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The Effects of Foreign Acquisition on Domestic and Exports

Markets Dynamics in China

by

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Abstract

Using recent data from the Chinese manufacturing industry and the generalised propensity score, this paper establishes economically significant causal effects of foreign acquisition on domestic and export markets dynamics.

Outline

1. *Introduction*
2. *Empirical approach*
3. *Database description*
4. *Main findings and discussion*
5. *Conclusions*

Non-Technical Summary

Critics of China's success in attracting export-oriented FDI argue that, because of financial discrimination by the state-dominated banking system, private enterprises in China have been forced to sell off their assets to foreign investors in order to realise their growth potential, especially in export markets. Some went as far as saying that more acquisition FDI may actually be less. However, is this view supported by empirical evidence? Or does acquisition FDI bring significant benefits to the acquired firms even after controlling for exporting and finance histories? In this paper, we seek to shed light on these questions by using a recent firm-level dataset from the Chinese manufacturing industry. We document robust evidence of causal relationships between foreign equity share and domestic and export markets dynamics. However, we uncover some interesting contrasts in the way foreign finance affects growth in the two markets. Whereas the effect on exporting starts to decline once the share of foreign equity exceeds the 45% mark, there is a monotonic relationship between domestic growth and foreign capital participation. Furthermore, there is tentative evidence that foreign acquisition-induced domestic growth is increasing through time, indicating that acquisition FDI in China is not simply motivated by the desire to use the country as an export platform. Policy makers should be hoping that as foreign investors become more embedded into the domestic economy, significant FDI spillovers to indigenous enterprises would start to materialise.

1. Introduction

Within the space of a generation, China has achieved a stupendous transformation from a near autarchic economy to one that is at the heart of the global production network. The country is now the most attractive destination of export-oriented foreign direct investment (FDI), earning it the epithet of "export processing zone of the world" (Lin, 2002).

China's success in attracting export-oriented FDI is not, however, without its critics. Huang (2003, 2004) argues that because of financial discrimination by the state-dominated banking system, private enterprises in China have been forced to sell off their assets to foreign investors in order to realise their growth potential. Moreover, importers of Chinese products can often be reluctant to enter into contractual arrangements with indigenous private enterprises since the latter do not generally enjoy adequate legal protection. The failure of the Chinese economic system to nurture the development of local firms has thus created a fertile ground for foreign investors to acquire the assets of indigenous enterprises.

Seen from the above vantage point, acquisition FDI in China is a symptom of the economy's weakness rather than its strength. As Huang (2004) put it more provocatively "…more [FDI] may actually be less". But, is more acquisition FDI really less? Or does it bring significant benefits to the acquired firms even after controlling for exporting and finance histories? This paper seeks to shed light on these questions by testing for the existence of a causal relationship between acquisition FDI in China, and domestic and export markets dynamics. The focus on domestic market activity is relevant since a less publicised, but equally important, policy initiative by the Chinese government has been to encourage multinational firms to integrate into the local economy. This initiative has gained momentum as policy makers started to view FDI as a channel of international knowledge transfer that would minimise the need for technology imports.

We define foreign acquisition as the share of foreign equity in firms that attracted foreign finance for the first time. The propensity score method due to Rosenbaum and Rubin (1983) has been widely used in recent evaluation studies of the causal effects of foreign acquisition on the performance of domestic firms (e.g. Girma and Görg, 2007). A limitation of this approach is that it is only appropriate in a world of binary treatment variables. Thus, a firm has to be classified as either foreign acquired or domestically owned with no allowance for the

fact that the share of foreign equity can take on any value in the continuous interval between 0 and 1. However, recent papers by Hirano and Imbens (2004) and Imai and van Dyk (2004) have extended the propensity score strategy to cases of continuous treatments, resulting in the generalised propensity score technique. In this paper, we apply this technique to a rich micro panel data from China in order to trace out the effects of successive changes in foreign equity share on domestic and export markets dynamics.

The remainder of this paper is structured as follows. Section II explains the empirical approach. Section III describes the data used in the analysis. The main findings of the paper are discussed in Section IV. Section V concludes.

2. Empirical approach

The fundamental problem in program evaluation without experimental data is that the counterfactual for the treatment groups is not observed. For example, it is not possible to observe what the performance of a foreign acquired firm would have been had it remained in domestic hands. The empirical success of the propensity score technique developed by Rosenbaum and Rubin (1983) lies in the fact that it provides a method of mimicking the counterfactual *ex post*. In the case of binary treatments, Rosenbaum and Rubin (1983) derive the powerful result that conditioning on the propensity score (that is the probability of receiving treatment given some pre-treatment characteristics) is sufficient to balance treatment and comparison groups.

Hirano and Imbens (2004) and Imai and van Dyk (2004) apply this intuition to the case of continuous treatments. They show that causal effects resulting from successive increases in the treatment level (share of foreign equity in our case) can be evaluated by conditioning on the generalised propensity score (GPS), defined as the conditional density of the treatment given some pre-treatment variables. As along the pre-treatment variables are balanced across the various treatment levels, conditioning on GPS will remove the bias associated with differences in pre-treatment variables.

Our objective is to estimate the causal effects of foreign equity share which takes on values in the interval F = [0, 1], on the growth of export/ domestic sales, denoted Y. For each firm *i*, there is a set of *potential* growth values $Y_i(f)$ for all $f \in F$. However, we only

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observe an actual level of foreign equity share $f_i \in [0,1]$, and a vector of pre-treatment covariates X that are hypothesised to impact on the level of the treatment. In our study, X consists of firm size, profitability, access to bank loans, exports, the output share of foreign firms in the region and sector and a Herfindhal index of industry concentration[1]. The inclusion of these covariates is motivated by the desire to control for pre-treatment firm size, export and finance. It is also partly guided by the existing literature on the determinants of foreign acquisition and privatisation in China (e.g. Guo and Yao, 2005; Gong et al, 2007).

Under the assumption that the treatment variable F is independent of the outcome variable Y conditional on the pre-treatment variables X, Hirano and Imbens (2004) derive the useful property that, within the same value of the GPS, the probability that F = f does not depend on X. This property allows for the identification of the casual effects of foreign financing on the growth of export and domestic sales.

Since the treatment variable F is a fraction over the interval [0, 1], it is natural to estimate the GPS using the fractional logit model due to Papke and Wooldridge (1996)[2]. For each firm i, given the share of foreign equity finance F_i, the covariates X_i and the estimated coefficients from the fractional logit model, $\hat{\gamma}$, the GPS $\hat{G}_i \equiv \hat{G}(X_i; F_i)$ can be estimated as

$$\hat{G}_i = \left[\frac{e^{X_i\hat{\gamma}}}{1+e^{X_i\hat{\gamma}}} \right]^{F_i} \left[1 - \frac{e^{X_i\hat{\gamma}}}{1+e^{X_i\hat{\gamma}}} \right]^{1-F_i} . \qquad (1)$$

Next, we estimate the expected values of export and domestic sales growth (Y) conditional on $\hat{G}_i$ and $\hat{F}_i$ via the following quadratic approximation

$$E\left[Y_i \mid \hat{G}_i, F_i\right] = \beta_0 + \beta_1 \hat{G}_i + \beta_2 F_i + \beta_3 \hat{G}_i^2 + \beta_4 F_i^2 + \beta_5 \hat{G}_i F_i . \qquad (2)$$

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[1] The exact definition of these covariates is given in Table 1.
[2] See Fryges and Wagner (2007) for a first application of this method in the context of evaluating the effects of exporting intensity on labour productivity growth.

After estimating Equation (2) by OLS, the average potential value of Y associated with a specific level of foreign equity share, f, can be obtained as

$$\bar{Y}(f) = \frac{1}{N} \sum_{i=1}^{N} \left(\hat{\beta}_0 + \hat{\beta}_1 \hat{G}(X_i, f) + \hat{\beta}_2 f + \hat{\beta}_3 \hat{G}(X_i, f)^2 + \hat{\beta}_4 f^2 + \beta_5 \hat{G}(X_i, f) f \right) \qquad (3)$$

Using the above expression, the average potential exports/domestic sales can be estimated at all possible (or desired) levels of foreign equity share $f \in [0,1]$. In this paper, we evaluate Equation (3) by increasing foreign equity share from 0 to 1, in steps of one percentage point. Finally the causal effect of a change in foreign equity share from f_0 to f_1 can be evaluated as

$$\Delta \bar{Y}(f_o, f_1) = \bar{Y}(f_1) - \bar{Y}(f_0), \quad \forall f_o, f_1 \in [0,1]. \qquad (4)$$

For example, $\Delta \bar{Y}(0, 0.10)$ gives the causal effect of increasing foreign capital participation from zero to 10 %. The standard errors (and confidence intervals) of $\Delta \bar{Y}(f_0, f_1)$ are bootstrapped to account for the fact that the GPS and the coefficients of Equation (2) are estimated.

3. Database description

Our econometric analysis draws on the Annual Report of Industrial Enterprise Statistics compiled by the State Statistical Bureau of China (SSB). The report covers the population of state-owned enterprises and all non-state firms with annual turnover of over five million Renminbi (just above $600,000). It is estimated that the firms contained in the dataset account for 85-90% of total output in most industries. The SSB performs several logic tests to ensure the accuracy of the information in the report and to identify illogical data points.

The variables contained in the dataset include firm ownership structure, industry affiliation, geographic location, establishment year, employment, gross output and exports.[3] The version of the dataset available to us spans the period 1999 to 2005, and comprises of more than 1.3 million observations from about 446,000 firms. It is worth noting that we used the whole sample to construct aggregate variables of interest (i.e. share of foreign firms' output in an industry-region and Herfindhal index of industry concentration). However, in view of the

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[3] Nominal values are deflated using industry-specific ex-factory price indices obtained from China Statistical Yearbook 2006.

objective of this paper, the econometric work is confined to domestic-owned enterprises that started with no foreign equity share, some of which subsequently registered foreign capital participation.

The SSB assigns to each firm in the database a categorical variable indicating its ownership status. Nevertheless, it is also possible to construct a continuous measure of foreign ownership composition from the database by looking at the fraction of paid-in capital by foreign investors. This is the key variable as far as this paper is concerned since it identifies the level of treatment received by domestic enterprises.

Our methodology relies on controlling for pre-treatment characteristics via the generalised propensity score. It is therefore necessary that have some information in the year preceding the receipt of foreign finance. Furthermore, a realistic evaluation of post-treatment growth effects requires the availability of at least two years data after acquisition. For these reasons, we only consider foreign acquisitions that took place between 2000 and 2003. In the final analysis, we have 144433 firms, 3766 of which received some foreign finance for the first time between 2000 and 2003.

Table 1 gives the definition of the variables used in the analysis and some summary statistics of interest. On average, the share of foreign equity in acquired firms is 46.9%. Table 2 provides information on some firm characteristics in the period preceding treatment. On average, future recipients of foreign equity finance are larger, have better access to finance and export more than firms with no foreign capital participation. Finally, Table 3 shows the frequency distribution of the foreign acquired firms by bands of foreign equity share. About a third of the firms sold off less than a quarter of their assets to overseas partners, while 28% of them ceded at least 75% of their assets to foreign investors. It is also worth noting that domestic investors tend to retain majority ownership of firms with larger export sales and greater access to bank loans.

4. Main findings and discussion

The results from the fractional logit regression of the determinants of foreign equity share are reported in Table 4. We find that the extent of foreign acquisition increases with firm size and level of export. Firms with limited access to domestic bank loans tend to end up with a higher foreign equity share, consistent with the statistics presented in Table 3. Our estimates

also suggest that the more open the region/ industry are to foreign investors, the higher the likelihood of domestic firms' access to foreign investment.

Although the analysis of the determinants of foreign equity share is interesting in its own right, as far as the GPS method is concerned the most important issue is ensuring that the GPS obtained from the regression is successful in controlling for firm-specific differences in the pre-acquisition period. It is therefore important to test whether the pre-treatment control variables are balanced across the treatment levels. Adopting the blueprint suggested by Hirano and Imbens (2004), we first define four blocks based on foreign equity share quartiles and another four blocks based on GPS quartiles. Then, for each covariate in the fractional logit regression, we test for equality of means across different foreign equity share quartiles but the same GPS quartile. In total, 144 such tests were carried out, and in all but 4 cases, we find that the differences in means are not statistically different from zero, at least at 10% level of significance[4]. This suggests that the GPS obtained from the fractional logit regression have been effective at balancing the pre-treatment variables.

We now turn to the discussion of the causal effects of foreign capital participation on the growth of export and domestic sales. Table 5 reports the estimated export effects at selected treatment points, where the outcome variable is defined as the change in log of real export relative to the year prior to acquisition. But since these effects are estimated across a continuous range of treatments, it is more elegant and informative to present the results graphically. Figure 1 shows the estimated export effects two years after foreign acquisition and the corresponding point-wise 95% confidence intervals. Two points are noteworthy from Tables 5 and Figure 1. Firstly, there are statistically and economically significant export growth effects once foreign equity share exceeds the 10 percent threshold. This is an interesting finding in that it suggests that domestic enterprises need only sell a small proportion of their assets to foreign investors in order to benefit from the latter's international market experience and firm-specific advantage. Secondly, there appears to be an optimal level of foreign equity share beyond which the causal effect of foreign acquisition on export growth starts to decline. This optimal level of foreign acquisition is in the region of 45% and it leads to more than a three-fold increase in the volume of export. Furthermore, as shown in Figure 2, these conclusions remain intact when one considers the exporting effects three years after

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[4] The details of the tests are not reported to save space.

acquisition. This is suggestive evidence that, at the margin, the scope for continuous export growth from acquisition FDI might be limited.

Table 6 reports the impact of foreign finance on the growth of domestic sales, defined as the change in log of domestic sales relative to the year prior to acquisition. We uncover robust evidence that access to foreign finance causes firms to expand in the domestic market. Figure 3 shows that, in sharp contrast to the case of export growth, the relationship between foreign equity share and domestic sales growth is positive and monotonic: the higher the share of foreign equity is, the larger the impact on domestic sales growth will be. Thus, the maximum impact of foreign acquisition occurs when the domestic firm becomes a wholly owned foreign enterprise. Our results appear to suggest that higher foreign equity shares signal greater commitment by multinationals to serve the domestic market in China, rather than simply using the country as an export platform. This finding should be encouraging from policy makers' perspectives as foreign investors' increased integration in the local economy raises hopes of significant FDI spillovers through horizontal and vertical linkages with indigenous enterprises.

Finally, it is worth noting that in contrast to the case for exports, the foreign acquisition effects on domestic sales growth exhibit marked increase as we move from two to three years post-acquisition. For example, at foreign equity share level of 0.7, the effect on domestic output growth more than doubles from 35.1 % to 76.2% between the two time windows. This would appear to suggest that the Chinese domestic market offers unexploited growth opportunities for foreign investors entering into partnership with domestic enterprises.

5. Conclusions

Using a recent firm-level panel data set from the Chinese manufacturing industry, this paper documents robust evidence of causal relationships between foreign equity share and domestic and export markets dynamics. However, we uncover some interesting contrasts in the way foreign finance affects growth in the two markets. Whereas the effect on exporting starts to decline once the share of foreign equity exceeds the 45% mark, there is a monotonic relationship between domestic growth and foreign capital participation. Furthermore, there is tentative evidence that foreign acquisition-induced domestic growth is increasing through time, indicating that acquisition FDI in China is not simply motivated by the desire to use the

country as an export platform. Policy makers should be hoping that as foreign investors become more embedded into the domestic economy, significant FDI spillovers to indigenous enterprises would start to materialise.

Table 1
Definition of variables and some summary statistics

Variable	Definition	*Mean (st.dev)*
Size	Log of employment	*4.822 (1.127)*
Profits	Operating profits divided by total sales	*0.033 (2.641)*
Bank loans	Total bank loans from domestic banks divided by total asset.	*1.012 (2.021)*
FDI	The share of foreign invested firms' output in the region and industry	*0.165 (0.180)*
Herfindhal	Three-digit industry index of industrial concentration.	*0.104 (0.141)*
Export	Log of real export +1	*1.541 (3.415)*
	(Proportion of exporters)	*17.5%*
Domestic sales	Log of domestic sales	*9.115 (2.352)*
Foreign equity share	The share of foreign finance in firms' total equity.	*0.001 (0.069)*
	Foreign equity share amongst acquired firms	*0.469 (0.357)*
Total number of firms	*144433 (3766 of which received foreign finance)*	

Table 2

Summary statistics of pre-treatment characteristics

	Non-acquired firms		*Foreign acquired firms*	
Firm characteristic	Mean	St. dev	Mean	*St. dev*
Size	4.726	1.218	5.434	*1.425*
Profits	-0.035	2.676	0.025	*0.199*
Bank loans	1.002	2.012	1.419	*2.303*
FDI	0.163	0.179	0.235	*0.213*
Herfindhal index	0.104	0.141	0.089	*0.133*
Export	1.468	3.337	5.434	*1.425*
Number of firms	*140667*		*3766*	

Note: Difference-in-means tests performed on the variables show statistically significant differences between the two groups of firms.

Table 3

Distribution of foreign acquired firms by foreign equity share

and average values of some pre-treatment variables

Share of foreign equity	Frequency	Size	Bank loans	Export	*Profits*
< 0.25	1287 (34.17%)	6.041	2.259	5.229	*0.015*
[0.25 0.50)	1029 (21.32%)	5.303	1.42	4.021	*0.037*
[0.50 0.75)	379 (10.06%)	5.193	0.979	3.747	*0.041*
>= 0.75	*1071 (28.44%)*	*4.921*	*0.564*	*3.425*	*0.018*

Table 4

The determinants of foreign equity share:

Estimate from the fractional logit model

Pre-treatment covariate	
Size	*0.521*
	(32.06)**
Profitability	*0.011*
	(5.81)**
Bank loans	*-0.010*
	(3.98)**
FDI	*2.456*
	(23.27)**
Herfindhal index	*-1.076*
	(5.03)**
Export	*0.450*
	(3.89)**
Number of firms	*144433*

Notes:
 a. Robust z statistics in parentheses
 b. ** significant at 1%
 c. Industry, regional and time dummies are included in the regression.

Table 5
The causal effects of foreign equity finance on export growth
at selected treatment levels

Foreign equity share	Two years after acquisition		Three years after acquisition	
	Estimate	St. error	Estimate	St. error
0.1	0.845	0.056	0.840	0.080
0.2	1.929	0.098	1.825	0.114
0.3	2.829	0.132	2.812	0.148
0.4	3.209	0.115	3.102	0.119
0.5	3.200	0.078	2.918	0.068
0.6	2.992	0.040	2.540	0.034
0.7	2.732	0.017	2.176	0.050
0.8	2.516	0.027	1.959	0.074
0.9	2.406	0.042	1.971	0.092
1	2.437	0.053	2.259	0.102

Notes:
a. Export growth is defined as the change in log real export sales relative to the year prior to acquisition.
b. The standard errors are bootstrapped using 1000 replications.
c. In all cases, the untreated group consists of firms with no access to foreign finance over the sample period.

Table 6
The causal effects of foreign equity finance on domestic sales growth at selected treatment levels

Foreign equity share	Two years after acquisition		Three years after acquisition	
	Estimate	St. error	Estimate	St. error
0.1	0.044	0.009	0.090	0.010
0.2	0.081	0.016	0.163	0.017
0.3	0.139	0.028	0.281	0.030
0.4	0.205	0.042	0.417	0.044
0.5	0.272	0.055	0.578	0.061
0.6	0.319	0.065	0.681	0.072
0.7	0.351	0.071	0.762	0.081
0.8	0.387	0.078	0.907	0.096
0.9	0.408	0.083	0.959	0.102
1	0.416	0.084	0.972	0.103

Notes:
a. Domestic sales growth is defined as the change in log of real domestic sales relative to the year prior to acquisition.
b. The standard errors are bootstrapped using 1000 replications.
c. In all cases, the untreated group consists of firms with no access to foreign finance over the sample period.

Figure 1: Foreign equity share and export sales growth: Causal effects two years after acquisition
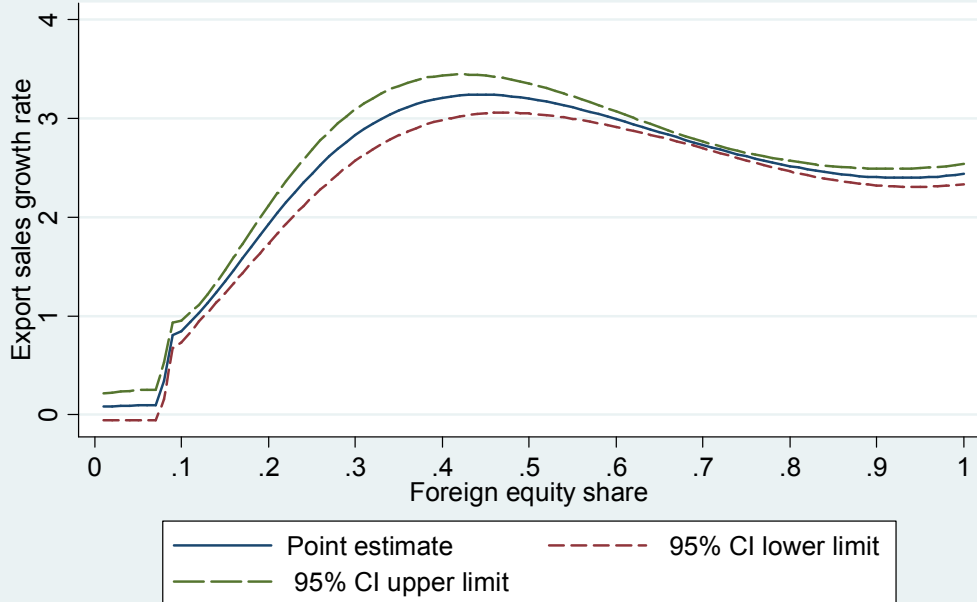

Figure 2: Foreign equity share and export sales growth: Causal effects three years after acquisition
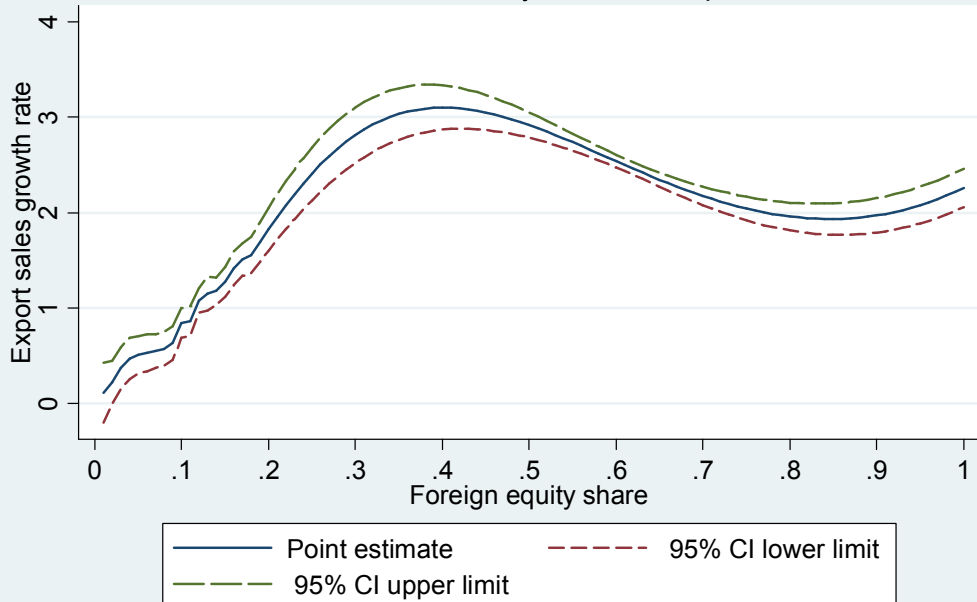
Figure 3: Foreign equity share and domestic sales growth: Causal effects two years after acquisition
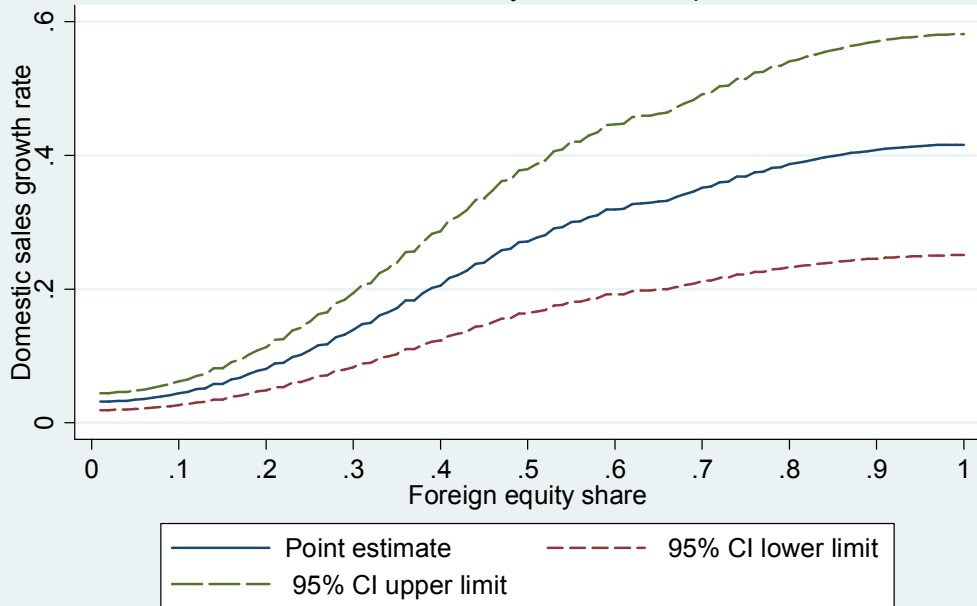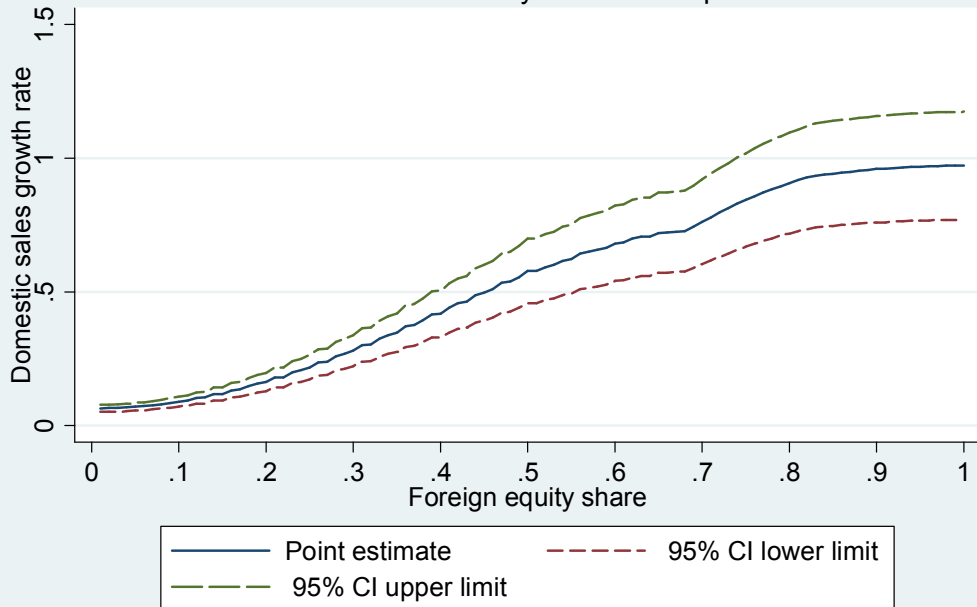

Figure 4: Foreign equity share and domestic sales growth: Causal effects three years after acquisition

References

Du, J. and Girma, S. (2007), "Finance and firm export in China", *Kyklos,* 60, 37-54.

Fryges, H. and Wagner, J. (2007), " Exports and productivity growth: First evidence from a continuous treatment approach" , IZA DP No.2782.

Girma, S. and Görg, H. (2007), "Evaluating the foreign ownership wage premium using a difference-in-differences matching approach", *Journal of International Economics*, 72(1), 97-112.

Gong, Y, Görg, H. and Maioli, S. (2007) " Employment effects of privatisation and foreign acquisition of Chinese state-owned enterprises", *International Journal of the Economics of Business,* 14 (2), 197-214

Guo, K. and Yao, Y. (2005), "Causes of privatization in China", *Economics of Transition*, 13(2), 211-238.

Hirano, K. and Imbens, G.W. (2004), "The propensity score with continuous treatments", in: Andrew Gelman and Xiao-Li Meng eds, *Applied Bayesian Modeling and Causal Inference from Incomplete-Data Perspectives*, Wiley.

Huang, Y. (2003), *Selling China.* Cambridge University Press.

Huang, Y. (2004), Why more may be actually less? Financing bias and labor-intensive FDI in China," in *Financial Sector Reforms in China*, (Harvard University Press, 2004).

Imai K. and van Dyk D.A. (2004), "Causal inference with general treatment regimes: Generalizing the propensity score", *Journal of the American Statistical Association* 99, 854-866.

Lin, Y. (2002), "China's accession to WTO: Exaggerated fears?" UNCTAD Discussion Papers, No. 165.

Papke, .E. and Wooldridge, J. (1996), "Econometric methods for fractional response variables with an application to 401(k) plan participation rates", *Journal of Applied Econometrics,* 11, 619-632.

Rosenbaum, P.R. and Rubin, D.B. (1983), "The Central Role of the Propensity Score in Observational Studies for Causal Effects", *Biometrika* , 70, 41-55.