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How Does the Productivity of Foreign Direct Investment Spill over to Local Firms in Chinese Manufacturing?

By

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Abstract

We use a firm-level dataset for Chinese manufacturing, to estimate productivity spillovers from foreign direct investment (FDI) to local firms. The spillover channels considered include inter-firm labour turnover/mobility; vertical input-output linkages; exporting externalities; and horizontal effects. The roles of these channels are dependent on various factors including export propensity, R&D expenditure per capita, employee training, and ownership structure. We find that export of MNEs is the most prominent spillover channel. Labour turnover and horizontal demonstration and competition bring positive spillovers to SOEs but not to local private firms. Vertical linkages are not found to be significant.

JEL Classifications: O33, F23, J63, L14, F14

Keywords: productivity spillover, foreign direct investment (FDI), labour mobility/turnover, linkages, export

Outline

Non-technical Summary

FDI plays an increasingly significant role in the global economic system. During the three decades of "reform and opening-up" policy implementation, China has become an attractive FDI destination because of its enormous labour supply and low labour cost, stable political and economic environment, and pro-FDI policies. As a result, FDI inflows to China increased dramatically from US$0.9 billion in 1983 to US$74.8 billion in 2007. Since 1993, China has been the largest FDI recipient among the developing countries.

Productivity spillovers are arguably one of the most important benefits of FDI. Productivity spillovers are economic externalities which the presence of FDI brings to the host country's domestic firms. These spillovers can take place through four broad channels, namely, inter-firm mobility of workers and managers; industry input-output linkages, exports by multinational affiliates, and horizontal effects.

There have been some firm-level studies on FDI productivity spillovers in the Chinese economy. However none of these studies has integrated all four spillover channels into a single empirical model. Given the extraordinarily high export propensity of foreign invested enterprises (FIEs) in China, their exports are potentially an important source of spillovers, yet this channel has been generally underestimated in the literature. Similarly a lack of data availability means inter-ownership labour turnover has not been investigated.

We use a dataset derived from a sample of 998 Chinese firms in five manufacturing industries. This dataset has the advantage of including information on whether workers had previously been employed in foreign-owned firms, which allows us to investigate all four spillover channels in a single regression equation. We are particularly interested in how labour transfer between foreign invested firms and local firms affects the productivity of local firms which employ foreign-trained workers.

Our results indicate that the absorptive capacity of local firms is important in determining the extent to which spillovers are effective in raising their productivity. Exports by MNE affiliates have positive spillovers for all local firms that export. Labour transfers and foreign firm presence in an industry (horizontal effects) also generate spillovers, but only to State-owned firms. Backward and forward linkages do not appear to generate spillovers.

1. Introduction

FDI plays an increasingly significant role in the global economic system. During the three decades of “reform and opening-up” policy implementation, China has become an attractive FDI destination because of its enormous labour supply and low labour cost, stable political and economic environment, and pro-FDI policies. As a result, FDI inflows to China increased dramatically from US$0.9 billion in 1983 to US$74.8 billion in 2007. Since 1993, China has been the largest FDI recipient among the developing countries.

Productivity spillovers are arguably one of the most important benefits of FDI. Productivity spillovers are economic externalities which the presence of FDI brings to the host country’s domestic firms. These spillovers can take place through four broad channels, namely, inter-firm mobility of workers and managers; industry input-output linkages, exports by multinational affiliates, and horizontal effects. There has been a rich emerging literature, both theoretical and empirical, on these FDI productivity spillover channels since the 1990s. The empirical results show that the effectiveness of the different spillover channels also depend on various properties of the potential local recipients, such as their export propensity, research and development expenditure, geographic proximity to foreign firms, and employee training. The sources of FDI are also found to have an impact on spillover effects. This literature indicates that FDI productivity spillovers are complex phenomena, whose investigation requires detailed firm-level data.

There have been some firm-level studies on FDI productivity spillovers in the Chinese economy, and these are reviewed in the next section. However none of these studies has integrated all four spillover channels into a single empirical model. Given the extraordinarily high export propensity of foreign invested enterprises (FIEs) in China, their exports are potentially an important source of spillovers, yet this channel has been generally underestimated in the literature. Similarly a lack of data availability means inter-ownership

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The remainder of the paper is organized as follows: the next section outlines the channels of FDI spillovers. The factor governing FDI productivity spillovers are discussed in Section 3. Section 4 discusses the methodology employed for the research. Variables and data used are also addressed. Section 5 presents the empirical results. Section 6 concludes.

2. Channels of Productivity Spillover from FDI

In this section we review the theoretical and empirical literature on the channels through which productivity may spillover from foreign affiliates to local firms.

2.1 Labour mobility

Productivity spillovers could take place when workers or managers in foreign-invested firms move to domestic firms or set up their own enterprises. In this process, the workers or managers will apply their knowledge legally acquired while working for multinationals in

their new domestic firm and exert a positive impact on its productivity. Fosfuri *et al* (2001) construct a two period model where a multinational trains a local worker to run its subsidiary in the first period, then in the second period the multinational and a local firm compete to employ the trained worker. Only if the MNE pays a higher wage can it stop the worker from moving to the local firm. Regardless of whether the worker moves to the local firm, the domestic economy can always benefit from the FDI presence. When the informed worker is hired by the local firm, a *technological* spillover takes place, while if the informed worker is retained by the multinational subsidiary at a higher wage, then a *pecuniary* benefit arises. These technological spillover and pecuniary benefits are echoed by Glass and Saggi (2002) who build a model with multiple host and source firms.

Markusen and Trofimenko (2008) situate the issue of FDI productivity spillover via labour mobility in a general equilibrium (rather than partial equilibrium) framework. When the analysis is applied to Colombian firm-level data, the paper confirms that the inter-ownership mobility of workers with skills acquired from contacts with foreign experts have substantial and persistent positive effects (though not always immediate) on the value added per worker of domestic firms.

Görg and Strobl (2005) investigate FDI spillovers through the channel of labour mobility using detailed firm-level data for a sample of manufacturing firms in Ghana. Specifically, the authors have data on whether the entrepreneurs of the domestic firms in the sample have worked for a foreign multinational or have taken professional training in an MNE before they joined or established their current companies. They control for the underlying capability of entrepreneurs, using years of schooling and previous experience in the same industry. This avoids potential ambiguity in the causality between the productivity of the firms and the labour mobility: firstly, foreign firms might hire or provide training to more skilled workers as they already demonstrate a stronger capability, possibly through higher education;

secondly, better domestic firms may attract better workers and managers. The econometric analysis shows that the FDI spillovers via labour mobility are significant and industry-specific.

2.2 Vertical input-output linkages

MNEs affiliates may help upstream and downstream domestic firms to set up production facilities, and provide them with technical assistance and training in management and organization. (Girma and Gong, 2008a, Girma et al., 2008, Javorcik, 2004, Markusen and Venables, 1999). Vertical input-output linkages include backward linkages and forward linkages as illustrated in Figure 1.

[Figure 1 about here]

Backward linkages result in backward feedback from multinational affiliates in downstream sectors to upstream indigenous firms. Sourcing locally can effectively reduce the production cost of multinational affiliates and thus is a natural choice for them. This can trigger competition among upstream domestic firms. Moreover, multinationals usually set high technical standards for their intermediate inputs and it is likely that downstream foreign firms need to transfer necessary techniques to the upstream domestic firms (Javorcik, 2004), improving the latter's technological capacity in the process. Thus the competition effect and high standards together with the knowledge transfer, all as a result of *backward linkages*, act as a channel of FDI productivity spillover.

Forward linkages promote the forward transfer of knowledge from multinational affiliates in upstream sectors to downstream indigenous firms. Domestic firms can improve their productivity via forward linkage in two ways. First by purchasing high-quality

intermediate products from multinational firms, domestic firms can improve their efficiency. Similar spillover effects via forward linkages in international trade have been widely acknowledged in the literature (Falvey et al., 2004, Keller, 2004). Second, in becoming a product distributor of a multinational firm, a domestic company often has to make a series of improvements, *e.g.* employee training, to meet the standards to be a retailer for the multinational.

Markusen and Venables (1999) develop a model with two imperfectly competitive industries which are linked by an input-output relationship. It is assumed that foreign investment takes place in the final goods sector, thus creating backward linkages to intermediate goods suppliers in the upstream sector. Multinational firms can help domestic firms in upstream sectors improve productivity via backward linkages. Domestic firms in downstream sectors can then also benefit from the improved intermediate products supplied by domestic suppliers. This benefit can *outweigh* the competition effect which multinational firms impose on domestic firms in downstream sectors, therefore leading to the development of local industry.

2.3 Exports of MNE affiliates

To export involves sunk costs incurred for market research, advertisement, distribution networks etc., which might deter entry. Trade models with heterogeneous firms predict, and evidence from firm level data sets confirm, that entry into exporting is a *self-selection* process in which more productive firms become exporters while less productive firms serve domestic markets only (Melitz, 2003, Clerides et al., 1998). But even when some domestic firms are *productive enough* to enter export markets, they may lack information of overseas markets and foreign consumers may be unfamiliar with Chinese products. As large multinationals have well established international trade networks and have extensive knowledge of

international markets, their presence can help lower information barriers facing domestic firms and help acquaint foreign consumers with Chinese products (Aitken et al., 1997, Greenaway and Kneller, 2008).

For domestic export candidates which are not currently productive enough to find exporting profitable, the success of multinational firms in international markets can stimulate domestic candidates to emulate them (Alvarez and López, 2005). To achieve this goal, they have to improve their productivity and product quality to meet international standards.

There is little evidence of exporting itself improving firm productivity in developed countries (e.g. Greenaway and Kneller, 2004, Greenaway and Kneller, 2007). However this does not necessarily imply that such productivity improvements may not occur in *emerging* markets, such as China. FDI from the East Asian economies have transferred their labour-intensive, export-oriented assembly centres to the coastal provinces in China (Deng et al., 2007), and the export of foreign-invested firms accounts for more than 50% of national total export volume in the last ten years. During 1980-2006, the commodity export volume of China has increased dramatically (53.5 fold), while in the same period, the commodity export volumes of the U.K. and U.S. have only increased by 3.9 fold and 4.7 fold, respectively.[*]

2.4 Horizontal effects: demonstration, competition, and resource reallocation

Demonstration is probably the "most evident" spillover channel (Crespo and Fontoura, 2007, pp. 411), especially in transition economies such as China which are transforming from a central-planning economy, dominated by SOEs, into a market economy with a variety of ownerships in a short time span. Foreign-invested firms with technological and managerial advantages open a fresh "window" of high productivity, and showcase their superior practices in production, management, and services to their indigenous counterparts. Domestic firms

[*] Authors' calculations based on data from United Nations Commodity Trade Statistics.

can thus imitate the production of foreign firms through “reverse engineering” (Das, 1987).

Increased competition in a host economy created by the entry of MNEs constrains the market power of monopolistic domestic firms, forcing them to make a more efficient use of existing resources.

Resource reallocation is a channel via which FDI presence can help the host economy relocate resources towards the most productive firms and increase industry-level and national productivity. The entry of foreign firms can intensify the competition for labour resources in host countries. Even for large transition economies with a huge hidden surplus labour supply like China (Fu and Balasubramanyam, 2005), the price of non-skilled labour in export-intensive sectors will inevitably rise (Ceglowski and Golub, 2007) due to the factor price convergence effect of international trade (Falvey and Kreickemeier, 2005). The rising labour cost will make the least productive domestic firms unprofitable and drive them out of market. Then resources will be relocated to more productive firms, allowing them to increase in production scale. Therefore the industry-level and aggregate-level productivity can be raised. This resource reallocation effect driven by FDI is consistent with that effect driven by trade which is modelled by Melitz (2003). This spillover via resource reallocation does *not* necessarily improve the productivity of any individual firm. But it helps explain why industry-level econometric analyses of FDI productivity spillovers tend to generate significantly positive results.

3. Factors Governing Productivity Spillovers from FDI in China

The potential for the foreign capital inflow attracted by preferential FDI policies, low labour cost, and improved infrastructure to bring positive productivity spillovers to Chinese indigenous enterprises has been strengthened by the following factors:

(1) *Freer labour market*. During the process of marketisation, the Chinese government

abandoned the life-long employment system, lowered the barriers between rural and urban areas, and gradually constructed a freer labour market (Knight and Yueh, 2004). A variety of "new" ownerships emerged, *e.g.* foreign-invested firms and private firms, which ended the dominance of state-owned enterprises. Employees are free to leave FIEs and set up their own private firms using the management techniques they have acquired during their work experience.

(2) *Stronger linkages with FIEs*. Upstream domestic enterprises have developed quickly in the past three decades and their product quality has improved. So FIEs in China are more willing to source *locally* from those qualified domestic firms, creating the opportunity for productivity spillovers via input-output linkages (Long, 2005, Farrell et al., 2004).

(3) *Learning to export by observation*. The striking export performance of FIEs provided examples for domestic firms to learn to enter overseas markets. They have also familiarised the world with Chinese exports. Both can effectively lower the entry cost of domestic firms' exportation. (Kneller and Pisu, 2007)

(4) *Increased but moderate competition*. The competition caused by the increased foreign presence has stimulated domestic firms to improve their productivity and performance. At the same time, the competition in most industries is not so fierce as to force a mass exit of domestic firms. The Chinese domestic market is growing sufficently fast that domestic firms have the opportunity to find their own niche (Long, 2005).

However FDI productivity spillovers are neither free nor automatic. In fact, there have been debates over whether spillovers really occur, and if so, their magnitude. The following factors influence the size of the spillovers:

(1) *Low absorptive capacity.* For domestic enterprises with low absorptive capacity due to a lack of R&D activity or the absence of employee skills, the foreign presence could lead to no spillovers at all (Buckley et al., 2002, Girma and Gong, 2008a, Girma and Gong,

2008b). Many less qualified domestic firms are forced to exit even before starting to absorb spillover benefits.

(2) *Limited scope of spillovers*. Evidence shows that firms in Chinese cities take advantage of FDI spillovers not only from local FDI inflows, but also from FDI inflows to *adjacent* cities (Madariaga and Poncet, 2007). However, due to the inter-*regional* trade barriers imposed by local governments, the inter-regional linkages are restricted (Young, 2000). Given that by the end of 2006 85% of the accumulated FDI flowed to 11 eastern and costal provinces, little inter-regional spillover from FDI will be received by the other 20 technologically backward inland provinces which host 61% of China's population and contribute 40% of total GDP (Girma and Gong, 2008b).

(3) *Different FIE technology intensity*. FDI to China can be differentiated by technology intensity, with less technology-intensive FDI from Hong Kong, Macau and Taiwan (*HMT*), and more technology-intensive FDI from the rest of world, especially from Europe and North America (Buckley et al., 2007). These two types of FDI generate different productivity spillover effects. The enterprises invested by FDI from *HMT* tend to engage in labour-intensive manufacturing with standardised rather than state-of-the-art technologies. Empirical studies show that the spillover of *HMT* FDI falls beyond a certain critical point of foreign presence due to the competition with domestic enterprises for limited resources (Buckley et al., 2007).

(4) *Short-term learning costs*. Facilitating spillovers is not free for numerous reasons. First, domestic firms need to pay a higher salary to attract employees with experience in FIEs. Second, domestic enterprises need to make additional investments to improve their product standards in order to become qualified candidate suppliers of FIEs (Wang and Blomström, 1992). Third, after observing the success of FIE's export, domestic firms also need to undertake costly overseas market investigation in preparing for exportation. Given these costs,

the perceived effect of spillovers over a short time span is often negative, although we observe a positive effect on long-term productivity growth (Liu, 2008).

(5) *Labour turnover and "reverse spillover"*. To survive in an emerging market like China, FIEs have to recruit local employees who are familiar with the cultural and political environment, and the idiosyncratic business practices in China. With a competitive salary package and attractive work environment, FIEs can easily "cherry-pick" experienced managers and salesmen from SOEs and other domestic firms. Evidence shows that SOEs with little care for the human capital development of their employees (*i.e.* no labour training expenditure) face a high possibility of losing talent and incurring negative spillovers (Girma and Gong, 2008a).

(6) *Indigenous technological capability suppressed*. Technological transfer through FDI may substitute for domestic technologies in production (Fan and Hu, 2007), and thus discourage indigenous R&D activities (Long, 2005). For example, in 1985 when Volkswagen established a joint venture with Shanghai Automobile, it introduced an outdated model *Santana* into the Chinese automobile market, and this model continued to be produced with little improvement for 20 years. At the same time the cars produced based on indigenous intellectual property struggled for a small market share (22% in 2007).

In brief, the roles of spillover channels are heavily dependent on a range of factors, and when investigating how FDI productivity spillovers occur, it is important to take these factors into consideration where possible.

4. Methodology and Data

4.1 Methodology

The roles of different channels in FDI spillovers are compared in a single equation which regresses the total factor productivity (TFP) of domestic firms against spillover channel

variables, controlling for a number of other covariates. To do this, we proceed in two steps. First, we estimate firm TFP in a standard fashion by regressing firm value added (VA) on capital (K) and labour (L) inputs:

$$\ln VA_i = \alpha_0 + \alpha_1 \ln K_i + \alpha_2 \ln L_i + \varepsilon \quad (1)$$

where K is the book value of fixed assets, and L is measured in three alternative ways, to allow for the human capital embodied in the workforce - total employment, employment weighted by workers' schooling years, and employment weighted by the economy-wide average wage for each type of employment ($\sum_i employment_i \times wage_i$).

Second, the total factor productivities obtained (*i.e.* $\ln(TFP_i) = \alpha_0 + \varepsilon$) will be regressed against spillover channel variables and other control variables:

$$\ln TFP_i = \beta_0 + \beta_1 \boldsymbol{SPILL}_i + \beta_2 \boldsymbol{SPILL}_i * \boldsymbol{F}_i + \beta_3 \boldsymbol{F}_i + \beta_4 \boldsymbol{D}_j + \varsigma \quad (2)$$

where i and j index domestic firms and sectors, respectively. Vector $\boldsymbol{D}_j$ denotes industry dummy variables, vector $\boldsymbol{SPILL}_i$ denotes the spillover channel variables, and $\boldsymbol{F}_i$ is a vector of firm characteristics. Specifically the independent variables that we use are:

(1) Labour turnover LT_i is the share of employees with work experience in foreign invested companies in total firm employment.

(2) Horizontal demonstration $HZDS_j$ is the share of foreign-invested firms in industry output. As the literature suggests,, it is likely that this spillover effect will depend on the absorptive capacity of local firms. We therefore interact it with firm-level R&D expenditure RND_i.

(3) Export concentration $EXCO_j$ denotes the proportion of foreign-invested firms' exports in total industry exports. While both exporting and non-exporting local firms can benefit through spillovers from the exports of MNEs, as discussed in Section 2, it is expected that local exporters will benefit more. We therefore interact $EXCO_j$ with the firm's export

propensity $EXPP_i$, *i.e.* the proportion of exports in a firm's total sales.

(4) Backward linkages BL_j and forward linkages FL_j. These variables are intended to capture local firm interactions with FIEs as purchasers and suppliers. The specifications of these two variables are similar to those of Javorcik (2004):

$$BL_j = \sum_k \alpha_{j,k} * HZDS_k$$

$$FL_j = \sum_k \beta_{k,j} * HZDS_k$$

where $\alpha_{j,k}$ and $\beta_{k,j}$ are input-output coefficients taken from the *Input-Output Table of China, 2002* (National Bureau of Statistics of China, 2006). $\alpha_{j,k}$ is the proportion of sector *j*'s output supplied to sector *k*, with $\sum_k \alpha_{j,k} = 1$; $\beta_{k,j}$ is the proportion of sector *k*'s output supplied to sector *j*, with $\sum_k \beta_{k,j} = 1$. We interact BL_j and FL_j with the average training per employee (TRN_i) to capture the potential importance of training in FDI spillovers via vertical linkages. Foreign-invested firms provide technical support and tutorials for their local upstream suppliers and downstream users or distributors, and subsequently these local firms need to train their employees to utilise this information. Thus the resources which local firms put into training is likely to determine the extent to which these spillovers are absorbed .

4.2 Data

Our firm-level data are derived from a survey conducted by Asia Market Intelligence. The database contains detailed information of 998 manufacturing firms in 2000. These firms are randomly selected from five manufacturing sectors in China, namely apparel and leather goods, consumer products, electronic components, electronic equipments, and vehicles. They are located in five super-sized cities in China – the capital (Beijing), the municipalities in the fast-growing eastern coastal provinces (Shanghai, Tianjin and Guangzhou) and the western

region (Chengdu). These cities are among the top cities in attracting FDI (Madariaga and Poncet, 2007).

The ownership composition of these 998 firms is given by Table 1. Firms in the database can be categorised into foreign-invested firms (FIEs) (those with at least 25% of the equity invested by foreign institutions or individuals), state-owned enterprises (SOEs) with the government as their largest shareholder, and private firms (Private) which are purely invested by domestic private capital. FIEs, SOEs, and Private firms account for 18.2%, 19.4% and 62.3% of the total number of firms, respectively. The percentage of workers with work experience in FIEs is very low, averaging 0.2%. The export propensity of each ownership class is given by Table 2. As can be seen, the average export propensity of FIEs is the highest, while that of SOEs is the lowest. The composition of average employees by work type and by technical qualifications is shown in Table 3. As we can see, the average employment of SOEs is largest, while that of private firms is smallest. FIEs and SOEs have equivalent shares of workers with technical qualifications (about 18%), while this figure for the private firms is only 15.3%.

[Tables 1, 2 and 3 about here]

5. Empirical Results

5.1 Productivity comparison between ownerships

The TFP of firms are estimated using equation (1) and the results for firms in different ownership classes are compared in Table 4. Regardless of how the labour input is measured, it is clear that in this dataset, FIEs are generally more productive than SOEs while private firms are the least productive firms. This productivity hierarchy indicates that SOEs and Private firms may differ in their absorptive capacity, which may affect their ability to take

advantage of potential productivity spillovers from FIEs (Girma, 2005).

[Table 4 about here]

5.2 FDI productivity spillovers

With the TFP obtained from the previous estimations, we can then employ equation (2) to examine the roles of different spillover channels. The results are presented in Table 5, and lead to the following conclusions. First, the broad picture of the firm results is consistent across the different measures of labour input. The signs are the same, though statistical significance can vary. Second, the export of MNEs has a significantly positive spillover effect on all domestic firms. Third, backward and forward linkages do not appear to be significant spillover channels. Fourth, while labour transfer generally has a significant negative impact on local firms combined, when they are separated into their component classes we find that labour transfer has a significant positive impact on the productivity of SOEs. When considered along with the productivity hierarchy shown in Table 4, this suggests that more productive firms (SOEs on average in this case) are in a better position to take advantage of the knowledge embodied in the transferred workers. The negative impact of labour transfer on private local firms might be explained by fact that those employees with foreign work experience are more expensive to be recruited; but do not bring the expected benefits due to these firms' low absorptive capacity. Finally, similar arguments apply to the horizontal demonstration (*HZDS*) which generally has negative impact on local firms, but has a significant positive impact on the productivity of SOEs, This implies that the SOEs in this sample not only effectively combat the competition posed by MNEs in the same industry but also absorb the productivity spillover from MNEs. Private firms are less successful.

[Tables 5 and 6 about here]

Finally, we perform a robustness check on our labour transfer results by retaining labour turnover as the only spillover channel, and adding other firm related control variables *e.g.* employee training, and R&D expenditure. The results are shown in Table 6. Again, we find that spillovers via labour transfer are generally negative, but that the state-owned enterprises have gained positive benefits from recruiting those people with work experience in multinational firms. Similar results arise when we restrict attention to firms in electronic component and product industries, which have the highest proportions of previously foreign employed workers.

Our support for spillovers that favour SOEs differs from the previous empirical literature which largely finds that SOEs are negatively affected by FDI presence (e.g. Girma and Gong (2008a)).The main reason for this difference probably lies in sample selection. The SOEs in this sample are located in five mega cities in China, have large scale (see Table 3) and relatively high TFP (see Table 4). However, the clear message from this research, is that only those domestic firms with higher productivity and better absorptive capacity are likely to benefit from FDI productivity spillovers.

6. Conclusions

This paper is the first to encapsulate *all* potentially important spillover channels into a single micro-econometric model with firm-level data. These channels include inter-ownership labour turnover, vertical input-output linkages, export of MNEs, and horizontal effects. Our results suggest the following. First, the extent to which spillover channels can play their role does depend on local firm characteristics, particularly R&D expenditure per capita and export status. Second, export spillovers from MNEs seem to have a particularly important role in

China, perhaps reflecting the extraordinarily high export propensity of MNEs. Third, labour turnover transmits positive productivity spillover to SOEs but not to private firms, reflecting the greater capability of SOEs to absorb FDI productivity spillover. Fourth, horizontal demonstration and competition also bring SOEs positive spillover effects for similar reasons.

In brief, more productive enterprises (SOEs in this study) are more likely to benefit from spillovers due to the presence of foreign investment. The main policy message of this paper is therefore that policy makers need to be aware that the "swapping market access for technology" strategy (Long, 2005) does not lead to success automatically. Measures should to be taken to encourage all domestic firms to increase their absorptive capacity.

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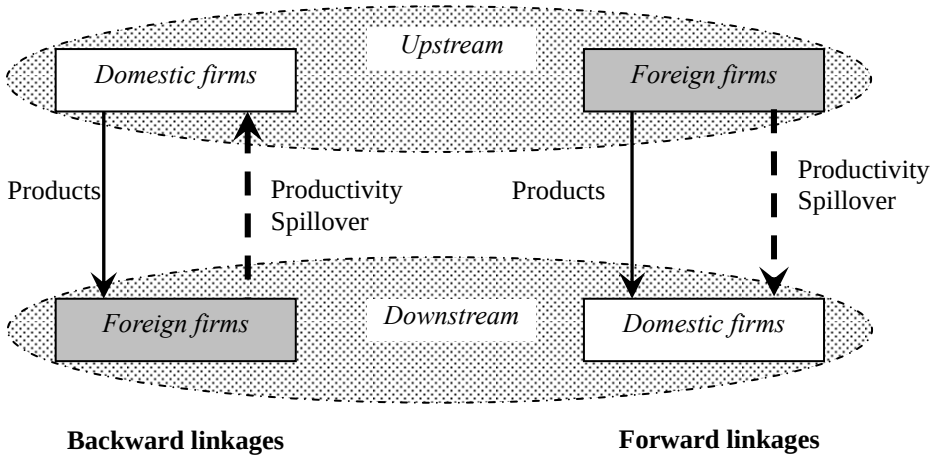
Figure

Figure 1: Backward and Forward Linkages as Spillover Channels



Tables

Table 1: Ownership Information

Industries	Total No. of firms	No. of FIEs	No. of SOEs	No. of Private	% of workers in local firms with foreign experience
Apparel and leather goods	222	21	50	151	0.1%
Consumer products	165	21	18	126	0.1%
Electronic components	203	48	37	118	0.2%
Electronic equipment	192	44	39	109	0.6%
Vehicles and vehicle parts	216	48	50	118	0.1%
Total	**998**	**182**	**194**	**622**	**0.2%**

Source: Asia Market Intelligence.

Table 2: Export Propensity (%)

Industries	FIEs	SOEs	Private
Apparel and leather goods	58.2	24.5	38.8
Consumer products	30.4	1.0	13.1
Electronic components	56.5	8.7	35.4
Electronic equipment	36.7	6.6	15.2
Vehicles and vehicle parts	19.1	3.6	11.0
Average	**39.1**	**10.3**	**23.5**

Source: Same as Table 1.

Table 3: Average Composition of Employees

	FIEs		SOEs		Private	
	Number	%	Number	%	Number	%
Classified by work type						
Basic production workers	414	58.0	336	36.6	287	53.7
Auxiliary production workers	73	10.2	93	10.1	60	11.2
Engineering and technical personnel	77	10.8	76	8.3	47	8.8
Managerial personnel	88	12.3	96	10.4	67	12.5
Service personnel	37	5.2	47	5.1	20	3.7
Other employees	25	3.5	119	12.9	42	7.9
Classified by technical titles						
Advanced technical titles	8	1.1	14	1.5	8	1.5
Intermediate technical titles	40	5.6	62	6.7	29	5.4
Preliminary technical titles	79	11.1	90	9.8	45	8.4
Total	**714**	**100**	**919**	**100**	**534**	**100**

Note: Some employees were double counted into two or three categories in the survey.

Table 4: A Comparison of Natural Logarithm of TFP

	Firm numbers	All five sectors (pooled)		
		L	***HC***	***HW***
FIEs	182	**2.91**	**2.41**	**1.85**
		(3.00)	**(2.95)**	**(3.03)**
SOEs	194	2.59	1.96	1.56
		(2.21)	(2.23)	(2.49)
Private	622	2.47	1.80	1.42
		(2.51)	(2.53)	(2.75)

Notes: (a) Estimation specification is equation (1). (b) "*L*" means the TFP data are estimated with data of capital and labour input; "*HC*" means the TFP data are estimated with data of capital and human capital (calculated using schooling years); "*HW*" means the TFP data are estimated with data of capital and human capital (calculated using economy-wide wages); (c) Standard deviations in parentheses.

Table 5: Channels of FDI Productivity Spillover

	(2-1)	(2-2)	(2-3)	(2-4)	(2-5)	(2-6)
	L	***HC***	***HW***	***L***	***HC***	***HW***
Constant	**2.1**	1.3	1.3	**2.1**	1.23	1.3
	(0.45)*	(0.45)	(0.45)	**(0.45)****	(0.45)	(0.45)
$LT_{d,j}$	**-6.5**	**-6.8**	**-7.0**	**-7.9**	**-8.2**	**-8.3**
	(3.76)*	**(3.76)***	**(3.74)***	**(3.86)****	**(3.87)****	**(3.84)****
*LT*SOE*				**26.0**	**25.7**	24.4
				(15.66)*	**(15.67)***	(15.59)
BL TRN*	0.1	0.1	0.1	0.1	0.1	0.1
	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)
FL TRN*	0.0	0.0	0.0	0.0	0.0	0.0
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
*HZDS*RND*	**-0.0**	**-0.0**	**-0.0**	**-0.0**	**-0.0**	**-0.0**
	(0.00)**	**(0.00)*****	**(0.00)*****	**(0.00)*****	**(0.00)*****	**(0.00)*****
*HZDS*RND*SOE*				**0.0**	**0.0**	**0.0**
				(0.01)*	**(0.01)***	**(0.01)***
*EXCO*EXPP*	**0.6**	**0.6**	**0.73**	**0.60**	**0.63**	**0.78**
	(0.33)*	**(0.33)***	**(0.33)****	**(0.33)***	**(0.33)***	**(0.33)****
Observations	741	727	730	741	727	730
R squared	0.02	0.03	0.03	0.03	0.03	0.03

Notes: (a) Only local firms are included; (b) The dependent variable is the logarithm of total factor productivity, log($TFP_{i,j}$), which is estimated using equation (1); (c) "*L*" means the TFP data are estimated with data of capital and labour input; "*HC*" means the TFP data are estimated with data of capital and human capital (calculated using schooling years); "*HW*" means the TFP data are estimated with data of capital and human capital (calculated using economy-wide wages); (d) *SOE* is a dummy variable which is equal to 1 if the corresponding firm is an SOE, and 0 otherwise; (e) Standard errors in parentheses. *Statistically significant at 10%; **significant at 5%; ***significant at 1%; (f) each regression includes industry dummies.

Table 6: FDI Productivity Spillover via Labour Turnover

	All five sectors (pooled)			**Electronic industry only**		
	(2-7)	**(2-8)**	**(2-9)**	**(2-10)**	**(2-11)**	**(2-12)**
	L	***HC***	***HW***	***L***	***HC***	***HW***
Constant	3.1	2.3	1.8	2.8	1.4	0.6
	(0.11)***	(0.11)***	(0.12)***	(0.14)***	(0.14)***	(0.14)***
$LT_{d,j}$	**-28.7**	**-33.3**	**-36.2**	**-27.9**	**-27.7**	**-28.8**
	(8.85)* **	**(9.24)*** **	**(9.52)*** **	**(8.70)*** **	**(8.73)*** **	**(8.74)*** **
$TRN_{d,j}$	0.0	-0.1	-0.2	0.0	-0.0	-0.0
	(0.10)	(0.10)	(0.10)*	(0.12)	(0.11)	(0.11)
$RND_{d,j}$	-0.0	-0.0	-0.0	0.0	0.0	-0.0
	(0.00)**	(0.00)**	(0.00)**	(0.00)	(0.00)	(0.00)
$LT_{d,j}$ *SOE	**93.5**	**89.8**	**87.2**	**180.8**	**177.7**	**170.7**
	(42.76) **	**(44.65)** **	**(45.95)* **	**(51.66)*** **	**(51.85)*** **	**(51.90)*** **
$TRN_{d,j}$*SOE	0.0	0.2	0.2	0.0	0.1	0.1
	(0.11)	(0.12)	(0.12)*	(0.12)	(0.12)	(0.12)
$RND_{d,j}$*SOE	0.0	0.0	0.0	0.0	0.0	0.0
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Observations	743	732	732	409	401	402
R squared	0.03	0.03	0.04	0.05	0.05	0.05

Notes: same as Table 5.