other columns drop those firms. Numbers in parentheses are t-values clustered at the firm level. *** denotes significance at the 1% level. All the results are consistent with part 3 of Proposition 1: SOEs are less likely to be engaged in outward FDI than private firms.

6 Appendix: Not For Publication

6.1 Appendix A: Data Description

This appendix draw heavily from Tian and Yu (2015).

FDI Decision Data. The nationwide data set of Chinese firms' FDI decisions was obtained from the Ministry of Commerce of China (MOC). MOC requires every Chinese FDI firm to report its detailed investment activity since 1980. To invest abroad, every Chinese firm is required by the government to apply to the MOC and its former counterpart, the Ministry of Foreign Trade and Economic Cooperation of China, for approval and registration. MOC requires such firms to provide the following information: the firm's name, the names of the firm's foreign subsidiaries, the type of ownership (i.e., state-owned enterprise (SOE) or private firm), the investment mode (e.g., trading-oriented affiliates, mining-oriented affiliates), and the amount of foreign investment (in U.S. dollars). Once a firm's application is approved by MOC, MOC will release the information mentioned above, as well as other information, such as the date of approval and the date of registration abroad, to the public. All such information is available except the amount of the firm's investment, which is considered to be confidential information to the firms.

Since 1980, MOC has released information on new FDI firms every year. Thus, the nationwide FDI decision data indeed report FDI starters by year. The database even reports specific modes of investment: trading office, wholesale center, production affiliate, foreign resource utilization, processing trade, consulting service, real estate, research and development center, and other unspecified types. Here trading offices and wholesale centers are classified as distribution FDI, whereas the rest are referred to as non-distribution FDI. However, since this data set does not report firms' FDI flows, researchers are not able to explore the intensive margin of firm FDI with this data set.

FDI Flow Data. To explore the intensive margin, we use another data set, which is compiled by the Department of Commerce of Zhejiang province. The most novel aspect of this data set is that it includes data on firms' FDI flows (in current U.S. dollars). The data set covers all firms with headquarters located (and registered) in Zhejiang and is a short, unbalanced panel from 2006 to 2008. In addition to the variables covered in the nationwide FDI data set, the Zhejiang data set provides each firm's name, city where it has its headquarters, type of ownership, industry classification, investment destination countries, and stock share from its Chinese parent company.

Although this data set seems ideal for examining the role of the intensive margin of firm FDI, the disadvantage is also obvious: the data set is for only one province in China.[32] Regrettably, as is the case for many other researchers, we cannot access similar databases from other provinces. Still, as discussed in Appendix C, we

[32] To our knowledge, almost all previous work was not able to access nationwide universal outward FDI flow data. An outstanding exception is Wang et al. (2012), who use nationwide firm-level outward FDI data to investigate the driving force of outward FDI of Chinese firms. However, the study uses data only from 2006 to 2007; hence, it cannot explore the possible effects of the financial crisis in 2008.

Table 6: Distortions in Input Factors Markets

Regressand	Measured Firm Interest Rates			City Land Price		
	(1)	(2)	(3)	(4)	(5)	(6)
SOE Indicator	-0.124***	-0.134*	-0.212*			
	(-2.58)	(-1.90)	(-1.75)			
SOE Intensity				-125.5***	-105.9**	-137.8**
				(-2.76)	(-2.08)	(-2.09)
Other Firm Factors Controls	No	No	Yes	No	No	Yes
Year-specific Fixed Effects	No	Yes	Yes	Yes	Yes	Yes
Industry-specific Fixed Effects	No	Yes	Yes	No	Yes	Yes
City-specific Fixed Effects	No	No	No	No	No	Yes
Number of Obs.	1,119,454	1,119,454	1,119,446	547	547	547
R-squared	0.01	0.01	0.01	0.08	0.15	0.11

Notes: Regressand in columns (1)-(3) is the firm-level interest rate calculated as the ratio of firm's interest expenses to its current liability. Column (1) is the simple OLS estimate, whereas column (2) controls for year-specific and industry-specific fixed effects. Column (3) adds other firm-characteristic controls such as firm TFP, log firm labor, foreign indicator, and export dummy as well as industry- and year-specific fixed effects. The SOE indicator is shown to be negative and statistically significant. Regressand in columns (4)-(6) is city-level average price of land purchased by firms from the government. This is defined as the ratio of government's total land revenue to its land area in each prefectural city. The SOE intensity is defined as the number of SOEs divided by the number of total manufacturing firms within each prefectural city. Cities in which SOE intensity equals zero or one are dropped from the estimation. Column (4) controls for year-specific fixed effects only, while column (5) controls for both year-specific and industry-specific fixed effects. Column (6) controls for cities' total land sales as well as city-specific, year-specific and industry-specific fixed effects. Numbers in parentheses are t-values. ***(**, *) denotes significance at the 1% (5%, 10%) level.

Table 7: Ratio of Foreign Sales to Domestic Sales by FDI firms in Zhejiang Province (2006-08)

Regressand: Ratio of foreign to domestic sales	(1)	(2)	(3)
SOE Indicator	-0.03**	-0.05*	-0.05*
	(-2.47)	(-1.75)	(-1.71)
Firm TFP		0.01	0.01
		(0.89)	(1.00)
Days of Import Document Preparation		-0.003	-0.003
		(-0.73)	(-0.74)
Year-specific Fixed Effects	No	No	Yes
Industry-specific Fixed Effects	No	Yes	Yes
Observations	199	198	198
R-squared	0.01	0.01	0.02

Notes: Data used in this table covers FDI firms from Zhejiang province for 2006-2008 during which data on foreign investment are available. Ratio of foreign sales to domestic sales is defined as foreign investment over parent firm's capital stock. Days of import document preparation in destination countries are used to proxy firm's fixed exporting cost in destination countries. Such findings are consistent with part 1 of proposition 4: The ratio of foreign sales to domestic sales is higher for private FDI firms than for state-owned FDI firms. Numbers in parentheses are t-values clustered at firm level. *** denotes significance at the 1% level.

Table 8: Change in Firm Size in Response to Investment Liberalization

Regressand:	FDI Firm's Total Capital			Log number of employees		
Type of FDI:	All FDI		Production FDI	All firms	FDI firms	Production FDI
	(1)	(2)	(3)	(4)	(5)	(6)
Log Licence Costs	-0.001*	-0.001*	-0.001***	-0.01***	-0.02	-0.02
	(-1.71)	(-1.64)	(-3.17)	(-57.49)	(-0.51)	(-0.32)
Licence Costs× SOE Indicator	0.31***	0.30***	0.24***	0.21***	0.67***	0.65***
	(32.20)	(25.49)	(8.92)	(75.23)	(6.48)	(6.10)
Year-specific Fixed Effects	No	Yes	Yes	Yes	Yes	Yes
Industry-specific Fixed Effects	No	Yes	Yes	Yes	Yes	Yes
Observations	180	180	32	86,773,376	777	347
R-squared	0.06	0.07	0.45	0.26	0.26	0.34

Notes: Regressand in columns (1)-(3) is FDI firm's total capital stock which is the sum of firm's foreign direct investment and its Chinese parent firm's fixed capital stock. FDI firms from Zhejiang province during 2006-2008 are used as observations due to data limitation. As the amount of FDI volume is in US dollar, we convert it to Chinese RMB using average exchange rate ($1=RMB 8.05) during 2006-2008. Regressand in columns (4)-(6) is log employment. Licence costs in destination countries are used to proxy firm's fixed costs of doing FDI in destination countries. Data are obtained from Doing Business Project (2008). Empirical findings from this table are consistent with part 2 proposition 4: Firm size increases more for private firms than for SOEs after the fixed FDI cost drops in the destination country. Numbers in parentheses are t-values and clustered at the firm level. *** denotes significance at the 1% level.

Table 9: Difference in FDI Size Premium

Regressand	FDI relative size $(l_o/l_d)_{jt}$			Difference in FDI relative size $(l_o/l_d)^{SOE}_{jt} - (l_o/l_d)^{PRI}_{jt}$			Ratio in FDI relative size $(l_o/l_d)^{SOE}_{jt}/(l_o/l_d)^{PRI}_{jt}$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Industrial Interest Rates (r_{jt})		-8.417**	-8.143*	–	–	–	–	–
		(-2.31)	(-1.74)					
Difference in Ind. Interest Rates $(r^{SOE}_{jt} - r^{PRIVATE}_{jt})$	–	–	–	-0.029**	-0.025*	-0.044*	-0.001	-0.034*
				(-2.17)	(-1.81)	(-1.70)	(-1.23)	(-1.77)
Ratio in Ind. Interest Rates $(r^{SOE}_{jt}/r^{PRIVATE}_{jt})$								
Industrial SOE Intensity	1.354***		1.373**	–	–	–	–	–
	(2.63)		(2.06)					
Industrial Relative TFP			-0.166		0.085*	-0.467	-0.577***	-0.065
			(-0.76)		(1.86)	(-1.12)	(-3.37)	(-0.15)
Year-specific Fixed Effects	Yes	Yes	Yes	No	No	No	No	Yes
2-digit Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	–	Yes	–
4-digit Industry Fixed Effects	No	No	No	No	No	Yes	No	Yes
Number of Obs.	160	160	160	147	147	205	147	205
R-squared	0.65	0.66	0.69	0.97	0.97	0.87	0.91	0.88

Notes: Columns (1)-(3) regress CIC 2-digit level industrial FDI relative size $(l_o/l_d)_{jt}$ on industrial interest rate (defined as the ratio of industry-average interest expenses to its current liability) and industrial SOE intensity (defined as the number of SOEs divided by the number of total manufacturing firms within each industry). Columns (4)-(6) regress the difference in relative size of FDI firms at the industry level $(l_o/l_d)^{SOE}_{jt} - (l_o/l_d)^{PRI}_{jt}$ on the difference in industrial interest rates $(r^{SOE}_{jt} - r^{PRIVATE}_{jt})$. Columns (7)-(8) regress the ratio of relative size of FDI firms at the industry level $(l_o/l_d)^{SOE}_{jt}/(l_o/l_d)^{PRI}_{jt}$ on the ratio of industrial interest rates $(r^{SOE}_{jt}/r^{PRIVATE}_{jt})$.Columns (3), (5)-(8) control for industrial average TFP, respectively. Industries in columns (1)-(5), and (7) are defined at CIC 2-digit level, while those in columns (7) and (8) are defined at CIC 4-digit level. Columns (1)-(3) show that FDI size premium becomes bigger (at the industry level), when input costs such as the interest rate fall at the industry level, or the share of SOEs increases. Columns (4)-(8) show that the difference in or ratio of (relative) FDI size premium (between SOEs and private firms) decreases, when the gap in interest rates (paid by SOEs and private firms) increases or the ratio in interest rates falls. This is consistent with part 3 of Proposition 4. Numbers in parentheses are t-values. ***(**, *) denotes significance at the 1% (5%, 10%) level.

believe that Zhejiang's firm-level FDI flow data are a good proxy for understanding the universal Chinese firm's FDI flows. In particular, the FDI flows from Zhejiang province are outstanding in the whole of China; the distribution of both types of ownership and that of Zhejiang's FDI firms' destinations and industrial distributions are similar to those for the whole of China.

Firm-Level Production Data. Our last database is the firm-level production data compiled by China's National Bureau of Statistics in an annual survey of manufacturing enterprises. The data set covers around 162,885 firms in 2000 and 410,000 firms in 2008 and, on average, accounts for 95 percent of China's total annual output in all manufacturing sectors. The data set includes two types of manufacturing firms: universal SOEs and non-SOEs whose annual sales are more than RMB 5 million (or equivalently $830,000 under the current exchange rate). The data set is particularly useful for calculating measured total factor productivity (TFP), since the data set provides more than 100 firm-level variables listed in the main accounting statements, such as sales, capital, labor, and intermediate inputs.

As highlighted by Feenstra et al. (2014) and Yu (2015), some samples in this firm-level production data set are noisy and somewhat misleading, largely because of mis-reporting by some firms. To guarantee that our estimation sample is reliable and accurate, we screen the sample and omit outliers by adopting the following criteria. First, we eliminate a firm if its number of employees is less than eight workers, since otherwise such an entity would be identified as self-employed. Second, a firm is included only if its key financial variables (e.g., gross value of industrial output, sales, total assets, and net value of fixed assets) are present. Third, we include firms based on the requirements of the Generally Accepted Accounting Principles.[33]

Data Merge. We then merge the two firm-level FDI data sets (i.e., nationwide FDI decision data and Zhejiang's FDI flow data) with the manufacturing production database. Although the two data sets share a common variable—the firm's identification number—their cFDIng systems are completely different. Hence, we use alternative methods to merge the three data sets. The matching procedure involves three steps. First, we match the three data sets (i.e., firm production data, nationwide FDI decision data, and Zhejiang FDI flow data) by using each firm's Chinese name and year. If a firm has an exact Chinese name in a particular year in all three data sets, it is considered an identical firm. Still, this method could miss some firms since the Chinese name for an identical company may not have the exact Chinese characters in the two data sets, although they share some common strings.[34] Our second step is to decompose a firm name into several strings referring to its location, industry, business type, and specific name, respectively. If a company has all identical strings, such a firm in the three data sets is classified as an identical firm.[35] Finally, to avoid possible mistakes, all approximate string-matching procedures are done manually.

6.2 Appendix B: Decreasing Returns to Scale Technology

In this part of the Appendix, we show that all our theoretical results continue to hold, when production technology features decreasing returns to scale. We choose a specific functional form for the cost function, and it is assumed

[33] In particular, an observation is included in the sample only if the following observations hold: (1) total assets are greater than liquid assets; (2) total assets are greater than the total fixed assets and the net value of fixed assets; (3) the established time is valid (i.e., the opening month should be between January and December); and (4) the firm's sales must be higher than the required threshold of RMB 5 million.

[34] For example, "Ningbo Hangyuan communication equipment trading company" shown in the FDI data set and "(Zhejiang) Ningbo Hangyuan communication equipment trading company" shown in the National Bureau of Statistics of China production data set are the same company but do not have exactly the same Chinese characters.

[35] In the example above, the location fragment is "Ningbo," the industry is "communication equipment," the business type is "trading company," and the specific name is "Hangyuan."

to be country-specific. Specifically, for an SOE that does not undertake FDI, its cost function is

$$\frac{(q_H + I_{\{q_E>0\}}q_E)^2 w_H}{2\varphi}, \tag{21}$$

where w_H is the wage paid to workers in the domestic market. $I_{\{}q_E > 0\}$ is an indication function which takes the value of one, if the firm exports and vice versa. q_H and q_F are domestic sales and exports respectively. If an SOE does domestic production and FDI, the total cost is a sum of two parts:

$$\frac{q_H^2 w_H}{2\varphi} + \frac{q_F^2 w_F}{2\varphi}, \tag{22}$$

where w_F is the wage paid to workers in the foreign market, and q_F is the output produced by the foreign affiliate. The cost function of private firms' is almost same as the SOEs' cost function except that the factor price the private firm pays is cw_H when it produces in the domestic market. For instance, if a private firm does domestic production and FDI, the total cost is

$$\frac{cq_H^2 w_H}{2\varphi} + \frac{q_F^2 w_F}{2\varphi}. \tag{23}$$

The key here is that the foreign affiliate of a private MNC pays a *lower* factor price than its headquarters at home.

6.2.1 Domestic Production, Exporting and FDI

In this subsection, we consider the choice between three types of production modes: domestic production, exporting and FDI. We derive the operating profit (inclusive of the fixed costs) and the final profit of an SOE that sells only domestically as[36]

$$\pi_{SD}(\varphi) = \Big[1 - \frac{\beta}{2}\Big]\Big(\frac{\beta\varphi}{w_H}\Big)^{\frac{\sigma-1}{\sigma+1}} C_H^{\frac{2\sigma}{\sigma+1}} \tag{24}$$

and

$$\Pi_{SD}(\varphi) = \Big[1 - \frac{\beta}{2}\Big]\Big(\frac{\beta\varphi}{w_H}\Big)^{\frac{\sigma-1}{\sigma+1}} C_H^{\frac{2\sigma}{\sigma+1}} - f_D. \tag{25}$$

For a private firm that sells only domestically, the respective profit functions are

$$\pi_{PD}(\varphi) = \Big[1 - \frac{\beta}{2}\Big]\Big(\frac{\beta\varphi}{cw_H}\Big)^{\frac{\sigma-1}{\sigma+1}} C_H^{\frac{2\sigma}{\sigma+1}} \tag{26}$$

and

$$\Pi_{PD}(\varphi) = \Big[1 - \frac{\beta}{2}\Big]\Big(\frac{\beta\varphi}{cw_H}\Big)^{\frac{\sigma-1}{\sigma+1}} C_H^{\frac{2\sigma}{\sigma+1}} - f_D. \tag{27}$$

[36] In this section, subscript S and P denote SOEs and private firms. Subscript D, X and O represent domestic production only, domestic production and exporting, and domestic production and outward FDI.

The exporting decision involves the allocation of output in the domestic market and the foreign market. First, for a firm that sells both domestically and internationally, the optimal output allocation is the solution to

$$\max_{q_E,q_H} \left(\frac{q_E}{\tau}\right)^{\frac{\sigma-1}{\sigma}} C_F + q_H^{\frac{\sigma-1}{\sigma}} C_H,$$

given that

$$q_E + q_H \leq q,$$

where q is the total output produced. Thus, the optimal share of output sold domestically is

$$s^*(C_H, C_F) = \frac{C_H^\sigma}{C_H^\sigma + C_F^\sigma/\tau^{\sigma-1}}, \tag{28}$$

which applies to both the SOE and the private firm. Based on equation (28), we obtain the operating profit and the final profit for an SOE that sells in the two markets as

$$\pi_{SX}(\varphi) = \left[1 - \frac{\beta}{2}\right]\left(\frac{\beta\varphi}{w_H}\right)^{\frac{\sigma-1}{\sigma+1}}\left(C_H^\sigma + \frac{C_F^\sigma}{\tau^{(\sigma-1)}}\right)^{\frac{2}{\sigma+1}} \tag{29}$$

and

$$\Pi_{SX}(\varphi) = \left[1 - \frac{\beta}{2}\right]\left(\frac{\beta\varphi}{w_H}\right)^{\frac{\sigma-1}{\sigma+1}}\left(C_H^\sigma + \frac{C_F^\sigma}{\tau^{(\sigma-1)}}\right)^{\frac{2}{\sigma+1}} - f_D - f_X, \tag{30}$$

where f_X is the fixed cost of exporting. For a private firm that sells in both markets, the operating profit and final profit are

$$\pi_{PX}(\varphi) = \left[1 - \frac{\beta}{2}\right]\left(\frac{\beta\varphi}{cw_H}\right)^{\frac{\sigma-1}{\sigma+1}}\left(C_H^\sigma + \frac{C_F^\sigma}{\tau^{(\sigma-1)}}\right)^{\frac{2}{\sigma+1}} \tag{31}$$

and

$$\Pi_{PX}^F(\varphi) = \left[1 - \frac{\beta}{2}\right]\left(\frac{\beta\varphi}{cw_H}\right)^{\frac{\sigma-1}{\sigma+1}}\left(C_H^\sigma + \frac{C_F^\sigma}{\tau^{(\sigma-1)}}\right)^{\frac{2}{\sigma+1}} - f_D - f_X \tag{32}$$

respectively. Note that exporting is subject to the same factor price differential, c.

The operating profit and final profit of SOEs and private firms that sell domestically and undertake FDI are derived as follows:

$$\pi_{SO}(\varphi) = \left[1 - \frac{\beta}{2}\right]\left[\left(\frac{\beta\varphi}{w_H}\right)^{\frac{\sigma-1}{\sigma+1}} C_H^{\frac{2\sigma}{\sigma+1}} + \left(\frac{\beta\varphi}{w_F}\right)^{\frac{\sigma-1}{\sigma+1}} C_F^{\frac{2\sigma}{\sigma+1}}\right]; \tag{33}$$

$$\Pi_{SO}(\varphi) = \left[1 - \frac{\beta}{2}\right]\left[\left(\frac{\beta\varphi}{w_H}\right)^{\frac{\sigma-1}{\sigma+1}} C_H^{\frac{2\sigma}{\sigma+1}} + \left(\frac{\beta\varphi}{w_F}\right)^{\frac{\sigma-1}{\sigma+1}} C_F^{\frac{2\sigma}{\sigma+1}}\right] - f_D - f_I; \tag{34}$$

$$\pi_{PO}(\varphi) = \left[1 - \frac{\beta}{2}\right]\left[\left(\frac{\beta\varphi}{cw_H}\right)^{\frac{\sigma-1}{\sigma+1}} C_H^{\frac{2\sigma}{\sigma+1}} + \left(\frac{\beta\varphi}{w_F}\right)^{\frac{\sigma-1}{\sigma+1}} C_F^{\frac{2\sigma}{\sigma+1}}\right]; \tag{35}$$

$$\Pi_{PO}(\varphi) = \left[1 - \frac{\beta}{2}\right]\left[\left(\frac{\beta\varphi}{cw_H}\right)^{\frac{\sigma-1}{\sigma+1}} C_H^{\frac{2\sigma}{\sigma+1}} + \left(\frac{\beta\varphi}{w_F}\right)^{\frac{\sigma-1}{\sigma+1}} C_F^{\frac{2\sigma}{\sigma+1}}\right] - f_D - f_I. \tag{36}$$

6.2.2 Sorting Pattern of FDI firms and Size-Premium of MNCs

In this subsection, we derive relationship between various cutoffs and explore how average firm size of FDI firms differs across SOEs and private firms. First, equations (24) and (26) show that

$$\bar{\varphi}_{PD} = c\bar{\varphi}_{SD} > \bar{\varphi}_{SD},$$

which implies that it is tougher for private firms to survive in the domestic market. Second, the relationship between the exporting cutoff and the exit cutoff is the same across the two types of firms and derived as:

$$\frac{\bar{\varphi}_{PX}}{\bar{\varphi}_{PD}} = \frac{\bar{\varphi}_{SX}}{\bar{\varphi}_{SD}} = \left[\frac{f_X/f_D}{\left(\frac{C_H^\sigma + C_F^\sigma/\tau^{(\sigma-1)}}{C_H^\sigma}\right)^{\frac{2}{\sigma+1}} - 1}\right]^{\frac{\sigma+1}{\sigma-1}}. \tag{37}$$

As usual, we assume that the fixed cost of exporting is high enough such that there is selection of exporting. Third, for an SOE that serves the foreign market, it chooses FDI over exporting if and only if

$$f_D\left(\frac{\bar{\varphi}_{SO}}{\bar{\varphi}_{SD}}\right)^{\frac{(\sigma-1)}{\sigma+1}}\left(1 + (w_H/w_F)^{\frac{\sigma-1}{\sigma+1}}(C_F/C_H)^{\frac{2\sigma}{\sigma+1}} - \left(\frac{C_H^\sigma + C_F^\sigma/\tau^{(\sigma-1)}}{C_H^\sigma}\right)^{\frac{2}{\sigma+1}}\right) > f_I - f_X.$$

Thus, the cutoff for doing FDI can be expressed as

$$\frac{\bar{\varphi}_{SO}}{\bar{\varphi}_{SD}} = \left((f_I - f_X)/f_D\right)^{\frac{\sigma+1}{\sigma-1}}\left(1 + (w_H/w_F)^{\frac{\sigma-1}{\sigma+1}}(C_F/C_H)^{\frac{2\sigma}{\sigma+1}} - \left(\frac{C_H^\sigma + C_F^\sigma/\tau^{(\sigma-1)}}{C_H^\sigma}\right)^{\frac{2}{\sigma+1}}\right)^{\frac{-(\sigma+1)}{\sigma-1}}. \tag{38}$$

A similar relationship applies to private firms:

$$\frac{\bar{\varphi}_{PO}}{\bar{\varphi}_{PD}} = \left((f_I - f_X)/f_D\right)^{\frac{\sigma+1}{\sigma-1}}\left(1 + (cw_H/w_F)^{\frac{\sigma-1}{\sigma+1}}(C_F/C_H)^{\frac{2\sigma}{\sigma+1}} - \left(\frac{C_H^\sigma + C_F^\sigma/\tau^{(\sigma-1)}}{C_H^\sigma}\right)^{\frac{2}{\sigma+1}}\right)^{\frac{-(\sigma+1)}{\sigma-1}}. \tag{39}$$

There are two points worth mentioning before proceeding. First, we assume that there is selection of multinational firms among firms that want to sell goods aborad. This is true if f_I is sufficiently large. Second, the variable trade cost, τ, is assumed to be large enough such that there are FDI firms in equilibrium.[37]

We use the following propositions to summarize how the likelihood of becoming an FDI firm, the fraction of FDI firms, and the average productivity of FDI firms differ across private firms and SOEs.

Proposition 5 *Sorting pattern of private firms and and SOEs:*

[37] In the case with two symmetric countries, there would be no multinational SOEs if $\tau = 1$ and $f_I > f_D$.

1. *The exit cutoff and the exporting cutoff are higher for private firms than for SOEs. However, the cutoff for becoming an MNC is lower for private firms than for SOEs (i.e., selection reversal).*

2. *Assume that the initial productivity draw follows the same Pareto distribution (for private firms and SOEs) except that the minimum productivity level can differ across the two types of firms. Then, the fraction of MNCs is bigger among private firms than among SOEs. In addition, the average productivity of private FDI (or non-exporting) firms is smaller (or bigger) than that of state-owned FDI firms (i.e., productivity premium for state-owned FDI firms).*

3. *Conditional on productivity (i.e., the initial draw), private firms are more likely to become FDI firm.*

Proof. First, we have already shown that the exit cutoff is higher for private firms:

$$\bar{\varphi}_{PD} = c\bar{\varphi}_{SD} > \bar{\varphi}_{SD}.$$

Second, from equations (37) to (39), we know that

$$\frac{\bar{\varphi}_{PX}}{\bar{\varphi}_{PD}} = \frac{\bar{\varphi}_{SX}}{\bar{\varphi}_{SD}}; \quad \frac{\bar{\varphi}_{PO}}{\bar{\varphi}_{PD}} < \frac{\bar{\varphi}_{SO}}{\bar{\varphi}_{SD}}.$$

Therefore, the exporting cutoff is higher for private firms as well. Third, from equations (38) and (39), we derive that

$$\frac{\bar{\varphi}_{PO}}{\bar{\varphi}_{SO}} = (A_0 - A_1)^{\frac{\sigma+1}{\sigma-1}} \frac{c}{\left(c^{\frac{\sigma-1}{\sigma+1}} A_0 - A_1\right)^{\frac{\sigma+1}{\sigma-1}}},$$

where

$$A_0 \equiv \left(\frac{w_H}{w_F}\right)^{\frac{\sigma-1}{\sigma+1}} \left(\frac{C_F}{C_H}\right)^{\frac{2\sigma}{\sigma+1}}; A_1 \equiv \left(\frac{C_H^\sigma + C_F^\sigma/\tau^{(\sigma-1)}}{C_H^\sigma}\right)^{\frac{2}{\sigma+1}} - 1 > 0.$$

Note that $\frac{c}{\left(c^{\frac{\sigma-1}{\sigma+1}} A_0 - A_1\right)^{\frac{\sigma+1}{\sigma-1}}}$ monotonically decrease in c as $A_0 - A_1 > 0$ and $c > 1$.[38] Thus, the (strict) upper bound for $\frac{\bar{\varphi}_{PO}}{\bar{\varphi}_{SO}}$ is one. Therefore, $\bar{\varphi}_{PO} < \bar{\varphi}_{SO}$, which implies that conditioning on the productivity draw, private firms are more likely to become FDI firms.

Fourth, suppose the productivity draw follows a Pareto distribution with the same shape parameter for SOEs and private firms. The result that

$$\bar{\varphi}_{PO} < \bar{\varphi}_{SO} \quad \bar{\varphi}_{PD} > \bar{\varphi}_{SD}$$

implies that

$$\frac{\bar{\varphi}_{PD}}{\bar{\varphi}_{PO}} > \frac{\bar{\varphi}_{SD}}{\bar{\varphi}_{SO}},$$

which leads to the result that the fraction of MNCs is bigger among private enterprises than among SOEs. Next, since $\bar{\varphi}_{PO} < \bar{\varphi}_{SO}$, and the productivity draw follows the Pareto distribution with the same shape parameter for

[38] otherwise there would be no outward FDI firms in equilibrium.

the two types of firms, average productivity of private FDI firms is smaller than that of state-owned FDI firms.

Finally, since

$$\frac{\bar{\varphi}_{PX}}{\bar{\varphi}_{PD}} = \frac{\bar{\varphi}_{SX}}{\bar{\varphi}_{SD}},$$

$\bar{\varphi}_{PX} > \bar{\varphi}_{SX}$, $\bar{\varphi}_{PD} > \bar{\varphi}_{SD}$, and the productivity draw follows the Pareto distribution with the same shape parameter for the two types of firms, average productivity of private non-exporting firms is bigger than that of state-owned non-exporting firms. ■

We use the next proposition to show how average firm size differs across private firms and SOEs.

Proposition 6 ***Absolute Size Premium for SOEs****: Suppose the initial productivity draw follows the same Pareto distribution (for private firms and SOEs) except that the minimum productivity level can differ across these two types of firms.*

1. *Average overall firm size (i.e., sales and employment) of exporting (and multinational) private firms is smaller than that of exporting (and multinational) SOEs.*
2. *Average domestic sales and employment of FDI firms (i.e., firm size of the domestic part of an FDI firm) are also smaller for private firms than for SOEs.*

Proof. First, since φ follows the same Pareto distribution, we only need to compare firm size of the marginal SOE and the marginal private firm in order to show the difference in average firm size. For the marginal SOE that has the draw of $\bar{\varphi}_{SO}$ and the marginal private firm that has the draw of $\bar{\varphi}_{PO}$, firm-level sales are

$$S(\bar{\varphi}_{SO}) = S(\bar{\varphi}_{SD})\frac{f_I - f_X}{f_D}\frac{1 + (w_H/w_F)^{\frac{\sigma-1}{\sigma+1}}(C_F/C_H)^{\frac{2\sigma}{\sigma+1}}}{1 + (w_H/w_F)^{\frac{\sigma-1}{\sigma+1}}(C_F/C_H)^{\frac{2\sigma}{\sigma+1}} - \left(\frac{C_H^\sigma + C_F^\sigma/\tau^{(\sigma-1)}}{C_H^\sigma}\right)^{\frac{2}{\sigma+1}}}$$

and

$$S(\bar{\varphi}_{PO}) = S(\bar{\varphi}_{PD})\frac{f_I - f_X}{f_D}\frac{1 + (cw_H/w_F)^{\frac{\sigma-1}{\sigma+1}}(C_F/C_H)^{\frac{2\sigma}{\sigma+1}}}{1 + (cw_H/w_F)^{\frac{\sigma-1}{\sigma+1}}(C_F/C_H)^{\frac{2\sigma}{\sigma+1}} - \left(\frac{C_H^\sigma + C_F^\sigma/\tau^{(\sigma-1)}}{C_H^\sigma}\right)^{\frac{2}{\sigma+1}}}.$$

Since $S(\bar{\varphi}_{SD}) = S(\bar{\varphi}_{PD}) = \frac{f_D}{(1-\beta/2)}$ and $c > 1$, we must have

$$S(\bar{\varphi}_{SO}) > S(\bar{\varphi}_{PO}).$$

Therefore, average sales of multinational private firms is smaller than that of multinational SOEs.

Second, since the cutoff for becoming FDI firms is smaller for private firms, and private firms pay higher input price when they produce at home, average domestic sales of private FDI firms is also smaller than that of state-owned FDI firms.

Next, since $\frac{\bar{\varphi}_{PX}}{\bar{\varphi}_{PD}} = \frac{\bar{\varphi}_{SX}}{\bar{\varphi}_{SD}}$ and $S(\bar{\varphi}_{SD}) = S(\bar{\varphi}_{PD})$, the marginal exporting SOE and the marginal exporting private firm have the same sales. Moreover, since $\frac{\bar{\varphi}_{PO}}{\bar{\varphi}_{PD}} < \frac{\bar{\varphi}_{SO}}{\bar{\varphi}_{SD}}$ and the productivity draw follows the Pareto distribution with the same parameter, average firm size of exporting private firms is smaller than that of exporting SOEs.

Finally, for all firms, $\frac{\beta}{2}$ fraction of revenue is paid to inputs, and the input price private firms pay is higher than what SOEs pay. Therefore, average employment or capital stock (i.e., depending on which input the firm uses) of private FDI firms is also smaller than that of state-owned FDI firms. Moreover, the difference in average employment between private FDI firms and state-owned FDI firms is even bigger than the difference in average

sales, since private firms pay higher input price which reduces their demand for inputs, *even conditioning on sales.* ■

The next proposition shows how the relative size premium of FDI firms differs across private firms and SOEs.

Proposition 7 ***Relative Size Premium for State-owned MNCs****: Suppose the initial productivity draw follows the same Pareto distribution (for private firms and SOEs) except that the minimum productivity level can differ across these two types of firms.*

1. *Relative domestic employment of private exporting firms (i.e., compared with private non-exporting firms) is smaller than that of state-owned exporting firms.*
2. *Relative domestic employment of private multinational firms (i.e., compared with private non-exporting firms) is smaller than that of state-owned multinational firms as well.*

Proof. The key observation is that average sales of non-exporting SOEs equals average sales of non-exporting private firms. To see this, first note that the marginal SOE (i.e., on the exit cutoff) and the marginal private firm have the same level of sales:

$$S(\bar{\varphi}_{SD}) = S(\bar{\varphi}_{PD}) = \frac{f_D}{(1-\beta/2)}.$$

Furthermore, since the draw of φ follows the Pareto distribution, and

$$\frac{\bar{\varphi}_{PX}}{\bar{\varphi}_{PD}} = \frac{\bar{\varphi}_{SX}}{\bar{\varphi}_{SD}},$$

average sales of non-exporting SOEs equals average sales of non-exporting private firms. As average sales of exporting SOEs is higher, the ratio of average sales of exporters to that of non-exporters is higher for SOEs than for private firms. Furthermore, among private firms or SOEs, exporting and non-exporting firms pay the same factor price and have the same share of revenue that is paid to employees. Therefore, the ratio of average employment of exporters to that of non-exporters is also higher for SOEs than for private firms.

Next, we discuss how the size premium for FDI firms varies across types of ownership. First, as shown in Proposition 6, average domestic sales of private FDI firms is smaller than that of state-owned FDI firms. Therefore, the ratio of average sales of FDI firms' domestic subsidiaries to that of non-exporting firms is higher for SOEs than for private firms. Second, domestic subsidiaries of private FDI firms' face the same factor price as non-exporting private firms. Thus, the ratio of average employment is the same as the ratio of average sales of domestic subsidiaries of private FDI firms' to non-exporting private firms. Similarly, domestic subsidiaries of state-owned FDI firms' face the same factor price as non-exporting SOEs. Therefore, the ratio of average employment is the same as the ratio of average sales of domestic subsidiaries of state-owned FDI firms' to non-exporting SOEs. In total, the ratio of average employment is the same as the ratio of average sales (between FDI firms' domestic subsidiaries and non-exporters) for both private firms and SOEs. Therefore, the ratio of average employment of FDI firms' domestic subsidiaries to that of non-exporting firms is higher for SOEs than for private firms. ■

6.2.3 Investment Cost, Distortion and Allocation of Sales across Borders

The following proposition discusses how FDI firms allocate their products across borders and how this differ across state-owned FDI firms and private FDI firms. Furthermore, it shows how overall firm size changes when the firm begins to undertake FDI and how it differs across SOEs and private firms.

Proposition 8 ***Global Allocation of Sales:***

1. *The ratio of foreign sales to domestic sales is higher for private FDI firms than for state-owned FDI firms.*

2. *Suppose there is a reduction in the fixed FDI cost (i.e., f_I). Conditional on the productivity draw of φ and other firm-level characteristics, an increase in overall firm size is larger for the new multinational private firm than for the new multinational SOE.*

3. *Suppose we are in a world with two symmetric countries. When distortion deteriorates (i.e, c increases), the difference in the ratio of relative (domestic) size of state-owned MNCs (compared with non-exporting firms) to that of private MNCs increases.*

Proof. First, equations (34) and (36) imply that, conditional on φ, the ratio of foreign sales to domestic sales is higher for private FDI firms than for state-owned FDI firms. The reason is that there is no distortion in the foreign market. Furthermore, this ratio does not vary with φ within private FDI firms or state-owned FDI firms. Therefore, we have the unconditional statement that the ratio of foreign sales to domestic sales is higher for private FDI firms than for state-owned FDI firms.

For the second part of the proposition, there are three cases to consider. The first case is the case in which both firms are non-exporters before the reduction in f_I. Equations (24), (26), (33) and (35) together imply that

$$\frac{\pi_{PO}(\varphi)}{\pi_{PD}(\varphi)} > \frac{\pi_{SO}(\varphi)}{\pi_{SD}(\varphi)},$$

which proves the second part of this proposition for the first case (remember overall sales are proportional to the operating profit). The next case is the case in which both firms are exporters before the reduction of f_I. In this case, equations (29), (31), (33) and (35) also imply that

$$\frac{\pi_{PO}(\varphi)}{\pi_{PX}(\varphi)} > \frac{\pi_{SO}(\varphi)}{\pi_{SX}(\varphi)}.$$

Therefore, after the two firms undertake FDI, the increase in overall firm size is bigger for the new multinational private firm than for the new multinational SOE.

The final case to consider is the case in which the SOE is an exporter and the private firm is a non-exporter before the reduction of the fixed FDI cost. In this case, we still have

$$\frac{\pi_{PO}(\varphi)}{\pi_{PD}(\varphi)} > \frac{\pi_{PO}(\varphi)}{\pi_{PX}(\varphi)} > \frac{\pi_{SO}(\varphi)}{\pi_{SX}(\varphi)},$$

since $\pi_{PX}(\varphi) > \pi_{PD}(\varphi)$. Therefore, after the two firms undertake FDI, conditioning on φ, the increase in overall firm size is bigger for the new multinational private firm than for the new multinational SOE as well. In total, the second part of this proposition is true for all possible cases.

For the third part of the proposition, note that the relative size of private FDI firms is

$$\frac{Ave(empl)_{PO,dom}}{Ave(empl)_{PD,dom}} = \frac{Ave(Sales)_{PO,dom}}{Ave(Sales)_{PD,dom}} = \left(\frac{\bar{\varphi}_{PO}}{\bar{\varphi}_{PD}}\right)^{\frac{\sigma-1}{\sigma+1}} \frac{1}{1-\left(\frac{\bar{\varphi}_{PD}}{\bar{\varphi}_{PX}}\right)^{k-\frac{\sigma-1}{\sigma+1}}},$$

where *dom* refers to employment and sales for domestic output. Similarly, the relative size of state-owned FDI firms is

$$\frac{Ave(empl)_{SO,dom}}{Ave(empl)_{SD,dom}} = \frac{Ave(Sales)_{SO,dom}}{Ave(Sales)_{SD,dom}} = \left(\frac{\bar{\varphi}_{SO}}{\bar{\varphi}_{SD}}\right)^{\frac{\sigma-1}{\sigma+1}} \frac{1}{1-\left(\frac{\bar{\varphi}_{SD}}{\bar{\varphi}_{SX}}\right)^{k-\frac{\sigma-1}{\sigma+1}}}.$$

Note that

$$\frac{\bar{\varphi}_{PX}}{\bar{\varphi}_{PD}} = \frac{\bar{\varphi}_{SX}}{\bar{\varphi}_{SD}},$$

and this ratio does ont depend on c. Therefore, the ratio of relative (domestic) size of state-owned FDI firms to that of private FDI firms can be expressed as

$$\frac{Ave(empl)_{SO,dom}/Ave(empl)_{SD,dom}}{Ave(empl)_{PO,dom}/Ave(empl)_{PD,dom}} = \frac{\left(\frac{\bar{\varphi}_{SO}}{\bar{\varphi}_{SD}}\right)^{\sigma-1}}{\left(\frac{\bar{\varphi}_{PO}}{\bar{\varphi}_{PD}}\right)^{\sigma-1}}.$$

Equations 38 and 39 imply that the relative size ratio increases with the distortion parameter, c, if we are in a world with two symmetric countries. It is straightforward to observe that the difference in the relative size:

$$\frac{Ave(empl)_{SO,dom}}{Ave(empl)_{SD,dom}} - \frac{Ave(empl)_{PO,dom}}{Ave(empl)_{PD,dom}}$$

increases with c in a world with two symmetric countries. For the case of two asymmetric countries, it is impossible to prove this result analytically. This is because all equilibrium variables (i.e., w_H, w_F, C_H, C_F) change, when the distortion changes. ■

Appendix Table 1: Summary Statistics of Key Variables (2000-08)

Variable	Mean	Std. dev.	Min	Max
Firm TFP (Olley-Pakes)	3.61	1.18	0.61	6.57
Firm FDI indicator	0.004	0.066	0	1
Firm export indicator	0.29	0.451	0	1
SOE indicator	0.05	0.219	0	1
Foreign indicator	0.20	0.402	0	1
Firm log labor	4.78	1.115	1.61	13.25

Notes: This table reports size difference between private FDI firms and state-owned FDI firms. Firm size is measured by log number of employees in the top module and by firm TFP (Olley-Pakes) in the bottom module. The top module shows that average firm size of private FDI firms is smaller than that of state-owned FDI firms by year, especially for years after 2004. Such a pattern exists for years after 2006 when measured by firm productivity. This is probably due to the fact that there were few state-owned FDI firms before 2005, as shown by Table 1. Numbers in parentheses are t-values. ***(**, *) denotes significance at the 1% (5%, 10%) level.