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Essays on Foreign Direct Investment, Agglomeration and Productivity

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ABSTRACT

This dissertation investigates the role of foreign direct investment and agglomeration economies in the process of industrial development, with a focus on the productivity of manufacturing firms. The first chapter analyzes the importance of the source of foreign direct investment on the performance of domestic Chinese firms. The second chapter studies the interaction between foreign and domestic manufacturing firms operating in the same industry and located within the same Chinese city. The third chapter examines the response of multinational companies to changes in domestic institutions. My findings highlight the importance of the source of foreign direct investment, proximity to economic activity, and strong institutional incentives in enhancing firm performance in developing economies.

ESSAYS ON FOREIGN DIRECT INVESTMENT, AGGLOMERATION, AND PRODUCTIVITY

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DISSERTATION

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1. Foreign Direct Investment, Agglomeration, and Productivity

My dissertation studies the role of foreign direct investment (FDI) and agglomeration economies in the industrial development process in the context of a developing economy, China. Recognizing technology as a driver of economic growth, governments in developing countries spend significant resources to attract FDI in the hopes of realizing positive spillovers in the form of international technology transfer as well as opportunities to imitate new products, hire foreign-trained labor, and become suppliers to and consumers of intermediate inputs produced by foreign companies, all of which are believed to enhance domestic firm performance. However, entry of foreign firms can also increase competition in output and input markets spurring domestic firm efficiency or forcing them out of the market. In each of my three chapters, outlined in greater detail in subsequent paragraphs, I argue that the source of foreign investment as well as the domestic economic landscape in which these investments are made shapes the gains that result from FDI. My empirical research leads to three main findings. First, foreign acquirers from more developed countries significantly increase domestic firm performance. Second, positive spillovers from FDI within a city-industry space tend to decline with increases in technological distance between firms. Finally, liberalized ownership rules produce changes in the control structures of foreign enterprises as they respond to domestic institutional distortions.

The first chapter examines the importance of the source of foreign direct investment on domestic firm performance in a developing country context. Using a newly created panel

of domestic Chinese firms who are acquired by foreign investors, I find evidence of higher productivity gains by firms acquired by investors from OECD countries relative to those acquired by investors from Hong Kong, Macao, and Taiwan (HMT). To control for possible endogeneity of the acquisition decision, I employ propensity score matching combined with a difference-in-differences approach. The results indicate that relative to HMT-acquired firms, OECD-acquired firms experience higher total factor productivity (TFP) in the initial year of acquisition and this productivity differential persists in subsequent years, reaching 24.5% in the third year. Further results point to the introduction of management techniques that reduce labor inefficiencies along with capital deepening as likely sources of the TFP increase. The TFP differential is stronger in industries with higher domestic content. Together, these results suggest that the development level of the investor source country affects the opportunities for technology transfer.

The second chapter examines how the presence of nearby foreign multinational companies (MNCs) alters the economic landscape in which domestic enterprises operate. MNCs are believed to generate positive own-industry (localization) spillovers. However, MNCs also tend to exert negative competitive pressures in output and input markets. Using panel data on manufacturing enterprises operating in China during 1998-2006, this paper provides empirical evidence on the net effect of these opposing forces that arise in the presence of MNCs. Central to the analysis is the opportunity to rank nearby activity, in ascending order of productivity, into state, private, and foreign ownership types. Results indicate that spillovers are largest within the same ownership types, consistent with the presence of traditional localization economies. However, across ownership types spillovers differ in two ways. They tend to be much weaker compared to within ownership type

spillovers. In addition, spillovers from more productive foreign to less productive domestic enterprises are smaller compared to spillovers in the reverse direction. I also find evidence of positive spillovers from private-owned enterprises to all three ownership types, suggestive of the important role of indigenous private enterprises in the Chinese economy. Finally, I find evidence for ethnic networks facilitating localization spillovers.

The third chapter, coauthored with Mary E. Lovely, utilizes a quasi-experiment in China's WTO accession to observe multinationals' response to changes in property rights in a developing country. WTO accession reduced incentives for joint ventures while reducing constraints on wholly owned foreign subsidiaries. Concomitant with these changes was a more liberal investment environment for indigenous investors. An adaptation of Feenstra and Hanson's (2005) property rights model suggests that higher productivity and value added of a joint venture, but lower domestic sales share, increases the likelihood that the venture will become wholly foreign owned following liberalization. Theory also suggests that an enterprise with lower productivity but higher value added and domestic sales will be more likely to switch from a joint venture to wholly domestic owned. Using newly created enterprise-level panel data on equity joint ventures and changes in registration type following China's WTO accession, we find evidence consistent with the property rights theory. More productive firms with higher value added and lower domestic sales shares are more likely to become wholly foreign owned, while less productive firms focused on the Chinese market are more likely to become wholly domestic owned rather than remain joint ventures. In addition to highlighting the importance of incomplete contracts and property rights in the international organization of production, these results support the view that external

commitment to liberalization through WTO accession influences multinational and indigenous firms' behavior.

To conclude, the three chapters of my dissertation investigate the roles of foreign direct investment and agglomeration economies in enhancing domestic manufacturing firm productivity. I find robust evidence that domestic institutions impact the types of foreign investment entering a country and that this investment affects local firm productivity and organizational form. Greater foreign investment can mean greater access to technology and higher domestic firm productivity, providing opportunity for higher incomes and better living standards. However, to maximize the benefits from foreign direct investment, my thesis underscores the need to understand the source of foreign direct investment and the domestic landscape where foreign and domestic firms interact.

2. Origin of FDI and Firm Performance: Evidence from Foreign Acquisitions of Chinese Domestic Firms

2.1 Introduction

Recognizing technology as a driver of economic growth, governments in developing countries spend significant resources to attract foreign direct investment (FDI) in the hope of international technology transfer.[1,2] Given the geographic concentration of innovation activity, however, not all FDI provides the same opportunity for transfer of advanced technology to the host country. In 2000, 82% of global research and development (R&D) expenditures were undertaken in Organization of Economic Cooperation and Development (OECD) countries and half were performed by the United States and Japan alone (Lovely and Popp, forthcoming). A consequence of this concentration is that multinational firms from OECD countries are believed to have superior technological capabilities.[3] That this superior technology will be transferred to less advanced settings is not guaranteed, however, as host-country firms may not have the capacity to absorb superior know-how into their production processes.[4] Thus, while there is reason to believe that the development level of

[1] "International technology transfer refers to any process by which a party in one country gains access to technical information of a foreign party and successfully absorbs it into its production process." (Glass and Saggi, 2008)

[2] See Keller (2004, 2010) for surveys of the literature on international technology diffusion.

[3] Global R&D activity is primarily carried out by multinationals (Pack and Saggi, 1997).

[4] The usage of the term absorptive capacity follows Cohen and Levinthal (1990).

the investor source country alters the opportunities for technology transfer, the extent of such transfer is an open empirical question.

This paper searches for evidence of technology transfer via FDI, in particular through foreign merger and acquisition activity in China, explicitly distinguishing between investors from OECD countries and those from the less innovative but nearby economies of Hong Kong, Macao, and Taiwan (HMT).[5] The analysis is carried out by comparing the post-acquisition productivity performance of OECD and HMT acquired firms.[6] An obvious challenge in comparisons is the possibility that OECD investors systematically choose high productivity Chinese firms as acquisition targets. Without appropriate recognition of possible selection bias, observed post-acquisition performance may reflect superior domestic capability rather than superior foreign firm technology transfer. I account for possible endogeneity of the acquisition decision through the use of propensity score matching, by which a HMT-acquired firm is assigned to every OECD-acquired firm as a proxy for the missing counterfactual of an OECD-acquired firm had it instead been acquired by a HMT investor. I then further employ a difference-in-differences approach to control for unobservable but time invariant differences between the two groups of acquired firms.

This paper offers two contributions to the literature that examines the causal link between FDI and productivity. First, this study distinguishes between the sources of FDI instead of treating all FDI alike and documents differences in post-acquisition productivity performance. Existing literature primarily focuses on the foreign ownership effects without

[5] The terms mergers and acquisitions are used interchangeably in this paper. See DePamphilis (2010) for a detailed overview.

[6] Foreign acquisition is defined as the event when the firm's foreign equity share exceeds or equals 25%. See section 2.4 for a discussion of the data.

distinguishing FDI by source. Although not the focal point of these studies, some exceptions include Conyon et al (2002), Harris and Robinson (2003), and Schiffbauer, Siedschlag, and Ruane (2009) who find that domestic firms in the U.K. who are acquired by U.S. investors experience the largest increase in productivity compared to those acquired by investors from the EU or other countries. More recently, a study by Chen (2009) finds that foreign acquisitions of U.S. domestic firms lead to increases in sales if the acquirers are from industrialized rather than developing countries.

The second contribution of the present study is its developing country context, unlike Chen (2009). Without distinguishing by source countries, previous studies investigate post-acquisition productivity performance of domestic firms in developing countries and generally find that foreign ownership increases post-acquisition productivity (Arnold and Javorcik (2009) focusing on Indonesia; Petkova (2008) on India; and Djankov and Hoekman (2000) on the Czech Republic). However, as noted above, technology transfer may be attenuated by the distance between source and host country development level. The present study fills this gap by estimating the post-acquisition productivity gain realized by a developing country receiving investment from relatively more advanced economies.

China provides a suitable setting to explore these issues. Since 1993, China has been the largest recipient of FDI inflows in the developing world.[7] Foreign direct investment in China can be broadly classified as originating from the ethnically Chinese economies of Hong Kong, Macao, and Taiwan (HMT) and all other economies but primarily OECD countries. Table 2.1 provides the source country share of actually utilized FDI in total non-HMT FDI between 1998 and 2006. On average, OECD countries accounted for 60% of all

[7] See Fung, Iizaka, and Tong (2004) for an overview of the development of China's FDI policy and subsequent changes in FDI inflows.

non-HMT FDI, with the United States and Japan the source of more than half of these inflows.[8] Hu and Jefferson (2002) find that the high share of FDI coming from advanced countries is important for technology transfer in China because OECD investment carries "higher technology content." Furthermore, Zhang (2005) argues that compared to OECD investors who operate on frontiers of world technology, HMT investors derive their advantages from marketing and on-time delivery skills.

These source country differences suggest that technology transfer should be more pronounced in domestic Chinese firms acquired by OECD firms relative to their HMT-acquired counterparts. I investigate this hypothesis by calculating and comparing the post-acquisition change in total factor productivity (TFP) experienced by OECD-acquired firms to that experienced by HMT-acquired firms. I interpret a positive post-acquisition productivity differential as evidence of differences in technology transfer by investor group. I build a panel of Chinese domestic manufacturing firms who are acquired by OECD or HMT investors between 1999 and 2004, using annual firm-level data collected by China's National Bureau of Statistics. Difference-in-differences analysis indicates that OECD-acquired firms experience higher productivity post-acquisition relative to HMT-acquired firms, net of the initial difference in the pre-acquisition period. In particular, the TFP differential is 12.3% in the year of acquisition, 11.1% one year after and reaches 24.5% in the third year. This result is strongest in industries with high domestic content in exports. This latter finding suggests that in developing countries with high shares of processing exports, such as China, Vietnam, and Mexico, transfer of advanced technology via foreign direct investment might not materialize if the local economy specializes in a narrow range of tasks.

[8] Henceforth, non-HMT will be referred to as OECD.

I further find that relative to HMT-acquired firms, OECD-acquired firms experience higher average wage and capital intensity in all post-acquisition periods. Moreover, because employment does not increase, average wage increase appears to result from application of techniques that improve labor productivity and thereby reduce inefficiencies. There is no support for "learning by exporting" effects as I find no post-acquisition increases in the share of output that is exported.[9] Likewise, there is no evidence of increases in innovation measured as the value of new products in total sales. Taken together, these results suggest that introduction of management techniques along with capital deepening are the likely sources of TFP increases in OECD-acquired firms.

To explore possible concerns about the propensity score matching technique, I re-do the analysis using data on acquired firms in the textile industry only.[10] Results from this analysis conform to the patterns observed earlier – OECD-acquired firms experience higher productivity in post-acquisition periods with the largest impact in the year of acquisition. The similar pattern of results lends confidence that the TFP differential is not being driven by specifics of the matching technique used.

The rest of the paper is organized as follows. Section 2.2 provides a conceptual framework that predicts differences in the post-acquisition performance of firms facing relatively high fixed acquisition costs. I then apply this framework to OECD and HMT acquisitions and derive the empirical acquisition model. Section 2.3 discusses the empirical strategy. Section 2.4 describes the data and measurement of total factor productivity.

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[9] "Learning by exporting" is the idea that firms improve their relative productivity after they begin exporting. For example, see De Loecker (2007) for a recent empirical study.

[10] For the baseline results, matches for each OECD-acquired firm are not constrained to be within the same industry in order to increase the likelihood of successful matches.

Section 2.5 presents the empirical findings for all industries and Section 2.6 for the textile industry alone. The final section discusses the relevance of these results to our understanding of technology transfer.

2.2 Conceptual Framework

To inform the empirical strategy used in this paper, a simple framework for analyzing the acquisition decision of OECD and HMT investors is adapted from Hall (1988). There are two types of multinational firms, f, (acquirers) – those from OECD countries and those from Hong Kong, Macao, and Taiwan. The acquirers may differ with respect to firm capabilities, c_{OECD} and c_{HMT}. Capability encompasses both productivity as well as perception of quality about a firm's products and underlying these 'revealed' capabilities is the know-how or technology of the firm (Sutton, 2005). There is a domestic target, t, among a pool of domestic Chinese firms, C, with a fixed capability, c_t , located in China. The multinational firms bid for the target. The value of acquiring a domestic Chinese target to a representative foreign multinational can be expressed as,

$$V_{f,t} = g_A(c_f, c_t) - FC_f + \varepsilon_{f,t} \tag{2.2.1}$$

where $g_A(c_f, c_t)$ is the discounted value of the flow of profits from the acquired firm which depends on the capabilities of the target as well as the capabilities of the acquirer. FC_f is a fixed cost of acquisition and $\varepsilon_{f,t}$ represents a random shock. I assume that OECD and HMT investors differ with respect to fixed costs of acquisition because HMT firms are physically and culturally closer to mainland China than are OECD firms. Distance impacts

the costs of acquiring information prior to acquisition for due diligence. If an acquirer is physically closer, it may be able to discern and act on information more expediently. HMT investors also have an advantage in terms of sharing the same language and culture as mainland China, and they may have business and family ties that facilitate transactions with local firms and authorities. HMT investors also had a first-mover advantage in that they entered China well before other investors (Huang, Jin, Qian, 2010) which could have allowed them to establish stronger local networks. Formally, I assume that fixed costs of acquisition for OECD investors are higher than for their HMT counterparts, $FC_{OECD} > FC_{HMT}$.[11] A domestic target will only be acquired if the value of the firm to the foreign acquirer exceeds the value of the target as a wholly owned domestic firm, V_t.[12] The probability that target t is acquired by an OECD investor rather than a HMT investor can be expressed as,[13]

$$P\big(V_{OECD,t} \geq V_{HMT,t}\ \forall\ t \epsilon C\ and\ V_{OECD,t} - V_t \geq 0\big). \tag{2.2.2}$$

Therefore, the expression for the probability in (2.2.2) becomes,

$$P\begin{bmatrix} \varepsilon_{HMT,t} - \varepsilon_{OECD,t} \leq \big(g_A(c_{OECD}, c_t) - g_A(c_{HMT}, c_t)\big) - (FC_{OECD} - FC_{HMT})\ and \\ \varepsilon_t - \varepsilon_{OECD,t} \leq \big(g_A(c_{OECD}, c_t) - g(c_t)\big) - FC_{OECD} \end{bmatrix}. \tag{2.2.3}$$

[11] See Huang, Lin, Qian (2010) for a discussion of how cultural proximity enjoyed by HMT investors may influence the fixed costs of setting up FDI.

[12] $V_t = g(c_t) + \varepsilon_t$, where $g(c_t)$ represents the discounted value of the flow of profits from the wholly domestic owned firm which depends on the capability of the target and ε_t is a random shock.

[13] The acquisition price in Hall (1988) is "an endogenously determined division of the rents which accrue to a merger" (p. 17). Guided by my matching strategy, I do not model the mechanism of how the actual acquisition price is determined in equilibrium. Equation (2.2.2) simply requires this price to exceed the value of the firm as a wholly domestic firm.

Assuming that the $\varepsilon_{f,t}$'s are independently and identically distributed across alternatives following a Type I extreme value distribution (McFadden, 1974), we obtain the multinomial logit probability that an acquisition will take place as,

$$P(f\ buys\ t|C) = \frac{\exp(g_A(c_f,c_t) - FC_f)}{\sum_{f \epsilon C} \exp(g_A(c_f,c_t) - FC_f)}. \quad (2.2.4)$$

If we observe a domestic firm that has an equal probability of being acquired by either an OECD or a HMT multinational, we can use (2.2.4) to compare the expected profits under the two possible outcomes. Because $FC_{OECD} > FC_{HMT}$, it must be the case that the OECD investor expects a larger flow of profits from acquisition than does the HMT investor. Higher profits are consistent with OECD multinationals having higher fixed capabilities, $c_{OECD} > c_{HMT}$, and should be observed as higher post-acquisition TFP and profits.

Intuitively, we can think about the implications of (2.2.2) within models with firm heterogeneity of acquirers such as Melitz (2003) and Helpman, Melitz, and Yeaple (2004) without making a formal argument. In heterogeneous firm models only higher productivity firms are able to cover higher fixed entry costs. Assuming OECD and HMT investors are similar in all respects except that OECD investors have a higher fixed cost of acquisition relative to HMT investors, then the TFP distribution of OECD buyers who acquire targets in China is shifted right compared to that of HMT buyers. Thus, higher fixed acquisition costs are consistent with the assumption that the firms from OECD countries investing in China have, on average, higher fixed capabilities than those from HMT. We can then expect that for a given target post-acquisition productivity will be higher if acquired by an OECD

firm than by a HMT firm due to the higher capabilities of OECD investors who enter China.

2.3 Empirical Strategy

The goal of this paper is to evaluate the importance of the source of FDI on post-acquisition performance of domestic firms in a developing country context. To that end, I compare the change in total factor productivity of a domestic Chinese firm acquired by an OECD investor (treatment group) to that of a domestic Chinese firm acquired by a HMT investor (control group). In an ideal setting, I would observe outcomes for an OECD target had it been acquired by a HMT investor. However, domestic Chinese firms can be in only one of three states of the world – (i) it is acquired by an OECD investor, (ii) it is acquired by a HMT investor, or (iii) it remains a domestic firm. In particular, $S\epsilon\{OECD, HMT, DOMESTIC\}$ where S denotes a state of the world or a particular treatment in the language of the microeconometric evaluation literature. Thus, we never observe the desired counterfactual, leading to a missing data problem.

Matching is used to construct the missing counterfactual or control group by selecting a group of firms from the pool of HMT-acquired firms that share similar observable characteristics as the OECD-acquired or treated firms in the pre-acquisition period. I employ propensity score matching to construct these counterfactuals, as discussed in detail below.[14] Matching attenuates potential endogeneity of the acquisition decision, as would occur if OECD investors select higher productivity targets.

[14] See Blundell and Costa Dias (2002) for a review of alternative methods used for program evaluation.

A preview of the unconditional data in Figure 2.1 shows that the distributions of TFP of both OECD and HMT targets in the pre-acquisition period are visually almost identical. However, the two-sided Smirnov-Kolmogorov test rejects the null hypothesis that the distribution of TFP of OECD versus HMT targets come from the same distribution at the 1% level.[15] This implies that the two distributions differ in a statistical sense and this difference could be a result of some sorting based on target TFP. This necessitates the use of propensity score matching to compare the performance of OECD-acquired firms with a carefully selected group of HMT-acquired firms sharing similar pre-acquisition characteristics. Prior to matching, I expect the mean difference between the two groups to be statistically significant while no statistical difference should remain after matching in the pre-acquisition period. The balancing tests, discussed in detail in Section 2.5.1, show that matching minimizes the pre-acquisition differences between OECD and HMT-acquired firms.

2.3.1 Propensity Score Matching

In this study a domestic Chinese firm can be acquired by either an OECD or HMT investor. The analysis focuses on the pair wise average treatment effects. Imbens (1999) and Lechner (2001) show that the Rosenbaum and Rubin (1983) propensity score for the binary treatment case extends to the multiple treatment case as well. The focus of this study is only on one particular set of pair wise average treatment effect – post-acquisition productivity between OECD and HMT acquired firms. Therefore, m and l will represent OECD and HMT, respectively. Adopting notation from Lechner (2002a, 2002b), the pair wise average

[15] The two-sided Smirnov-Kolmogorov test statistic is 0.0744(0.0000) with p-value in parentheses.

treatment effects, $\theta_0^{m,l}$, of treatments m and l for the target firm in treatment m can be estimated as,

$$\theta_0^{m,l} = E(Y^m - Y^l | S = m) = E(Y^m | S = m) - E(Y^l | S = m) \qquad (2.3.1.1)$$

where $\theta_0^{m,l}$ is the expected effect for a target firm randomly drawn from the population of participants in treatment m. The first expression after the second equality in (2.3.1), $(Y^{OECD} | S = OECD)$ which is the outcome for a Chinese domestic target that is acquired by an OECD investor, is readily observed for targets that have been acquired by OECD investors. However, the counterfactual $(Y^{HMT} | S = OECD)$ which is the outcome for the same domestic target had it been acquired by a HMT investor, cannot be observed leading to an omitted variable problem.

It is not possible to design an experiment where assignment of treatment is random, in this study an OECD acquisition, which would guarantee that the post-acquisition outcomes are independent of the assignment mechanism such that $E(Y^l | S = m) = E(Y^l | S = l)$. In non-experimental studies such as this, the acquisition decision is not random and therefore $E(Y^l | S = m)$ cannot be measured using $E(Y^l | S = l)$. Propensity score matching is used to construct $E(Y^l | S = m)$ by selecting a match for every OECD-acquired firm from the group of HMT-acquired firms, based on a set of similar observable characteristics, X. Matching eliminates differences between OECD and HMT acquired firms based on the observable characteristics included in X. However, the vector of covariates, X, may be very large leading to the "curse of dimensionality" that arises when trying to match

on multiple observable characteristics (Rosenbaum and Rubin, 1983) and can be overcome using the propensity score that is a scalar variable.

In order to estimate the marginal probabilities, the value of acquisition to a representative foreign multinational is modeled as a function of the target's pre-acquisition characteristics, including productivity, sales, age, capital-labor ratio, average wage, and state equity share. The estimation also includes year, region, and industry fixed effects. The estimation results are discussed in detail under Section 2.5.

2.3.2 Propensity Score Matching Difference-in-Differences

In addition to observable differences, there might be other systematic, unobservable differences between the two groups of acquired firms that are time invariant. The difference-in-differences matching (DDM) estimator addresses this issue by eliminating unobservable, time-invariant differences between the two acquired groups of firms. The estimator, $\theta_{DDM}^{m,l}$, compares the change in the average TFP between a time period preceding the acquisition and a time period after the acquisition. Specifically,

$$\theta_{DDM}^{m,l} = E\left((Y_{t+u}^{m} - Y_{t-1}^{m}) - \left(Y_{t+u}^{l} - Y_{t-1}^{l}\right)\middle| X, S = m\right) =$$

$$E(Y_{t+u}^{m} - Y_{t-1}^{m} | X, S = m) - E\left(Y_{t+u}^{l} - Y_{t-1}^{l}\middle| X, S = m\right) \qquad (2.3.2.1)$$

where t denotes the year of acquisition and u denotes the number of years after the acquisition and $t-1$ is the year preceding the acquisition.

Formally, two conditions must be satisfied to achieve identification. The first is the conditional independence assumption (CIA) which requires that treatment participation is

orthogonal to treatment outcome conditional on observable characteristics, X. This condition is sometimes called a "data hungry" identification strategy because it requires the researcher to observe all characteristics that jointly influence the potential outcomes as well as the selection into the treatments. The dataset used in this paper contains detailed balance sheet, income sheet and other demographic information about the targets in the pre and post-acquisition periods which acquirers use to make their acquisition decisions. The detailed nature of the dataset makes it easier to justify that CIA is not being violated (Lechner, 2002a). When propensity score matching is combined with difference-in-differences, CIA is extended to condition on both observables and time-invariant unobservables and is known as the bias stability assumption (Heckman, Ichimura, Todd, 1997). In the context of this study, the bias stability assumption implies that time varying unobservables play no role in which Chinese domestic target gets acquired by either an OECD or HMT investor.

The second condition is the common support or overlap condition. This requires that all economic agents with the same values of X have a positive probability of being in both the treated or control groups. The overlap condition substitutes for the absence of experimental control units. In a randomized experiment where the treatment and control samples are randomly drawn from the same population, the treatment effect for the treated and untreated groups are identical. In the context of this study, the common support requirement ensures that although matches for OECD-acquired firms, from the pool of HMT-acquired firms, might not necessarily be drawn from the same population, we will observe the same set of pre-treatment characteristics for these two groups so that comparisons are only made with similar firms.

Adopting Lechner's (2001) notation the propensity score matching difference-in-differences estimator can be written as,

$$\theta_{DDM}^{m,l} = E(Y_{t+u}^{m} - Y_{t-1}^{m} | S = m) - E_{P^{l|ml}(X)}\left[E\left(Y_{t+u}^{l} - Y_{t-1}^{l} \middle| P^{l|ml}(X), S = l\right) | S = m\right] \quad (2.3.2.2)$$

where $P^{l|ml}(x) = \frac{P^{l}(x)}{P^{l}(x)+P^{m}(x)}$ is the propensity score in the multiple treatment framework and $X = x$. Replacing m and l with OECD and HMT, $P^{HMT}(x)$ and $P^{OECD}(x)$ are the individual marginal probabilities of being acquired by a HMT and OECD investor respectively, conditional on X.[16] These individual marginal probabilities $\left[\hat{P}^{HMT}(x), \hat{P}^{OECD}(x)\right]$ can be estimated in the multiple treatment case using multinomial logit or probit functions to estimate the conditional probability, $P^{HMT|OECD,HMT}(x) = \frac{P^{HMT}(x)}{P^{HMT}(x)+P^{OECD}(x)}$. Alternatively, Lechner (2002a) shows that the average treatment effect on the treated, $\theta_0^{m,l}$, is also identified by conditioning jointly on the individual marginal probabilities instead of conditioning on the conditional probability alone. Lechner (2002a, 2002b) also argues that it may be attractive to condition jointly on the marginal probabilities instead of on the conditional probability since $P^{l|ml}(x)$ is the expectation of $\frac{P^{l}(x)}{P^{l}(x)+P^{m}(x)}$ conditional on the marginal probabilities.

I follow the matching protocol described in Lechner (2002) to construct the missing counterfactual, $E(Y_{t+u}^{OECD} - Y_{t-1}^{OECD} | S = HMT)$. First, $\hat{P}^{HMT}(x)$ and $\hat{P}^{OECD}(x)$ are estimated from a multinomial logit model. Second, the common support condition is implemented

[16] $P^{HMT}(x) = P(S = HMT | x = x)$; $P^{OECD}(x) = P(S = OECD | x = x)$.

using the minima and maxima comparison. Under this criterion, all observations whose propensity score is smaller than the minimum and larger than the maximum in the opposite group are deleted. Only one firm was deleted from the sample of OECD-acquired firms after implementing the common support condition. The common support condition ensures that any combination of characteristics observed in the group of OECD-acquired firms can also be observed among the group of HMT-acquired firms. Finally, a HMT-acquired firm that is closest in terms of the multivariate score, $\left[\hat{P}^{HMT}(x), \hat{P}^{OECD}(x)\right]$, to an OECD-acquired firm is chosen as the missing counterfactual.[17] Closeness is measured using the Mahalanobis distance metric.[18] Once each OECD-acquired firm has been assigned a counterfactual firm, difference-in-differences is performed as shown in (2.3.2.2). I expect $\theta_{DDM}^{OECD,HMT} > 0$, when the outcome is productivity, since capabilities of OECD acquirers are posited to be higher relative to those of HMT acquirers.

2.4 Data

The sample used in this study has been constructed from the Annual Surveys of Industrial Production (ASIP) conducted by China's National Bureau of Statistics (NBS) during 1998-2006. The Annual Surveys of Industrial Production includes all non-state owned firms whose annual sales exceed 5 million yuan[19] (referred to as "above-scale" by

[17] A HMT-acquired firm may be chosen multiple times for different OECD-acquired firms. This could lead to an inflation of variance if few observations are used repeatedly. This is not a problem in this study due to a sufficiently large pool of HMT-acquired firms.

[18] $\sqrt{\left(\hat{P}^{OECD}(x) - \hat{P}^{HMT}(x)\right)^{T} S_{HMT}^{-1} \left(\hat{P}^{OECD}(x) - \hat{P}^{HMT}(x)\right)}$, where $\mathrm{S_{HMT}}$is the sample covariance matrix of the HMT-acquired group. See Rosenbaum and Rubin (1985) for further details.

[19] This amounts to approximately $US 600,000 over this period.

NBS) and all state-owned enterprises.[20] The dataset contains detailed information on the firm and its operations, including geographic administrative code, ownership type, gross industrial output value, value added, export value, total employment, capital stock, and intermediate inputs. The dataset also provides information about the equity shares in a firm distinguishing between domestic and foreign sources. The foreign sources of equity are further subdivided into those from OECD and HMT investors. Unfortunately, information about individual source countries within these two broad categories is not available, so I restrict the analysis to a comparison between these two groups.

The sample of firms used in the matching analysis is constructed as follows. From the overall sample, I identify domestic firms that are observed one year prior to acquisition and henceforth are acquired by either a HMT or OECD investor and remain under that particular foreign ownership for two years after acquisition. Thus, the sample consists of firms that are acquired between 1999 and 2004.[21] Foreign acquisition is defined as an event where the foreign equity share equals or exceeds 25%.[22] The final matching sample used in the analysis consists of 1,493 firms acquired by OECD investors and each of these firms is paired with a firm from a group of 1,813 firms acquired by HMT investors.[23] Table A2

[20]The NBS classifies non state-owned enterprises to include collectively-owned enterprises, Chinese indigenous privately-owned enterprises, and foreign-owned enterprises operating in China. The industry section of China Statistical Yearbook is compiled based on this dataset. Basic information of each four-digit industry in the China Markets Yearbook is also based on this dataset.

[21] To alleviate concerns that only survivors and by implication higher productivity firms are disproportionately included in the sample, I calculate the exit rates for acquired firms, differentiated by the origin of the investor, who drop out of the sample in years t+1 and t+2 respectively. The exit rates do not differ substantially by investor type lending confidence that the sample of OECD and HMT-acquired firms are comparable.

[22] This threshold is set by the Chinese government.

[23] The original sample consisted of 1,798 firms acquired by OECD investors and 2,151 firms acquired by HMT investors. Of those acquired by OECD (HMT) investors, 304 (338) change two-digit industry categories in the

provides a breakdown of the number of acquired firms by two-digit industry under the Chinese Industrial Classification (CIC).

I estimate the marginal probabilities using what Lechner (2002a) calls the structural approach where "the idea is to formulate the complete choice problem in one model and estimate it on the full sample." (p. 209). Therefore, for constructing the propensity scores, I utilize the full sample to model the separate marginal probabilities of being acquired by either an OECD or HMT investor using a multinomial logit model. The advantage of the structural approach is the ease of understating the empirical factors behind the joint selection process as opposed to computing binary conditional choices, one at a time.[24]

2.4.1 Productivity

The key outcome variable of interest in this study is firm-level total factor productivity (TFP). TFP is an indirect measure of technology transfer in that it is an outcome due to gains in efficiency following technological diffusion after an acquisition (Keller 2004, 2010). Unavailability of data prohibits the use of more direct measures such as expenditure on patent licensing fees or payments for blueprints of technology.

Using TFP levels as a measure of technology transfer, however, could pose a particular challenge. Keller (2004, 2010) cautions that TFP may suffer from measurement error, due to usage of the values of outputs and inputs rather than the physical quantities. Thus, gains due to technological transfers may be confounded by higher mark-ups. This

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post-acquisition period and are consequently dropped to ensure comparison within the same industry. 1 OECD-acquired firm was not on the common support and also excluded from the analysis.

[24] Lechner (2002a) calls computing binary conditional choices one at a time the reduced form approach. He finds that in application, the matching estimators using the reduced form versus the structural approach yield similar results.

paper considers changes in TFP as opposed to TFP levels in order to mitigate concerns about measurement error. Keller (2004, 2010) argues that considering changes in TFP as opposed to level "will help in identifying technology if spurious factors do not change over time, or more generally, if they change less than technology."

Total factor productivity is measured as the residual of a Cobb-Douglas production function estimation. Specifically, TFP of a firm i in period t is,

$$TFP_{it} = \exp(\ln value\ added_{it} - \beta_l \ln labor_{it} - \beta_k \ln capital_{it}). \quad (2.4.1.1)$$

The input coefficients, β_l and β_k, are first determined by estimating,

$$\ln value\ added_{it} = \beta_l \ln labor_{it} + \beta_k \ln capital_{it} + \omega_{it} + \varepsilon_{it} \quad (2.4.1.2)$$

where ω_{it} represents the part of productivity shock that is observed by the firm but unobserved by the econometrician and ε_{it} represents an error term uncorrelated with the other inputs. Since the firm observes ω_{it}, the unobserved component of productivity could affect input choices so that OLS yields inconsistent estimates of the production factors (Marschak and Andrews, 1944).

To address this potential simultaneity bias, I employ the semi-parametric method proposed by Levinsohn and Petrin (2003).[25] I estimate the production function for each CIC four digit industry to allow the returns to inputs to vary across industries. This procedure uses intermediate inputs to proxy for the unobservable productivity shock, ω_{it}.

[25] Carried out using the Stata module *levpet* (Petrin, Poi, Levinsohn, 2004).

Computation of TFP using the Levinsohn and Petrin (2003) method requires information on firm value added, labor, capital and intermediate inputs. The dataset provides information on nominal values of firm value added, capital, and intermediate inputs. These are converted to real terms using the output, investment, and input deflators, respectively, in Brandt et al. (2009).[26] In addition, an alternative measure of productivity, labor productivity, is used to establish robustness of the results to different measures of productivity.

2.5 Results

2.5.1 Multiple Treatment Matching Results

Two marginal probabilities must be estimated to construct the counterfactuals for the pool of firms acquired by OECD investors. The first is the probability that a domestic Chinese firm is acquired by an OECD investor, $\hat{P}_{OECD}(x)$, and the second is the probability that a domestic Chinese firm is acquired by a HMT investor, $\hat{P}_{HMT}(x)$, both conditional on observable characteristics, x. I obtain these probabilities through estimation of the multinomial logit model in (2.2.4). Explanatory variables that affect both the treatment (acquired by an OECD investor) as well as the outcome (total factor productivity) are included in this equation.[27] The choice of variables is also guided by existing literature including Huang, Ma, Yang, Zhang (2008), Arnold and Javorcik (2004), Petkova (2008), and Chen (2009). All explanatory variables are measured as of the pre-acquisition period.

Evidence suggests that foreign investors rely on observable characteristics of a target firm to make acquisition decisions (Arnold and Javorcik, 2004; Chen, 2009) making it more

[26] The deflators are available at http://www.econ.kuleuven.be/public/N07057/CHINA/appendix/.

[27] See Caliendo and Kopeinig (2008) for a discussion of implementing propensity score matching techniques.

likely that CIA holds. However, there might be concerns that selection of targets by acquirers could be guided by unobservable preferential policy treatments that vary over time. Selection on unobservables will pose challenges for identification in this study if OECD investors received preferential treatment over HMT investors. However, evidence suggests otherwise. Huang, Jin, Qian (2010) document that Chinese domestic policy has been uniformly non-discriminatory for all FDI since the early 1990s.

Variables included in the multinomial logit model are pre-acquisition TFP, sales and sales squared, age and age squared, capital to labor ratio, wage per worker, share of exports in total sales, share of equity held by the state in total capital[28] Inclusion of TFP is intended to control for any selection on productivity such as "cherry-picking", a phenomenon where some foreign firms acquire better performing domestic firms. Because TFP is a generated regressor, standard errors are bootstrapped. Total sales proxy for firm size. Age captures the stage of development of the firm as well as variations in production and management experiences. It also acts as a control for survival of more productive companies. Capital per worker is a measure of the potential productive capacity of the firm embodied in its capital stock. Average enterprise wage captures the average skill level of the domestic firm's labor. Share of exports in total sales is indicative of the level of integration of the firm in world markets.

In addition, the model includes a set of year, two-digit industry, and region fixed effects.[29] Year dummies control for macroeconomic shocks, such as inflation and other

[28] All nominal values are converted to real values.

[29] Regions are comprised of the following groups of provinces – (i) Coastal: Beijing, Fujian, Guangdong, Hainan, Jiangsu, Shandong, Tianjin, Zhejiang, Hebei; (ii) Inland: Shanxi, Anhui, Jiangxi, Henan, Hubei, Hunan; (iii) Northeast: Liaoning, Jilin, Heilongjiang; (iv) Southwest: Guangxi, Sichuan, Guizhou, Yunnan, Chongqing; (v) Northwest: Inner Mongolia, Tibet, Shaanxi, Gansu, Qinghai, Ningxia, Xinjiang.

national shocks. Industry dummies control for industry specific technology, skill requirements, and other industry specific common shocks. Region dummies control for location specific natural resources, infrastructure, and policies. Region dummies further control for the scale of activity or agglomeration of firms. For instance, OECD (HMT) investors who acquire targets in a region where there are other OECD (HMT) firms may face lower fixed costs of acquisition due to pre-established networks that reduce the cost of acquiring information.

Table 2.2 reports the coefficients from the multinomial logit model. Results indicate that smaller (proxied by sales), older, more export-oriented and firms with lower capital-labor ratios and higher state equity shares are more likely to be acquired by either OECD or HMT investors. The coefficients on TFP, although not significant at conventional levels, along with the coefficients on wage per worker suggest that more productive firms are more attractive to OECD compared to HMT investors. After obtaining $\hat{P}_{OECD}(x)$ and $\hat{P}_{HMT}(x)$ for every target firm, I apply one-to-one Mahalanobis matching to assign a counterfactual firm for every OECD target.

To assess how well the propensity score matching performs, tests of the balancing hypothesis are carried out and presented in Appendix 2A. The first test calculates the standardized bias for each of the covariates included in the multinomial logit model. This measures the distance in marginal distributions of the covariates and is defined as the difference in the sample means of the OECD-acquired and HMT-acquired firms weighted

by the square root of the average sample variances in both groups.[30] A bias reduction of 3 to 5% once matching has been performed is considered to be sufficient (Caliendo and Kopeinig, 2008). The second test compares the sample means between OECD-acquired and HMT-acquired firms before and after matching. The expectation is that prior to matching we should find that the difference between the means are statistically significant which becomes statistically insignificant after matching. Both sets of tests pass the required standards. Also, on average, the absolute distance in terms of the multivariate score between the matched pairs is 0.02, a measure that is bound between 0 and 1. These results from tests of the balancing hypothesis show that matching is capable of creating a control group that is very similar to the treatment group in the pre-acquisition period.

2.5.2 Baseline Results from Matching Difference-in-Differences

Table 2.3 provides the baseline results. The upper panel reports results on TFP and the lower panel considers labor productivity measured as the logarithm of value added per worker. The estimator reported is the average treatment effect on the treated (ATT) from (2.3.2.2), which is the average difference in TFP between the matched pair of firms, net of the initial difference in the pre-acquisition period. In the year of acquisition, the ATT is equal to 0.123. This means that having accounted for the initial difference between the two groups, OECD-acquired firms exhibit 12.3% higher TFP compared to HMT-acquired firms. The TFP differential is 11.1% in the year after acquisition. By the third year, it increases to 24.5%. These effects are all statistically significant. Focusing on labor productivity, I observe

[30] $SB_{before} = 100 * \frac{\bar{X}_T - \bar{X}_C}{\sqrt{0.5*(V_T(x)+V_C(x))}}$; $SB_{after} = 100 * \frac{\bar{X}_{MT} - \bar{X}_{MC}}{\sqrt{0.5*(V_{MT}(x)+V_{MC}(x))}}$; where T and C are the treated and control groups and MT and MC are the same for the matched sample.

similar patterns. In the year of acquisition, OECD-acquired firms exhibit 17.7% higher productivity relative to HMT-acquired firms. This difference persists in the year after at 15.3% and reaches 22.4% in the third year. These effects are also statistically significant.

The productivity gains are highest in the year of acquisition and relatively modest thereafter. This pattern is similar to that found for domestic firms who are acquired by foreign firms in Indonesia (Arnold and Javorcik, 2009).[31] I also find that the positive TFP differential is not a result of decreases in TFP at HMT-acquired firms in the post-acquisition period.[32] Both acquired groups of firms experience higher TFP in the post-acquisition period. However, the increase is larger for OECD-acquired firms in the post-acquisition period. These results suggest that OECD ownership confers a productivity advantage relative to HMT ownership.

2.5.3 Endogeneity

This paper identifies the differential causal impact of OECD versus HMT ownership on Chinese target firm performance using a propensity score matching difference in differences approach. The identification assumption underlying this approach is that there is no role for time varying unobservable factors in the foreign acquisition decision. In the context of this study, one type of unobservable time varying factor that might be cause for potential concern is the possibility that relative to HMT investors, OECD investors are

[31] Using propensity score matching difference-in-differences technique, the authors find that ATT using TFP is 0.106, 0.122, and 0.135 in the year of acquisition, one and two years after respectively. Arnold and Javorcik (2009) do not distinguish between the different sources of FDI. The comparison is between firms who were acquired by foreign firms and those that remained domestic owned.

[32] For example, the average TFP of OECD (HMT) acquired firms is 6.06 (6.096) in the pre-acquisition period and increases to 6.281 (6.194) in the year of acquisition.

better at identifying and acting on information not directly available from financial statements and other observable target characteristics. For example, OECD investors could be better at identifying talented managers who would contribute to the future growth of the firm. These types of information differ from "hard" verifiable information and are referred to as "soft" information in the finance and accounting literatures (Stein, 2002).

To address concerns of particular time varying unobservable characteristics driving the results such as OECD investors' superior ability to gather "soft" information compared to HMT investors, I carry out two checks. First, I focus on acquisitions that take place in HMT-dense provinces. Figure 2.2 shows the distribution of the number of foreign projects by type of investor across China's twenty eight provinces.

I consider provinces to be HMT-dense where the share of HMT projects in total number of foreign projects exceeds 70%.[33] Since HMT investors share cultural, business and family ties to mainland China, we would expect these investors to have an advantage over OECD investors in gathering "soft" information in HMT-dense provinces. Therefore, if we observe an OECD ownership premium even in these provinces it would allay fears that the results are not predominantly being driven by such time varying unobservable factors. Panel (a) in Table 2.4 presents the results for log profits and panel (b) for log total factor productivity. Looking at both panels, it indeed appears that HMT investors may have an advantage over OECD investors in the year of acquisition as suggested by the negative

[33] These include provinces of Henan, Hunan, Jiangxi, Fujian, Guangdong, Inner Mongolia, and Guangxi. The results are qualitatively similar if I focus only on those provinces where the HMT share in investment exceeds 80%, namely provinces of Jiangxi and Fujian.

results. However, by the second and third year after acquisition, OECD-acquired targets exhibit both higher profits and higher productivity compared to HMT-acquired targets.[34]

Second, I divide the acquired sample by those that are state-owned versus those that are domestic private-owned in the pre-acquisition period. Peng (2006) cautions foreign investors to consider particular characteristics of Chinese state-owned enterprises (SOEs) prior to acquisition. One is that SOEs are characterized by organizational slack. However, their books could show high depreciation and reserve funds as well as retained earnings that would provide an inaccurate picture of the firm. The other cautionary characteristic is that SOEs are known to maintain three sets of books – one for administrative superiors exaggerating performance, one for tax purposes underreporting performance, and finally one for the managers themselves accurately reflecting performance. Foreign investors are likely to be shown the books exaggerating performance. In light of these SOE characteristics, we would expect foreign investors to conduct more careful due diligence both in terms of "hard" and "soft' information when considering state compared to domestic private targets. Therefore, if "soft" information was a major driver of the results, we would expect the performance of OECD acquired targets that were state-owned in the pre-acquisition period to differ markedly, in particular be higher, compared to private-owned targets.

Table 2.5 displays the results for log of total factor productivity divided by the two target ownership types in the pre-acquisition period. We see that in all years after acquisition, both types of OECD-acquired targets are more productive than their HMT-acquired counterparts. The performance of OECD relative to HMT acquired firms do not differ by

[34] The results are not significant at conventional levels, except for profit differential in the third year of acquisition, which is most likely due to the reduction in sample size.

the target ownership type.[35] Together, the results in Tables 2.4 and 2.5 provide robust evidence of persistent OECD relative to HMT ownership premium.

2.5.4 What Explains the OECD Productivity Premium?

To understand the restructuring process that takes place after a foreign acquisition, as well as the factors that might explain the differential increase in TFP in OECD-acquired firms relative to HMT-acquired firms, I consider several other outcomes. These results are presented in Table 2.6. Since it is hypothesized that OECD multinationals have a higher fixed cost of acquisition, it should be the case that post-acquisition the OECD-acquired firms exhibit higher profits to justify their willingness to incur the higher fixed cost of acquisition. Changes in log of total profits between the two acquired groups of firms support this framework. Panel (a) in Table 5 shows that relative to HMT-acquired firms, OECD-acquired firms experience higher total profits in all years during and after acquisition. The difference is in the order of 26.6%, 35.3%, and 52.3% for the year of, one and two years after acquisition, respectively.[36]

Similar analyses are conducted for five additional outcomes: changes in average wage, employment, capital intensity (capital-labor ratio), export intensity (export to sales ratio), and innovation intensity (the share of new product output value in total sales) between the acquired firms. Panel (b) shows that OECD-acquired firms pay higher average

[35] Pair-wise t-tests of differences in mean differential productivity between the two ownership types reject the null at the 1% significance level.

[36] There might be concern that relative to OECD firms, HMT firms engage more in transfer pricing which leads to lower reported profits. However, Huang, Jin, and Qian (2010) do not find evidence to support that lower profits in HMT firms are a result of transfer pricing activities. Moreover, Chan and Chow (1997) do not find evidence to support transfer pricing activities by foreign owned firms, either HMT or non-HMT, operating in China.

wages in each year post-acquisition. Higher average wages could mean that OECD-acquired firms employ higher skilled workers on average. However, panel (c) shows that OECD-acquired firms do not experience changes in employment relative to HMT-acquired firms. The Annual Surveys of Industrial Production do not provide information by skill level of workers in all years. Therefore, I cannot directly observe changes in the skill intensity of the labor force post-acquisition, which would have provided evidence that the productivity differential between OECD and HMT-acquired firms is driven partly by changes in skill composition. If higher average wages are not a result of employing more skilled worker, it is also consistent with workers becoming more productive once they are under new management. Such an interpretation suggests that OECD-acquired firms bring superior management know-how that reduces waste and increases labor productivity.

Referring to panel (d), we see that relative to HMT-acquired firms, OECD-acquired firms increase the amount of capital per worker in the year of acquisition while the increase is more modest in the following two years. Capital intensity increases differentially by 21.5%, 25.9%, and 21.4% respectively in these years and these results are statistically significant. The largest increase is in the year of acquisition which is also the same time period when I observe the largest increase in TFP. This suggests that OECD investors immediately improve capital in the acquired firms.

Next, I consider if OECD-acquired firms export a larger share of their output. Productivity differential could be driven by "learning by exporting" effects where knowledge transfer occurs via exporting activity. However, results show that OECD-acquired firms do not raise the share of exports in total sales any more or less than HMT-acquired firms. Recall that domestic Chinese firms with high exports to sales ratios were more likely to be acquired

by both types of investors (see Table 2.2). It is possible that the acquired firms were already well integrated into world markets and therefore there are limited opportunities for knowledge transfer via the exporting channel.

Finally, under panel (f), I look for changes in innovative activity in the acquired firms, measured as the output value of new products produced in a given year as a share of total sales. The idea is that if OECD firms operate on the frontiers of world technology relative to HMT firms, they are more likely to introduce product innovation within the acquired firm. Results show that there is no difference in changes to innovation intensity of OECD relative to HMT-acquired firms.[37]

The evidence presented so far reveal that the likely source of the TFP differential between OECD and HMT acquired firms is technology transfer embodied in the capital brought in by OECD investors. Evidence also suggests that OCED investors might also be introducing management techniques that boost worker productivity and thereby reduce inefficiencies.

2.5.5 Technology Transfer and Domestic Content

To explore the technology transfer channel further, I distinguish between industries with high and low domestic content in production. Domestic content embodies the domestic value added in the production process. In particular, I consider the role of domestic content in exports due to the pervasive nature of export processing in Chinese

[37] The new product output value is zero for most firms and becomes positive over the sample period for a given firm leading to different sample sizes each year. Expenditures on R&D would have been a better measure of innovative activity since new products might take time to introduce while R&D activity could begin relatively soon. However, data on R&D expenditures are only available for the years 2005 and 2006 so that changes in this outcome cannot be measured for my sample. Post-acquisition differential changes in intangible assets in the share of total assets were also found to be insignificant.

trade and the important role of foreign firms. In 2002, the share of processing exports in total Chinese exports was 60% while processing exports accounted for 71% of exports by Sino-foreign joint venture firms (Koopman, Wei, Zhang, 2008).[38] The scope for improvement in TFP via technology transfer is expected to be greater in industries where the domestic content in production is higher. In industries with low domestic content, the production process could simply involve assembling imported parts into a final good or processing according to foreign specifications leaving no room for innovation.[39] For example, Chinese workers account for only about 3% of the value added for one iPod assembled in China and exported to the U.S.[40] Therefore, there may be little scope for technology transfer in industries characterized by low domestic content.

Dean, Fung, and Zhang (forthcoming) measure domestic content by input-output sectors.[41] Using the concordance provided in Brandt, Biesebroeck, Zhang (2009), the input-output sectors are matched to four-digit industries under the Chinese Industrial Classification. Then using the domestic content for each four-digit industry within a two-digit industry, an average is computed at the two-digit industry level.[42] Appendix 2B provides a ranking of the two-digit industries by domestic content. We see that the industries with

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[38] In 2002, processing exports accounted for 87.9% of total exports by wholly owned foreign firms.

[39] See Feenstra and Hanson (2005) for details on China's export processing regime.

[40] Koopman, Wang, Wei (2008) provide citations that estimate the value added attributable to Chinese workers to be about $4 for a unit of 30GB video model of the iPod whose total export value in 2006 was $150.

[41] Dean, Fung, Wang (2007) provide estimates of vertical specialization (VS) by sector which represents the foreign content in exports. Domestic content is calculated as (1 - VS).

[42] For example, the VS measures for four-digit industries 2412 ("Pen manufacturing") and 2440 ("Toy manufacturing") are 0.028 and 0.132 respectively. Therefore, the average for two-digit industry 24 ("Manufacture of articles for culture education, and sport activity") is 0.08 and the domestic content is calculated as (1 – 0.08) = 0.92. The VS numbers used are from the last column in Table 3 in Dean, Fung, Zhang (2007)

high domestic content are what might traditionally be considered less technologically sophisticated.[43] Industries that are thought to have higher technology content or to be R&D intensive actually have very low domestic content in their exports.

Table 2.7 extends the baseline results by differentiating industries with high and low domestic content in exports. We find that, post-acquisition, the productivity differential between OECD and HMT-acquired firms is most pronounced in high domestic content industries. This is consistent with the idea that the productivity advantage is due to transfer of technology from OECD partners in terms of technological, management, or marketing know-how. These results are also consistent with the finding in Hu, Jefferson, and Jinchang (2005) that foreign technology transfer in China (measured as a firm's expenditure on technology purchased from a foreign provider such as payments for blueprints of technology) is more intensive in less technologically advanced industries.[44]

2.6 Matching within Industry

Although controls for two-digit industry fixed effects are included in the multinomial logit model used to construct the propensity scores, the HMT-acquired firms that form the comparison group are not necessarily chosen from within the same industry as the OECD-acquired firms. In general, the sample size does not allow it. Therefore, a potential concern is that industry sorting could be driving the differences in post-acquisition TFP. Appendix 2C provides the number of acquisitions within each two-digit industry. We see that the number

[43] Dean, Fung, Zhang (2007) define an industry to be highly vertically specialized if the foreign content of exports exceeds 25%. Following their definition, an industry is categorized as having high domestic content if the domestic content of exports exceeds 75%.

[44] Hu, Jefferson, Jinchang (2005) categorize the following industries as less technologically advanced – tobacco, textile, apparel, leather, furniture, paper, printing, and rubber.

of acquisitions by the two types of investors is similar within each industry providing a relatively limited pool to choose from. The average treatment effect on the treated is identified only in the region of common support. To ensure that there is sufficient overlap between the two groups a larger number of HMT-acquired firms would increase the likelihood of better matches for each OECD-acquired firm propelling the choice to match across industries having controlled for industry effects in the propensity score estimation.

Previous studies of the impact of foreign ownership on domestic firm productivity using matching difference-in-differences technique face similar constraints. For example, Petkova (2008) and Chen (2009) who study Indian and U.S. firms, respectively, carry out their difference-in-differences analyses after matching across industries. A notable exception is Arnold and Javorcik (2009), who study post-acquisition TFP gains to Indonesian firms and conduct their analysis after matching within the same four-digit industry as well as year when the foreign acquisition occurred. Their counterfactual is constructed from the universe of all domestic Indonesian firms employing more than twenty workers, providing a sufficiently large pool for selecting good matches.

To attenuate concerns about matching across industries, I repeat the matching difference-in-differences analysis for the group of acquired firms within the textile industry only. I group the textile industry to be composed of two-digit industries 17 (Manufacture of Textile) and 18 (Manufacture of Textile Wearing Apparel, Footwear, and Caps). The textile industry provides the largest number of HMT-acquired firms relative to OECD-acquired firms to choose and, thus, provide a sufficient pool for matching. There are a total of 416 possible HMT-acquired firms that can potentially be matched to the 258 OECD-acquired firms.

The multinomial logit model and the results from the balancing tests are provided in Appendix 2D and 2E respectively. The coefficients in Appendix 2D, for multinomial logit model, are similar to those in Table 2 for all industries. The balancing tests in Appendix 2E show that overall, matching reduces the standardized bias by at least 3-5% while the t-tests yield statistically insignificant differences between the mean of the variables once matching is performed.[45]

The matching difference-in-differences results for textiles only are presented in Table 2.8. We find that OECD-acquired firms exhibit higher TFP in all years after acquisition although the result is only statistically significant in the year of acquisition. The results are imprecisely measured in the following two years and are likely a result of the reduced sample size. However, the pattern of results is similar to those reported in Table 2.3 where the largest increase in TFP occurs in the year of acquisition. Carrying out the analysis within the same industry and finding evidence of higher TFP in OECD-acquired firms lends confidence that the main results are not being driven by industry differences.

2.7 Conclusions

Developing countries compete to attract foreign direct investment in hopes of bridging the technology gap with advanced nations and spurring economic growth. Multinational firms are viewed as conduits of sophisticated know-how, management techniques and marketing skills. However, an overwhelming share of global R&D activity undertaken in OECD countries suggests that the source of foreign investment is an

[45] The standardized bias actually increases and the t-tests are significant for sales and capital per worker after matching. However, the average absolute distance between the matched pairs in terms of $\left[\hat{P}^{HMT}(x), \hat{P}^{OECD}(x)\right]$ is only 0.12, a measure that is bound between 0 and 1.

important determinant of how much technology transfer actually occurs. Although we may expect the possibility of technology transfer to increase with the superiority in technological capabilities of multinational firms, host-country firms in a developing country like China may not have the capacity to absorb superior know-how into their production processes. This study compares the performance of domestic Chinese firms acquired by OECD and HMT investors to search for the extent of such transfers. In particular, every OECD-acquired firm is matched with a HMT-acquired firm and we look for changes in TFP between these two groups of firms in the post-acquisition period.

We find that OECD-acquired firms outperform HMT-acquired firms. In particular, relative to HMT-acquired firms, OECD-acquired firms experience higher productivity in the initial year of acquisition and this productivity differential persists in subsequent years, reaching 24.5% in the third year. Further, post-acquisition increases in average wages accompanied by no changes in total employment and increases in capital usage per worker point to the introduction of management techniques that reduce labor inefficiencies along with capital deepening as likely sources of the TFP increase.

These results suggest that the development level of the investor source country affects the opportunities for technology transfer differentially and underscore the importance of distinguishing between sources of FDI. Since evidence shows that OECD multinationals have superior technological capabilities relative to HMT multinationals, we could infer that Chinese firms are closer, with respect to capabilities, to HMT compared to OECD firms. The results can then be interpreted to imply that there are more opportunities for productivity improvement if the capability gap between acquirer and target are sufficiently large. This interpretation is akin to studies that relate absorptive capacity of

domestic firms to their ability to benefit from FDI spillovers, such as Blalock and Gertler (2009) who find that firms with smaller "technology gap" benefit less from FDI than those with weaker technological competencies. The results can also be interpreted as showing that ethnic ties do not necessarily lead to better firm performance, a finding also corroborated by Huang, Jin, and Qian (2010).

Looking across industry groups, we further find that the productivity differential is most pronounced in industries with high domestic content. This finding has important policy implications for countries heavily engaged in export processing activities. If the local economy specializes in a narrow range of activities it makes it unlikely for productivity gains to materialize from foreign direct investment via the technology transfer channel.

3. FDI, Agglomeration Economies, and Productivity: Evidence from China

3.1 Introduction

The presence of foreign multinational companies (MNCs) in a country alters the economic landscape in which domestic enterprises operate. MNCs typically bring with them advanced technology that is believed to generate knowledge spillovers to domestic enterprises (Blomström and Kokko, 1998). However, foreign presence also tends to increase competition in input markets for skilled labor (Driffield and Taylor, 2000) as well as in output markets (Aitken and Harrison,1999). Increased competition for skilled labor could diminish the gains to domestic enterprises of locating in close proximity to own-industry activity (Combes and Duranton, 2006) while output market competition could generate negative market stealing effects. On the one hand, the presence of MNCs can strengthen the forces that attract domestic enterprises to locate in close proximity (localization economies) via increased opportunity for knowledge spillovers.[46] On the other hand, the presence of MNCs can diminish the value of localization economies via increased competition for skilled labor, a phenomenon known as "labor poaching" as well as via negative competitive forces in output markets. This paper provides empirical evidence on the net effect between positive localization economies and negative competition forces arising in the presence of MNCs.

The analysis is carried out by ranking enterprises and nearby activity, in ascending order of productivity, into state, private and foreign owned enterprises operating in China.

[46] See Rosenthal and Strange (2004) for a survey of the empirical literature on agglomeration economies.

China provides a suitable setting due to a well-established productivity hierarchy among these three broad ownership types. On average, foreign-owned enterprises (FOEs) operating in China are more productive than their domestic counterparts; and among domestic-owned enterprises, the private-owned enterprises (POEs) are more productive compared to state-owned enterprises (SOEs) (Wen, Li, Lloyd, 2002; Zhang, Zhang, Zhao, 2001).[47] Ownership type of an enterprise embodies enterprise-specific assets such as technology, brand name, managerial know-how, local networks, etc. which are associated positively with productivity.[48] Studies looking at how organization of economic activity within a city affects the value of agglomeration find that industrial structure and corporate organization are important determinants (Rosenthal and Strange, 2003 and 2008). Thus, there is reason to believe that the coexistence of various ownership types alters the opportunity and value of localization spillovers.

This paper combines insights from the agglomeration literature and the study of spillovers from foreign direct investment (FDI), similar in spirit to Mayer *et al* (2010), to analyze interactions among enterprises within an industry-city space.[49] This paper makes three contributions. First, the agglomeration literature posits location specific externalities to extend along three dimensions – spatial, industrial and temporal.[50] However, firms may be

[47] It is accepted as conventional wisdom that MNCs exhibit superior performance in comparison to domestic firms in many countries, not only in China. See Arnold and Javorcik (2009) for specific examples.

[48] See Syverson (2010) for a survey of firm-specific factors that affect productivity.

[49] Mayer *et al* (2010) analyze firm location decisions incorporating trade economists' views on why firms locate abroad and urban economists' views on inter-city location patterns.

[50] For example, using data on new firm births in the U.S., Rosenthal and Strange (2003) find that localization economies attenuate rapidly in the first few miles and then much slowly over longer distances. Using U.S. plant level data, Henderson (2003) finds that localization economies have a positive effect on plant level productivity in high tech industries but not in machinery industries. Henderson (2003) also finds that firms in high tech industries benefit from scale of past own industry activity.

'nearer' or 'farther' from each other in a fourth dimension that may not be captured by industrial, physical, or temporal distance, namely technological distance. I organize enterprises by their ownership types capturing enterprise-specific assets that differ across enterprises albeit within the same industrial, geographic, and temporal space.[51] This organization allows me to observe attenuation of localization spillovers as enterprise ownership structure becomes dissimilar.

Second, empirical studies in the agglomeration literature are predominantly based in developed country settings. In most developed countries production units are privately owned and policy biases towards particular ownership types are absent. In contrast, the industrial ownership structure in developing countries, particularly in transition economies like China, differs substantially.[52] The state has a significant presence and often enacts policies biased in favor of state-owned enterprises.[53] In addition, governments are eager to attract foreign direct investment (FDI) leading to the coexistence of domestic and foreign enterprises, which differ from each other, notably in terms of productivity.

China provides a unique setting to investigate heterogeneity in firms' responses to economic activity in own and across ownership types due to the coexistence of enterprises under various ownership structures.[54] Since opening its economy in 1978, China's economic landscape has transformed from being entirely composed of thousands of state-owned enterprises to one shared by private-owned and foreign-owned enterprises. For instance, in

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[51] Rosenthal and Strange (2003) organize establishments by size and by subsidiary and non-subsidiary status to search for evidence of the importance of industrial structure and corporate organization, respectively.

[52] See Brandt, Rawski, Sutton (2008) for an overview of China's industrial development.

[53] See Huang (2003) for a discussion of policy biases against China's domestic private-owned enterprises.

[54] See Naughton (2007, p. 298 – 304) for details on the evolution of ownership types in China.

1980, state-owned enterprises accounted for 81% of industrial output and only 41% in 2005; private-owned and foreign-owned enterprises accounted for 27% and 30% of total industrial output respectively in 2005 (Perkins and Rawski, 2008). Figure 3.1 shows a similar trend for employment.

The third contribution is to the literature on foreign direct investment, which has extensively studied the spillover effects of foreign enterprises on their domestic counterparts. However, studies focusing on potential spillovers in the opposite direction, from domestic to foreign enterprises, are less common (some exceptions include Li, Liu, Parker, 2001 and Chang and Xu, 2008). Organizing enterprises by their ownership types permits a focus on interactions between foreign and domestic enterprises, allowing measurement of spillovers in both directions. Evidence of positive spillovers from domestic to foreign enterprises has policy implications for the importance of indigenous private enterprises in the market reform process in China.

I estimate differences in the strength of localization spillovers within and across ownership types using enterprise level data on manufacturing enterprises operating in China during 1998-2006. The data comes from the Annual Surveys of Industrial Production.[55] The dataset contains detailed information on the ownership structure of an enterprise in addition to enterprise level inputs and output. I estimate an augmented production function for enterprises in each type, including measures of intra-industry employment differentiated by ownership types within a city. In addition, the preferred specification includes industry and

[55] The Annual Surveys of Industrial Production is not a plant level dataset. However, the majority of observations are of single-plant operations mitigating concerns about measurement error in the localization variables. See Section 4 for a detailed discussion.

city by year fixed effects to control for a range of industry specific and time varying city level characteristics that potentially impact enterprise level productivity.

This paper offers three core results. First, within the same ownership type (own-type), I find evidence of traditional localization economies consistent with a large literature on agglomeration economies. Second, across different ownership types (cross-type), spillovers differ in two ways. They tend to be much weaker compared to within ownership type spillovers. In addition, spillovers from more productive foreign to less productive domestic enterprises are smaller than spillovers in the reverse direction. This asymmetric pattern of spillovers is consistent with labor poaching at work in the presence of foreign multinational companies. Finally, I find positive productivity spillovers from domestic private-owned enterprises to all ownership types, suggesting the importance of this emerging group in the Chinese economy.

As an additional exercise, I further decompose foreign enterprises into those originating from ethnically Chinese economies (ECEs) and those enterprises originating primarily from OECD countries (non-ECEs) allowing for the possibility of ethnic business networks influencing the value of localization economies.[56] The basic patterns discussed above still persist, but the decomposition allows us to observe that private-owned enterprises benefit from the presence of non-ECEs while state-owned enterprises do not. Notably, I find that nearby activity in ECEs has no impact on productivity of non-ECEs and vice versa. This result offers preliminary evidence on relationships between MNCs, particularly between MNCs operating at different technology levels.

[56] Kerr (2008) provides evidence of knowledge diffusion through ethnic networks.

The paper is organized as follows. Section 3.2 provides a conceptual framework for understanding why we would expect differences in localization spillovers within own and across different ownership types and develops a set of testable hypotheses. Section 3.3 presents the empirical specification and discusses estimation issues. Section 3.4 describes the data and measurement of key variables. Section 3.5 presents the empirical findings and the final section concludes.

3.2. Ownership Type and Differential Localization Spillovers

Foreign-owned and domestic-owned enterprises in China have different productivity profiles. FOEs are more productive than POEs who are, in turn, more productive than SOEs, giving rise to a distinct productivity hierarchy. This productivity hierarchy has implications for the ability of enterprises to benefit from traditional localization economies (labor market pooling, input sharing, knowledge spillovers) and withstand negative competition for skilled labor (labor poaching).

Evidence from the literature on spillovers from FDI emphasizes the importance of absorptive capacity of an enterprise to internalize potential spillovers.[57] A common measure of absorptive capacity is a firm's distance to the industry's technology frontier.[58] Using data on U.K. firms, Girma (2005) finds that the industry leaders are predominantly foreign firms and that spillovers increase with absorptive capacity but up to a threshold level beyond

[57] The usage of the term absorptive capacity closely follows Cohen and Levinthal (1990) who describe it as the "ability to recognize value of new information, assimilate it, and apply it to commercial ends" (p.128).

[58] The distance is computed as the difference between the productivity of the industry leader(s) and the productivity of the individual firm.

which spillovers diminish. He also finds that there is a minimum absorptive capacity threshold level below which spillovers from FDI are very small or even negative.

Appealing to the productivity hierarchy among the three ownership types in China, we make a set of assumptions about the absorptive capacity of enterprises in each type. First, we assume that of the three sources of traditional localization economies, strength of knowledge spillovers is most directly affected by an enterprise's absorptive capacity. FOEs are known to use more sophisticated technology and management strategies and thus, we expect knowledge spillovers to flow from FOEs to domestic-owned enterprises. POEs, being generally more productive than SOEs, are expected to benefit more from foreign presence.[59] Lastly, we expect SOEs to benefit from nearby presence of both FOEs and POEs. However, benefits from co-location with POEs are expected to be larger than that from foreign presence because the productivity gap between SOEs and POEs is smaller than that between SOEs and FOEs.

The presence of foreign companies increases competition in both the domestic output and input markets. However, competition in the output market is less of a concern in this study.[60] Typically, final output markets span larger geographic areas than cities such as the province where the company resides, other provinces, or overseas markets. In fact, a significant portion of inward FDI in China is export-oriented (Zhang, 2005). These foreign companies produce almost exclusively for export markets. This leads us to believe that within an industry-city space, competition in input markets is a more important outcome from foreign presence.

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[59] Hale and Long (2006) find that POEs in China benefit more from foreign presence than SOEs.

[60] See Aitken and Harrison (1999) for evidence of negative output market competition from FDI.

Input competition arises when an enterprise endowed with superior enterprise-specific assets, therefore more productive, lures away skilled workers from its rivals by offering higher wages. This "labor poaching" assumes that higher skilled workers boost the productivity of firms to justify offering higher wages. Labor poaching diminishes the benefits from co-location (Combes and Duranton, 2006). Foreign firms, in general, are known to pay higher wages and there is some evidence that they attract the best workers away from domestic firms (Gorg, Strobl, Walsh, 2007). In China, Cai, Park, and Zhao (2008) find that the returns to education are higher in nonpublic enterprises. Zhao (2002) finds that unskilled workers earned significantly less in foreign-invested enterprises compared to those in the state sector while the opposite is true of skilled workers.

Although China's comparative advantage is in cheap, unskilled labor, it has a growing pool of skilled workers. For example, Yan (2010) writes in a recent article in China Daily that U.S. MNC, Pfizer, is making plans to open up a new R&D center in the city of Wuhan to tap into low cost, high skilled university-educated workers. Science parks are another example where MNCs tap into highly skilled workers from nearby research universities (Todo, Zhang, Zhou, 2009). Strong demand for skilled workers from foreign enterprises is reciprocated by a strong desire from workers to be employed at MNCs in China. Wall Street Journal correspondent Leslie Chang (2009) provides some anecdotal evidence. One of the workers she interviewed in the province of Guangdong succinctly relates that "American and European bosses treated workers best, followed by Japanese, Korean, Hong Kong, and then Taiwanese factory owners. Domestic Chinese factories were the worst, because they "always go bankrupt"." (p. 27).

Taken together, we can expect to see asymmetry in the labor poaching effect - poaching would lead skilled workers to flow from less productive towards more productive enterprises. In the Chinese context, FOEs, endowed with superior firm-specific assets, would be able to successfully poach the high skilled workers away from domestic-owned enterprises by offering higher wages. Similarly, within the domestic-owned enterprises, POEs would have the ability to offers higher wages and entice skilled workers away from SOEs.

To summarize the discussion above, Table 3.1 compiles the anticipated effects of nearby own-industry activity by ownership type on enterprise level productivity. The leftmost column indicates the ownership type of intra-industry activity and the topmost row indicates the ownership type of the sample of enterprises. We expect the diagonal terms to be positive and largest in each column since productivity distance between 'sender' and 'receiver' is smallest which implies that the influence of labor poaching is expected to be smallest. These own-type spillovers represent traditional localization economies.

The cross-diagonal effects in the bottom left quadrant capture the effects of activity in higher productivity types on enterprises in lower productivity types. Localization spillovers could be positive or negative depending on the magnitude of the labor poaching effect, but we expect them to be smaller than own-type effects. The cross-diagonal effects in the top right quadrant capture the effects of activity in lower productivity types on enterprises in higher productivity types. Based on the above discussion, we can also expect these effects to be smaller than own-type spillovers. Knowledge spillovers are not expected to be the likely source of any localization economies since such spillovers are generally associated with more sophisticated technology which higher productivity enterprises employ.

The likely source of positive spillovers is input sharing including labor. *A priori*, the exact signs are unknown. However, enterprises in ownership types lower in the hierarchy are less likely to exert labor poaching forces on enterprises higher in the hierarchy. Therefore, we may expect these effects to be larger than those in the bottom left quadrant.

3.3 Empirical Strategy and Estimation Issues

To examine the relationship between manufacturing activity in different ownership types and enterprise productivity, I divide the data into three samples - state-owned, private-owned and foreign-owned. Then, using enterprise level data, I estimate an augmented production function that includes measures of intra-industry employment within a city, differentiated by ownership types, as explanatory variables. The estimating equation is as follows[61]:

$$\ln Y_{foict} = \beta_0 + \beta_1 \ln L_{foict} + \beta_2 \ln K_{foict} + \gamma_0^{SOE} \ln(A_{ict})_{SOE} + \gamma_0^{POE} \ln(A_{ict})_{POE} + \gamma_0^{FOE} \ln(A_{ict})_{FOE} + \varepsilon_{foict}, \quad (3.3.1)$$

where Y_{foict} is measured as real value added, L_{foict} is the total employment, K_{foict} is the real fixed assets of enterprise f, under ownership type o, in industry i, city c at time t; $(A_{ict})_{SOE}$, $(A_{ict})_{POE}$, and $(A_{ict})_{FOE}$ represent intra-industry employment within a city at time t under state-owned, private-owned, and foreign-owned enterprise types respectively,

[61] This equation is derived assuming a Cobb-Douglas production function for enterprise f and taking logs of:

$$Y_{foict} = L_{foict}^{\beta_1} K_{foict}^{\beta_2} \prod_{o=1}^{3} A_{oict}^{\gamma},$$

where Y is output, L is labor, K is capital, and A is a measure of intra-industry activity under each of the three ownership types (o), industry (i), and city (c) at time (t).

and ε_{foict} is a white noise error term that captures idiosyncratic differences in enterprise level value added.

An alternative strategy to (3.3.1) is to estimate the total factor productivity (TFP) for each enterprise and then regress enterprise level TFP on the agglomeration measures. The results are robust to this alternative and are provided in Appendix 3B and 3C, giving confidence that the results are not driven by specification of the production function.

Estimation issues

In estimating own and cross-type localization spillovers, there are four estimation issues of particular concern. First, selection bias is a likely issue in the Chinese context. The sample years coincide with a period of rapid privatization of state-owned enterprises. There might be concern that unproductive SOEs were disproportionately being privatized during this period so that relatively productive enterprises remained in the state-owned category. This selection could lead to a positive correlation between productivity of SOEs and economic activity under the three ownership types. In order to address such concerns, I estimate model (3.3.1) on a balanced panel of SOEs, constructed to include only those enterprises that were state-owned in 1998 and remained state-owned throughout the entire sample period.[62]

The second concern is measurement error in the key variables of interest, intra-industry employment within a city organized by ownership type. In the context of this study, measurement error arises when employment at a multi-plant firm is allocated to a particular

[62] The definition used to designate enterprises as state-owned include shareholding limited and other limited types. These hybrid ownership forms emerged out of the state enterprise reform process and retain a significant amount of state control (Huang, 2008, p.13 -19).

location when in fact the employment is located across a number of different locations. The Annual Surveys of Industrial Production collects observations at the firm level.[63] In principle, this creates ambiguity as to where a firm's workers are located and could therefore complicate efforts to measure the degree of employment agglomeration in a given location and industry. The ideal dataset instead would report establishment level data for which there would be no ambiguity with respect to the location of a company's workers.[64] Fortunately, this issue turns out to be much less of a concern than might otherwise be feared.

In China, more than 95% of all firms in the entire sample are single-plant firms (Brandt *et al*, 2009). Table 3.2 indicates that the number of multi-plant firms is decreasing over time. This trend can be explained by observing that SOEs have the largest share of multi-plant firms, as shown in Table 3.3, compared to private and foreign-owned enterprises. Beginning in the mid-nineties, the Chinese government aggressively privatized SOEs, leading to massive reorganization that decreased the number of SOEs and hence number of multi-plant firms. Table 3.3 shows that the share of employment represented by single-plant firms within each ownership type is lowest in SOEs. This implies that any measurement error issue will be more pronounced for measures of economic activity for the sample of state-owned enterprises compared to the other two ownership types.

[63] There are two types of basic units used by statistical agencies in China. These are legal units and establishments. Legal units conform to the definition of an organization unit in the System of National Accounts (SNA) published by the United Nations. Establishments conform to the definition of establishments in SNA. The National Bureau of Statistics surveys legal units in the annual surveys.

[64] Lu (2008), for example, uses 1996 and 2001 establishment level data to study agglomeration patterns in China.

Robustness checks are carried out to test the sensitivity of the results to measures of agglomeration derived from employment in single-plant firms only. An additional check is carried out where localization measures using employment in single-plant firms and employment in multi-plant firms are included separately as explanatory variables. The basic patterns in the results remain qualitatively unchanged.

The third estimation issue arises because there may be industry-, city-, and time-unobservable factors that the firm observes but the econometrician does not. To address time invariant omitted variables a full set of industry, city, and time dummies are included in (3.3.1) as follows:

$$\begin{aligned}\ln Y_{foict} = {} & \beta_0 + \beta_1 \ln L_{foict} + \beta_2 \ln K_{foict} + \gamma_o^{SOE} \ln(A_{ict})_{SOE} \\ & + \gamma_o^{POE} \ln(A_{ict})_{POE} + \gamma_o^{FOE} \ln(A_{ict})_{FOE} \\ & + \mu_i + \delta_c + \varphi_t + \varepsilon_{foict}, \end{aligned} \tag{3.3.2}$$

where μ_i is a set of four digit industry dummies; δ_c is a set of city dummies; and φ_t is a set of year dummies and ε_{foict} is white noise.

Each set of fixed effects controls for various types of unobservable variables that could affect enterprise level productivity. Industry dummies control for industry specific technology, skill requirements, and other industry specific common shocks. City dummies control for location specific natural resources, infrastructure and local policies. For example, several cities and parts of cities in China are designated as Special Economic Zones and other special economic areas such as Economic and Technological Development Area, Hi-Technology Development Areas, and Export Processing Zones (Wang and Wei, 2008).

These areas were primarily set up to encourage interactions between foreign and domestic firms in the hopes of realization of positive externalities. Without city level controls or city dummies, effects of such policies on productivity would be incorrectly attributed to the localization variables. City dummies further absorb any aggregate employment or urbanization effect. Time dummies control for macroeconomic shocks such as inflation, the Asian financial crisis, accession of China to the World Trade Organization (WTO), and other national shocks.

Finally, after controlling for industry, city, and time specific unobservable variables it is still possible that time varying unobservables remain which are correlated with the error term. For example, policies set at the level of the central government that are implemented at different times at the city level will not be picked up by city fixed effects alone. In particular, privatization of state-owned enterprises is carried out at the level of the city government and the pace and time of implementation varies across cities and time. Controlling for city-time effects could also potentially capture the influence of unobservable variables that might be correlated with the error term but that might have drawn in talented entrepreneurs to a city. To address such concerns, city by year fixed effects replace city and year fixed effects in (3.3.2).

$$\begin{aligned} \ln Y_{foict} = \; & \beta_0 + \beta_1 \ln L_{foict} + \beta_2 \ln K_{foict} + \gamma_0^{SOE} \ln(A_{ict})_{SOE} \\ & + \gamma_0^{POE} \ln(A_{ict})_{POE} + \gamma_0^{FOE} \ln(A_{ict})_{FOE} \\ & + \mu_i + (\delta_c * \varphi_t) + \; \varepsilon_{foict}, \end{aligned} \tag{3.3.3}$$

where $\boldsymbol{\delta_c * \varphi_t}$ is a set of city by year dummies; $\boldsymbol{\mu_i}$ is a set of four digit industry dummies and $\boldsymbol{\varepsilon_{foict}}$ is white noise. This specification is the most demanding of the data and results from this model form the basis of discussion in Section 5.

3.4 Data and Variables

3.4.1 Data Description

Data used in this study are drawn from Annual Surveys of Industrial Production conducted by the Chinese government's National Bureau of Statistics (NBS). The dataset includes a panel of all non-state owned firms whose annual sales exceed 5 million yuan (referred to as "above-scale" industrial firms) and all state-owned enterprises during 1998-2006.[65,66] The dataset contains detailed information on about hundred variables, including enterprise identification code, four-digit industry code, six-digit geographic administrative code, ownership type, gross industrial output value, value added, export value, total employment, capital stock, and intermediate inputs.

The NBS classifies enterprises into 23 detailed ownership categories. Each enterprise is assigned a registration code at time of establishment designating its ownership type. These codes have been grouped into three broad categories for purposes of the study.[67] The groupings were motivated by the well documented hierarchy in terms of average productivity

[65] The NBS classifies non state-owned enterprises to include collectively-owned enterprises, Chinese indigenous privately-owned enterprises, and foreign-owned enterprises operating in China. The industry section of China Statistical Yearbook is compiled based on this dataset. Basic information of each four-digit industry in the China Markets Yearbook is also based on this dataset.

[66] 5 million yuan amounts to approximately $US 600,000 over this period.

[67] State-owned enterprises (SOE): 110, 141, 143, 151, 159, 160; Private-owned enterprises (POE): 120, 130, 142, 149, 171, 172, 173, 174, 190; Enterprises from ethnically Chinese economies of Hong Kong, Macao, and Taiwan (ECE): 210, 220, 230, 240; Enterprises from all other countries (non-ECE): 310, 320, 330, 340; Foreign-owned enterprises (FOE): ECE and non-ECE.

where foreign-owned enterprises are more productive than private-owned enterprises and who are in turn more productive than state-owned enterprises.

Average characteristics by ownership type

To compare characteristics between enterprises in the three ownership types, especially to see if the productivity hierarchy between ownership types is evident in the data, Table 3.4 presents results from running a simple descriptive regression. Six outcome variables for an enterprise f, S_f - output, exporting value, labor productivity (value added per worker), new product output value per worker, wage, and capital per worker - are regressed on ownership ($OwnershipType_f$), two-digit industry (μ_i), and province (δ_p) dummies for each year in the sample, 1998 - 2006.

$$\ln(S_f) = \beta_0 + \beta_1 OwnershipType_f + \mu_i + \delta_p + \varepsilon_f, \quad (3.4.1)$$

Results indicate that on average, enterprises differ markedly by ownership type. FOEs are on average larger (in terms of gross output value), export more, are more productive, innovative, pay higher wages, and use more capital per worker compared to their domestic counterparts. Within the domestic-owned enterprises, POEs are on average more productive than SOEs providing evidence for the productivity hierarchy found in previous studies. For example, in 1998, FOEs were 259% and 30% more productive and paid 79% and 45% higher wages per worker compared to SOEs and POEs respectively. POEs were 177% more productive and paid 23% higher wages per worker compared to SOEs.[68] On

[68] The percentage difference in any of the outcome variables between any two ownership types can be calculated from β_1 as $[100 * (\exp(\beta_1) - 1)]$.

average, the private-owned were also larger and more innovative than state-owned enterprises.

SOEs are consistently more capital intensive compared to POEs. This is consistent with evidence of the state-sector becoming concentrated in large, capital-intensive firms as the reform process continues (Naughton, 2007, p. 301 – 304). The higher wage trend at POEs relative to SOEs is visible except for the last three years in the sample. This is suggestive of SOEs becoming more market oriented towards the end of the sample period. In general, we observe a declining trend in the differences between enterprises in the three broad ownership types.

3.4.2 Key Variables

Productivity

Under the augmented production function approach real firm value added is regressed on labor, real capital, and localization measures. The dataset provides information on nominal value added that is converted to real terms using the Brandt-Rawski two-digit industry output deflators (Brandt, Biesebroeck, Zhang, 2005).[69]

Under the alternative specification, enterprise level productivity is regressed on measures of nearby own-industry activity. Productivity is measured using a semi-parametric method proposed by Olley and Pakes (1996).[70] Details on this method are provided in Appendix 3A.

Localization economies

[69] The deflators are available at http://www.econ.kuleuven.be/public/N07057/CHINA/appendix/.

[70] Carried out using the Stata module *opreg* (Yasar, Raciborski, Poi, 2008).

$$A_{foict} = \sum_{g,g \neq f} Employment_{goict} \quad (3.4.2.1)$$

where $Employment_{goict}$ is total employment summed over all enterprises g in the same industry i and city c, at time t as enterprise f but excluding f, for each ownership type o (o = *SOE, POE, FOE*).

Information on location of an enterprise is crucial for construction of the localization variables. The dataset provides information on the six digit county codes where the first two digits represent the province, the second two the city, and finally the last two digits designate the county. China's administrative boundaries change often so that county codes, the most disaggregated level of geography, also change over the sample period.[71] To ensure consistency over time, county codes for all enterprises were matched and recoded against one benchmark system. The benchmark system adopted was the set of 2873 county codes used in the 2000 China County Population Census Data.[72]

In addition to ownership and location information, we need to distinguish enterprises by industry. The dataset provides information on four-digit manufacturing industries according to the Chinese Industrial Classification (CIC) system. CIC codes were readjusted and renumbered in 2003.[73] Consequently, industry codes were adjusted for years prior to 2003 ensuring that codes are comparable across the sample period.

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[71] See Lu and Tao (2009) for a discussion about this issue.

[72] The 2000 China County Population Census Data was purchased from the China Data Center at the University of Michigan.

[73] Prior to 2003, NBS followed GB/T 4754 - 1994 industry classification system and 2003 onwards GB/T 4754 - 2002 was adopted. Two changes were made in the 2 digit divisions: (i) the 1994 division 39 ("Arms and Ammunition Manufacturing") was added to 2002 division 36 ("Special Equipment Manufacturing"). Then the remaining 2002 division codes were renumbered accordingly i.e. 1994 division 40 corresponds to 2002 division 39, 1994 division 41 corresponds to 2002 division 40, 1994 division 42 corresponds to 2002 division 41, and

3.5 Results

In Tables 3.5 – 3.11, separate panels present the results for each sample.[74] Two columns are reported for each sample. The first column presents results from model (3.3.2) which includes a full set of four-digit industry, city, and year dummies. The second column presents results from model (3.3.3) which includes four-digit industry and city by year dummies. Standard errors are clustered at the four-digit industry level. I focus on results in column (2) for each sample in the discussion below, as these are the most demanding of the data.

3.5.1 Localization Spillovers by Ownership Type

Table 3.5 presents the main results. The key pattern observed is that localization spillovers attenuate as enterprises become more dissimilar. For each sample, localization spillovers are positive and largest from nearby own-type activity, except for the sample of state-owned enterprises, which is discussed shortly. For the sample of state-owned enterprises, we observe that a doubling of employment in nearby own-type activity increases productivity by 1.10%; for the sample of private and foreign-owned enterprises the magnitude of the own-type effect is 1.90% and 1.40% respectively. To gain perspective on the magnitude of these positive spillover effects, I compare them to localization spillovers found in the U.S. by Henderson (2003), who studies the impact of own-industry activity on

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1994 division 43 corresponds to 2002 division 42 (ii) 2002 division 43 ("Waste Resources and Old Material Recycling and Processing") was added which was not part of manufacturing in the previous period.

[74] All results exclude Industry 16 "Tobacco Products Processing" since close to 100% of the enterprises operating in this industry is state-owned.

establishment level productivity. Henderson's (2003) estimates of the elasticities of own-industry activity are in the range of 0.012 to 0.021.[75] The elasticities of own-type intra-industry activity fall within this range and attest to the presence of traditional localization economies typically found in the agglomeration literature.

As hypothesized earlier, we find that cross-type spillovers are smaller compared to own-type spillovers. Foreign presence confers spillovers of much smaller magnitude on both POEs and SOEs relative to own-type spillovers for each sample. The coefficient on the foreign localization variable is similar in magnitude for both the state-owned and private-owned samples although it fails to attain significance at conventional levels for the former.

For the state-owned sample, the presence of private-owned enterprises offers double the productivity boost of enterprises in its own type. This is contrary to the idea of attenuation as enterprises become dissimilar in their technology levels. We expect own-type spillovers to be largest and POEs to exert labor poaching forces on SOEs. This is suggestive of the role of absorptive capacity at work. Since the productivity distance between state-owned and private-owned enterprises is smaller relative to the distance between state-owned and foreign-owned enterprises, SOEs are hypothesized to better absorb spillovers originating from POEs. Still, the magnitude of the spillover is puzzling.

There is evidence showing that SOEs often outsource their production activities to POEs, particularly collective-owned enterprises (Jefferson and Rawski, 1999), which may explain the significantly large positive effect from POEs.[76] Although, POEs may lure away

[75] Henderson (2003) measures nearby activity as the number of own industry plants in a U.S. county for machinery and high tech industries.

[76] Collective owned-enterprises (COEs) are factories that are nominally owned by the workers in the enterprise but controlled by local governments (Banister, 2005).

skilled workers, SOEs are able to tap into the skilled labor pool via outsourcing arrangements.

To explore this idea further, I estimate model (3.3.3) for the sample of SOEs only, excluding collective-owned enterprises from the measure of localization economies in the private-owned type. The results are displayed in Table 3.6. Column (1) includes intra-industry employment within a city at POEs excluding employment at COEs; column (2) includes an additional measure of intra-industry employment within a city at COEs as a separate explanatory variable. Results indicate that even after removing COEs from the measure of localization represented by the private-owned type, POEs confer strong positive spillovers on SOEs that are larger than own-type localization spillovers.

Cross-type spillovers, originating from lower to higher productivity enterprises, are also smaller compared to own-type spillovers. As noted earlier, we expect these effects to be smaller than own-type spillovers and more likely larger than spillovers from higher to lower productivity enterprises due to smaller likelihood of negative labor poaching forces. Activity in SOEs appears to have no effect on the productivity of private and foreign-owned enterprises. SOEs rank lowest in terms of productivity and workers tend to be older, less educated, have less foreign work experience, and get lower wages in comparison to the domestic private sector (Hale and Long, 2008). Therefore, it is reasonable to find that SOEs do not confer localization spillovers to their neighbors. Activity in POEs confers strong, positive spillovers on both SOEs and FOEs. The spillover effect on FOEs is larger than spillovers in the reverse direction.

Results on cross-type spillovers, both from foreign to domestic enterprises and from domestic to foreign enterprises, together support the hypothesis that labor poaching

diminishes the value of localization spillovers. In the absence of labor poaching, we would expect all cross-type spillovers to be of similar magnitudes.

One particular result that stands out is the impact of employment at private-owned enterprises. Results in Tables 3.5 – 3.11 indicate that POEs exert positive spillovers on enterprises under all ownership types. POEs are the fastest growing segment in China in terms of employment (see Figure 1) despite facing several financial and regulatory policy biases.[77] Private ownership is an essential ingredient in moving towards a market oriented economy. Positive spillovers from POEs underline their importance in the transition of the Chinese economy towards a market-oriented environment.

3.5.2 Differences by Source of Foreign Investment

To further tease out the nuances in cross-type spillovers, Table 3.7 divides foreign-owned enterprises into enterprises originating from ethnically Chinese economies of Hong Kong, Macao, and Taiwan (ECEs) and enterprises from all other countries but dominated by the U.S., European Union and Japan (non-ECEs).[78] This further stratification of ownership types allows us to consider the role of ethnic business networks facilitating localization spillovers.

ECEs and non-ECEs have different motivations for locating in China. Investors from ethnically Chinese economies primarily engage in export-oriented FDI, locating in China to tap into the large and cheap source of labor to carry out production for export

[77] See Huang (2008) who argues that a political pecking order exists in China where state-owned firms have been favored by the Chinese government over firms in the domestic private-owned sector.

[78] Between 1979-1999, the US, EU, and Japan together accounted for half of the FDI originating from non-ethnically Chinese economies (Zhang, 2005).

markets. On the other hand, investors from non-ethnically Chinese economies primarily engage in market-oriented FDI, locating in China to access the large domestic markets (Zhang, 2005). Foreign enterprises producing for the domestic market are more likely to source intermediate inputs from other domestic enterprises strengthening the opportunity for positive spillovers. Export-oriented foreign enterprises are more likely to source intermediate inputs from the parent company restricting the opportunity for interactions with domestic enterprises. Therefore, non-ECEs producing for the domestic market are more likely to interact with domestic enterprises compared to ECEs.

Foreign-owned and domestic-owned enterprises also have different cultural profiles that can impact the absorptive capacity of an enterprise.[79] Within the FOEs operating in China, there are distinct cultural differences between ECEs and non-ECEs relative to the host country. ECEs share cultural and linguistic ties with China, as well as family and business ties. Non-ECEs are primarily from OECD countries who do not share cultural or language similarities with China. Shared culture can facilitate communication and transactions with local businesses. From a domestic enterprise's perspective it may be 'easier' to learn from ECEs compared to non-ECEs due to cultural similarities.

The general patterns observed in Table 3.5 still persist. Own-type spillovers are the largest while cross-type spillovers are much smaller with spillovers from foreign to domestic enterprises being smaller than those in the reverse direction. Additionally, we observe that spillovers from foreign enterprises to POEs are found to originate from non-ECEs only. Since ECEs primarily engage in export processing activities, domestic-owned enterprises

[79] I refer to cultural differences as encompassing differences in language and ethnicity in particular although it could also include culture in the sense of Saxenian (1996). However, corporate culture in the Saxenian sense is difficult to measure, so I focus on observable differences in enterprises by their country of origin.

may have fewer opportunities to interact with them as explained above. In contrast, the market orientation of non-ECE investment increases the likelihood of interaction with domestic enterprises. There is some evidence of negative spillovers from non-ECEs to SOEs, although lacking statistical significance under the preferred specification in column 2.

The novel result revealed in this table is that ECEs and non-ECEs virtually have no impact on each other. This is particularly surprising since the respective own-type spillovers are positive, statistically significant, and of similar magnitude. Because these regressions include controls for industries, cities, and time we cannot attribute the results to any inter-city or inter-industry differences. Although it is beyond the scope of this paper to explain the apparent lack of interaction between enterprises in these two foreign ownership types, I offer a few preliminary suggestions. Ethnic business networks might be a strong candidate in explaining why ECEs appear to interact only with other ECEs. Managers and workers in ECEs share a common language and close cultural ties that would facilitate economic transactions, in addition to being engaged in processing export activities.

However, the absence of spillovers from non-ECEs to ECEs cannot be attributed to cultural differences alone since non-ECEs experience positive spillovers from POEs despite the absence of common culture or language. Zero spillovers in the opposite direction, ECEs to non-ECEs, might be a facet of the export driven orientation of ECE investment. Availability of FDI data by country of origin for non-ECEs would shed further light on this result. For example, Todo, Zhang, Zhou (2009), using detailed data from a large high technology park in Beijing, find that Japanese MNCs do not have any productivity improving spillovers on domestic Chinese firms. The authors attribute this to the small size of the highly educated and the overseas educated labor employed by Japanese MNCs.

3.5.3 Robustness Checks

3.5.3.1 Single-Plant Firms Only

To address concerns about measurement error in the localization variables, I reconstruct the localization variables to include employment in single-plant firms only. I also exclude multi-plant firms from each sample before re-estimating model (3.3.2). The results are displayed in Tables 3.8 – 3.11. Table 3.8 includes measures of localization using employment in single-plant firms only. Table 3.9 further divides foreign-owned enterprises into ECEs and non-ECEs. Tables 3.10 and 3.11 mirror Tables 3.8 and 3.9 respectively, except that they also include localization measures using employment in multi-plant firms only as separate explanatory variables in addition to measures of localization using employment in single-plant firms only. All four tables display results for the augmented production function approach. Column (1) presents results from model (3.3.2) which includes a full set of four-digit industry, city, and year dummies. Column (2) presents results from model (3.3.3) which includes four-digit industry and city by year dummies. I focus on results in column (2) for each sample in the discussion below.

In general, the results attest to the robustness of own-type spillovers being larger than cross-type localization spillovers. The results also attest to the persistent positive spillovers from POEs to enterprises in all other ownership types. The absence of spillovers between ECEs and non-ECEs remain. However, I find no statistically significant cross-type spillovers from foreign-owned to domestic-owned enterprises except in Table 3.11, where negative spillovers from non-ECEs to SOEs become statistically significant. Positive productivity spillovers from SOEs to foreign enterprises also gain statistical significance in

Tables 3.8 – 3.11. After separating foreign enterprises into ECEs and non-ECEs, this effect is visible for the sample of non-ECEs only. This is surprising since non-ECEs are the most technologically superior and productive group while SOEs rank the lowest. Lower productivity is posited to be associated with lower skilled workers and inferior technology, so the labor pooling and knowledge spillover channels are unlikely to explain this result. The likely candidate would be input sharing.

3.5.3.2 Controlling for Output Market Competition

Previous studies, such as Aitken and Harrison (1999), find that foreign presence is negatively correlated with domestic-owned enterprise productivity due to a negative market stealing effect. This possibility may raise concerns that the smaller spillovers to domestic-owned enterprises from foreign-owned enterprises are being driven by output market competition instead of labor poaching as hypothesized in this study. This section considers the possibility that negative output market competition is driving the observed pattern of results by controlling for local competition.

I re-estimate model (3.3.3) including proxies for local competition within an industry-city space. The results are reported in Table 3.12. Competition is measured as the total number of firms in an industry within a city, differentiated by ownership types. State-owned enterprises are counted as a single enterprise since there is a single owner, the Chinese government. The results indicate that even after controlling for local competition the basic patterns observed in Table 3.5 still persist. Competition from POEs is found to have a positive impact on enterprise level productivity controlling for overall scale of activity in an industry-city space. This is consistent with existing evidence (Glaeser, Kallal,

Scheinkman, Shleifer, 1992; Rosenthal and Strange, 2003) that finds local competition to enhance growth. Competition from FOEs only impacts productivity of FOEs positively while the effect is statistically insignificant for domestic-owned enterprises.

3.5.4. Estimated Magnitude of Labor Poaching

Using estimates of own and cross-type spillovers, I conduct a simple exercise to offer indirect evidence for the size of the labor poaching effect. I have argued that own-type spillovers primarily reflect traditional localization spillovers. Cross-type spillovers, particularly those from foreign to domestic-owned enterprises, are weakened by labor poaching forces. We can difference own and cross-type spillovers to arrive at a range of estimates for the negative labor poaching effect. The coefficients of interest are those spillovers originating from high to low productivity enterprises in Table 3.5, notably spillovers from foreign to domestic-owned enterprises. Differencing yields elasticities of -0.011 and -0.017 respectively.[80] Implicitly, it is assumed that the strength of localization spillovers would be similar in the absence of differences between firms by ownership types. This exercise suggests that the labor poaching effects can be as large as own-type spillovers. Chinese policy makers interested in attracting FDI should be cautioned by the potential for labor poaching to diminish desired spillovers from foreign multinational companies.

3.6. Conclusions

The empirical agglomeration literature finds robust evidence of benefits arising from the proximity to nearby own-industry activity. However, these benefits have previously not

[80] $\gamma_{SOE}^{FOE} = (\gamma_{SOE}^{SOE} - labor\ poaching\ effect)$ and $\gamma_{POE}^{FOE} = (\gamma_{POE}^{POE} - labor\ poaching\ effect)$

been considered to vary along the ownership dimension of an enterprise, particularly in the context of a transition economy. Meanwhile, the literature on foreign direct investment has paid particular attention to benefits arising to domestic firms from the proximity to foreign firms. However, spillovers in the reverse direction are less well examined. This paper addresses these gaps.

Using data on manufacturing enterprises operating in China during 1998-2006, this study estimates and offers explanations as to why localization spillovers might vary by ownership type of an enterprise. Exploiting a well-established productivity hierarchy in China, where foreign-owned enterprises are more productive compared to private-owned enterprises who are in turn more productive than state-owned enterprises, I find evidence of attenuation of localization spillovers as enterprises become more dissimilar in their productivity levels. In particular, the pattern of results is consistent with conflicting forces of positive agglomeration economies and negative labor poaching at work in the presence of foreign multinational companies.

In addition, I find evidence of positive localization spillovers from private-owned enterprises to enterprises in all other ownership types. This finding underscores the important role of indigenous private enterprises in the Chinese economy and points towards the possibility of larger productivity spillovers in the absence of domestic policy biases against domestic private-owned enterprises.

Finally, I find that within the foreign-owned sector, own-industry activity in enterprises originating from ethnically Chinese economies within a city has virtually no impact on the productivity of enterprises originating primarily from OECD countries and vice versa. This result points to the role of ethnic business networks facilitating localization

spillovers and warrants further research to understand interactions among multinational corporations.

4. Evolving Property Rights and Shifting Organization Forms: Evidence From Joint-Venture Buyouts Following China's WTO Accession

4.1 Introduction

A remarkable flowering of research has shed light on the rapidly changing international organization of production. As reviewed by Helpman (2006), this research has greatly expanded our understanding of why firms outsource, whether they source intermediate inputs domestically or from a foreign trading partner, and whether they choose to procure the inputs through arm's length transactions or to produce the components within the firm's boundaries. With extensive reliance on foreign-funded enterprises in its export sector and detailed trade data, China has proved to be a useful testing ground for some of these new theories and observations. Feenstra and Hanson (2005) use Chinese trade data to test hypotheses from the property rights theory against observed propensities to process inputs under alternative arrangements of ownership and control over imported inputs. Fernandes and Tang (2010) extend this work by introducing firm heterogeneity as an additional determinant of vertical integration in export processing.

We also test the ability of incomplete contracts and property rights theory to aid our understanding of firm's organizational choices in China. Rather than focus on vertical integration and export processing, however, we study the incentive problems guiding multinational firms' organizational choices when engaged in horizontal FDI. Our presumption is that substantial changes to Chinese law and policy in 1999 and China's 2001

accession to the World Trade Organization enhanced the ability of foreign firm to produce and sell in China as wholly owned subsidiaries rather than as joint ventures. We adapt the Feenstra-Hanson (2005) property rights model to predict how the characteristics of an ongoing equity joint venture determine the surplus value derived from alternative organizational form. The theory predicts that higher productivity and higher value added, but a lower domestic sales share, increase the probability that a joint venture will become a wholly foreign owned subsidiary rather than remain an EJV. The theory also predicts that enterprises with lower productivity but higher value added and domestic sales share are more likely to be acquired by their Chinese partners rather than remain an EJV.

We test these theoretical predictions using newly created enterprise-level panel data on equity joint ventures and changes in registration type after 2000. We estimate a multinomial logit model of organization choice, with our choice of regressors closely matched to the theory. Our empirical results provide strong support for the property rights model and for the view that changes in Chinese policies have led to predictable changes in multinational organizational strategies.

4.2. Chinese Regulation and the Changing Integration Strategy of Foreign Firms in China

Deng Xiaoping's famous Southern Tour of January 1992 ushered in large flows of foreign direct investment (FDI) to mainland China. Even though wholly owned foreign enterprises (WFOEs) were permitted outside of Special Economic Zones by the 1986 Law on Wholly Foreign-Owned Enterprises, most of the foreign investment entering China during the 1990s took the form of Sino-foreign joint ventures (SFJVs) (Cheung, 2007). As

shown by Figure 4.1(a), funds entering China for joint ventures exceeded funds entering for wholly owned operations until at least 1998 (using contracted FDI) and, as shown in Figure 4.1(b), probably until 1999 (using actually utilized FDI). The period from Deng's tour until 1997 was one of substantial FDI liberalization, with substantial preferences given for foreign firms to engage in joint ventures with indigenous enterprises. While Huang (2003) focuses on why international production integration with China took the form of FDI rather than contractual arrangements common in the take-off phase of other East Asian economies, it is equally noteworthy that this FDI took the form of joint ventures rather than WFOEs.

Policies of the central and provincial governments surely are part of the explanation for the dominance of joint ventures during the 1990s. Although WFOEs were permitted in many sectors and offered similar incentives, foreign firms report barriers to establishing wholly owned subsidiaries ranging from substantial delays in approval to vigorous suggestions for local partners.[81] Wholly owned enterprises were not permitted in "strategically important" infrastructure, such as nuclear power plants, but they were also essentially barred from projects in aerospace, automobiles, chemicals, defense, medical institutions, petrochemicals, pharmaceuticals, printing and publications, shipping, satellite communications, soft drinks, and tourism.[82] On the other hand, SFJVs enjoyed access to special economic and development zones, preferential tax treatment, and access to sectors where WFOEs were not permitted. Yan and Warner (2002) emphasize the differences by concluding that "at the inception of economic reforms the Chinese government intentionally

[81] Some of the restricted sectors required Chinese partners within SFJVs to hold a majority share.

[82] See Foreign Investment Administration (1998).

packaged EJVs with preferential privileges, while granting WFOEs virtually nothing but regulations (p.141).

In addition to policies that favored joint ventures, foreign investors may have preferred them to wholly owned subsidiaries for reasons specific to Chinese governance and market development.[83] First, the Chinese government at that time was ambivalent toward the rule of law, offering seeing the law as an instrument of the state. Regulatory and unwritten policy changes, for instance, offer trumped laws in the administration of foreign claims. A Chinese partner could be helpful in understanding and anticipating these changes. Secondly, the Chinese state lacked institutional capacity, due to fragmentation, overlapping jurisdiction, lack of cooperation, and corruption. Again, a Chinese partner could be helpful solving local regulatory and procurement problems. Finally, exchange in China is anchored by informal social ties. Relational contracting in Chinese societies focuses on *guanxi* to the extent that, according to Clarke *et al* (2008, p. 407), "discussion of *guanxi* links not only relations among entrepreneurs but also relations between entrepreneurs and government officials."[84] Many companies find that a local partner helps nurture local customers, gain access to marketing and distribution networks as well as government connections (Sutter, 2000).

Indigenous firms also may have preferred a foreign partner to going it alone. As forcefully argued by Haggard and Huang (2008), indigenous private entrepreneurs in the 1990s were largely credit constrained and often entered into joint venture agreements to gain access to capital and to circumvent substantial restrictions imposed on the development of

[83] See Wang (2001, ch. 3) for an overview of the legal framework for FDI.

[84] See Bian (1994) for a definition and discussion of *guanxi*, or interpersonal relationships, in China.

the private sector but not on foreign investors. In this view, Chinese policy "followed the unusual course of favoring foreign private investors over domestic ones (p. 363)."

By the late nineties policies that influenced the organizational form chosen by both foreign and indigenous investors seem to have changed. By 2000, the majority of inward FDI took the form of wholly foreign-owned investment (see Figure 4.1(b))[85]. Locating the exact source of this dramatic take-off in WFOEs is difficult and is probably attributable to a convergence of domestic policy changes. First, in 1999, the Chinese Constitution was amended to sanction a larger role for nonpublic sector enterprises and to recognize the legitimacy of interest and dividend income. Secondly, in the same year a new, unified Contract Law was promulgated granting natural individuals, not just legal persons, the ability to enter into legally enforceable contracts and giving oral contracts a stronger legal footing. According to Clarke *et al* (2008, p. 406), this "principle of freedom of contract signals a definitive move away from the planned economy." They also report that court records from Nanjing from 1999 to 2001 show "private enterprises entering into legally enforceable contracts and enjoying recourse to the courts – features of contract regime that were absent through the early 1990s (p. 406)."

Perhaps as importantly, in 1999 China and the United State reached a bilateral agreement clearing the way for China's accession to the WTO in 2001. WTO entry improved the rule of law and the property rights of foreign investors in many ways. Perhaps most importantly, WTO accession eliminated many restrictions placed on WFOEs that were not also placed on other forms of investments. Perhaps most notable in this regard are the

[85] Data on utilized FDI inflow is unavailable prior to 1997. Figure 1(b) plots contracted FDI inflows by registration type between 1992 and 1999 illustrating the declining trend in joint ventures, the increasing trend in wholly foreign owned by 1999 and the spike in inflows in 1993.

elimination of export requirements for WFOEs and the granting of rights to engage in distribution and after-sales service. Both of these changes expand local market access for these foreign owned firms. WTO accession also brings external commitment to China's evolving property rights, as emphasized by Tang and Wei (2009). Tang and Wei quote a recent U.S. Government Accounting Office report as noting that in its accession negotiations, China has "made a substantial number of important, specific commitments in the rule-of-law-related areas of transparency, judicial review, uniform enforcement of legal measures, and nondiscrimination in its commercial policy."[86]

Despite amendment to its Constitution and accession to the WTO, contract enforcement in China is far from certain. Despite recent developments, according to Clarke *et al*, "Contract Law and the courts still play a minor role in underpinning exchange agreements." They do, however, cite new evidence that despite the role of social networks, formal, written contracts have become the norm in business agreements. Of particular note, a World Bank (2001) study finds that written contracts were used for 90% of contracts with clients and 82% with suppliers. Nevertheless, Clarke *et al* conclude that "the Chinese legal system does not provide a secure system of property rights (p. 399).

What emerges from a review of the evolving legal basis for contractual enforcement of property rights is that incomplete contracts remain a significant feature of investing in China. However, substantial changes to domestic laws culminating in amendment of the Chinese constitution and completion of bilateral agreements for WTO accession in 1999 fundamentally altered the Chinese business landscape. The dramatic take-off of WFOEs as

[86] Tang and Wei (2009) citing GAO-05-53-2004.

an investment vehicle observed in the aggregate FDI data, in this light, is a response by foreign investors to changes in the benefits of this organization form over the SFJV.

Testing the importance of incomplete contracts and changes in property rights to the organization choices of multinational firms is difficult. We do not observe projects prior to inception, often lack detailed information on parents, and do not know the set of options actually considered by the firm. We propose an alternative approach, based on observations of equity joint ventures established prior to the substantial reforms of 1999. These ongoing enterprises experienced the same liberalization as did potential investors, permitting changes in organization form that, if consideration of incomplete contracts and property rights theory is useful, should occurs in ways that we can predict. Such a test adds to a still small, but growing, body of research that seeks empirical evidence on the role of formal and informal institutions in the international organization of production. We turn now to a theoretical model of organizational choice in the presence of imperfect contracts.

4.3 A Property Rights Model of Organizational Form in China

We consider the options facing the foreign and domestic partners of an equity joint venture operating in China. Our framework is based on the Feenstra and Hanson (2005) model (hereafter the FH model), which applies the Grossman-Hart-Moore property rights theory to export-processing firms in China.[87] The FH model centers on the use of control rights to ameliorate holdup problems created by incomplete contracts. Our adaptation retains their original emphasis on partners' responses to imperfect contracts but it shifts the focus away from export processing and toward the use of advanced technology in China by

[87] The model draws on foundation provided by Hart (1995), Hart and Moore (1990) and Grossman and Hart (1986).

firms serving local markets. The FH framework is well suited to our purpose as it permits easily interpretable expressions for the project's surplus value under alternative organizational forms and to predict how these relationships evolve as a consequence of strengthened property rights.

4.3.1. Production and Effort

We consider the interaction of a foreign partner, *f*, and a domestic Chinese partner, *s*, who join to produce a good in China using foreign technology, local production labor, and local marketing services. Surplus from the project is divided by ex-post Nash bargaining. The project requires the application of foreign technology (proprietary designs, processes, or customized equipment) to local labor, with output marketed to local Chinese customers. Foreign technology is contributed by the foreign partner. Local production may be controlled by either the foreign or the Chinese partner while domestic marketing services must be performed by the Chinese partner. Timing is standard: in period 0 the partners decide who will own the firm and who will control production; in period 1 the partners simultaneously make effort investments; and in period 2 the partners carry out production and final sales.

Although our model is derived from Feenstra and Hanson (2005), we shape it to reflect the issues central to a foreign investor's choice of organizational structure. While Chinese law assigns firm control and residual property rights in proportion to partner's equity shares, in practice, equity shares are not a guide to ownership and control.[88] Equity shares are often based on non-market valuations and, in any case, do not reflect the outside

[88] See the extensive interviews with joint venture partners in Wang (2001) and the extensive descriptions in Huang (2003, 2008).

options facing each partner and, hence, bargaining power within the partnership.[89] We assume that when the partners choose an organization form for their activities, they choose the partner who will have rights to residual profits and the partner who will control production. If ownership and control are split, we assume that both partners make equity investments and the organization is registered as a joint venture. If ownership and control reside with a single partner, only one partner makes an equity investment and the organization is registered as a wholly-owned foreign enterprise or a wholly-owned domestic enterprise. Organizational form is chosen to maximize the surplus from the project, given effort levels by each partner when surplus is divided through Nash bargaining.[90]

A second deviation from the FH model structure is that we shift focus away from input processing and input search effort and toward the use of advanced technology and the adaptation of local production processes to that technology. For example, in a joint venture created to produce industrial boilers, the foreign partner may exert effort adapting proprietary boiler specifications for local customers while the Chinese partner adapts local production processes to the advanced designs. Greater effort by each partner increases the surplus from the project.

Third, we deviate from FH by focusing our attention on the domestic Chinese market rather than on export sales, although we control for the export intensity of the firm in our empirical work. While export sales remain an important source of revenue for SFJVs,

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[89] Sutter (2000) notes that equity stake does not necessarily equal managerial control, but rather that control rests in the JV contract and the choice of partner. She notes that with properly structured contracts, a foreign firm can get as much managerial control in an EJV as they get in a WFOE (p15-16.)

[90] Although SFJVs may have state-affiliated Chinese partners, Haggard and Huang (2008) argue that these firms are private, not state, firms. This view is reflected in our assumption that surplus division occurs within the partnership.

local sales are as important as export sales for investors outside East Asia and in certain sectors. For example, among U.S. manufacturing majority-owned non-bank affiliates in China, 67.4% of sales in 2005 were to the local market, and local sales accounted for more than 85% of total sales in food, chemicals, and transport equipment. Japanese majority-owned affiliates, which are more deeply engaged in export-platform FDI in China than are U.S. multinationals, made 53.6% of their total sales in 2005 to the local Chinese market.[91] Consistently, local market barriers for wholly foreign firms and implicit preferences for domestic firms by state-affiliated customers are mentioned in the business literature as a factor tilting foreign investors toward a joint venture as a means of entry into the Chinese market during the 1990s. For example, Karen Sutter, director of Business Advisory Services at the US-China Business Council, notes that by 2000 WFOEs had emerged as a popular investment form, yet she still advises foreign investors that "An EJV offers several potential benefits, including the use of the local partner's marketing and distribution network and the ability to offer after-sales services. An EJV can also benefit from any government connections the local partner may have." Our model reflects the advantages of marketing through a local partner by positing that the Chinese partner acts as marketing representative for the firm in the local market, a modeling decision based on pre-WTO-accession

We assume that domestic sales revenue is given by $B(1+e_1+\lambda e_2),$ where e_1 is effort exerted by the foreign partner adapting technology to the local market and e_2 is effort exerted by either party adapting production to the foreign designs or specifications. These efforts may be seen as raising quality and hence produce price. We restrict

[91] Greaney and Li (2009) provide sales shares for both U.S. and Japanese majority-owned non-bank affiliates.

$0 \le e_1 \le 1;\ 0 \le e_2 \le 1;\ 0 \le \lambda \le 1$. Production costs for achieving the foreign quality level are also influenced by production managers' effort and are given by $A(1-e_2)$. Marketing is done by the Chinese partner and marketing costs are reduced when the local partner exerts effort, e_3, to use its local connections: $P_M(1-e_3)$. These connections can be particularly valuable for foreign firms seeking domestic contracts, as noted repeatedly by the business partners and government officials interviewed by Wang (2001) and by Sutter (2000, p.15), who states "the absence of a Chinese partner able to make the right connections can make government relations works difficult."

Given these forms for revenues and costs, profits from the joint venture are given by

$$B(1+e_1+\gamma e_2)-A(1-e_2)-P_M(1-e_3)>0, \tag{4.3.1.1}$$

where additional sales raise profits so that $B > A + P_M > 0$. As in FH, we have introduced a link between sales revenue and production costs, with the production manager's effort influencing both. This joint production reflects the assumption that it is difficult to fully compensate the production partner for his contribution to profits.

Period 1 effort investments impose a cost on those who make them. Let $\delta_C \in (0,1)$ indicate whether the foreign partner, $\delta_C = 0,$ or the Chinese partner controls production. Retaining the simple functional forms used by FH, the cost of supplying effort to the foreign partner is $C_f[e_1,(1-\delta_C)e_2] = (\gamma_f / 2)(e_1^2 + (1-\delta_C)e_2^2),$ while the cost of supplying effort to the Chinese partner is $C_s[\delta_C e_2, e_3] = (\gamma_s / 2)(\delta_C e_2^2 + e_3^2)$. The parameter, γ_j, captures the disutility of effort to party *j*. Given the extra costs associated with managing international activities, we assume $\gamma_f > \gamma_s > 0$.

Total surplus from the project is profits net of investment costs:

$$W = \pi - C_f[e_1, (1-\delta_C)e_2] - C_s[\delta_C e_2, e_3], \tag{4.3.1.2}$$

where π is given by (4.3.1.1). Optimal effort levels maximize total surplus. If perfect contracts were possible, optimal effort levels would be $e_1^* = B/\gamma_f$; $e_2^* = (A+\lambda B)/\gamma_s$; and $e_3^* = P_M/\gamma_s$. Optimal assignment of production control to the Chinese partner results from our assumption that the disutility of effort is higher for the foreign partner than for the domestic partner.

Optimal efforts will not, in general, be made because contract imperfections lead the parties to Nash bargain over division of the surplus. Effort levels depend on organizational form, which defines residual property rights, and the outside options available to each partner in the event that bargaining breaks down. Letting $\delta_0 \in (0,1)$ indicate ownership, with $\delta_0 = 0$ signifying foreign ownership and $\delta_0 = 1$ signifying Chinese ownership, imperfect contracts imply that total surplus depends on organizational form, $W(\delta_0, \delta_C)$. We turn now to define each partner's outside options and the marginal investment incentives for effort under each ownership and control arrangement.

4.3.2. Marginal Investment Incentives

To solve for the individually optimal effort levels under each organizational form, we need to specify threat-point payoffs. We make three assumptions, closely following Feenstra and Hanson (2005). The first two assumptions are standard in the property-rights approach, although we adapt them to the Chinese context. The third assumption is drawn from the FH approach and it captures the effort incentive for the Chinese partner provided by control of production. We also add a fourth assumption that results in the elimination from one

organization form, a Chinese-owned firm in which production is controlled by a foreign manager. This asymmetry reflects the fact that foreign firms operating in China have little or no incentive to exert effort in firms they do not own, unlike their Chinese partners.

(A.1) When Nash bargaining breaks down, the party owning the factory is entitled to the residual profits that flow from completing the project using services purchased on the spot market. If the foreign partner owns the factory, $\delta_O = 0,$ it hires a domestic distribution agent to sell its output on the domestic market. If the Chinese partner owns the factory, $\delta_O = 1,$ it pays the foreign firm a licensing fee for use of its technology.

(A.2) Under the spot contracts in (A.1) the parties earn only a fraction of their marginal products. Specifically, we assume the payoffs are (1-ψ) times the first-best level. As FH note, ψ may be interpreted as a measure of human-capital specificity of these investments or, alternatively, the ability to contract over them. We allow the degree of specificity to vary across the production tasks: ψ_{IPR} reflects the proportionate loss in return on technology adaptation effort if the foreign firm licenses it rather than uses it within firm boundaries, ψ_C is the proportionate loss in the return to production control effort, and ψ_M is the proportionate loss in return to marketing effort.

(A.3) If the foreign partner owns the factory and Nash bargaining breaks down, the Chinese partner seeks a job elsewhere. His prior investment in marketing is valued if and only if he has been in control of production. This reflects the difference between being viewed by potential outside employers as a technical, rather than sales, representative for a foreign enterprise. Production control also influences the threat

point payoff for the foreign firm. Because technology transfer may occur outside his control, we assume that if bargaining breaks down, the foreign partner receives only a portion of the value of its technological adaptation effort, even if it owns the firm.[92]

(A.4) If the Chinese partner owns the factory and Nash bargaining breaks down, the foreign partner is not rewarded for any effort, whether in adapting technology or controlling production.[93]

These assumptions are similar to those in FH, except that we allow for the possibility of intellectual property violations if the technology is transferred outside the boundaries of the foreign firm. We make the extreme assumption that this form of transfer can occur even if the foreign firm engages in a joint venture.

In bargaining over division of the surplus, the foreign firm has the primitive bargaining weight, θ, while the Chinese firm has bargaining weight, $1-\theta$.[94] With threat point payoffs denoted $\hat{\pi}_j$, $j = f, s$, and total profits defined by (4.3.1.1), profits earned by each party are

$$\begin{aligned} &\textit{Party } f \textit{ receives} \quad \pi_f = \theta(\pi - \hat{\pi}_s) + (1-\theta)\hat{\pi}_f, \\ &\textit{Party } s \textit{ receives} \quad \pi_s = (1-\theta)(\pi - \hat{\pi}_f) + \theta\hat{\pi}_s. \end{aligned} \tag{4.3.2.1}$$

[92] It is widely recognized that the Chinese government preferred joint ventures to wholly owned foreign enterprises because the EJV promised more transfer of technology and production know-how to the Chinese managers. See Sutter (2000) for further discussion.

[93] A similar assumption is used by Antràs (2003), who assumes that investments by either party of a trade relationship are completely relationship-specific and that if the relationship breaks down, the value of the inputs outside the relationship is 0.

[94] Nash bargaining with fixed bargaining weights is maintained not only in Feenstra and Hanson (2005) but also in models with firm productivity heterogeneity, such as Antràs and Helpman (2004).

Each party chooses effort levels to maximize the difference between these payoffs and the costs of supplying efforts. Using our assumptions about threat-point payoffs, marginal investment incentives can be derived for each organizational form. If the foreign firm owns the factory, then (A.1) to (A.4) imply:

$$\begin{aligned}
\frac{\partial \hat{\pi}_f}{\partial e_1} &= B/\gamma_f;\ \text{if } \delta_C = 0 \\
\frac{\partial \hat{\pi}_f}{\partial e_1} &= B(1-\psi_{IPR})/\gamma_f;\ \text{if } \delta_C = 1 \\
\frac{\partial \hat{\pi}_f}{\partial e_2} &= (A+\lambda B)/\gamma_f;\ \text{if } \delta_C = 0 \\
\frac{\partial \hat{\pi}_s}{\partial e_2} &= (1-\psi_C)(A+\lambda B)/\gamma_s;\ \text{if } \delta_C = 1.
\end{aligned} \tag{4.3.2.2}$$

As seen by (4.3.2.1), ownership provides less than full incentives for the foreign partner to adapt its technology to local market conditions since some share of its value is eroded by having exposed the Chinese partner to its proprietary technology. Ownership, however, does provide full incentives to exert effort adapting production to its own technological specifications. The Chinese partner, however, if given production control, earns a fraction of the marginal product of his efforts on the spot market and, thus, has less than full incentives to adapt local production to the foreign technology.

When the foreign partner has residual property rights, the Chinese partner has an incentive to use his connections to lower per unit marketing costs if and only if he controls production. This implies that when the foreign firm owns the factory, marginal incentives for marketing effort by the Chinese firm are:

$$\frac{\partial \hat{\pi}_s}{\partial e_3} = \delta_C[(1-\psi_M)P_M]/\gamma_s. \tag{4.3.2.3}$$

Because the Chinese partner will not be rewarded for marketing effort should bargaining break down, he will not exert any if he does not also control production.

If the Chinese partner owns the project and has residual property rights (A.1) to (A.4) imply:

$$\begin{aligned} \frac{\partial \hat{\pi}_s}{\partial e_3} &= P_M / \gamma_s; \\ \frac{\partial \hat{\pi}_f}{\partial e_2} &= 0; \text{ if } \delta_C = 0 \\ \frac{\partial \hat{\pi}_s}{\partial e_2} &= (A + (1-\psi_C)\lambda B) / \gamma_s; \text{ if } \delta_C = 1. \end{aligned} \tag{4.3.2.4}$$

With ownership, the Chinese partner has full marginal incentives in marketing. However, if bargaining breaks down, customers will consider the Chinese partner's efforts to raise quality through production effort as less successful since in that case the technology is only licensed. Therefore, he earns his full marginal product of effort reducing production costs (A), but less than full marginal product raising sales revenue (λB). As defined by (A.4), if given production control the foreign partner has no incentive to exert effort since effort adds nothing to his outside option. Combined with the assumption that $\gamma_f > \gamma_s$, this behavior implies that it will never be optimal for the parties to choose Chinese ownership with foreign production control as the venture's organizational form.

With Chinese ownership, the foreign firm receives no payment for effort if bargaining breaks down, as defined by (A.4). Therefore,

$$\frac{\partial \hat{\pi}_f}{\partial e_1} = 0. \tag{4.3.2.5}$$

Imperfect contracting over technology leads the foreign firm to have less than full marginal incentives to adapt its technology for the Chinese market.

Effort levels can be found under each organizational form using the marginal investment incentives (4.3.2.2) to (4.3.2.5). Inspection of the effort levels in Table 4.1 indicates that Chinese ownership with foreign production control arrangement is dominated by Chinese ownership and control. Efforts devoted to technology adaptation and marketing are the same across the two regimes, but production effort is lower with the split arrangement. As a result, profits under Chinese ownership and production control are at least as high as they are under split ownership and control. Consequently, we would not expect to observe the organizational form Chinese ownership-with-foreign control in the data.

In other organizational arrangements, ownership leads to full marginal incentives for effort by the partner with residual property rights, the exception being foreign ownership but Chinese production control. In this case, the foreign firm devotes less than first-best effort to adapting its technology because if bargaining breaks down, some of its efforts will be lost through "leakage" of its proprietary technology to the Chinese partner. This joint venture arrangement, however, induces the Chinese partner to exert greater effort in marketing because production control ameliorates the holdup problem when the foreign firm owns the project. Thus, for some projects a joint venture will be preferred by both partners.

4.3.3. Comparison of Alternative Organizational Forms

We use the individually optimal effort levels given in Table 4.1 to compute and compare the total surplus $W(\delta_O, \delta_C)$ generated by each ownership and control arrangement. Because our empirical approach is based upon a sample of established equity joint ventures, we compare the surplus generated by a wholly foreign owned (WFOE) or wholly domestic

owned (DOM) enterprise to that generated by a joint venture with foreign ownership and Chinese production control (SFJV). As in FH, these comparisons have a linear form and can be expressed as:

$$\begin{aligned} &\text{WFOE v. SFJV: } W(0,0)-W(0,1)=a_1B^2+c_1(A+\lambda B)^2+d_1P_M^2; \\ &\text{DOM v. SFJV: } W(1,1)-W(0,1)=a_2B^2+c_2(A+\lambda B)^2+d_2P_M^2. \end{aligned} \tag{4.3.3.1}$$

Project surplus comparisons depend on three characteristics of the firm. Recalling the first-best effort levels, we may interpret B^2 as the income generated by technological adaptation, $(A+\lambda B)^2$ as the value added in production, and P_M^2 as the income generated by domestic marketing effort, when each is evaluated at the first best.[95]

Using the effort levels in Table 4.1 to compute and compare project surplus, we can determine the signs of the coefficients in (4.3.3.1). Comparing a WFOE to a SFJV, concentrating ownership and control in the foreign partner leads to greater effort in both technology and production adaptation, while providing less incentive for the Chinese firm to market the final product to domestic customers. Therefore, for comparison of a WFOE to a SFJV, $a_1>0; c_1>0; d_1<0.$ Comparing a DOM to a SFJV, concentrating ownership and control in the Chinese partner leads to greater effort in both marketing and production, while providing less incentive for the foreign firm to adapt its technology to Chinese production conditions. Therefore, for comparison of a domestic owned enterprise to a SFJV, $a_2<0; c_2>0; d_2>0$.

[95] See Feenstra and Hanson (2005, p. 749) for a thorough discussion of these interpretations in the context of their model.

4.4. Empirical Strategy

Our empirical strategy is based on the liberalizations that occurred with Chinese accession to the WTO, which allowed equity joint venture partners greater latitude in choosing the organizational form that provides the highest surplus value. As discussed in section II, foreign investors were constrained in their mode of entry into China prior to 2000, but that substantial changes in law and policy associated with China's WTO accession significantly eased investors' ability to shape the form of their investments. Our presumption is that the determinants of surplus value identified by our theoretical model will predict which enterprises shift from a joint venture to a wholly owned enterprise. For example, firms using advanced technology may find that, once relieved of the export requirements that had been imposed on WFOEs, project surplus is higher if they operate as a wholly owned subsidiary and invest more in technology than was optimal when they operated as a joint venture. Similarly, projects in which a significant share of value is added domestically on the shop floor may find that project surplus is higher if they operate as a domestic Chinese enterprise and bring their production effort closer to first-best.

4.4.1. Econometric Specification

Our sample consists of all Sino-foreign equity joint venture projects established between 1992 and 2000, operating "above scale" and, therefore, included in the Annual Survey of Industrial Firms, and surviving as an ongoing industrial enterprise until 2006.[96] We observe transitions from the initial joint-venture arrangement into one of three forms:

[96] Anecdotal evidence and interviews with joint venture managers suggest that few projects switched from a SFJV to a wholly owned enterprise prior to 2000. Exact numbers are not available; a firm-level panel can only be constructed from 1998 onward.

continuing as an equity joint venture (SFJV), transitioning to a wholly owned foreign enterprise (WFOE), or transitioning to a domestic enterprise without foreign equity participation (DOM). We use our theoretical model to predict which firms, conditional on characteristics observed by 2000, will change status from an equity joint venture into one of the two wholly owned forms.

EJV partners choose the organizational form that maximizes the surplus value, which we do not observe directly, but instead treat as a latent variable, W_i^*. Our model provides an expression for the unobserved latent variable, $W_i^* = X'\beta_i + \varepsilon_i$, where X is a vector of enterprise characteristics, β_i is a coefficient vector associated with organization form *i*, and ε_i is a random error term. We observe W_i, where

$$W_i = \begin{cases} 1, & W_i^* = \max\left[W_{SFJV}^*, W_{WFOE}^*, W_{DOM}^*\right] \\ 0, & otherwise \end{cases} \tag{4.4.1.1}$$

We assume errors are distributed i.i.d. and have an extreme value distribution.[97] The probability of choosing organization form *i* is given by

$$\begin{aligned} &p_i = \exp(X'\beta_i)/D, \quad i = 1,2 \text{ and } p_3 = 1/D \\ &\text{where } D = 1 + \sum_{i=1}^{2} \exp(X'\beta_i). \end{aligned} \tag{4.4.1.2}$$

We use the multinomial logit (MNL) model to estimate the coefficient vectors β_i, allowing the SFJV form to be the reference choice. Consequently, coefficients for this choice are set equal to zero. Equations (4.3.3.1) provide expressions for the difference in surplus value for

[97] The cumulative distribution function is given by $F(w_i < k) = \exp(-e^{-k})$

the two wholly owned forms versus a joint venture. This expression guides our choice of regressors, which we construct to measure the value to the firm of technological effort, production effort, and marketing effort. As frequently noted, the empirical tractability of the MNL model is obtained at the expense of strong maintained assumptions, particularly the Independence of Irrelevant Alternatives (IIA). Although restrictive, tests proposed by Hausman and McFadden (1980) indicate that IIA is appropriate for our application.[98]

4.4.2. Data

Data used in this study are drawn from the Annual Surveys of Industrial Production conducted by the Chinese government's National Bureau of Statistics (NBS). The Annual Surveys of Industrial Production includes all non-state owned firms whose annual sales exceed 5 million yuan (referred to as "above-scale" industrial firms) and all state-owned enterprises.[99, 100] The dataset contains detailed information on the firm and its operations, including geographic administrative code, ownership type, gross industrial output value, value added, export value, total employment, capital stock, and intermediate inputs. In addition to ownership and location information, we make extensive use of the industry identifiers in the dataset. The ASIF classifies enterprises using the four-digit Chinese Industrial Classification (CIC) system. CIC codes were readjusted and renumbered in

[98] Using the Hausman and McFadden (1980) test, we fail to reject the null hypothesis that IIA holds at greater than the 96% significance level.

[99]The NBS classifies non state-owned enterprises to include collectively-owned enterprises, Chinese indigenous privately-owned enterprises, and foreign-owned enterprises operating in China. The industry section of China Statistical Yearbook is compiled based on this dataset. Basic information of each four-digit industry in the China Markets Yearbook is also based on this dataset.

[100] This amounts to approximately $US 600,000 over this period.

2003.[101] Consequently, we recode observations in years prior to 2003 thereby ensuring that industry codes are comparable across the sample period.

Sino-foreign joint ventures are identified by the registration codes assigned to the firm.[102] The final dataset includes 12,443 Sino-foreign joint ventures in 2000 that were established between 1992 and 2000, and which we use to create our balanced panel. Figure 4.2 shows that by 2006, 79.6% of these joint ventures remain as SFJVs; 13.6% become wholly foreign-owned enterprises (WFOE) while 6.7% become wholly domestic-owned enterprises (DOM).[103]

The property rights theory suggests that transitions from one organizational form to another can be explained by three characteristics of the joint venture: the value added by technology adaptation effort (*B*), value added by production effort $(A+\lambda B)$, and value added by domestic marketing effort (P_M). Allowing for heterogeneity among enterprises, we treat each of these values as firm specific and use firm-level data to create measures of them. All firm-level characteristics are measured as of 2000, prior to their transitions from one form to another. All variables are defined and descriptive statistics displayed in Table 4.2.

To capture the value added by technology adaptation effort, we create a measure of how technologically advanced the joint venture is relative to domestic firms operating in the

[101] Prior to 2003, NBS followed GB/T 4754 - 1994 industry classification system and 2003 onwards GB/T 4754 - 2002 was adopted. Two changes were made in the 2 digit divisions: (i) the 1994 division 39 ("Arms and Ammunition Manufacturing") was added to 2002 division 36 ("Special Equipment Manufacturing"). Then the remaining 2002 division codes were renumbered accordingly i.e. 1994 division 40 corresponds to 2002 division 39, 1994 division 41 corresponds to 2002 division 40, 1994 division 42 corresponds to 2002 division 41, and 1994 division 43 corresponds to 2002 division 42 (ii) 2002 division 43 ("Waste Resources and Old Material Recycling and Processing") was added which was not part of manufacturing in the previous period.

[102] Registration codes 210, 220, 310, and 320 are categorized as SFJVs.

[103] If a firm transitions into multiple states throughout the sample period, only the first transition state is considered. Multiple transitions are very rare in the data.

same industry. The presumption inherent in this choice is that effort by the foreign partner is more valuable the more advanced the technology used by the Chinese factory relative to that used by domestic competitors. This regressor, which we call "*distance from domestic technology frontier*" is calculated as the difference between a firm's own TFP (measured in logs) and the maximum TFP of the domestic Chinese firm within its two-digit industry in 2000. We calculate TFP for each enterprise using the Olley-Pakes (1996) methodology.[104]

We measure value added by production effort using *firm value added*, while adding the level of employment at the enterprise as an additional control for enterprise size. The ASIF provides information on nominal value added and we converted this to real value added using the Brandt-Rawski two digit industry output deflators (Brandt, Biesebroeck, Zhang, 2005).[105]

The third effort measure, *domestic sales share*, reflects the value of the Chinese partner efforts creating domestic sales. To capture this at the firm level, we use the firm's local (Chinese) sales as a share of total sales. Perhaps surprisingly, even within industries enterprises have widely varying degrees of success in selling locally.

We push our model and data further by testing for differences in the probability of switching organizational form in ways suggested by the property rights theory and Chinese laws and policies. First, because the propensity for Chinese officials to approve the creation of a WFOE varies by industry and by province, we estimate the MNL adding industry and province fixed effects. Secondly, we introduce interactions between our three main

[104] Carried out using the Stata module *opreg* (Yasar, Raciborski, Poi, 2008). Appendix 3A provides details on our use of the Olley-Pakes (1996) methodology and estimates of capital and labor coefficients at the two-digit CIC.

[105] The deflators are available at http://www.econ.kuleuven.be/public/N07057/CHINA/appendix/.

regressors and variables that capture regional or industrial variation in the outside options available to SFJV partners.

Our first interaction term is an interaction between our technology measure, distance from the domestic frontier, and a dummy variable indicating whether or not the Chinese partner has a central government or provincial government affiliation. Our hypothesis is that foreign partners in joint ventures with powerful government affiliation will be better compensated for any technological adaptations they make, should bargaining with their local partner break down. While certainly the foreign partner may have lower bargaining power if the Chinese partner has powerful connections, these connections also may raise the profits that flow from Chinese operations by blocking direct competition from domestic private firms, other foreign competitors, or other state firms. Indeed, some of the most successful joint ventures in China have powerful local partners. For example, one of the most successful overseas-funded industrial enterprises in China is Shanghai Volkswagen Co, Ltd., a joint venture between Volkswagen and the Shanghai government.

Our second interaction is an interaction between firm-level value added and a measure of the production manager's outside employment options. Our hypothesis is that in locations where managers have many options within the same industry, they will be willing to exert more effort within the relationship as they will be better compensated should bargaining break down. Our measure of the *manager's outside option* is the share of all firms in the manager's city that are in the same four-digit industry. Creation of this variable requires use of the full ASIF database as well as geo-coding of all enterprises in the database. The dataset provides six digit county codes where the first two digits represent the province, the second two the city, and finally the last two digits designate the county.

Our third interaction is an interaction between our measure of the value added by domestic marketing effort, share of domestic sales, and a measure of growth in the state share of sales in that four-digit industry between 1998 and 2000. Our hypothesis is that marketing effort will be more important in industries where the state is expanding operations rather than retreating.

4.5. Multinomial Logit Results

4.5.1. Testing the Property Rights Model

Regression coefficients and their standard errors from the MNL model are displayed in Table 4.3. Because SFJV is the reference form, the estimated coefficients reflect the effect of X_i on the likelihood of switching to organization form *i* relative to remaining as a joint venture. We begin by including in the MNL estimation only the three enterprise characteristics suggested by the property rights model. We add industry and then industry and province fixed effects, each in turn. We calculate both the Schwarz and the Aikake criterion for model selection, and find that the former favors the model without industry and province controls while the latter points to the model with both sets of fixed effects. Because both models lead to similar conclusions regarding tests of the property rights theory, we have no reason to favor one over the other.

Model (1) in Table 4.3 does not include industry or province controls. Looking at this first model, we see that the data strongly support the theoretical predictions, with one exception. Considering first the level of technology used by the enterprise, as measured by the distance between the venture's own TFP and the maximum of similar domestic operations, we find that relatively technologically advanced firms are significantly more likely

to become wholly foreign owned and significantly less likely to become wholly domestic owed than they are to remain joint ventures. This result is consistent with the hypothesis that foreign managers exert more effort transferring technology to their Chinese subsidiaries when they own the entire operation.

Moving down the column, we see that firms with larger value added, controlling for enterprise employment, are significantly more likely to become wholly foreign owned and less likely to become wholly domestic owned than they are to remain joint ventures. Again, this finding is consistent with the property rights theory, which predicts that managers will exert more effort when they also own the firm. We note that the theory predicted no difference between the managerial effort exerted in a SFJV and a wholly domestic enterprise and, in the absence of industry and province controls, we find the coefficient on log value added is insignificant in explaining the propensity of firms to become wholly domestically owned. We also note that the size of the firm, as measured by enterprise employment, is significant only for the transition to wholly domestic ownership: joint ventures that employ more workers are more likely to be acquired by their domestic partner than are smaller ventures. Employment size seems to play no role in the transition to wholly foreign owned.

Continuing with the next regressor in Table 4.3, domestic sales share, again we find the results consistent with the theoretical predictions. A large domestic sales share makes it significantly less likely that the SFJV will switch to a WFOE while a large domestic sales share makes it significantly more likely that the SFJV will become a wholly domestic firm. This result is consistent with the hypothesis that the Chinese partner is more willing to cultivate and use its domestic connections to gain domestic customers when it is assured residual rights to profits from these sales.

In model (2) we introduce two-digit industry controls. As mentioned above, because regulations and policies guiding the approval of foreign acquisitions varies by industry, the associations we have uncovered between transition probabilities and firm characteristics could be entirely industry specific. Importantly, the coefficients estimated with these controls for the three firm-level characteristics vary very little from those estimated without them. Indeed, some coefficients become more significant. The only unexpected result is that the negative coefficient estimated for log value added in the likelihood of switching to DOM becomes highly significant. As noted above, the theory suggests that this coefficient should be insignificantly different from zero and the fact that it is negative and highly significant poses an interesting puzzle. Strictly interpreted, the result suggests that Chinese managers are willing to exert less effort when the enterprise is fully domestically owned than when it is foreign owned. While outside the scope of this study, this finding suggests that there may be important differences in human resource management by foreign and domestic owners and that these differences influence the effort levels of managers.[106]

In model (3) we introduce both industry and province controls. Because only the largest projects require central government approval, provincial government policies may significantly influence the ability of firms to switch ownership forms. The introduction of provincial controls reduces the magnitude of our estimated coefficients somewhat, but no signs or significance levels are affected. Therefore, the general consistency of our MNL results with our theoretical predictions is maintained, even when we include both industry and province fixed effects.

[106] Yan and Warner (2002) discuss indigenous management practices, especially human resource management, and their relevance to the choice of organizational form for multinational firms.

Table 4.4 provides estimated elasticities and associated standard errors for the regression explanatory variables in Table 4.3, with respect to the probability share for each organization form. Looking at model (3), which includes both provincial and industry fixed effects, we find that changes in value added lead to the largest changes in the probability of switching from a SFJV. A one percentage change in value added, controlling for employment, reduces the probability of switching from a joint venture to a domestic firm by 0.93 percent while increasing the probability of becoming a WFOE by 0.67 percent. Raising productivity, relative to domestic firms in the same four-digit industry, by one percent boosts the likelihood of switching from a joint venture to a WFOE by 0.19 percent while decreasing the likelihood of the domestic partner buying out the foreign investor by 0.35 percent. A percent increase in the share of sales sold locally works in the opposite direction, however, raising the probability of switching to a wholly domestic firm by 0.56 percent while reducing the probability of becoming a wholly foreign owned enterprise by 0.25 percent.

4.5.2. Allowing for Differences across Firms and Markets

We use interaction terms to test whether differences in partner affiliation, local industrial concentration, and state ownership influence the decision to switch organizational forms. Table 4.5 provides the MNL estimates for this model, which interacts the three main regressors drawn from property rights theory with variables that attempt to capture aspects of each partner's outside options.

In model (1), we see that an interaction of technological distance with partner affiliation is negative and highly significant. Indeed, when the affiliation dummy takes the value of unity, distance from the domestic technology frontier is associated with a lower

rather than higher probability of switching from a joint venture to a WFOE. This result implies that foreign investors affiliated with central or provincial governments are less likely to buy out their domestic joint venture partner, controlling for enterprise productivity. Using the property rights theory as a lens, this suggests that powerful affiliation protects the property rights of foreign technology providers, perhaps by reducing local start-ups by former employees familiar with the technology. Powerful affiliation also makes it less likely that the joint venture will become wholly domestic owned, conditional on productivity, again suggesting a strengthening of the outside option for the foreign partner within the relationship. As seen in models (2) and (3) in Table 4.5, including industry fixed effects or industry and province fixed effects does not change these conclusions.

We interact the enterprise's value added with a measure of the Chinese manager's outside option: the density of own-industry firms located in the same city as the joint venture. Again using the property rights model as a lens, increases in own-industry density should make it easier for a manager to gain similar employment should Nash bargaining inside the joint venture break down. Consequently, increases in own-industry density should reduce the influence of value added on transition probabilities because manager effort is easier to obtain inside the SFJV relationship. Looking at model (1), we see that the estimates support this interpretation as the influence on value added on the transition probability is smaller for enterprises in cities with better outside options. For transitions to wholly foreign owned, the estimated coefficient is -0.874 and it is highly significant. When evaluated at the mean, enterprises with larger value added remain more likely to become WFOEs although this effect is smaller in cities with better outside options for managers. Interestingly, in the transition from SFJV to DOM, the interaction of value added and manager's outside option

is insignificant at the 5% level across all specifications. As in models estimated without interactions, higher value added makes it significantly more likely that the firm will remain a joint venture rather than become wholly domestic owned. Again, the motivation of managers inside wholly domestic firms appears to be different than that suggested by the property rights model.

Lastly, we include an interaction of the share of sales sold on domestic markets and the change in state share of industry sales.[107] The hypothesis is that in industries where state dominance is growing, having a Chinese partner is more important for a joint venture attempting to make local sales. For the transition to WFOE, this interaction is positive but insignificant across all models. For the transition to DOM, the interaction is significant when we add industry fixed effects or industry and province fixed effects. We conclude that increasing in state dominance of the industry does not significantly influence the value of having a domestic partner for firms selling to local markets.

4.6. Conclusions

Changes in policy and practice signaled by China's accession to the WTO offer a rare opportunity to observe how multinationals respond to changes in property rights in a developing country. WTO accession reduced incentives for multinational firms to form joint ventures with Chinese enterprises while simultaneously reducing constraints placed on operation of wholly owned subsidiaries. Changes in Chinese leadership also produced a more liberal investment environment for indigenous Chinese investors. An adaptation of the property rights model developed by Feenstra and Hanson (2005) suggests that higher the

[107] We also created a variable measuring the state share of downstream sales for the enterprise's industry, using the 2002 Chinese input-output table. This variable was never significant, as an interaction term or a regressor.

productivity and value added of the joint venture, but lower its domestic sales share, the more likely the joint venture will be to transition to a wholly foreign owned subsidiary following liberalization of the choice of organization form. The theory also suggests that enterprises with lower productivity but higher value added and domestic sales share will be more likely to be acquired by their Chinese partners, transitioning from joint ventures to wholly domestic firms.

Using newly created enterprise-level panel data on equity joint ventures and changes in registration type following China's WTO accession, we find evidence consistent with the property rights theory of organization form. Enterprises with higher productivity, measured by the distance of their estimated TFP from the maximum TFP of domestic firms in the same industry, are more likely to become WFOEs and less likely to become wholly domestic firms. This finding indicates that the decision by the Chinese leadership to liberalize its stance toward wholly foreign owned firms may indeed promote greater transfer of technology to China, as is its intent. While the foreign business community continues to question China's commitment to IPR protection, this finding does indicate that WTO accession created a regime change strong enough to alter incentives that guide the choice of multinationals' organizational form.[108]

We also find that joint ventures having affiliations with central or provincial governments are less likely to become wholly owned by their foreign partners, given the

[108] A recent and prominent criticism of China's stance toward IPR protection comes from Ian Bremmer, Chairman of the Eurasia Group, who voices the fears of Western multinationals when he states, "What China needs is technology, advanced technology, quite advanced technology. But Western corporations, increasingly, aren't willing to provide that level of technology, especially given how bad intellectual property protection and regulation is in China" (McKinsey Quarterly, 2010, p.3).

extent of their productivity advantage over domestic competitors. We have interpreted this result as an indication that powerful affiliations within China work to protect the intellectual property of the foreign partner and, thus, raise the effort they exert within the joint-venture and reduce the value of buying out of the relationship. This finding is consistent with views powerfully expressed and carefully supported by Yasheng Huang (2008), who argues that state-affiliated firms maintain an advantage over unaffiliated domestic entrepreneurs. It is possible that foreign firms, aided by state affiliation, are shielded from competition from indigenous start-ups. There are many dimensions to this issue that warrant further research, with policy implications stretching beyond foreign technology transfer to the promotion of indigenous entrepreneurship.

Our results also suggest that selling to local Chinese markets remains difficult for foreign firms without local connections. Perhaps this is to be expected in a society in which the rule of law is new, discretion in the application of the law remains great, and property rights are evolving rapidly. Nevertheless, the significant of domestic sales share as a predictor of which firms will choose to be wholly foreign or wholly domestic owned suggests that access to the Chinese market is certain to generate continuing WTO dispute settlement activity.

Taken together, our findings affirm the relevance of property rights and incomplete contracts as a determinant of firm behavior within China. While previous theory and empirics have focused on ownership and control over input search among export processing operations in China, we extend the literature to consider how evolving property rights alter decisions about ownership and control for enterprises serving, at least partially, the domestic Chinese market. Our results suggest that changing incentives for technology, production,

and marketing effort provide a useful guide to organizational choices made by both Chinese and foreign investors. They also indicate that improvements in contractibility influence firms in ways that depend on firm-level characteristics, a finding in keeping with the theoretical insights of Antràs and Helpman (2008), who also stress heterogeneity in firm response to improvement in property rights. They also support the contention that external commitment to liberalization of foreign business operations through rigorous WTO accession procedures influences multinational and indigenous firms' behavior. Embedded incentives for particular organizational forms, therefore, emerge as determinants of firms' response to evolving property rights.

Appendices

Appendix 2A: Balancing Tests, All Industries.

Variable	Sample	Mean OECD	Mean HMT	% Bias	% Reduction |Bias|	t-test t	t-test p > t
TFP	Unmatched	6.0541	5.8613	8.9		2.55	0.011
	Matched	6.0603	6.0958	-1.6	81.6	-0.46	0.648
Sales	Unmatched	10.184	10.00	8.8		2.51	0.012
	Matched	10.184	10.232	-2.3	74.1	-0.65	0.515
Sales Squared	Unmatched	108.31	104.18	12.9		3.72	0.000
	Matched	108.31	108.02	0.9	92.8	0.26	0.798
Capital per Worker	Unmatched	3.8455	3.6912	7.2		2.06	0.040
	Matched	3.8446	3.8854	-0.0	99.5	-0.01	0.992
Wage per Worker	Unmatched	2.2764	2.1825	8.7		2.50	0.013
	Matched	2.2767	2.2897	-1.2	86.1	-0.33	0.741
Age	Unmatched	1.5838	1.6173	-3.7		-1.07	0.287
	Matched	1.5836	1.5591	2.7	26.8	0.75	0.451
Age^2	Unmatched	3.3195	3.4195	-2.6		-0.75	0.455
	Matched	3.3192	3.1948	3.3	-24.5	1.00	0.318
Export Intensity	Unmatched	.33588	.34647	-2.5		-0.72	0.474
	Matched	.33610	.33622	-0.0	98.9	-0.01	0.994
State Equity Share	Unmatched	.48352	.44528	8.4		2.39	0.017
	Matched	.48058	.47684	0.8	90.2	0.231	0.821

Notes: Export intensity measured as (value of exports/total sales); Total factor productivity (TFP) measured using Levinsohn-Petrin (2003) method; All variables, other than those expressed as shares, are in the log form.

Appendix 2B: Industry Ranking by Domestic Content.

Two Digit CIC	Industry Name	DC
13	Processing of Food from Agricultural Products	0.943
15	Manufacture of Beverages	0.940
36	Manufacture of Special Purpose Machinery	0.925
31	Manufacture of Non-metallic Mineral Products	0.920
24	Manufacture of Articles For Culture, Education and Sport Activity	0.920
42	Manufacture of Artwork and Other Manufacturing	0.908
29	Manufacture of Rubber	0.871
23	Printing, Reproduction of Recording Media	0.859
17	Manufacture of Textile	0.857
26	Manufacture of Raw Chemical Materials and Chemical Products	0.853
28	Manufacture of Chemical Fibers	0.846
41	Manufacture of Measuring Instruments and Machinery for Cultural Activity and Office Work	0.838
27	Manufacture of Medicines	0.828
21	Manufacture of Furniture	0.824
37	Manufacture of Transport Equipment	0.810
33	Smelting and Pressing of Non-ferrous Metals	0.772
14	Manufacture of Foods	0.749
25	Processing of Petroleum, Coking, Processing of Nuclear Fuel	0.741
19	Manufacture of Leather, Fur, Feather and Related Products	0.740
22	Manufacture of Paper and Paper Products	0.732
39	Manufacture of Electrical Machinery and Equipment	0.727
32	Smelting and Pressing of Ferrous Metals	0.725
35	Manufacture of General Purpose Machinery	0.706
20	Processing of Timber, Manufacture of Wood, Bamboo, Rattan, Palm, and Straw Products	0.590
40	Manufacture of Communication Equipment, Computers and Other Electronic Equipment	0.585
18	Manufacture of Textile Wearing Apparel, Footwear, and Caps	0.584
34	Manufacture of Metal Products	0.455
30	Manufacture of Plastics	0.240

Source: Author's calculations.
Notes: See section 5.5 for details on calculation of domestic content (DC).

Appendix 2C: Number of Acquired Firms, By Industry.

Two Digit CIC	OECD	HMT
13	96	69
14	58	45
15	35	21
17	111	214
18	147	202
19	72	97
20	31	33
21	17	24
22	26	51
23	11	36
24	43	45
25	8	4
26	90	107
27	47	41
28	6	5
29	14	7
30	63	122
31	82	120
32	23	21
33	17	18
34	70	94
35	92	56
36	30	26
37	69	47
39	78	100
40	99	115
41	15	29
42	43	64
Total	1,493	1,813

Notes: The table reports number of acquired firms by two-digit Chinese Industrial Classification (CIC). Industry 16 "Tobacco Products and Processing" has been excluded. The numbers exclude firms that switch two-digit industry post-acquisition. All firms are on the common support.

Appendix 2D: Multinomial Logit Model of Number of Foreign Acquisitions, Textile Industry Only.

	OECD	HMT
TFP	0.058	-0.065**
	(0.061)	(0.031)
Sales	-0.132	-0.293***
	(0.217)	(0.083)
Sales Squared	0.017*	0.028***
	(0.010)	(0.004)
Capital per Worker	0.008	-0.068**
	(0.045)	(0.035)
Wage per Worker	0.014	0.096
	(0.083)	(0.059)
Age	0.049	0.059
	(0.187)	(0.299)
Age^2	-0.147***	-0.127
	(0.054)	(0.094)
Export Intensity	0.606***	0.391***
	(0.150)	(0.121
State Equity Share	1.217***	1.125***
	(0.133)	(0.118)
Constant	-7.273***	-5.077***
	(1.136)	(0.459)
Observations	116,074	
Log Likelihood	-4,958.49	
Pseudo-R^2	0.06	
Schwarz criterion	10,383.46	
Aikake criterion	9,996.98	

Notes: The base category are all firms not acquired by HMT or OECD investors; Bootstrapped standard errors in parentheses; Significant at * 10% , ** 5%, *** 1% levels; Export intensity measured as (value of exports/total sales); All regressions include year, region, and two-digit industry dummies; All explanatory variables, other than dummies or those expressed as shares, enter in the log form.

Appendix 2E: Balancing Tests, Textile Industry Only.

		Mean			% Reduction	t-test	
Variable	Sample	OECD	HMT	% Bias	|Bias|	t	p > t
TFP	Unmatched	5.9005	5.6039	16.8		2.06	0.040
	Matched	5.9005	6.9666	-3.8	77.7	-0.51	0.610
Real Sales	Unmatched	10.111	9.9761	8.0		0.98	0.326
	Matched	10.111	10.315	-12.0	-50.5	-1.70	0.090
Real Sales Squared	Unmatched	104.49	103.00	5.9		0.73	0.465
	Matched	104.49	107.84	-13.1	-123.7	-1.61	0.107
Capital per Worker	Unmatched	3.2972	3.2926	0.20		-0.03	0.977
	Matched	3.2972	3.5666	-14.3	-5,864.7	-1.87	0.062
Wage per Worker	Unmatched	2.1570	2.0777	9.1		1.16	0.245
	Matched	2.1570	2.1422	1.7	81.3	0.20	0.843
Age	Unmatched	1.5824	1.6586	-8.0		-1.01	0.314
	Matched	1.5824	1.5898	-0.4	94.7	-0.05	0.958
Age^2	Unmatched	3.3008	3.5974	-7.9		-0.95	0.344
	Matched	3.3008	3.1207	4.8	39.3	0.80	0.425
Export Intensity	Unmatched	0.51027	0.4515	13.3		1.68	0.094
	Matched	0.51027	0.4737	8.3	37.8	0.94	0.349
State Equity Share	Unmatched	0.41822	0.39699	4.8		0.60	0.550
	Matched	0.41822	0.41383	1.0	79.3	0.11	0.913

Notes: Export intensity measured as (value of exports/total sales); Total factor productivity (TFP) measured using Levinsohn-Petrin (2003) method; All variables, other than those expressed as shares, are in the log form; Textile industry is composed of two-digit CIC industries 17 (Manufacture of Textile) and 18 (Manufacture of Textile Wearing Apparel, Footwear, and Caps).

Appendix 3A: TFP Measure using Olley-Pakes (1996).

The Olley and Pakes (1996) method corrects for two issues that arise when calculating productivity as the residual from an OLS regression. First, OLS estimate of the production function leads to biased coefficients on labor due to simultaneity bias. Simultaneity bias arises since the variable input choice of a firm is positively correlated with its productivity. Firms will increase employment if they experience positive productivity shocks and vice versa. Fixed effects could be used to address this problem if we are willing to assume that the productivity shocks do not vary over time.

Second, sample selection bias arises when using OLS due to the exit of firms because of adverse productivity shocks. For example, if more productive firms are also more capital intensive, they will be able to better withstand periods of low or negative productivity shocks in anticipation of future profitability so that OLS estimation of the capital coefficient will be biased downwards. The Olley and Pakes methodology uses investment as a proxy for unobserved productivity to address these two issues and obtain consistent estimates of the labor and capital coefficients.

Input coefficients are calculated for each two digit industry under the Chinese Industrial Classification system. Then these coefficients are used to calculate the log TFP of each enterprise as:

$$tfp_f = va_f - \hat{\beta}_l l - \hat{\beta}_k k$$

where value added and the input coefficients are in logs and $\widehat{\boldsymbol{\beta}}_{\boldsymbol{l}}\boldsymbol{l}$ and $\widehat{\boldsymbol{\beta}}_{\boldsymbol{k}}$ are estimated under the Olley and Pakes methodology. As expected, OLS produces larger estimates of the labor coefficients but smaller capital coefficients than the Olley and Pakes method.

Appendix 3B: Own and Cross Type Localization Spillovers.

Dependent Variable: Log of Enterprise TFP (Olley-Pakes)

	STATE OWNED		**PRIVATE OWNED**		**FOREIGN OWNED**	
	(1)	(2)	(1)	(2)	(1)	(2)
Log Own Industry Employment						
(State-owned)	0.014***	0.013***	-0.001	-0.004	0.001	0.002
	(0.004)	(0.003)	(0.002)	(0.003)	(0.001)	(0.002)
(Private-owned)	0.031***	0.032***	0.025***	0.026***	0.010***	0.012***
	(0.003)	(0.004)	(0.001)	(0.007)	(0.002)	(0.003)
(Foreign-owned)	-0.001	0.002	0.002	0.002	0.014***	0.014***
	(0.004)	(0.004)	(0.001)	(0.003)	(0.002)	(0.002)
Year, City, 4-Digit Industry Dummies	Y	-	Y	-	Y	-
City*Year Dummies	-	Y	-	Y	-	Y
4-Digit Industry Dummies	-	Y	-	Y	-	Y
Adjusted R^2	0.47	0.47	0.49	0.46	0.54	0.55
# Enterprises	58,879	58,879	1,092,188	1,092,188	334,888	334,888

Notes: Standard errors in parentheses are robust and clustered at the 4-Digit Industry level; ***Significant at the 1% level; **Significant at the 5% level; *Significant at the 10% level; Industry 16 "Tobacco Products Processing" has been excluded.

Appendix 3C: Own and Cross Type Localization Spillovers, by Source of Foreign Investment.

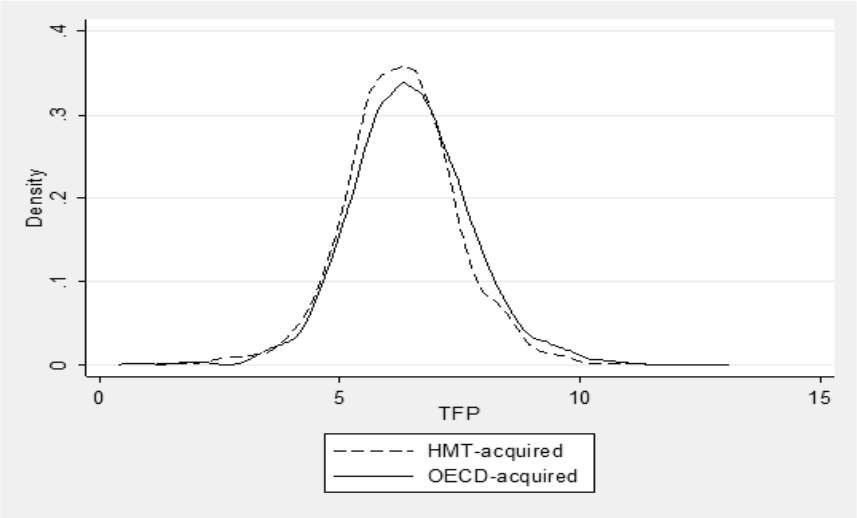
Dependent Variable: Log of Enterprise TFP (Olley-Pakes)

	STATE OWNED		**PRIVATE OWNED**		**ETHNICALLY CHINESE OWNED**		**NON-ETHNICALLY CHINESE OWNED**	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Log Own Industry Employment								
(State-owned)	0.014***	0.014***	-0.001	-0.004	0.001	0.003	0.001	0.002
	(0.004)	(0.003)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
(Private-owned)	0.031***	0.032***	0.024***	0.026***	0.008***	0.011***	0.012***	0.013***
	(0.003)	(0.004)	(0.001)	(0.007)	(0.002)	(0.003)	(0.002)	(0.003)
(Ethnically Chinese-owned)	0.005	0.005	0.001	-0.001	0.013***	0.013***	0.004**	0.004**
	(0.05)	(0.005)	(0.001)	(0.003)	(0.002)	(0.005)	(0.002)	(0.002)
(Non-ethnically Chinese-owned)	-0.007*	-0.004	0.001	0.004**	0.001	0.002	0.014***	0.014***
	(0.004)	(0.004)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)
Year, City, 4-Digit Industry Dummies	Y	-	Y	-	Y	-	Y	-
City*Year Dummies	-	Y	-	Y	-	Y	-	Y
4-Digit Industry Dummies	-	Y	-	Y	-	Y	-	Y
Adjusted R^2	0.47	0.47	0.49	0.46	0.56	0.58	0.52	0.53
# Enterprises	58,879	58,879	1,092,188	1,092,188	178,933	178,933	155,955	155,955

Notes: Standard errors in parentheses are robust and clustered at the 4-Digit Industry level; ***Significant at the 1% level; **Significant at the 5% level;*Significant at the 10% level; Industry 16 "Tobacco Products Processing" has been excluded.

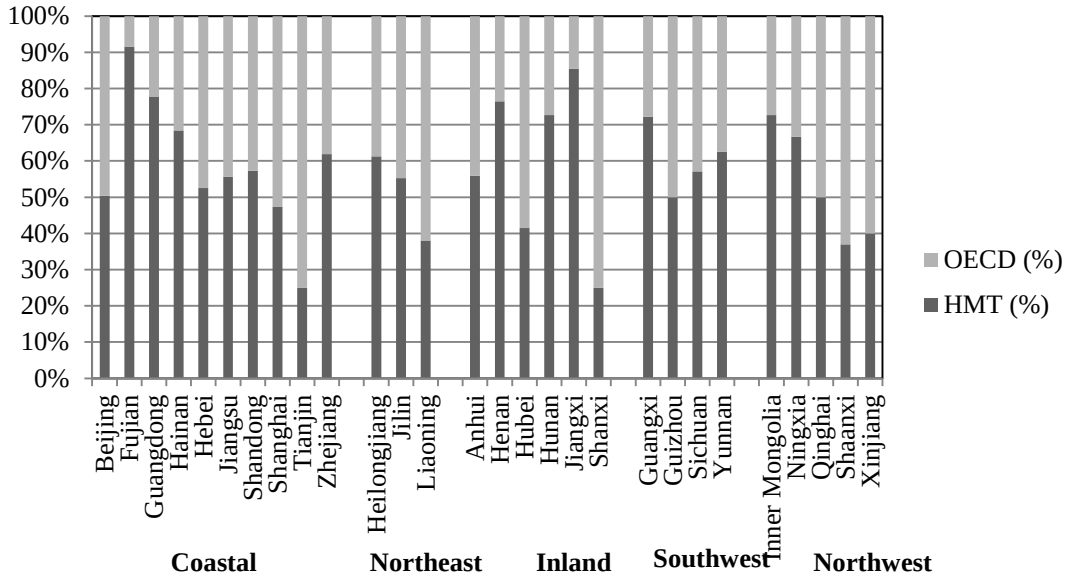
Figures and Tables

Figure 2.1: TFP Distribution of Acquired Firms in the Pre-Acquisition Period.



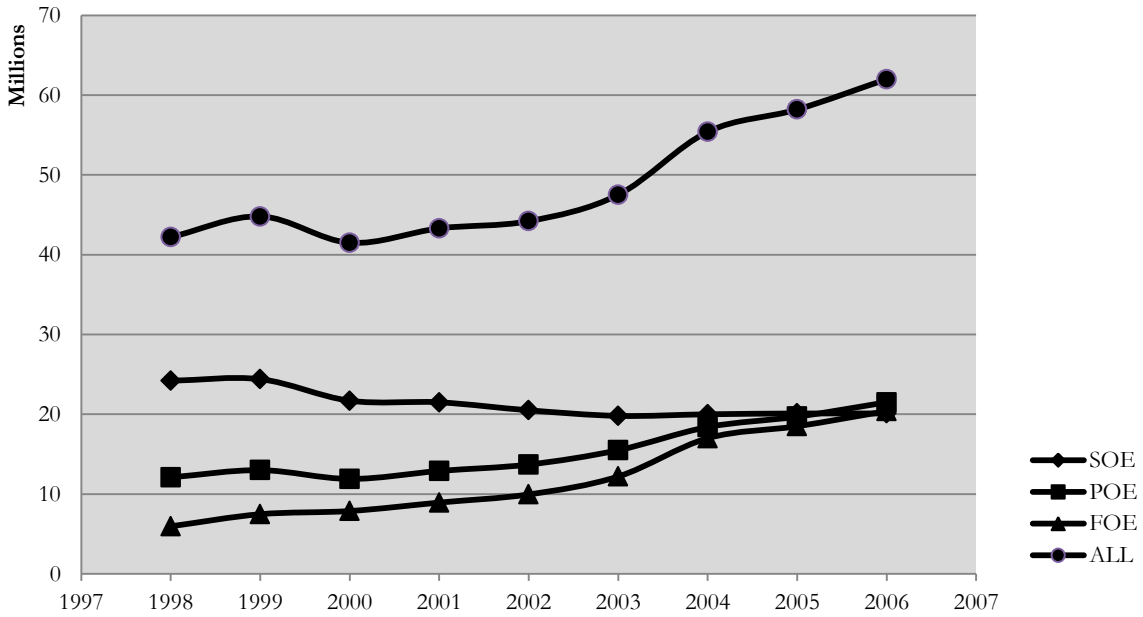
Notes: TFP measured using the Levinsohn-Petrin (2003) method.

Figure 2.2: Source Distribution of Foreign Projects, By Province, 1993 – 1996.



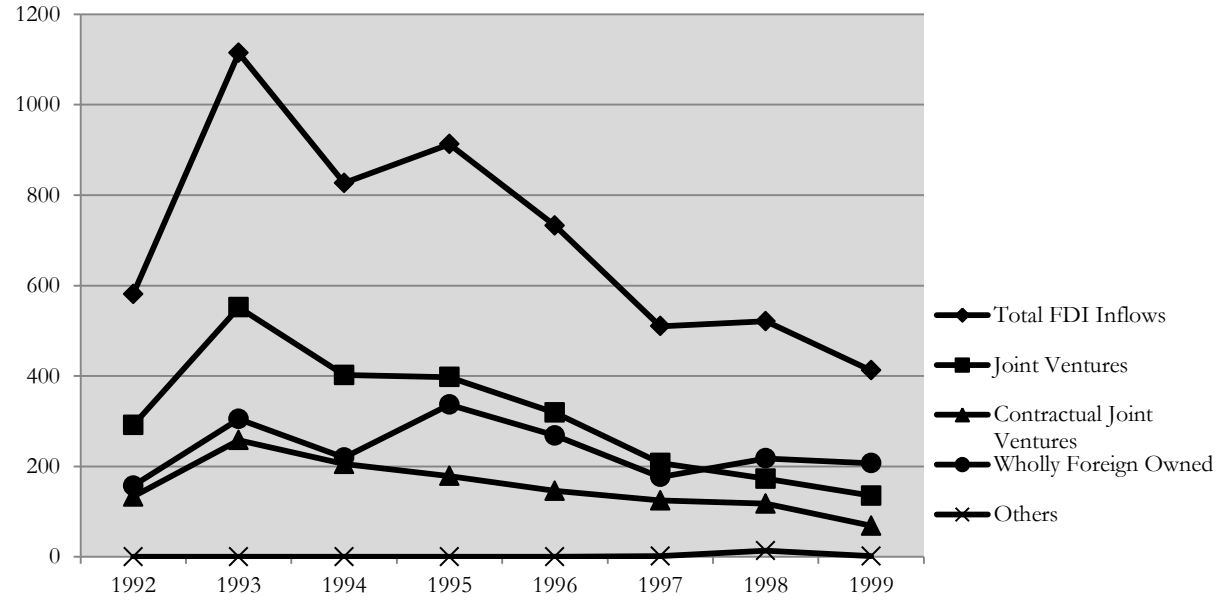
Source: Dean, Lovely, Wang (2005).

Figure 3.1: Employment by Ownership Type, 1998-2006.



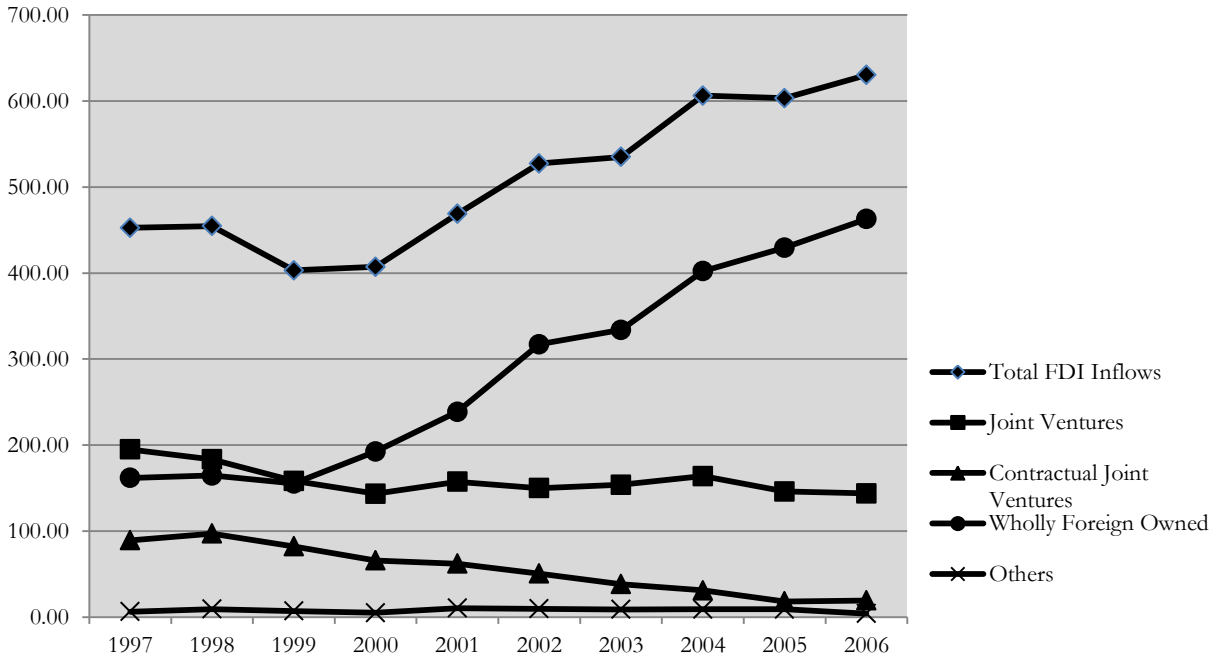
Source: Author's calculations.
Notes: SOE (state-owned enterprises), POE (private-owned enterprises), FOE (foreign-owned enterprises); ALL (all enterprises).

Figure 4.1 (a): Contracted FDI Inflows to China by Registration Type, 1992 – 1999 (in 100 million USD).



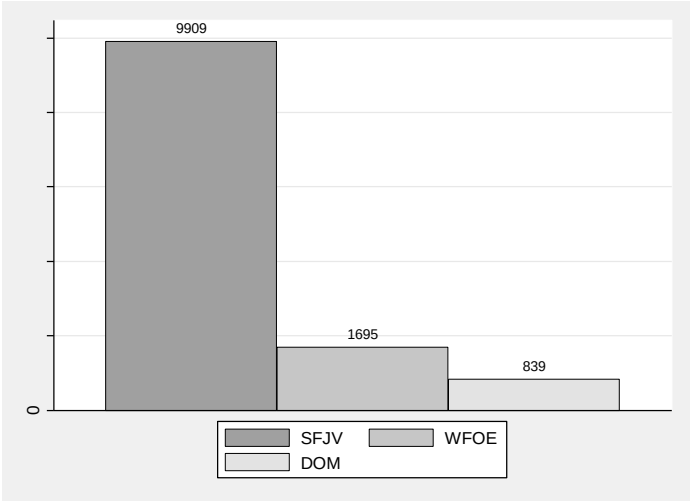
Source: China Statistical Yearbook (Beijing: China Statistics Press), various years.
Notes: "Others" include Foreign Investment Share Enterprises, Cooperative Development, and Others.

Figure 4.1 (b): Utilized FDI Inflows to China by Registration Type, 1997 – 2006 (in 100 million USD).



Source: China Statistical Yearbook (Beijing: China Statistics Press), various years.
Notes: "Others" include Foreign Investment Share Enterprises, Cooperative Development, and Others.

Figure 4.2: Sino-Foreign Joint Ventures by Initial Ownership and Transition State by 2006.



Notes: Sino-foreign joint venture (SFJV); Wholly foreign-owned (WFOE); Wholly domestic-owned (DOMESTIC).

Table 2.1: Actually Utilized FDI from OECD Countries (%).

	1998	1999	2000	2001	2002	2003	2004	2005	2006
United States	16.51%	22.30%	22.41%	17.68%	18.20%	13.46%	10.25%	7.73%	7.15%
Japan	14.40%	17.99%	17.38%	13.56%	11.41%	10.90%	14.18%	16.48%	11.48%
Germany	3.12%	7.26%	5.32%	4.84%	3.11%	2.75%	2.75%	3.86%	4.94%
United Kingdom	4.97%	5.53%	5.95%	4.20%	3.01%	2.38%	2.06%	2.43%	1.81%
France	3.03%	4.68%	4.36%	2.12%	1.93%	1.94%	1.71%	1.55%	0.96%
Denmark	0.27%	0.45%	0.25%	0.22%	0.24%	0.14%	0.17%	0.25%	0.48%
Switzerland	0.97%	1.31%	0.99%	0.82%	0.67%	0.58%	0.53%	0.52%	0.49%
Canada	1.34%	1.66%	1.43%	1.76%	1.97%	1.81%	1.60%	1.15%	1.06%
Australia	1.15%	1.39%	1.58%	1.34%	1.28%	1.90%	1.72%	1.01%	1.38%
Austria	0.09%	0.12%	0.12%	0.23%	0.23%	0.30%	0.25%	0.19%	0.37%
Belgium	0.12%	0.44%	0.29%	0.08%	0.42%	0.35%	0.21%	0.14%	0.20%
Czech Republic	0.02%	0.07%	0.05%	0.02%	0.05%	0.04%	0.09%	0.01%	0.05%
Finland	0.17%	0.36%	0.31%	0.29%	0.22%	0.10%	0.07%	0.05%	0.14%
Greece	0.00%	0.00%	0.07%	0.03%	0.02%	0.01%	0.07%	0.00%	0.00%
Hungary	0.05%	0.06%	0.05%	0.09%	0.07%	0.08%	0.13%	0.11%	0.08%
Iceland	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%
Ireland	0.00%	0.02%	0.00%	0.01%	0.04%	0.03%	0.01%	0.02%	0.06%
Italy	1.16%	0.99%	1.07%	0.88%	0.59%	1.01%	0.73%	0.81%	0.87%
Korea	7.63%	6.74%	7.61%	8.58%	9.13%	14.39%	16.25%	13.04%	9.73%
Luxembourg	0.05%	0.02%	0.12%	0.11%	0.05%	0.56%	0.07%	0.36%	0.24%
Mexico	0.01%	0.00%	0.00%	0.01%	0.02%	0.02%	0.06%	0.02%	0.03%
Netherlands	3.04%	2.87%	4.04%	3.10%	1.92%	2.33%	2.11%	2.63%	2.10%
New Zealand	0.11%	0.10%	0.09%	0.19%	0.15%	0.21%	0.30%	0.33%	0.21%
Norway	0.11%	0.10%	0.12%	0.02%	0.10%	0.06%	0.00%	0.07%	0.03%
Poland	0.00%	0.02%	0.02%	0.01%	0.01%	0.01%	0.01%	0.02%	0.02%
Portugal	0.04%	0.04%	0.02%	0.10%	0.03%	0.01%	0.09%	0.01%	0.02%
Slovak Republic	0.01%	0.00%	0.00%	0.05%	0.00%	0.04%	0.01%	0.00%	0.00%
Spain	0.23%	0.09%	0.17%	0.14%	0.31%	0.29%	0.39%	0.50%	0.59%
Sweden	0.56%	0.82%	0.81%	0.34%	0.33%	0.39%	0.31%	0.28%	0.51%
Turkey	0.00%	0.02%	0.01%	0.01%	0.01%	0.04%	0.02%	0.06%	0.03%
Total OECD Share in non-HMT Total	59.16%	75.47%	74.67%	60.84%	55.54%	56.11%	56.15%	53.65%	45.04%

Source: Author's calculations, China Statistical Yearbook (various years).
Note: The table reports the percentage share of actually utilized FDI in the non-HMT total.

Table 2.2: Multinomial Logit Model of Foreign Acquisitions, All Industries.

	OECD	HMT
TFP	0.007	-0.004
	(0.017)	(0.017)
Sales	-0.321***	-.253***
	(0.039)	(0.041)
Sales Squared	0.028***	0.023***
	(0.002)	(0.002)
Capital per Worker	-0.018	-0.035*
	(0.018)	(0.002)
Wage per Worker	0.138***	0.061*
	(0.028)	(0.034)
Age	0.169	0.148
	(0.129)	(0.115)
Age^2	-0.204***	-0.182***
	(0.039)	(0.037)
Export Intensity	0.789***	0.749***
	(0.071)	(0.063)
State Equity Share	1.123***	1.097***
	(0.075)	(0.067)
Constant	-6.310***	-6.224***
	(0.257)	(0.246)
Observations	942,771	
Log Likelihood	-26,493.76	
Pseudo-R^2	0.08	
Schwarz criterion	53,661.59	
Aikake criterion	53,085.52	

Notes: The base category are all firms not acquired by HMT or OECD investors; Bootstrapped standard errors in parentheses; Significant at * 10% , ** 5%, *** 1% levels; Export intensity measured as (value of exports/total sales); All regressions include year, region, and two-digit industry dummies; All explanatory variables, other than dummies or those expressed as shares, enter in the log form.

Table 2.3: Matching Difference-in-Differences Results for Productivity.

Log (TFP)

Year (t)	Matching Estimate†	Bootstrapped Std. Error	Z-Stat	Matched Pairs
Year of Acquisition	0.123*	0.064	1.922	1,493
One Year After	0.111*	0.062	1.780	1,493
Two Years After	0.245**	0.083	2.947	1,493

Log (Labor Productivity)

Year (t)	Matching Estimate†	Bootstrapped Std. Error	Z-Stat	Matched Pairs
Year of Acquisition	0.177**	0.083	2.130	1,493
One Year After	0.153**	0.069	2.219	1,493
Two Years After	0.224**	0.086	2.592	1,493

Notes: †$\frac{1}{n}\sum_{n\epsilon OECD}[(Y_t^{OECD}-Y_u^{OECD})-(Y_t^{HMT}-Y_u^{HMT})]$where u is the pre-acquisition year; Bootstrapped standard errors in parenthesis using 100 repetitions; *, **, ** indicate statistical significance at the 10, 5, and 1% levels, respectively.

Table 2.4: Matching Difference-in-Differences Results, HMT-dense provinces.

Log (Profits)

Year (t)	Matching Estimate†	Bootstrapped Std. Error	Z-Stat	Matched Pairs
Year of Acquisition	-0.056	0.254	0.221	350
One Year After	0.253	0.261	0.969	350
Two Years After	0.741**	0.320	2.316	350

Log (TFP)

Year (t)	Matching Estimate†	Bootstrapped Std. Error	Z-Stat	Matched Pairs
Year of Acquisition	-0.008	0.175	0.046	350
One Year After	0.061	0.135	0.452	350
Two Years After	0.142	0.190	0.747	350

Notes: †$\frac{1}{n}\sum_{n\epsilon OECD}[(Y_t^{OECD}-Y_u^{OECD})-(Y_t^{HMT}-Y_u^{HMT})]$where u is the pre-acquisition year; Bootstrapped standard errors in parenthesis using 100 repetitions; *, **, ** indicate statistical significance at the 10, 5, and 1% levels, respectively. Total factor productivity (TFP) measured using Levinsohn-Petrin (2003) method.

Table 2.5: Matching Difference-in-Differences Results for Productivity, by Target Ownership Type.

Private-owned firms

Year (t)	Matching Estimate†	Bootstrapped Std. Error	Z-Stat	Matched Pairs
Year of Acquisition	0.129	0.128	1.008	711
One Year After	0.132	0.106	1.245	711
Two Years After	0.199*	0.129	1.543	711

State-owned firms

Year (t)	Matching Estimate†	Bootstrapped Std. Error	Z-Stat	Matched Pairs
Year of Acquisition	0.117	0.092	1.272	782
One Year After	0.093	0.093	1.000	782
Two Years After	0.287*	0.102	2.814	782

Notes: †$\frac{1}{n}\sum_{n\epsilon OECD}[(Y_t^{OECD}-Y_u^{OECD})-(Y_t^{HMT}-Y_u^{HMT})]$where u is the pre-acquisition year; Bootstrapped standard errors in parenthesis using 100 repetitions; *, **, ** indicate statistical significance at the 10, 5, and 1% levels, respectively. Log total factor productivity (TFP) measured using Levinsohn-Petrin (2003) method.

Table 2.6: Matching Difference-in-Differences Results for non-TFP Outcomes.

Year (t)	Matching Estimate†	Bootstrapped Std. Error	Z-Stat	Matched Pairs
(a) Log (Profits)				
Year of Acquisition	0.266**	0.113	2.354	1,493
One Year After	0.353**	0.125	2.817	1,493
Two Years After	0.523***	0.136	3.833	1,493
(b) Log (Average Wage)				
Year of Acquisition	0.143***	0.039	3.717	1,493
One Year After	0.117***	0.041	2.818	1,493
Two Years After	0.128***	0.041	3.111	1,493
(c) Log (Employment)				
Year of Acquisition	0.018	0.039	0.479	1,493
One Year After	0.037	0.039	0.962	1,493
Two Years After	0.084*	0.048	1.763	1,493
(d) Log (Capital per Worker)				
Year of Acquisition	0.215***	0.062	3.477	1,493
One Year After	0.259***	0.068	3.782	1,493
Two Years After	0.214***	0.065	3.280	1,493
(e) Export Intensity				
Year of Acquisition	0.005	0.011	0.436	1,493
One Year After	0.007	0.012	0.524	1,493
Two Years After	0.005	0.012	0.386	1,493
(f) Innovation Intensity				
Year of Acquisition	0.008	0.008	0.994	720
One Year After	0.004	0.008	0.574	1,109
Two Years After	0.001	0.008	0.067	1,192

Notes: †$\frac{1}{n}\sum_{n\epsilon OECD}[(Y_t^{OECD}-Y_u^{OECD})-(Y_t^{HMT}-Y_u^{HMT})]$where u is the pre-acquisition year; Bootstrapped standard errors in parenthesis using 100 repetitions; *, **, ** indicate statistical significance at the 10, 5, and 1% levels, respectively. Export intensity measured as (value of exports/total sales); Innovation intensity measured as (new product output value/total sales).

Table 2.7: Matching Difference-in-Differences Results for Productivity, By Industry Grouping.

(a) *High Domestic Content Industries*

Year (t)	Matching Estimate†	Bootstrapped Std. Error	Z-Stat	Matched Pairs
Year of Acquisition	0.186*	0.089	2.113	726
One Year After	0.127	0.089	1.427	726
Two Years After	0.254**	0.119	2.136	726

(b) *Low Domestic Content Industries*

Year (t)	Matching Estimate†	Bootstrapped Std. Error	Z-Stat	Matched Pairs
Year of Acquisition	0.063	0.121	0.515	767
One Year After	0.097	0.100	0.975	767
Two Years After	0.236*	0.142	1.657	767

Notes: †$\frac{1}{n}\sum_{n\epsilon OECD}[(Y_t^{OECD}-Y_u^{OECD})-(Y_t^{HMT}-Y_u^{HMT})]$where u is the pre-acquisition year; Bootstrapped standard errors in parenthesis using 100 repetitions; *, **, ** indicate statistical significance at the 10, 5, and 1% levels, respectively. Log total factor productivity (TFP) measured using Levinsohn-Petrin (2003) method.

Table 2.8: Matching Difference-in-Differences Results for Productivity, Textile Industry Only.

Log (TFP)

Year (t)	Matching Estimate†	Bootstrapped Std. Error	Z-Stat	Matched Pairs
Year of Acquisition	0.181*	0.099	1.814	258
One Year After	0.137	0.129	1.062	258
Two Years After	0.150	0.103	0.103	258

Log (Labor Productivity)

Year (t)	Matching Estimate†	Bootstrapped Std. Error	Z-Stat	Matched Pairs
Year of Acquisition	0.197*	0.121	1.630	258
One Year After	0.070	0.134	0.526	258
Two Years After	0.068	0.120	0.568	258

Notes: †$\frac{1}{n}\sum_{n\epsilon OECD}[(Y_t^{OECD}-Y_u^{OECD})-(Y_t^{HMT}-Y_u^{HMT})]$where u is the pre-acquisition year; Bootstrapped standard errors in parenthesis using 100 repetitions; *, **, ** indicate statistical significance at the 10, 5, and 1% levels, respectively; Total factor productivity (TFP) measured using Levinsohn-Petrin (2003) method; Labor productivity measured as value added per worker; Textile industry is composed of two-digit CIC industries 17 (Manufacture of Textile) and 18 (Manufacture of Textile Wearing Apparel, Footwear, and Caps).

Table 3.1: Interactions Between Ownership Types.

	Enterprise Ownership Type		
Own-Industry Activity In:	**State Owned**	**Private Owned**	**Foreign Owned**
State Owned	+	?	?
Private Owned	+/-	+	?
Foreign Owned	+/-	+/-	+

Table 3.2: Distribution of Enterprises by Number of Plants (percentage), 1998-2006.

Year	Single-Plant Firms	Firms with 2 Plants	Firms with 3 or more Plants
1998	96.69	1.43	1.88
1999	95.58	1.40	3.02
2000	97.09	1.15	1.76
2001	95.35	1.89	2.76
2002	94.97	2.30	2.73
2003	96.76	1.49	1.75
2004	95.60	2.42	1.98
2005	97.00	1.57	1.43
2006	97.40	1.38	1.22

Source: Author's calculations.
Notes: Enterprises with missing information on number of plants have been excluded.

Table 3.3: Percentage Share of Employment Represented by Single-Plant Enterprises Within Each Ownership Type, 1998-2006.

Year	**SOE**	**POE**	**ECE**	**non-ECE**
1998	79	94	99	99
1999	75	94	98	98
2000	77	95	99	98
2001	64	89	97	95
2002	65	90	96	94
2003	76	95	98	98
2004	67	92	96	93
2005	72	94	97	96
2006	73	95	97	94

Source: Author's calculations.
Notes: Enterprises with missing information on number of plants have been excluded; SOE (state-owned enterprises), POE (private-owned enterprises), ECE (enterprises from Hong Kong, Macao, Taiwan), non-ECE (enterprises from all other countries).

Table 3.4: Differentials of Characteristics Between Enterprises Under Three Ownership Types.

A. Comparing state-owned and private-owned enterprises

Outcome Variable	1998	1999	2000	2001	2002	2003	2004	2005	2006
ln(Output)	0.67	0.66	0.59	0.53	0.51	0.39	0.52	0.23	0.12
ln(Exporting value)	0.24	0.19	0.13	0.09	0.03	-0.03	-0.18	-0.30	-0.42
ln(Value added per Worker)	1.02	0.96	0.96	0.86	0.83	0.78	0.73	0.65	0.62
ln(New product output value per worker)	0.70	0.70	0.73	0.77	0.71	0.69	-	0.58	0.54
ln(Wage per worker)	0.21	0.14	0.19	0.11	0.07	0.05	-0.02	-0.05	-0.05
ln(Capital per Worker)	-0.16	-0.24	-0.18	-0.27	-0.27	-0.27	-0.20	-0.22	-0.20

B. Comparing state-owned and foreign-owned enterprises

Outcome Variable	1998	1999	2000	2001	2002	2003	2004	2005	2006
ln(Output)	1.12	1.12	1.11	1.04	1.02	0.92	1.09	0.80	0.72
ln(Exporting value)	0.72	0.67	0.64	0.56	0.58	0.45	0.39	0.25	0.14
ln(Value added per Worker)	1.28	1.21	1.20	1.08	1.03	0.93	0.83	0.75	0.70
ln(New product output value per worker)	1.47	1.42	1.52	1.28	1.17	1.15	-	0.72	0.73
ln(Wage per worker)	0.58	0.53	0.54	0.45	0.40	0.36	0.25	0.21	0.21
ln(Capital per Worker)	0.60	0.51	0.47	0.38	0.32	0.26	0.30	0.21	0.20

C. Comparing private-owned and foreign-owned enterprises

Outcome Variable	1998	1999	2000	2001	2002	2003	2004	2005	2006
ln(Output)	0.45	0.46	0.52	0.51	0.50	0.53	0.58	0.57	0.60
ln(Exporting value)	0.49	0.48	0.52	0.47	0.55	0.48	0.57	0.55	0.55
ln(Value added per Worker)	0.26	0.26	0.23	0.22	0.20	0.15	0.10	0.09	0.08
ln(New product output value per worker)	0.76	0.72	0.80	0.51	0.47	0.47	-	0.15	0.19
ln(Wage per worker)	0.37	0.39	0.34	0.34	0.32	0.31	0.27	0.26	0.26
ln(Capital per Worker)	0.76	0.74	0.65	0.65	0.58	0.53	0.50	0.43	0.40

Notes: Tables A, B, and C report the coefficients of Ownership Type dummy in (3.4.1); All coefficients are significant at the 1% level.

Table 3.5: Own and Cross Type Localization Spillovers.

Dependent Variable: Log of Enterprise Value Added

	STATE OWNED		PRIVATE OWNED		FOREIGN OWNED	
	(1)	(2)	(1)	(2)	(1)	(2)
Log Own Industry Employment						
(State-owned)	0.013***	0.013***	-0.001	-0.001	0.000	0.002
	(0.003)	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)
(Private-owned)	0.029***	0.030***	0.020***	0.019***	0.005***	0.007***
	(0.003)	(0.003)	(0.001)	(0.001)	(0.002)	(0.002)
(Foreign-owned)	0.000	0.002	0.001	0.002**	0.014***	0.014***
	(0.004)	(0.004)	(0.001)	(0.001)	(0.002)	(0.002)
Log Production Inputs						
Labor	0.722***	0.708***	0.512***	0.520***	0.548***	0.559***
	(0.018)	(0.018)	(0.006)	(0.006)	(0.007)	(0.007)
Capital	0.296***	0.306***	0.249***	0.244***	0.316***	0.311***
	(0.015)	(0.015)	(0.003)	(0.003)	(0.008)	(0.008)
Year, City, 4-Digit Industry Dummies	Y	-	Y	-	Y	-
City*Year Dummies	-	Y	-	Y	-	Y
4-Digit Industry Dummies	-	Y	-	Y	-	Y
Adjusted R^2	0.71	0.71	0.48	0.49	0.51	0.54
# Enterprises	58,879	58,879	1,092,188	1,092,188	334,888	334,888

Notes: Standard errors in parentheses are robust and clustered at the 4-Digit Industry level; ***Significant at the 1% level; **Significant at the 5% level; *Significant at the 10% level; Industry 16 "Tobacco Products Processing" has been excluded.

Table 3.6: Own and Cross Type Localization Spillovers Differentiating Between Private and Collective Owned Enterprises.

Dependent Variable: Log of Enterprise Value Added

	STATE OWNED	
	(1)	(2)
Log Own Industry Employment		
(State-owned)	0.014***	0.012***
	(0.003)	(0.003)
(Private-owned)	0.029***	0.027***
	(0.004)	(0.004)
(Collective-owned)	-	0.012***
		(0.003)
(Foreign-owned)	0.002	0.000
	(0.004)	(0.003)
Log Production Inputs		
Labor	0.711***	0.709***
	(0.020)	(0.018)
Capital	0.305***	0.305***
	(0.015)	(0.015)
City*Year Dummies	Y	Y
4-Digit Industry Dummies	Y	Y
Adjusted R^2	0.71	0.71
# Enterprises	58,879	58,879

Notes: Standard errors in parentheses are robust and clustered at the 4-Digit Industry level; ***Significant at the 1% level; **Significant at the 5% level; *Significant at the 10% level; Industry 16 "Tobacco Products Processing" has been excluded.

Table 3.7: Own and Cross Type Localization Spillovers, by Source of Foreign Investment.

Dependent Variable: Log of Enterprise Value Added.

	STATE OWNED		PRIVATE OWNED		ETHNICALLY CHINESE OWNED		NON-ETHNICALLY CHINESE OWNED	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Log Own Industry Employment								
(State-owned)	0.014***	0.013***	-0.001	-0.001	-0.001	0.001	0.002	0.002
	(0.003)	(0.004)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
(Private-owned)	0.029***	0.030***	0.020***	0.019***	0.001	0.004**	0.008***	0.009***
	(0.003)	(0.003)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
(Ethnically Chinese-owned)	0.006	0.006	-0.000	0.001	0.013***	0.013***	0.003	0.003
	(0.004)	(0.004)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
(Non-ethnically Chinese-owned)	-0.007*	-0.004	0.000	0.002*	0.001	0.001	0.014***	0.015***
	(0.004)	(0.004)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Log Production Inputs								
Labor	0.721***	0.708***	0.512***	0.520***	0.562***	0.579***	0.542***	0.546***
	(0.018)	(0.018)	(0.006)	(0.006)	(0.007)	(0.007)	(0.008)	(0.009)
Capital	0.296***	0.306***	0.249***	0.244***	0.289***	0.282***	0.327***	0.326***
	(0.015)	(0.015)	(0.003)	(0.003)	(0.007)	(0.007)	(0.009)	(0.009)
Year, City, 4-Digit Industry Dummies	Y	-	Y	-	Y	-	Y	-
City*Year Dummies	-	Y	-	Y	-	Y	-	Y
4-Digit Industry Dummies	-	Y	-	Y	Y	Y	Y	Y
Adjusted R^2	0.71	0.71	0.48	0.49	0.48	0.50	0.53	0.54
# Enterprises	58,879	58,879	1,092,188	1,092,188	178,933	178,933	155,955	155,955

Notes: Standard errors in parentheses are robust and clustered at the 4-Digit Industry level; ***Significant at the 1% level; **Significant at the 5% level;*Significant at the 10% level; Industry 16 "Tobacco Products Processing" has been excluded.

Table 3.8: Own and Cross Type Localization Spillovers (single-plant firms only).

Dependent Variable: Log of Enterprise Value Added

	STATE OWNED		**PRIVATE OWNED**		**FOREIGN OWNED**	
	(1)	(2)	(1)	(2)	(1)	(2)
Log Own Industry Employment						
(State-owned)	0.014***	0.013***	-0.000	-0.000	0.003*	0.004***
	(0.004)	(0.004)	(0.001)	(0.001)	(0.001)	(0.001)
(Private-owned)	0.032***	0.032***	0.018***	0.017***	0.001	0.005***
	(0.004)	(0.004)	(0.001)	(0.001)	(0.002)	(0.002)
(Foreign-owned)	-0.004	-0.002	-0.000	0.001	0.015***	0.014***
	(0.004)	(0.004)	(0.001)	(0.001)	(0.002)	(0.002)
Log Production Inputs						
Labor	0.729***	0.716***	0.475***	0.483***	0.547***	0.559***
	(0.019)	(0.019)	(0.006)	(0.006)	(0.007)	(0.007)
Capital	0.280***	0.290***	0.236***	0.231***	0.312***	0.307***
	(0.016)	(0.016)	(0.003)	(0.003)	(0.007)	(0.008)
Year, City, 4-Digit Industry Dummies	Y	-	Y	-	Y	-
City*Year Dummies	-	Y	-	Y	-	Y
4-Digit Industry Dummies	-	Y	-	Y	-	Y
Adjusted R^2	0.68	0.68	0.42	0.44	0.50	0.51
# Enterprises	45,744	45,744	769,860	769,860	300,736	300,736

Notes: Standard errors in parentheses are robust and clustered at the 4-Digit Industry level; ***Significant at the 1% level; **Significant at the 5% level;*Significant at the 10% level; Industry 16 "Tobacco Products Processing" has been excluded.

Table 3.9: Own and Cross Type Localization Spillovers, by Source of Foreign Investment (single-plant firms only).

Dependent Variable: Log of Enterprise Value Added

	STATE OWNED		PRIVATE OWNED		ETHNICALLY CHINESE OWNED		NON-ETHNICALLY CHINESE OWNED	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Log Own Industry Employment								
(State-owned)	0.014***	0.013***	0.000	-0.000	0.001	0.002	0.004*	0.005***
	(0.004)	(0.004)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
(Private-owned)	0.032***	0.032***	0.019***	0.017***	-0.002	0.003	0.004*	0.007***
	(0.004)	(0.004)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
(Ethnically Chinese-owned)	0.003	0.003	-0.001	0.000	0.015***	0.013***	0.003	0.003
	(0.005)	(0.005)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
(Non-ethnically Chinese-owned)	-0.009**	-0.006	0.001	0.002	0.001	0.001	0.015***	0.015***
	(0.004)	(0.004)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)
Log Production Inputs								
Labor	0.729***	0.715***	0.475***	0.483***	0.561**	0.578***	0.539***	0.544***
	(0.019)	(0.019)	(0.006)	(0.006)	(0.007)	(0.008)	(0.008)	(0.009)
Capital	0.280***	0.290***	0.236***	0.231***	0.289***	0.282***	0.323***	0.321***
	(0.016)	(0.016)	(0.003)	(0.003)	(0.007)	(0.007)	(0.009)	(0.009)
Year, City, 4-Digit Industry Dummies	Y	-	Y	-	Y	-	Y	-
City*Year Dummies	-	Y	-	Y	-	Y	-	Y
4-Digit Industry Dummies	-	Y	-	Y	-	Y	-	Y
Adjusted R^2	0.68	0.68	0.42	0.44	0.48	0.50	0.52	0.54
# Enterprises	45,744	45,744	769,860	769,860	163,744	163,744	136,992	136,992

Notes: Standard errors in parentheses are robust and clustered at the 4-Digit Industry level; ***Significant at the 1% level; **Significant at the 5% level; *Significant at the 10% level; Industry 16 "Tobacco Products Processing" has been excluded.

Table 3.10: Own and Cross Type Localization Spillovers (single-plant and multi-plant firms only)[a] .

Dependent Variable: Log of Enterprise Value Added

	STATE OWNED		PRIVATE OWNED		FOREIGN OWNED	
	(1)	(2)	(1)	(2)	(1)	(2)
Log Own Industry Employment						
(State-owned)	0.013***	0.013***	0.000	-0.000	0.003*	0.004***
	(0.004)	(0.004)	(0.001)	(0.001)	(0.001)	(0.001)
(Private-owned)	0.031***	0.031***	0.019***	0.017***	0.001	0.005***
	(0.004)	(0.004)	(0.001)	(0.001)	(0.002)	(0.002)
(Foreign-owned)	-0.004	-0.003	0.000	0.001	0.015***	0.013***
	(0.004)	(0.004)	(0.001)	(0.001)	(0.002)	(0.002)
Log Production Inputs						
Log Labor	0.730***	0.716***	0.475***	0.483***	0.547***	0.559***
	(0.019)	(0.019)	(0.006)	(0.006)	(0.007)	(0.007)
Log Capital	0.280***	0.289***	0.236***	0.231***	0.312***	0.307***
	(0.016)	(0.016)	(0.003)	(0.003)	(0.007)	(0.008)
Year, City, 4-Digit Industry Dummies	Y	-	Y	-	Y	-
City*Year Dummies	-	Y	-	Y	-	Y
4-Digit Industry Dummies	-	Y	-	Y	-	Y
Adjusted R^2	0.68	0.68	0.42	0.44	0.50	0.51
# Enterprises	45,744	45,744	769,860	769,860	300,736	300,736

Notes: [a]Table displays Own Industry Employment in single-plant firms only. Coefficients of own industry employment in multi-plant firms are not reported in the interest of space. Observations include single-plant firms only; Standard errors in parentheses are robust and clustered at the 4-Digit Industry level; ***Significant at the 1% level; **Significant at the 5% level;*Significant at the 10% level; Industry 16 "Tobacco Products Processing" has been excluded.

Table 3.11: Own and Cross Type Localization Spillovers, by Source of Foreign Investment (single-plant and multi-plant firms only).

Dependent Variable: Log of Enterprise Value Added

	STATE OWNED		PRIVATE OWNED		ETHNICALLY CHINESE OWNED		NON-ETHNICALLY CHINESE OWNED	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Log Own Industry Employment								
(State-owned)	0.013***	0.013***	0.000	-0.000	0.001	0.002	0.004**	0.005***
	(0.004)	(0.004)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
(Private-owned)	0.031***	0.031***	0.019***	0.017***	-0.002	0.003	0.004**	0.006***
	(0.004)	(0.004)	(0.001)	(0.001)	(0.002)	(0.002)	(002)	(0.002)
(Ethnically Chinese-owned)	0.003	0.002	-0.001	-0.000	0.014***	0.013***	0.003	0.002
	(0.005)	(0.004)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
(Non-ethnically Chinese-owned)	-0.009**	-0.007*	0.001	0.002	0.001	0.001	0.015***	0.015***
	(0.004)	(0.004)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(.002)
Log Production Inputs								
Labor	0.730***	0.716***	0.475***	0.483***	0.561**	0.578***	0.539***	0.544***
	(0.019)	(0.019)	(0.006)	(0.006)	(0.007)	(0.008)	(0.008)	(0.009)
Capital	0.280***	0.289***	0.236***	0.231***	0.289***	0.282***	0.323***	0.321***
	(0.016)	(0.016)	(0.003)	(0.003)	(0.007)	(0.007)	(0.009)	(0.009)
Year, City, 4-Digit Industry Dummies	Y	-	Y	-	Y	-	Y	-
City*Year Dummies	-	Y	-	Y	-	Y	-	Y
4-Digit Industry Dummies	-	Y	-	Y	-	Y	-	Y
Adjusted R^2	0.68	0.68	0.48	0.44	0.48	0.50	0.52	0.51
# Enterprises	45,744	45,744	769,860	769,860	163,744	163,744	136,992	136,992

Notes: [a]Table displays Own Industry Employment in single-plant firms only. Coefficients of own industry employment in multi-plant firms are not reported in the interest of space. Observations include single-plant firms only; Standard errors in parentheses are robust and clustered at the 4-Digit Industry level; ***Significant at the 1% level; **Significant at the 5% level;*Significant at the 10% level; Industry 16 "Tobacco Products Processing" has been excluded.

Table 3.12: Own and Cross Type Localization Spillovers Controlling for Output Market Competition.

Dependent Variable: Log of Enterprise Value Added

	STATE OWNED	PRIVATE OWNED	FOREIGN OWNED
Log Own Industry Employment			
(State-owned)	0.012***	-0.005***	0.001
	(0.003)	(0.001)	(0.001)
(Private-owned)	0.024***	0.009***	-0.002
	(0.004)	(0.002)	(0.002)
(Foreign-owned)	0.000	0.000	0.007***
	(0.004)	(0.002)	(0.002)
Log Number of Own Industry Enterprises			
(Private-owned)	0.030***	0.040***	0.038***
	(0.020)	(0.005)	(0.006)
(Foreign-owned)	-0.003	-0.008	0.017**
	(0.025)	(0.006)	(0.006)
Log Production Inputs			
Labor	0.708***	0.516***	0.550***
	(0.018)	(0.006)	(0.007)
Capital	0.305***	0.248***	0.315***
	(0.015)	(0.003)	(0.0078)
City*Year Dummies	Y	Y	Y
4-Digit Industry Dummies	Y	Y	Y
Adjusted R^2	0.71	0.42	0.52
# Enterprises	58,879	1,092,188	334,888

Notes: Standard errors in parentheses are robust and clustered at the 4-Digit Industry level; ***Significant at the 1% level; **Significant at the 5% level;*Significant at the 10% level; Industry 16 "Tobacco Products Processing" has been excluded.

Table 4.1: Optimal Effort Levels.

Control of Production	Ownership of Enterprise	
	$\delta_0 = 0$, Foreign firm f owns	$\delta_0 = 1$, Chinese firm s owns
$\delta_c = 0$, Foreign firm f controls production	Wholly Foreign Owned	Not Observed
$\delta_c = 1$, Chinese firm s controls production	$e_1 = B/\gamma_f$ $e_2 = (A + \lambda B)/\gamma_f$ $e_3 = (1-\theta)\, P_M/\gamma_s$ Sino-Foreign Joint Venture	$e_1 = \theta\, B/\gamma_f$ $e_2 = \theta(A + \lambda B)/\gamma_f$ $e_3 = P_M/\gamma_s$ Domestic Firm
	$e_1 = (1-(1-\theta)\psi_{IPR})\, B/\gamma_f$ $e_2 = \big((1-\theta\psi_C)(A + \lambda B)\big)/\gamma_S$ $e_3 = (1-\theta\psi_M)\, P_M/\gamma_s$	$e_1 = \theta\, B/\gamma_f$ $e_2 = (A + (1-\theta\psi_C)\lambda B)/\gamma_s$ $e_3 = P_M/\gamma_s$

Table 4.2: Data Definitions and Summary Statistics.

Variable	Definition	Mean	St. Dev.
Firm Level			
Distance to Domestic Technology Frontier	Difference between own and maximum log TFP of domestic Chinese firms within four digit CIC	3.523	2.111
Log Value Added	Log of real value added, in 1000 Yuan	8.486	2.109
Domestic Sales Share	Share of total sales directed to the domestic Chinese market	0.642	0.427
Affiliation Dummy	Takes the value 1 if joint venture affiliated with central government or provincial government, 0 otherwise	0.112	0.315
Log Employment	Log of total employment	5.024	1.024
4-digit Industry Level			
Increase in State Share of Industry Sales	Increase in SOE share of industry sales, at the four digit CIC between1998 and 2000	-0.048	0.060
Manager's Outside Option	Total number of firms in 4- digit CIC and city as a share of total number of firms in city x 100	0.007	0.012

Notes: All variables are measured as of 2000 unless otherwise noted; CIC is the Chinese Industrial Classification; SOE is state-owned enterprise.

Table 4.3: Multinomial Logit Model of Changes in Organizational Form.

	(1)		(2)		(3)	
	WFOE	**DOM**	**WFOE**	**DOM**	**WFOE**	**DOM**
Firm-level variables						
Distance to Domestic Technology Frontier	0.072***	-0.054*	0.075***	-0.111***	0.056**	-0.097***
	(0.023)	(0.029)	(0.026)	(0.035)	(0.027)	(0.035)
Log Value Added	0.105***	-0.054	0.101***	-0.111***	0.083***	-0.105***
	(0.026)	(0.033)	(0.029)	(0.037)	(0.029)	(0.038)
Domestic Sales Share	-0.509***	0.285***	-0.517***	0.950***	-0.383***	0.867***
	(0.064)	(0.045)	(0.070)	(0.107)	(0.072)	(0.112)
Log Employment	0.027	0.285***	0.035	0.347***	0.055	0.301***
	(0.034)	(0.045)	(0.036)	(0.049)	(0.037)	(0.050)
Two Digit Industry Dummies?	N		Y		Y	
Province Dummies?	N		N		Y	
Number of Observations	12,339		12,339		12,339	
Log Likelihood	-7,709.26		-7,648.21		-7,435.68	
Pseduo-R^2	0.016		0.023		0.05	
Schwarz criterion	15,512.73		15,899.33		16,039.50	
Aikake criterion	15,438.53		15,424.42		15,119.36	

Notes: Estimations based on sample of all Sino-foreign joint ventures established between 1992 and 2000 in the 2000 Annual Survey of Industrial Production; Sino-foreign joint venture is the base category; * significant at 10%; ** significant at 5%; *** significant at 1%; Standard errors in parentheses are corrected for heteroskedasticity.

Table 4.4: Elasticities and Standard Errors.

	(1)		(2)		(3)	
	WFOE	**DOMESTIC**	**WFOE**	**DOMESTIC**	**WFOE**	**DOMESTIC**
Distance to Domestic	0.232***	-0.214**	0.253***	-0.401***	0.193**	-0.347***
Technology Frontier	(0.069)	(0.098)	(0.079)	(0.114)	(0.082)	(0.116)
Log Value Added	0.798***	-0.550**	0.807***	-1.004***	0.674***	-0.929***
	(0.189)	(0.261)	(0.211)	(0.299)	(0.217)	(0.305)
Domestic Sales Share	-0.323***	0.648***	-0.324***	0.617***	-0.249***	0.555***
	(0.36)	(0.063)	(0.039)	(0.065)	(0.040)	(0.068)
Log Employment	0.030	1.325***	0.047	1.615***	0.159	1.392***
	(0.146)	(0.210)	(0.156)	(0.230)	(0.163)	(0.235)

Notes: Elasticity calculations based on MNL models given in Table 3. * significant at 10%; ** significant at 5%; *** significant at 1%; Standard errors in parentheses.

Table 4.5: Multinomial Logit Tests of the Property Rights Theory.

	(1)		(2)		(3)	
	WFOE	**DOM**	**WFOE**	**DOM**	**WFOE**	**DOM**
Firm-level variables						
Distance to Domestic Technology Frontier	0.082***	-0.041	0.092***	-0.093***	0.072***	-0.090**
	(0.023)	(0.030)	(0.026)	(0.035)	(0.027)	(0.035)
Distance to Domestic Technology Frontier * Affiliation Dummy	-0.092***	-0.117***	-0.102***	-0.111***	-0.127***	-0.061
	(0.027)	(0.037)	(0.027)	(0.037)	(0.032)	(0.037)
Log Value Added	0.106***	-0.055*	0.111***	-0.109***	0.094***	-0.108***
	(0.026)	(0.034)	(0.029)	(0.038)	(0.030)	(0.038)
Log Value Added * Manager's Outside Option	-0.874***	-0.068	-0.999***	0.311	-0.959***	0.658*
	(0.275)	(0.359)	(0.329)	(0.357)	(0.327)	(0.359)
Domestic Sales Share	-0.512***	0.953***	-0.493***	0.925***	-0.379***	0.847***
	(0.073)	(0.110)	(0.076)	(0.113)	(0.078)	(0.118)
Domestic Sales Share * Change in State Share of Industry Sales	0.111	-1.302**	0.0.329	-0.915	0.189	-0.641
	(0.611)	(0.562)	(0.626)	(0.658)	(0.640)	(0.667)
Log Employment	0.040	0.296***	0.040	0.348***	0.064*	0.303***
	(0.035)	(0.046)	(0.036)	(0.049)	(0.037)	(0.050)
Two Digit Industry Dummies?	N		Y		Y	
Province Dummies?	N		N		Y	
Number of Observations	12,334		12,334		12,334	
Log Likelihood	-7,686.19		-7,625.25		-7,414.64	
Pseduo-R^2	0.018		0.030		0.053	
Schwarz criterion	15,523.1		15,909.90		16,053.90	
Aikake criterion	15,404.38		15,390.49		15,089.29	

Notes: Estimations based on sample of all Sino-foreign joint ventures established between 1992 and 2000 in the 2000 Annual Survey of Industrial Production; Sino-foreign joint venture is the base category; * significant at 10%; ** significant at 5%; *** significant at 1%; Standard errors in parentheses are corrected for heteroskedasticity.

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