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Abstract: This paper investigates the determinants of FDI sectoral allocation in 29 China's manufacturing sectors from 2000 to 2007. We find that FDI sectoral allocation has a strong self-reinforcing effect. MNCs with ownership advantages tend to invest more in local high productivity sectors. The FDI presence, however, is discouraged in China's high productivity sectors in which the major market share is dominated by SOEs. We also find that the degree of FDI penetration is higher in sectors that are producing labor-intensive goods and also export-oriented.

Key Words: Foreign Direct Investment; Dynamic Panel Regression

JEL Classification: F21, F23, O53

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1. INTRODUCTION

Cross-border business activities of multinational enterprises (MNE) are one of the most salient features of the modern global economy. Many governments also see attracting foreign direct investment (FDI) pivotal in their economic development strategy. In this paper we document econometrically the determinants of inward FDI sectoral location in China by means of dynamic panel regression analysis with a dataset of 29 manufacturing sectors over the years 2000-2007. The Chinese experience is valuable in the study of FDI location, partly because of the sheer magnitude and phenomenal growth of FDI the country has received since her reform in 1978, but more importantly because of the diversity and richness of the data. Due to the fast growth of the country and occurrence of major economic and political events that caused changes in FDI flows – both over time as well as across sectors – the Chinese case serves like a natural experiment that allows us to test various theories of FDI incidence. We believe the test results should not only be relevant to those who are interested in China's development but also relevant for improving our understanding of FDI and MNE theory in general.

Figure 1 plots the foreign share of owner's equities for each of the 29 manufacturing sectors over the eight years from 2000 to 2007. It can be seen that the 29 time series of FDI shares spread out from nearly zero to a maximum of about 0.7 and there are also quite a number of crossovers among the series. Clearly the location of FDI in China is characterized by enormous sectoral as well as temporal diversity. Another eye-catching feature of Figure 1 is the persistence of the FDI shares over time, a pattern that reflects the self-reinforcing or agglomeration effect of FDI activities as emphasized by Head *et al.* (1995), Cheng and Kwan (2000), and Blonigen *et al.* (2005), among many others. A satisfactory empirical model ought to explain these salient features of FDI location in a consistent framework, and this motivates our adoption of the dynamic panel regression model as the econometric platform in this study.

There has been a vast literature studying the incentives and determinants of FDI geographical location. These studies, though different in terms of theoretical framework, data source, and empirical methodology, tend to arrive at more or less consistent conclusions about certain aggregate variables such as quality of infrastructure and work force, market access, factor costs, and concessionary tax policy. There also exists a line of literature offering theoretical explanations, mostly from the industrial organization and trade theory perspective, for FDI allocation and MNE activities across different sectors. Nevertheless the theoretical suggestions from this literature very often conflict with each other and no single theory seems to be able to provide the complete answer (Cave 1974; Faeth 2009). Therefore, an empirical testing of the predictions by various analytical schools, which is what we are going to do in this paper, should be a useful complement to the theoretical literature.

Early empirical research on FDI sectoral allocation tends to focus on the role of specific factors in determining FDI presence.[1] Research going beyond one analytical school that compares several determinants of FDI sectoral allocation has become

[1] For instance, Horst (1972) shows that Canadian MNEs in US tend to invest in R&D intensive industries and scale economies is a prior condition for FDI to penetrate local industry. Buckley and Casson (1976) also document that a higher degree of MNE internalization is observed in R&D intensive industries. Swedenborg (1979) reports that industries with scale economies and more capital intensive are more attractive to Swedish outward FDI.

more popular after the late 1970s.[2] Though most of these studies examine FDI in a comparative statics setting, recent empirical research shows that it may be more reasonable to describe FDI activities in a dynamic framework. For instance, Wheeler and Mody (1992) document that manufacturing and electronics FDI are positively correlated to agglomeration benefit indices that capture infrastructure quality, degree of industrialization and level of FDI penetration. Head *et al.* (1995) and Blonigen *et al.* (2005) show that Japanese firms' location decisions are affected by the participation of other Japanese MNCs in either vertical or horizontal keiretsu. Cheng and Kwan (2000a, b) provide evidence for the self-reinforcing effect of FDI location in China. While most of these studies examined geographical and sectoral allocation of FDI, little work has been done to explore the interactions between MNE activities across sectors *vis-à-vis* local firms' reaction. Moreover, existing studies mainly examine FDI sectoral activities in developed countries and relatively little work has been done for developing countries.[3]

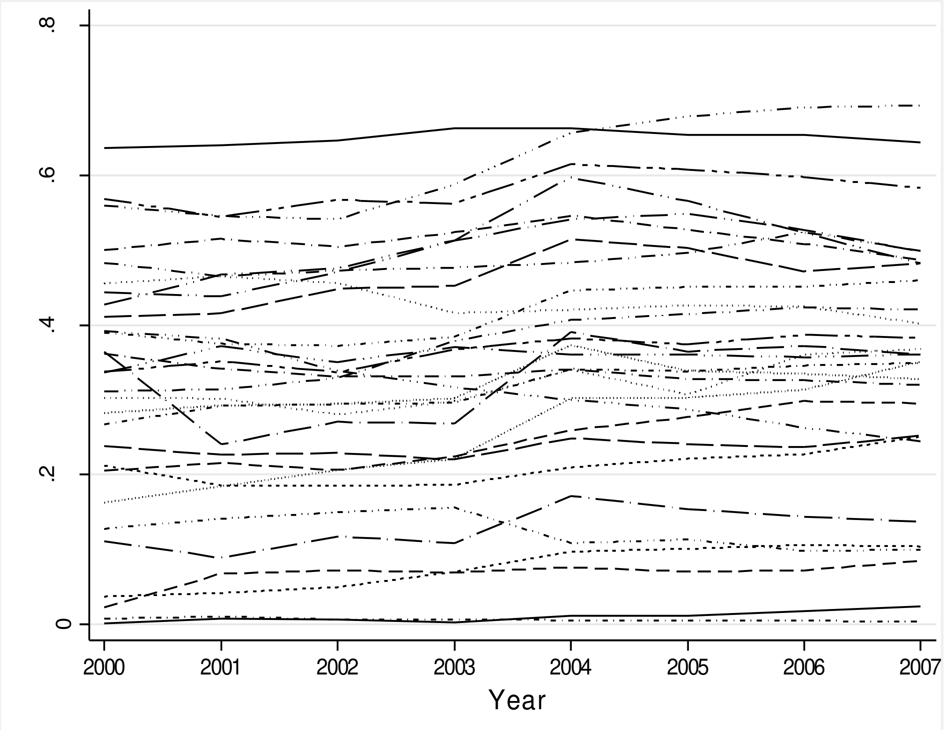
This paper attempts to fill the vacuum in the literature by examining dynamic activities of FDI sectoral allocation *vis-à-vis* local firms' activities in China's manufacturing industry. Section 2 is a brief survey of the theoretical literature on FDI sectoral allocation which motivates our empirical specification. In section 3 we present our empirical model and discuss the data and other econometric issues. Section 4 reports the results and compares them with the earlier findings in the literature. The final section concludes the paper.

FIGURE 1

Foreign Share of Owner's Equities for 29 Manufacturing Sectors
in China (2000-2007)

[2] Caves (1974) investigates the determinants of FDI activities from 64 countries in Canada and the UK. The author documents that intangible assets (measured by expenditure on advertising and R&D) are significant in both Canada and UK, while firm size only matters in Canada. Industry concentration and entry barriers have a positive effect on MNE activities, whereas entrepreneurial resource is not a significant factor. Blomström and Lipsey (1986) study the role of firm size as a determinant of FDI and document that firm size only has a threshold effect on FDI; however, domestic sales, capital–labor ratio, expenditure on R&D and advertising have positive effects on the share of FDI sales. Santiago (1987) explores the interaction of industry- and location-specific determinants for FDI and reports that foreign investment at industry level is positively correlated with firm size and relative profits, but negatively correlated with relative fuel costs. Other studies include Saunders (1982), Ray (1989), Kogut and Chang (1991), Drake and Caves (1992), and Milner and Pentecost (1996).

[3] One exception is Santiago (1987) who explores the case of Puerto Rico.



Notes:
(a) foreign share of owner's equities in a sector is defined as the proportion of owner's equities owned by three types of foreign-funded enterprises (namely Sino-foreign joint ventures, enterprises with Sino-foreign cooperation, and wholly foreign-owned enterprises). (b) data for owner's equities are obtained from various issues of *China Statistical Yearbook*.

2. DETERMINANTS OF FDI SECTORAL ALLOCATION

For ease of reference we highlight in this section several determinants of FDI sectoral allocation suggested in the literature that are most relevant to our empirical investigation using Chinese sectoral data. The reader is referred to Faeth (2009) for a detailed survey of the theoretical literature and Blonigen *et al.* (2005) for the empirical literature on FDI determinants.

The 'ownership advantages' hypothesis of MNE suggests that, in order to outlive competition in a foreign market, a firm must possess some ownership-specific assets such as proprietary knowledge, technology, organizational structure, management or marketing skills. These ownership-specific assets should at least generate profit that can exceed the extra costs that foreign firms may encounter in foreign markets. More specifically, these extra costs are due to host country uncertainties like cultural difference, language obstacle, and policy risk (Kindleberger 1969; Hymer 1976; Dunning 1980, 2001). This argument leads to the hypothesis that the existence of economies of scale or higher productivity compared to local firms, due to certain ownership advantages, is a prior condition for FDI presence. An extension of this argument is that, in order to obtain and maintain ownership-specific assets, MNE may rely on R&D activities to sustain their monopolistic power in the market; consequently, one should expect that the degree of FDI penetration is higher in R&D intensive industry. Horst (1972), Caves (1974), Swedenborg (1979), and Blomström and Lipsey (1986) provide empirical support for the ownership advantages hypothesis. Typically these studies document that factors like R&D and advertising expenditure, capital intensity, labor skills, and scale economies have positive effects on FDI or MNE activities.

A notable feature of the Chinese economy is that, as a transition economy, firms with various ownership structures co-exist in the same industry. Huang (2003) argues that 'political pecking order' plays an important role in determining FDI pattern in China. The political pecking order of domestic firms in China refers to the phenomenon that SOEs (state-owned enterprises) are favored – over FIEs (foreign-invested enterprises) and other firms – in terms of market access, subsidies, bank credits, and general political and legal protection. The impact of political pecking order on FDI presence is ambiguous, however. On the one hand, unequal treatment discourages foreign firms from penetrating those industries in which the bulk of market share is under the control of SOEs. On the other hand, FDI presence may be higher, via joint venture or other similar channels, in industries in which SOEs enjoy soft budget constraint and local private firms subject to hard budget constraint. By forming joint venture with an SOE that enjoys soft budget constraint, the foreign firm may be able to access preferential treatments which would not have been possible otherwise. Subject to hard budget constraint, in order to obtain growth opportunity, local private firms may be motivated to demise their equity and seek joint venture with foreign firms.

Being the most populous country in the world, China enjoys a comparative advantage in labor-intensive goods. Qiu (2003) proposes the 'trade-cum-FDI' theory to explain prominent FDI presence in China's labor-intensive sectors. Assuming that the FDI source country has comparative advantage in capital-intensive product and the host country has comparative advantage in labor-intensive products, Qiu (2003) constructs a model to show that given sectors are different in terms of market size and export opportunities which are determined by comparative advantage, the host country's comparative advantage sector will be more attractive to FDI than its comparative disadvantage sector. By investing in the host country's comparative advantage industry MNEs not only avoid competition from home country's exporters but also benefit from further export opportunities. The trade-cum-FDI theory therefore predicts that the degree of FDI presence in China should be higher in industries that are producing labor-intensive goods and also export-oriented.

3. EMPIRICAL MODEL AND DATA

Conceptually the FDI theories surveyed in last section are comparative statics analysis of FDI incidence in which the foreign firm's desired investment or location decisions are related to a number of potential determinants. An empirical panel data model that captures such kind of theoretical relationship is

$$y_{it}^{*} = \pi' x_{it} + \lambda_i + \eta_t + \varepsilon_{it}, \quad i = 1,2,...,N; \quad t = 1,2,...,T. \tag{1}$$

where y_{it}^{*} is desired or equilibrium FDI in sector i at time t; x_{it} is a vector of potential determinants such as ownership advantages; λ_i and η_t are unobserved sector-specific and time-specific effects, respectively. In particular, η_t represents time-varying factors that affect FDI in all 29 manufacturing sectors in China at the same time, for instance, international sentiment of investing in China. To capture self-reinforcing or agglomeration effect of FDI activities, we postulate a partial stock adjustment model as in Cheng and Kwan (2000a, b):

$$y_{it} - y_{i,t-1} = \alpha(y_{it}^{*} - y_{i,t-1}) \tag{2}$$

where y_{it} is realized FDI. Combining (1) and (2), we arrive at a dynamic panel regression model ready for empirical implementation:

$$y_{it} = (1-\alpha)y_{i,t-1} + \beta' x_{it} + \gamma_i + \omega_t + v_{it}, \quad i = 1,2,...,N; \quad t = 2,...,T. \tag{3}$$

where $\beta = \alpha\pi, \gamma_i = \alpha\lambda_i, \omega_t = \alpha\eta_t,$ and $v_{it} = \alpha\varepsilon_{it}$. It is well known that consistent estimation of a dynamic panel regression requires special methods rather than the conventional fixed or random effects estimator (Hsiao 2003, Chapter 4). In this paper we rely on the system GMM approach initiated by Arellano and Bover (1995) and fully developed by Blundell and Bond (1998) which estimates (3) as a system of equations in both first-differences and levels. As for linear GMM estimators, the Arellano-Bond and Blundell-Bond estimators have one- and two-step versions. Though two-step GMM is asymptotically more efficient, the conventional two-step standard errors tend to be severely downward biased (Arellano and Bond 1991; Blundell and Bond 1998). Windmeijer (2005) proposes a small-sample correction for the two-step standard errors which facilitate two-step robust estimations to be more efficient than corresponding one-step estimation, especially for system GMM. A brief description of the econometric procedures can be found in Appendix A.

We use foreign share of owner's equities (*PTOE*) to measure FDI incidence in a sector. This is the dependent variable y_{it} that our empirical model (3) tries to explain. We include a number of explanatory variables in vector x_{it} as suggested by economic theory. Here we discuss the motivation behind the introduction of these explanatory variables and refer the reader to Appendix B for precise variable definitions. To capture the profit incentive effect on FDI we include variable *TPPTA* – profit per dollar asset in FDI firms – as a control variable in all model specifications. Naturally *TPPTA* is expected to have a positive impact on FDI incidence. The ownership advantages hypothesis suggests that economies of scale or higher productivity, due to certain ownership-specific assets, is a prior condition for FDI penetration. To test this hypothesis, we include variable *OA* – the productivity ratio of FDI firms to domestic firms – to capture the disparity in scale economies and productivities between MNCs and domestic firms. *PI* and *PID* are dummy variables that single out local high productivity sectors. The interaction terms, *OA**PI* and *OA**PID*, allow us to investigate whether the ownership advantages hypothesis holds in all sectors or only in high productivity sectors. These two interaction terms are of interest because the effect of ownership advantages may vary according to the characteristics of different sectors and it may be more profound when MNCs intend to penetrate into local high productivity sectors. The political pecking order hypothesis suggests that the presence of state-owned enterprise (SOE) should affect FDI incidence in a sector, although the direction of impact could be positive or negative. We construct two variables to measure the extent of SOE presence. *TLOS* is the liabilities ratio of SOE to private firms and *PSIOS* is the sales income share of SOE in a sector. If the political pecking order hypothesis holds, we would observe that both

TLOS and *PSIOS* have negative effects on FDI incidence, after controlling for other determinants of FDI location. The trade-cum-FDI hypothesis applied to China predicts that FDI would tend to invest in sectors that are labor-intensive and also export-oriented. To measure sectoral labor intensity we construct *LBVCP*, which takes 1 if the underlying sector is labor intensive and 0 otherwise, and *GREXP*, which is the growth rate of export of a specific sector. If trade-cum-FDI hypothesis holds, we should observe that the interaction term between *LBVCP* and *GREXP* is significantly positive.

We employ a panel dataset of 34 manufacturing sectors reported by the National Bureau of Statistics of China. Detailed and consistent data for foreign-funded enterprises are only available from 2000; consequently, we choose 2000 as the starting point of our sample period. Trade data are obtained from the CEINET database.[4] There is a mismatch between the sectoral classification for China's industry statistical report (which is named '*GB/T 4754*') and the one for China's trade statistics (which is based on international standard *SITC Rev.3*, and *Harmonized System* as well). By carefully comparing the definitions for these two systems, we combine some sectors under *GB/T 4754* classification and construct a balanced panel dataset, which contains 29 manufacturing sectors from 2000 to 2007. The final list of sectors and details for the trade data construction are reported in Appendix C.

4. EMPIRICAL RESULTS

Empirical results for two-step system GMM estimation are reported in Table 1 and Table 2. Following the suggestion by Roodman (2009b), we also report results after reducing certain instruments so as to check robustness with respect to alternative instrument choice.

TABLE 1
Empirical Results

Dependent variable: ln(PTOE) Sample Period: 2000-2007 (29 Sectors)

	IV(a)				IV(b)			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
L.PTOE	0.519**	0.527***	0.509**	0.489***	0.490**	0.510***	0.514***	0.491***
	(0.197)	(0.163)	(0.199)	(0.150)	(0.213)	(0.181)	(0.183)	(0.163)
TPPTA	0.316*	0.408**	0.362**	0.453***	0.337*	0.423**	0.359**	0.442***
	(0.168)	(0.169)	(0.153)	(0.149)	(0.184)	(0.190)	(0.139)	(0.141)
OA	-0.280	-0.601*	-0.360	-0.861***	-0.298	-0.671	-0.367	-0.853***
	(0.213)	(0.349)	(0.291)	(0.256)	(0.227)	(0.447)	(0.218)	(0.246)
OA*PI	0.705**	0.814***			0.724**	0.855**		
	(0.276)	(0.289)			(0.301)	(0.336)		
OA*PID			0.891**	1.142***			0.922***	1.147***
			(0.337)	(0.231)			(0.290)	(0.226)
PI	-0.060	0.006			-0.080	-0.072		
	(0.282)	(0.217)			(0.385)	(0.216)		
PID			-0.063	-0.123			0.042	-0.110
			(0.409)	(0.221)			(1.195)	(0.265)
TLOS	-0.370		-0.316		-0.427		-0.298	
	(0.299)		(0.332)		(0.366)		(0.305)	
PI*TLOS	-0.090				-0.037			
	(0.321)				(0.485)			
PID*TLOS			-0.441				-0.439	
			(0.417)				(0.548)	

[4] The source of data: National Statistics Online Database of P.R. China (http://219.235.129.54/cx/table/table.jsp), various issues of *China Statistic Yearbook*, and CEINET database (http:// www1.cei.gov.cn/ce/cedb/index.htm). The 'valued-add for industry' for the year 2004 is collected from various issues of sectoral reports for that year issued by corresponding industry associations.

PSIOS		-0.173		-0.161		-0.178		-0.153
		(0.125)		(0.177)		(0.159)		(0.186)
PI*PSIOS		-0.311**				-0.357**		
		(0.134)				(0.160)		
PID*PSIOS				-0.400***				-0.391**
				(0.130)				(0.171)
Hansen *J* Statistic	19.951	23.486	22.308	20.029	21.998	19.461	23.976	21.579
P-value of Hansen *J* Statistic	0.866	0.708	0.767	0.863	0.579	0.727	0.463	0.604
D.O.F of Hansen *J* Statistic	28	28	28	28	24	24	24	24
Number of instruments	35	35	35	35	31	31	31	31
Arellano-Bond m_1 statistic	-1.761	-1.742	-1.869	-1.790	-1.633	-1.731	-1.564	-1.739
P-value of m_1 test	0.078	0.082	0.062	0.074	0.103	0.083	0.118	0.082
Arellano-Bond m_2 statistic	0.247	0.357	0.278	0.721	0.267	0.464	0.215	0.693
P-value of m_2 test	0.805	0.721	0.781	0.471	0.789	0.642	0.830	0.488
N	203	203	203	203	203	203	203	203

Notes:

1) IV(a): lag 2 to all deeper lag variables for lagged 1 dependent variable; lag 2 to all deeper lags for all other independent variables for first-differenced equations; lag 1 to all deeper lagged differenced independent variables for level equations. Dummies (*PI* and *PID*) and interaction terms are not included in the instrument list.
2) IV(b): lag 2 to all deeper lag variables for lagged 1 dependent variable; lag 2 to lag 6 for all other independent variables for first-differenced equations; lag 1 to lag 5 differenced independent variables for level equations. Dummies (*PI* and *PID*) and interaction terms are not included in the instrument list.
3) L.PTOE is 1 period lag of dependent variable. All variables are in logarithm and in first differences as well.
4) Asymptotic standard errors, asymptotically robust to heteroskedasticity, are reported in parentheses. *** indicates significant at the 1 percent level, ** indicates significant at the 5 percent level, and * indicates significant at the 10 percent level.
5) The GMM estimates reported are all two-step results. Windmeijer's correction for the two-step standard errors is employed.
6) Collapsed instrument matrix technique is employed to reduce the instrument count.
7) m_1, m_2, and *Hansen* statistic reported are all two-step versions and are robust. Numbers reported in corresponding parentheses are degrees of freedom.

Table 1 presents empirical results for testing the 'ownership advantages' and 'political pecking order' hypotheses. The net influence of ownership advantage (*OA*) depends on the level of labor productivity of the underlying sector. The coefficient for interaction terms (*OA*PI* and *OA*PID*) are highly significant and stable, which suggests that, ceteris paribus, given a certain level of ownership advantage, FDI firms tend to invest more in local high productivity sector (dummy variable *PI* or *PID* equals 1). The coefficient for *OA* is negative but not significant. A possible explanation for this negative coefficient is that, it may be less likely for MNEs to profit from or make the best use of their ownership advantages in domestic low productivity sectors (*PI* or *PID* equals 0). Consequently, these low productivity sectors are less attractive to MNEs with ownership advantages.

Most estimated coefficients of proxies for 'political pecking order' (*TLOS* and *PSIOS*) are negative across specifications, though not significant. When interaction terms are taken into account, the partial effects of these two proxies are still negative, which is consistent with the prediction of the political pecking order hypothesis. The coefficient for interaction terms associated with these two proxies, however, provide slightly different results. When the power of SOEs in the underlying sector is measured by market share (*PSIOS*), the coefficient for the interaction terms (*PI*PSIOS* and *PID*PSIOS*) is negative and highly statistically significant. When the political pecking order bias is measured by the soft budget constraint (*TLOS*) for SOEs, the coefficient for the interaction terms (*PI*TLOS* and *PID*TLOS*) is also negative but not significant. Consequently, our empirical results suggest that the impact of political pecking order on sectoral location of FDI may depend on the source of distortion and the productivity level of the underlying sector as well, which is no documented in Huang (2008). Estimation results presented in Table 1 show that the distortion is much severe in local high productivity sector in which the major share of the market is under the control of SOEs.

TABLE 2
Estimation Results (continued)

Dependent variable: ln(PTOE) Sample Period: 2000-2007 (29 Sectors)

	IV(a)				IV(b)			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
L.PTOE	0.799***	0.701***	0.778***	0.669***	0.762***	0.704***	0.753***	0.670***
	(0.101)	(0.079)	(0.097)	(0.066)	(0.074)	(0.077)	(0.096)	(0.081)
TPPTA	0.299**	0.350**	0.303*	0.330**	0.306*	0.351**	0.319*	0.343**
	(0.140)	(0.154)	(0.154)	(0.120)	(0.151)	(0.155)	(0.163)	(0.145)
OA	0.022	-0.220	0.017	-0.313**	-0.084	-0.179	-0.033	-0.344**
	(0.172)	(0.204)	(0.233)	(0.123)	(0.121)	(0.207)	(0.191)	(0.147)
OA*PI	0.218	0.385**			0.369***	0.361*		
	(0.197)	(0.185)			(0.124)	(0.190)		
OA*PID			0.338*	0.596***			0.386*	0.628***
			(0.188)	(0.185)			(0.191)	(0.211)
PI	-0.195	-0.110			-0.008	-0.038		
	(0.289)	(0.225)			(0.279)	(0.225)		
PID			0.239	0.043			0.139	0.003
			(0.396)	(0.123)			(0.358)	(0.160)
TLOS	-0.098		0.003		-0.048		-0.011	
	(0.121)		(0.207)		(0.136)		(0.209)	
PI*TLOS	-0.108				-0.215			
	(0.233)				(0.322)			
PID*TLOS			-0.589				-0.582	
			(0.407)				(0.592)	
PSIOS		-0.182		-0.180*		-0.187		-0.176*
		(0.110)		(0.102)		(0.116)		(0.097)
PI*PSIOS		-0.222				-0.189		
		(0.133)				(0.171)		
PID*PSIOS				-0.250**				-0.229**
				(0.102)				(0.101)
LBVCP	-0.273	0.004	-0.328	-0.049	-0.219	0.133	-0.384	0.002
	(0.597)	(0.217)	(0.441)	(0.263)	(0.524)	(0.355)	(0.697)	(0.291)
GREXP	0.296	0.123	0.001	0.053	0.041	0.133	0.054	0.068
	(0.342)	(0.266)	(0.303)	(0.122)	(0.317)	(0.225)	(0.272)	(0.151)
LBVCP*GREXP	1.276***	1.138***	1.553***	1.249**	1.495***	1.213***	1.413**	1.256**
	(0.420)	(0.386)	(0.519)	(0.472)	(0.397)	(0.414)	(0.522)	(0.523)
Hansen *J* Statistic	17.190	24.124	22.280	20.543	22.095	24.244	23.230	21.423
P-value of Hansen *J* Statistic	0.985	0.840	0.900	0.941	0.733	0.617	0.673	0.766
D.O.F of Hansen *J* Statistic	32	32	32	32	27	27	27	27
Number of instruments	42	42	42	42	37	37	37	37
Arellano-Bond m_1 statistic	-1.994	-2.290	-1.719	-2.312	-1.913	-2.351	-1.541	-2.394
P-value of m_1 test	0.046	0.022	0.086	0.021	0.056	0.019	0.123	0.017
Arellano-Bond m_2 statistic	0.632	0.852	0.466	0.566	0.628	0.814	0.424	0.624
P-value of m_2 test	0.527	0.394	0.641	0.572	0.530	0.416	0.671	0.532
N	203	203	203	203	203	203	203	203

Notes:

1) IV(a): lag 2 to all deeper lag variables for lagged 1 dependent variable; lag 2 to all deeper lags for all other independent variables for first-differenced equations; lag 1 to all deeper lagged differenced independent variables for level equations. Dummies (*PI*, *PID* and *LBVCP*) and interaction terms are not included in the instrument list.
2) IV(b): lag 2 to all deeper lag variables for lagged 1 dependent variable; lag 2 to lag 6 for all other independent variables for first-differenced equations; lag 1 to lag 5 differenced independent variables for level equations. Dummies (*PI*, *PID* and *LBVCP*) and interaction terms are not included in the instrument list.
3) L.PTOE is 1 period lag of dependent variable. All variables are in logarithm and in first differences as well.
4) Asymptotic standard errors, asymptotically robust to heteroskedasticity, are reported in parentheses. *** indicates significant at the 1 percent level, ** indicates significant at the 5 percent level, and * indicates significant at the 10 percent level.
5) The GMM estimates reported are all two-step results. Windmeijer's correction for the two-step standard errors is employed.
6) Collapsed instrument matrix technique is employed to reduce the instrument count.
7) m_1, m_2, and *Hansen* statistic reported are all two-step versions and are robust. Numbers reported in corresponding parentheses are degrees of freedom.

Table 2 provides further estimation results for exploring the interaction between FDI and international trade. When additional variables are added to the regression equation, major conclusions drawn from Table 1 are still hold. The coefficient for interaction term between *LBVCP* and *GREXP* is positive and highly significant, which is consistent with the prediction of 'trade-cum-FDI' hypothesis.

Estimated coefficient for the lagged dependent variable under different model specifications is persistently significant and positive, with a mean of about 0.62, indicating a fairly strong self-reinforcing effect of the past FDI on its current value. This result is consistent with the FDI agglomeration effect documented by Head *et al.* (1995), Cheng and Kwan (2000), and Blonigen *et al.* (2005). Estimated coefficient for *TPPTA* is highly significant and positive, which is consistent with economic intuition. We rely on Sargan/Hansen over-identification test and Arellano-Bond residual-based m_1 and m_2 statistics to test the validity of the moment conditions we adopted. The Sargan statistic is the minimized value of the one-step GMM criterion function which is not robust to heteroscedasticity or autocorrelation. Consequently, we only report Hansen J statistic, which is the minimized value of the two-step GMM criterion function and is robust to heteroscedasticity or autocorrelation. The Hansen J statistic reported in Table 1 and Table 2 do not reject the null hypothesis of no misspecification, suggesting that the moment conditions are valid. In most cases Arellano-Bond m_1 statistics reject the null hypothesis of zero first-order autocorrelation and m_2 statistics do not reject the null of zero second-order autocorrelation, which further confirm the validity of moment conditions we adopted. Following Andersen and Sørensen (1996), Bowsher (2002), and Roodman (2009b), we use both 'collapse' technique and also use only certain lags rather than all available lags for instruments to handle the instrument proliferation problem. Robustness checks under smaller instrument sets reported in Table 1 and Table 2 show that our estimation results are not sensitive to the reductions in the number of instruments.

5. CONCLUSION

This paper attempts to provide some empirical evidence on the dynamic activities of FDI sectoral allocation *vis-à-vis* local firms' activities in China's manufacturing industry. Estimation results based on 29 China's manufacturing sectors over the years 2000-2007 indicate that, besides the profit-seeking nature of MNEs, there are several factors also have impact on the FDI sectoral allocation activity in China. The FDI sectoral allocation has a fairly strong self-reinforcing effect on itself. MNCs with certain 'ownership advantages' tend to invest more in China's high productive sector. The FDI presence is discouraged in the sectors in which SOEs enjoy 'political pecking order' preferential treatment through market access. The degree of FDI penetration is higher in sectors that are labor-intensive and also export-oriented.

Due to data constraints, we can only provide a primary investigation of this FDI sectoral allocation issue. Further work adopting firm-level data is expected to provide more evidence in details. Remaining questions include but are not confined to what are listed as follows. Is FDI sectoral self-reinforcing driven by horizontal FDI or vertical FDI? Will MNCs make cross-sector investments? What are the sources of 'ownership advantages' for FDI in China's manufacturing industry?

APPENDIX A

Equation (3) is a two-factor dynamic panel data model. Following Hsiao and Tahmiscioglu (2008), we take care of the time specific effects η_t by subtracting from each variable its cross-sectional mean, i.e. for variable x_{it} the transformation looks like

$$x_{it}^{*} = x_{it} - \sum_{i=1}^{N} x_{it} / N \tag{A1}$$

We then make use of the transformed variables in the rest of the analysis as if there were no time specific effects. To lighten notation we will omit the asterisk from now on and simply write x_{it} which is understood to have been transformed by the operation in (A1). Let $u_{it} = \lambda_i + v_{it}$. The Blundell-Bond (1998) system GMM approach makes use of two kinds of moment conditions (A2) and (A3):

$$E(y_{i,t-s}\Delta u_{it}) = 0, \quad i = 1, \dots, N; \ t = 3, \dots, T \text{ and } s \geq 2. \tag{A2}$$

$$E(\Delta y_{i,t-s}u_{it}) = 0, \quad i = 1, \dots, N; \ t = 2, \dots, T \text{ and } s \geq 1. \tag{A3}$$

Compared with the Arellano-Bond (1991) first-differenced GMM estimator which makes use of (A2) alone, the Blundell-Bond system GMM approach also makes use of the level moment conditions (A3) which has been shown to make the GMM estimator much better behaved, especially when the coefficient of the lagged dependent variable is close to one and the individual fixed effects are prominent. Using lagged dependent variables alone as instruments as in (A2) and (A3) may lead to highly inefficient estimates. It is important to incorporate explanatory variables as additional instruments. In our application most explanatory variables like productivity, profit, export and import are arguably endogenous with respect to FDI activities. Consequently, the issue of reverse causality will have to be properly addressed in the econometric estimation. To deal with endogeneity we assume all explanatory variables to be weakly exogenous (which would allow feedback effect from current FDI activities to present and future FDI determinants) and the following moment conditions would hold:

$$E(x_{i,t-s}\Delta u_{it}) = 0, \quad i = 1, \dots, N; \ t = 3, \dots, T; \ s \geq 2 \tag{A4}$$

.

$$E(\Delta x_{i,t-s}u_{it}) = 0, \quad i = 1, \dots, N; \ t = 3, \dots, T; \ s \geq 1 \tag{A5}$$

Moment conditions (A2) – (A5) are what we assume in our application of the system GMM method. All computations in this paper are done by Stata package *xtabond2* described in Roodman (2009a). The details of the Blundell-Bond system GMM method and various implementation issues can also be found in Roodman's paper.

APPENDIX B

Variable Name	Definition
$PTOE_{it}$	The proportion of owner's equities of FDI in total owner's equities (*TOE*) of each manufacturing sector. $$PTOE_{it} = \frac{TOE_{it}^{FDI}}{TOE_{it}^{T}}$$
OA_{it}	The ratio of value-added per labor of FDI to value-added per labor of domestic firms in the same sector. $$OA_{it} = \frac{VA_{it}^{FDI} / AAEP_{it}^{FDI}}{\left(VA_{it}^{T} - VA_{it}^{FDI}\right) / \left(AAEP_{it}^{T} - AAEP_{it}^{FDI}\right)}$$ where *AAEP* denotes annual average employed person and *VA* denotes value-added.
PI_{it}	A dummy indicating the productivity level of underlying sector. $$PI_{it} = \begin{cases} 1 \quad if \quad \dfrac{VA_{it}^{T} / AAEP_{it}^{T}}{\frac{1}{N}\sum_{i=1}^{N}\left(VA_{it}^{T} / AAEP_{it}^{T}\right)} \geq 1 \\ 0 \quad if \quad \dfrac{VA_{it}^{T} / AAEP_{it}^{T}}{\frac{1}{N}\sum_{i=1}^{N}\left(VA_{it}^{T} / AAEP_{it}^{T}\right)} < 1 \end{cases}$$ where *AAEP* denotes annual average employed person and *VA* denotes value-added.
PID_{it}	A dummy indicating the productivity level of domestic firms in underlying sector. $$PID_{it} = \begin{cases} 1 \quad if \quad \dfrac{\left(VA_{it}^{T} - VA_{it}^{FDI}\right) / \left(AAEP_{it}^{T} - AAEP_{it}^{FDI}\right)}{\frac{1}{N}\sum_{i=1}^{N}\left(\left(VA_{it}^{T} - VA_{it}^{FDI}\right) / \left(AAEP_{it}^{T} - AAEP_{it}^{FDI}\right)\right)} \geq 1 \\ 0 \quad if \quad \dfrac{\left(VA_{it}^{T} - VA_{it}^{FDI}\right) / \left(AAEP_{it}^{T} - AAEP_{it}^{FDI}\right)}{\frac{1}{N}\sum_{i=1}^{N}\left(\left(VA_{it}^{T} - VA_{it}^{FDI}\right) / \left(AAEP_{it}^{T} - AAEP_{it}^{FDI}\right)\right)} < 1 \end{cases}$$ where *AAEP* denotes annual average employed person and *VA* denotes value-added.

$TLOS_{it}$	The ratio of total liabilities (*TL*) per state-owned enterprises to the total liabilities per enterprise with other ownership structures in the same sector. $$TLOS_{it} = \frac{TL_{it}^{S} / NOE_{it}^{S}}{\left(TL_{it}^{T} - TL_{it}^{S}\right) / \left(NOE_{it}^{T} - NOE_{it}^{S}\right)}$$
$PSIOS_{it}$	The proportion of sales income (*SI*) of state-owned firms in the total sales income of each sector. $$PSIOS_{it} = \frac{SI_{it}^{S}}{SI_{it}^{T}}$$
$GREXP_{it}$	The growth rate of export of each manufacturing sector.
$LBVCP_{it}$	A dummy indicating whether the underlying sector is labor-intensive or not. *LBVCP* takes 1 if the labor-capital ratio of a specific sector divided by the mean of labor-capital ratio of the whole manufacturing industry is larger or equal to 1, 0 otherwise.
$TPPTA_{it}$	Total profit per total asset of FDI in each manufacturing sector.

Note:
Superscript '*FDI*' means data for MNCs, '*S*' means data for state-owned firms, and '*T*' means data for the whole sector.

APPENDIX C

Sector	Sector (*GB/T 4754* System)	Source of Trade Data
1	1. Mining and Washing of Coal	SITC_32
2	2. Extraction of Petroleum and Natural Gas 18. Processing of Petroleum, Coking, Processing of Nuclear Fuel	SITC_33; SITC_34
3	3. Mining and Processing of Ferrous Metal Ores 25. Smelting and Pressing of Ferrous Metals	SITC_67
4	4. Mining and Processing of Non-Ferrous Metal Ores 26. Smelting and Pressing of Non-ferrous Metals	SITC_68
5	5. Mining and Processing of Nonmetal Ores 24. Manufacture of Non-metallic Mineral Products	SITC_66
6	6. Processing of Food from Agricultural Products 7. Manufacture of Foods	SITC_01 to SITC_09
7	8. Manufacture of Beverages	SITC_11
8	9. Manufacture of Tobacco	SITC_12
9	10. Manufacture of Textile	SITC_26; SITC_25
10	11. Manufacture of Textile Wearing Apparel, Footwear, and Caps	SITC_84; SITC_85
11	12. Manufacture of Leather, Fur, Feather and Related Products	SITC_21; SITC_61
12	13. Processing of Timber, Manufacture of Wood, Bamboo, Rattan, Palm, and Straw Products	SITC_24; SITC_63
13	14. Manufacture of Furniture	SITC_82
14	15. Manufacture of Paper and Paper Products	SITC_25; SITC_64
15	16. Printing, Reproduction of Recording Media	HS_49; HS_37
16	17. Manufacture of Articles For Culture, Education and Sport Activity	HS_95
17	19. Manufacture of Raw Chemical Materials and Chemical Products	SITC_51 to SITC_53; SITC_55 to SITC_56; SITC_59
18	20. Manufacture of Medicines	SITC_54
19	21. Manufacture of Chemical Fibers	HS_54; HS_55
20	22. Manufacture of Rubber	SITC_62
21	23. Manufacture of Plastics	SITC_57; SITC_58
22	27. Manufacture of Metal Products	SITC_69
23	28. Manufacture of General Purpose Machinery	SITC_74
24	29. Manufacture of Special Purpose Machinery	SITC_71 to SITC_73
25	30. Manufacture of Transport Equipment	SITC_78; SITC_79
26	31. Manufacture of Electrical Machinery and Equipment	SITC_77
27	32. Manufacture of Communication Equipment, Computers and Other Electronic Equipment	SITC_76
28	33. Manufacture of Measuring Instruments and Machinery for Cultural Activity and Office Supplies	SITC_75; SITC_87; SITC_88
29	34. Production and Supply of Electric Power and Heat Power	SITC_35

Note:
SITC stands for Standard International Trade Classification. HB stands for Harmonized System.

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