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Journal of Chinese Economic and Business Studies

ISSN: 1476-5284 (Print) 1476-5292 (Online) Journal homepage: http://www.tandfonline.com/loi/rcea20

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To cite this article: Alyson C. Ma (2006) Export Spillovers to Chinese Firms: Evidence from Provincial Data, Journal of Chinese Economic and Business Studies, 4:2, 127-149

To link to this article: http://dx.doi.org/10.1080/14765280600736908

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Journal of Chinese Economic and Business Studies
Vol. 4, No. 2, 127–149, July 2006

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Export Spillovers to Chinese Firms: Evidence from Provincial Data

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ABSTRACT *Multinational firms are important conduits of managerial skills, foreign market linkages, and technology. Foreign export spillovers associated with multinational firms have the potential to reduce entry costs for local exporting firms. This paper examines whether exports by multinational firms increase the probability of exporting by domestic Chinese firms. The findings from the Probit estimation highlight the varying relationships between multinational exports and local foreign entry based on the type of ownership. The results from separating foreign-invested enterprises into overseas Chinese companies and OECD-based multinational firms suggest that the export activity of the former does not increase the probability of exporting by local firms, whereas the latter positively influence the export decision of local firms, particularly under processing trade.*

KEY WORDS: Export spillover, multinational firm, China, foreign direct investment

JEL Classifications: F1, F14, F23

Introduction

It is widely believed that multinational firms (MNEs) are important conduits of managerial skills, foreign market linkages (Javorcik, 2004; Markusen & Venables, 1999), innovation, and technology (Blomstrom & Kokko, 1998).[1] As such, many governments offer elaborate incentive packages ranging from tax concessions, grants, subsidies, land, and other financial assistances in order to attract foreign direct investment.[2] The general argument is that foreign investment generates externalities on domestic productivity and economic growth through the spillovers of firm-specific assets characterized by multinational firms.

One source of productivity gain is the increase in export activity of domestic producers located in proximity to multinational firms. Whether through observation and imitation, labor turnover (Fosfuri *et al*., 2001), or backward and forward linkages, foreign export spillovers associated with multinational firms have the potential to reduce entry costs for local exporting firms (Blomstrom & Kokko, 1998).[3] Since exporting involves substantial fixed costs related to gaining knowledge

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1476-5284 Print/1476-5292 Online/06/020127–149 © 2006 The Chinese Economic Association-UK
DOI: 10.1080/14765280600736908

of foreign preferences and regulations, distribution networks, and transportation (Greenaway *et al.*, 2004), domestic firms may overcome the initial hurdle by operating near foreign exporters. Namely, multinationals may directly or indirectly provide information and distribution services, which may enhance the export prospects of local firms (Aitken *et al.*, 1997).

The focus of this paper is to examine whether exports by multinational firms increase the exporting activity of domestic firms by reducing the cost of foreign market access. Using Chinese provincial data, I test the impact of multinational performance on the export behavior of local manufacturing firms over the period 1993 to 2000. The purpose is to highlight the varying relationships between multinational exports and foreign entry by local firms based on the type of ownership. More specifically, a comparison will be made of whether private-owned enterprises and collective-owned enterprises benefit more from operating in the proximity of exporting multinational firms than state-owned enterprises due to their differences in economic incentives.[4]

The organization of this paper is as follows. The next section provides a brief review of FDI and economic growth in China. A synopsis of the current literature is then presented, followed by the empirical model. After which, a brief description of the data is given. Lastly the empirical results are discussed and a summary and conclusion provided.

Chinese Economic Development

Like many developing countries, China views FDI as an important ingredient of economic growth. In contrast to portfolio and other types of investments, FDI has the potential to affect the recipient economy through a variety of channels. The importance of FDI is not only in terms of the flow of capital but also as a source of advanced technology, modern management skills, and access to international markets.

As part of its market-oriented reforms China actively sought FDI with lucrative incentive packages in an effort to advance technological development and to promote its export trade capabilities. The total amount of inward FDI rose from almost zero in 1978 to a record breaking $52.7 billion in 2003.[5] This significant surge of FDI in China is even more striking when measured against its neighbors. Figure 1 shows that from 1993 the net inflow of FDI to China surpassed the amount received by the rest of the Asian countries. Thus, China transformed itself from a country hostile to FDI in the early 1970s to the world's largest recipient in 2003.

The majority of the FDI inflow to China is from Hong Kong with about 34% of the country's total foreign investment in 2002. From Figure 2, it is clear that FDI from the next source, the United States, is considerably less, with about 10%. Rounding off the top five are Japan, Taiwan, and the European Union, respectively, with about 7% to 8% each. Moreover, Hong Kong has been the main source of FDI for China since the beginning of the Open Door Policy (see Figure 3).

However, in contrast to the 1980s' FDI, where Hong Kong, Macao, and Taiwan-based investors dominated all foreign production, the 1990s' FDI in China

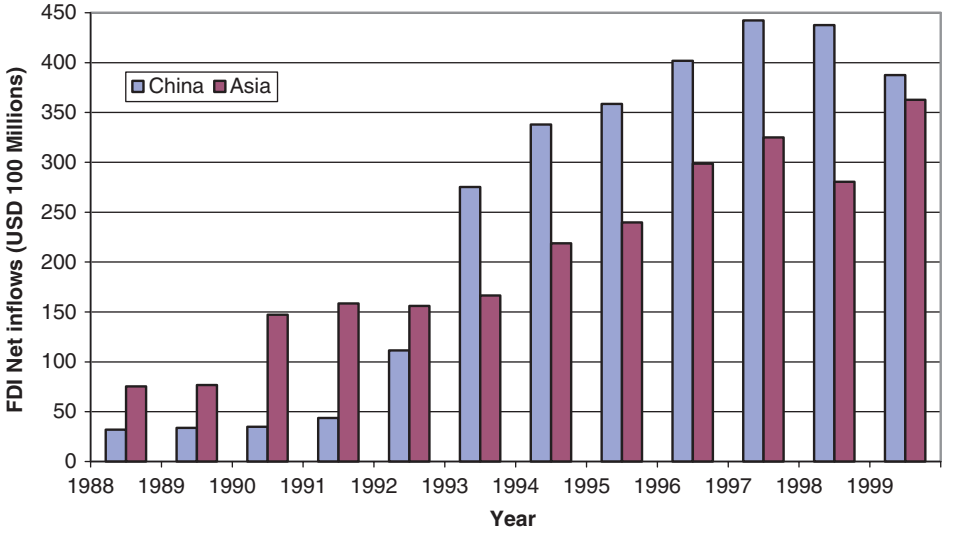

Figure 1. Foreign direct investment net inflows to Asia & China, 1988–1999
Source: World Development Indicators, 2000
Note: Countries included in the Asia category are Cambodia, Indonesia, Japan, South Korea, Lao PDR, Malaysia, Mongolia, Myanmar, Philippines, Singapore, Thailand, and Vietnam.

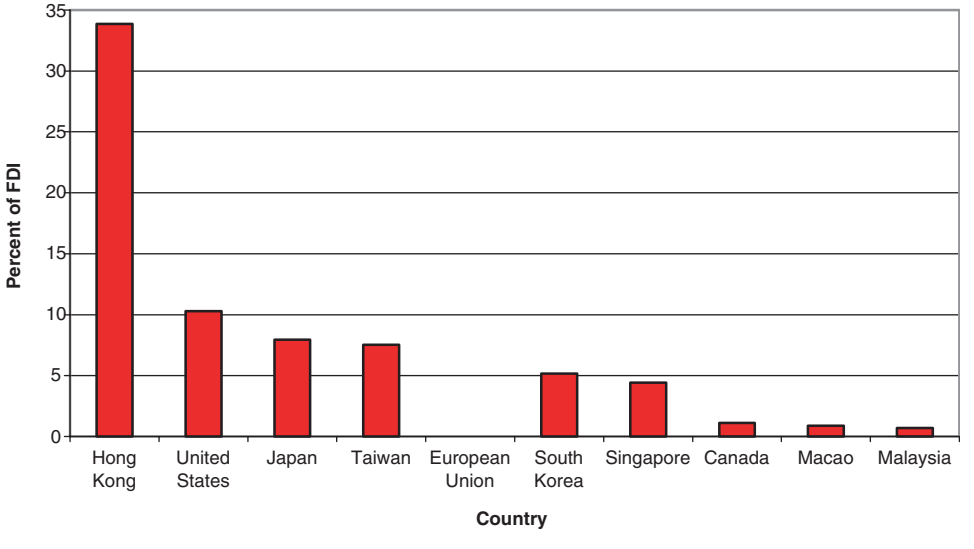

Figure 2. Foreign direct investment in China by countries for 2002
Source: http://www.chinafdi.org.cn/english/O1/f/21/5.htm

increasingly consisted of investments by Western and Japanese multinational firms (Branstetter & Feenstra, 2002). The OECD-based multinational firms differ from the overseas Chinese companies in that they invest in local product development and staff training with modern technology. Therefore, while Hong Kong continues to be

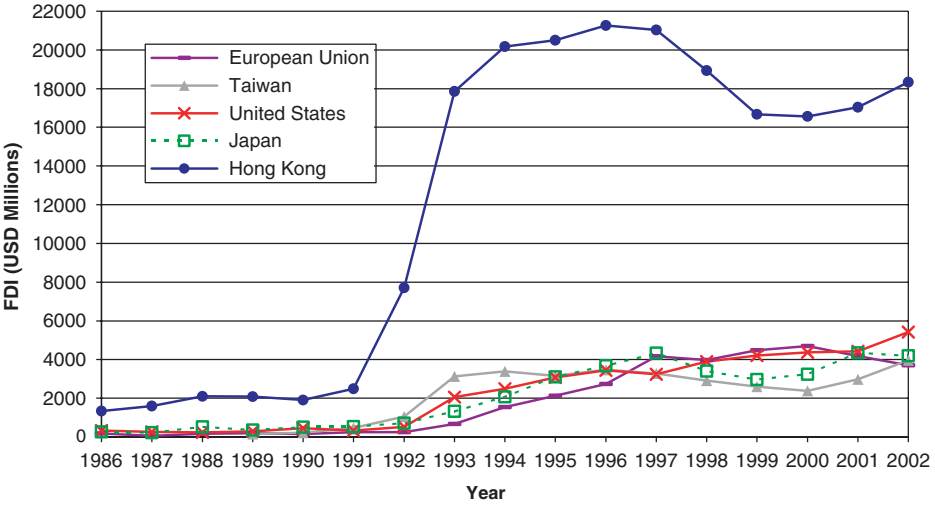

Figure 3. Foreign direct investment in China by countries, 1986–2002
Source: http://www.chinafdi.org.cn/english/O1/f/21/5.htm

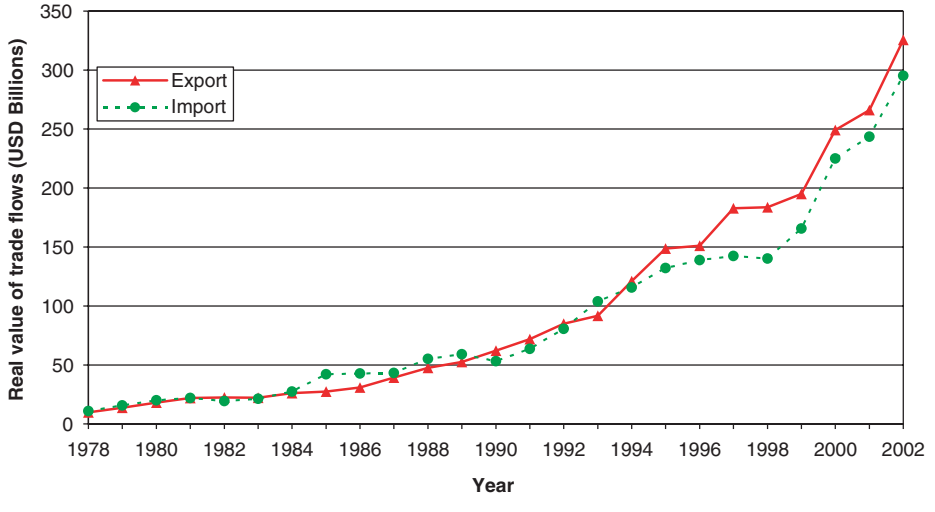

Figure 4. Total value of trade flows, 1978–2002
Source: China Statistical Yearbook, 2003

the largest contributor to the inflow of FDI to China, the composition of the foreign investments is changing.

Largely due to the inflow of FDI, the real GDP has grown at an average rate of 10% annually since 1978. China's real GDP increased in the 1980s and skyrocketed in the 1990s. Similarly, China's trade flow also grew significantly in the 1990s as shown in Figure 4. As China continues to transform itself from a closed economy to an integral part of the global supply chain, research on this dynamic nation will produce insights into international trade.

Literature Review

The impact of FDI spillovers in the host countries has been widely studied.[6] The majority of the literature analyzes whether foreign spillovers positively affect the productivity of domestic firms. While Aitken & Harrison (1999) find negative spillovers from foreign to domestic enterprises using Venezuelan data, Caves (1974), Globerman (1979), Blomstrom & Persson (1983), Liu *et al*. (2000) and Lutz & Talavera (2004), obtain positive spillovers in Australia, Canada, Mexico, the United Kingdom, and Ukraine, respectively. Sgard (2001) finds a positive spillover effect on aggregate TFP growth in Hungary but only with export-oriented FDI. Other studies observe a lack of spillovers from FDI (Konings, 1999, for Bulgaria and Romania, and Kinoshita, 2000, for the Czech Republic).

An emerging body of work is focused on the spillover of foreign-markets knowledge from multinationals to domestic firms. Aitken *et al*. (1997) (henceforth AHH) lead the way in exploring this particular strand of externalities associated with FDI, namely export spillovers. They examine the role of geographic and multinational spillovers on the export decision of local plants in Mexico for the period 1986 to 1990. AHH control for the overall industry concentration in order to focus on spillovers specific to exporting or multinational performance. Arguing that proximity to multinational activity reduces the cost of access to foreign markets, they find evidence of positive effects on the probability of exporting by domestic firms in the same sector and region.

Extending the AHH model, Greenaway *et al*. (2004) also investigate whether spillovers affect the domestic firm's probability of exporting using firm level data for the United Kingdom from 1992 to 1996. By estimating a two-step Heckman selection model, they further examine factors that affect the local firm's export propensity. Their results suggest that externalities pertaining to information on the international market have an impact on the decision of whether or not to export, but not on the export ratio.

Another paper focusing on the spillovers of multinational activity is Barrios *et al*. (2001). Using Spanish data of manufacturing firms from 1990 to 1997, they find no evidence on the probability that domestic firms will export following the export activity of multinationals in a sector. By contrast, other foreign-owned firms benefit from these multinational export spillovers.

In a Cournot model, Lutz *et al*. (2003) test for spillover effects using data of Ukrainian manufacturing firms from 1996 to 2000. Their research does not find strong evidence for regional spillovers of FDI on export, although there is significant evidence for domestic investment. Furthermore, they observe that a domestic firm's performance responds both to industry-wide and region-wide spillover effects as well as to an increase in foreign presence in an industry.

A study which examines the export performance of Chinese firms is that of Zheng *et al*. (2004). The authors empirically analyze the inflow of foreign direct investment and other control variables on two separate dependent variables: provincial exports by all firms and provincial exports excluding those from foreign firms. They find that the impact of FDI on the export performance of all firms is greater than that of indigenous firms.

This paper contributes to the current literature by applying the AHH model to detailed Chinese data to analyze the export decision of domestic firms, taking into account fixed costs associated with supplying the foreign markets. More importantly, this empirical analysis examines the export externalities on firm types by ownership. The hypothesis is that cost reductions relating to foreign access due to multinational activity have a smaller impact on state-owned enterprises (SOEs) than collective-owned enterprises (COEs) and private-owned enterprises (POEs) since the latter two firm types may be more responsive to changes in market conditions given their organizational structure.

The Empirical Model

The framework is given by Aitken *et al.* (1997) and is incorporated to analyze the decision of a local firm type choosing to serve the domestic and/or foreign market.[7] The following empirical equation estimates the probability of exporting by a representative firm type,

$$\Pr(y_k = 1) = \Pr\left[\begin{array}{l} \beta_1 \Gamma_{MNL} + \beta_2 \Gamma_{j\neq k} + \beta_3 \Gamma_{j\neq k\neq l} + \beta_4 Geo + \beta_5 Coastal \\ \quad + \beta_6 FirmSize + \beta_7 RWage + \beta_8 FuelPI + \beta_9 ConPI \\ \quad + \beta_{10} MacPI + \beta_{11} TelPI + \beta_{12} CPI + \upsilon_k > 0 \end{array}\right] \quad (1)$$

where the left-hand side equals 1 if exports by firm type k are positive and 0 otherwise. The multinational export concentration is denoted by Γ_{MNE}. The firm export concentration, Γ_k is indexed by province, year, industry, and firm type where $k =$ SOE, POE, and COE.

Equation (1) will be estimated separately for processing trade (PT) and ordinary trade (OT). The motivation is to capture the dualistic trade regime established in China since the mid 1980s. The processing trade regime allows a great degree of freedom to firms but mainly foreign-invested enterprises (FIEs) may participate, whereas the ordinary trade regime has considerably more restrictions (Naughton, 1996). During the 1990s, China reformed its trade regime by first allowing some domestic participation in processing trade and later combining the two regimes as one. However, the unification of these two trade regimes has not been entirely successful (Naughton, 1999).

Figure 5 shows the real value of exports by firm-type and trade regime for FIEs, SOEs, COEs, and POEs in panels A, B, C, and D, respectively, where the lighter (darker) column denotes processing (ordinary) trade. It is clear from Figure 5, panel A, that FIEs export mainly through PT. In addition, exports by FIEs are increasing under both trade regimes. By contrast, although the level of exports through PT is relatively high and stable for SOEs between 1994 and 2000, state-owned enterprises have more exports in OT.

Panel C of Figure 5 shows that exports by COEs are substantially lower than that by FIEs and SOEs. Moreover, COEs mainly export through ordinary trade. COE exports through PT grew slower than through OT such that PT exports are half of OT in 2004. For POEs, prior to 1998, exports were negligible relative to the other firm types. Although still relatively low, POEs' exports grew in 1999, particularly in OT.

Another explanatory variable, geographic concentration, *Geo*, measures the province-firm-type share of national establishments relative to the province share of national establishments. This measure controls for the effects of general spillovers and exogenous site-specific factors of production that may impact particular firm types. Namely, it accounts for the case in which each firm type benefits from

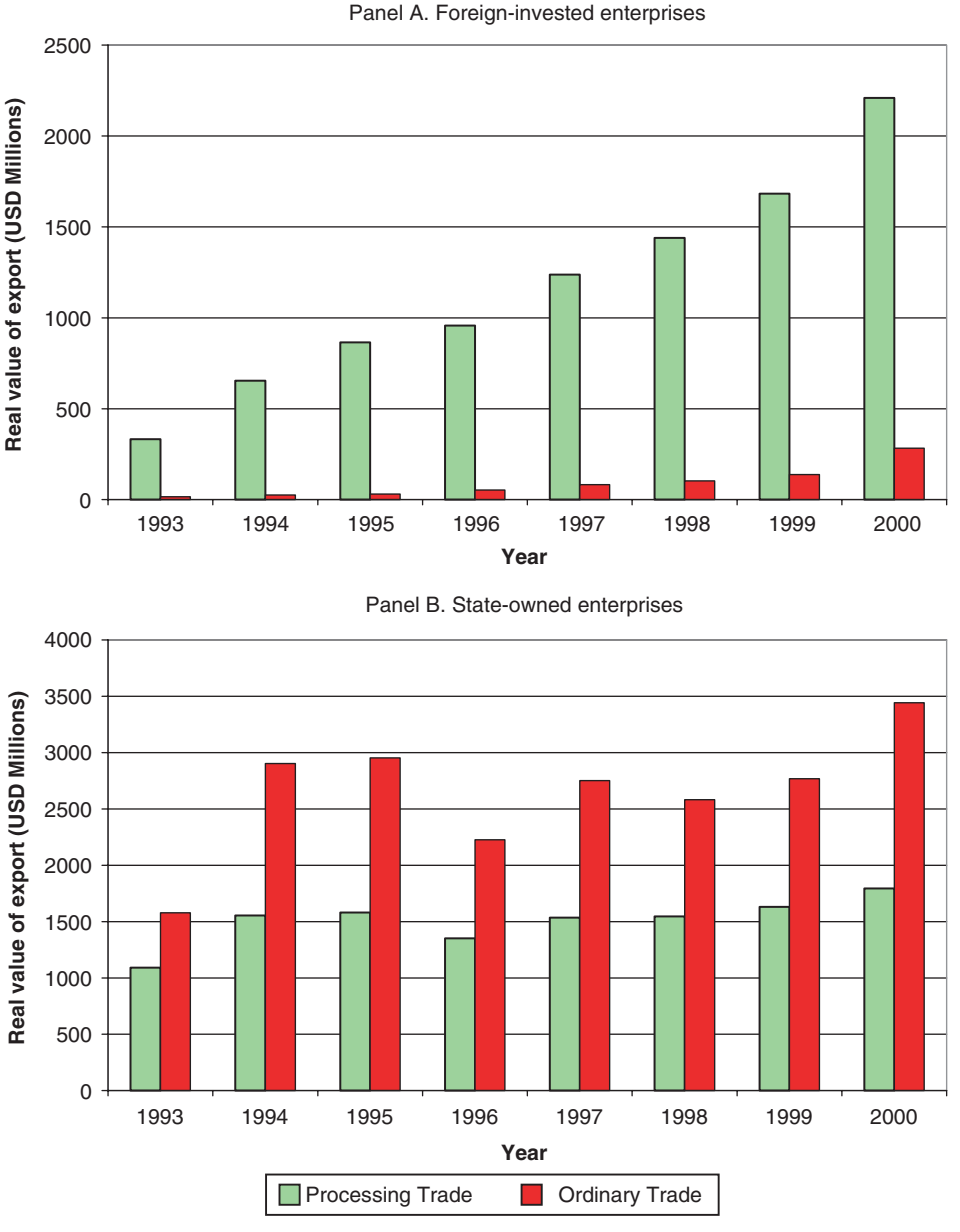

Figure 5. Real value of exports by firm-type and trade regime, 1993–2000

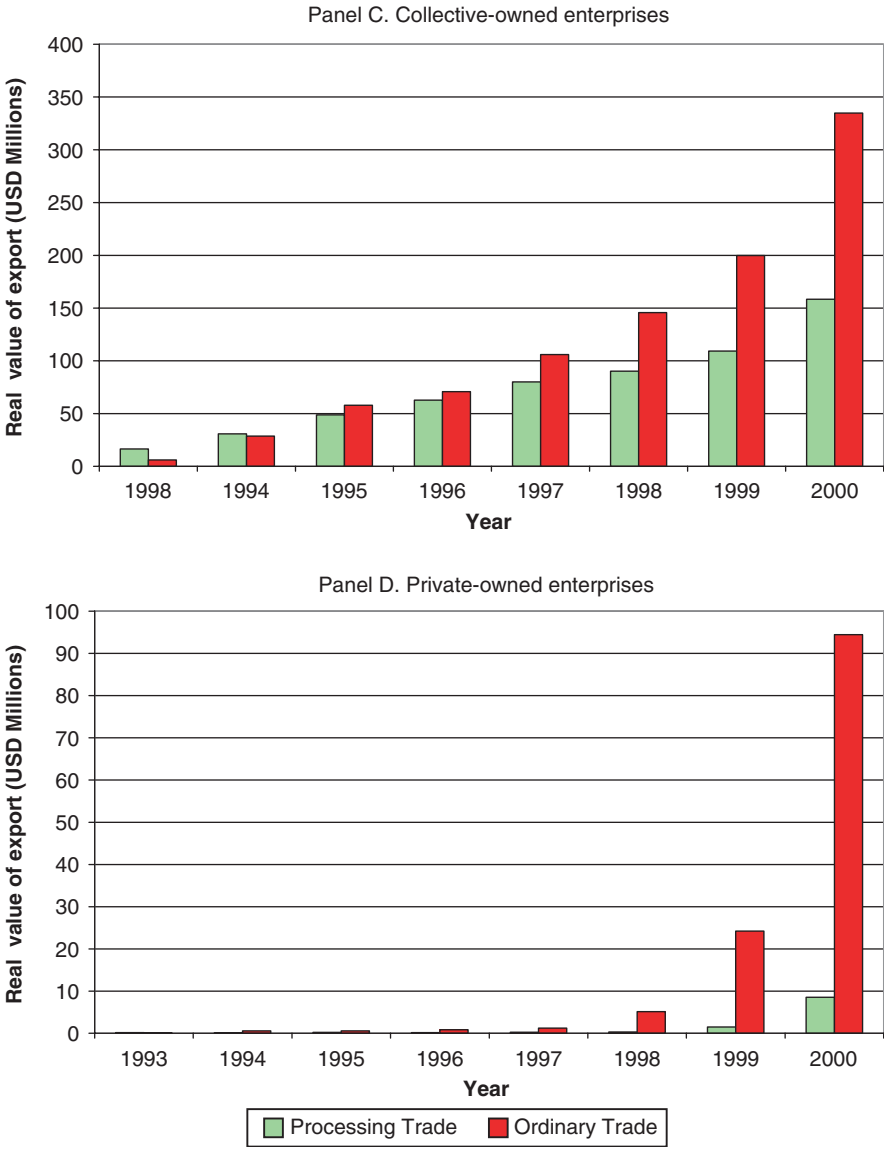

Figure 5. Continued

the proximity to other firm types in the same industry, regardless of market destinations.[8]

To control for the regional differences in export performance in China, the dummy variable *Coastal* (equals one if a province is not located in the interior region) is included. Figure 6 presents the real value of exports by firm-type, trade regime, and region for FIEs, SOEs, COEs, and POEs in panels A, B, C, and D, respectively. Panel A of Figure 6 shows that the majority of FIEs' exports is through PT located in the coastal provinces. For SOEs, while exports occur predominately through OT,

Panel B of Figure 6 indicates that the coastal provinces have an advantage over the inland provinces for SOE exports. Similarly, access to international markets via the coast is also important for COEs, particularly in OT. Likewise, exports by POEs occur mainly through OT in the coastal provinces.

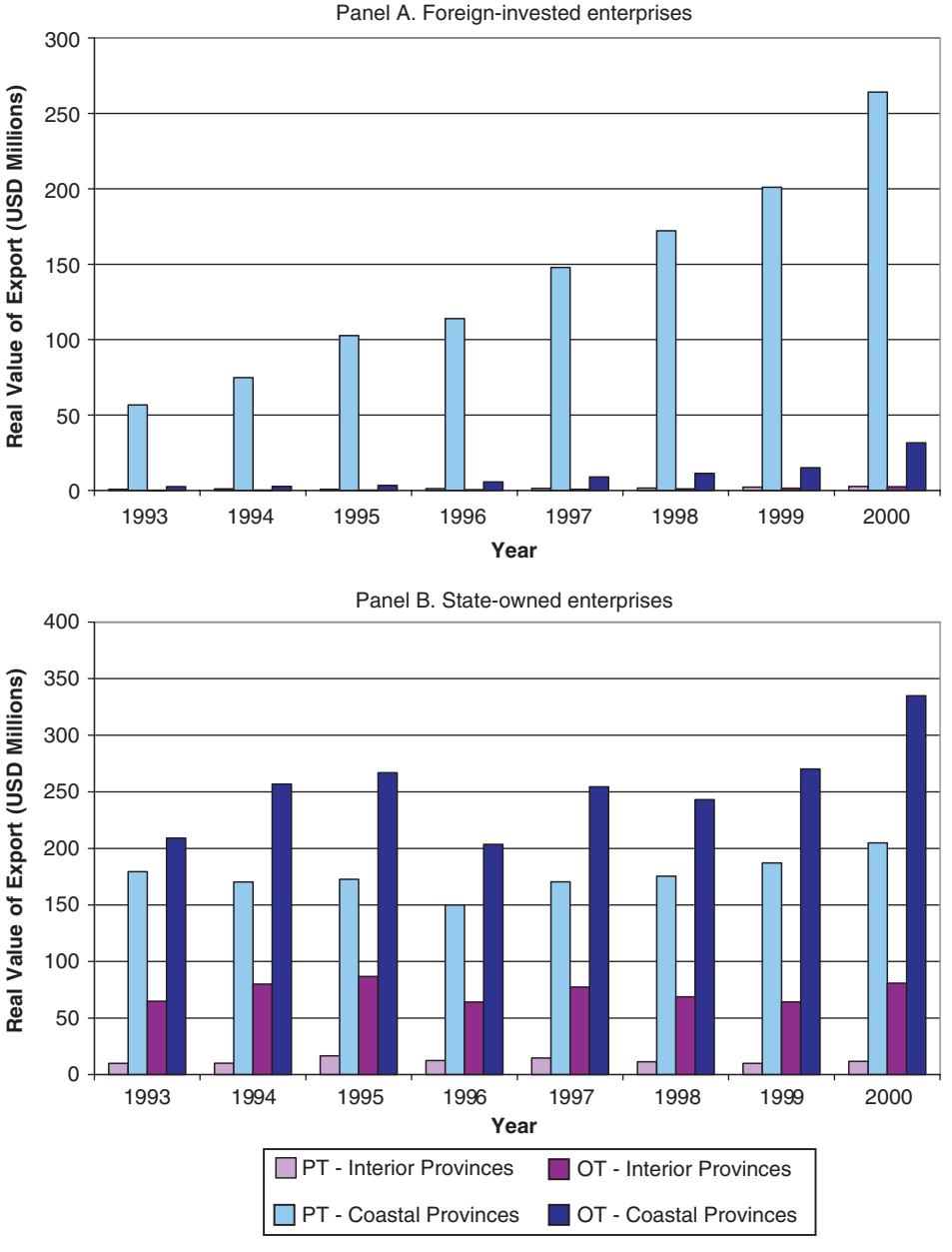

Figure 6. Real value of exports by trade regime and region, 1993–2000

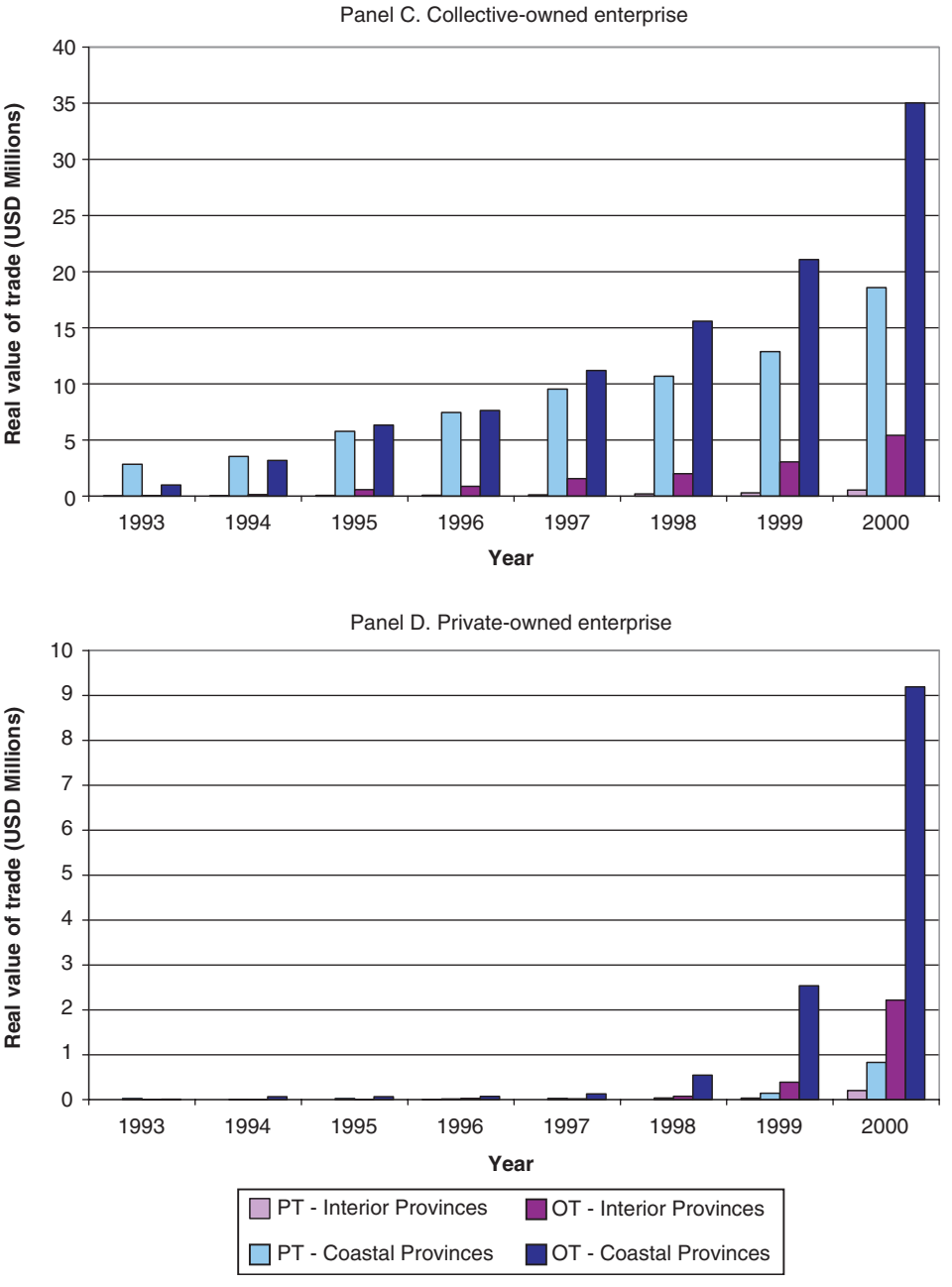

Figure 6. Real value of exports by trade regime and region, 1993–2000

Other explanatory variables include domestic prices given by provincial consumer price indices, *CPI* (indexed at 1992). Non-labor costs are proxied by price indices for construction (*ConPI*), machinery (*MacPI*), fuel (*FuelPI*), and telecommunication (*TelPI*) at the provincial level (indexed at 1992). Labor costs consist of the average

real wage per worker, *RWage* by province and firm type. The province share of employment by firm type relative to the firm type average employment provides a measure for firm size, *FirmSize*. The specification also includes dummy variables for province, industry, and year.

Following AHH, the variables, Γ_k and Γ_{MNE}, are treated as endogenous and are estimated using a two-stage conditional maximum likelihood estimator.[9] The motivation is to address the possibility that the level of local and multinational export concentration may be determined simultaneously with the export decision of individual firm types. In the first stage, OLS is performed on each of the export concentration variables as specified by the following:

$$\Gamma_k = \alpha Y_k + \varepsilon_k \tag{2}$$

$$\Gamma_{MNL} = \alpha Y + \mu \tag{3}$$

where ε_k and μ are normally distributed random errors with mean zero and variances σ_ε^2 and σ_μ^2. Y_k is a vector that includes the independent variables in equation (1).[10]

Moreover, the estimation includes instruments correlated with the corresponding local export activity but uncorrelated with unobserved shocks that affect the export decision of other firm types. Similarly, valid instruments would be correlated with multinational export activity and uncorrelated with local exporting performance. In estimating the OLS regression the level of fixed asset per worker is included by respective firm type. For example, the estimation of γ_k for SOE export concentration includes a measure of investment per worker by state-owned enterprises.[11]

In addition, the value of provincial-industry exports by firm type in processing trade (ordinary trade) is included as a regressor in the estimation for ordinary trade (processing trade).[12] The motivation is that shocks affecting a firm type are likely to impact the export activity of the particular firm type under both trade regimes. The OLS regression of the multinational export concentration includes an additional variable, *Policy*, capturing the degree of preferential treatment available to FIEs by province.

Data

The data set runs from 1993 to 2000 for 29 provinces and three domestic firm types (SOEs, COEs, and POEs) in addition to FIEs.[13] Data on Chinese trade are available through the Customs General Administration of the People's Republic of China, as part of the project described in Feenstra *et al.* (1998). This source contains trade values disaggregated by the type of trade regime (PT and OT). The detailed manufacturing export data is aggregated up to the two-digit SITC level by province according to the type of firm and trade regime.

Another data source is the *China Statistical Yearbook*, which provides data on the number of establishments, number of employees, industrial output, and investment in fixed assets by firm type. This source also provides data on construction, machinery, fuel, telecommunication, consumer, and retail price indices. The preferential policy index, obtained from Demurger *et al.* (2002) is based on the

number of designated open economic zones in a province and the extent of the preferential treatment available to foreign firms.[14]

The composition of the manufacturing sector as well as the wage rates is taken from the *China Labour Statistical Yearbook*. Total wage rates are only available for SOEs, COEs, and FIEs. Wages for POEs are constructed as a weighted average of the rural household income per capita and the urban household income per capita, where the weights are given by the number of employees in private-owned enterprises in the rural and urban regions.

Empirical Results

This section estimates the probability a firm type exports given the local export concentration of other firm types and the export activity of multinationals in the same province and industry. In the first part of the empirical analysis, 'multinational firms' refers to all foreign-invested enterprises, namely both overseas Chinese companies (mainly Hong Kong-, Macao-, and Taiwan-based) and other foreign-funded enterprises (FFEs) of non-Chinese affiliations. In the second part, multinational export spillovers will be estimated separately for overseas Chinese companies (OCC) and OECD-based FFEs (OECD) as part of the robustness checks.

To begin with, the concentration of local export activity is measured as the province-industry-firm-type share of national industry exports normalized by the province share of national manufacturing exports. This measure of local export concentration controls for the case where a firm type may have high exports by province-industry because of agglomeration or preferential policies.

The multinational export activity, Γ_{MNE} is defined by the share of province-industry multinational exports in national industry exports relative to the province share of national manufacturing exports. The existence of multinational spillovers would imply an increase in the probability that a firm type would engage in foreign market export due to a higher concentration of MNE export activity.

Standard Probit Results

The results of the empirical estimation using the standard Probit techniques are available in Table 1 for OT in columns 1 to 3 and PT in columns 4 to 6. The findings indicate positive and significant multinational-export spillovers to COEs and POEs but negative externalities to SOEs for both ordinary and processing trade. Therefore, a higher level of multinational export activity is correlated to a higher probability of export by private-owned and collective-owned enterprises.[15] The negative localized spillovers from multinational firms to state-owned enterprises may be due to greater competition, which causes the less efficient SOEs to decrease export activities.[16] In addition, the impact of MNE export activity is larger for OT relative to PT. This result may be driven by higher domestic participation in ordinary trade due to previous policies of requiring local firms to operate under this government-controlled regime.

The local export concentration of SOEs has a positive and statistically significant influence on the probability of exporting by COEs and POEs. Moreover, the

Table 1. Probit specification for decision to export

	Ordinary trade			Processing trade		
	SOE	COE	POE	SOE	COE	POE
	(1)	(2)	(3)	(4)	(5)	(6)
MNE Export Activity	−0.018	0.021	0.024	−0.002	0.006	0.008
	[0.007]***	[0.004]***	[0.005]***	[0.001]	[0.002]***	[0.004]**
SOE Export Concentration		0.047	0.063		0.006	0.008
		[0.004]***	[0.010]***		[0.001]***	[0.002]***
COE Export Concentration	−0.010		0.007	0.004		0.009
	[0.006]*		[0.004]**	[0.003]		[0.003]***
POE Export Concentration		0.002		0.001	0.001	
		[0.002]		[0.001]	[0.001]	
Geographic Concentration	−0.231	−0.071	22.856	−0.106	−0.094	29.113
	[0.271]	[0.041]*	[5.673]***	[0.068]	[0.049]**	[12.653]**
Coastal	−4.116	1.500	2.558	1.862	2.246	2.313
	[8.198]	[0.296]***	[0.439]***	[0.600]***	[0.456]***	[0.930]***
Firm Size	−3.090	0.055	−0.109	0.102	−0.014	0.242
	[4.720]	[0.141]	[0.099]	[0.547]	[0.176]	[0.140]*
Real Wage	0.024	−0.029	0.020	0.008	−0.007	0.071
	[0.055]	[0.010]***	[0.029]	[0.008]	[0.011]	[0.047]
Fuel Price Index	−0.029	0.003	−0.008	0.002	0.004	−0.009
	[0.012]***	[0.002]*	[0.002]***	[0.002]	[0.002]**	[0.004]**
Construction Price Index	0.021	−0.002	−0.019	−0.001	0.008	0.015
	[0.026]	[0.003]	[0.004]***	[0.004]	[0.004]*	[0.008]**
Machinery Price Index	0.057	−0.009	0.041	−0.004	−0.0002	0.064
	[0.044]	[0.008]	[0.013]***	[0.010]	[0.012]	[0.025]***
Telecom Price Index	0.002	−0.003	−0.004	0.0002	−0.001	0.0002
	[0.012]	[0.001]**	[0.002]**	[0.002]	[0.002]	[0.004]
Consumer Price Index	−0.018	−0.004	−0.001	0.002	−0.018	−0.022
	[0.028]	[0.005]	[0.007]	[0.006]	[0.007]***	[0.013]
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Province Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Industry Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observation	1436	9538	8911	6455	6244	4941
Log likelihood	−115.23	−2901.10	−1824.01	−1835.85	−1721.90	−580.01

Notes: Standard errors in brackets.
* significant at 10%, ** significant at 5%, *** significant at 1%.

magnitude of the coefficients *SOE export concentration* is larger than that on *MNE export activity* for ordinary trade. These positive findings may capture particular province-industries in which the SOEs have a comparative advantage. Again, the spillover is larger in OT relative to PT. This finding is consistent with the separation in firm-type activities between the two trade regimes.

The impact of COEs export concentration is positive and significant on POEs for both PT and OT. By contrast, a higher concentration of COEs export is associated with a lower probability of exporting by SOEs in OT at the 10% level but a statistically insignificant impact on SOEs in PT. The results also indicate that POEs' export concentration is insignificant in PT for both SOEs and COEs and in OT for COEs.[17]

The general lack of statistical significance on the geographic concentration variable for SOEs in both ordinary and processing trade suggests that higher overall economic activity does not lead to a greater probability of exporting by state-owned firms.

By contrast, the overall economic activity has a positive and statistically significant impact on the probability of exporting by POEs. The impact of the overall economic activity is statistically negative on COEs.

The coefficient on the variable capturing the coastal provinces is positive and statistically significant for all firm types in both trade regimes, with the exception of SOEs in OT. Therefore, having easy access to the international market is an important factor influencing the probability that a firm type engages in exports. By contrast, the results suggest that the size of the firm does not have an impact on the export activity of the domestic firms, except for POEs in PT. Therefore, unlike the findings AHH obtained for firm size using Mexican data, the results of this paper indicate the lack of a significant relationship between the probability of exporting and firm size using Chinese data.

According to AHH, wage rates reflect the level of human capital. Namely, the higher the wage rates, the higher the skill-level embodied in the activity. Contrary to AHH, the results using Chinese data show that an increase in the wage does not lead to a higher probability of exporting by the three firm types. This may be because the share of in-country value added is low in China where labor is the main input (Naughton, 1996). Surprisingly, an increase in the wage rates leads to a lower probability of exporting by COEs in OT. Results on the input prices are difficult to interpret given that the estimation follows a reduced form and affects production for both domestic and foreign markets (Aitken *et al.*, 1997).

Two-stage Probit Results

To address the issue of simultaneity between Γ_k and Γ_{MNL}, equation (1) is estimated in the second stage with the inclusion of the residuals from the regression of the first stage as independent variables. Zero coefficient values on the OLS residuals in the Probit equation would suggest exogeneity under the null hypothesis.

The results of the conditional likelihood ratio test (Rivers & Vuong, 1988) find evidence to reject the null at the 1% level for COEs' estimations under both trade regimes and POEs in ordinary trade. For the SOEs' estimation, there is not enough evidence to reject the null hypothesis for both processing and ordinary trade and POEs for processing trade.

Table 2 shows the results of the two-stage Probit where the residuals from the first-stage OLS regression are included as *ResidSOE*, *ResidCOE*, *ResidPOE*, and *ResidMNE*.[18] Unlike the results of the standard Probit estimation, higher concentration of multinational activity does not generate a higher probability of exporting by COEs and POEs in both trade regimes. More specifically, *MNE export activity* has a positive influence on the export activity of POEs only in OT and COEs only in PT. In addition, the coefficients on *MNE export activity* in the SOEs equations are now positive and insignificant in both trade regimes. Consistent with AHH, the coefficient estimates on *MNE export activity* are noticeably larger in the two-stage, relative to the standard, Probit estimation. However, the results suggest that export spillovers from MNEs are limited. The general lack of significant

Table 2. Two-stage Probit specification for decision to export

	Ordinary trade			Processing trade		
	SOE	COE	POE	SOE	COE	POE
	(1)	(2)	(3)	(4)	(5)	(6)
MNE Export Activity	0.250	−0.099	0.533	0.019	0.140	0.031
	[1.108]	[0.185]	[0.215]***	[0.055]	[0.054]***	[0.080]
SOE Export Concentration		0.733	0.122		0.236	0.036
		[0.292]***	[0.172]		[0.031]***	[0.024]
COE Export Concentration	0.068		0.177	0.103		−0.026
	[0.361]		[0.091]**	[0.048]**		[0.069]
POE Export Concentration		0.106		0.028	−0.018	
		[0.072]		[0.026]	[0.011]	
ResidMNE	−0.268	0.121	−0.510	−0.021	−0.135	−0.023
	[1.109]	[0.185]	[0.215]**	[0.055]	[0.054]***	[0.081]
ResidSOE		−0.687	−0.060		−0.231	−0.029
		[0.293]***	[0.172]		[0.031]***	[0.024]
ResidCOE	−0.078		−0.170	−0.099		0.034
	[0.350]		[0.091]**	[0.048]**		[0.069]
ResidPOE	0.357	−0.104		−0.027	0.018	
	[0.639]	[0.072]		[0.026]	[0.011]	
Geographic Concentration	−0.285	−0.052	24.029	−0.130	−0.158	27.162
	[0.321]	[0.044]	[5.894]***	[0.070]**	[0.050]***	[13.363]**
Coastal	−4.261	1.768	2.374	2.750	5.781	3.287
	[9.412]	[1.183]	[0.479]***	[1.094]***	[0.722]***	[1.285]***
Firm Size	−3.168	0.076	−0.116	−0.213	0.039	0.240
	[4.935]	[0.142]	[0.104]	[0.578]	[0.175]	[0.145]*
Real Wage	0.034	−0.025	0.020	0.022	0.016	0.071
	[0.067]	[0.010]***	[0.034]	[0.011]**	[0.012]	[0.048]
Fuel Price Index	−0.031	0.001	−0.008	0.002	0.007	−0.009
	[0.015]**	[0.002]***	[0.003]***	[0.003]	[0.002]***	[0.004]**
Construction Price Index	0.008	0.006	−0.012	−0.004	0.013	0.015
	[0.047]	[0.005]	[0.006]**	[0.004]	[0.005]***	[0.008]**
Machinery Price Index	0.063	−0.013	0.030	−0.003	−0.073	0.049
	[0.049]	[0.009]	[0.013]***	[0.014]	[0.016]***	[0.030]
Telecom Price Index	0.002	−0.003	−0.004	−0.003	0.0002	0.001
	[0.013]	[0.002]*	[0.002]**	[0.002]	[0.002]	[0.004]
Consumer Price Index	0.015	−0.014	−0.005	0.007	−0.051	−0.025
	[0.069]	[0.008]	[0.008]	[0.008]	[0.008]***	[0.014]*
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Province Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Industry Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observation	1436	9538	8911	6455	6244	4941
Log likelihood	−115.00	−2897.09	−1816.73	−1833.09	−1690.22	−579.00

Notes: Standard errors in brackets.
* significant at 10%, ** significant at 5%, *** significant at 1%.

spillovers generated from the FIEs on the domestic firms coincides with the findings of Zheng *et al*. (2004).

Moreover, the results imply the SOEs' export activity has a larger impact on the probability of exports by COEs than the export activity of MNEs. In this

Table 3. Estimates of economic impact

	Ordinary trade		Processing trade	
	At mean (1)	Marginal effect of MNE (2)	At mean (3)	Marginal effect of MNE (4)
SOEs	0.996	–	0.947	–
COEs	0.245	–	0.100	0.025
POEs	0.022	0.028	0.004	–

Notes: – insignificant.

two-stage estimation, the coefficients on SOEs' export concentration in the POEs' estimation for both OT and PT are insignificant. The findings also indicate that locating in the proximity of COEs increases the probability of exporting by POEs in OT and SOEs in PT, while there are no spillovers from operating near POEs. In addition, the results also suggest that coastal access has a significant impact on the export activity of the three firm types but mostly in PT.

To interpret the economic significance of the findings, the change in the probability of exporting resulting from the marginal increase in the independent variables is calculated. The predicted probabilities of exporting, at the mean of the independent variables and the marginal effect of MNE export activity, are presented in Table 3. The estimates suggest that SOEs are active exporters relative to the other firm types irrespective of any export spillovers. These results are supported by the fact that the share of SOEs in national exports is 70% in 1994. Therefore, it is not surprising that the marginal effect of MNE export activity on SOEs is insignificant. By contrast, the marginal effect of MNE export activity is significant but only on POEs in OT and COEs in PT.

To focus purely on multinational spillovers, I re-estimate the two-stage Probit estimation with only MNE export activity. The results in Table 4 are relatively similar to those in the original two-stage regression. It is noteworthy that the significant *MNE export activity* on POEs in OT and COEs in PT is now slightly larger.

Two-stage Probit Results for OCC and OECD-based FFEs

In this section, the estimation of the two-stage Probit will separately identify the export activity of FIEs as overseas Chinese companies (OCC) and OECD-based foreign-funded enterprises (OECD) using the destination of sales. The motivation stems from the important role played by the OCC, particularly Hong Kong, as middlemen in China's export performance (Feenstra & Hanson, 2004; Wan & Weisman, 1999; Sung, 1991). As noted by Feenstra & Hanson (2004), China shipped 53% of its exports through Hong Kong from 1988 to 1998.

Hong Kong is the main provider of foreign market information as well as trade and transport services to China. In addition, this city-state serves as a significant source of capital and foreign exchange to domestic Chinese firms (Sung, 1991). Moreover, due to its cultural ties and proximity to the southern coastal province of Guangdong, Hong Kong is likely to generate greater export spillovers to local firms relative to FFEs that are non-Chinese in affiliation.[19]

Table 4. Two-stage Probit specification for decision to export with MNE only

	Ordinary trade			Processing trade		
	SOE	COE	POE	SOE	COE	POE
	(1)	(2)	(3)	(4)	(5)	(6)
MNE Export Activity	0.318	0.080	0.651	0.015	0.167	0.094
	[1.049]	[0.171]	[0.180]***	[0.054]	[0.052]***	[0.073]
ResidMNE	−0.335	−0.056	−0.623	−0.017	−0.162	−0.087
	[1.050]	[0.172]	[0.180]***	[0.054]	[0.052]***	[0.073]
Geographic Concentration	−0.244	−0.069	21.567	−0.108	−0.095	26.501
	[0.278]	[0.041]*	[5.509]***	[0.068]	[0.049]**	[12.364]**
Coastal	−6.286	3.660	4.190	1.861	0.746	1.583
	[8.485]	[1.042]***	[0.508]***	[0.600]***	[0.630]	[0.692]**
Firm Size	−3.704	0.033	−0.053	0.109	−0.024	0.234
	[4.812]	[0.140]	[0.099]	[0.546]	[0.175]	[0.138]*
Real Wage	0.011	−0.031	−0.017	0.007	−0.012	0.058
	[0.059]	[0.010]***	[0.029]	[0.008]	[0.011]	[0.046]
Fuel Price Index	−0.027	0.003	−0.006	0.002	0.004	−0.009
	[0.013]**	[0.002]*	[0.002]***	[0.002]	[0.002]**	[0.004]**
Construction Price Index	0.025	−0.001	−0.019	−0.001	0.009	0.015
	[0.025]	[0.003]	[0.004]***	[0.004]	[0.004]**	[0.008]**
Machinery Price Index	0.048	−0.009	0.029	−0.005	−0.019	0.047
	[0.046]	[0.009]	[0.013]**	[0.012]	[0.014]	[0.026]*
Telecom Price Index	0.002	−0.003	−0.005	0.0001	−0.002	0.0002
	[0.012]	[0.001]**	[0.002]**	[0.002]	[0.002]	[0.004]
Consumer Price Index	−0.019	−0.003	0.001	0.002	−0.017	−0.018
	[0.027]	[0.005]	[0.007]	[0.006]	[0.007]***	[0.013]
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Province Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Industry Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observation	1503	9538	8911	6455	6244	4941
Log likelihood	−117.54	−2946.70	−1838.92	−1837.06	−1723.52	−593.22

Notes: Standard errors in brackets.
* significant at 10%, ** significant at 5%, *** significant at 1%.

Furthermore, isolating Hong Kong from the export activity associated with FFEs helps to address the issue of 'round-tripping'. The true activities of the FIEs are likely overstated as some Chinese firms take advantage of preferential treatments available to FIEs by setting up subsidiaries in Hong Kong. Feenstra & Hanson (2004) note that this illicit activity creates an artificial correlation between FIEs' activity and trade through Hong Kong.

Considering only OECD countries, instead of all other non-Chinese enterprises, should increase the influence of multinational export activity on the domestic exporting decision.[20] The rationale is that multinational firms are mainly headquartered in industrialized countries, where technological advancement originates. Moreover, excluding the non-OECD countries further captures the foreign export activity by eliminating export destinations where China serves as an export platform.

Figure 7 shows the real value of exports by OCC and OECD-based FFEs by region. Corresponding to the earlier graphs, OCC and OECD-based FFEs export

mainly from the coastal provinces. The figure also indicates that while exports by OCC are larger than those of OECD-based FFEs between 1993 to 2000, exports by the latter are increasing relative to the former.

For a further insight of the export activity by the FIEs, Figure 8 presents the real value of exports by OCC and OECD-based FFEs in the coastal region by

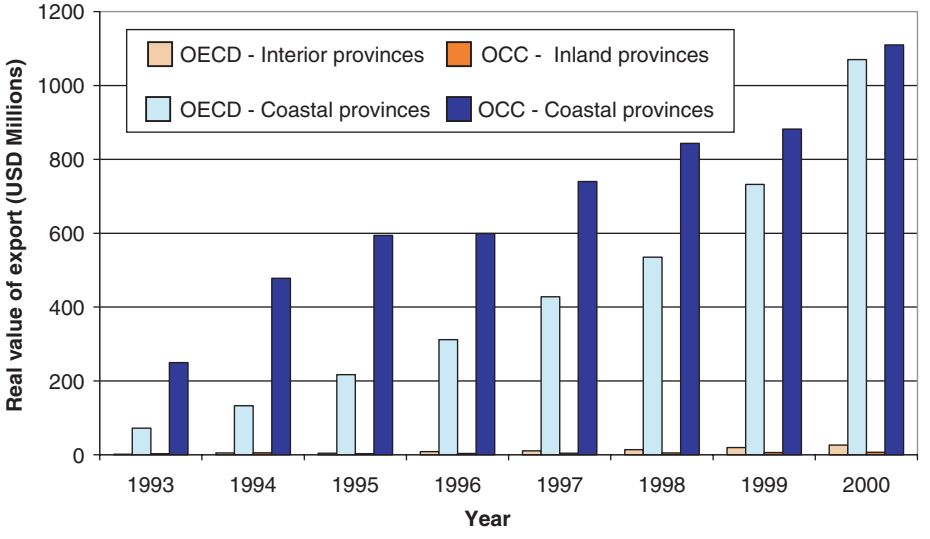

Figure 7. Real value of exports by region for OCC and OECD-based FFEs, 1993–2000

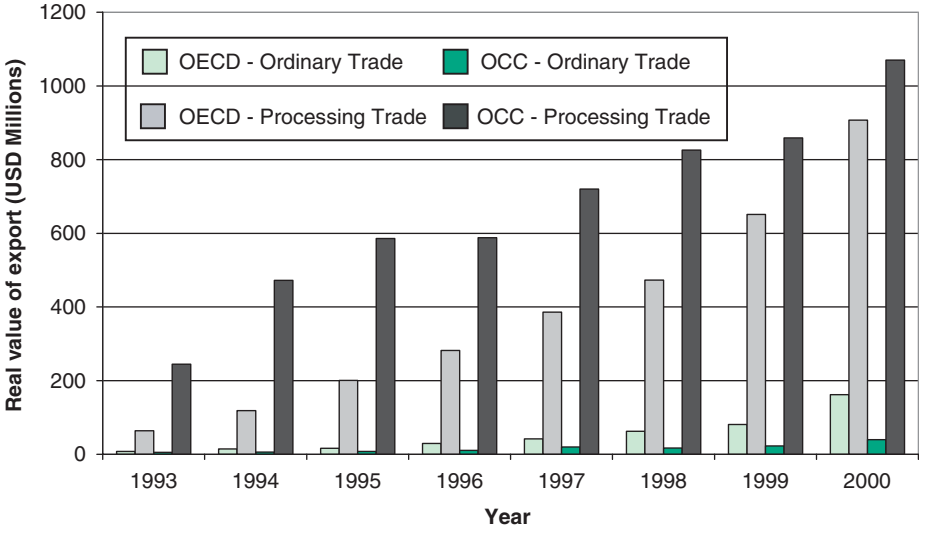

Figure 8. Real value of exports in coastal provinces by trade regime for OCC and OECD-based FFE, 1993–2000

trade regime. The figure indicates that while the coastal area is important for exporting, the FIEs mainly operate through PT. Once again, the figure shows that exports by OECD-based FFEs are increasing relative to OCC, although the absolute value of export by the latter remains higher.

Table 5 shows the result of the two-stage Probit with the separate inclusion of OCC and OECD-based FFE export activity. The results of the local export concentration in this extension are similar to those in the benchmark two-stage Probit. For brevity, the findings on these local export spillovers will not be discussed.

The most noticeable difference between these results and those of the benchmark two-stage Probit is that the coefficients on *OCC export activity* are mostly insignificant with the exception of POEs in OT at the 10% level. These results suggest that while Hong Kong may act as a middleman in the export of firms in China, these overseas Chinese companies do not provide the domestic firms with any positive export spillovers from their involvement.

Spillovers stemming from OCED-based FFE have a significant impact on the probability of exporting by POEs in OT and SOEs and COEs in PT. The significance of OECD-based FFE export activity in PT for SOEs and COEs is consistent with the higher participation of OECD-based foreign-funded enterprises in processing trade relative to ordinary trade, in addition to greater firm-specific assets and technological advancement characterized by these multinational firms.

The findings of this two-stage Probit with the inclusion of OCC and OECD-based FFEs' export activity suggest that overseas Chinese companies do not provide positive spillovers on exporting by domestic firms. However, local firms in the proximity of OECD-based multinational firms do increase their probability of participating in the global market under processing trade for SOEs and COEs and ordinary trade for POEs. More importantly, the results of the OECD export activity give some evidence to support the hypothesis that firm-specific assets unique to multinational firms are an essential source of export spillovers. Namely, spillovers generated from OECD-based multinational firms have a positive impact on the exporting activities of local-owned firms, particularly in processing trade.

Summary and Conclusion

This paper examines whether multinational firms act as 'catalysts' for domestic firms by reducing the cost of foreign market access through export spillovers. Using detailed Chinese data to identify the three local firm types (state-owned enterprises, collective-owned enterprises, and private-owned enterprises), the results of the two-stage Probit estimation suggest that the probability a domestic-firm-type exports is positively correlated with the proximity to multinational firms.

As a robustness check, the two-stage Probit is re-estimated with the inclusion of separate export activity concentration measures for overseas Chinese companies and OECD-based foreign-funded enterprises. The separation accounts for the important role played by the OCC, particularly Hong Kong, as middlemen in China's export performance in addition to addressing the 'round-tripping' of funds by domestic firms through the city-state to take advantage of

Table 5. Two-stage Probit specification for decision to export with OCC and OCED-based FFE

	Ordinary trade			Processing trade		
	SOE	COE	POE	SOE	COE	POE
	(1)	(2)	(3)	(4)	(5)	(6)
OCC Export Activity	−0.156	0.082	0.388	0.241	0.050	−0.138
	[0.997]	[0.191]	[0.214]*	[0.189]	[0.159]	[0.135]
OECD Export Activity	0.510	−0.014	0.435	0.748	0.218	0.111
	[1.610]	[0.186]	[0.149]***	[0.339]**	[0.120]**	[0.099]
SOE Export Concentration		0.617	0.154		0.336	0.062
		[0.260]***	[0.169]		[0.044]***	[0.036]*
COE Export Concentration	0.065		0.255	0.126		−0.037
	[0.369]		[0.097]***	[0.062]**		[0.092]
POE Export Concentration		0.106		0.042	−0.029	
		[0.070]		[0.041]	[0.017]*	
ResidOCC	0.122	−0.074	−0.391	−0.243	−0.045	0.138
	[0.997]	[0.191]	[0.214]*	[0.189]	[0.159]	[0.135]
ResidOECD	−0.514	0.024	−0.420	−0.747	−0.218	−0.102
	[1.610]	[0.186]	[0.149]***	[0.339]**	[0.120]**	[0.099]
ResidSOE		−0.572	−0.090		−0.329	−0.049
		[0.260]**	[0.169]		[0.044]***	[0.036]
ResidCOE	−0.074		−0.248	−0.123		0.48
	[0.369]		[0.097]***	[0.062]**		[0.092]
ResidPOE	0.347	−0.104		−0.042	0.029	
	[0.614]	[0.070]		[0.041]	[0.017]*	
Geographic Concentration	−0.334	−0.060	28.298	−0.123	−0.150	29.425
	[0.337]	[0.044]	[6.177]***	[0.069]*	[0.050]***	[13.781]**
Coastal	−8.069	3.978	5.198	−5.985	3.977	0.842
	[13.236]	[1.333]***	[0.712]***	[2.575]***	[1.555]***	[0.814]
Firm Size	−4.728	0.089	−0.091	−0.180	0.046	0.208
	[4.998]	[0.143]	[0.105]	[0.589]	[0.176]	[0.150]
Real Wage	0.038	−0.030	0.008	0.008	0.008	0.085
	[0.068]	[0.010]***	[0.033]	[0.011]	[0.012]	[0.049]*
Fuel Price Index	−0.025	0.001	−0.008	0.010	0.009	−0.007
	[0.020]	[0.003]	[0.003]***	[0.005]**	[0.003]***	[0.004]*
Construction Price Index	0.013	0.006	0.011	0,024	0.010	0.020
	[0.047]	[0.006]	[0.006]**	[0.010]***	[0.008]	[0.010]**
Machinery Price Index	0.064	−0.016	0.022	−0.007	−0.050	0.057
	[0.064]	[0.010]	[0.013]*	[0.017]	[0.016]***	[0.028]**
Telecom Price Index	0.001	−0.003	−0.004	−0.011	−0.001	−0.001
	[0.017]	[0.002]	[0.002]**	[0.005]***	[0.002]	[0.004]
Consumer Price Index	0.014	−0.012	−0.004	0.025	−0.047	−0.028
	[0.071]	[0.008]	[0.008]	[0.011]***	[0.009]***	[0.015]**
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Province Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Industry Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observation	1436	9538	8911	6455	6244	4941
Log likelihood	−115.10	−2902.07	−1814.72	−1828.74	−1690.21	−577.71

Notes: Standard errors in brackets.
* significant at 10%, ** significant at 5%, *** significant at 1%.

Table 6. Estimates of economic impact with OCC and OECD-based FFE

	Ordinary trade			Processing trade		
	At mean	Marginal effect of OCC	Marginal effect of OECD	At mean	Marginal effect of OCC	Marginal effect of OECD
	(1)	(2)	(3)	(4)	(5)	(6)
SOEs	0.996	–	–	0.950	–	0.077
COEs	0.246	–	–	0.101	–	0.039
POEs	0.022	0.020	0.023	0.004	–	–

Notes: – insignificant.

preferential tax treatment. Even accounting for the preferential location of the coastal region, the results indicate that increases in the concentration of multinational export activity positively influence the domestic exporting decision of SOEs and COEs in processing trade and POEs in ordinary trade. The benefit of this subcategorization of foreign-invested enterprises is that multinational firms are mainly headquartered in industrialized countries. Since multinationals are characterized by firm-specific assets that may impact the productivity and export behavior of domestic firms, this methodology clearly identifies the spillovers exclusive to MNE export activity.

Overall, the results imply that OECD-based foreign-funded enterprises provide information for domestic firms deciding whether to participate in the international market. Moreover, the influence of multinational export activity is statistically different from zero for state-owned enterprises in processing trade. These findings suggest that government firms are not less responsive to market conditions than other domestic enterprises. However, the results also suggest that collective-owned enterprises benefit more from producing in the proximity of state-owned enterprises. This finding may be due to the informal network between the two domestic firm types.

In general, the results suggest that governments may maximize the benefit from their efforts to attract foreign direct investment by creating environments in which domestic firms contemplating whether to participate in exporting are able to locate nearby OECD-based multinational firms. These policies include preferential treatment or tax holidays, improvements in infrastructure, and increase in the domestic human capital.

Acknowledgements

This paper is part of the author's dissertation requirement at the University of California, Davis. The author is grateful to Robert C. Feenstra, Deborah L. Swenson and Giovanni Peri for guidance, and would like to thank an anonymous referee and seminar participants at the University of California, Davis for helpful valuable comments.

Notes

[1] Motorola trained local engineers in its factory in China, while BMW and DaimlerChrysler transfer know-how to their local suppliers involved in their car production in South Africa (*The Economist*, 2001).
[2] In Costa Rica, for example, Intel was given a bundle of tax concessions to build a factory (*The Economist*, 2001).
[3] Cheung & Lin (2004: 1) find that FDI does 'benefit innovation activity in the host country via spillover channels such as reverse engineering, skilled labor turnovers, demonstration effects, and supplier-customer relationships.'
[4] It is widely noted that, unlike non-state-owned firms, SOEs have access to soft budgets, operate with excess workers and outdated technology, and are poorly managed (Qian & Xu, 1993; Sachs & Woo, 2001; US Department of State, 2001).
[5] *World Investment Report* (2003).
[6] See Blomström & Kokko (1998) for a survey.
[7] Refer to Aitken *et al*. (1997) for more information.
[8] AHH argue that Γ_{MNE} captures positive spillovers on exports as long as the effects outweigh the potential positive impact on domestic sales.
[9] See Rivers & Vuong (1988) for more information regarding the estimator.
[10] AHH notes that estimating only local-owned firms in the empirical analysis further controls for the issue concerning the endogeneity of MNE activity.
[11] The correlation of the investment per worker between the different firm types is less than 0.30, except for SOEs and COEs, which is 0.67.
[12] The highest correlation between the values of provincial-industry exports by firm type across the dual trade regimes is between PT for COEs and OT for SOEs at 0.60.
[13] Tibet is excluded owing to the lack of data.
[14] Data on the preferential policy index run until 1998; therefore, later years are repeated using 1998 values.
[15] The results are invariant to the inclusion of the lag of MNE export activity.
[16] However, it may also be driven by the endogeneity of the export concentration variables.
[17] The variable capturing POEs' export concentration in the SOEs' estimation is dropped owing to the lack of variation.
[18] Results of the first-stage estimation are available upon request.
[19] Rauch & Trindade (1999) find that ethnic Chinese networks facilitate international trade by providing information regarding the international market.
[20] The OECD export activity excludes the Czech Republic, Hungary, Korea, Mexico, Poland, and the Slovak Republic since these countries gained membership during the period of analysis.

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