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

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August 30, 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 companies (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-FDI firms) is *larger* than that of private MNCs. A theoretical model is built to rationalize these facts. The 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. 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 strongly supported by the firm-level data of China.

JEL: F13, O11, P51

Keywords: Outward FDI, Institutional Distortion, Resource Misallocation, State-owned Enterprises

*We thank Pol Antràs, Taiji Furusawa and Marc Melitz for their insightful comments. We thank seminar participants from Histotsubashi University 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.

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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 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 dataset, 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

Our first dataset is Chinese manufacturing firm's production data set which comes from annual surveys of industrial firms (ASIF) complied by the National Bureau of Statistics of China from 2000 to 2008. The dataset includes all SOEs and non-SOEs (i.e., private firms) with annual sales of RMB five million (or equivalently, about $830,000) or more. The data set includes more than 100 variables listed in main accounting sheets such as information on firm's number of employees, capital stock, total sales, and export value. These firms contribute about 95 percent of China's total sales in all manufacturing sectors. This data set is particularly useful for us to identify firm's type of ownership (i.e., SOE or not) and to understand firm's key charateristics such as firm size (which is usually proxyed by log number of employees) and firm TFP. As a key interest of the paper is to consider how input misallocation between SOEs and non-SOEs affect firm outward FDI, we need to carefully classify SOEs. As discussed in Yu (2015), by the official definition reported in the China City Statistical Yearbook (2006), SOEs include firms such as domestic SOEs (code in the firm data set: 110), state-owned joint venture enterprises (141), and state-owned and collective joint venture enterprises (143) but exclude state-owned limited corporations (151). Appendix Table 1 also provides summary statistics for the SOEs indicator which equals one if a firm is a SOE and zero otherwise.

We also use two datasets of firm outward FDI in the paper, as discussed carefully in Tian and Yu (2015). The first data set is nationwide firm-level outward FDI data from 1980 to 2012 whereas the second one is outward FDI data for firms in Zhejiang province only during 2006-2008. In terms of time span and regional coverage, the former one has significant advantage than the latter one. However, the nationwide dataset suffers from a critical drawback that it does not include information of the investment amount for Chinese multinational firms. However, the information of FDI flow is available in Zhejiang's FDI data set. Nevertheless, both data sets provide information of the first year that a firm engages in outward FDI, the specific modes of investment (wholesale or production FDI), and investment destination countries.

Following Tian and Yu (2015), we merge the two outward FDI data sets with firm-level production data set by using firm's Chinese name and year. If a firm has an exact Chinese firm in a particular year in all three data sets, it is considered as an identical firm.

Table 1 reports the FDI in our matched data sets. Row (1) of Table 1 shows the number of manufacturing firms whereas row (2) shows the number of FDI starting firms by year during 2000-08. Row (3) reports the number of matching FDI manufacturing firms.[11] Row (4) reports number of SOEs within the FDI manufacturing firms. Finally, row (5) reports FDI share by dividing the number of FDI starting firms shown in Row (2) by number of manufacturing firms in Row (1). Clearly, FDI indeed is a rare event—the share is less than 1 percent each year. The number of FDI manufacturing firms increased quickly after 2004. Finally, the last row exhibits the share of SOE within FDI firms which is obtained by dividing number in row (4) by that in row (3), suggesting that share of state-owned multinational firms is small over year.

[Insert Table 1 Here]

We first estimate and calculate firm TFP using the augmented Olley-Pakes (1996) approach as in Yu (2015). As processing exporting firms may use different techonology than non-processing

[11] Note that we merge FDI data and manufacturing production data by firm name rather than by name-year. Number of FDI manufacturing firms in row (3) reports not only FDI starting firms, but also FDI continuing firms. Thus, it is possible that there are fewer FDI starters than *matched* FDI manufacturing firms, as shown in 2007 and 2008.

exporting firms (Feenstra and Hanson, 2005) and processing trade accounts for accound a half of China's foreign trade, we estimate the production for exporting and non-exporting firm separately in each industry. As suggested by Arkolakis (2010), firm productivity cannot be compared across industries, we hence normalize the Olley-Pakes TFP in the range between zero and one by each 2-digit Chinese-industrial-classfication industry to obtain firm's relative TFP, which will be used in ther rest of the paper.

3 Data and Stylized Facts

3.1 Data

We use three main firm-level data sets to conduct our empirical analysis. Our first dataset is Chinese manufacturing firm's production dataset which comes from annual surveys of industrial firms (ASIF) complied by the National Bureau of Statistics of China from 2000 to 2008. The dataset includes all SOEs and non-SOEs (i.e., private firms) with annual sales of RMB five million (or equivalently, about $830,000) or more. The dataset includes more than 100 variables listed in main accounting sheets such as information on firm's number of employees, capital stock, total sales, and export value. These firms contribute about 95 percent of China's total sales in all manufacturing sectors. This dataset is particularly useful for us to identify firm's type of ownership (i.e., SOE or private firms) and to understand firm's key characteristics such as firm size (usually proxyed by log number of employees) and firm TFP.

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Following Tian and Yu (2015), we merge the two outward FDI datasets with firm-level production dataset by using firm's Chinese name and year. If three observations (in three datasets) have exactly the same Chinese name, it is considered as an identical firm.[12]

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[Insert Table 1 Here]

[12] Appendix A provides the detailed procedures of merging the three data sets.

[13] Note that we merge FDI data and manufacturing production data by firm name rather than by name-year. Number of FDI manufacturing firms in row (3) reports not only FDI starting firms, but also FDI continuing firms. Thus, it is possible that there are fewer FDI starters than *matched* FDI manufacturing firms, as shown in 2007 and 2008.

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3.2 Stylized Facts

The main purpose of this subsection is to document three stylized facts using Chinese data on MNCs. As our interest is to explore how domestic resource misallocation affects firm's outward FDI behavior, we start to ask which type of firms, SOEs or private firms, is more productive if they only serve the domestic market.

Stylized Fact One: Productivity Premium for State-Owned MNCs

Table 2 compares the differences in firm productivity between SOEs and private firms. The simple t-test in Column (1) clearly suggests that private firms are more productive than SOEs for non-FDI firms. Admittedly, a simple t-test comparison is insufficient to conclude that private non-FDI firms are more productive, as SOEs are usually larger and have more sales than private firms. We thus perform the nearest-matching propensity score matching (PSM) by choosing firm sales and the number of firm employees as covariates.[14] Column (2) shows the estimates for average treatment for the treated (ATT) for private firms. Again, the coefficient of the productivity difference between SOEs and private firms is highly significant, suggesting that SOEs are less productive than private firms. We then compare TFP difference between SOEs and private firms that either serve the domestic market (only) or sell domestically and export. Both

[14] To avoid the case that an observation has identical propensity score value, we perform a random sorting before matching.

the simple t-test comparison reported in column (3) and PSM-matching comparison reported in column (4) suggest that private firms are, overall, more productive than SOEs. In total, our above findings for non-FDI firms are consistent with other studies such as Hsieh and Klenow (2009).

[Insert Table 2 Here]

On the contrary, when focusing on FDI firms, we find a phenomenon of *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 check the robustness of this finding, we focus on the productivity difference between private and state-owned MNCs that are engaged in both FDI *and* exporting as well.[15] Column (6) reveals the same pattern as before. Namely, private FDI firms are less productive than state-owned FDI firms in China.

Stylized Fact Two: Smaller Fraction of State-Owned MNCs

We state our second stylized fact now. Column (9) of Table 2 reports 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 (compared with private 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: as state-owned FDI firms are more productive than private FDI firms, the fraction of SOEs engaged in doing FDI should be larger.

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

Finally, we document our last stylized fact. we first see the absolute preium of state-owned MNCs. Columns (3) to (6) of Table 4 show that private FDI firms (i.e., parent firms) are smaller

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

than state-owned FDI firm (i.e., parent firms) in terms of employment and sales. Columns (1) and (2) of the top module in Table 3 show that, among non-FDI exporting firms, private firms are smaller than SOEs. Their difference is statistically significant. Regarding FDI Chinese parent firms, we examine two groups respectively: (i) FDI non-exporting firms which are engaged in outward investment but not exporting (as shown in columns (3) and (4)); (ii) FDI firms with both outward investment and exporting (as shown in columns (5) and (6)). Different from the case of productivity comparison, we see that, both types of private FDI firms are smaller than the state-owned FDI firms.[16] In short, SOEs are bigger than private firms irrespective of their FDI and exporting status.

[Insert Table 3 Here]

More 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.[17] To sum up, our third stylized fact states that both absolute and relative (compared with non-exporting firms) size of private MNCs are smaller than 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

[16] The bottom module of Appendix Table 2 examines the size difference by year for such two type of firms. Still, state-owned FDI firms are larger than private FDI firms each year. Finally, the last column of Table 3 shows that domestic sales of private FDI firms is also smaller than that of state-owned FDI firms.

[17] The first module of Table 5 reports the comparison of the relative size of FDI firms to non-exporting firms between private firms and SOEs. The relative size is measured by l_o^j/l_d^j where l_o^j and l_d^j represents log employment of FDI firms and log employment 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 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 a relative size premium for state-owned MNCs, and the difference in the relative size (between private firms and SOEs) is more pronounced after 2004.

non-FDI firms. Second, we find that a smaller proportion of SOEs to undertake FDI, despite that they are much bigger than private firms. Finally, we document that both the absolute and relative size of state-owned FDI firms are bigger than private FDI firms. We call this size premium for state-owned FDI firms. In what follows, we construct a theoretical model to rationalize all these findings.

4 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 difference in foreign investment cost impacts investment behavior of private MNCs and state-owned MNCs differently.

4.1 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. A productivity draw of φ means that the firm needs to use $h(q)/\varphi$ units of labor to produce $h(q)$ unit of output, where $h(q)$ is a convex function of output which will be specified soon. Since there are only two asymmetric countries in the model, we use w_H and w_F to denote the equilibrium wage level 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.[18] 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.[19]

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

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

[18] 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.

[19] 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.

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 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 market respectively.

The cost function features decreasing returns to scale and is country-specific. Specifically, for an SOE that does not undertake FDI, its cost function is

$$\frac{(q_H + I_{\{q_E>0\}} q_E)^2 w_H}{2\varphi}, \tag{4}$$

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:

$$\frac{q_H^2 w_H}{2\varphi} + \frac{q_F^2 w_F}{2\varphi}, \tag{5}$$

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

$$\frac{cq_H^2 w_H}{2\varphi} + \frac{q_F^2 w_F}{2\varphi}. \tag{6}$$

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

4.2 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[20]

$$\pi_{SD}(\varphi) = \Big[1 - \frac{\beta}{2}\Big]\Big(\frac{\beta\varphi}{w_H}\Big)^{\frac{\sigma-1}{\sigma+1}} C_H^{\frac{2\sigma}{\sigma+1}} \tag{7}$$

and

$$\Pi_{SD}(\varphi) = \Big[1 - \frac{\beta}{2}\Big]\Big(\frac{\beta\varphi}{w_H}\Big)^{\frac{\sigma-1}{\sigma+1}} C_H^{\frac{2\sigma}{\sigma+1}} - f_D. \tag{8}$$

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

$$\pi_{PD}(\varphi) = \Big[1 - \frac{\beta}{2}\Big]\Big(\frac{\beta\varphi}{cw_H}\Big)^{\frac{\sigma-1}{\sigma+1}} C_H^{\frac{2\sigma}{\sigma+1}} \tag{9}$$

and

$$\Pi_{PD}(\varphi) = \Big[1 - \frac{\beta}{2}\Big]\Big(\frac{\beta\varphi}{cw_H}\Big)^{\frac{\sigma-1}{\sigma+1}} C_H^{\frac{2\sigma}{\sigma+1}} - f_D. \tag{10}$$

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

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

given that

$$q_E + q_H \leq q,$$

[20] 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.

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

$$s^*(C_H, C_F) = \frac{C_H^\sigma}{C_H^\sigma + C_F^\sigma/\tau^{\sigma-1}}, \tag{11}$$

which applies to both the SOE and the private firm. Based on equation (11), we obtain the operating profit and the final profit for an SOE that sells in the two markets as

$$\pi_{SX}(\varphi) = \Big[1 - \frac{\beta}{2}\Big]\Big(\frac{\beta\varphi}{w_H}\Big)^{\frac{\sigma-1}{\sigma+1}}\Big(C_H^\sigma + \frac{C_F^\sigma}{\tau^{(\sigma-1)}}\Big)^{\frac{2}{\sigma+1}} \tag{12}$$

and

$$\Pi_{SX}(\varphi) = \Big[1 - \frac{\beta}{2}\Big]\Big(\frac{\beta\varphi}{w_H}\Big)^{\frac{\sigma-1}{\sigma+1}}\Big(C_H^\sigma + \frac{C_F^\sigma}{\tau^{(\sigma-1)}}\Big)^{\frac{2}{\sigma+1}} - f_D - f_X, \tag{13}$$

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

$$\pi_{PX}(\varphi) = \Big[1 - \frac{\beta}{2}\Big]\Big(\frac{\beta\varphi}{cw_H}\Big)^{\frac{\sigma-1}{\sigma+1}}\Big(C_H^\sigma + \frac{C_F^\sigma}{\tau^{(\sigma-1)}}\Big)^{\frac{2}{\sigma+1}} \tag{14}$$

and

$$\Pi_{PX}^F(\varphi) = \Big[1 - \frac{\beta}{2}\Big]\Big(\frac{\beta\varphi}{cw_H}\Big)^{\frac{\sigma-1}{\sigma+1}}\Big(C_H^\sigma + \frac{C_F^\sigma}{\tau^{(\sigma-1)}}\Big)^{\frac{2}{\sigma+1}} - f_D - f_X \tag{15}$$

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:

$$\pi_{SO}(\varphi) = \Big[1 - \frac{\beta}{2}\Big]\Bigg[\Big(\frac{\beta\varphi}{w_H}\Big)^{\frac{\sigma-1}{\sigma+1}} C_H^{\frac{2\sigma}{\sigma+1}} + \Big(\frac{\beta\varphi}{w_F}\Big)^{\frac{\sigma-1}{\sigma+1}} C_F^{\frac{2\sigma}{\sigma+1}}\Bigg]; \tag{16}$$

$$\Pi_{SO}(\varphi) = \Big[1 - \frac{\beta}{2}\Big]\Bigg[\Big(\frac{\beta\varphi}{w_H}\Big)^{\frac{\sigma-1}{\sigma+1}} C_H^{\frac{2\sigma}{\sigma+1}} + \Big(\frac{\beta\varphi}{w_F}\Big)^{\frac{\sigma-1}{\sigma+1}} C_F^{\frac{2\sigma}{\sigma+1}}\Bigg] - f_D - f_I; \tag{17}$$

$$\pi_{PO}(\varphi) = \Big[1 - \frac{\beta}{2}\Big]\Bigg[\Big(\frac{\beta\varphi}{cw_H}\Big)^{\frac{\sigma-1}{\sigma+1}} C_H^{\frac{2\sigma}{\sigma+1}} + \Big(\frac{\beta\varphi}{w_F}\Big)^{\frac{\sigma-1}{\sigma+1}} C_F^{\frac{2\sigma}{\sigma+1}}\Bigg]; \tag{18}$$

$$\Pi_{PO}(\varphi) = \Big[1 - \frac{\beta}{2}\Big]\Bigg[\Big(\frac{\beta\varphi}{cw_H}\Big)^{\frac{\sigma-1}{\sigma+1}} C_H^{\frac{2\sigma}{\sigma+1}} + \Big(\frac{\beta\varphi}{w_F}\Big)^{\frac{\sigma-1}{\sigma+1}} C_F^{\frac{2\sigma}{\sigma+1}}\Bigg] - f_D - f_I. \tag{19}$$

4.3 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 (7) and (9) 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:

$$\frac{\bar{\varphi}_{PX}}{\bar{\varphi}_{PD}} = \frac{\bar{\varphi}_{SX}}{\bar{\varphi}_{SD}} = \Bigg[\frac{f_X/f_D}{\Big(\frac{C_H^\sigma + C_F^\sigma/\tau^{(\sigma-1)}}{C_H^\sigma}\Big)^{\frac{2}{\sigma+1}} - 1}\Bigg]^{\frac{\sigma+1}{\sigma-1}}. \tag{20}$$

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

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

Thus, the cutoff for doing FDI can be expressed as

$$\frac{\bar{\varphi}_{SO}}{\bar{\varphi}_{SD}} = \Big((f_I - f_X)/f_D\Big)^{\frac{\sigma+1}{\sigma-1}}\Bigg(1 + (w_H/w_F)^{\frac{\sigma-1}{\sigma+1}}(C_F/C_H)^{\frac{2\sigma}{\sigma+1}} - \Big(\frac{C_H^\sigma + C_F^\sigma/\tau^{(\sigma-1)}}{C_H^\sigma}\Big)^{\frac{2}{\sigma+1}}\Bigg)^{\frac{-(\sigma+1)}{\sigma-1}}. \tag{21}$$

A similar relationship applies to private firms:

$$\frac{\bar{\varphi}_{PO}}{\bar{\varphi}_{PD}} = \Big((f_I - f_X)/f_D\Big)^{\frac{\sigma+1}{\sigma-1}} \left(1 + (cw_H/w_F)^{\frac{\sigma-1}{\sigma+1}} (C_F/C_H)^{\frac{2\sigma}{\sigma+1}} - \Big(\frac{C_H^{\sigma} + C_F^{\sigma}/\tau^{(\sigma-1)}}{C_H^{\sigma}}\Big)^{\frac{2}{\sigma+1}}\right)^{\frac{-(\sigma+1)}{\sigma-1}}. \tag{22}$$

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.[21]

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 1 *Sorting pattern of private firms and and SOEs:*

1. *The exit cutoff and the exporting cutoff are higher for private firms than for SOEs. However, the cutoff for becoming an MNE 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.*

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

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 (20) to (22), 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 (21) and (22), 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 $c > 1$.[22] 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

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

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

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 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. ■

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. As a result, the exit cutoff and exporting cutoff are bigger for private firms. However, investing abroad helps private firms to alleviate distortion. Thus, *relative* to the exit cutoff, the FDI cutoff is actually smaller for private firms. Moreover, setting up a plant abroad and ceasing to export help the firm overcome diseconomies of scale for domestic production. This benefit is disproportionately higher for private firms, since they face a higher input price at home. Therefore, the absolute value of the FDI cutoff is also smaller for private firms than for SOEs.

The above theoretical results rationalize the first two empirical findings 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, Tabe 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.

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

Proposition 2 ***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 above results receive significant statistical support from Table 3, since average firm size (i.e., log sales and employment) of private exporting and FDI firms is much smaller than that of state-owned exporting and FDI firms. This is expecially the case when we focus on the domestic sales of FDI firms as well.

Finally, we use the next proposition to show how firm size premium of exporters and FDI firms differ across private firms and SOEs.

Proposition 3 ***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 also 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 across types of ownership. First, as shown in 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 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. ■

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

4.4 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 4 ***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 incraeses.*

Proof. First, equations (17) and (19) 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 (7), (9), (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 (12), (14), (16) and (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 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

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

Equations 21 and 22 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. ■

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 (i.e., the global market share allocation) 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, distortion in factor markets generates two economic forces that have not been explored much 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. These two key insights continue to hold, if we assume there are distortions in the product market.[23]

5 Empirical Estimates

Our theoretical model states four propositions. Most of them are exactly consistent with the stylized facts in Section 2. However, some of them needs further empirical examination. In this section we thus explore whether or not such theoretical predictions are supported by Chinese firm-level data.

5.1 FDI decision and firm type of ownership

Proposition 1 has three predictions. Its first point states that both the exit cutoff and exporting cutting are higher for private firms than for SOEs, suggesting that survival private firms overall are more productive than SOEs. This is exactly what we observe in the first stylized fact. The second prediction of Proposition 1 emphasizes the productive premium for state-owned MNCs. First, the average productivity of private MNCs (or non-exporting firms) is smaller (or bigger) than that of state-owned MNCs (or non-exporting firms). Second, the fraction of MNCs is larger among private firms than among SOEs. These two points have also already confirmed in Table

[23] Interested reader are referred to Appendix B for more details.

2. Finally, Proposition 1 suggests that private firms are more likely to engage in outward FDI. We now go to empirically test this.

Estimates in Table 5 start from a linear probability model (LPM) in which the regressand is outward FDI indicator (equal one if a firm engages in FDI and zero otherwise). To see whether SOEs are less likely to engage in FDI, we include a SOE indicator in the estimates. In addition, we control for key firm characteristics such firm size (in log number of employees), firm TFP, and export indicator. As discussed in Tian and Yu (2015), our nationwide FDI data are pooled cross-section data as we only know the first year that firms engage in FDI but do not know the year that firms stop or continue to FDI. Thus estimates in Table 5 and other tables only includes non-FDI firms and FDI starters. We thus control for year-specific fixed effects and industry-specific fixed effects in Column (2). The SOE indicator is negative and significant, suggesting that SOEs are less likely to engage in outward FDI. However, the magnitude of the SOE seems too small. We suspect that this is due to the well-know pitfall of LPM in which its predicted probability could be great than one or less than zero. To overcome such drawback, we thus perform probit estimates in Column (3) and logit estimates in Column (4) which still yield similar qualitatively finding: compared to private firms, SOEs are less likely to engage in outward FDI.

However, there are two important caveats for the probit (or logit) estimates. First, as shown in Table 1, there are only less than one percent of firms engage in FDI. Within FDI firms, only a very small proportion of firms are SOEs. Thus, state-owned MNCs are rare events which distribution exhibit 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 perform the complementary log-log model in column (5) which allows a faster convergence speed toward the rare events. Second, as highlighted by King and Zeng (2001, 2002), the standard binary nonlinear models, such as logit or probit, would underestimate the probability of rare events. To address this concern, they recommend using the rare-event

logit approach which can corrects for possible underestimation.[24] The last column of Table 5 reports the logit estimates with rare-event corrections. The key coefficient 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 significant, confirming that SOEs are less likely to engage in outward FDI. This is exactly consistent with the prediction in Proposition 1.

[Insert Table 5 Here]

5.2 Discussions in 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, it is still curious whether it can be validated by Chinese data. We now turn to this job.

Previous works suggest that Chinese SOEs can access to working capital by paying a lower interest rate (Feenstra et al, 2014). Similarly, SOEs can also acquire land at a lower market price, which is especially true in the manufacturing sectors (Tian et al., 2015). To see whether such conjectures are supported by data, we first construct a measured firm-level interest rate by dividing firm's interest expenses by its current liability in each year, which both can be obtained from the ASIF data set. We regress measured interest rate over the SOE indicator in Columns (1)-(3) of Table 6. Our underlying assumption is 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 negative and 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 control for other key

[24] 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.

firm-characteristics such as firm TFP and firm size (proxied by log firm labor). It turns out that the key coefficient, the SOE indicator, is always negative and significant, suggesting that SOEs pay less interest rate and hence bear lower capital costs than private firms.

Columns (4)-(6) turn to check whether or not SOEs acquire land input at a lower cost. However, an empirical challenge is that data on each firm's land price are unavailable. Instead, we are only able to access the price of land sale (conversion) at the prefectural city level by year.[25] We thus construct a variable of 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, a city with a higher proportion of SOEs is expected to have a lower price. The estimates in Columns (4)-(6) thus regress city-average land price on the SOE intensity.[26] We expect a negative coefficient of the SOE intensity. In particular, Column (4) only controls for year-specific fixed effects whereas Column (5) controls for both year-specific and industry-specific fixed effects. It is possible that the aggregate demand for land acquisition in each city could affect city's land price, Column (6) thus also controls for cities' total sales as well as city-specific, year-specific and industry-specific fixed effects. In any case, the coefficients of SOE intensity in all estimates are negative and statistically significant, suggesting that, on average, SOEs pay less land price and hence bear lower land costs than private firms.

[Insert Table 6 Here]

5.3 Firm size and host investment liberalization

We now turn to test 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. However, we are not able to directly test this theoretical prediction as we are not able to access to data on

[25] 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.

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

the sales of Chinese affiliates. To detour such data challenge, we proxy foreign sales and domestic sales with foreign investment volume and parent firm's total capital stock respectively.[27] Column (1) of Table 7 regresses such an investment ratio on the SOE indicator. It turns out that the SOE indicator has a negative and statistically significant coefficient, which is exactly consistent with our prediction that foreign sales ratio is lower for state-owned MNCs than for private MNCs. Column (2) includes firm TFP and days of import document preparation which is a proxy of firm's exporting fixed costs.[28] In addition, Column (3) even controls for both year-specific fixed effects and industry-specific fixed effects. In both experiments, the SOE indicator is still negative and significant. Thus, our estimation results are robust. As the nationwide FDI data set does not provide information on FDI volume, we instead use Zhejiang's FDI sample during 2006-2008 to run regressions. Accordingly, the number of observations decrease a lot in all estimations.

[Insert Table 7 Here]

Furthermore, the second prediction in Proposition 4 stresses that, in response to investment liberalization in the hosting countries, the increase in overall firm size is larger for new private MNCs than for the new state-owned MNCs. Several points in Table 8 merit special attention. First, since firm size is usually measured by firm sales and log number of employees, Table 8 tests such a prediction using these two variables. Second, as data on the sales of foreign affiliates are unavailable, we replace firm sales with capital stocks for both domestic parent firms and foreign affiliates. Thus, the regressands in Columns (1)-(3) of Table 8 are FDI firms' total capital stock which is the sum of firm's direct investment and the Chinese parent firm's fixed capital stock. Third, we use a variable of licence costs (in log) to measure the investment fixed costs in the destination countries, which measure the average cost of getting a business licence in destination countries and is reported by the project of *Doing Business* (2009) compiled by the World Bank. Finally, the sample in Table 8 covers only Zhejiang province as introduced above.

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

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

To conduct the empirical analysis, we include log licence cost and its interaction with the SOE indicator as regressors. If the theoretical prediction gains support from the data, the variable of licence cost is expect to be negative whereas its interaction with the SOE indicator is anticipated to be positive, indicating that a decline in foreign investment fixed costs leads to a larger firm size, and the effect is more pronounced for private MNCs than for state-owned MNCs. The simple OLS estimates in Column (1) and the fixed-effects estimates in Column (2) confirms such a theoretical prediction. As our model implicitly assume a substitute between export and FDI, we thus drop distribution FDI but only keep production FDI (Tian and Yu, 2015). In all columns, we find a negative sign of log licence costs and a positive sign of the interaction term between log licence costs and the SOE indicator, which are exactly consistent with our theoretical predictions. Finally, Columns (4)-(6) focus on Chinese parent firms only and use log labor of Chinese parent firms as the regressands. The estimation results in Columns (4)-(6) are qualitatively identical to those in columns (1)-(3).

[Insert Table 8 Here]

5.4 Estimates with size premium

Proposition 3 predicts that relative size premium of state-owned MNCs. State-owned MNCs relative to state-owned non-exporting firms are expected to have a larger size ratio than those of private MNCs relative to of private non-exporting firms. Section 2 provides some preliminary statistical evidence. In this sub-section we further to provide some rigorous empirical evidence to validate such a theoretical prediction.

We start with the following empirical specification:

$$(l^o_{jt}/l^d_{jt}) = \alpha_0 + \alpha_1 SOEInt_{jt} + \alpha_2 r_{jt} + \eta_t + \lambda_i + \varepsilon_{it} \tag{23}$$

where l^o_{jt} and l^d_{jt} represents log labor of FDI firms and that of non-exporting firms for firm type j (i.e., private or state-owned), respectively. Thus, the regressand in (23) measures industrial

FDI relative size. $SOEInt_{jt}$ denotes the SOE intensity which is defined as the number of SOEs divided by the number of total manufacturing firms in industry j at year t. r_{jt} is average measured interest rate in industry j at year t. Finally, the error term is decomposed into three components: (1) year-specific fixed effects η_t to control for industry-invariant factors such as Chinese RMB appreciation after 2005; (2) industry-specific fixed effects, and (3) an idiosyncratic effect ε_{it} with normal distribution to control for some other unspecified factors. If proposition 3 is supported by data, we should observe a positive coefficient of $SOEInt_{jt}$: the higher the industrial SOE intensity, the larger is the state-owned FDI size premium. The fixed-effects estimates in column (1) of Table 9 clearly suggest that industries with higher SOE intensity have larger FDI size premium.

Similarly, if an industry with lower capital input cost (i.e., lower interest rate), firms in the industry will have a larger profit which would in turn affects its industrial FDI size premium. Column (2) regresses FDI relative size on industrial interest rate and found that a lower industrial interest rate is associated with larger industrial FDI relative size premium. Column (3) includes both interest rate and SOE intensity as regressors and still yields similar results.

More interestingly, one of the key ideas in the present paper is that distortions in input factor market lead to state-owned MNC relative size premium. Thus, it is important to see how the difference in interest rates between SOEs and private firms, $r_{jt}^{SOE} - r_{jt}^{PRIVATE}$, affects the difference in FDI relative size premium $((l^o/l^d)_{jt}^{SOE} - (l^o/l^d)_{jt}^{PRIVATE})$. The last prediction in Proposition 4 suggests that the FDI relative size premium differential between SOEs and private firms will be more pronounced when the distortions in domestic input markets deteriorate.

If such a theoretical prediction is supported by data, a smaller difference in interest rates should lead to less FDI relative size premium. We thus perform the following specifications in Columns (4)-(8) of Table 9:

$$(l^o/l^d)_{jt}^{SOE} - (l^o/l^d)_{jt}^{PRIVATE} = \gamma_0 + \gamma_1(r_{jt}^{SOE} - r_{jt}^{PRIVATE}) + \epsilon_{jt}. \tag{24}$$

The industries in estimates of Columns (4) and (5) are defined at 2-digit Chinese-industrial classifications (CIC) level. We also provide some robustness checks in Columns (5) and (6) by defining industries at the 4-digit CIC level. As not every 4-digit industry has outward FDI, the numbers of observations in Columns (6)-(8) are smaller than those in Columns (1)-(5). The estimates in Columns (5) and (7) also control for industrial relative TFP. In addition, Column (8) controls for both year-specific and industry-specific fixed effects. It turns out that the coefficient of $\hat{\gamma}_1$ is always positive and statistically significant, suggesting that the difference in interest rates is positively associated to the difference in FDI relative size premium.

Our last interest is to discuss the economic magnitude of the key estimated coefficient $\hat{\gamma}_1$. As the mean of the difference in interest rates is around 0.30 and that of the FDI relative size premium differential is 0.08, the contribution of interest rates differential to the difference in FDI relative size premium is around 7.5% which is obtained from $0.02 \times 0.30/0.08$. So, if there is no domestic discrimination of interest rates against private firms, the state-owned FDI relative size premium will fall around 8 percent.

[Insert Table 9 Here]

6 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

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 research agenda on how outward FDI and MNCs from developing economies behave differently from those from developed economies. At the micro-level, how do these differences impact firm productivity and firm-level R&D. At the macro-level, how do these differences affect misallocation, aggregate TFP and welfare quantitatively is also worth exploring. At the same time, more data on MNCs of developing economies are becoming available. Our work points out one important aspect of these firms' investment behavior and deserves more attention in future research.

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Table 1: FDI Share in Number of 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

Note: Data are from Ministry of Commerce of China and authors' calculations. FDI share in (5)=(2)/(1)) is obtained by dividing the number of FDI starting firms by the number of manufacturing firms. SOE FDI share in (6)=(4)/(3).

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=(ii)-(i)	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 SOE for non-FDI firms with only domestic sales. Columns (3) and (4) shows 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 which is consistent with the main predictions in Proposition 1. Column (9) shows the fraction of firms engaged in FDI activity which is obtained from column (8) divided by column (7). Firm size (in log labor) 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 the 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 larger for non-FDI exporting firms, non-exporting FDI firms, and FDI firms respectively. Such results are consistent with the predictions in 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	4.71	4.83	4.83	4.79	4.76	4.74	4.73	4.71	4.71
(2) SOE	5.60	5.17	5.17	5.13	5.11	5.42	5.59	5.72	5.60
Size Difference=(1)-(2)	-0.89***	-0.34	-0.34	-0.34	-0.35*	-0.68***	-0.86***	-1.01***	-0.89***
	(-9.43)	(-0.98)	(-1.21)	(-1.42)	(-1.64)	(-4.27)	(-6.28)	(-8.91)	(-9.43)
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)

Note: The table reports firm relative size difference between private FDI firms and state-owned FDI firms. Firm size is proxy by log number of employees. The top module shows that relative size of FDI firms to non-exporting firms for private firms is smaller 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. The findings are consistent with Propostion 3 that FDI size premia for private firms are smllar than those for SOEs. Numbers in parentheses are t-values. ***(**, *) denotes significance at the 1% (5%, 10%) level.

Table 5: Private firms are more to undertake likely to 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

Note: The regressand is the FDI indicator. All columns except column (1) include both 2-digit level industry dummies and year dummies. Column (1) includes foreign-invested firms whereas the rest columns drop those firms. Numbers in parentheses are t-values clustered at firm level. *** denotes significance at the 1% level. Such results are highly consistent with Prediction 1(ii): SOEs are less likely to engage in FDI whereas private firms are more likely to engage in FDI.

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 firm-level interest rate calculated as firm interest expenses divided by its current liability. Column (1) is simple OLS estimate whereas column (2) controls for year-specific and industry-specific fixed effects. Column (3) also adds some 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) are city-level average land price purchased from government, which is defined by government's total land revenue in each prefectural city divided by its land area. The SOE intensity is defined as the number of SOE 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 estimates. Column (4) controls for year-specific fixed effects only whereas Column (5) controls for both year-specific and industry-specific fixed effects. Column (6) controls for cities' total 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 (2006-08 Zhejiang)

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

Note: Data used in this table only covers FDI firms from Zhejiang province for 2006-2008 during which data on foreign investment are available. Ratio of foreign 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 export fixed cost in destination countries. Such findings are exactly consistent with the predictions in proposition 4 (ii): 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: Frim 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

Note: Regressands in Columns (1)-(3) are FDI firms' total capital stock which is the sum of firm's direct investment and the Chinese parent firm's fixed capital stock. FDI firms from Zhejiang province during 2006 to 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) are log number of employees. Licences costs in destination countries are used to proxy firm's outward FDI fixed cost in destination countries. Data are from Doing Business Project (2008). Such findings are exactly consistent with the predictions in proposition 4: firm size increases more for the private firm than for the SOE with investment liberalization in the destination countries. Numbers in parentheses are t-values clustered at firm level. *** denotes significance at the 1% level.

Table 9: Estimates on FDI Size Premium

Regressand	FDI relative size $(l_o/l_d)_{jt}$			Difference in FDI relative size $(l_o/l_d)^{SOE}_{jt} - (l_o/l_d)^{PRI}_{jt}$				
	(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 $(r^{SOE}_{jt} - r^{PRIVATE}_{jt})$	–	–	–	0.021**	0.028**	0.010**	0.011***	0.018***
				(2.04)	(2.52)	(2.06)	(2.75)	(3.41)
Industrial SOE Intensity	1.354***		1.373**	–	–	–	–	–
	(2.63)		(2.06)					
Industrial Relative TFP			-0.166		-0.259		0.346	2.867
			(-0.76)		(-1.39)		(1.17)	(0.98)
Year-specific Fixed Effects	Yes	Yes	Yes	No	No	No	No	Yes
Industry-specific Fixed Effects	Yes	Yes	Yes	No	No	No	No	Yes
Number of Obs.	160	160	160	147	147	39	39	39
R-squared	0.65	0.66	0.69	0.27	0.29	0.03	0.06	0.57

Notes: Columns (1)-(3) regress CIC 2-digit level industrial FDI relative size $(l_o/l_d)_{jt}$ on industrial measured interest rate, which is defined as industry-average interest expenses over its current liability, and industrial SOE intensity, which is defined as number of SOE divided by the number of total manufacturing firms within each industry. Columns (4)-(8) regress the difference in industrial FDI relative size $(l_o/l_d)^{SOE}_{jt} - (l_o/l_d)^{PRI}_{jt}$ on difference in industrial interest rates $(r^{SOE}_{jt} - r^{PRIVATE}_{jt})$. Columns (3), (5), (7) and (8) control for industrial TFP, respectively. The industries in Columns (1)-(5) are measured at CIC 2-digit level whereas those in Columns (6)-(8) are measured at CIC 4-digit level. As not every 4-digit industry has outward FDI, the numbers of observations in Columns (6)-(8) are smaller than those in columns (1)-(5). Columns (1)-(3) show that SOEs have larger FDI size premium. As input cost such as interest reate falls, industrial FDI relative size decreases. Columns (4)-(8) show that difference in FDI size premium between SOE and private firms decreases as their interest gap falls. Numbers in parentheses are t-values. ***(**, *) denotes significance at the 1% (5%, 10%) level.

7 Appendix

7.1 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.[29] Regrettably, as is the case for many other researchers, we cannot access similar databases from other provinces. Still, as discussed in Appendix C, we 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

[29] 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.

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.[30]

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.[31] 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.[32] Finally, to avoid possible mistakes, all approximate string-matching procedures are done manually.

7.2 Appendix B: Distortions in the Product Market

In this subsection of the appendix, we explore how discriminations against private firms and liberalization on foreign investment affect MNCs' behavior in the domestic as well as global markets. We will show that the main economic insights and testable predictions are the same as the ones derived in the main model

The key idea is that a larger scale production (owing to investing in the foreign market) helps private enterprises compete against SOEs in the *global* market, since going aborad helps private firms get rid of discriminations. In order to make this point as transparent as possible, we build up a model focusing on domestic production and FDI only in this subsection. Second, we assume that average cost of overall production is an increasing function of total output q, which takes the form of $\frac{q}{2\varphi}$ in this subsection. As a result, production decisions in the domestic market and the foreign market are made jointly.

[30] 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.

[31] 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.

[32] 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."

We analyze the behavior of the SOE first. If an SOE only serves the domestic market, its operating profit is

$$q_H^{\beta} C_H - \frac{q_H^2}{2\varphi} - f_D, \tag{25}$$

while the profit is

$$q_H^{\beta} C_H + q_F^{\beta} C_F - \frac{(q_H + q_F)^2}{2\varphi} - f_D - f_I, \tag{26}$$

if it serves both markets. Finally, the two countries are assumed to be symmetric for simplicity in this subsection, and we normalize the wage rate in the two countries to one, which justify the above profit functions.

Based on the above simplifying assumption, we can derive the domestic SOE's final profit as

$$\Pi_{SD}(\varphi) = \Big(1 - \frac{\beta}{2}\Big)(\beta\varphi)^{\frac{\sigma-1}{\sigma+1}} C^{\frac{2\sigma}{\sigma+1}} - f_D, \tag{27}$$

where $C \equiv C_H = C_F$. Output in the domestic market is

$$q^{SD}(\varphi) = (\beta C \varphi)^{\frac{\sigma}{\sigma+1}}. \tag{28}$$

Output decision of the multinational SOE is more involved. However, the assumption of two symmetric countries substantially simplifies the analysis. First, symmetry implies output are equalized across borders:

$$q_H(\varphi) = q_F(\varphi).$$

Based on this result, we can rewrite the multinational SOE's optimization problem as

$$\max_q q^{\frac{\sigma-1}{\sigma}} 2^{\frac{1}{\sigma}} C - \frac{q^2)}{2\varphi} - f_D - f_I,$$

which results in the following final profit:

$$\Pi_{SO}(\varphi) = \Big[1 - \frac{\beta}{2}\Big](\beta\varphi)^{\frac{\sigma-1}{\sigma+1}} 2^{\frac{2}{\sigma+1}} C^{\frac{2\sigma}{\sigma+1}} - f_D - f_I. \tag{29}$$

Output in both the domestic market and the foreign market is

$$q^{SOD}(\varphi) = q^{SOF}(\varphi) = \Big(\frac{\beta C \varphi}{2}\Big)^{\frac{\sigma}{\sigma+1}} < q^{SD}(\varphi), \tag{30}$$

and total output is

$$q^{SO}(\varphi) = 2^{\frac{1}{\sigma+1}} (\beta C \varphi)^{\frac{\sigma}{\sigma+1}} > q^{SD}(\varphi). \tag{31}$$

Since average cost increases in output, domestic output falls when an SOE becomes an MNE.

Following Hsieh and Klenow (2009), we model discriminations against private firms as dis-

tortions in the product market in this section. Specifically, we assume that the home government takes $\frac{c-1}{c}$ $(c > 1)$ fraction of the revenue earn from the *domestic* market from private firms. As a result, the profit function of a domestic private firm is

$$\frac{1}{c} q_H^{\frac{\sigma-1}{\sigma}} E_H^{\frac{1}{\sigma}} P_H^{\frac{\sigma-1}{\sigma}} - \frac{q_H^2}{2\varphi} - f_D, \tag{32}$$

which leads the optimal output as

$$q^{PD}(\varphi) = \Big(\frac{\beta C \varphi}{c}\Big)^{\frac{\sigma}{\sigma+1}} \tag{33}$$

and the final profit as

$$\Pi_{PD}(\varphi) = \Big[1 - \frac{\beta}{2}\Big] \Big(\frac{\beta\varphi}{c}\Big)^{\frac{\sigma-1}{\sigma+1}} C^{\frac{2\sigma}{\sigma+1}} \frac{}{c} - f_D. \tag{34}$$

The interesting question is how a multinational private firm allocates its output across borders. We can write the objective function of such a firm as

$$\max_{q,s} \Big[\frac{(1-s)^{\frac{\sigma-1}{\sigma}}}{c} + s^{\frac{\sigma-1}{\sigma}}\Big] q^\beta C - \frac{q^2}{2\varphi}, \tag{35}$$

where s is the share of output allocated in the foreign market. First, given the total output q, the optimal allocation is

$$s^*(c) = \frac{c^\sigma}{1 + c^\sigma} > \frac{1}{2}, \tag{36}$$

which increases in c. A more distorted domestic market incentivizes the private firm to sell *disproportionately* more in the foreign market. Next, after substituting equation (36) into equation (35), we can rewrite the objective function defined in equation (35) as

$$\max_{q} \Big[\frac{\big(1 + c^\sigma\big)^{\frac{1}{\sigma}}}{c}\Big] q^\beta C - \frac{q^2}{2\varphi}, \tag{37}$$

which leads to the solution as

$$q^{PO}(\varphi) = (1 + c^\sigma)^{\frac{1}{\sigma+1}} \Big(\frac{\beta C \varphi}{c}\Big)^{\frac{\sigma}{\sigma+1}}. \tag{38}$$

As a result, output allocated to the domestic market is

$$q^{POD}(\varphi) = \frac{1}{(1+c^{\sigma})^{\frac{\sigma}{\sigma+1}}}\Big(\frac{\beta C\varphi}{c}\Big)^{\frac{\sigma}{\sigma+1}}, \tag{39}$$

and the final profit is

$$\Pi_{PO}(\varphi) = \frac{\big(1+c^{\sigma}\big)^{\frac{2}{\sigma+1}}}{c}\Big[1-\frac{\beta}{2}\Big]\Big(\frac{\beta\varphi}{c}\Big)^{\frac{\sigma-1}{\sigma+1}}C^{\frac{2\sigma}{\sigma+1}} - f_D - f_I. \tag{40}$$

Now, we are in the position to characterize how distortions affect the sorting patter of MNCs and how an improvement in distortions affect the behavior of private MNCs. First, following the literature, we assume that the fixed cost of doing FDI is higher enough such that only the most productive firms choose to do FDI. Next, we use the following proposition to summarize our main theoretical results.

Proposition 5 *The exit cutoff and the cutoff for becoming an MNE are higher for private firms than for SOEs. Next, suppose the initial productivity draw follows the same Pareto distribution (for private firms and SOEs) except that the minimum productivity level can differ. Then, the fraction of MNCs is bigger among private enterprises than among SOEs. Furthermore, the average firm size (i.e., revenue or employment) of private MNCs is smaller than that of multinational SOEs. After distortions are mitigated in the domestic market (i.e., c goes down), the share of private MNCs decreases.*

Proof. Define $\bar{\varphi}_{ij}$ where $i \in \{S, P\}$ and $j \in \{D, O\}$ as the cutoff for exiting or becoming an MNE for the SOE and the private firm. Based on equations (27), (29), (34), (40), we have

$$\bar{\varphi}_{SD} = \left(\frac{f_D}{\big[1-\frac{\beta}{2}\big]\beta^{\frac{\sigma-1}{\sigma+1}}C^{\frac{2\sigma}{\sigma+1}}}\right)^{\frac{\sigma+1}{\sigma-1}} = \frac{\bar{\varphi}_{PD}}{c^{\frac{2\sigma}{\sigma-1}}},$$

$$f_D\left(\frac{\bar{\varphi}_{SO}}{\bar{\varphi}_{SD}}\right)^{\frac{\sigma-1}{\sigma+1}}(2^{\frac{2}{\sigma+1}}-1) = f_I \tag{41}$$

and

$$f_D\left(\frac{\bar{\varphi}_{PO}}{\bar{\varphi}_{PD}}\right)^{\frac{\sigma-1}{\sigma+1}}\Big[(1+c^{\sigma})^{\frac{2}{\sigma+1}}-1\Big] = f_I. \tag{42}$$

Based on equations (41) and (42)), we can derive the cutoffs for becoming an MNE as

$$\bar{\varphi}_{SO} = \bar{\varphi}_{SD}\frac{(\frac{f_I}{f_D})^{\frac{\sigma+1}{\sigma-1}}}{(2^{\frac{2}{\sigma+1}}-1)^{\frac{\sigma+1}{\sigma-1}}},$$

and

$$\bar{\varphi}_{PO} = \bar{\varphi}_{PD} \frac{(\frac{f_I}{f_D})^{\frac{\sigma+1}{\sigma-1}}}{[(1+c^\sigma)^{\frac{2}{\sigma+1}}-1]^{\frac{\sigma+1}{\sigma-1}}}.$$

Therefore, we must have

$$\bar{\varphi}_{PD} > \bar{\varphi}_{SD}; \;\; \frac{\bar{\varphi}_{PO}}{\bar{\varphi}_{PD}} < \frac{\bar{\varphi}_{SO}}{\bar{\varphi}_{SD}}.$$

Furthermore, the cutoff for becoming an MNE for private firms can be expressed as

$$\bar{\varphi}_{PO} = \bar{\varphi}_{SD} \Big(\frac{f_I}{f_D}\Big)^{\frac{\sigma+1}{\sigma-1}} \frac{c^{\frac{2\sigma}{\sigma-1}}}{[(1+c^\sigma)^{\frac{2}{\sigma+1}}-1]^{\frac{\sigma+1}{\sigma-1}}}. \tag{43}$$

Since

$$\frac{c^{\frac{2\sigma}{\sigma-1}}}{[(1+c^\sigma)^{\frac{2}{\sigma+1}}-1]^{\frac{\sigma+1}{\sigma-1}}} > \frac{1}{(2^{\frac{2}{\sigma+1}}-1)^{\frac{\sigma+1}{\sigma-1}}},$$

we must have:

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

For the result on the comparison of average firm size, it is sufficient to show that firm size of the marginal private MNE is strictly smaller than the marginal multinational SOE, since φ follows a Pareto distribution and the resulting firm size (i.e., revenue or employment) is a log-linear transformation of φ. First, we use $S(\varphi)$ to define revenue of a firm with the productivity draw of φ. Second, for the marginal firms we have

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

Third, based on equations (27), (29), (34), (40), (41) and (42), we derive that

$$S(\bar{\varphi}_{SO}) = \frac{f_D}{1-\frac{\beta}{2}} 2^{\frac{2}{\sigma+1}} \frac{\frac{f_I}{f_D}}{(2^{\frac{2}{\sigma+1}}-1)}$$

and

$$S(\bar{\varphi}_{PO}) = \frac{f_D}{1-\frac{\beta}{2}} (1+c^\sigma)^{\frac{2}{\sigma+1}} \frac{\frac{f_I}{f_D}}{[(1+c^\sigma)^{\frac{2}{\sigma+1}}-1]}.$$

Obviously, $S(\bar{\varphi}_{SO}) > S(\bar{\varphi}_{PO})$, which establishes our result for revenue. Note that total wage payment is a fixed fraction of revenue, and the wage rate paid by SOEs and private firms is the same. Therefore, employment of the marginal private MNE is smaller than that of the marginal multinational SOE, which establishes our result for employment.

For the final part of this proposition, we have

$$\frac{d[\bar{\varphi}_{PO}/\bar{\varphi}_{PD}]}{dc} < 0,$$

which establishes the result. ■

The intuition for the above proposition is straightforward. First, since private firms face tougher market environment at home, the cutoffs for survival and becoming an MNE are higher for them. However, the attractiveness of becoming an MNE is higher for private firms, since going abroad not only presents them another market to make profits, but also makes them be subject to less distortions (i.e., institutional arbitrage). As a result, the share of MNCs is bigger for private firms. Although a decrease in the misallocation parameter does not affect the share of MNCs for SOEs, it reduces this share for private enterprises, as the attractiveness of going abroad decreases. Finally, since private firms face distortions in the domestic market, and there are relative more private firms going abroad, the average firm size of private MNCs is smaller than that of SOEs.

Proposition 6 *Suppose after f_I decreases, one SOE and one private enterprise that have exact the same productivity, φ, become MNCs. Overall firm size increases more for the private firm than for the SOE, while domestic sales shrink more for the private firm than for the SOE.*

Proof. Based on equations (28), (31), (33), (38), wee have

$$1 < \frac{q^{SO}(\varphi)}{q^{SD}(\varphi)} = 2^{\frac{1}{\sigma+1}} < \frac{q^{PO}(\varphi)}{q^{PD}(\varphi)} = (1+c^{\sigma})^{\frac{1}{\sigma+1}}.$$

Thus, overall firm size increases more for the private firm than for the SOE. From equations (28), (30), (33), (39), we have

$$1 > \frac{q^{SOD}(\varphi)}{q^{SD}(\varphi)} = \left(\frac{1}{2}\right)^{\frac{\sigma}{\sigma+1}} > \frac{q^{POD}(\varphi)}{q^{PD}(\varphi)} = \frac{1}{(1+c^{\sigma})^{\frac{\sigma}{\sigma+1}}}.$$

Therefore, the shrinking of domestic sales is larger for the private firm than for the SOE. ■

The intuition for the above proposition is straightforward. Since there is an extra benefit for private firms to go abroad, the increase in overall firm size is bigger for them as well (i.e., the size effect). 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. In total, this reallocation effect dominates the size effect which makes the domestic sales of private MNCs drop more.

The above result implies that which part of firm sales we use is crucial when we calculate the degree of misallocation.

Think about a private firm which has a better productivity draw than an SOE. After investing abroad becomes easier (owing to liberalization on foreign investment flows), both firms become MNCs. If we only take into account their domestic sales, we must conclude that the market share of the less productive SOE actually increases relative to the more productive private firm. However, when we take into account both their domestic sales and foreign sales, we will conclude that the *global* market share of the less productive SOE decreases relative to the more productive

private firm. Therefore, we should be more careful when we evaluate how misallocation changes after liberalization on foreign investment flows.

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

Appendix Table 2: Size Difference by Year

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008
					Log Number of Employees				
(1) Non-FDI Firms	5.173	5.096	5.057	4.947	4.685	4.746	4.685	4.634	4.556
(2) All FDI Firms	8.146	8.075	7.874	7.901	5.949	5.957	5.975	5.908	5.502
(3) SOE FDI Firms	8.645	8.629	8.593	9.048	8.756	8.049	8.824	8.820	6.602
(4) Private FDI Firms	8.010	7.957	7.748	7.724	5.836	5.866	5.890	5.833	5.485
Size Difference=(3)-(4)	0.635	0.672	0.845	1.324	2.919***	2.183***	2.934***	2.986***	1.117***
	(0.71)	(0.64)	(0.79)	(1.16)	(2.79)	(5.62)	(2.25)	(10.01)	(2.32)
					Firm TFP				
(5) Non-FDI Firms	3.109	3.002	3.218	3.283	3.065	3.421	3.540	3.659	4.966
(6) All FDI Firms	4.396	4.190	4.376	5.309	4.163	3.855	3.738	3.877	5.194
(7) SOE FDI Firms	3.713	3.451	3.973	4.638	5.208	4.154	4.217	4.570	5.222
(8) Private FDI Firms	4.582	4.348	4.447	5.413	4.120	3.842	3.724	3.859	5.193
Size Difference=(7)-(8)	-0.869	-0.897*	-0.473	-0.774	1.087	0.312	0.492**	0.710***	0.029
	(-1.49)	(-1.66)	(-0.73)	(-1.20)	(1.63)	(1.16)	(2.12)	(3.41)	(0.13)

Note: The table reports firm size difference between private FDI firms and state-owned FDI firms. Firm size is proxy by log number of employees in the top module and by firm TFP (Olley-Pakes) in the bottom module. The top module shows that the average firm size of private FDI firms is smaller than that of state-owned FDI firms by year. However, such a pattern exist only for year after 2004 when measured by firm productivity. Numbers in parentheses are t-values. ***(**, *) denotes significance at the 1% (5%, 10%) level.