

Origin of Foreign Direct Investment and Firm Performance: Evidence from Foreign Acquisitions of Chinese Domestic Firms

Fariha Kamal

US Census Bureau, Washington, DC, USA

1. INTRODUCTION

RECOGNISING technology as a driver of economic growth, governments in developing countries spend significant resources to attract foreign direct investment (FDI). FDI is considered a vehicle for superior technology in the form of advanced human resource management practices, production methods and other tacit and codified knowledge that are linked to greater firm efficiencies. However, innovative activity is highly geographically concentrated, and we could expect heterogeneity in FDI by source country. In 2000, 82 per cent of global research and development (R&D) expenditures were undertaken in countries belonging to the Organisation of Economic Cooperation and Development (OECD) and half were performed by the United States and Japan alone (Lovely and Popp, 2011).¹ Transfer of superior technology to less advanced settings is not guaranteed, however, as host-country firms may not have the capacity to absorb superior know-how into their production processes.² While there is reason to believe that the origin of the foreign investor affects target firm performance differentially, the extent of such performance differences is an open empirical question.

This paper evaluates the performance of domestic Chinese firms that receive FDI, explicitly distinguishing between FDI originating from OECD countries and those from the nearby, ethnically Chinese economies of Hong Kong, Macao and Taiwan (HMT). The two groupings of acquirers are motivated by existing evidence pointing to superior technological capabilities of OECD compared to HMT firms (Hu and Jefferson, 2002). On the other hand, the literature on the importance of ethnic ties in facilitating trade and investment flows suggest that HMT acquirers may be better at diffusing knowledge as a result of sharing a common language and culture (Huang et al. 2010). HMT investors also had a first-mover advantage, in that they entered mainland China well before other investors that could have allowed them to establish stronger local networks that facilitate transactions with local firms and authorities.

The analysis is carried out by comparing the post-acquisition performance of OECD and HMT-acquired firms.³ Various measures of firm performance including total factor productivity (TFP), labour productivity, profits, average wages, and capital/labour ratio are considered.

The research in this paper was undertaken while the author was at Syracuse University. Any opinions and conclusions expressed herein are those of the author and do not necessarily represent the views of the US Census Bureau. The research in this paper does not use any confidential Census Bureau information.

¹ Global R&D activity is primarily carried out by multinationals (Pack and Saggi, 1997).

² The usage of the term absorptive capacity follows Cohen and Levinthal (1990, p. 128) as the 'ability to recognise the value of new information, assimilate it and apply it to commercial ends'.

³ A domestic Chinese firm is considered to be 'acquired' in the year in which its foreign equity participation rate equals or exceeds 25 per cent. See Section 3 for details on sample construction.

An obvious challenge in comparison is the possibility that OECD (HMT) investors systematically choose high performing Chinese firms as acquisition targets relative to HMT (OECD) investors. Without appropriate recognition of possible selection bias, observed post-acquisition performance may reflect superior domestic rather than superior foreign firm capabilities. I account for possible endogeneity of the acquisition decision through the use of propensity score matching, by which a HMT-acquired firm is assigned to each OECD-acquired firm as a proxy for the missing counterfactual of an OECD-acquired firm had it instead been acquired by an HMT investor. I then further employ a difference-in-differences approach to control for unobservable but time invariant differences between the two groups of acquired firms.

This paper offers two main contributions to the literature that examines the causal link between FDI and productivity. First, this study distinguishes between the sources of FDI instead of treating all FDI alike and documents differences in post-acquisition productivity performance. Existing literature primarily focuses on foreign ownership effects without distinguishing FDI by source. Although not the focal point of these studies, some exceptions including Conyon et al. (2002); Harris and Robinson (2003); and Schiffbauer et al. (2009) who find that domestic firms in the UK which are acquired by US investors experience the largest increase in productivity compared with those acquired by investors from the EU or other countries. More recently, Chen (2011) finds that domestic US targets acquired by firms from industrialised compared to developing countries experience increases in labour productivity, sales and employment.

The second contribution of the present study is its developing country context, unlike Chen (2011). Without distinguishing by source countries, previous studies investigate post-acquisition productivity performance of domestic firms in developing countries and generally find that foreign ownership increases post-acquisition productivity (Arnold and Javorcik, 2009 focusing on Indonesia; Petkova, 2008 on India; and Djankov and Hoekman, 2000 on the Czech Republic). An exception is Javorcik and Spatareanu (2011) who link TFP of Romanian firms to FDI in its upstream and downstream industries distinguishing between FDI originating from Europe, US and Asia. The focus of this study is on ownership changes taking place within the same firm rather than estimating geographic or industrial spillovers from FDI.

China provides a suitable setting to explore these issues. Since 1993, China has been the largest recipient of FDI inflows in the developing world.⁴ Foreign direct investment in China can be broadly classified as originating from the ethnically Chinese economies of Hong Kong, Macao and Taiwan and all other but primarily OECD countries. Table 1 shows the source country share of actually utilised FDI in total non-HMT FDI between 1998 and 2006. On average, OECD countries accounted for 60 per cent of all non-HMT FDI, with the United States and Japan the source of more than half of these inflows.⁵ Hu and Jefferson (2002) document that the high share of FDI coming from advanced countries is important for technology transfer in China because OECD investment carries 'higher technology content'. Furthermore, Zhang (2005) argues that compared with OECD investors who operate on frontiers of world technology, HMT investors derive their advantages from marketing and on-time delivery skills. However, HMT acquirers may have an advantage over OECD acquirers as a result of the close ethnic ties they share with mainland China.

⁴ See Fung et al. (2004) for an overview of the development of China's FDI policy and subsequent changes in FDI inflows.

⁵ Henceforth, non-HMT will be referred to as OECD.

TABLE 1
Actually Utilised FDI from OECD Countries (%)

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

Note

The table reports the percentage share of actually utilised FDI from OECD countries in the non-HMT total. Chile, Estonia, Israel and Slovenia joined the OECD in 2010 and are not included in the table.

Source: Author's calculations, China Statistical Yearbook (various years).

I investigate these source country differences on target firm performance by calculating and comparing the post-acquisition change in various performance measures experienced by OECD-acquired firms to that experienced by HMT-acquired firms. I build a panel of Chinese domestic manufacturing firms which are acquired by OECD or HMT investors during 1999–2004, using annual firm-level data collected by China's National Bureau of Statistics (NBS). Propensity score matching difference-in-differences analysis indicates that OECD-acquired firms experience higher productivity post-acquisition relative to HMT-acquired firms, the net of the initial difference in the pre-acquisition period. In particular, the TFP differential is 13.1 per cent in the year of acquisition, 11.7 per cent one year after and reaches 27.8 per cent in the third year. This result is more pronounced in industries with high domestic content in

exports. This latter finding suggests that in developing countries with high shares of processing exports, such as China, Vietnam and Mexico, gains from FDI might not materialise if the local economy specialises in a narrow range of tasks.

I further find that relative to HMT-acquired firms, OECD-acquired firms exhibit higher profits, average wage and capital intensity in all post-acquisition periods. I do not find significant statistical difference in the post-acquisition share of output that is exported, employment or changes in the share of the value of new products in total sales between OECD and HMT acquired firms. Taken together, these results are consistent with the introduction of management techniques along with capital deepening characterising the OECD ownership premium.⁶

To explore possible concerns about the propensity score matching technique, I re-do the analysis using data on acquired firms in the textile industry only.⁷ Results from this analysis conform to the patterns observed earlier – OECD-acquired firms experience higher productivity in post-acquisition periods with the largest impact in the year of acquisition. The similar pattern of results lends confidence that the performance differential is not being driven by specifics of the matching technique used.

I begin with a discussion of the empirical strategy. Section 3 describes the data and measurement of the firm level outcomes of interest. Section 4 presents the main empirical findings and Section 5 presents a set of robustness checks. The final section concludes.

2. EMPIRICAL STRATEGY

The goal of this paper is to evaluate the importance of the origin of FDI on post-acquisition performance of domestic firms in a developing country context. I first consider two measures of firm productivity – TFP and labour productivity. I also consider firm profits.⁸ Five other outcome variables are studied to augment our understanding of the restructuring process that takes place once a firm is acquired – employment, wage per worker, capital per worker, share of exports in total sales and the share of new product output value in total sales. I compare the change in each of these outcome variables of a domestic Chinese firm acquired by an OECD investor to that of a domestic Chinese firm acquired by a HMT investor. In an ideal setting, we would observe outcomes for an OECD target had it been acquired by a HMT investor. However, domestic Chinese firms can be in only one of three states of the world: (i) it is acquired by an OECD investor; (ii) it is acquired by a HMT investor; or (iii) it remains a domestic firm. Thus, we never observe the desired counterfactual, leading to a missing data problem.

Propensity score matching is used to construct the missing counterfactual by selecting a group of firms from the pool of HMT-acquired firms that share similar observable characteristics as the OECD-acquired firms in the pre-acquisition period.⁹ Propensity score matching

⁶ I cannot rule out alternative explanations for the wage differential such as relative to HMT firms, OECD firms employ higher skilled workers or pay efficiency wages.

⁷ For the baseline results, matches for each OECD-acquired firm are not constrained to be within the same industry in order to increase the likelihood of successful matches, propensity score estimation includes industry fixed effects.

⁸ In trade models with heterogeneous firms that decide between serving the domestic and foreign markets, such as Helpman et al. (2004), profits are solely determined by productivity.

⁹ See Blundell and Costa-Dias (2002) for a review of alternative methods used for programme evaluation. Imbens (2000) and Lechner (2001) show that the Rosenbaum and Rubin (1983) propensity score for the binary treatment case extends to the multiple treatment case as well.

attenuates potential endogeneity of the acquisition decision, as would occur if OECD investors select higher productivity targets, by eliminating differences between the two groups based on a set of observable characteristics, $X = x$. In addition to observable differences, there might be other systematic, unobservable differences between the two groups of acquired firms that are time invariant. The difference-in-differences matching (DDM) estimator eliminates unobservable, time-invariant differences between the two acquired groups of firms. The DDM estimator compares the change in the average outcome between a time period preceding the acquisition and a time period after the acquisition between the two groups of acquired firms.

I follow the matching protocol described in Lechner (2002) to construct the missing counterfactual. First, I estimate the propensity scores that are estimates of the marginal probabilities of the acquisition decision by each group of investors, $\hat{P}^{HMT}(x)$ and $\hat{P}^{OECD}(x)$ using a multinomial logit model of foreign acquisition. The value of acquisition to a representative foreign multinational is modelled as a function of the target's pre-acquisition characteristics including TFP, sales, age, capital-labour ratio, average wage, and state-owned equity share. The estimation also includes year, region and industry fixed effects. The estimation results are discussed in detail under Section 4. Second, the common support condition is implemented using the minima and maxima comparison. Under this criterion, all observations whose propensity score is smaller than the minimum and larger than the maximum in the opposite group are deleted. The common support condition ensures that any combination of characteristics observed in the group of OECD-acquired firms can also be observed among the group of HMT-acquired firms. Finally, an HMT-acquired firm that is closest in terms of the multivariate propensity score, $[\hat{P}^{HMT}(x)\hat{P}^{OECD}(x)]$, to an OECD-acquired firm is chosen as the missing counterfactual. Matching is performed with replacement so that a HMT-acquired firm may be chosen multiple times for different OECD-acquired firms. This could lead to an inflation of variance if few observations are used repeatedly. This is not a problem in this study due to a sufficiently large pool of HMT-acquired firms. Closeness is measured using the Mahalanobis distance metric.¹⁰ Once each OECD-acquired firm has been assigned, a counterfactual firm difference-in-differences is performed.

3. DATA

The sample used in this study has been constructed from the Annual Surveys of Industrial Production (ASIP) conducted by China's NBS during 1998 through 2006. The ASIP includes all non-state owned¹¹ firms whose annual sales exceed 5 million yuan¹² (referred to as 'above-scale' by NBS) and all SOEs. The surveys contain detailed information on the firm and its operations, including geographic administrative code, ownership type, gross industrial output value, value added, export value, total employment, capital stock and intermediate inputs. It provides information about the firm's capital structure distinguishing between domestic and foreign sources. The foreign capital sources are further subdivided into those

¹⁰ $\sqrt{(\hat{P}^{OECD}(x) - \hat{P}^{HMT}(x))S_{HMT}^{-1}(\hat{P}^{OECD}(x) - \hat{P}^{HMT}(x))}$, where S_{HMT} is the sample covariance matrix of the HMT-acquired group. See Rosenbaum and Rubin (1983) for further details.

¹¹ The NBS classifies non-state-owned enterprises (SOEs) to include collectively owned enterprises, Chinese indigenous privately owned enterprises and foreign-owned enterprises operating in China. The industry section of China Statistical Yearbook is compiled based on this dataset. Basic information of each four-digit industry in the China Markets Yearbook is also based on this dataset.

¹² This amounts to approximately US\$ 600,000 over this period.

originating from OECD and HMT investors. Unfortunately, information about individual source countries within these two broad categories is not available, so analysis is restricted to a comparison between these two groups. The annual surveys do not collect information on the identity of the foreign affiliate's parent.

a. Identifying Foreign Acquisitions

In this study, foreign acquisition is defined as an event where the foreign equity share (either HMT or OECD) equals or exceeds 25 per cent, a threshold set by the Chinese government.¹³ The year in which the firm gains 25 per cent or more in foreign equity share is identified as the year of acquisition. To measure pre-acquisition characteristics and firm performance in multiple post-acquisition periods, the sample includes domestic firms that are observed one year prior to receiving FDI and, henceforth, are acquired by either an HMT or OECD investor and remain under that particular foreign ownership for two additional years. Thus, the sample consists of firms that receive FDI for the first time between 1999 and 2004.¹⁴ The final matching sample used in the analysis consists of 1,493 firms receiving FDI from OECD investors and each of these firms is paired with a firm from a group of 1,813 firms receiving FDI from HMT investors.¹⁵

On average, the target firms in the sample have 0.05 per cent foreign capital share in the pre-acquisition year to over 65 per cent foreign equity participation in the post-acquisition period. Figure 1 shows the distribution of foreign ownership share, distinguished by source, in the post-acquisition period. Further analysis of the data confirms that almost all of the increase in foreign equity share takes place in the year of acquisition and not continuously over the post-acquisition years.¹⁶ The sample of foreign-acquired firms includes both what would be classified by NBS as joint ventures (typically with foreign equity share above 25 per cent but less than 100 per cent) as well as wholly foreign-owned firms (typically with foreign equity share equal to 100 per cent). Therefore, it is possible that a firm designated as a joint venture by NBS is simultaneously defined as majority or minority foreign-owned based on foreign equity shares information.

b. Productivity

Firm-level TFP is an indirect measure of technology transfer, in that it is an outcome due to gains in efficiency following technological diffusion after an acquisition (Keller, 2004, 2010). Unavailability of data prohibits the use of more direct measures such as expenditure

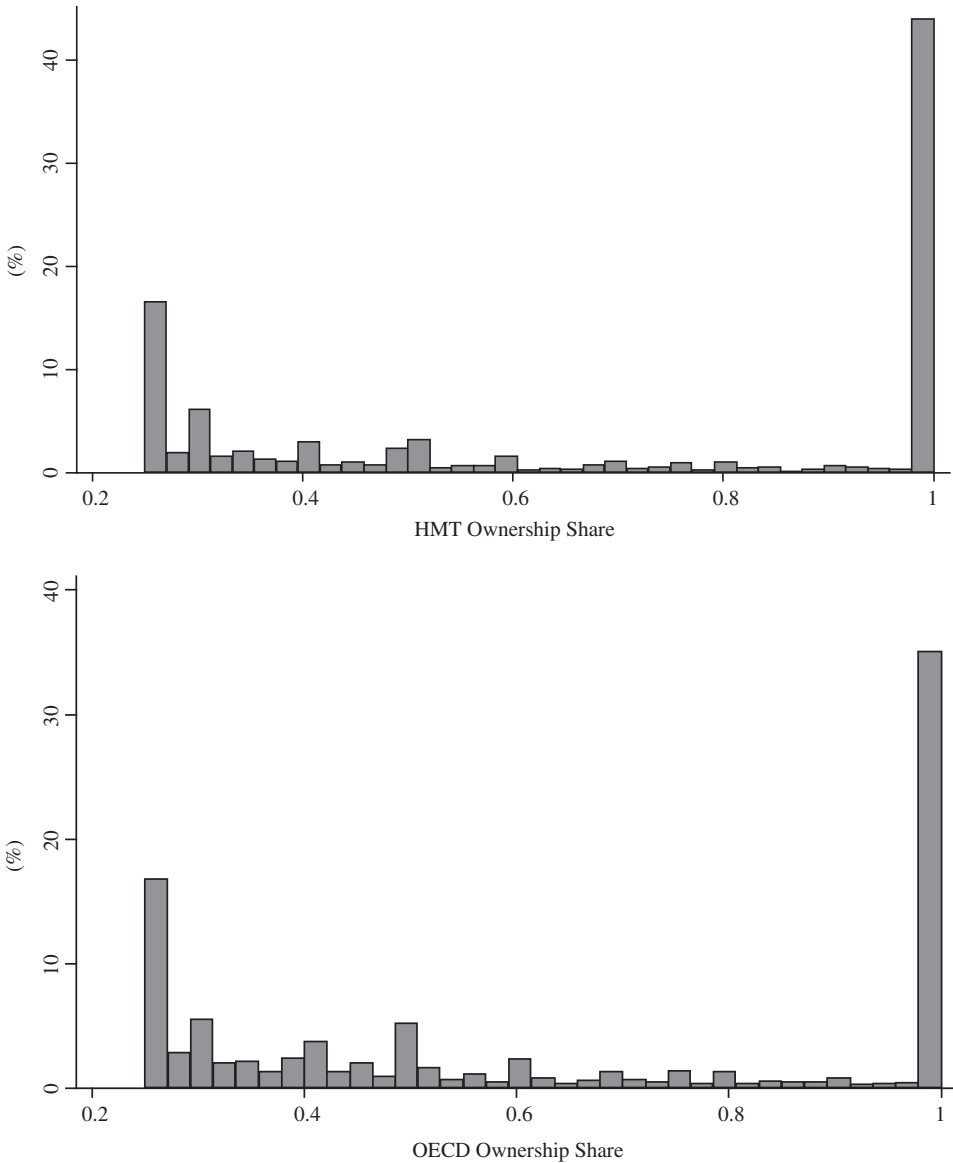
¹³ Arnold and Javorcik (2009) use a similar definition of foreign acquisition as a situation where the foreign ownership share in an Indonesian firm exceeds 20 per cent.

¹⁴ To alleviate concerns that only survivors and by implication higher productivity firms are disproportionately included in the sample, I calculate the exit rates for acquired firms, differentiated by the origin of the investor, who drop out of the sample in years $t + 1$ and $t + 2$, respectively. The exit rates do not differ substantially by investor type.

¹⁵ The original sample consisted of 1,798 firms acquired by OECD investors and 2,151 firms acquired by HMT investors. Of those acquired by OECD (HMT) investors, 304 (338) change two-digit industry categories in the post-acquisition period and are consequently dropped to ensure comparison within the same industry. One OECD-acquired firm fails the common support condition and is excluded from the analysis.

¹⁶ Figures or tables have not been included in the interest of space but are available upon request.

FIGURE 1
Distribution of Foreign Ownership Equity Share in the Post-acquisition Period



on patent licensing fees or payments for blueprints of technology. However, TFP captures productivity gains in a broader sense, in that it reflects gains to new technology via patents, R&D, blueprints, tacit or codified technical knowledge as well as gains due to management and human resource leadership skills that reduce inefficiencies, extend capacity usage and reduce slack or moral hazard problems in general.

Using TFP levels as a measure of technology transfer may suffer from measurement error due to usage of the values of outputs and inputs rather than the physical quantities. Gains due

to technological transfers may be confounded by higher mark-ups.¹⁷ However, data on physical output does not exist in the ASIP.¹⁸ This paper considers changes in TFP to mitigate concerns about measurement error. Keller (2004, 2010, p. 804) argues that considering changes in TFP as opposed to levels ‘will help in identifying technology if spurious factors do not change over time, or more generally, if they change less than technology’. Total factor productivity is measured as the residual of a Cobb–Douglas production function estimation. Specifically, TFP of a firm i in period t is,

$$TFP_{it} = \exp(\ln \text{value added}_{it} - \beta_l \ln \text{labour}_{it} - \beta_k \ln \text{capital}_{it}). \quad (1)$$

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

$$\ln \text{value added}_{it} - \beta_l \ln \text{labour}_{it} - \beta_k \ln \text{capital}_{it} + \omega_{it} + \varepsilon_{it}, \quad (2)$$

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

To address this potential simultaneity bias, I employ the semi-parametric method proposed by Levinsohn and Petrin (2003).¹⁹ I estimate the production function for each of the Chinese Industrial Classification (CIC) four-digit industry using the entire ASIP allowing the returns to inputs to vary across industries. This procedure uses intermediate inputs to proxy for the unobservable productivity shock, ω_{it} .²⁰ Computation of TFP using the Levinsohn and Petrin (2003) method requires information on firm value added, labour, capital and intermediate inputs. The dataset provides information on nominal values of firm value added, capital and intermediate inputs. These are converted to real terms using the output, investment and input deflators, respectively, in Brandt et al. (2011).²¹ In addition, log of value added per worker is used to establish robustness of the results to an alternate measure of productivity.²²

A preview of the unconditional data in Figure 2 shows that the distributions of TFP of both OECD and HMT targets in the pre-acquisition period are visually almost alike. How-

¹⁷ To the extent that mark-ups do not differ by source of FDI, the DDM estimator will capture foreign ownership premium.

¹⁸ Availability of data on output quantity is rare. For instance, Foster et al. (2008), one of the few studies using physical measures of output to construct TFP, only consider 11 product categories to study in the US manufacturing sector to ensure comparability of the physical output measures.

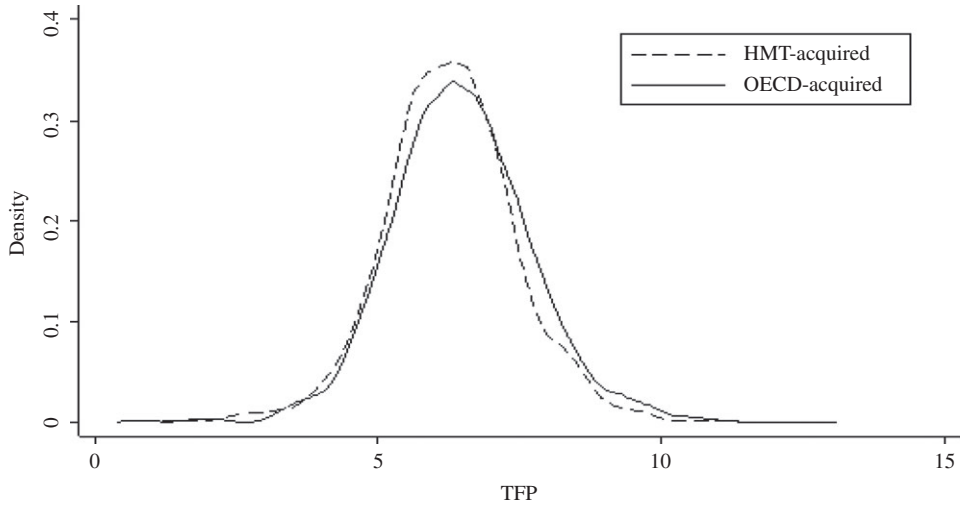
¹⁹ Carried out using the Stata module *levpet* (Levinsohn et al., 2004).

²⁰ The production function coefficients are estimated in two stages. First, the labour coefficient is consistently identified from a regression of value added on an intercept term, labour, and unobserved productivity modelled as a function of capital and intermediate inputs. The second stage identifies the capital coefficient assuming productivity innovation is orthogonal to current capital input and lagged intermediate inputs.

²¹ The deflators were accessed at <http://www.econ.kuleuven.be/public/N07057/CHINA/appendix/>.

²² TFP calculated using the Olley and Pakes (1996) methodology that uses investment as a proxy for the unobserved productivity component also attests to the robustness of the results. However, Levinsohn and Petrin (2003) is preferred due to availability of a larger number of observations with positive intermediate inputs compared with positive investments.

FIGURE 2
Productivity Distribution of Acquired Firms in the Pre-acquisition Period.



Note:

Total factor productivity (TFP) measured using Levinsohn and Petrin (2003) method.

ever, the two-sided Smirnov–Kolmogorov test rejects the null hypothesis that the distribution of TFP of OECD versus HMT targets come from the same distribution at the 1 per cent level.²³ This implies that the two distributions differ in a statistical sense and this difference could be a result of sorting based on target TFP. This entails the use of propensity score matching to compare the performance of OECD-acquired firms with a carefully selected group of HMT-acquired firms sharing similar pre-acquisition characteristics.

4. RESULTS

a. Multiple Treatment Matching Results

Two marginal probabilities are estimated to construct the counterfactuals for the pool of firms acquired by OECD investors. The first is the probability that a domestic Chinese firm is acquired by an OECD investor, $\hat{P}_{OECD}(x)$, and the second is the probability that a domestic Chinese firm is acquired by a HMT investor, $\hat{P}_{HMT}(x)$, both conditional on observable pre-acquisition characteristics. I estimate these marginal probabilities using what Lechner (2002, p. 209) calls the structural approach, where ‘the idea is to formulate the complete choice problem in one model and estimate it on the full sample’. Therefore, for constructing the propensity scores, I utilise the full ASIP to model the separate marginal probabilities of being acquired by either an OECD or HMT investor. The advantage of the structural approach is the ease of understanding the empirical factors behind the joint selection process

²³ The two-sided Smirnov–Kolmogorov test statistic is 0.074 (0.000) with p -value in parentheses.

as opposed to computing binary conditional choices, one at a time.²⁴ I obtain these probabilities through estimation of a multinomial logit model of foreign acquisition. Explanatory variables that affect the acquisition decision as well as the outcomes are included in this equation.²⁵ The choice of variables is also guided by existing literature including (Huang et al. 2008; Petkova 2008; Arnold and Javorcik 2009; and Chen 2011). All explanatory variables are measured as of the pre-acquisition period.

Evidence suggests that foreign investors rely on observable characteristics of a target firm to make acquisition decisions (Arnold and Javorcik, 2009; Chen, 2011). There might be concerns that selection of targets by acquirers could be guided by unobservable preferential policy treatments that vary over time. Selection on unobservables will pose challenges for identification in this study if one group of investors received preferential treatment over another. However, evidence suggests otherwise. Huang et al. (2010) document that Chinese domestic policy has been uniformly non-discriminatory for all FDI since the early 1990s.

The multinomial logit model includes pre-acquisition TFP, sales and sales squared, age and age squared, capital to labour ratio, wage per worker, share of exports in total sales, state share in total capital with all nominal values converted to real terms. Inclusion of TFP is intended to control for any selection on productivity such as 'cherry-picking', a phenomenon where some foreign firms acquire better performing domestic firms. Because TFP is a generated regressor, standard errors are bootstrapped. Total sales proxy for firm size. Age captures the stage of development of the firm as well as variations in production and management experiences. It also acts as a control for survival of more productive companies. Capital per worker is a measure of the potential productive capacity of the firm embodied in its capital stock. Average enterprise wage captures the average skill level of the domestic firm's labour force. Share of exports in total sales is indicative of the level of integration of the firm in world markets. State equity share is a proxy for firm specific assets particular to the Chinese context. For instance, SOEs are known to receive preferential access to bank loans and receive perks not available to private-owned enterprises (Huang, 2003).

In addition, the model includes a set of year, two-digit industry and region-fixed effects.²⁶ Year dummies control for macroeconomic shocks, such as inflation and other national shocks. Industry dummies control for industry-specific technology, skill requirements, and other industry-specific common shocks. Region dummies control for location specific natural resources, infrastructure, and policies. Region dummies further control for the scale of activity or agglomeration of firms. For instance, OECD (HMT) investors who acquire targets in a region where there are other OECD (HMT) firms may face lower costs of acquisition due to pre-established networks that reduce costs of acquiring information.

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

²⁵ See Caliendo and Kopeinig (2008) for a discussion of implementing propensity score matching techniques.

²⁶ Regions are designated as comprising of the following groups of provinces – (i) Coastal: Beijing, Fujian, Guangdong, Hainan, Jiangsu, Shandong, Tianjin, Zhejiang, Hebei; (ii) Inland: Shanxi, Anhui, Jiangxi, Henan, Hubei, Hunan; (iii) Northeast: Liaoning, Jilin, Heilongjiang; (iv) Southwest: Guangxi, Sichuan, Guizhou, Yunnan, Chongqing; and (v) Northwest: Inner Mongolia, Tibet, Shaanxi, Gansu, Qinghai, Ningxia, Xinjiang.

TABLE 2
Multinomial Logit Model of Foreign Acquisitions, All Industries

	<i>OECD</i>	<i>HMT</i>
TFP	0.007 (0.017)	-0.004 (0.017)
Sales	-0.321*** (0.039)	-0.253*** (0.041)
Sales squared	0.028*** (0.002)	0.023*** (0.002)
Capital per worker	-0.018 (0.018)	-0.035* (0.002)
Wage per worker	0.138*** (0.028)	0.061* (0.034)
Age	0.169 (0.129)	0.148 (0.115)
Age ²	-0.204*** (0.039)	-0.182*** (0.037)
Export intensity	0.789*** (0.071)	0.749*** (0.063)
State equity share	1.123*** (0.075)	1.097*** (0.067)
Constant	-6.310*** (0.257)	-6.224*** (0.246)
Observations		942,771
Log likelihood		-26,493.76
Pseudo- <i>R</i> ²		0.08
Schwarz criterion		53,661.59
Akaike criterion		53,085.52

Notes:

- (i) The base category are all firms not acquired by HMT or OECD investors.
- (ii) Bootstrapped standard errors in parentheses.
- (iii) Significant at *10%, **5%, ***1% levels.
- (iv) Export intensity measured as (value of exports/total sales).
- (v) All regressions include year, region and two-digit industry dummies.
- (vi) All explanatory variables, other than dummies or those expressed as shares, enter in the log form.
- (vii) Total factor productivity (TFP) measured using Levinsohn and Petrin (2003) method.

Table 2 reports the coefficients from the multinomial logit model. Results indicate that firms that are more likely to be acquired by either OECD or HMT investors are smaller (proxied by sales), older, more export-oriented and have lower capital/labour ratios and higher state equity shares. The coefficients on TFP are not significant at conventional levels. However, the positive sign on the TFP coefficient under the first column compared to the negative sign under the second column, suggest that more productive firms are more attractive to OECD compared to HMT investors. After obtaining $\hat{P}_{OECD}(x)$ and $\hat{P}_{HMT}(x)$ for every target firm, I apply one-to-one Mahalanobis matching to assign a counterfactual firm for every OECD target.

To assess how well the propensity score matching performs, tests of the balancing hypothesis are carried out and presented in Table A1 in the Appendix. The first test calculates the standardised bias for each of the covariates included in the multinomial logit model. This measures the distance in marginal distributions of the covariates and is defined as the difference in the sample means of the OECD-acquired and HMT-acquired firms weighted by the

square root of the average sample variances in both groups.²⁷ A bias reduction of 3 to 5 per cent once matching has been performed is considered to be sufficient (Caliendo and Kopeinig, 2008). The second test compares the sample means between OECD-acquired and HMT-acquired firms before and after matching. The expectation is that prior to matching, we should find statistically significant differences between the means that become statistically insignificant after matching. Both sets of tests pass the required standards. Also, on average, the absolute distance in terms of the multivariate score between the matched pairs is 0.02, a measure that is bound between 0 and 1. The results from tests of the balancing hypothesis show that matching is capable of grouping together firms that are comparable in terms of observable characteristics in the pre-acquisition period.

b. Baseline Results from Matching Difference-in-differences Analysis

Table 3 presents the baseline results. The two upper panels show results on log TFP and log labour productivity measured as the logarithm of value added per worker, and the lower panel shows results on log profits. The DDM estimator reports the average difference in the outcome considered between the matched pair of firms, the net of the initial difference in the pre-acquisition period. In the year of acquisition, the DDM estimator for TFP is equal to 0.123. This means that having accounted for the initial difference between the two groups, OECD-acquired firms exhibit 13.1 per cent higher TFP compared to HMT-acquired firms.²⁸

TABLE 3
Baseline Matching Difference-in-differences Results, All Industries

<i>Year (t)</i>	<i>Matching Estimate^a</i>	<i>Bootstrapped Standard Error</i>	<i>Z-Stat</i>	<i>Matched Pairs</i>
Log TFP				
Year of acquisition	0.123*	0.064	1.922	1,493
One year after	0.111*	0.062	1.780	1,493
Two years after	0.245**	0.083	2.947	1,493
Log labour productivity				
Year of acquisition	0.177**	0.083	2.130	1,493
One year after	0.153**	0.069	2.219	1,493
Two years after	0.224**	0.086	2.592	1,493
Log profits				
Year of acquisition	0.266**	0.113	2.354	1,493
One year after	0.353**	0.125	2.817	1,493
Two years after	0.523***	0.136	3.833	1,493

Notes

- (i) $1/n \sum_{n \in OECD} [(Y_t^{OECD} - Y_u^{OECD}) - (Y_t^{HMT} - Y_u^{HMT})]$ where u is the pre-acquisition year.
(ii) Bootstrapped standard errors in parenthesis using 100 repetitions.
(iii) *, **, *** indicate statistical significance at the 10, 5 and 1% levels, respectively.
(iv) Total factor productivity (TFP) measured using Levinsohn and Petrin (2003) method.
(v) Labour productivity measured as value added per worker.

²⁷ $SB_{before} = 100 * \frac{\bar{X}_T - \bar{X}_C}{\sqrt{0.5 + (V_{MT}(x) + V_{MC}(x))}}$; $SB_{after} = 100 * \frac{\bar{X}_{MT} - \bar{X}_{MC}}{\sqrt{0.5 + (V_{MT}(x) + V_{MC}(x))}}$; where T and C are the treated and control groups and MT and MC are the same for the matched sample.

²⁸ As the average treatment effect on the treated (ATT) is calculated for logged values, the percentages reported in the text are obtained by taking the exponent of ATT and subtracting one.

The TFP differential is 11.7 per cent in the year after acquisition. By the third year, it increases to 27.8 per cent. These effects are all statistically significant. Focusing on labour productivity, we observe similar patterns. In the year of acquisition, OECD-acquired firms exhibit 19.4 per cent higher productivity in relation to HMT-acquired firms. This difference persists in the year after at 16.5 per cent and reaches 25.1 per cent in the third year. These effects are all highly statistically significant.

The productivity gains are highest in the year of acquisition and relatively modest thereafter compared to the pre-acquisition period. I also find that the positive TFP differential is not a result of decreases in TFP at HMT-acquired firms in the post-acquisition period.²⁹ Both acquired groups of firms experience higher TFP in the post-acquisition period. However, the increase is larger for OECD-acquired firms in the post-acquisition period.

Firm profits are highly correlated with productivity, so we can expect OECD-acquired firms to exhibit higher profits in the post-acquisition period. Changes in log of total profits between the two acquired groups of firms support this hypothesis. In relation to HMT-acquired firms, OECD-acquired firms experience higher total profits in all years during and after acquisition. The difference is in the order of 30.5, 42.3, and 68.7 per cent for the year of, one, and two years after acquisition, respectively.³⁰ These results provide evidence of an OECD ownership premium.

c. Endogeneity

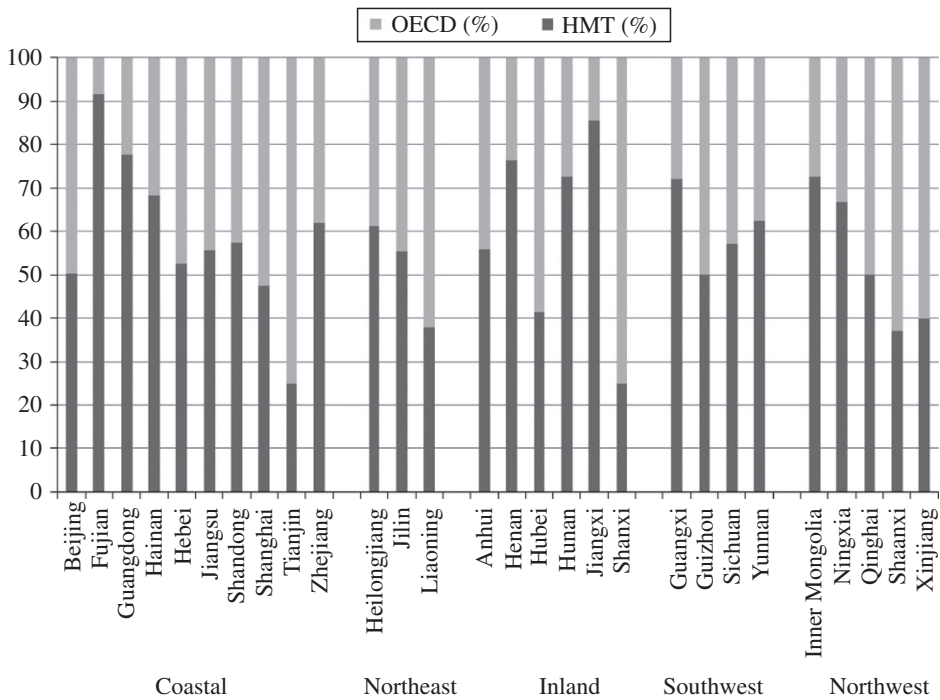
This paper evaluates the causal impact of OECD versus HMT ownership on Chinese target firm performance using a propensity score matching difference in differences approach. The identification assumption underlying this approach is that time varying unobservable factors do not play a role in the foreign acquisition decision. This section considers a potential unobservable time varying factor that might be cause for concern in the context of this study. This is the possibility that one group of foreign investors is better at identifying and acting on information not directly available from financial statements and other observable target characteristics. For example, OECD investors could be better than HMT investors at identifying talented managers who would contribute to the future growth of the firm. These types of information differ from 'hard' verifiable information and are referred to as 'soft' information in the finance and accounting literatures (Stein, 2002). There may be reason to believe that the ability to acquire 'soft' information varies over time due to region-specific experience accumulated through prior arm's length business transactions or establishment of subsidiaries in mainland China. HMT investors have close family and business ties to mainland China that could potentially translate into better region and country-specific knowledge about cultural and economic institutions that subsequently translates into differential ability to select acquisition targets.

I carry out two exercises to mitigate concerns about investors' differential ability to gather 'soft' information. First, I focus on acquisitions that take place in HMT-dense provinces. Figure 3 shows the distribution of the number of foreign projects by type of investor across

²⁹ For example, the average TFP of OECD (HMT)-acquired firms is 6.06 (6.096) in the pre-acquisition period and increases to 6.281 (6.194) in the year of acquisition.

³⁰ There might be concern that OECD and HMT engage differentially in transfer pricing behaviour that leads to lower reported profits by HMT firms. However, Huang et al. (2010) do not find evidence to support that lower profits in HMT firms are a result of transfer pricing activities. Moreover, Chan and Chow (1997) do not find evidence to support transfer pricing activities by foreign-owned firms, either HMT or non-HMT, operating in China.

FIGURE 3
Source Distribution of Foreign Projects, by Province, 1993–96



Notes:

(i) OECD denotes foreign projects originating from all countries except Hong Kong, Macao and Taiwan; HMT denotes foreign projects originating from Hong Kong, Macao and Taiwan.

(ii) This table displays equity joint venture projects only

Source: Dean et al. (2009).

China’s 28 provinces.³¹ I consider provinces to be HMT-dense where the share of HMT projects in total number of foreign projects exceeds 70 per cent.³² As HMT investors share cultural, business and family ties to mainland China, we would expect these investors to have an advantage over OECD investors in gathering ‘soft’ information in HMT-dense provinces. Therefore, finding an OECD ownership premium in these provinces attenuates concerns that the results are predominantly being driven by time-varying unobservable factors such as the ability to gather ‘soft’ information. Table 4 presents the results for log TFP, log labour productivity and log profits. It indeed appears that HMT investors may have an advantage over OECD investors in the year of acquisition, as suggested by the negative results for TFP and

³¹ The graph represents the number of equity joint ventures only and excludes wholly foreign-owned investment. Other sources of disaggregated geographical data on the distribution of total FDI by type of investment in China is not publicly available to the best of my knowledge.

³² These include provinces of Henan, Hunan, Jiangxi, Fujian, Guangdong, Inner Mongolia and Guangxi. The results are qualitatively similar if only considering those provinces where the HMT share in investment exceeds 80 per cent, namely Jiangxi and Fujian.

TABLE 4
Matching Difference-in-differences Results, HMT-dense Provinces

<i>Year (t)</i>	<i>Matching Estimate^a</i>	<i>Bootstrapped Standard Error</i>	<i>Z-Stat</i>	<i>Matched Pairs</i>
Log TFP				
Year of acquisition	-0.008	0.175	0.046	350
One year after	0.061	0.135	0.452	350
Two years after	0.142	0.190	0.747	350
Log labour productivity				
Year of acquisition	0.047	0.159	0.296	350
One year after	0.092	0.155	0.594	350
Two years after	0.179	0.187	0.957	350
Log profits				
Year of acquisition	-0.056	0.254	0.221	350
One year after	0.253	0.261	0.969	350
Two years after	0.741**	0.320	2.316	350

Notes:

(i) $1/n \sum_{n \in OECD} [(Y_t^{OECD} - Y_u^{OECD}) - (Y_t^{HMT} - Y_u^{HMT})]$ where u is the pre-acquisition year.

(ii) Bootstrapped standard errors in parenthesis using 100 repetitions.

(iii) *, **, *** indicate statistical significance at the 10, 5 and 1% levels, respectively.

(iv) Total factor productivity (TFP) measured using Levinsohn and Petrin (2003) method.

(v) Labour productivity measured as value added per worker.

(vi) HMT-dense provinces include Henan, Hunan, Jiangxi, Fujian, Guangdong, Inner Mongolia and Guangxi.

profits. However, by the second and third year after acquisition, OECD-acquired targets exhibit both higher profits and higher productivity compared to HMT-acquired targets.³³

Second, I divide the acquired sample by those that are state-owned versus those that are domestic private-owned in the pre-acquisition period. 'Soft' information may play a relatively more important role in foreign acquisitions of Chinese SOEs compared to private firms. Peng (2006) argues that SOEs are often characterised by organisational slack. However, their books could show high depreciation and reserve funds as well as retained earnings that would provide an inaccurate picture of the firm. He also argues that SOEs are also known to maintain three sets of books – one for administrative superiors exaggerating performance, one for tax purposes underreporting performance and, finally, one for the managers themselves, accurately reflecting performance. Foreign investors are likely to be shown the books exaggerating performance. In light of these SOE characteristics, we would expect foreign investors to conduct more careful due diligence both in terms of 'hard' and 'soft' information when considering state compared to domestic private targets. Therefore, if 'soft' information was a major driver of the results, we would expect the performance of OECD-acquired targets that were state-owned in the pre-acquisition period to differ markedly, in particular be higher, compared with private-owned targets.

Table 5 displays the results for productivity and profits separately for the two target ownership types in the pre-acquisition period. We see that in all years after acquisition, both types of OECD-acquired targets are more productive than their HMT-acquired counterparts. The TFP performance of OECD relative to HMT acquired firms do not differ by the target ownership type.³⁴ Labour pro-

³³ The results are not significant at conventional levels, except for profit differential in the third year of acquisition, most likely a consequence of the reduction in sample size.

³⁴ Pair-wise t -tests of differences in mean differential productivity between the two ownership types reject the null at the 1 per cent significance level.

TABLE 5
Matching Difference-in-differences Results, by Target Ownership Type

<i>Year (t)</i>	<i>Matching Estimate^a</i>	<i>Bootstrapped Standard Error</i>	<i>Z-Stat</i>	<i>Matched Pairs</i>
(a) Private-owned firms				
Log TFP				
Year of acquisition	0.129	0.128	1.008	711
One year after	0.132	0.106	1.245	711
Two years after	0.199*	0.129	1.543	711
Log labour productivity				
Year of acquisition	0.170	0.136	1.250	711
One year after	0.134	0.119	1.126	711
Two years after	0.147	0.160	0.919	711
Log profits				
Year of acquisition	0.191	0.172	1.110	711
One year after	0.242	0.187	1.294	711
Two years after	0.466**	0.207	2.251	711
(b) State-owned firms				
Log TFP				
Year of acquisition	0.117	0.092	1.272	782
One year after	0.093	0.093	1.000	782
Two years after	0.287**	0.102	2.814	782
Log labour productivity				
Year of acquisition	0.184**	0.091	2.022	782
One year after	0.170*	0.097	1.753	782
Two years after	0.294**	0.110	2.673	782
Log profits				
Year of acquisition	0.334*	0.178	1.876	782
One year after	0.455**	0.172	2.645	782
Two years after	0.575***	0.197	2.919	782

Notes:

- (i) $1/n \sum_{n \in OECD} [(Y_t^{OECD} - Y_u^{OECD}) - (Y_t^{HMT} - Y_u^{HMT})]$ where u is the pre-acquisition year.
- (ii) Bootstrapped standard errors in parenthesis using 100 repetitions.
- (iii) *, **, *** indicate statistical significance at the 10, 5 and 1% levels, respectively.
- (iv) Log total factor productivity (TFP) measured using Levinsohn and Petrin (2003) method.
- (v) Labour productivity measured as value added per worker.

ductivity and profits are higher in the post acquisition periods for both types, however, the results are quite a bit larger and statistically significant for the state-owned targets. State-owned firms are known to be over-manned and results for employment (not reported) indicate that post-acquisition, OECD-acquired targets that were state-owned (private-owned) experience statistically significant declines (increases) in employment in relation to HMT-acquired targets. This would mechanically lead to larger labour productivity and profit results. Together, the results in Tables 4 and 5 provide robust evidence of persistent OECD in relation to HMT ownership premium.

d. Post-acquisition Restructuring

To understand the restructuring process that takes place after a foreign acquisition, as well as various dimensions of the OECD ownership premium, I consider several other firm level outcomes: average wage, employment, capital intensity (capital/labour ratio), export intensity (export to sales ratio), and innovation intensity (the share of new product output

TABLE 6
Matching Difference-in-Differences Results^a, Various Outcomes

(a) Log average wage				
Year of acquisition	0.143***	0.039	3.717	1,493
One year after	0.117***	0.041	2.818	1,493
Two years after	0.128***	0.041	3.111	1,493
(b) Log employment				
Year of acquisition	0.018	0.039	0.479	1,493
One year after	0.037	0.039	0.962	1,493
Two years after	0.084*	0.048	1.763	1,493
(c) Log capital per worker				
Year of acquisition	0.215***	0.062	3.477	1,493
One year after	0.259***	0.068	3.782	1,493
Two years after	0.214***	0.065	3.280	1,493
(d) Export intensity				
Year of acquisition	0.005	0.011	0.436	1,493
One year after	0.007	0.012	0.524	1,493
Two years after	0.005	0.012	0.386	1,493
(e) Innovation intensity				
Year of acquisition	0.008	0.008	0.994	720
One year after	0.004	0.008	0.574	1,109
Two years after	0.001	0.008	0.067	1,192

Notes:

(i) $1/n \sum_{n \in OECD} [(Y_t^{OECD} - Y_u^{OECD}) - (Y_t^{HMT} - Y_u^{HMT})]$ where u is the pre-acquisition year.

(ii) Bootstrapped standard errors in parenthesis using 100 repetitions.

(iii) * and *** indicate statistical significance at the 10% and 1% levels, respectively.

(iv) Export intensity measured as (value of exports/total sales).

(v) Innovation intensity measured as (new product output value/total sales).

value in total sales). Panel (a) in Table 6 shows that compared with HMT-acquired firms, OECD-acquired firms pay higher average wages. Panel (b) shows that OECD-acquired firms do not experience statistically different changes in employment in relation to HMT-acquired firms. The ASIP does not provide information by skill level of workers in all years, such that I cannot observe changes in the skill composition between the two groups of acquired firms.³⁵ If higher average wages are not a result of employing more skilled workers, these two results taken together is consistent with workers becoming more productive once they are under new management. Such an interpretation suggests OECD-acquired firms employing superior management know-how that reduces waste and increases labour productivity.

In panel (c), we see that relative to HMT-acquired firms, OECD-acquired firms increase the amount of capital per worker in the year of acquisition; the increase is more pronounced in the following year and more modest in the second year after acquisition. Capital intensity increases differentially by 24.0, 29.6 and 23.9 per cent, respectively, in these years, and these results are statistically significant. The largest increase occurs in the year of acquisition compared with the pre-acquisition period, which is also the same period when we observe the largest increase in productivity. The results suggest that OECD investors immediately increase capital outlays in the acquired firms.

³⁵ Information on employment by skill is available for 2004 only, and wage bills are not distinguished by skill.

Next, I consider if OECD-acquired firms tend to participate more in international markets. Results show that OECD-acquired firms do not raise the share of exports in total sales any more or less than HMT-acquired firms. Recall that domestic Chinese firms with high exports to sales ratios were more likely to be acquired by both types of investors (see Table 2). Thus, it is possible that the acquired firms were already well-integrated into world markets.

Finally, under panel (e), I look for changes in innovative activity between the acquired firms, measured as the output value of new products produced in a given year as a share of total sales. The presumption is that if OECD firms operate on the frontiers of world technology relative to HMT firms, they may be more likely to introduce a larger number and higher quality products.³⁶ Results show that there is no difference in changes to innovation intensity of OECD in relation to HMT-acquired firms.³⁷

e. Industry Heterogeneity

In 2002, the share of processing exports in total Chinese exports was 60 per cent and processing exports accounted for 71 per cent (87.9 per cent) of exports by Sino-foreign joint venture (wholly foreign-owned) firms (Koopman et al., 2008). To account for the pervasive nature of export processing and the important role of foreign firms in Chinese trade, I distinguish between industries with high and low domestic content in production.³⁸ Domestic content embodies the domestic value added in the production process. In industries with low domestic content, the production process could simply involve assembling imported parts into a final good or processing according to foreign specifications leaving no room for innovation.³⁹ For example, Chinese workers account for only about 3 per cent of the value added for one iPod assembled in China and exported to the US.⁴⁰ Therefore, there might be little scope for transferring sophisticated know-how through FDI in industries characterised by low domestic content.

Using newly available detailed input–output tables, Dean et al. (2011) measure domestic content by input–output sectors.⁴¹ Using the concordance provided in Brandt et al. (2011), input–output sectors are matched to four-digit CIC industries. Then using the domestic content for each four-digit industry within a two-digit industry, an average is computed at the two-

³⁶ As far as price is a reliable proxy for quality, the output value of new products will capture both larger number and quality of new products.

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

³⁸ This exercise indirectly allows me to consider the integration strategies of foreign firms in China. It is possible that *ex ante*-OECD and HMT firms may be equally productive but may differ in terms of the type of activities transferred to China. It is more likely that in industries where processing activities are pervasive, foreign firms might be locating their least skill intensive production activities. Differentiating industries on this dimension permits focus on foreign firms engaged in similar activities.

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

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

⁴¹ Dean et al. (2011) estimate the degree of vertical specialisation (VS) by sector that represents the foreign content in exports. Domestic content is calculated as $(1 - VS)$.

digit industry level.⁴² Table A2 in the Appendix provides a ranking of the two-digit industries by domestic content. We see that high domestic content industries are those that we may consider less technologically sophisticated.⁴³ Industries considered to have higher technology content or be R&D intensive exhibit very low domestic content in their exports.

Table 7 extends the baseline results by differentiating industries with high and low domestic content in exports. We find that, post-acquisition, the productivity and profit differentials between OECD and HMT-acquired firms is more pronounced in high domestic content industries. These results are also consistent with the finding in Hu et al. (2005) that foreign technology transfer in China (measured as a firm's expenditure on technology purchased from a foreign provider such as payments for blueprints of technology) is more intensive in less technologically advanced industries.⁴⁴

5. ROBUSTNESS CHECKS

a. Matching within Industry

Although controls for two-digit industry fixed effects are included in the multinomial logit model used to construct the propensity scores, the HMT-acquired firms that form the comparison group are not necessarily chosen from within the same industry as the OECD-acquired firms. In general, the sample size does not allow it. Therefore, a potential concern is that industry sorting could be driving the differences in post-acquisition TFP. Table A3 in the Appendix provides the number of acquisitions within each two-digit industry. We see that the number of acquisitions by the two types of investors is similar within each industry providing a relatively limited pool to choose from. The average treatment effect on the treated captured by the DDM estimator is identified only in the region of common support. To ensure that there is sufficient overlap between the two groups, a larger number of HMT-acquired firms would increase the likelihood of better matches for each OECD-acquired firm propelling the choice to match across industries having controlled for industry effects in the propensity score estimation.

Previous studies of the impact of foreign ownership on domestic firm productivity using matching difference-in-differences technique face similar constraints. For example, Petkova (2008) and Chen (2011) who study Indian and US firms, respectively, carry out their difference-in-differences analyses after matching across industries. A notable exception is Arnold and Javorcik (2009), who study post-acquisition TFP gains to Indonesian firms and conduct their analysis after matching within the same four-digit industry as well as year when the foreign acquisition occurred. Their counterfactual is constructed from the universe of all domes-

⁴² For example, the VS measures for four-digit industries 2,412 ('pen manufacturing') and 2,440 ('toy manufacturing') are 0.028 and 0.132, respectively. The average for two-digit industry 24 ('manufacture of articles for culture education and sport activity') is 0.08 and the domestic content is $(1 - 0.08) = 0.92$. A more appropriate measure would be a weighted average using export shares by four-digit industry, but this data is not publicly available. Dean et al. (2011) only provide a graphical representation of VS numbers; therefore, the VS numbers used are from the last column in Table 3 in Dean et al. (2007) using the 2002 benchmark input-output table.

⁴³ Dean et al. (2007) define an industry to be highly vertically specialised if the foreign content of exports exceeds 25 per cent. Following their definition, an industry is categorised as having high domestic content if the domestic content of exports exceeds 75 per cent.

⁴⁴ Hu et al. (2005) categorise tobacco, textile, apparel, leather, furniture, paper, printing and rubber industries as less technologically advanced.

TABLE 7
Matching Difference-in-differences Results, by Industry Grouping

<i>Year (t)</i>	<i>Matching Estimate^a</i>	<i>Bootstrapped Standard Error</i>	<i>Z-Stat</i>	<i>Matched Pairs</i>
(a) High domestic content industries				
Log TFP				
Year of acquisition	0.186**	0.089	2.113	726
One year after	0.127	0.089	1.427	726
Two years after	0.254**	0.119	2.136	726
Log labour productivity				
Year of acquisition	0.274**	0.117	2.342	726
One year after	0.182*	0.099	1.838	726
Two years after	0.247**	0.112	2.205	726
Log profits				
Year of acquisition	0.400**	0.153	2.614	726
One year after	0.695***	0.171	4.064	726
Two years after	0.663***	0.198	3.348	726
(b) Low domestic content industries				
Log TFP				
Year of acquisition	0.063	0.121	0.515	767
One year after	0.097	0.100	0.975	767
Two years after	0.236*	0.142	1.657	767
Log labour productivity				
Year of acquisition	0.086	0.110	0.782	767
One year after	0.125	0.104	1.202	767
Two years after	0.207*	0.116	1.784	767
Log profits				
Year of acquisition	0.140	0.162	0.864	767
One year after	0.029	0.174	0.167	767
Two years after	0.390*	0.205	1.902	767

Notes:

- (i) $1/n \sum_{n \in OECD} [(Y_t^{OECD} - Y_u^{OECD}) - (Y_t^{HMT} - Y_u^{HMT})]$ where u is the pre-acquisition year.
- (ii) Bootstrapped standard errors in parenthesis using 100 repetitions.
- (iii) *, **, *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.
- (iv) Log total factor productivity (TFP) measured using Levinsohn and Petrin (2003) method.
- (v) Labour productivity measured as value added per worker.

tic Indonesian firms employing more than 20 workers, providing a sufficiently large pool for selecting good matches.

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

The multinomial logit model and the results from the balancing tests are provided in Tables A4 and A5 in the Appendix respectively. The coefficients in Table A4, for multinomial logit model, are similar to those in Table 2 for all industries. The balancing tests in Table A5

TABLE 8
Matching Difference-in-differences Results, Textile Industries Only

<i>Year (t)</i>	<i>Matching Estimate^a</i>	<i>Bootstrapped Standard Error</i>	<i>Z-Stat</i>	<i>Matched Pairs</i>
Log TFP				
Year of acquisition	0.181*	0.099	1.814	258
One year after	0.137	0.129	1.062	258
Two years after	0.150	0.103	0.103	258
Log labour productivity				
Year of acquisition	0.197*	0.121	1.630	258
One year after	0.070	0.134	0.526	258
Two years after	0.068	0.120	0.568	258
Log profits				
Year of acquisition	0.442*	0.247	1.789	258
One year after	0.606**	0.281	2.157	258
Two years after	0.238	0.336	0.708	258

Notes:

(i) $1/n \sum_{n \in OECD} [(Y_t^{OECD} - Y_u^{OECD}) - (Y_t^{HMT} - Y_u^{HMT})]$ where u is the pre-acquisition year.

(ii) Bootstrapped standard errors in parenthesis using 100 repetitions.

(iii) * and *** indicate statistical significance at the 10% and 5% levels, respectively.

(iv) Total factor productivity (TFP) measured using Levinsohn and Petrin (2003) method.

(v) Labour productivity measured as value added per worker.

(vi) The textile industries considered are the two-digit CIC industries 17 (manufacture of textile) and 18 (manufacture of textile wearing apparel, footwear, and caps).

show that overall, matching reduces the standardised bias by at least 3 to 5 per cent while the t -tests yield statistically insignificant differences between the mean of the variables, once matching is performed.⁴⁵

Table 8 presents the propensity score matching difference-in-differences results for textiles only. We find that OECD-acquired firms exhibit higher productivity (measured as TFP and labour productivity) in all years after acquisition, although the result is only statistically significant in the year of acquisition. The results are imprecisely measured in the following two years and are likely a result of the reduced sample size. The characteristics of the textile industry could also explain the statistical insignificance. The textile industry is labour intensive relying on simple and nonproprietary technology (Huang et al., 2008) that diminish the role for OECD versus HMT know-how advantage. However, the pattern of results is similar to those reported in Table 3 where the largest increase in productivity occurs in the year of acquisition. Results also indicate that OECD-acquired firms exhibit higher profits in relation to HMT acquire firms, and the results are statistically significant in the year of and one year after acquisition. Carrying out the analysis within the same industry and finding evidence of higher productivity in OECD-acquired firms lends confidence that the main results are not being driven by industry differences.

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

TABLE 9
Matching Difference-in-differences Results, Majority Foreign-Owned

<i>Year (t)</i>	<i>Matching Estimate^a</i>	<i>Bootstrapped Standard Error</i>	<i>Z-Stat</i>	<i>Matched Pairs</i>
Log TFP				
Year of acquisition	0.367***	0.115	3.191	756
One year after	0.200**	0.100	2.000	756
Two years after	0.424***	0.134	3.164	756
Log labour productivity				
Year of acquisition	0.339**	0.132	2.568	756
One year after	0.149	0.113	1.319	756
Two years after	0.311**	0.116	2.681	756
Log profits				
Year of acquisition	0.322**	0.161	2.000	756
One year after	0.284*	0.172	1.651	756
Two years after	0.882***	0.213	4.141	756

Notes:

- (i) $1/n \sum_{n \in OECD} [(Y_t^{OECD} - Y_u^{OECD}) - (Y_t^{HMT} - Y_u^{HMT})]$ where u is the pre-acquisition year.
(ii) Bootstrapped standard errors in parenthesis using 100 repetitions.
(iii) *, **, *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.
(iv) Total factor productivity (TFP) measured using Levinsohn and Petrin (2003) method.
(v) Labour productivity measured as value added per worker.
(vi) Majority foreign-owned is defined as having a foreign equity share equal to or in excess of 50%.

b. Round-trip FDI

Round-trip FDI in China is estimated to be around 25 to 33 per cent of total FDI inflows to mainland China. Round tripping refers to the capital belonging to a country, which leaves a country and is then reinvested into the country in the form of FDI. FDI from Hong Kong is believed to suffer disproportionately more from round-tripping than other source countries. Both mainland Chinese firms and foreign multinationals have been known to establish subsidiaries in Hong Kong. It is beyond the scope of this paper to identify which of the HMT-acquired firms in my sample is part of round-tripping FDI, and this may confound the true HMT ownership effect.

I address this issue indirectly. Huang (2003) argues that foreign-majority-owned investments are unlikely to be funded by round-trip FDI. I re-do the baseline analysis on the group of firms with foreign equity ownership equal to or exceeding 50 per cent.⁴⁶ The results are presented in Table 9. We can see that for the group of OECD-acquired firms that are in majority foreign-owned results are similar to the baseline results in Table 3 except that OECD labour productivity premium fails to gain statistical significance in the first year after acquisition.

6. CONCLUSION

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

⁴⁶ Majority-owned OECD-acquired firms are paired with majority-owned HMT-acquired firms.

source of foreign investment is an important determinant of the extent to which FDI improves host-country firm performance. Although we may expect the possibility of technology transfer to increase with the superiority in technological capabilities of multinational firms, host-country firms in a developing country like China may not have the capacity to absorb superior know-how into their production processes. This study compares the performance of domestic Chinese firms acquired by OECD and HMT investors to search for evidence of the importance of the origin of FDI on firm performance. In particular, every OECD-acquired firm is matched with a HMT-acquired firm, and we look for changes in various performance outcomes between these two groups of firms in the post-acquisition period.

We find that OECD-acquired firms outperform HMT-acquired firms. In particular, in relation to HMT-acquired firms, OECD-acquired firms experience higher TFP in the initial year of acquisition and this productivity differential persists in subsequent years, reaching 27.8 per cent in the third year. Further, post-acquisition increases in average wages accompanied by no changes in total employment and increases in capital usage per worker point to the introduction of management techniques that reduce labour inefficiencies along with capital deepening as characterising the OECD ownership premium. These results underscore the importance of distinguishing between sources of FDI. They also lend evidence that ethnic ties do not necessarily lead to better firm performance, a finding corroborated by Huang et al. (2010).

Looking across industry groups, we further find that the productivity differential is more pronounced in industries with high domestic content. This finding has important policy implications for countries heavily engaged in export processing activities. If the local economy specialises in a narrow range of activities, it makes it unlikely for realising performance enhancing gains by host-country firms from foreign direct investment.

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APPENDIX

TABLE A1
Balancing Tests, All Industries

Variable	Sample	Mean		% Reduction		t-test	
		OECD	HMT	% Bias	Bias	t	p > t
TFP	Unmatched	6.0541	5.8613	8.9	81.6	2.55	0.011
	Matched	6.0603	6.0958	-1.6		-0.46	0.648
Sales	Unmatched	10.184	10.000	8.8	74.1	2.51	0.012
	Matched	10.184	10.232	-2.3		-0.65	0.515
Sales squared	Unmatched	108.31	104.18	12.9	92.8	3.72	0.000
	Matched	108.31	108.02	0.9		0.26	0.798
Capital per worker	Unmatched	3.8455	3.6912	7.2	99.5	2.06	0.040
	Matched	3.8446	3.8854	-0.0		-0.01	0.992
Wage per worker	Unmatched	2.2764	2.1825	8.7	86.1	2.50	0.013
	Matched	2.2767	2.2897	-1.2		-0.33	0.741
Age	Unmatched	1.5838	1.6173	-3.7	26.8	-1.07	0.287
	Matched	1.5836	1.5591	2.7		0.75	0.451
Age ²	Unmatched	3.3195	3.4195	-2.6	-24.5	-0.75	0.455
	Matched	3.3192	3.1948	3.3		1.00	0.318
Export intensity	Unmatched	0.33588	0.34647	-2.5	98.9	-0.72	0.474
	Matched	0.33610	0.33622	-0.0		-0.01	0.994
State equity share	Unmatched	0.48352	0.44528	8.4	90.2	2.39	0.017
	Matched	0.48058	0.47684	0.8		0.231	0.821

Notes:

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

TABLE A2
Industry Ranking by Domestic Content

<i>Two Digit CIC</i>	<i>Industry Name</i>	<i>Domestic Content</i>
13	Processing of food from agricultural products	0.943
15	Manufacture of beverages	0.940
36	Manufacture of special purpose machinery	0.925
31	Manufacture of non-metallic mineral products	0.920
24	Manufacture of articles for culture, education and sport activity	0.920
42	Manufacture of artwork and other manufacturing	0.908
29	Manufacture of rubber	0.871
23	Printing, reproduction of recording media	0.859
17	Manufacture of textile	0.857
26	Manufacture of raw chemical materials and chemical products	0.853
28	Manufacture of chemical fibers	0.846
41	Manufacture of measuring instruments and machinery for cultural activity and office work	0.838
27	Manufacture of medicines	0.828
21	Manufacture of furniture	0.824
37	Manufacture of transport equipment	0.810
33	Smelting and pressing of non-ferrous metals	0.772
14	Manufacture of foods	0.749
25	Processing of petroleum, coking, processing of nuclear fuel	0.741
19	Manufacture of leather, fur, feather and related products	0.740
22	Manufacture of paper and paper products	0.732
39	Manufacture of electrical machinery and equipment	0.727
32	Smelting and pressing of ferrous metals	0.725
35	Manufacture of general purpose machinery	0.706
20	Processing of timber, manufacture of wood, bamboo, rattan, palm and straw products	0.590
40	Manufacture of communication equipment, computers and other electronic equipment	0.585
18	Manufacture of textile wearing apparel, footwear and caps	0.584
34	Manufacture of metal products	0.455
30	Manufacture of plastics	0.240

Notes:

See Section 4e for details on calculation of domestic content (DC).

Source: Author's calculations.

TABLE A3
Number of Acquired Firms, by Industry

<i>Two Digit CIC</i>	<i>Industry Name</i>	<i>OECD</i>	<i>HMT</i>
13	Processing of food from agricultural products	96	69
14	Manufacture of foods	58	45
15	Manufacture of beverages	35	21
17	Manufacture of textile	111	214
18	Manufacture of textile wearing apparel, footwear and caps	147	202
19	Manufacture of leather, fur, feather and related products	72	97

TABLE A3 *Continued*

<i>Two Digit CIC</i>	<i>Industry Name</i>	<i>OECD</i>	<i>HMT</i>
20	Processing of timber, manufacture of wood, bamboo, rattan, palm and straw products	31	33
21	Manufacture of furniture	17	24
22	Manufacture of paper and paper products	26	51
23	Printing, reproduction of recording media	11	36
24	Manufacture of articles for culture, education and sport activity	43	45
25	Processing of petroleum, coking, processing of nuclear fuel	8	4
26	Manufacture of raw chemical materials and chemical products	90	107
27	Manufacture of medicines	47	41
28	Manufacture of chemical fibers	6	5
29	Manufacture of rubber	14	7
30	Manufacture of plastics	63	122
31	Manufacture of non-metallic mineral products	82	120
32	Smelting and pressing of ferrous metals	23	21
33	Smelting and pressing of non-ferrous metals	17	18
34	Manufacture of metal products	70	94
35	Manufacture of general purpose machinery	92	56
36	Manufacture of special purpose machinery	30	26
37	Manufacture of transport equipment	69	47
39	Manufacture of electrical machinery and equipment	78	100
40	Manufacture of communication equipment, computers and other electronic equipment	99	115
41	Manufacture of measuring instruments and machinery for cultural activity and office work	15	29
42	Manufacture of artwork and other manufacturing	43	64
Total		1,493	1,813

Notes:

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

Source: Author's calculations, Annual Surveys of Industrial Production.

TABLE A4
Multinomial Logit Model of Foreign Acquisitions, Textile Industries Only

	<i>OECD</i>	<i>HMT</i>
TFP	0.058 (0.061)	-0.065** (0.031)
Sales	-0.132 (0.217)	-0.293*** (0.083)
Sales squared	0.017* (0.010)	0.028*** (0.004)
Capital per worker	0.008 (0.045)	-0.068** (0.035)
Wage per worker	0.014 (0.083)	0.096 (0.059)

TABLE A4 *Continued*

	<i>OECD</i>	<i>HMT</i>
Age	0.049 (0.187)	0.059 (0.299)
Age ²	-0.147*** (0.054)	-0.127 (0.094)
Export intensity	0.606*** (0.150)	0.391*** (0.121)
State equity share	1.217*** (0.133)	1.125*** (0.118)
Constant	-7.273*** (1.136)	-5.077*** (0.459)
Observations	116,074	
Log likelihood	-4,958.49	
Pseudo-R ²	0.06	
Schwarz criterion	10,383.46	
Akaike criterion	9,996.98	

Notes:

(i) The base category are all firms not acquired by HMT or OECD investors.

(ii) Bootstrapped standard errors in parentheses.

(iii) Significant at ***1% level.

(iv) Export intensity measured as (value of exports/total sales).

(v) Total factor productivity (TFP) measured using Levinsohn and Petrin (2003) method.

(vi) All regressions include year, region and two-digit industry dummies.

(vii) All explanatory variables, other than dummies or those expressed as shares, enter in the log form.

(viii) Textile industry is composed of two-digit CIC industries 17 (manufacture of textile) and 18 (manufacture of textile wearing apparel, footwear and caps).

TABLE A5
Balancing Tests, Textile Industries Only

<i>Variable</i>	<i>Sample</i>	<i>Mean</i>		<i>% Reduction</i>		<i>t-test</i>	
		<i>OECD</i>	<i>HMT</i>	<i>% Bias</i>	<i> Bias </i>	<i>t</i>	<i>p > t</i>
TFP	Unmatched	5.9005	5.6039	16.8	77.70	2.06	0.040
	Matched	5.9005	6.9666	-3.8		-0.51	0.610
Real sales	Unmatched	10.111	9.9761	8.0	-50.5	0.98	0.326
	Matched	10.111	10.315	-12.0		-1.70	0.090
Real sales squared	Unmatched	104.49	103.00	5.9	-123.7	0.73	0.465
	Matched	104.49	107.84	-13.1		-1.61	0.107
Capital per worker	Unmatched	3.2972	3.2926	0.2	-5,864.7	-0.03	0.977
	Matched	3.2972	3.5666	-14.3		-1.87	0.062
Wage per worker	Unmatched	2.1570	2.0777	9.1	81.3	1.16	0.245
	Matched	2.1570	2.1422	1.7		0.20	0.843
Age	Unmatched	1.5824	1.6586	-8.0	94.7	-1.01	0.314
	Matched	1.5824	1.5898	-0.4		-0.05	0.958
Age ²	Unmatched	3.3008	3.5974	-7.9	39.3	-0.95	0.344
	Matched	3.3008	3.1207	4.8		0.80	0.425
Export intensity	Unmatched	0.51027	0.4515	13.3	37.8	1.68	0.094

TABLE A5 *Continued*

<i>Variable</i>	<i>Sample</i>	<i>Mean</i>		<i>% Reduction</i>		<i>t-test</i>	
		<i>OECD</i>	<i>HMT</i>	<i>% Bias</i>	<i> Bias </i>	<i>t</i>	<i>p > t</i>
State equity share	Matched	0.51027	0.4737	8.3		0.94	0.349
	Unmatched	0.41822	0.39699	4.8	79.3	0.60	0.550
	Matched	0.41822	0.41383	1.0		0.11	0.913

Notes:

(i) Export intensity measured as (value of exports/total sales).

(ii) Total factor productivity (TFP) measured using Levinsohn and Petrin (2003) method.

(iii) All variables, other than those expressed as shares, are in the log form.

(iv) Textile industry is composed of two-digit CIC industries 17 (manufacture of textile) and 18 (manufacture of textile wearing apparel, footwear and caps).