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The More the Better? Foreign Ownership and Corporate Performance in China

by

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Abstract

We examine the relationship between the degree of foreign ownership and performance of recipient firms, using a panel of 21,582 Chinese firms over the period 2000-2005. We find that joint-ventures perform better than wholly foreign owned and purely domestic firms. Although productivity and profitability initially rise with foreign ownership, they start declining once foreign ownership reaches beyond 64%. This suggests that some domestic ownership is necessary to ensure optimal performance. We rationalize these findings with a model of a joint-venture, where strategic interactions between a foreign and a domestic owner's inputs may lead to an inverse U-shaped ownership-performance relationship.

JEL Classification: F2, G32, L25, O5

Keywords: Foreign ownership, corporate performance, China

Outline

1. *Introduction*
2. *Data and summary statistics*
3. *Baseline specification and estimation methodology*
4. *Evaluation of the results*
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Non-Technical Summary

A vast literature has investigated whether foreign firms perform better than their domestic counterparts. Most studies in this literature have partitioned firms into domestic and foreign owned and compared the two groups, without assessing whether firms with different degrees of foreign ownership perform differently. Our paper fills this gap, by using a panel of 21,582 unlisted Chinese firms over the period 2000-2005 to analyze the exact nature of the relationship between the degree of foreign ownership characterizing these firms and their performance.

Focusing on the return on assets, the return on sales, labor productivity, and total factor productivity, we find that joint-ventures generally perform better than wholly foreign owned and purely domestic firms. This finding is robust to defining joint-ventures on the basis of the capital paid in by foreign agents, and on the basis of registration information. It can be explained considering that both the domestic and the foreign parties of a joint-venture bring in attributes essential to achieving high performance. Specifically, the former contribute knowledge of the Chinese market and legal environment, as well as important political connections with local governments; and the latter, modern technologies, capital, better corporate governance through monitoring and market discipline, and managerial and international networking skills.

We then investigate the exact nature of the relationship between foreign ownership and corporate performance of our Chinese firms, and find that the two variables are linked by an inverted U-shaped relationship. Specifically, corporate performance increases as foreign participation rises up to the range 47% to 64%, depending on the measure of performance used, and declines thereafter. This suggests a certain degree of domestic ownership is necessary to ensure optimal performance. Furthermore, we show that it is those firms owned by investors other than those originating from Hong Kong, Macao, and Taiwan that benefit most from their foreign ownership.

Finally, we rationalize these findings with a simple theoretical model of a joint-venture, where, under plausible conditions, strategic interactions between the non-contractible inputs contributed by a foreign and a domestic owner may lead to a non-monotonic relationship between a firm's degree of foreign ownership and its performance similar to that found in our Chinese data.

Our findings contribute to understanding the link between FDI and economic growth: in countries where FDI inflows are large and mainly take the form of joint-ventures between domestic and foreign firms, the effect of FDI penetration on the performance of recipient firms could be an important channel through which FDI affects economic growth. Attracting more FDI in the form of joint-ventures could hence be beneficial to long-run growth.

1. Introduction

A vast literature has investigated the effects of Foreign Direct Investment (FDI) on economic growth reaching a consensus that, especially in developing countries, FDI is an engine of growth (see De Mello, 1997, for a survey). Yet, there is still uncertainty about the exact ways in which FDI may foster growth. Factors such as knowledge spillovers from foreign owned to domestic enterprises or technological upgrading could represent possible channels. A wave of papers has tried to measure these spillovers by estimating regressions of the productivity of domestic firms on alternative indicators of the importance of foreign firms in a given sector. Much of this work, however, fails to find evidence of positive spillovers, with some studies reporting negative effects (see Blomström and Kokko, 1998; and Görg and Greenaway, 2004, for surveys).

One condition for spillovers to take place is that foreign owned firms are more productive than their domestic counterparts. A number of papers within the international economics literature, have tested whether or not this is the case, obtaining once again, mixed results¹. The issue has also been tackled within the privatization literature, which has analyzed the effects of ownership on corporate performance in transition economies, including China (see Megginson and Netter, 2001; and Estrin et al., 2008, for surveys). Although their main focus is generally on the effects of state ownership or private ownership, most studies in this literature control for foreign ownership, and find that foreign owned firms tend to perform better than their domestic counterparts.

A shortcoming of many of these studies, especially those in the international economics literature, is that they simply divide firms into foreign owned and purely domestic using some a priori criterion, and compare various measures of firm performance across the two groups², ignoring the considerable heterogeneity that typically characterizes foreign owned firms. These include wholly foreign owned firms, as well as joint-ventures between a domestic and a foreign partner, with different degrees of foreign ownership. Joint-ventures represent a popular form of

¹ Papers that find little or no evidence of superior performance of foreign owned firms compared to their domestic counterparts are Globerman et al. (1994), Griffith (1999a, 1999b), and Benfratello and Sembenelli (2006). Papers that find positive evidence are Doms and Jensen (1998), Girma et al. (2001), Harris (2002), Harris and Robinson (2003), and Temouri et al. (2008).

² For instance, focusing on UK data, Girma et al. (2001) define a firm as foreign owned if the country of origin of its ultimate holding company is not the UK.

FDI: they account for more than 40% of the foreign affiliates of almost a quarter of the respondents to a global survey recently conducted by UNCTAD (UNCTAD, 2006). Furthermore, based on survey evidence for 1995, Javorcik and Saggi (2004) document that in Eastern European countries, which are large FDI recipients, joint-ventures outnumber direct entries and account for 59% of all projects. Finally, our Chinese data show that in 2005, just under half of the foreign owned firms covered were joint-ventures.

Aitken and Harrison (1999), Blomström and Sjöholm (1999), Chhibber and Majumdar (1999), Dimelis and Louri (2002), and Takii (2004) are among the few who have considered the possibility that firms characterized by different degrees of foreign ownership may perform differently. The last four differentiate foreign owned firms into a few sub-groups such as minority foreign owned, majority foreign owned, and wholly foreign owned. Blomström and Sjöholm (1999) make use of Indonesian establishments and show that although foreign ownership is always associated with higher labor productivity of recipient firms, whether firms are majority or minority owned by foreigners does not matter. In contrast, focusing on cross-sectional data for Greece, Dimelis and Louri (2002) find that foreign ownership is associated with a productivity advantage, which stems from the fully and majority foreign owned firms. Chhibber and Majumdar reach a similar conclusion for Indian firms. Finally, Takii (2004) shows that wholly foreign owned Indonesian firms tend to be the most productive. Aitken and Harrison (1999) go one step further and analyze the extent to which the actual degree of foreign equity participation affects performance of Venezuelan manufacturing plants. To this end, they estimate a production function augmented with a linear term measuring the share of foreign equity participation at the plant level, and find a positive coefficient on the latter variable only for small plants. Although they do consider that firms with different degrees of foreign ownership may perform differently, none of these studies provides a full investigation of the exact nature and possible non-monotonicity of the relationship between the degree of foreign ownership and corporate performance of recipient firms³.

³ Contrary to the international economics literature, many studies in the privatization literature control for the degree of foreign ownership. See, for instance, Konings (2001) who adopts an approach similar to Aitken and Harrison's (1999), and finds that foreign ownership positively affects productivity of Polish firms, but not of Bulgarian and Romanian firms. To the best of our knowledge, Djankov (1999) is the only study that allows for a non-monotonic relationship between the degree of foreign ownership and labor productivity growth in a sample of firms from Georgia, Kazakstan, the Kyrgyz Republic, Moldova, Russia, and Ukraine. Yet, his focus is on enterprise restructuring, rather than corporate

Our aim is to provide, for the first time, an in-depth analysis of this relationship. For this purpose, we use a panel of 21,582 Chinese unlisted firms operating in the entire economy, over the period 2000-2005⁴. The Chinese case represents an ideal laboratory for two reasons. First, China is among the top FDI recipients in the world. Over the past decade, it has accounted for about one-third of gross FDI flows to all emerging markets and about 60% of these flows to Asian emerging markets (Prasad and Wei, 2005). Together with a considerable decline in the number of state-owned and collective firms, and a rise of privately owned enterprises, the increasing number of foreign firms in China has contributed dramatically to its changing corporate landscape⁵. Second, joint-ventures and wholly foreign owned firms coexist, which makes a study of the degree of foreign ownership on corporate performance particularly relevant⁶.

We measure the degree of foreign ownership as the share of a firm's equity owned by foreign investors. We make use of several measures of corporate performance and find that joint-ventures generally perform better than wholly foreign owned and purely domestic firms. This finding, which is robust to defining the degree of foreign ownership on the basis of registration information, can be explained considering that both the domestic and the foreign parties of a joint-venture bring in attributes essential to achieving high performance. Specifically, the former contribute knowledge of the Chinese market and legal environment, as well as important political connections with local governments; and the latter, modern technologies, capital, better corporate governance through monitoring and market discipline, and managerial and international networking skills. We then investigate the exact nature

performance. Moreover, he himself admits that his results might not be representative given the small number of foreign owned firms in his sample.

⁴ Also see Abraham et al. (2007) and Liu (2008) who investigate whether domestic Chinese firms benefit from horizontal spillovers from foreign firms, controlling respectively for whether or not firms are joint-ventures, and for the percentage of the firms' equity owned by foreign investors. Neither of these studies allows for a non-monotonic relationship between the degree of foreign ownership and the performance of recipient firms. Another related paper is Du and Girma (2008), who use data for Chinese firms to investigate the effects of foreign acquisitions on export markets dynamics.

⁵ Specifically, while until 1993, state-owned enterprises still dominated the scenario, in 2005, they represented less than 5% of the total number of firms operating in China, while private firms represented 73.53%; collective firms, 6.33%; and foreign firms, 15.38% (Guariglia et al., 2008).

⁶ In the early days of China's opening up, foreign agents invested mainly into large and well performing state owned enterprises (SOEs) in the form of joint-ventures. Fully foreign owned firms were only allowed later. Until 2000, they were required to either provide advanced technology or to be primarily export-oriented, and were located mainly in the special economic zones, where they received favorable tax treatment, and benefited from streamlined regulations (Dougherty and McGuckin, 2002). In recent years, fully foreign owned firms have become increasingly widespread, and joint-ventures have more and more frequently become partnerships with private rather than state owned enterprises.

of the relationship between foreign ownership and corporate performance of our Chinese firms, and find that the two variables are linked by an inverted *U*-shaped relationship: corporate performance initially rises with foreign ownership, but declines once foreign ownership reaches beyond 64%. This suggests a certain degree of domestic ownership is necessary to ensure optimal performance. Furthermore, we show that it is those firms owned by investors other than those originating from Hong Kong, Macao, and Taiwan that benefit most from their foreign ownership.

To underpin these empirical findings, we construct a simple theoretical model of a joint-venture, where a domestic and a foreign owner contribute non-contractible inputs to boost the company's productivity. The choice of the level of such inputs by each owner depends on his/her share in the firm's ownership and profits, as well as on the inputs contributed by the other owner. Under plausible conditions, the model yields predictions of a non-monotonic relationship between the firm's degree of foreign ownership and its performance similar to that found in our Chinese data.

Our findings contribute to understanding the link between FDI and economic growth: in countries where FDI inflows are large and mainly take the form of joint-ventures between domestic and foreign firms, the effect of FDI penetration on the performance of recipient firms could be an important channel through which FDI affects economic growth. Attracting more FDI in the form of joint-ventures could hence be beneficial to long-run growth.

The remainder of the paper is organized as follows. In section 2, we describe our data and present some descriptive statistics. Section 3 illustrates our baseline specification and our estimation methodology. Section 4 describes and evaluates our regression results. Section 5 presents our theoretical model, and section 6 concludes.

2. Data and summary statistics

2.1 Data: Our data set is drawn from the annual accounting reports taken from the *ORIANA* database, published by Bureau Van Dijk Electronic Publishing (*BvDEP*). The database includes balance sheet and profit and loss information for over 23,000 Chinese companies, over the period 2000-2005. We dropped observations with negative sales; as well as observations with negative total assets minus total fixed assets and total assets minus liquid assets. Firms that did not have complete records on our main regression variables were also dropped. Finally, to control for the

potential influence of outliers, we excluded observations in the one percent tails for each of our regression variables. Our final dataset covers 21,582 unlisted firms, which operate in the entire economy, and corresponds to 91,576 firm-year observations⁷. Our panel is unbalanced, with number of observations ranging from a minimum of 11,813 in 2000 to a maximum of 17,665 in 2004⁸.

As *ORIANA* does not include complete time-varying ownership information, we have augmented it with data on the ownership of industrial firms obtained from the National Bureau of Statistics (NBS) of China. Specifically, ownership is defined on the basis of the fraction of paid-in-capital contributed each year by six different types of investors: the state; foreign investors (excluding those from Hong Kong, Macao, and Taiwan); investors from Hong Kong, Macao, and Taiwan; legal entities; individuals; and collective investors. Our foreign ownership variable is given by the share of the firm's capital paid in by all foreign investors, including those from Hong Kong, Macao, and Taiwan. We will also provide specifications showing whether the effects of ownership by the two groups of foreign investors are different. We will verify the robustness of our results to the use of registration-based ownership measures. However, defining ownership categories on the basis of the fraction of capital paid in by various groups is preferable to using registration codes. The latter are in fact updated only with considerable delay (Dollar and Wei, 2007). Moreover, firms might have an incentive to falsely register as foreign simply to take advantage of the tax benefits accorded to the latter.

2.2 Summary statistics: We divide our observations into four categories on the basis of the share of capital paid in by foreign investors⁹. Our first category encompasses those firm-years with no foreign participation, which make up 60.95% of our sample. Our second category contains those observations with a share of foreign capital, which is positive but lower than 50% (10.47% of our sample); our

⁷ We have excluded listed firms from our analysis as information on their ownership was not available. Most of the studies that tried to assess the effects of foreign ownership on firm performance focused on the manufacturing sector. In the Chinese context, it is important to consider other sectors as well, as non-manufacturing sectors also attract significant levels of foreign investment (see Table A2 in Appendix 1C for details). All our results were robust to considering only firms operating in the manufacturing sector.

⁸ See Appendixes 1A and 1B for details about the structure of our panel, and complete definitions of all variables used.

⁹ Our observations refer to firm-years. We therefore allow our firms to switch across ownership categories each year.

third category includes observations with a share higher than or equal to 50% but lower than 100%, (8.61% of our sample); our final category contains firms that are 100% foreign owned, (19.07% of our sample).

Our empirical analysis focuses on four measures of corporate performance: the Return on Assets (*ROA*, the ratio of the firm's net income to total assets); the return on sales (*ROS*, the ratio of the firm's net income to its total sales); labor productivity (*PROD*, the ratio of the firm's net income to number of employees); and Total Factor Productivity (*TFP*, measured using the Levinsohn and Petrin, 2003, method)¹⁰. All four have been frequently used in the literature assessing the effects of government ownership on corporate performance (Tian and Estrin, 2008; Jiang et al., 2008)¹¹.

Table 1 presents summary statistics about the behavior of our performance variables and other relevant variables for our four categories of ownership¹². We can see that *ROA*, *ROS*, *PROD*, and *TFP*, all increase with the degree of foreign ownership, but decline for those observations that are 100% foreign owned. This suggests that joint-ventures perform better than foreign owned and purely domestic firms, and may reflect the fact that both the domestic and the foreign parties of a joint-venture bring in attributes essential to achieving high performance. Specifically, domestic investors have a widespread knowledge of the Chinese markets, and legal and political environment, while foreign investors bring in capital, modern technologies, better corporate governance through monitoring and market discipline, as well as managerial and international networking skills, which together are likely to lead to high performance. Foreign ownership is hence beneficial to corporate performance only up to a certain threshold beyond which it becomes detrimental. Although they exhibit better performance than the purely domestic firms, firms that are fully (or almost fully) owned by foreign investors are unlikely to perform as well as joint-ventures, due to a limited knowledge of the Chinese market, legal, regulatory,

¹⁰ A key issue in the estimation of production functions is the correlation between unobservable productivity shocks and input levels. Profit-maximizing firms respond to positive productivity shocks by expanding output, which requires additional inputs; and to negative shocks, by decreasing output and input usage. Olley and Pakes' (1996) estimator uses investment as a proxy for these unobservable shocks. This could cause problems as any observation with zero investment would have to be dropped from the data. Levinsohn and Petrin (2003), by contrast, introduce an estimator which uses intermediate inputs as proxies, arguing that these (which are generally non-zero) are likely to respond more smoothly to productivity shocks.

¹¹ Jiang et al. (2008) note that in the Chinese context, extraordinary income and income from non-core operations may be subject to manipulations: they therefore suggest an alternative measure of corporate performance, which excludes them, namely the ratio of operating profits to total assets. All our results were robust to using this alternative measure of firm performance.

¹² See Appendix 1C for descriptive statistics of foreign presence by industry and province.

and bureaucratic environment, and workers' attitudes towards incentives, as well as to a lack of political connections with local governments (*Guanxi*), which are often considered as a key factor in determining firm performance in China (Hsieh and Klenow, 2007). The best performers in the Chinese economy are therefore joint-ventures with a sufficiently large share of domestic ownership. A minority of these joint-ventures are between foreign and state firms. Specifically, those firm-years with a positive but lower than 100% share of capital paid in by foreign investors exhibit an average share of private capital of 35.74%, and an average share of state capital of 8.93%.

Focusing on the other variables reported in Table 1, we see that firm size, measured by the logarithm of its total assets, also increases with the degree of foreign ownership, and declines for 100% foreign owned firms. Leverage, defined as the ratio of the firm's total liabilities to total assets declines monotonically as the share of foreign ownership increases; and collateral, defined as the firm's ratio of tangible fixed assets to total assets, remains approximately constant across the four categories. Finally, only 36.7% of the purely domestic firm-years export, while the corresponding percentages for joint-ventures and fully foreign owned firm years are, respectively, 70.7% and 86.0%.

In the sections that follows, we first formally analyze the extent to which, controlling for other relevant variables, the performance of minority foreign-owned, majority foreign owned, and fully foreign owned firms differs from that of their purely domestic counterparts. We then investigate the exact nature of the relationship between foreign ownership and corporate performance.

3. Baseline specification and estimation methodology

3.1 Baseline specifications: We initially estimate the following equation:

$$(1) \quad \begin{aligned} PERF_{it} = & a_0 + a_1 PERF_{i(t-1)} + a_2 \text{Minority foreign}_{it} + a_3 \text{Majority foreign}_{it} + \\ & + a_4 \text{All foreign}_{it} + a_5 \text{Size}_{it} + a_6 \text{Leverage}_{it} + a_7 \text{Collateral}_{it} + a_8 \text{Expdum}_{it} + \\ & + v_i + v_t + v_{jt} + e_{it} \end{aligned}$$

where the subscript i indicates firms, and t , time. $PERF_{it}$ indicates in turn our four performance indicators. We control for foreign ownership by including the dummy

variables *Minority foreign_{it}*, *Majority foreign_{it}*, and *All Foreign_{it}*. *Minority foreign_{it}* is equal to 1 if the share of foreign ownership is positive but lower than 50%, and 0 otherwise; *Majority foreign_{it}* is equal to 1 if the share is greater than or equal to 50% but lower than 100%, and 0 otherwise; and *All Foreign_{it}* is equal to 1 if the firm is 100% foreign owned, and 0 otherwise. The omitted category is a dummy equal to 1 for purely domestic firms, and 0 otherwise. This exercise is aimed at determining the extent to which the performance of fully foreign owned firms and joint-ventures characterized by different degrees of foreign participation differs from that of purely domestic firms¹³.

The other regressors in equation (1) are motivated by the finance literature (e.g. McConnell and Servaes, 1990). *Size* is included to control for the fact, that as suggested by Chhibber and Majumdar (1999), larger firms may benefit from economies of scale and better access to external finance, which might enhance their profitability. *Collateral_{it}* is expected to affect profitability negatively, as firms with more intangible assets are expected to have more investment opportunities and grow faster (Tian and Estrin, 2008). Finally, *Leverage_{it}* is also expected to have a negative impact on firm performance, due to the debt overhang problem (Jensen and Meckling, 1976; Myers, 1977)¹⁴. Because more than 50% of Chinese firms in our sample export, we also include a dummy *Expdum_{it}*, which is equal to 1 if the firm exports, and 0 otherwise¹⁵.

The error term in equation (1) comprises three components: v_i , which is a firm-specific component; v_t , a time-specific component accounting for possible business cycle effects; v_{jt} , a time-specific component which varies across industries, accounting for industry-specific shifts in company performance; and e_{it} , an idiosyncratic component. We control for v_i by estimating our equation in first-differences; for v_t , by including time dummies in all our specifications; and for v_{jt} , by including time dummies interacted with industry dummies.

¹³ It has been argued that comparing foreign firms with all domestic firms may lead to a selection problem as domestic firms may include domestic multinationals, which are likely to be as productive as foreign multinationals (Criscuolo and Martin, 2005). This is not an issue in the Chinese case considering the small size of China's outward FDI (Morck et al., 2008).

¹⁴ In the presence of a high debt to assets ratio, debt holders will share future investment returns, which might lead the firm to forego some profitable investment opportunities.

¹⁵ One could argue that foreign ownership and other firm characteristics affect corporate performance with a lag. All our results were robust to using lagged values of our regressors. This also addresses the issue of possible reverse causality in the relationship between foreign ownership and corporate performance, which is extensively discussed in Section 4.2.

To better understand the nature of the relationship between foreign ownership and firm performance, we next estimate the following variant of equation (1), which includes the actual percentage of the firm's capital paid in by foreign investors, $Foreigncap_{it}$:

$$(2) \quad \begin{aligned} PERF_{it} = & a_0 + a_1 PERF_{i(t-1)} + a_2 Foreigncap_{it} + a_3 Foreigncap_{it}^2 + a_4 Size_{it} + \\ & + a_5 Leverage_{it} + a_6 Collateral_{it} + a_7 Expdum_{it} + a_8 Statecap_{it} + \\ & + a_9 Privatecap_{it} + v_i + v_t + v_{jt} + e_{it} \end{aligned}$$

Equation (2) includes both $Foreigncap_{it}$ and $Foreigncap_{it}^2$ to account for the possible non-linearity of the relationship between $Foreigncap_{it}$ and $PERF_{it}$. Considering the large literature on the effects of privatization on corporate performance (Estrin et al., 2008), the percentage of the firm's total capital paid in by the state ($Statecap_{it}$) and by private investors ($Privatecap_{it}$) are also included¹⁶.

3.2 Estimation methodology: All equations are estimated in first-differences, to control for firm-specific, time-invariant effects. Given possible endogeneity of the regressors, we use a first-difference Generalized Method of Moments (GMM) approach¹⁷. Two or more lags of each of the regressors are used as instruments.

To check whether the first-difference GMM estimator is likely to suffer from finite sample bias, we compared the GMM and the Within Groups estimates of the coefficient on the lagged dependent variable in equation (1). Because the Within Groups estimate is typically downward biased in short panels (Nickell, 1981), one would expect a consistent estimate of the coefficient on the lagged dependent variable to lie above this. As our GMM coefficient was larger than its Within Groups counterpart, we concluded that the first-difference GMM estimates are unlikely to be subject to serious finite sample bias¹⁸.

¹⁶ The squares of these additional variables never had precisely determined coefficients. For this reason, we decided to omit them. We also attempted to include cubic terms of all our ownership variables, which always had poorly determined coefficients.

¹⁷ See Arellano and Bond (1991) on the application of the GMM approach to panel data. Most of our results were robust to using Ordinary Least Squares, which, however, does not take into account unobserved firm heterogeneity and the possible endogeneity of the regressors.

¹⁸ If the estimates obtained using the first-difference GMM estimator lie close or below the Within Groups estimates, one could suspect the GMM estimate to be downward biased as well, possibly due to weak instruments. In such case, the use of a GMM system estimator (which combines in a system the

To evaluate whether our instruments are legitimate and our model is correctly specified, we use the test for second-order serial correlation of the residuals in the differenced equation ($m2$). The $m2$ test is asymptotically distributed as a standard normal under the null of no second-order serial correlation of the differenced residuals, and provides a check on the specification of the model and legitimacy of variables dated $t-2$ as instruments in the differenced equation¹⁹.

4. Evaluation of the results

4.1 Are joint-ventures the best performers? Estimates of equation (1) are reported in columns 1 to 4 of Table 2, which are respectively based on *ROA*, *ROS*, *PROD*, and *TFP* as measures of corporate performance²⁰. We can see that the lagged dependent variable always has a positive and statistically significant coefficient, suggesting persistence. *Minority foreign* always has a positive and precisely determined coefficient, while the coefficient on *Majority foreign* is also positive but is only significant for *ROS* and *TFP*. Finally, the coefficient on *All Foreign* is never precisely determined, suggesting that being fully foreign owned is not associated with a statistically significant performance advantage. These findings confirm that joint-ventures generally perform better than purely domestic and purely foreign owned firms. Yet, the fact that in two out of four cases, the coefficient associated with *Majority Foreign* is not precisely determined indicates that, as suggested by the descriptive statistics in section 2.2, there may be a level of foreign ownership beyond which corporate performance starts to decline. Hence, foreign ownership is associated with improved firm performance only as long as it is accompanied by a sufficient degree of local investors' participation, without which foreign agents may be unable to perform optimally.

original specification expressed in first differences and in levels) would be required (Blundell and Bond, 1998).

¹⁹ If the un-differenced error terms are *i.i.d.*, then the differenced residuals should display first-order, but not second-order serial correlation. Note that the $m2$ test does not allow to discriminate between bad instruments and model specification. As in Benito (2003), we do not rely on the Sargan test (test for overidentifying restrictions) because when samples with a very large cross-sectional dimension are used in estimation, this test tends to over-reject the null hypothesis of instrument validity (also see Blundell et al., 2000).

²⁰ Note that column 4 of Table 2 contains fewer observations than columns 1 to 3 because *TFP* is only available from 2001 onwards.

As for the other regressors included in equation (1), *Size* is positively and significantly associated with *ROS* and *PROD*, but negatively associated with *TFP*. *Leverage* is negatively linked with *ROA* and *ROS*, suggesting evidence of debt overhang. *Collateral* has a negative and precisely determined coefficient for *ROA* and *TFP*, indicating that a relative prevalence of tangible assets in the firm's capital structure may hamper its performance. Finally, our export dummy (*Expdum*) is positively associated with *TFP*. This is in line with the vast literature, which has shown that exporters are typically more productive than non-exporters (see Greenaway and Kneller, 2007, for a survey). Yet, surprisingly, *Expdum* is negatively associated with *PROD*. In all cases, the *m2* test does not indicate problems with the specification or choice of instruments.

Next, because our ownership measures based on the share of capital may suffer from miscoding problems, we verify the robustness of our results to the use of registration-based firm ownership characteristics. In particular, we replace the *Minority foreign*, *Majority foreign* and *All foreign* dummies in equation (1) with dummies indicating whether, according to its registration code, the firm is a joint-venture (*JV*) or fully foreign owned (*WFO*)²¹. Joint-ventures can be either equity joint-ventures (*EJV*) or contractual joint-ventures (*CJV*). In the case of *EJVs*, profit, control, and risks are divided according to the equity shares invested by the parties. On the other hand, the *CJV* parties' profit, control, and risks are divided according to negotiated contract terms (Folta, 2005). Focusing on these new definitions of foreign ownership, 15.95% of our firm-years are made up of equity joint-ventures; 2.78%, by contractual joint-ventures; and 17.28%, by wholly foreign owned firms. This leaves 63.98% of domestically owned firm-years, which compares favorably with the corresponding share based on the capital paid in by non foreign agents (60.95%).

Estimates of equation (1), using registration information are reported in columns 5 to 8 of Table 2. In column 5, *ROA* is used as our measure of corporate performance. Column 6 refers to *ROS*; column 7, to *PROD*; and column 8, to *TFP*. We can see that the *JV* dummy always has a positive and strongly significant coefficient for all our measures of corporate performance, while the coefficient on the *WFO* dummy is generally smaller and only marginally significant in three out of four

²¹ Unfortunately, using registration-based ownership information does not allow us to differentiate between different degrees of foreign ownership in joint-ventures.

cases²². In line with Abraham et al. (2007), Yusuf et al. (2006), and Pan et al. (1999), these findings indicate that while both joint-ventures and fully foreign owned firms perform better than purely domestic firms, the former have a larger advantage. Our main result that joint-ventures are top performers in China is therefore robust to using registration-based ownership measures. It should be noted, however, that registration-based measures may be inaccurate, since they are typically updated with significant delay, and firms may have incentives to falsely register as foreign to take advantage of tax benefits (Dollar and Wei, 2007).

4.2 What is the exact nature of the relationship between the degree foreign ownership and corporate performance? Table 3 provides estimates of equation (2), which is aimed at better understanding the precise nature of the relationship between the degree of foreign ownership and corporate performance. Columns 1, 2, 3, and 4 contain estimates respectively for *ROA*, *ROS*, *PROD*, and *TFP*. In all specifications *Foreigncap* attracts a positive and statistically significant coefficient, while *Foreigncap*² has a negative and precisely determined coefficient. This suggests that foreign ownership and corporate performance are linked by an inverted *U*-shaped relationship. The turning points are 47.33% for *ROA*, 55.23% for *ROS*, and 58.79% for *PROD*, and 59.54% for *TFP*: foreign ownership enhances corporate performance if it is below these thresholds, and decreases it thereafter. These findings confirm the results reported in sections 2.2 and 4.1, which showed that it is partially foreign owned firms which are the top performers in the Chinese economy. Foreign ownership is associated with improved firm performance only as long as it is accompanied by some degree of local investors' participation: without sufficient participation by private agents, foreign investors may be unable to perform optimally.

Turning to the other control variables, *Statecap* generally displays a negative coefficient, statistically significant for *ROA* and *ROS*, which suggests the higher the state's participation in a firm's capital, the lower its performance. This is consistent with the findings in many of the studies on privatization surveyed by Estrin et al. (2008). *Privatecap*, on the other hand, is positively related only with *PROD*. As in the previous specifications, *Leverage* and *Collateral* display either negative or poorly determined coefficients. *Size* is positively associated with *ROS* and *PROD*, but

²² These results were robust to including two separate dummies for equity joint-ventures (*EJV*) and contractual joint-ventures (*CJV*).

negatively associated with *TFP*, and *Expdum* displays a positive and significant coefficient in the *TFP* regression. In none of the specifications does the *m2* test highlight problems with the specification of the model or the choice of instruments.

As foreign presence typically varies considerably across provinces (see Appendix 1C), we next verify whether our estimates of equation (2) are robust to replacing the industry dummies interacted with time dummies, with province dummies interacted with time dummies²³. Results are reported in Table 4. Once again, *Foreigncap* has a positive and statistically significant coefficient, while *Foreigncap*² has a negative and precisely determined coefficient, suggesting an inverted *U*-shaped relationship between foreign ownership and corporate performance, with turning points of 52.31%, 64.24%, 55.65%, and 46.79%, respectively for *ROA*, *ROS*, *PROD*, and *TFP*. These turning points are comparable to those reported in Table 3.

Our data indicate that the average share of foreign capital paid in by all foreign investors is 28.92%. A share of 14.51% is paid in by investors from Hong Kong, Macao, and Taiwan (*HMT*), while a share of 14.36% is paid in by other foreign investors. It has been argued that although investors from *HMT* may enjoy an advantage based on cultural and geographical proximity to China, they are likely to be fundamentally different from investors from other parts of the world. Specifically, it may be that investment by *HMT* firms simply represents “round-tripping” by domestic Chinese investors hoping to take advantage of the favorable tax and regulatory treatment received by foreign investors (Huang, 2001). In such cases, one would not necessarily expect firms owned by investors originating from Hong Kong, Macao, and Taiwan to perform better than domestic firms.

Tables A3 and A4 in Appendix 1D report descriptive statistics similar to those presented in Table 1, where observations are partitioned on the basis of the share of total capital paid in by investors originating from countries other than *HMT*, and by *HMT* entrepreneurs, respectively. Like Table 1, Table A3 indicates that corporate performance increases with the share of non *HMT* capital participation, but declines for 100% non *HMT* owned firms. The pattern in Table A4 is less clear, as very little

²³ These dummies also control for factors such as the prevalence of foreign owned firms in a given province and year.

difference in corporate performance is observed among firms with *HMT* participation between 1% and 49.99%, and between 50% and 99.99%. Moreover 100% *HMT* owned firms exhibit the worst performance (column 4). In summary, ownership by *HMT* investors does not seem to lead to a clear-cut productivity advantage: this can be seen as indirect evidence in favor of the “round-tripping” hypothesis.

To shed further light on this issue, we estimate a new version of equation (2), in which we replace *Foreigncap* and *Foreigncap*² with corresponding variables for non *HMT* investors (*Non HMT Foreigncap* and *Non HMT Foreigncap*²), and *HMT* investors (*HMT Foreigncap* and *HMT Foreigncap*²). The estimates are reported in Table 5. On the one hand, *Non HMT Foreigncap* always attracts a positive and statistically significant coefficient, while *Non HMT Foreigncap*² has a negative and precisely determined coefficient. The turning points are 50.00%, 60.68%, 55.03%, and 48.73%, respectively for *ROA*, *ROS*, *PROD*, and *TFP*. These are comparable to those reported in Table 3. On the other hand, ownership by investors from *HMT* has less clear-cut effects: the coefficients on both foreign ownership variables are in fact poorly determined for *TFP*, and in the regression for *ROA*, only the coefficient on *HMT Foreigncap*² is marginally significant. In the regression for *PROD*, *HMT Foreigncap* has a significant coefficient, which is much smaller in magnitude compared to the corresponding coefficient in Table 3, and *HMT Foreigncap*² has a negative but marginally significant coefficient. The turning point is 73%. For *ROS*, both the coefficients on *HMT Foreigncap* and *HMT Foreigncap*² are precisely determined at conventional levels, and the turning point of 57.85%. In summary, these results suggest that the inverted *U*-shaped relationship between foreign ownership and corporate performance is mainly driven by non *HMT* foreign investors

The use of a GMM estimator, which makes use of lagged values of foreign ownership (and other variables) as instruments, ensures in principle that the relationship found between foreign ownership and corporate performance is essentially explained by the effects of the exogenous component of foreign ownership on corporate performance. Yet, it could be argued that if foreign investors target the most productive domestic firms, the direction of causality could in fact go from corporate performance to the foreign equity share of the firm. To investigate this, we perform a panel Granger causality test (Holtz-Eakin et al., 1989). Specifically, we estimate an equation of the following type:

$$(3) \quad \text{Foreigncap}_{it} = a_0 \text{Foreigncap}_{i(t-1)} + a_1 \text{Foreigncap}_{i(t-2)} + b_1 \text{PERF}_{i(t-1)} + \\ + b_2 \text{PERF}_{i(t-2)} + v_i + v_t + v_{it} + e_{it}$$

where *PERF* represents in turn one of our four indicators of corporate performance. The structure of the error term in equation (3) is similar to that in equations (1) and (2). In this framework, *PERF* is said not to Granger cause *Foreigncap* if the coefficients on $\text{PERF}_{i(t-1)}$ and $\text{PERF}_{i(t-2)}$ in equation (3) are not significantly different from 0, i.e. if $b_1 = b_2 = 0$. The results of the estimates of equation (3), together with the *p*-values associated with the *F*-test aimed at testing our null hypothesis are presented in Table 6. We can see that for each of our four measures of corporate performance, the null hypothesis cannot be rejected. We therefore conclude that there is no obvious evidence that corporate performance Granger causes foreign ownership²⁴.

Overall, our findings indicate that foreign ownership is only beneficial to the performance of Chinese firms, as long as the degree of foreign ownership does not pass a certain threshold which ranges between 47% and 64%, depending on the measure of corporate performance used. This suggests that a certain degree of domestic ownership is necessary to ensure optimal performance. We next construct a simple theoretical model aimed at underpinning these empirical findings.

5. Theoretical model

We now construct a simple theoretical model which can generate predictions of a non-monotonic relationship between a firm's degree of foreign ownership and its performance similar to that found in the previous section²⁵.

5.1. The model: We assume that the market is made up of *I* firms labeled with the subscript *i* ($i = 1 \dots I$), each of which produces a different product, also labeled with *i*.

²⁴ These results were robust to adding other control variables to the regressions.

²⁵ Some features of this model resemble the “property rights” approach to the analysis of firm behavior pioneered by Hart and Moore (1990) and Grossman and Hart (1986), where business partners choose their relation-specific investments on the basis of the allocation of the project's joint surplus. Also see Chapter 5.2 in Barba Navaretti and Venables (2006). We thank Arijit Mukherjee for offering inspiring ideas for this section.

Let q_i and q_0 denote the quantity of firm i 's product, and that of a competitively supplied numeraire good, respectively. Consumers maximize the following utility function:

$$(4) \quad U = q_0 + \sum_{i=1}^I \gamma q_i^\rho, \quad \rho < 1, \gamma_i > 0$$

Utility maximization yields the following demand curve:

$$(5) \quad q_i = A_i p_i^{-\sigma}, \quad \sigma \equiv \frac{1}{1-\rho} > 1, \quad A_i \equiv (\gamma_i \rho)^\sigma,$$

where p_i represents the price of good i , and A_i is a demand shifter, which is exogenous to individual firms. Labor is the only factor of production, and production technology exhibits constant returns to scale, with total labor costs given by $c_i = \frac{q_i w}{v_i}$, where w and v_i represent respectively the wage (common to all firms) and productivity (firm-specific).

Each firm is potentially a joint-venture between two owners: a foreign (F) and a domestic owner (D). Each may contribute a non-contractible input (such as effort) to affect the productivity of the joint-venture (v_i). Productivity can hence be expressed as follows (for simplicity, we hereafter suppress the firm subscript i):

$$(6) \quad v = (x+a)^\alpha (y+b)^\beta, \quad a \geq 0, b \geq 0, \alpha + \beta = 1.$$

x and y represent the non-contractible inputs supplied respectively by F and D . x may be interpreted as the foreign owner's effort aimed at improving the quality of the design of the product, or any other form of "knowledge capital". y could be seen as the domestic owner's effort aimed at promoting the sale and marketing of the product in the local market (e.g. through the organization and monitoring of a sales team), or at facilitating the political connection (*Guanxi*) with local governments, which is often considered as a key factor in determining firms' performance in China (Hsieh and Klenow, 2007). Both inputs are assumed to be greater than or equal to 0, (i.e. $x \geq 0$ and $y \geq 0$)²⁶. Furthermore, equation (6) implies decreasing returns to scale of x and y (i.e. $v_{xx} < 0, v_{yy} < 0$)²⁷.

²⁶ This non-negativity assumption means that neither party can contribute negative inputs to incur "damage" to the productivity of the joint-venture, by making v fall below its benchmark level given by $v(0,0) = a^\alpha b^\beta$.

²⁷ As we will show below, this feature will turn out to be crucial for the inverse- U shaped ownership-productivity relationship that our model predicts under plausible conditions.

The parameter $\alpha(\beta)$ captures the “relative importance” of the contribution of $x(y)$ to productivity. The relative marginal return to x is in fact given by:

$$\frac{\partial v / \partial x}{\partial v / \partial y} = \frac{\alpha}{1-\alpha} \frac{y+b}{x+a},$$

which is increasing in α . The greater α , the greater the contribution of x to firm productivity. In the extreme case in which $\alpha = 0$, x is completely “unimportant” to v , which is purely determined by y .

The parameter $a(b)$ *inversely* captures the “absolute indispensability” of $x(y)$: the lower $a(b)$, the greater the marginal return to $x(y)$. In the extreme case in which $a = 0$ ($b=0$), $v=0$ if $x=0$ ($y=0$), indicating that $x(y)$ is completely “indispensable”, since $x(y)$ must be strictly positive in order to achieve a positive productivity.

We further assume that there are implicit costs borne by each party to increase their inputs. These can be expressed as:

$$(7) \quad G_F(x) = \frac{rx^k}{k}, \quad G_D(y) = \frac{ty^k}{k}, \text{ where } k \geq 1, r > 0, t > 0.$$

Note that these implicit costs are assumed not to be incurred by the joint-venture, but only by the individual owners. For example, the domestic party may need to devote some of his/her own time to monitor the local sales team, incurring a disutility. Finally, the ownership shares of the firm allocated to parties F and D are respectively S and $1-S$. S is assumed to be exogenous: it could partly depend on the bargaining power of the foreign party and on other factors beyond the control of individual investors (such as government interventions).

5.2 Nash equilibrium: Each firm’s profit is given by $\pi(v) = pq - c$. Profit

maximization leads to the following optimal price: $p = \frac{\sigma w}{(\sigma - 1)v}$, which yields the

following optimal profit:

$$(8) \quad \pi = Bv^{\sigma-1}, \quad B \equiv A w^{1-\sigma} (\sigma-1)^{\sigma-1} \sigma^{-\sigma}$$

Parties F and D receive respectively shares S and $1-S$ of the total profits. Each simultaneously chooses the inputs that it contributes to maximize his/her individual net payoff, taking the other party’s inputs as given. The two parties’ maximization problems can therefore be expressed as follows:

$$(9) \quad F: \quad \max_x [S\pi(x, y) - G_F(x)] \quad \Leftrightarrow S\alpha(x+a)^{u-1} (y+b)^{1-z} = \frac{r}{B(\sigma-1)} x^{k-1}$$

$$(10) \quad D: \quad \max_y [(1-S)\pi(x, y) - G_D(y)] \Leftrightarrow (1-S)\beta(x+a)^u (y+b)^{-z} = \frac{t}{B(\sigma-1)} y^{k-1},$$

$$\text{where } z \equiv 1 - \beta(\sigma - 1), \quad u \equiv \alpha(\sigma - 1).$$

Equations (9) and (10) imply a standard Nash equilibrium problem, whereby each party strategically chooses its input, depending on the choice made by the other party. For the purpose of the presentation, we will hereafter focus on the simple case in which the cost functions of x and y are symmetric ($r = t$) and linear ($k=1$)²⁸. In this case, the equilibrium is determined by:

$$(11) \quad S\alpha(x+a)^{u-1} (y+b)^{1-z} = Q^{-1}$$

$$(12) \quad (1-S)\beta(x+a)^u (y+b)^{-z} = Q^{-1},$$

where $Q \equiv r^{-1}[B(\sigma-1)]$. To ensure that the second order conditions for each party's optimization problem hold, we assume that $\sigma < 2$ ²⁹. As shown in figure 1, equations (11) and (12) define y , respectively, as a concave and a convex function of x , ensuring the existence of a unique Nash equilibrium³⁰. The equilibrium values of x and y , x_I and y_I , are thus given by:

$$(13) \quad x_I = S^{\frac{z}{2-\sigma}} (1-S)^{\frac{1-z}{2-\sigma}} M^{\frac{1}{2-\sigma}} - a$$

$$(14) \quad y_I = S^{\frac{u}{2-\sigma}} (1-S)^{\frac{1-u}{2-\sigma}} N^{\frac{1}{2-\sigma}} - b,$$

where $M \equiv \beta^{1-z} \alpha^z Q$ and $N \equiv \beta^{1-u} \alpha^u Q$. Inspection of these two equations reveals that

both x_I and y_I are inverse U -shaped functions of S [since $\frac{\partial x_I}{\partial S} \geq (<)0$ if $S \leq (>) z$ and

$\frac{\partial y_I}{\partial S} \geq (<)0$ if $S \leq (>) u$]. Focusing on the relationship between S and x , the intuition

behind these relationships can be explained considering that, according to the setup of our model, an increase in S has two opposing effects on x . On the one hand, when

²⁸ Although our qualitative results were largely unaffected in more general cases, the example allows us to derive simple closed form solutions to the problem.

²⁹ The second order conditions associated with (11) and (12) are, respectively: $u - 1 = \alpha(\sigma - 1) - 1 < 0$ and $-z = (1 - \alpha)(\sigma - 1) - 1 < 0$. Since $\alpha < 1$, $\sigma < 2$ ensures that both of these inequalities hold.

³⁰ The figure is based on the following parameter values: $\sigma=1.5$, $\alpha=0.6$, $r=1$, $B=10$, $a=0.05$, $b=0.08$.

his/her share in total profit (S) increases, party F tends to provide more input x , as this raises the reward to his/her input. We call this the “share effect”. On the other hand, an increasing share S means a decreasing share of party D in total profits ($1-S$), leading to a decreasing input from D , which in turn tends to reduce productivity and hence total profit. This decreases the marginal return to F ’s inputs, and hence induces F to provide less input. We call this the “strategic effect”. The overall effect turns out to depend on the value of S : when S is low (high), the “share effect” (“strategic effect”) dominates, leading to a positive (negative) relationship between S and x .

Equations (13) and (14) imply that x and y could possibly be negative. Yet, we assumed that neither x nor y can take a value below zero (non-negativity assumption). It follows that:

$$(15) \text{ if } x_1 < 0, x = 0 \Rightarrow y = y_2 \equiv \arg \max_y [(1-S)\pi(0, y) - ry] = [\beta(1-S)a^u Q]^{\frac{1}{z}} - b$$

$$(16) \text{ if } y_1 < 0, y = 0 \Rightarrow x = x_2 \equiv \arg \max_x [S\pi(x, 0) - rx] = [\alpha S b^{1-z} Q]^{\frac{1}{1-u}} - a$$

Note that x_2 (y_2) is monotonically increasing in $S(1-S)$. Using the non-negativity assumption and combining equations (13) to (16), the equilibrium levels of the inputs x^* and y^* contributed respectively by F and D are given by :

$$(17) \quad x^* = \begin{cases} x_1(S) & , \quad x_1 > 0, y_1 > 0 \\ x_2(S) & , \quad x_2 > 0, y_1 < 0 \\ 0 & , \quad \text{otherwise} \end{cases}$$

$$(18) \quad y^* = \begin{cases} y_1(S) & , \quad x_1 > 0, y_1 > 0 \\ y_2(S) & , \quad y_2 > 0, x_1 < 0 \\ 0 & , \quad \text{otherwise} \end{cases}$$

5.3 Relationship between ownership and productivity: We now investigate the central issue of the model, i.e. its predictions regarding the relationship between the

share of foreign ownership (S) and firm productivity (v^*)³¹. Substituting (17) and (18) into (6), we obtain the equilibrium value of productivity as a function of S , i.e.:

$$(19) \quad v^* = \begin{cases} v_1 = v(x_1, y_1) = \left[S^\alpha (1-S)^\beta \alpha^\alpha \beta^\beta Q \right]^{\frac{1}{2-\sigma}} & , \quad x_1 > 0, y_1 > 0 \\ v_2 = v(0, y_2) = a^\alpha (y_2 + b)^\beta = a^\alpha \left[\beta(1-S) a^u Q \right]^{\frac{\beta}{z}} & , \quad x_1 < 0, y_2 > 0 \\ v_3 = v(x_2, 0) = (x_2 + a)^\alpha b^\beta = \left[\alpha S b^{1-z} Q \right]^{\frac{\alpha}{1-u}} b^\beta & , \quad y_1 < 0, x_2 > 0 \\ v_4 = v(0, 0) = a^\alpha b^\beta & , \quad \text{otherwise} \end{cases}$$

From (19), it is straightforward that $\frac{\partial v_1}{\partial S} \geq (<)0$ if $S \leq (>) \alpha$. In words, v_1 is an inverse

U -shaped function of S , maximized at $S = \alpha$. Furthermore, $\frac{\partial v_2}{\partial S} < 0$, $\frac{\partial v_3}{\partial S} > 0$, and

$$\frac{\partial v_4}{\partial S} = 0.$$

What conclusions can we draw from the above analysis about the effects of the degree of foreign ownership on owners' inputs and corporate productivity? As can be seen from equations (17)-(19), depending on the model parameters, x^* , y^* , and v^* could either be linked to S by an inverted U -shaped relationship, or be monotonically increasing or decreasing in S , or be independent of S . This implies that, in general, the impact of S on x^* , y^* , and v^* is ambiguous.

However, under reasonable parameter ranges, the model yields clear-cut predictions on the relationship between foreign ownership (S) and firm productivity (v^*) that broadly fit the empirical results obtained in section 4. Figures 2a and 2b, which plot the values of x^* , y^* , and v^* against S , illustrate a situation of this type³².

The following important features emerge. First, the best performing joint-venture is more productive than the wholly foreign owned company, which in turn outperforms the purely domestic company. This can be expressed as follows:

$$(20) \quad v^*(\alpha) > v^*(1) > v^*(0)$$

³¹ These predictions can be generalized to other types of firm performance indicators such as profitability (π), which are monotonically increasing in v^* (see equation 8).

³² Like figure 1, figures 2a and 2b are based on the parameter values: $\sigma=1.5$, $\alpha=0.6$, $r=1$, $B=10$, $a=0.05$, $b=0.08$. Note that v_4 does not appear in figure 2b, as it requires that $x^* = y^* = 0$, which only occurs when both a and b are very large.

Note that according to (19) and (13)-(14), $v^*(0) = v_2(0)$, $v^*(1) = v_3(1)$, and $v^*(\alpha) = v_1(\alpha)$. As shown in Appendix 2A, it follows that necessary and sufficient conditions for (20) are that both a and b are sufficiently small, and that a is sufficiently small relative to b (given α, β and Q). In word, the above pattern of productivity ordering requires that both the foreign and domestic party's inputs are crucial to the joint-venture's productivity performance, with the foreign party's inputs being relatively more important. This is consistent with the fact that, in developing countries, the foreign parties of joint-ventures usually provide core technology and design of the products, which are often regarded as "key inputs" to production and, hence, to productivity.

Second, for a joint-venture with an intermediate ownership share S (between 5% and 95% in our example), there exists an inverse U -shaped relationship between the share of foreign ownership and productivity, with maximum productivity level at $S = \alpha$. As shown in Appendix 2B, this feature requires that $v^*(S)$ is dominated by the inverse U -shaped function $v_1(S)$, which in turn requires that both parameters a and b are sufficiently small. To understand the intuition behind this inverse U -shaped relationship, it is important to note that the firm's productivity depends on the joint inputs from both parties. As can be seen from figures 2a and 2b, when S is low, the input contributed by party F is low, leading to relatively low productivity. Similarly, when S is high, party D 's contribution is low, which once again leads to relatively low productivity. This is because, as shown in section 5.1, the contributions of inputs x and y to overall firm productivity are characterized by decreasing return to scales. Hence, a high S ($1-S$) leads to "undersupply" of input $y(x)$, as the marginal return to this input is relatively high, and to "oversupply" of input x (y), whose marginal return is low. It is only when S is at an intermediate level, which depends on the relative marginal returns of the two inputs, and equals the foreign owner's share in the productivity function (α) that the joint inputs contributed by both parties lead to the highest productivity of the joint-venture. This result mirrors a well-known conclusion from the "property rights" theory of the firm, according to which the optimal allocation of property rights should assign more assets to the party whose investment has greater impact on production (Grossman and Hart 1986, Hart and Moore 1990).

Third, when foreign ownership (S) is very low (high), firm productivity (v^*) is monotonically decreasing (increasing) in S . This is because, as can be seen from

figure 2a, when S is very low (<5% in this example), party F will always provide zero inputs, meaning that a marginal increase in S will decrease party D 's share in total profits $(1-S)$. This will reduce party D 's incentive to contribute to production (y^*), leading to a lower level of total productivity. Reasoning analogously, when S is very high, party D will always provide zero inputs, whilst party F 's incentive to contribute to production will increase in S . Consequently, productivity will increase in S .

To conclude, although the above theoretical predictions on the relationship between ownership and performance depend on model parameters, and in particular on the degree of “indispensability” of both parties’ inputs (a, b), the key merit of this theoretical model is to provide a rationale for why there could exist a productivity ordering between joint-ventures, wholly foreign owned firms, and purely domestic firms, and an inverse U -shaped relationship between the degree of foreign ownership and corporate performance, similar to those empirically revealed in sections 2 and 4. This rationale hinges on the strategic interactions between the owners’ non-contractible inputs, and the optimal allocation of ownership according to the relative importance of each owner’s inputs.

6. Conclusions

We have used a panel of 21,582 unlisted Chinese firms over the period 2000-2005 to analyze the relationship between the degree of foreign ownership and corporate performance. Focusing on the return on assets, the return on sales, labor productivity, and TFP , we have found that joint-ventures generally perform better than purely foreign owned and purely domestic firms. This finding is robust to defining joint-ventures on the basis of the capital paid in by various foreign agents, and on the basis of registration information. It can be explained considering that both the domestic and foreign parties of a joint-venture bring in attributes essential to achieving high performance. Specifically, the former contribute knowledge of the Chinese market and legal environment, as well as important political connections with local governments; and the latter, modern technologies, capital, better corporate governance through monitoring and market discipline, and managerial and international networking skills.

We have then shown that foreign ownership and the performance of our Chinese firms are linked by an inverted U -shaped relationship. Specifically, corporate performance increases as foreign participation rises up to the range 47% to 64%,

depending on the measure of performance used, and declines thereafter. This suggests a certain degree of domestic ownership is necessary to ensure optimal performance. Furthermore, it is those firms owned by investors other than those originating from Hong Kong, Macao, and Taiwan that benefit most from their foreign ownership.

Finally, we have rationalized these results with a simple theoretical model of a joint-venture, where, under plausible conditions, strategic interactions between the non-contractible inputs contributed by a foreign and a domestic owner may lead to a non-monotonic relationship between a firm's degree of foreign ownership and its performance similar to that found in our data.

Our findings contribute to understanding the link between FDI and economic growth: in countries where FDI inflows are large and mainly take the form of joint-ventures between domestic and foreign firms, the effect of FDI penetration on the performance of recipient firms could be an important channel through which FDI affects economic growth. Attracting more FDI in the form of joint-ventures could hence be beneficial to long-run growth.

Appendix 1: Data

A. Structure of the unbalanced panel

<i>Number of obs. per firm</i>	<i>Number of observations</i>	<i>Percent</i>	<i>Cumulative</i>
2000	11,813	12.77	12.77
2001	13,864	14.98	27.75
2002	15,822	17.10	44.84
2003	16,564	17.90	62.74
2004	17,665	19.09	81.83
2005	16,814	18.17	100.00
Total	91,139	100.00	

<i>Number of obs. per firm</i>	<i>Number of observations</i>	<i>Percent</i>	<i>Cumulative</i>
1	1,404	1.52	1.52
2	5,922	6.40	7.92
3	8,052	8.70	16.62
4	12,616	13.63	30.25
5	18,630	20.13	50.38
6	45,918	49.62	100.00
Total	91,139	100.00	

B. Definitions of the variables used

Ownership variables

Minority foreign: dummy variable (*DV*) equal to 1 if the share of the firm's total capital owned by foreign investors is positive but lower than 50%, and 0 otherwise.

Majority foreign: *DV* equal to 1 if the share of the firm's total capital owned by foreign investors is greater than or equal to 50% but lower than 100%, and 0 otherwise.

All foreign: *DV* equal to 1 if the share of the firm's total capital owned by foreign investors is equal to 100%, and 0 otherwise.

Foreigncap: share of the firm's capital paid in by foreign investors (including investors from Hong Kong, Macao, and Taiwan).

HMT Foreigncap: share of the firm's capital paid in by investors from Hong Kong, Macao, and Taiwan.

Non HMT Foreigncap: share of the firm's capital paid in by foreign investors other than those from Hong Kong, Macao, and Taiwan.

Statecap: share of the firm's capital paid in by the state.

Privatecap: share of the firm's capital paid in by private investors.

EJV: *DV* equal to 1 if the firm is registered as an equity joint-venture (registration codes 210 or 310), and 0 otherwise.

CJV: *DV* equal to 1 if the firm is registered as a contractual joint-venture (registration codes 220 or 320), and 0 otherwise.

JV: *DV* equal to 1 if the firm is registered as an *EJV* or as a *CJV*, and 0 otherwise.

WFO: *DV* equal to 1 if the firm is registered as wholly foreign owned (registration codes 230 or 330), and 0 otherwise.

Corporate performance variables

Return on Assets (ROA): ratio of the firm's net income to total assets.

Return on Sales (ROS): ratio of the firm's net income to total sales.

PROD: labor productivity, calculated as the ratio of the firm's net income to total number of employees.

TFP: total factor productivity calculated using the Levinsohn and Petrin (2003) method, applied separately to different industrial groups.

Other variables

Total assets: sum of the firm's fixed and current assets, where the former include tangible, intangible, and other fixed assets; and the latter include inventories, accounts receivable, and other current assets.

Size: logarithm of the firm's total assets.

Leverage: ratio of current liabilities plus non-current liabilities to total assets, where current liabilities include loans, accounts payable, and other current liabilities; and non-current liabilities include long-term debt and other non-current liabilities.

Collateral: ratio of tangible assets to total assets.

Employees: total number of people employed by the firm.

Expdum: dummy equal to 1 if the firm reports a positive value of firm's overseas sales, and 0 otherwise.

Deflators: all variables are deflated using provincial GDP deflators, taken from various issues of the China Statistical Yearbook.

C. FDI patterns by region and industry

Table A1 shows how our observations are distributed among the four foreign ownership categories described in section 2.2, within China's 30 provinces, which are in turn divided into three broad regions (Coastal, Central, and Western)³³. We can see that most of the foreign owned firm-years are concentrated in the Coastal region, where only 50.62% of the firms are domestically owned. The corresponding figures in the Central and Western regions are 87.36% and 89.86%, respectively. This

³³ China is administratively decomposed into 31 provincial units, which fall into three categories: 22 provinces or *sheng*; 4 autonomous regions or *zizhiqu* (Neimenggu, Xinjiang, Tibet, Ningxia and Guangxi); and 4 municipal cities or *zhixiashi*, under direct supervision of the central power (Shanghai, Tianjin, Beijing, and Chongqing). Tibet is excluded from our dataset due to lack of data.

geographical concentration of foreign owned firms may have its root in the FDI promotion policies adopted in the past, and in the inadequate infrastructures characterizing the Central and Western regions (Dougherty and McGuckin, 2002). Focusing on specific provinces, Guandong contains the lowest percentage of domestically owned firm-years (25.74%), while Qinghai has the highest (98.61%). Guandong also contains the highest share of wholly foreign owned firms (52.73%), while the highest share of partially foreign owned firms is in Shanghai (34.79%). In sum, Table A1 indicates that although all Chinese provinces exhibit some degree of foreign ownership, there is a substantial heterogeneity in the degree of foreign presence across provinces.

Table A2 presents a similar analysis for 15 industrial groups³⁴. 87.90% of our sample is made up of manufacturing firm-years. Yet, because foreign ownership also characterizes other sectors in the economy, we include some of these in our analysis. The Table shows that except for “Mining” and “Transportation; Communication, Electric, Gas, and Sanitary Services”, all sectors are characterized by a percentage of foreign owned firm-years in excess of 20%³⁵. There is also considerable heterogeneity in the degree of foreign ownership across sectors. In particular, “Other Manufacturing” contains the highest share of wholly foreign owned firm years (45.95%)³⁶. The highest percentage of partially foreign owned firm-years is in the wholesale and retail sector (30.84%). The Table also shows that foreign firms have entered both labor-intensive industries such as “Textiles, Clothing, and Leather”, and capital-intensive industries such as “Chemicals, Petroleum, and Man Made Fibres”, and “Electrical, Machinery and Computer Equipment”.

³⁴ These groups are based on two-digit SIC groups for the manufacturing sector, and on the broader SIC divisions for the non-manufacturing sector for which fewer observations are available.

³⁵ Note that 96.74% of the observations in the broad sector “Transportation, Communication, Electric, Gas, and Sanitary Services” comes from “Electric, Gas, and Sanitary Services”. This broad sector is largely controlled by the State.

³⁶ “Other Manufacturing” contains, among others: measuring, analyzing, and controlling instruments; photographic, medical and optical goods; watches and clocks; jewellery, silverware, and plated ware; musical instruments; dolls, toys, games, sporting and athletic goods; pens, pencils and other artists materials.

D. Descriptive statistics differentiating foreign owners into those origination from Hong Kong, Macao, and Taiwan, and those originating from other parts of the world

Table A3 presents descriptive statistics similar to those presented in Table 1 for investors originating from Hong Kong, Macao, and Taiwan. Table A4 presents similar statistics from investors originating from other parts of the world.

Appendix 2: Proofs

A. Necessary and sufficient conditions for the productivity ordering

$$v^*(\alpha) > v^*(1) > v^*(0)$$

From (19), it follows that $v^*(0) = v_2(0) = a^{\frac{\alpha}{z}} [\beta Q]^{\frac{\beta}{z}}$, which is increasing in a ; and that

$v^*(1) = v_3(1) = b^{1-u} [\alpha Q]^{\frac{\alpha}{1-u}}$, which is increasing in b . Furthermore,

$v^*(\alpha) = v_1(\alpha) = \left[\alpha^{2\alpha} \beta^{2\beta} Q \right]^{\frac{1}{2-\sigma}}$ is independent of a and b . Hence,

$v^*(0) < v^*(1) < v^*(\alpha)$ requires the following necessary and sufficient conditions to be satisfied:

$$(A.1) \quad a^{\frac{\alpha}{z}} < b^{1-u} \left[\alpha^{\frac{\alpha}{1-u}} \beta^{\frac{-\beta}{z}} \right] Q^{\frac{\alpha-\beta}{z(1-u)}} < \alpha^{\frac{2\alpha}{2-\sigma}} \beta^{\left(\frac{2}{2-\sigma} - \frac{1}{z}\right)} Q^{\left(\frac{1}{2-\sigma} - \frac{\beta}{z}\right)}$$

(A.1) implies that for given values of α , β , and Q , both a and b must be sufficiently small. Moreover, a must be sufficiently small relative to b , for the inequality chain $v^*(\alpha) > v^*(1) > v^*(0)$ to hold.

B. Necessary and sufficient conditions for the quasi inverse- U shaped ownership-productivity relationship

Recall that v_1 is an inverse U -shaped function of S , while v_2 and v_3 are respectively monotonically decreasing and increasing in S , and v_4 is independent of S (equation 19). Let Δ_i represent the sets of S that correspond to $v^* = v_i$, $i \in \{1, 2, 3, 4\}$. For the

non-monotonic part v_1 to dominates v^* , Δ_1 must be large. Note that $S \in \Delta_1$ should satisfy the following conditions: $x_1 > 0$ and $y_1 > 0$. Using (13) and (14), these imply:

$$(B.1a) \quad J^x(S) \equiv S^z(1-S)^{1-z} > a^{2-\sigma}M^{-1}$$

$$(B.1b) \quad J^y(S) \equiv S^u(1-S)^{1-u} > b^{2-\sigma}N^{-1}$$

Since $\frac{\partial J^x(S)}{\partial S} \geq (<)0$ if $S \leq (>) z$, it can be shown that (B.1a) holds if and only

if $S \in \Delta_1^x \equiv [S_L^x, S_H^x]$, where $S_H^x > S_L^x > 0$ are such that $J^x(S_j^x) = a^{2-\sigma}M^{-1}$, $j = H, L$,

and $\frac{\partial S_H^x}{\partial a} \left(\frac{\partial S_L^x}{\partial a} \right) < (>)0$. This implies that Δ_1^x increases as a declines.

Reasoning analogously, it can be shown that (B.1b) holds if and only if

$S \in \Delta_1^y \equiv [S_L^y, S_H^y]$, where $S_H^y > S_L^y > 0$ are such that $J^y(S_j^y) = b^{2-\sigma}N^{-1}$, $j = H, L$,

and $\frac{\partial S_H^y}{\partial b} \left(\frac{\partial S_L^y}{\partial b} \right) < (>)0$. This implies that Δ_1^y increases as b declines.

Hence, $\Delta_1 = \Delta_1^x \cap \Delta_1^y$ will be larger, the smaller a and b . In other words, the more “indispensable” the inputs x and y are to the production process, the more the relationship between S and v^* will be dominated by the inverse U -shaped function v_1 . In the extreme case in which $a = b = 0$, $S_L^x = S_L^y = 0$, $S_H^x = S_H^y = 1$. This implies that

$\Delta_1 = [0, 1]$, and $\Delta_2 = \Delta_3 = \Delta_4 = \emptyset$, i.e. $v^* = v_1 = \left[S^\alpha (1-S)^\beta \alpha^\alpha \beta^\beta Q \right]^{\frac{1}{2-\sigma}}$ for $S \in [0, 1]$.

This represents a purely inverse U -shaped relationship between v^* and S .

References

- Abraham, F., Konings, J., and V. Sloottmaekers (2007). “FDI spillovers in the Chinese manufacturing sector: evidence of firm heterogeneity.” CEPR Discussion Paper No. 6573.
- Aitken, B. and A. Harrison (1999). “Do domestic firms benefit from direct foreign investment? Evidence from Venezuela.” *American Economic Review*, 89, 605-618.
- Arellano, M. and S. Bond (1991). “Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations.” *Review of Economic Studies*, 58, 277-97.

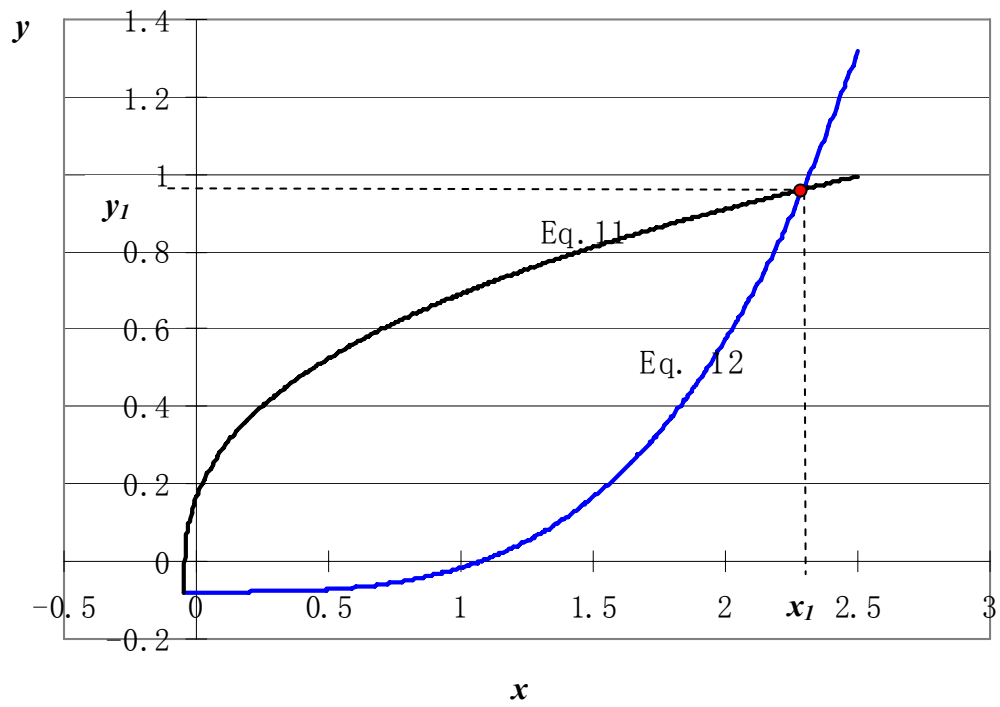
- Barba Navaretti, G. and T. Venables (2006). *Multinational Firms in the World Economy*. Princeton University Press.
- Benito, A. (2003). "The capital structure decisions of firms: is there a pecking order?" Bank of Spain Working Paper No. 0310.
- Blomström, M. and A. Kokko (1998). "Multinational corporations and spillovers." *Journal of Economic Surveys*, 12, 47-77.
- Blomström, M. and F. Sjöholm (1999). "Technology transfers and spillovers: does local participation with multinationals matter?" *European Economic Review*, 43, 915-23.
- Blundell, R. and S. Bond (1998). "Initial conditions and moment restrictions in dynamic panel data models." *Journal of Econometrics*, 87, 115-43.
- Blundell, R., Bond, S., and F. Windmeijer (2000). "Estimation in dynamic panel data models: improving on the performance of the standard GMM estimators." In: B. Baltagi (ed.), *Nonstationary Panels, Panel Cointegration, and Dynamic Panels*, Advances in Econometrics 15, Amsterdam: JAI Press, Elsevier Science.
- Chhibber, P. and S. Majumdar (1999). "Foreign ownership and profitability: property rights, control and the performance of firms in Indian industry." *Journal of Law and Economics*, 42, 209-39.
- Crisuolo, C. and R. Martin (2005). "Multinationals, foreign ownership and productivity in UK businesses." Working Paper No. 024. Advanced Institute of Management Research, London.
- De Mello, L. (1997). "Foreign direct investment in developing countries and growth: a selective survey." *Journal Development Studies*, 34, 1, 1-34.
- Dimelis, S. and H. Louri (2002). "Foreign ownership and production efficiency: a quantile regression analysis." *Oxford Economic Papers*, 54, 449-69.
- Djankov, S. (1999). "Ownership structure and enterprise restructuring in six newly independent states." *Comparative Economic Studies*, 41, 75-95.
- Dollar, D. and S-J Wei (2007). "Das (wasted) capital: firm ownership and investment efficiency in China." NBER Working Paper No. 13103.
- Doms, M. and J. Jensen (1998). "Comparing wages, skills, and productivity between domestic and foreign owned manufacturing establishments in the United States". In: Baldwin, R., Lipsey, R., Richardson, J. (Eds.), *Geography and Ownership as Bases for Economic Accounting*. University of Chicago Press.

- Dougherty, S. and R. McGuckin (2002). "The effects of federalism and privatization on productivity of Chinese firms." EconWPA – Development and Comp Systems Working Paper No. 0411016.
- Du, J. and S. Girma (2008). "The effects of foreign acquisition on domestic and export markets dynamics in China." Leverhulme Centre for Research on Globalization and Economic Policy Research paper 2008/04.
- Estrin, S., Hanousek, J., and J. Svejnar (2008). "Effects of privatization and ownership in transition economies." *Journal of Economic Literature* (forthcoming).
- Folta, P. (2005). "Cooperative joint-ventures. Savvy foreign investors may wish to consider the benefits of this flexible investment structure." *The China Business Review* on line, January-February.
<http://www.chinabusinessreview.com/public/0501/folta.html>.
- Girma, S., Greenaway, D. and K. Wakelin (2001). "Who benefits from foreign domestic investment in the UK." *Scottish Journal of Political Economy*, 48, 2, 119–133.
- Globerman, S., Ries, J. and I. Vertinsky (1994). "The economic performance of foreign affiliates in Canada." *Canadian Journal of Economics* 27, 143–156.
- Görg, H. and D. Greenaway (2004). "Much ado about nothing? Do domestic firms really benefit from foreign direct investment?" *World Bank Research Observer*, 19, 171-197.
- Greenaway, D. and R. Kneller (2007). "Firm heterogeneity, exporting and foreign direct investment." *Economic Journal*, 117, F134-F161.
- Griffith, R. (1999a). "Productivity and foreign ownership in the UK car industry." IFS working paper 99/11.
- Griffith, R. (1999b). "Using the ARD establishment data to looking at foreign ownership and productivity in the United Kingdom." *Economic Journal*, 109, 416– 442.
- Grossman, G. and O. Hart (1986). "The costs and benefits of ownership: a theory of vertical and lateral integration." *Journal of Political Economy*, 94, 691-719.
- Guariglia, A., Liu, X., and L. Song (2008). "Is the growth of Chinese firms constrained by internal finance?" Leverhulme Centre for Research on Globalization and Economic Policy, Research Paper 08/37; IZA Discussion paper No. 3808.

- Harris, R. (2002). "Foreign ownership and productivity in the United Kingdom—some issues when using the ARD establishment level data." *Scottish Journal of Political Economy*, 49, 318–335.
- Harris, R. and C. Robinson (2003). "Foreign ownership and productivity in the United Kingdom: estimates for UK manufacturing using the ARD." *Review of Industrial Organization*, 22, 207-23.
- Hart, O. and J. Moore (1990). "Property rights and the nature of the firm." *Journal of Political Economy*, 98, 1119-1158.
- Holtz-Eakin, D., Newey, W. and H. S. Rosen (1989). "The revenues-expenditure nexus: evidence from local government data." *International Economic Review*, 30, 415- 429.
- Hsieh, C.T. and P. Klenow (2007). "Misallocation and manufacturing TFP in China and India." NBER Working Paper No. 13290. (Forthcoming in the *Quarterly Journal of Economics*).
- Huang, Y. (2001). "The role of foreign-invested enterprises in the Chinese economy: an institutional foundation approach." In: Chen, S. and C. Wolf Jr. (Eds.), *China, the United States, and the Global Economy*. Santa Monica: CA: Rand Corporation.
- Javorcik Smarzynska, B. and K. Saggi (2004). "Technological asymmetry and the mode of foreign investment." World Bank Policy Research Working Paper No. 3196.
- Jensen, M. and W. Meckling (1976). "Theory of the firm: managerial behaviour, agency costs, and ownership structure." *Journal of Financial Economics*, 3, 305-60.
- Jiang, B-B, Laurenceson, J., and K. Tang (2008). "Share reform and the performance of China's listed companies." *China Economic Review*, 19, 489-501.
- Konings, J. (2001). "The effects of foreign direct investment on domestic firms: evidence from firm-level panel data in emerging economies." *Economics of Transition*, 9, 619-33.
- Levinsohn, J. and A. Petrin (2003). "Estimating production functions using inputs to control for unobservables." *Review of Economic Studies* 70, 317-342.
- Liu, Z. (2008). "Foreign direct investment and technology spillovers: theory and evidence." *Journal of Development Economics*, 85, 176-93.

- McConnel, J. and H. Servaes (1990). "Additional evidence on equity ownership and corporate value." *Journal of Financial Economics*, 27, 595-612.
- Meggison, W. and J. Netter (2001). "From state to market: a survey of empirical studies on privatization." *Journal of Economic Literature*, 39, 321-89.
- Morck, R., B. Yeung, and M. Zhao (2008). "Perspectives on China's outward foreign direct investment." *Journal of International Business Studies*, 39, 337-350.
- Myers, S. (1977). "The determinants of corporate borrowing." *Journal of Financial Economics*, 5, 147-75.
- Nickell, S. (1981). "Biases in dynamic models with fixed effects." *Econometrica*, 49, 1417-26
- Olley, S. and A. Pakes (1996). "The dynamics of productivity in the telecommunications equipment industry." *Econometrica* 64, 1263-1297.
- Prasad, E. and S-J Wei (2005). "The Chinese approach to capital inflows: patterns and possible explanations." International Monetary Fund Working Paper No. 79.
- Takii, S. (2004). "Productivity differentials between local and foreign plants in Indonesian manufacturing, 1995." *World Development*, 32, 1957-69.
- Temouri, Y., N. Driffield, and D. Anon Higon (2008). "Analysis of productivity differences among foreign and domestic firms: evidence from Germany." *Review of World Economics*, 144, 1, 32-54.
- Tian, L. and S. Estrin (2008). "Retained state ownership in Chinese PLCs: does government ownership always reduce corporate value?" *Journal of Comparative Economics*, 36, 74-89.
- United Nations Conference on Trade and Development (UNCTAD) (2006). *World Investment Report 2006. FDI from Developing and Transition Economies: Implications for Development*. United Nations, New York and Geneva.
- Yusuf, S., K. Nabeshima, and D. Perkins (2006). *Under New Ownership: Privatizing China's State-Owned Enterprises*. Washington DC: World Bank.

Figure 1: Nash equilibrium of inputs contributed by foreign and domestic owners



Note: $S=60\%$, $\sigma = 1.5$, $\alpha = 0.6$, $r = 1$, $B = 10$, $a = 0.05$, $b = 0.08$

Figure 2a: Ownership and inputs

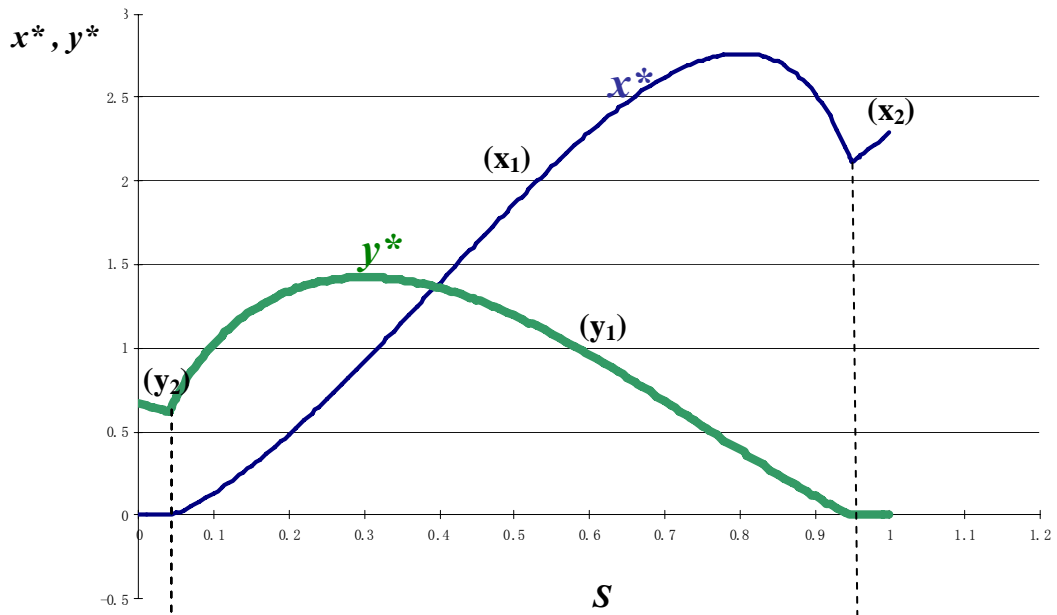
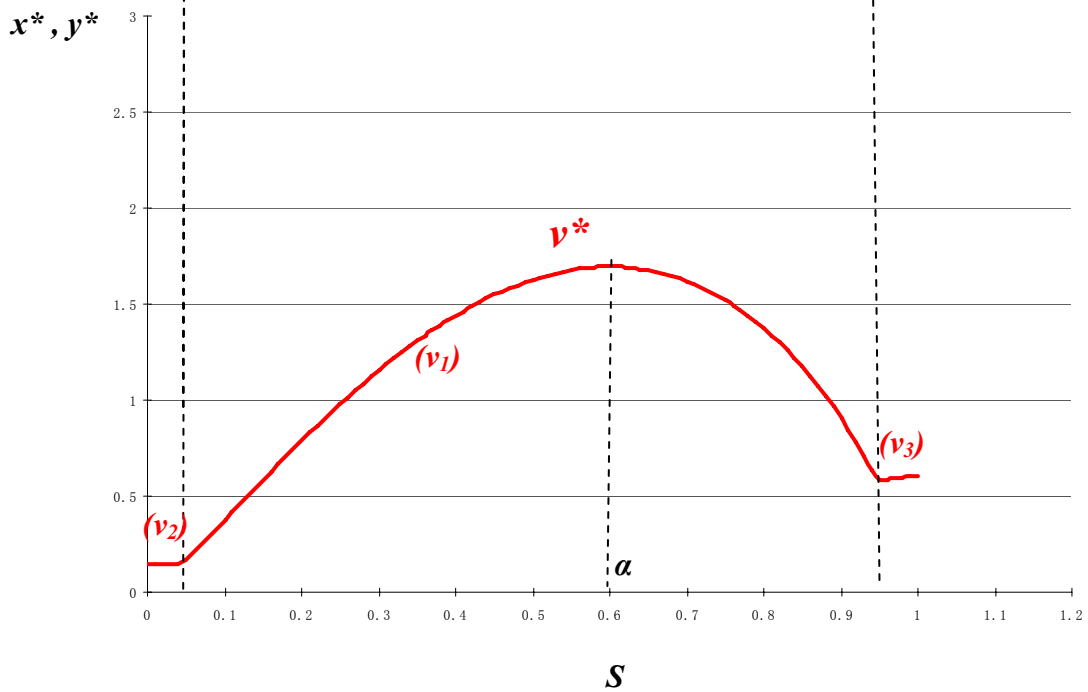


Figure 2b: Ownership and productivity



Note: $S=60\%$, $\sigma = 1.5$, $\alpha = 0.6$, $r = 1$, $B = 10$, $a = 0.05$, $b = 0.08$.

Table 1: Summary statistics

	<i>Foreigncap=0%</i>	<i>0%<Foreigncap<50%</i>	<i>50% ≤Foreigncap<100%</i>	<i>Foreigncap=100%</i>
	(1)	(2)	(3)	(4)
<i>ROA</i>	0.037	0.056	0.060	0.046
<i>ROS</i>	0.025	0.042	0.047	0.032
<i>PROD</i>	0.058	0.112	0.185	0.091
<i>TFP</i>	0.027	0.033	0.037	0.028
<i>Size</i>	6.58	6.74	6.83	6.31
<i>Leverage</i>	0.616	0.595	0.512	0.505
<i>Collateral</i>	0.398	0.337	0.355	0.360
<i>Expdum</i>	36.69	70.40	71.10	85.96
<i>Foreigncap</i>	0	27.00	71.06	100
<i>Statecap</i>	26.16	10.49	7.04	0
<i>Privatecap</i>	62.27	51.23	16.90	0
<i>Observations</i>	55817	9584	7884	18291

Notes: *Foreigncap* represents the fraction of the firm's capital paid in by foreign investors. *ROA* represents the firm's returns to assets and is given by its net income over its total assets. *ROS* represents the firm's returns to sales and is given by its net income over its total sales. *PROD* represents labor productivity, i.e. the ratio of the firm's net income to its number of employees. *TFP* is total factor productivity calculated using the Levinsohn and Petrin (2003) method. *Size* is the logarithm of the firm's total assets. *Leverage* is given by the sum of the firm's current and non-current liabilities to its total assets. *Collateral* is given by the ratio of the firm's fixed tangible assets to its total assets. *Expdum* is a dummy equal to 1 if the firm exports, and 0 otherwise. *Statecap* represents the fraction of the firm's capital paid in by the state. *Privatecap* represents the fraction of the firm's capital paid in by individual investors and legal entities. See Appendix 1B for complete definitions of all variables.

Table 2: Are joint-ventures the best performers?

	<i>ROA</i>	<i>ROS</i>	<i>PROD</i>	<i>TFP</i>	<i>ROA</i>	<i>ROS</i>	<i>PROD</i>	<i>TFP</i>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Lagged dep. variable</i>	0.386 (21.81)***	0.376 (25.26)***	0.430 (11.26)***	0.197 (4.36)***	0.389 (21.77)***	0.379 (23.54)***	0.421 (11.17)***	0.198 (4.72)***
<i>Minority foreign</i>	0.018 (1.94)*	0.023 (2.91)***	0.045 (2.01)**	0.008 (1.93)*				
<i>Majority foreign</i>	0.017 (0.81)	0.037 (2.10)**	0.060 (1.16)	0.018 (1.93)*				
<i>All foreign</i>	-0.012 (0.43)	0.011 (0.51)	-0.017 (0.27)	0.015 (1.32)				
<i>JV</i>					0.079 (2.93)***	0.090 (3.89)***	0.203 (3.16)***	0.216 (2.05)**
<i>WFO</i>					0.070 (1.82)*	0.080 (2.43)**	0.157 (1.80)*	0.246 (1.72)*
<i>Size</i>	0.001 (0.43)	0.012 (3.30)***	0.033 (3.09)***	-0.009 (3.23)***	-0.0002 (0.04)	0.008 (2.16)**	0.032 (3.05)***	-0.009 (3.89)***
<i>Leverage</i>	-0.032 (2.74)***	-0.040 (3.81)***	0.024 (0.93)	-0.007 (1.29)	-0.036 (2.96)***	-0.041 (3.85)***	0.015 (0.57)	-0.006 (1.11)
<i>Collateral</i>	-0.042 (3.25)***	-0.004 (0.31)	-0.022 (0.69)	-0.013 (2.11)**	-0.047 (3.60)***	0.005 (0.39)	-0.026 (0.78)	-0.019 (3.22)***
<i>Expdum</i>	-0.007 (1.19)	-0.018 (3.19)**	-0.030 (1.90)*	0.005 (1.80)*	0.001 (0.17)	-0.012 (1.87)*	-0.010 (0.58)	0.007 (2.47)**
<i>m2</i>	0.65	-0.09	1.26	1.25	1.27	0.55	1.46	1.43
<i>Observations</i>	47149	47149	47149	33749	47763	47763	47763	34133

Notes: *Minority foreign* is a dummy equal to 1 if the share of the firm's total capital owned by foreign investors is positive but lower than 50%, and 0 otherwise. *Majority foreign* is a dummy equal to 1 if the same share is greater than or equal to 50% but lower than 100%, and 0 otherwise. *All foreign* is a dummy variable equal to 1 if the share of the firm's total capital owned by foreign investors is equal to 100%, and 0 otherwise. *JV* is a dummy variable equal to 1 if the firm is registered as an equity joint-venture or as a contractual joint-venture, and 0 otherwise. *WFO* is a dummy variable equal to 1 if the firm is registered as wholly foreign owned, and 0 otherwise. All specifications were estimated using a GMM first-difference estimator. The figures reported in parentheses are asymptotic *t*-statistics. Time dummies and time dummies interacted with industry dummies were included in all specifications. Standard errors and test statistics are asymptotically robust to heteroskedasticity. The instrument set includes two or more lags of all explanatory variables, time dummies, and time dummies interacted with industry dummies. *m2* is a test for second-order serial correlation in the first-differenced residuals, asymptotically distributed as $N(0,1)$ under the null of no serial correlation. Also see Notes to Table 1. * indicates significance at the 10% level. ** indicates significance at the 5% level. *** indicates significance at the 1% level.

Table 3: Relationship between foreign ownership and firm performance: allowing for nonlinearities

	<i>ROA</i>	<i>ROS</i>	<i>PROD</i>	<i>TFP</i>
	(1)	(2)	(3)	(4)
<i>Lagged dep. variable</i>	0.378 (20.49)***	0.368 (23.65)***	0.415 (10.40)***	0.214 (4.78)***
<i>Foreigncap</i>	0.142 (2.36)**	0.169 (3.36)***	0.595 (3.86)***	0.057 (2.21)**
<i>Foreigncap</i> ²	-0.150 (3.23)***	-0.153 (3.88)***	-0.506 (3.86)***	-0.048 (2.29)**
<i>Size</i>	0.007 (1.54)	0.013 (3.59)***	0.048 (4.66)***	-0.007 (2.35)**
<i>Leverage</i>	-0.032 (2.32)**	-0.034 (2.77)***	-0.008 (0.26)	-0.011 (1.86)*
<i>Collateral</i>	-0.053 (3.62)***	-0.003 (0.22)	-0.045 (1.24)	-0.014 (2.31)**
<i>Expdum</i>	-0.005 (0.71)	-0.014 (2.20)**	-0.019 (1.04)	0.005 (1.80)*
<i>Statecap</i>	-0.017 (2.09)**	-0.018 (2.17)**	-0.028 (1.64)	0.004 (1.09)
<i>Privatecap</i>	0.000 (0.05)	-0.002 (0.36)	0.041 (2.78)***	-0.003 (0.79)
<i>Turning points</i>	47.33%	55.23%	58.79%	59.54%
<i>m2</i>	0.67	-0.06	1.21	1.20
<i>Observations</i>	47149	47149	47149	33749

Notes: All specifications were estimated using a GMM first-difference estimator. The figures reported in parentheses are asymptotic *t*-statistics. Time dummies and time dummies interacted with industry dummies were included in all specifications. Standard errors and test statistics are asymptotically robust to heteroskedasticity. The instrument set includes two or more lags of all explanatory variables, time dummies, and time dummies interacted with industry dummies. *m2* is a test for second-order serial correlation in the first-differenced residuals, asymptotically distributed as $N(0,1)$ under the null of no serial correlation. Also see Notes to Table 1. * indicates significance at the 10% level. ** indicates significance at the 5% level. *** indicates significance at the 1% level.

Table 4: Relationship between foreign ownership and firm performance: allowing for non-linearities and including time dummies interacted with provincial dummies

	<i>ROA</i>	<i>ROS</i>	<i>PROD</i>	<i>TFP</i>
	(1)	(2)	(3)	(4)
<i>Lagged dep. variable</i>	0.371 (20.29)***	0.363 (23.30)***	0.409 (10.23)***	0.174 (0.049)***
<i>Foreigncap</i>	0.136 (2.36)**	0.194 (3.99)***	0.498 (3.38)***	0.049 (1.93)*
<i>Foreigncap</i> ²	-0.130 (2.83)***	-0.151 (3.79)***	-0.447 (3.50)***	-0.052 (2.40)**
<i>Size</i>	0.005 (1.19)	0.012 (3.10)***	0.049 (4.51)***	-0.012 (3.26)***
<i>Leverage</i>	-0.028 (2.02)**	-0.036 (2.98)***	-0.001 (0.05)	-0.006 (1.14)
<i>Collateral</i>	-0.061 (4.13)***	-0.009 (0.67)	-0.049 (1.29)	-0.014 (2.11)**
<i>Expdum</i>	-0.002 (0.34)	-0.011 (1.75)*	-0.025 (1.32)	0.010 (3.18)***
<i>Statecap</i>	-0.018 (2.18)**	-0.018 (2.19)**	-0.016 (0.98)	0.013 (0.31)
<i>Privatecap</i>	0.001 (0.08)	0.001 (0.14)	0.042 (2.88)***	-0.008 (2.17)**
<i>Turning points</i>	52.31%	64.24%	55.65%	46.79%
<i>m2</i>	0.82	-0.04	1.21	1.34
<i>Observations</i>	47349	47349	47349	33749

Notes: All specifications were estimated using a GMM first-difference estimator. The figures reported in parentheses are asymptotic *t*-statistics. Time dummies and time dummies interacted with provincial dummies were included in all specifications. Standard errors and test statistics are asymptotically robust to heteroskedasticity. The instrument set includes two or more lags of all explanatory variables, time dummies, and time dummies interacted with provincial dummies. *m2* is a test for second-order serial correlation in the first-differenced residuals, asymptotically distributed as $N(0,1)$ under the null of no serial correlation. Also see Notes to Table 1. * indicates significance at the 10% level. ** indicates significance at the 5% level. *** indicates significance at the 1% level.

Table 5: Relationship between foreign ownership and firm performance: allowing for nonlinearities and distinguishing foreign investors into those originating from Hong Kong, Macao, and Taiwan, and others.

	<i>ROA</i>	<i>ROS</i>	<i>PROD</i>	<i>TFP</i>
	(1)	(2)	(3)	(4)
<i>Lagged dep. var.</i>	0.377 (20.41)***	0.366 (23.50)***	0.415 (10.50)***	0.207 (4.63)***
<i>Non HMT Foreigncap</i>	0.171 (2.62)***	0.172 (3.06)***	0.749 (4.00)***	0.062 (2.28)**
<i>Non HMT Foreigncap</i> ²	-0.171 (2.96)***	-0.142 (2.82)**	-0.680 (3.87)***	-0.064 (2.65)**
<i>HMT Foreigncap</i>	0.091 (1.42)	0.132 (2.50)***	0.330 (2.02)**	0.039 (1.42)
<i>HMT Foreigncap</i> ²	-0.094 (1.93)*	-0.114 (2.84)***	-0.226 (1.70)*	-0.026 (1.17)
<i>Size</i>	0.005 (1.30)	0.012 (3.31)***	0.045 (4.36)***	-0.008 (2.65)**
<i>Leverage</i>	-0.033 (2.41)**	-0.036 (2.98)***	-0.011 (0.36)	-0.009 (1.65)
<i>Collateral</i>	-0.055 (3.73)***	-0.005 (0.40)	-0.050 (1.37)	-0.014 (2.26)**
<i>Expdum</i>	-0.004 (0.56)	-0.012 (1.94)*	-0.018 (0.96)	0.005 (1.74)*
<i>Statecap</i>	-0.018 (2.17)**	-0.018 (2.28)**	-0.030 (1.80)	0.005 (1.26)
<i>Privatecap</i>	-0.0007 (0.10)	-0.003 (0.56)	0.036 (2.48)**	-0.003 (0.94)
<i>Non HMT Foreigncap turning points</i>	50.00%	60.68%	55.03%	48.73%
<i>HMT Foreigncap turning points</i>	-	57.85%	73.00%	-
<i>m2</i>	0.77	0.03	1.36	1.51
<i>Observations</i>	47146	47146	47146	33748

Notes: *HMT Foreigncap* represents the fraction of the firm's capital paid in by foreign investors from Hong Kong, Macao, and Taiwan. *Non HMT Foreigncap* represents the fraction of the firm's capital paid in by foreign investors other than those from Hong Kong, Macao, and Taiwan. All specifications were estimated using a GMM first-difference estimator. The figures reported in parentheses are asymptotic *t*-statistics. Time dummies and time dummies interacted with industry dummies were included in all specifications. Standard errors and test statistics are asymptotically robust to heteroskedasticity. The instrument set includes two or more lags of all explanatory variables, time dummies, and time dummies interacted with industry dummies. *m2* is a test for second-order serial correlation in the first-differenced residuals, asymptotically distributed as $N(0,1)$ under the null of no serial correlation. Also see Notes to Table 1. * indicates significance at the 10% level. ** indicates significance at the 5% level. *** indicates significance at the 1% level.

Table 6: Investigating the reverse causality issue: a Granger causality test

<i>Dep.variable:</i> <i>Foreigncap_{it}</i>	$PERF_{it} = ROA_{it}$ (1)	$PERF_{it} = ROS_{it}$ (2)	$PERF_{it} = PROD_{it}$ (3)	$PERF_{it} = TFP_{it}$ (4)
$Foreigncap_{i(t-1)}$	0.544 (4.91)***	0.573 (5.04)***	0.586 (5.10)***	0.755 (4.80)***
$Foreigncap_{i(t-2)}$	0.080 (2.21)**	0.088 (2.37)**	0.914 (2.44)**	0.174 (2.66)***
$PERF_{i(t-1)}$	-0.068 (-1.54)	-0.034 (-0.89)	-0.007 (-0.25)	0.0008 (1.71)*
$PERF_{i(t-2)}$	-0.011 (-0.51)	-0.015 (-0.71)	-0.002 (-0.20)	0.0003 (2.03)**
<i>Granger causality</i> (<i>p-value</i>)	0.280	0.638	0.969	0.127
<i>m2</i>	0.70	0.61	0.58	-
<i>Observations</i>	30617	30617	30617	19565

Notes: *PERF* indicates in turn our 4 performance indicators. All specifications were estimated using a GMM first-difference estimator. The figures reported in parentheses are asymptotic *t*-statistics. Time dummies and time dummies interacted with industry dummies were included in all specifications. Standard errors and test statistics are asymptotically robust to heteroskedasticity. The instrument set includes two or more lags of all explanatory variables, time dummies, and time dummies interacted with industry dummies. The Granger causality test is an *F*-test aimed at testing the null hypothesis that the coefficients on the two lags of our performance indicators are jointly equal to 0. The *m2* is a test for second-order serial correlation in the first-differenced residuals, asymptotically distributed as $N(0,1)$ under the null of no serial correlation. This test is not reported in column 4 due to the lack of a sufficient number of time series observations. Also see Notes to Table 1. * indicates significance at the 10% level. ** indicates significance at the 5% level. *** indicates significance at the 1% level.

Table A1: Foreign ownership by region

<i>Provincename</i>	<i>Foreigncap=0%</i>	<i>0%<Foreigncap<50%</i>	<i>50% ≤ Foreigncap < 100%</i>	<i>Foreigncap=100%</i>
	(1)	(2)	(3)	(4)
<i>Coastal</i>				
Beijing	54.29129	12.41873	18.98569	14.30429
Fujian	28.11617	10.25443	11.33385	50.29556
Guangdong	25.73669	8.540097	12.99393	52.72928
Hainan	81.36646	3.10559	7.453416	8.074534
Hebei	82.67504	9.335727	5.116696	2.872531
Jiangsu	56.70476	14.62857	8.961905	19.70476
Liaoning	64.70788	8.933424	9.103261	17.25543
Shandong	71.76608	12.6646	4.870255	10.69907
Shanghai	34.72512	13.03062	21.76409	30.48017
Tianjin	46.20075	9.803001	17.72983	26.26642
Zhejiang	66.229	19.17557	6.045802	8.549619
<i>Total</i>	<i>50.62489</i>	<i>12.36288</i>	<i>10.44776</i>	<i>26.56447</i>
<i>Central</i>				
Anhui	83.86648	7.649513	3.894298	4.589708
Heilongjiang	86.46543	5.160662	4.868549	3.505355
Henan	90.63361	4.683196	3.236915	1.446281
Hubei	85.53086	6.419753	4.493827	3.555556
Hunan	87.86181	4.388422	2.894491	4.855276
Jiangxi	83.26118	7.792208	3.318903	5.627706
Jilin	81.23711	7.216495	8.556701	2.989691
Shanxi	92.86182	4.256712	1.899149	.9823183
<i>Total</i>	<i>87.36165</i>	<i>5.705706</i>	<i>3.921064</i>	<i>3.011583</i>
<i>Western</i>				
Chongqing	86.882	7.119315	4.482532	1.51615
Gansu	91.27517	6.040268	.8053691	1.879195
Guangxi	81.02288	7.806191	8.008076	3.162853
Guizhou	93.19797	3.350254	3.045685	.4060914
Neimenggu	90.17857	6.760204	1.020408	2.040816
Ningxia	90.22801	6.514658	3.257329	0
Qinghai	98.61111	1.388889	0	0
Shaanxi	91.95711	3.552279	2.613941	1.876676
Sichuan	91.07827	4.21456	3.475643	1.231527
Xinjiang	93.5743	2.409639	.4016064	3.614458
Yunnan	90.96346	4.784053	3.056479	1.196013
<i>Total</i>	<i>89.86276</i>	<i>5.072409</i>	<i>3.449845</i>	<i>1.614982</i>

Notes: Foreigncap represents the fraction of the firm's capital paid in by foreign investors. All numbers in the Table are percentages.

Table A2: Foreign ownership by industry

<i>Industry</i>	<i>Foreigncap=0%</i>	<i>0%<Foreigncap<50%</i>	<i>50% ≤ Foreigncap < 100%</i>	<i>Foreigncap=100%</i>
	(1)	(2)	(3)	(4)
Manufacturing				
Food, drink, tobacco	65.90055	9.48251	11.63631	12.98063
Textiles, clothing, leather	50.32337	15.84503	8.81025	25.02135
Wood, furniture	45.72468	13.4627	9.763493	31.04912
Paper, printing, publishing	63.06897	11.72414	9.655172	15.55172
Chemicals, petroleum, man made fibres	64.79431	10.04607	7.64568	17.51394
Electrical, machinery, computer equipment	49.91	9.286759	10.75487	30.04837
Stone, clay, glass, concrete products	78.81558	7.352941	7.492051	6.339427
Metal, metal goods	70.75137	10.31155	5.803299	13.13378
Transport equipment	70.28352	9.614155	8.015348	12.08698
Other manufacturing	33.09529	11.11359	9.841554	45.94957
<i>Total</i>	<i>58.23227</i>	<i>11.03524</i>	<i>8.9767</i>	<i>21.75579</i>
Non manufacturing				
Mining	94.24577	2.990897	.8777633	1.885566
Construction	50.70422	18.30986	4.225352	26.76056
Transportation; communication; electric, gas, sanitary services	90.19159	4.269054	3.519367	2.019992
Wholesale and retail trade	49.6677	13.55782	17.27958	19.49491
Finance, insurance, real estate, and other services	74.80916	10.1145	5.343512	9.732824
<i>Total</i>	<i>81.61281</i>	<i>6.31423</i>	<i>5.74021</i>	<i>6.33275</i>

Notes: Foreigncap represents the fraction of the firm's capital paid in by foreign investors. All numbers in the Table are percentages.

Table A3: Summary statistics: partitioning observations on the basis of the degree of ownership by investors other than those from Hong Kong, Macao, and Taiwan

	<i>Non HMT Foreigncap=0%</i>	<i>0%<non HMT Foreigncap<50%</i>	<i>50% ≤non HMT Foreigncap<100%</i>	<i>Non HMT Foreigncap=100%</i>
	(1)	(2)	(3)	(4)
<i>ROA</i>	0.039	0.061	0.065	0.057
<i>ROS</i>	0.027	0.047	0.053	0.039
<i>PROD</i>	0.063	0.13	0.227	0.13
<i>TFP</i>	0.027	0.035	0.041	0.032
<i>Size</i>	6.51	6.86	7.05	6.54
<i>Leverage</i>	0.60	0.58	0.51	0.51
<i>Collateral</i>	0.39	0.34	0.36	0.37
<i>Expdum</i>	46.59	72.62	71.77	85.77
<i>Non HMT Foreigncap</i>	0	25.96	70.16	100
<i>HMT Foreigncap</i>	17.93	3.21	0.51	0
<i>Statecap</i>	20.86	10.40	7.66	0
<i>Privatecap</i>	51.36	49.47	17.62	0
<i>Observations</i>	73016	5350	4846	8362

Notes: *Non HMT Foreigncap* represents the fraction of the firm's capital paid in by foreign investors other than those from Hong Kong, Macao, and Taiwan. *HMT Foreigncap* represents the fraction of the firm's capital paid in by foreign investors from Hong Kong, Macao, and Taiwan. Also see Notes to Table 1. See Appendix 1B for complete definitions of all variables. Note that column 1 may include observations with positive capital paid in by investors from *HMT*.

Table A4: Summary statistics: partitioning observations on the basis of the degree of ownership by investors from Hong Kong, Macao, and Taiwan

	<i>HMT Foreigncap=0%</i>	<i>0%<HMT Foreigncap<50%</i>	<i>50% ≤ HMT Foreigncap<100%</i>	<i>HMT Foreigncap=100%</i>
	(1)	(2)	(3)	(4)
<i>ROA</i>	0.042	0.051	0.052	0.037
<i>ROS</i>	0.030	0.039	0.037	0.026
<i>PROD</i>	0.081	0.11	0.116	0.060
<i>TFP</i>	0.029	0.033	0.031	0.025
<i>Size</i>	6.61	6.77	6.46	6.10
<i>Leverage</i>	0.59	0.60	0.52	0.50
<i>Collateral</i>	0.39	0.34	0.34	0.35
<i>Expdum</i>	46.73	69.31	70.71	86.16
<i>HMT Foreigncap</i>	0	25.05	72.21	100
<i>Non HMT Foreigncap</i>	17.57	3.90	0.90	0
<i>Statecap</i>	20.97	10.88	5.75	0
<i>Privatecap</i>	51.63	4.55	14.73	0
<i>Observations</i>	73521	5224	3063	9766

Notes: *HMT Foreigncap* represents the fraction of the firm's capital paid in by foreign investors from Hong Kong, Macao, and Taiwan. *Non HMT Foreigncap* represents the fraction of the firm's capital paid in by foreign investors other than those from Hong Kong, Macao, and Taiwan. Also see Notes to Table 1. See Appendix 1B for complete definitions of all variables. Note that column 1 may include observations with positive capital paid in by investors other than those from *HMT*.