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Productivity Spillovers among OECD, Diaspora and Indigenous Firms in Chinese Manufacturing

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Abstract

It is the conventional wisdom that productivity spillovers from home based to foreign owned firms occur only in the economies of developed countries. This paper argues that there are exceptions to the conventional wisdom. Given the importance of indigenous knowledge in productivity enhancement, spillovers could occur from domestically owned to foreign owned firms in developing countries. Given their unique position, diaspora firms could play a special role in facilitating such reverse spillovers. These propositions are tested in the context of the OECD, diaspora and domestically owned firms in China, utilising data relating to a sample of firms in China's manufacturing sector.

Key words: Foreign direct investment, indigenous knowledge sourcing, diaspora firms, productivity spillovers

JEL classification: F23, O31

1. Introduction

The creation and exploitation of rent yielding assets is one of the main reasons for the growth and spread of multinational corporations (MNCs). Countries which play host to MNCs are able to enjoy a share of these rents mostly through spillovers of technology and know-how from foreign owned to locally owned firms. This is all well documented in the literature.

Recently the literature has identified the presence of reverse spillovers from domestically owned to foreign owned firms. It is suggested that FDI may be motivated by the desire to source technology from domestically owned firms in the host countries (Kogut and Chang 1991, Cantwell 1995, Neven and Siotis 1996, and Driffield and Love 2001). Firms decide to invest abroad not so much to exploit advantages they already possess but to acquire new technological knowledge (Fosfuri and Motta 1999). This phenomenon, however, is usually identified in the case of FDI in developed countries, and it is the presumption that reverse spillovers can only occur when the technological distance between the foreign owned and domestically owned firms is not too long. This would be so mostly in the economies of developed countries who are leaders in technology.

This paper argues that reverse spillovers can occur in developing countries too. Although technological capabilities are generally lower in developing than in developed countries, MNCs can benefit from *indigenous knowledge* (such as knowledge of local markets, technology developed to suit local factor and market conditions). Indigenous knowledge can contribute to productivity enhancement of

foreign firms, and as such there may be mutual productivity spillovers between foreign and local firms in a developing country.

China provides an interesting case study of such two-way spillovers between foreign owned and locally owned firms. China was the largest FDI recipient in developing countries for most of the last decade and in 2002 she became the largest FDI recipient in the world. A special feature of FDI in China is that the majority of investors are Chinese diaspora. For instance, in the peak year of 1992, around 80 per cent of 11 billion US$ inward FDI was from Hong Kong, Macao and Taiwan (HMT). Although HMT's share has since decreased, it still accounted for 45 per cent of total inward FDI in China in 2000, while the share of the US and the EU accounted for 11 per cent each (Wei, 2003).

In the literature the impact of direct investment from Chinese diaspora in the Chinese economy is often considered to be limited, as Chinese diaspora firms possess relatively less advanced technologies and concentrate more on labor intensive activities than their OECD counterparts. Chinese diaspora firms may generate very little, if any, spillovers. However, this argument may be flawed. Given their close cultural and organisational proximity to locally owned firms, Chinese diaspora firms may not only generate spillovers for other foreign owned firms but also act as a conduit for spillovers from locally owned to foreign owned firms.

The paper examines productivity spillovers between OECD, diaspora and indigenous firms in the Chinese manufacturing sector. Section 2 provides a brief discussion of the possible impact of indigenous knowledge on productivity of foreign firms in a developing country. The special role of diaspora firms in the process of spillovers will also be discussed. Empirical models and data source are described in

section 3. Econometric estimation results will be presented in section 4. Section 5 offers conclusions and discusses policy implications.

2. Mutual spillovers in a developing country

The existing studies mainly focus on productivity spillovers from MNCs to locally owned firms in host countries. As summarised in Blomstrom and Kokko (1998), productivity spillovers occur through the following channels. MNCs may break supply bottlenecks, demonstrate the efficiency of advanced or new technologies, train local workers who later take employment in local firms or establish their own businesses, break down monopolistic industrial structures, stimulate competition, transfer techniques for inventory and quality control and standardisation to their local suppliers and distribution channels, and force local firms to increase their managerial efficiency or to adopt marketing techniques. These activities may introduce new know-how and intensify competition and hence lead to efficiency gains. If such efficiency gains outweigh losses arising from competition due to crowding out effects, there will be positive productivity spillovers. Otherwise, the impact of foreign presence on the productivity of local firms may be negative.

However, as discussed in the preceding section, technology spillovers can also occur from indigenous to foreign owned firms. Furthermore, The phenomenon may not be restricted to FDI in developed countries. If the important role of indigenous knowledge is recognised, reverse spillovers can occur in developing countries. For a foreign firm to be competitive in a developing host country, indigenous knowledge is essential. In labour abundant countries such as China a variety of labour intensive technologies in manufacturing exist. These may require streamlining and organisation

which the MNCs can do. Also management of labour intensive technologies is obviously much more difficult and complicated than management of capital-intensive technologies. Knowledge of local language, local customs and local work ethic would be essential to effectively utilise relatively cheap labour. MNCs who invest in countries such as China in order to take advantage of her endowments of relatively cheap labour may have a lot to learn from their indigenous counterparts through observation, imitation and also through contractural arrangements such as sub-contracting. Yet another facet of indigenous know-how is knowledge of local markets including tastes and preferences, channels of marketing and methods of advertising to suit local culture and mores. This too can be acquired by foreign firms through observation, imitation, and contractural methods. Indigenous technologies in developing countries may not be as advanced as technologies possessed by MNCs from developed countries. However, indigenous technologies may be more appropriate for the local market than technologies from MNCs, and may play an important role when advanced foreign technologies from MNCs are adapted to the local conditions. In addition, indigenous technologies may be complementary to foreign technologies and may interact with each other to promote productivity in foreign-invested firms.

If the direction of the channels of productivity spillovers listed in Blomstrom and Kokko (1998) is reversed, several ways of indigenous knowledge spillovers from local to foreign firms can be identified. For instance, they can occur when local firms demonstrate the efficacy of indigenous technologies or local knowledge, when they train workers who later take employment in foreign firms, and when they force foreign firms to increase their efficiency via competition. Improvements in efficiency on the part of indigenous firms may compel foreign firms to search for efficient

indigenous technologies and methods of managing labour. They may be forced to locate suppliers of components and parts in the host country, seek locally trained managers well versed in managing labour and marketing of products. The attraction of working in foreign owned firms which pay relatively high wages may induce labour in locally owned firms to gravitate towards foreign firms.

In the case of China, the presence of substantial amounts of FDI from Chinese diaspora introduces a new dimension to the phenomenon of reverse spillovers. The cultural and organisational distance between diaspora and locally owned firms may be much shorter than that between foreign and locally owned firms. Their cultural orientation including familiarity with the local language, consumer taste patterns and managerial functions may be much nearer to that of locally owned firms than that of foreign owned firms. The presence of diaspora firms may enhance reverse spillovers, from diaspora to foreign owned firms for several reasons. First diaspora firms are likely to be familiar with both local cultural norms and methods of operations in China and those required to operate in overseas markets. They are in a sense doubly blessed because they share traits of both locally owned and foreign owned firms. Second, they may act as an intermediary between locally owned firms and foreign owned firms. Third, they may be better placed to imitate and absorb the knowledge possessed by locally owned firms than foreign owned firms. In sum the diaspora firms may not only generate spillovers for foreign firms but also act as a conduit for the spillovers of technology and know-how from locally owned to foreign owned firms and the reverse is also possible.

The foregoing suggests that there can be mutual productivity spillovers between foreign and local firms in a host developing country if the role of indigenous knowledge in productivity enhancement is acknowledged. If productivity spillovers

from foreign to local firms are mainly caused by advanced technological knowledge spillovers, those from local to foreign firms may result chiefly from indigenous knowledge diffusion through the channels identified earlier. Given their unique position, diaspora firms may not only spill over their knowledge but also facilitate spillovers between other foreign owned and indigenous firms.

3. Empirical models, data and methodology

In order to test the hypothesis of spillovers among OECD, diaspora and indigenous firms in Chinese manufacturing, the following extended production functions are constructed:

$$Log(Y_{ij}) = \alpha_0 + \alpha_1 Log(K_{ij}) + \alpha_2 Log(L_{ij}) + \alpha_3 (IAR_{ij}) + \alpha_4 (MS_{ij}) + \alpha_5 (FDI\_Sector_j) + \alpha_6 (FDI\_Sector_j)^2 + \alpha_7 (IDs) + \alpha_8 (RDs) + u_{ij} \quad (1a)$$

$$Log(Y_{ij}) = \beta_0 + \beta_1 Log(K_{ij}) + \beta_2 Log(L_{ij}) + \beta_3 (IAR_{ij}) + \beta_4 (MS_{ij}) + \beta_5 (DDI\_Sector_j) + \beta_6 (DDI\_Sector_j)^2 + \beta_7 (IDs) + \beta_8 (RDs) + v_{ij} \quad (1b)$$

where Y_{ij}, K_{ij}, and L_{ij} are value added, capital stock, and employment for plant *i* in sector *j*. IAR_{ij} is the ratio of intangible assets to total assets in plant *i* and MS_{ij} is plant *i*'s sales as a proportion of four-digit industry *j*' sales. FDI_Sector_j and DDI_Sector_j are the presence of FDI and the presence of domestic direct investment in sector *j*, respectively. Following Aitken and Harrison (1999), the presence of FDI and the presence of domestic direct investment are measured as the share of foreign and domestic equity in the sector, respectively, weighted by plant's share in sectoral employment. Employment is used as a weight because many spillover effects

discussed in the previous sections involve interpersonal interactions[1]. A positive (negative) coefficient on the variable indicates a positive (negative) productivity spillover effect. Given that productivity spillovers may be nonlinear, a squared presence variable ($(FDI\_Sector_j)^2$ or $(DDI\_Sector_j)^2$) is introduced. *IDs* are the industry dummies for 49 manufacturing industries defined at the three-digit level according to China's Standard Industrial Classification. This is consistent with Aitken and Harrison (1999) who suggest the use of plant level data together with the corresponding industry dummies to control for differences in productivity across sectors. By so doing, the fact that FDI is attracted to more productive sectors would not be mistakenly regarded as evidence of positive productivity spillovers. *RDs* are the region dummies for 29 regions in China. Finally, *u,* and *v* are the usual error terms.

The data used for the current study are from the Annual Report of Industrial Enterprise Statistics compiled by the State Statistical Bureau of China, covering 53,715 plants in eight industries, including food processing, food manufacturing, beverage manufacturing, garments, pharmaceuticals, machinery manufacturing, transport equipment manufacturing and electrical goods manufacturing for the year 2000. In this data set, there are two types of foreign presence: overseas Chinese from Hong Kong, Macao and Taiwan (HMT), and other foreign investors mainly from OECD countries (OECD). When the overall impact of FDI is examined, the variable *FDI* is used. When their different roles and mutual relationships in productivity spillovers are examined, the separate variables *OECD* and *HMT* are introduced.

Ideally, a panel data set should be used to consider dynamic effects of mutual productivity spillovers. But as data for the current study are available for one year

[1] Alternative measures for FDI_Sector_j and DDI_Sector_j are used to check for robustness and similar

only, cross-sectional econometric analyses are conducted. The White tests indicate the existence of heteroskedasticity in all regressions. Consequently, all variance-covariance matrices are estimated according to the White method for heteroskedasticity adjustment. Finally, because the null hypotheses of industry and region dummies being jointly equal to zero can be rejected at the standard significance levels, such dummies are included in all estimations.

4. Empirical Results

The coefficients of capital, labour, intangible asset ratio and market share variables all have the expected positive sign and are highly statistically significant. These results confirm the need to control for the productivity impacts of R&D and market power (Table 1). Columns (1) and (2) of Table 1 report the empirical results of productivity spillovers from foreign owned plants to local Chinese plants. The positive and significant coefficient on *FDI_Sector* and the negative and significant coefficient on $(FDI\_Sector)^2$ in column 1 suggest that the presence of FDI has a nonlinear and positive impact on the productivity of local Chinese plants and the positive impact increases with the degree of foreign presence at a decreasing rate.

Column (2) divides foreign presence into OECD and HMT respectively. It shows that the presence of FDI from OECD countries is highly significant in generating spillovers, although the squared foreign presence variable is no longer significant. This suggests that, after controlling for the impact of HMT FDI, the productivity spillover impact of FDI from OECD countries seems to be positively and linearly associated with the degree of its presence.

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results are obtained.

Column (2) also shows that the spillover effects of HMT or diaspora FDI exhibit a nonlinear pattern. In the absence of a sufficiently high volume of HMT presence, competition effects appear to outweigh spillover effects and result in net negative spillovers. This result is surprising. There are two possible explanations. The first one is that HMT firms in some segments may be a bit more capital intensive than technologies employed by locally owned firms. So employment share is low and the weighted HMT presence is low. This suggests that capital intensive HMT firms displace labour intensive local firms. The second one is that HMT firms bring nothing but parts and components to China. These are small sized operations. They attract labour from locally owned firms in the mainland (e.g. by paying slightly higher wages) and hence the negative sign. But as China attracts large amount of HMT investments, spillovers become positive. Therefore, if China tries to attract diaspore investments, the lesson for China is either to attract a large volume or not at all.

In column (3) we examine whether there are productivity spillovers from OECD firms to Chinese diaspora firms. The results indicate that the presence of OECD firms has a positive and non-linear impact. This shows that Chinese diaspora firms benefit from the presence of OECD firms, but the positive impact decreases with size. This suggests that Chinese diaspora firms enjoy relatively low level of spillovers from OECD countries than indigenous firms. As stated earlier, OECD presence has a significantly positive and linear impact on indigenous firms. Given that the technical and cultural distance between OECD firms and indigenous firms is greater than that between OECD firms and Chinese diaspora firms, the presence of the diaspora firms may facilitate spillovers from OECD firms to local Chinese firms. In this process, diaspora firms set an example for indigenous firms in the use of foreign technologies

and managerial skills. In other words, they are a conduit of technology and know-how from OECD firms to locally owned firms.

The productivity impact of Chinese diaspora firms on OECD firms is presented in column (4). The positive but marginally (in)significant (at the 10.5% level) coefficient on (*HMT_Sector*) and the negative and significant coefficient on $(HMT\_Sector)^2$ show that Chinese diaspora firms seem to exert positive effects on OECD firms at a diminishing rate in the China's manufacturing sector. This result lends some support to our argument that Chinese diaspora firms can generate spillovers for other foreign owned firms because of their knowledge of local environment.

Columns (5) to (7) present the results of productivity spillovers from Chinese domestic direct investment to plants in the foreign sector. As indicated in column (5), the productivity spillover effect of Chinese presence shows the same pattern as that of foreign presence: there is positive and nonlinear relationship between Chinese presence and productivity enhancement in all foreign-invested firms in China's manufacturing sector. The highly significant coefficients on (*DDI_Sector*) and $(DDI\_Sector)^2$ lend strong support to our argument that indigenous knowledge spillovers promote productivity in foreign-invested firms.

However, when the foreign sector is divided into the OECD and HMT sub-sector respectively, some interesting results emerge. As indicated in column (6), the presence of local Chinese firms continues to have a positive and nonlinear impact on the productivity in OECD invested firms in Chinese manufacturing. On the other hand, it does not seem to impact on the productivity in Chinese diaspora firms, as indicated in column (7). This result may not be surprising. HMT investors share the same culture with their local Chinese counterparts, and therefore have sufficient local

knowledge. Furthermore, local Chinese technologies and managerial skills are more similar and therefore less complementary to diaspora than OECD firms. Diaspora firms may act as a conduit for facilitating spillovers of technology and know-how from locally owned to OECD owned firms given their possession of traits of both locally and OECD owned firms, although they themselves may not gain from the presence of indigenous firms.

5. Conclusions

This paper attempts to examine productivity spillovers between OECD, diaspora and indigenous firms in China. The empirical results based on a large sample from China lend strong support to the mutual spillovers hypothesis. Indigenous knowledge spillovers have an important impact on productivity of OECD rather than HMT firms who share the same culture with local Chinese firms. Chinese diaspora firms from Hong Kong, Macao and Taiwan possess traits of both locally owned and foreign owned firms, therefore they tend to not only provide positive spillovers for OECD firms but also facilitate spillovers from indigenous firms to OECD firms. In this process, disapora firms set examples for other foreign firms for the application of indigenous knowledge and for indigenous firms for the application of advanced technologies and know-how.

The findings of this study have important implications for both policy makers and business managers. For home-country governments and businesses, outward FDI into a developing country may enable investing firms to obtain indigenous knowledge which plays a complementary role in productivity enhancement. For host developing countries, inward FDI needs to be promoted as it may have a positive impact on

productivity in local firms, and therefore enhance economic growth. Diaspora firms could play a unique role in facilitating productivity spillovers from reverse spillovers.

This initial research is based on a cross-section date set, and the evidence for the role of diaspora firms is not very strong. Further research is needed on this new dimension to the phenomenon of reverse spillovers, and a panel data approach may be fruitful.

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Table 1. Productivity Spillovers among OECD, Diaspora and Indigenous Firms in Chinese Manufacturing

Variable	Local Sector (1)	Local Sector (2)	HMT Sector (3)	OECD Sector (4)	Foreign Sector(5)	OECD Sector (6)	HMT Sector (7)
Log(K)	0.1699 (0.0060)***	0.1704 (0.0060)***	0.2447 (0.0118)***	0.3053 (0.0129)***	0.2766 (0.0088)***	0.3051 (0.0129)***	0.2448 (0.0118)***
Log(L)	0.6281 (0.0091)***	0.6281 (0.0091)***	0.5366 (0.0175)***	0.5192 (0.0190)***	0.5253 (0.0131)***	0.5183 (0.0190)***	0.5374 (0.0175)***
Intangible assets/K	0.0256 (0.0072)***	0.0255 (0.0072)***	0.0105 (0.0185)	0.0097 (0.0022)***	0.0099 (0.0027)***	0.0097 (0.0022)***	0.0107 (0.0184)
Market share	0.0993 (0.0162)***	0.0987 (0.0162)***	0.1196 (0.0190)***	0.0781 (0.0099)***	0.1002 (0.0106)***	0.0780 (0.0100)***	0.1187 (0.0187)***
FDI_Sector	0.0130 (0.0028)***				0.0500 (0.0182)***	0.0567 (0.0261)**	0.0277 (0.0250)
$(FDI\_Sector)^2$	-0.0001 (0.0001)**				-0.0003 (0.0001)***	-0.0004 (0.0002)**	-0.0002 (0.0002)
OECD_Sector		0.0190 (0.0047)***	0.0285 (0.0134)**				
$(OECD\_Sector)^2$		-0.0002 (0.0002)	-0.0009 (0.0005)*				
HMT_Sector		-0.0091 (0.0052)*		0.0175 (0.0108)#			
$(HMT\_Sector)^2$		0.0003 (0.0002)*		-0.0006 (0.0003)*			
DDI_Sector					0.0500 (0.0182)***	0.0567 (0.0261)**	0.0277 (0.0250)
$(DDI\_Sector)^2$					-0.0003 (0.0001)***	-0.0004 (0.0002)**	-0.0002 (0.0002)
Adjusted R^2	0.4711	0.4713	0.5444	0.5960	0.5665	0.5962	0.5441
White test	2956.548***	2956.100***	306.1169***	252.0252***	447.4008***	254.8156***	305.9542***
No. of Obs.	38602	38602	4972	4830	9641	4830	4972

Notes: 1. Standard errors within brackets are based on White's adjustment for heteroskedasticity. 2. *, ** and *** denote significance at the 10%, 5% and 1% level, respectively. 3. # denotes significance at the 11% level. 4. Industry and region dummies are all included in the estimation. Intercept and coefficients on dummy variables are not reported.