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FDI Spillovers in China

Connecting the Missing Link between Micro and Macro

by

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Abstract

Using a panel of 20,460 Chinese manufacturing firms over the period 2001-2005, we apply both parametric and non-parametric estimation techniques to examine the underlying relationship between the economic development of the host province and FDI spillovers. We find that provincial economic development does not systematically influence FDI spillovers. Moreover, there exists considerable heterogeneity in the FDI spillovers not only across the 29 provinces, municipalities and autonomous regions but also across the 10 manufacturing sectors within each of the 29 provinces, municipalities and autonomous regions. This suggests that FDI spillovers in China may be affected by a combination of both the characteristics of the sector within a province and the characteristics of the province itself.

JEL classification: F23, O1, O33,

Keywords: FDI spillovers, economic development, heterogeneity, China

Outline

1. *Introduction*
2. *Related Literature*
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Non-Technical Summary

From a closed economy prior to 1978, the People's Republic of China has consistently and continuously designed policies such as lowering income taxes, income tax holidays, import duty exemptions, etc, to attract more FDI (foreign firms). The rationale for this often stems from the belief that, in addition to direct benefits of capital inflows and employment, FDI generates positive externalities in the form of productivity gains, technology transfer, and access to international markets. Yet empirical evidence remains ambiguous. Researchers have argued that this may either be due to the absence of appropriate datasets/analytical techniques or the limited knowledge on the determining factors of FDI spillovers.

In this study, we contribute to the literature by using advanced econometric methods to test whether and how the level of economic development of the host province affect the nature and extent of productivity spillovers from foreign to domestic firms. Without this evidence we would be uncertain about the influence of provincial economic development on FDI spillovers. On the one hand one might argue that domestic firms in the relatively low-income provinces such as Guangxi, Gansu in the western region, may be, on an average, further away from the technology frontier (indicating a large technology gap) giving them a greater scope for catch-up and competitive effects. But, on the other, at low levels of economic development, domestic firms may not be in a strong position to acquire the resources to either develop or intensify the development process of their technological capabilities. This may restrict the transfer of new knowledge from foreign firms. Moreover, a large technology gap may also discourage the inflow of technologically advanced foreign firms and hence lower the potential of FDI spillovers in the relatively low developed provinces.

To investigate this issue, we estimate a production function for 20,460 manufacturing Chinese domestic firms over the period 2001-2005. In addition to the standard capital and labour inputs, we also include the amount of FDI in the same sector and province as an additional input to production to see if the output of firms is higher or lower than it would be if there were no FDI inputs.

Our analysis yields some distinct conclusions. Provincial economic development does not systematically influence FDI spillovers, though there are positive spillovers from FDI in some provinces, on average, but not necessarily in all sectors in that province. The variation observed in FDI spillovers across the sectors within a province appears to be affected by a combination of both the characteristics of the sector within a province and the characteristics of the province itself. As a result, the average FDI spillover effect should be interpreted with caution. We need to know more precisely what the combination of factors is before we can fully understand the processes involved and their policy implications. Indeed, we show that there exists substantial variation in the FDI spillovers not only across the 29 provinces, municipalities and

autonomous regions of China but also across the 10 classified manufacturing sectors. For example, domestic productivity increases by 9% for every 10% increase in foreign presence in the transportation equipment sector in Jiangxi province. However, domestic firms in the remaining 9 sectors do not enjoy any significant spillover benefits from foreign presence in their sectors.

1 INTRODUCTION

The role of FDI in international technology transfer, including productivity spillovers from foreign to domestic firms, has been extensively discussed in the literature (see Caves, 1982; Helleiner, 1989 for surveys of FDI and technology transfer). In this discussion, many have argued that the contributions FDI can make are strongly dependent on several factors such as the motive of FDI, the nationality of FDI, absorptive capacity of the recipient countries, sectors, and firms, etc. However, empirical studies investigating the role of these factors in determining the existence, sign and magnitude of FDI spillovers either find inconsistent results or are still insufficient to draw unequivocal conclusions. Moreover, there could be other possible determinants of FDI spillovers that have not yet been identified in the growing literature.

In addition to the existing determinants of FDI spillovers, this article argues that local environmental (macro-economic) factors such as the economic development of the host province/region within a country, is also an important pre-condition for determining the nature and extent of productivity spillovers from foreign to domestic firms. However, there is ambiguity as to the expected influence of the economic development of the host province/region on the FDI spillovers. The rationale for this hypothesis stems from the belief that if the level of economic development of a province[1], measured in terms of GDP per capita, can influence the development process of domestic firm-level technological capabilities (Lall, 1982), then domestic firms in the low-income provinces may be, on an average, further away from the technology frontier (indicating a large technology gap) leaving a greater scope for catch-up and competitive effects (Findlay, 1978), *ceteris paribus*. But, on the contrary, a large technology gap may limit the flow of FDI to low quality levels and hence lower the potential of FDI productivity spillovers to domestic firms in the lower developed provinces (Glass and Saggi, 1998). Moreover, at low levels of economic development, domestic firms may not be in a better position to acquire the resources to either develop or fasten the development process of their technological capabilities thereby restricting or limiting the knowledge transfer from foreign firms, *ceteris paribus*. Nevertheless, provincial economic development may not systematically influence productivity spillovers from foreign firms and there may be other possible determinant(s) of the same.

To test whether and how the economic development of the host province/region influences the nature and extent of productivity spillovers from foreign to domestic firms, we use an unbalanced panel of 20,460 Chinese manufacturing firms operating in the entire economy over the period 2001-2005 and employ both parametric and non-parametric econometric methods. This may be particularly relevant in the case of China given the considerable provincial heterogeneity with respect to factor endowments, level of economic development, infrastructure and institutional quality that may influence the scope for catch-up and absorptive capacity.

We contribute to the existing growing literature on the determinants of FDI spillovers in four important ways. First, we provide evidence on whether and how economic development of the host province within China determines the nature and extent of FDI spillovers. Second, by employing both parametric and non-parametric estimation techniques, we provide a better understanding of the underlying relation between local environmental (macro-economic) factors and FDI spillovers at the micro firm level. Third, we establish that productivity spillovers from foreign firms significantly differ not only across the 29 province, municipalities and autonomous regions of China (which can easily be interpreted

[1] Although the level of economic development may encompass many dimensions such as human capital and institutional quality, this article explores the dimension which is more closely related to it, namely per capita income.

as an industrial composition effect) but also across the 10 manufacturing sectors within each of the 29 provinces, municipalities and autonomous regions. These contributions can assist policy decisions regarding (1) the location and type of FDI that should be attracted to a host province; (2) the potential externalities of FDI to the host province and industry; (3) changing economic and industrial composition of the host province.

Our analysis yields three distinct conclusions. Firstly, provincial economic development does not systematically influence FDI spillovers. Second, the heterogeneity observed in FDI spillovers across the sectors within a province may be affected by a combination of both the characteristics of the sector within a province and the characteristics of the province itself. Third, the average spillover affect should be interpreted with caution as it might be misleading for a diverse country like China. In this context, we show that there exists substantial FDI spillover heterogeneity not only across the 29 provinces, municipalities and autonomous of China but also across the 10 sectors within each of the 29 provinces, municipalities and autonomous regions. For example, domestic firms, on an average, in the Jiangxi province in the central region experience an increase in their productivity by 1.6% when the foreign presence in the same sector and province increase by 10%. However, in the Jiangxi province, it is only in the transportation equipment sector that the productivity of domestic firms is influenced by the presence of foreign firms, i.e. domestic productivity increases by 9% when foreign investment in the sector increases by 10%. For the remaining 9 sectors in the Jiangxi province, domestic firms do not enjoy any significant spillovers benefits from the presence of foreign firms in their sector.

In section 1, we begin with a general discussion on the determinants of FDI spillovers and extend the same in section 2 by providing a simple framework on whether and how the interaction between domestic and foreign firms evolves with the local environment in which both of them operate. Section 3 describes the Chinese dataset and estimation methodology used. Section 4 discusses the main empirical findings. Section 5 concludes with some policy recommendation and room for future research.

2 RELATED LITERATURE

The role of FDI in stimulating economic/productivity growth through technology transfer in the form of new production processes and techniques, managerial skills, ideas, and new varieties of capital goods, at both aggregate and detailed level, has received enormous attention in the literature. Yet, empirical evidence to support the same is far from conclusive (see Gorg and Greenaway (2004), Blomstrom and Kokko (1998) and Lipsey (2004) for a detail survey[2]).

Apart from the standard problems associated with the use of appropriate comprehensive data and statistical methodology, literature argues that these inconclusive results may be because of a multiplicity of factors associated with the characteristics of FDI, in addition to those of the host countries, sectors and firms, to name a few (Crespo and Fontoura, 2007; Hermes and Lensink, 2003).

For instance, some authors argue that FDI can stimulate economic growth when there is sufficient absorptive capacity in the host country (Borensztein et al., 1998; Balasubramanyam et al., 1996), sector (Kokko, 1994; Sjoholm, 1999)

[2]Most of the studies dealt in these surveys look at the productivity effects of FDI spillovers on firms or plants using micro level data.

and firm (Aitken and Harrison, 1999; Girma, 2003). For example, Borensztein et al. (1998) reveal that FDI and human capital are complementary in the process of technological diffusion and that spillovers from FDI is only possible when there is a certain minimum, or 'threshold' level of human capital available in the host country. Sjoholm (1999) show that the FDI spillovers are found in sectors with a high degree of competition as the degree of competition affects the choice of the technology that is transferred to the MNE's affiliates and, hence, the potential for spillovers. Aitken and Harrison (1999) show that the (negative) spillovers are double or triple in size for small plants when compared to the large plants as small enterprises cannot compete as effectively with foreign entrants as their large domestic counterparts.

Other authors argue that the process of FDI spillovers may be influenced by the national origin from which the FDI emanates as different sources of FDI can be associated to several factors, such as culture, language, levels of technology, modes of technology transfer, distance, and the sectoral structures of FDI, among other aspects (Crespo and Fontoura, 2007; Banga, 2003; Girma, 2008). For example, Banga (2003) finds that Japanese FDI is more likely to create spillovers for Indian domestic firms than US FDI. This is because of the difference in the levels of technologies and modes of transferring technologies between Japanese and US FDI in India.

Some authors stress that productivity spillovers from foreign firms have a circumscribed geographic dimension or, at least, that they decrease with distance (Audretsch, 1996). This is because the channels of technological diffusion are reinforced at the regional level (Crespo and Fontoura, 2007). For example, training of employees by MNEs and subsequent labour turnover is one of the main technologic transmission mechanisms (Fosfuri et al., 2001). In this case, if regional labour mobility is really low (Greenaway et al., 2002), then the expected likely benefits from MNEs will be experienced by local employers only. Similarly, demonstration effects may also be limited in space if firms closely observe and imitate other firms in the same region (Blomstrom and Kokko, 1998). Vertical linkages are mainly regionally confined as direct contacts with local suppliers and distributors may be local so as to minimise transport costs and facilitate communication between suppliers/distributors and the MNEs. Lastly, competition effect is also enhanced at a more circumscribed scale, both in its positive and negative dimensions. In the context of FDI literature, distinction is sometimes made between FDI in the same sector and region and total FDI at the regional level. For example, Harris and Robinson (2002) and Haskel et al. (2002) consider aggregate regional FDI and fail to establish any beneficial effect from total FDI activities in the region. Girma (2003) argues that the aggregate regional FDI captures general agglomeration effect rather than intra-industry spillovers. By contrast, Girma and Wakelin (2001) and Driffield (2000) consider FDI in the same sector and region and find that there are positive aggregate productivity spillovers from FDI in the same sector and region.

Very few authors stress that the process of technological diffusion from foreign firms may also be influenced by the local environmental (macro-economic) factors in which both the foreign and domestic firms operate. For example, Ponomareva (2000) and Yudaeva et al. (2003), Sgard (2001) and Jordan (2008) reveal that FDI spillovers depend on the educational level of the domestic labour force, the economic development level, and the economic reform progress of the host/province in which both the domestic and foreign firms operate. Meyer and Sinani (2009) argue that the host country's level of development in terms of income, institutional framework and human capital, influences FDI spillovers in a curvilinear way, taking a U-shaped form[3].

[3]Findlay (1978) in his model assumes that the rate at which technology is diffused in the backward regions is also a function of many other environmental factors such as the educational level of domestic labour force, the market structure in which the foreign and domestic firms operate, the terms of royalties and licensing agreements, patent laws, and so on. This opinion was

3 FRAMEWORK

The previous discussion shows there may be several determining factors that may be important to promote productivity spillovers from foreign firms. Yet, we argue that one crucial determining factor has not received much attention in the literature, particularly in the case of China, that is, the role of external (macro-economic) factors such as the economic development level of the region/province in which both the foreign and domestic firms operate.

The importance of the external factors as a precondition for determining the nature and extent of productivity spillovers from foreign firms can be illustrated by a simple model which takes the form of a Cobb-Douglas production function where output (Y) for a domestic firm i at time t is given by:

$$Y_{it} = A_{it} \cdot L_{it}^{\alpha} \cdot K_{it}^{1-\alpha} \tag{1}$$

where $0 < \alpha < 1$, L and K are the conventional labour and capital inputs, and A is the index of knowledge (or the level of technology) available to the domestic firm.

The model assumes that productivity spillovers from foreign firms (or FDI) influence the output of domestic firms through A, the level of technology. Hence the expression of A_{it} is given by:

$$A_{it} = TFP_{it} = G(FDI) \tag{2}$$

The underlying idea is that foreign firms not only utilize advanced technological process but also a more efficient organizational structure which in turn increases the efficiency of their production process. However, such knowledge about productivity improvements, even though kept secret, gradually leaks out and eventually becomes a common knowledge in the market in which both domestic and foreign firms operate. Hence, the spillover assumption is reasonable as knowledge regarding the productivity improvements are not only limited to the receiving affiliate of the foreign firms, but are also likely to spill over to the domestic firms that come in contact with the affiliates of the foreign firms. However, these spillovers are not automatic and it may take place through (1) imitation and/or demonstration-domestic firms imitate new technologies of foreign firms (Das 1987; Wang and Blomstrom, 1992); (2) competition-entrance of foreign firms leads to pressure on domestic firms to adjust their activities and to introduce new technologies (Wang and Blomstrom, 1992); (3) vertical linkages-spillovers through transactions between foreign and domestic firms (Smarzynska, 2002); (4) movement of labour-trained domestic labour can either move from foreign firm to an existing domestic firm or start new firms (Fosfuri et al. 2001); and/or (5) exports-domestic firms might learn how to penetrate the exports market either through collaboration or more likely through imitation, (Aitken et al. 1997).

Nevertheless, the existence, sign and magnitude of productivity spillovers from foreign firms depends on the external (macro-economic) factors of the host province, such as the level of economic development of the host province, in which both the foreign and domestic firms operate. However, the fashion in which these external factors might influence the nature and extent of productivity spillovers from FDI remains ambiguous. The rationale for this hypothesis stems from the belief that if the economic development of a province, measured in terms of GDP per capita, can influence

also mirrored by Lall (1992) who states that external (macro-economic) forces can strongly influence the development process of firm-level technological capabilities.

the development process of domestic firm-level technological capabilities (Lall, 1982), then domestic firms in the low-income provinces may be, on an average, further away from the technology frontier (indicating a large technology gap) leaving a greater scope for catch-up and competitive effects (Findlay, 1978), *ceteris paribus*. Hence domestic firms in low-incomes provinces may enjoy greater productivity spillovers from foreign firms. On the contrary, a large technology gap may limit the flow of FDI to low quality levels and hence lower the potential of FDI spillovers to domestic firms in the lower developed provinces (Glass and Saggi, 1998). Moreover, at low levels of economic development, domestic firms may not be in a better position to acquire the resources to either develop or fasten the development process of their technological capabilities thereby restricting or limiting the knowledge transfer from foreign firms, *ceteris paribus*. Nevertheless, provincial economic development may not systematically influence FDI spillovers and there may be other possible determinant(s) of the same.

The model assumes that productivity spillovers from foreign firms not only have a circumscribed provincial range but are more pronounced within provincial industrial clusters in China, as shown, for example, in Hseih (2006) and Girma (2008). Moreover, it assumes the distinguishing spillovers from foreign firms that originate from HMT and other countries (non-HMT), as shown, for example, in Girma (2008), Wei and Liu (2006), Huang (2004) and Hu and Jefferson (2002).

Thus, in conclusion, FDI and the external (macro-economic) factors of the host region/province are complementary with respect to promoting the process of technological diffusion from foreign to domestic firms, thereby raising the productivity of domestic firms. This hypothesis can be tested empirically, which will be the focus of the next two sections.

4 DATA AND METHODOLOGY

The dataset employed in this paper is drawn from the annual accounting reports taken from the Oriana database compiled by Bureau Van Dijk. It covers over 20,000 manufacturing firms for the period 2001 to 2005. These firms consist of few small firms, where the annual revenue from sales is over Yuan 1 million, and many large firms, where the annual revenue from sales is over Yuan 5 million. In terms of value added, these manufacturing firms represent, on an average, approximately 35 percent of the total manufacturing output in China. In terms of employment, they represent approximately 18 percent of the total manufacturing employment in China.

The dataset contains information on value added, employment, input costs, foreign ownership, geographic location, establishment year, total tangible fixed assets, sectoral affiliation and exporting sales. Interestingly, the firm ownership variable provides information on the extent of foreign capital participation (distinguished between foreign investors from Hong Kong Macau and Taiwan, HMT, and other non-HMT foreign countries). Using this information on ownership, a firm is identified to be foreign owned if the foreign participation is at least 25 percent[4]. Since observations

[4]Apart from the co-operative joint venture where the proportion of capital to be contributed by each of the parties to the venture is stipulated in the contract and the wholly-foreign-owned enterprises where the entire capital is invested by foreign investor(s), the National Bureau of Statistics of China recognizes a lower threshold of 25 percent of the company's registered capital in case of limited liability corporations with foreign funds and, at least 25 percent of the registered capital of a joint venture in case of a Chinese-foreign equity joint venture, all of them are recognized as foreign-funded enterprises. Several authors in the literature such

refer to firm-years, firms are allowed to switch across ownership categories each year. Accordingly, 37-40 percent of firm-year observations are classified as foreign firms while the remaining is classified as domestic firms. Foreign firms are, on an average, larger in size in terms of value added and more productive in terms of value added per worker when compared to their domestic counterparts.[5]

The methodology for the empirical analysis in this article closely follows the FDI spillover literature. In particular, assuming the above model (1) to be linear in logs after substituting for A_{it} from equation (2), the regression analysis for the unbalanced panel of domestic firm i at time t is specified as follows:

$$log(Y_{it}) = \alpha log(L_{it}) + \gamma log(K_{it}) + \beta log(FDI_{pt/jpt}) + D_j + D_p + D_t + f_i + e_{it} \quad (3)$$

where real value added, number of employees and the real value of tangible fixed assets are used to measure log output Y_{it}, log labour L_{it}, and log capital K_{it}. The parameters α,γ on L_{it} and K_{it} measure the output elasticities of labour and capital respectively. To take into account the fact that FDI spillovers not only have a circumscribed geographic range but are also more pronounced within geographical industry clusters, the analysis focuses on aggregate provincial FDI (Province-FDI) and FDI in the same sector and province (Industry-Province-FDI).Province-FDI (FDI_{pt}) is defined as the amount of value added accounted for by foreign firms within a province. On the other hand, Industry-Province-FDI (FDI_{jpt}) is defined as the amount of value added accounted for by foreign firms in an industry in a province.To the extent that the productivity advantages of foreign firms spills over to domestic firms, the parameter β (which also measures the output elasticity of FDI) on $FDI_{pt/jpt}$ should be positive. To separate productivity spillover affects based on the ownership of FDI, $FDI_{pt/jpt}$ is further divided into $FDI\_HMT_{pt/jpt}$ (amount of value added accounted for by foreign firms that originate from Hong Kong, Macau and Taiwan) and $FDI\_OC_{pt/jpt}$ (amount of value added accounted for by foreign firms that originate from other countries, i.e. non-HMT). In addition, sectoral dummies D_j and provincial dummies D_p are included to control for time-invariant productivity differences across the ten manufacturing sectors (Aitken and Harrison, 1999) and 29 provinces, municipalities and autonomous regions of China. Firm dummies f_i are also included to control for unobserved time-invariant firm specific effect. Lastly, e_{it} denotes an idiosyncratic error term with iid (independently and identically distributed) properties.

To test whether or not host province's economic development systematically influence the nature and extent of productivity spillovers from foreign to domestic firms, we employ both parametric and non-parametric estimation techniques.

We believe that the estimation of specification (3) is less likely to suffer from reverse causality for two reasons. First, the focus of the study is to determine the nature and extent of technological spillovers from foreign to domestic firms in the same sector and province. For this purpose, the sample is limited to domestic firms only. Therefore, our analysis might be less subject to the reverse causality problem that occurs when comparing foreign and domestic firms where foreign firms may choose to invest in those sectors and/or provinces where domestic firms already perform better (Hale and Long, 2006). Second, Poncet et al. (2010) argues that when the dependent firm-specific variable (Y_{it} in our case) is regressed on variables defined at the aggregate level ($FDI_{pt/jpt}$ in our case), then reverse causality is not likely as it is unlikely that a firm shock translates into a change in the aggregate level variables.

as Wei and Liu (2006), Blake et al. (2009), also use 25 percent of equity capital invested by foreigners as the threshold to distinguish between foreign and domestic firms.

[5]Further information available on request.

5 RESULTS

Baseline Specification

The analysis starts by estimating the base equation(s), that is, the conditioning influence of host province's economic development on FDI spillovers is not yet taken into consideration in the regression models. The results of these estimations are presented in table 1 below where column 1 and 2 represents results for Province-FDI (scenario 1) and column 3 and 4 for Industry-Province-FDI (scenario 2).

For both scenarios, estimated coefficients on capital and labour are positive and statistically significant suggesting that both physical capital and labour force are important factors in the firm's production.

However, when the estimated coefficients on the FDI variable is taken into consideration, contrasting results are observed. The point estimates for the FDI variable in the 'Province-FDI' regression reported in column 1 is positive but statistically insignificant suggesting that the productivity of domestic firms is not affected by the presence of foreign firms in the same province[1]. These results are consistent with the findings reported by Harris and Robinson (2002) who, while estimating a Cobb-Douglas production function on the UK domestic firms for the period 1974-1995, also fails to establish any beneficial effect from aggregate regional FDI.

On the other hand, the point estimate for the FDI variable in the 'Industry-Province-FDI' regression reported in column 3 is positive and significant, although smaller in magnitude. The results imply that an increase of 10% in foreign investment in the same sector and province, increases domestic firms' productivity by 0.31%.[6] These results are consistent with the results reported by Hseih (2006) who, while estimating a Cobb-Douglas production function on all state and non-state Chinese manufacturing plants for the period 1998 to 2004, also finds little evidence that an increase in the share of foreign investment in the same sector and province, from 0 to 10 percent leads to an increase in the domestic productivity between 0.31 to 0.34 percentage points.

But when foreign firms are separated based on their ownership, it is seen that the coefficient estimates for FDI_HMT for both Province-FDI and Industry-Province-FDI in column 2 and 4 are statistically insignificant suggesting that there no domestic productivity gain associated with the presence of FDI coming from HMT. These results are fairly intuitive given that majority of FDI coming from HMT is subject to the round-tripping problem (Wei and Balasubramanyam, 2004). Nevertheless, previous econometric studies such as Girma and Gong (2008) also provide support to the fact that foreign investments coming from HMT do not benefit domestic firms in the same sector and region. When the estimated coefficient on FDI_OC is taken into consideration, it is seen that although the estimates are consistent in terms of sign and significance across both the scenario, they are observably different in terms of their magnitude. It is seen that the point estimate for FDI_OC in the Industry-Province-FDI regression, i.e. 0.02 reported in column 4, is smaller than the point estimate for the same in the Province-FDI regression, i.e. 0.04 reported in column 2. However,

[6] Results reported in column 1 and 3 of table 1 are fairly robust to the inclusion of additional time-varying firm characteristics, direct TFP methodology, where TFP is calculated using the Levinsohn and Petrin (2003) approach and the inclusion of the FDI variable with a lag of one year into the estimation. The results are robust to the correction of Moultan (1990) problem. These can be obtained from the author.

such a difference in the magnitude of the coefficient estimates on FDI_OC is expected as 'FDI in a sector and province' is a smaller concept than 'FDI in a province'. Hence, the result implies that productivity of domestic firms increases by 0.4% when foreign presence in a province increases by 10 percent while domestic productivity gain is only 0.2% when foreign presence in a sector and province increases by 10 percent.

Besides intra-industry spillovers from FDI_OC within a province, i.e. 0.02, is reported (in column 4) as half of the total (intra-and/or-inter) spillovers from FDI_OC, i.e. 0.04, within a province (in column 2), it can be concluded that the remaining half, i.e. 0.02, implicitly constitutes the inter-industry spillovers from FDI_OC within a province.

A Wald test of equality on the coefficient estimates of FDI_OC and FDI_HMT reported at the bottom of the table indicates there is a significant difference in the magnitude of the coefficient for FDI_HMT and FDI_OC for scenario1 but there is no significant difference for scenario 2. These results are consistent with the results obtained by Wei and Liu (2006) who also finds that spillovers from FDI_OC and FDI_HMT significantly differ in the Province-FDI regression but they do not in the Industry-Province-FDI regression.

Table 1: FDI Productivity Spillovers

Dependent Variable: Log of Value Added of Domestic Firms only				
	Scenario 1 (Province-FDI)		**Scenario 2 (Industry-Province-FDI)**	
	(1)	**(2)**	**(3)**	**(4)**
Log Capital	0.204***	0.203***	0.204***	0.202***
	(0.011)	(0.011)	(0.011)	(0.012)
Log Wages	0.568***	0.570***	0.570***	0.565***
	(0.017)	(0.017)	(0.017)	(0.019)
Log FDI	0.022	-	**0.031*** **	-
	(0.020)	-	**(0.009)**	-
Log FDI from Other Countries (FDI_OC)	**-**	**0.044*** **	**-**	**0.023*** **
	-	**(0.016)**	**-**	**(0.009)**
Log FDI from HMT (FDI_HMT)	-	-0.019	-	0.010
	-	(0.012)	-	(0.007)
Constant	0.356	0.298	0.326**	0.092
	(0.257)	(0.247)	(0.138)	(0.148)
Number of Observations	46959	46512	44377	38410
R-Squared	0.230	0.233	0.234	0.238
Wald Test of Equality on estimated coefficients on FDI_HMT and FDI_OC		**6.17****		1.39

Note: (1) $*p < 0.10$, $**p < 0.05$, $***p < 0.01$. (2) Standard Errors, shown in parenthesis, are clustered at the firm-level. (3) Unless specified, all specifications include industry, provincial and annual time dummies.

The remaining empirical analysis in this article will ignore FDI from HMT (as the outcome in table 1 shows that domestic firms do not benefit from the presence of FDI from HMT) and focus on FDI that originate from other countries (non-HMT).[7]

As explained above the main aim of the article is to empirically investigate the hypothesis that host province's economic development systematically influences the nature and extent of productivity spillovers from foreign to domestic firms. Therefore, the next section discusses the results for the three different approaches which include (1) linear (and continuous) interaction term; (2) exogenous sample splitting; and (3) endogenous threshold model by Hansen (1999), adopted in this article at length.

[7]Contact author to receive estimates for the remaining of the analysis where FDI from HMT is taken into account.

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Linear (and continuous) interaction term.

The results from the linear interaction model are presented in table 2 where column 1 and 2 represents results for scenario 1 and column 3 and 4 for scenario 2 respectively. Since a statistically significant F-test, likelihood ratio test and LM test/Score test reported at the bottom of the table suggest that the model with all the constituent terms of the interaction term is a better fit model; the discussion below will focus on the results reported in column 1 and 3 for scenario 1 and 2 respectively.

We see that the estimated coefficients on the interaction term ($FDI\_pt/jpt * GDPpc$) reported in column 1 and 3 are negative and statistically significant at one percent level suggesting an inverse relationship between the level of provincial economic development and the presence of FDI_OC[8]. In other words, the negative coefficient implies that for domestic firms in the higher developed provinces, there are less or may be even negative spillovers from the presence of FDI_OC, - in contrast to domestic firms in the lower developed provinces. The result is fairly intuitive and finds support in the ideas proposed by Findlay (1978) and Lall (1992) where they discuss the importance of 'catching-up' hypotheses and 'environmental factors' in explaining technological diffusion from foreign to indigenous firms. Based on their proposed line of argument, one would expect that domestic firms in the lower developed provinces, on an average, to be further away from the technology frontier as external forces such as provincial economic development can strongly influence the development process of domestic firm-level technological capabilities. Hence domestic firms in the lower developed provinces will have a greater scope for catch-up leaving more room for technological diffusion from the presence of FDI_OC to the domestic firms in the lower developed provinces.

Moreover, the estimation below allows the identification of the threshold value of GDPpc where the productivity enhancing effects of FDI_OC switches from being positive to negative. In this respect, it is seen that the presence of FDI_OC has a positive but declining productivity growth effects up to GDPpc of Yuan 18983.2 (100 million) for the 'Province-FDI' regression and Yuan 22380 (100 million) for 'Industry-Province-FDI' regression. Beyond these threshold values of GDPpc, one would expect an increasingly negative growth effect from FDI_OC.

One of the major limitations of a simple linear (and continuous) interaction effect model is the strong assumption that FDI spillovers monotonically decrease with provincial economic development it imposes. However, it might be the case that the Cobb-Douglas production functions are not identical across all the observations in the sample and they fall into discrete classes. Hence it would be more credible to argue that the domestic productivity gain associated with the presence of FDI_OC may be different for groups of provinces with different levels of economic development. Accordingly, one would expect that domestic firms in the 'lower' developed provinces will tend to have greater positive spillover benefits from FDI_OC, - in contrast to the comparable ones in higher developed provinces, all other things being equal. Such thresholds between 'higher' and 'lower' developed provinces might by either exogenously imposed upon the data or identified endogenously within the data itself.

[8]The results are robust to the inclusion of FDI_pt/jpt interacted with other dimensions of level of economic development such as human capital and transport infrastructure. This indicates that the coefficient estimate on $FDI\_pt/jpt * GDPpc$ is not capturing other aspects of economic development. These results can be obtained from the author.

Table 2: FDI Spillovers and Provincial Economic Development

Dependent Variable: Log of Value Added of Domestic Firms only				
	Scenario 1 (Province-FDI)		**Scenario 2 (Industry-Province-FDI)**	
	(1)	**(2)**	**(3)**	**(4)**
Log Capital	0.204***	0.205***	0.202***	0.203***
	(0.011)	(0.011)	(0.011)	(0.011)
Log Wages	0.570***	0.570***	0.567***	0.567***
	(0.017)	(0.017)	(0.018)	(0.018)
Log FDI_OC	**0.256*** **	**0.130*** **	**0.194*** **	**0.116*** **
	(0.042)	**(0.033)**	**(0.036)**	**(0.029)**
Log GDPpc	**0.856*** **		**0.588*** **	
	(0.157)		**(0.155)**	
Log FDI_OC*Log GDPpc	**-0.055*** **	**-0.020*** **	**-0.043*** **	**-0.023*** **
	(0.010)	**(0.007)**	**(0.009)**	**(0.007)**
Constant	-3.308***	0.148	-1.966***	0.602***
	(0.667)	(0.215)	(0.687)	(0.136)
Number of Observation	46811	46811	42627	42627
R-Squared	0.233	0.232	0.235	0.235
Joint Significance Test of FDI, GDPpc, FDI*GDPpc	**14.54*** **		**11.20*** **	
Likelihood Ratio Test	**69.87*** **		**33.84*** **	
LM Test/Score Test	**30.02*** **		**14.44*** **	

Note: (1) $*p < 0.10$, $**p < 0.05$, $***p < 0.01$. (2) Standard Errors, shown in parenthesis, are clustered at the firm-level. (3) Unless specified, all specifications include industry, provincial and annual time dummies.

Exogenous sample splitting.

The results for what effectively splits the sample of provinces into "higher" and "lower" developed provinces based on the two different strategies which include (1) taking the year averages[9]; and (2) standard definition that is widely used in the literature[10], are reported in table 3, where column 1 and 3 represents results for scenario 1 and column 2 and 4 for scenario 2 respectively.

Contrasting results are observed across the two scenarios when FDI spillovers in the classified 'higher" and 'lower" developed provinces are taken into consideration.

Consider scenario 1. It is seen that the pattern of results is robust to the fashion in which the sample of provinces is split. The estimated coefficient on the interaction term ($FDI\_pt * Develop$) reported in column 1 and 3 is large in magnitude, negative and statistically significant. The large negative coefficient suggest that for domestic firms in the higher developed provinces, there are less or may be even negative spillovers from the presence of FDI_OC, - in

[9]Provinces are divided into higher and lower developed based on the following development status ratio (DSR):

$$DSR = \frac{AverageGDPpercapitaofprovince'p'for2001-2005}{NationalAverageGDPpercapitafor2001-2005} \tag{4}$$

where p=1,2,3,..30.

Provinces that have a DSR of at least 1 are classified as higher developed provinces and provinces that have a DSR of less than 1 are classified as lower developed provinces. Accordingly Beijing, Fujian, Guangdong, Hebei, Jiangsu, Liaoning, Shandong, Shanghai, Tianjin Zhejiang, and Heilongjiang are classified as higher developed provinces while the remaining 18 provinces are classified as lower developed provinces.

[10]According to the standard definition widely used in the literature (Buckley et al., 2002), Beijing, Fujian, Guangdong, Jiangsu, Liaoning, Shandong, Shanghai, Tianjin, Zhejiang, and Hainan, are classified as higher developed provinces while the remaining provinces in the central and western region are classified as lower developed provinces.

contrast to domestic firms in the lower developed provinces. The result is fairly intuitive and confirms the results of linear (and continuous) interaction term.

Now consider scenario 2. It is seen that the pattern of results is not robust to the fashion in which the sample of provinces is split. When the sample of provinces is split based on the year averages, it is seen that the estimated coefficient for the interaction term ($FDI\_jpt * Develop$) reported in column 2 is positive but statistically insignificant suggesting that domestic productivity gain associated with the presence of FDI_OC do not differ significantly across the higher and lower developed provinces. Then what would matter are possibly the other regional characteristics of the province such as quantity and quality of human capital available, quality of infrastructure, etc, or the characteristics of sector in the province or it may be affected by a combination of both the characteristics of the sector within a province and the characteristics of the province itself. The details are discussed at length later.

However, when the sample of provinces is split based on a pre-conceived definition, it is seen that the estimated coefficient for the interaction term ($FDI\_jpt * Develop$) reported in column 4 is negative and statistically significant. The negative coefficient suggest that domestic firms in the higher developed provinces benefit less or even negatively from the presence of FDI_OC, -in contrast to domestic firms in the lower developed provinces. In this case, the catch-up hypothesis applies.

We find that the contradictory story that emerges for scenario 2 is because of the fashion in which the sample is split[11].

Table 3: FDI Spillovers and Provincial Economic Development

Dependent Variable: Log of Value Added of Domestic Firms only				
	Taking Year Averages		**Standard Definition in the Literature**	
	Scenario 1 (Province-FDI)	**Scenario 2 (Industry-Province-FDI)**	**Scenario 1 (Province-FDI)**	**Scenario 2 (Industry-Province-FDI)**
	(1)	**(2)**	**(3)**	**(4)**
Log Capital	0.205***	0.202***	0.205***	0.202***
	(0.011)	(0.011)	(0.011)	(0.011)
Log Wages	0.570***	0.566***	0.570***	0.567***
	(0.017)	(0.018)	(0.017)	(0.018)
Log FDI_OC	**0.0893*** **	**0.0218** **	**0.0643*** **	**0.0294*** **
	(0.018)	**(0.009)**	**(0.017)**	**(0.009)**
Log FDI_OC *Develop	**-0.115*** **	**0.00128**	**-0.0978*** **	**-0.0289***
	(0.023)	**(0.016)**	**(0.024)**	**(0.017)**
Constant	0.525**	0.464***	0.604**	0.593***
	(0.232)	(0.145)	(0.241)	(0.148)
Number of Observations	46811	42627	46811	42627
R-Squared	0.233	0.234	0.232	0.234

Note: (1) $*p < 0.10$, $**p < 0.05$, $***p < 0.01$. (2) Standard Errors, shown in parenthesis, are clustered at the firm-level. (3) Unless specified, all specifications include industry, provincial and annual time dummies

The exogenous sample splitting discussed above shows that for domestic firms in the higher developed provinces, there are less or may be even negative spillovers from the presence of FDI_OC,-in contrast to domestic firms in the lower developed provinces. This conclusion strongly holds for scenario 1. However, for scenario 2, it only holds when the sample is split based on a standard definition adopted in the literature. This suggest that the results are not only sensitive to the manner in which the sample is split but also there exist multiple break points for which advanced econometric needs to be applied to explore the same.

[11] Contact author for further details.

Since the parametric model discussed above does not provide any consistent direction in the productivity growth-FDI relation, the next section discusses the results based on the non-parametric endogenous threshold model proposed by Hansen (1999) for modeling threshold effects.

Endogenous threshold model.

Spurious results are obtained from estimating an endogenous threshold model proposed by Hansen (1999).[12] This is because of the following reasons. Firstly, the model developed by Hansen (1999) for identifying thresholds has not been developed for thresholds for more than two while the model identifies six thresholds when implemented on the data at hand. Secondly, the estimated confidence interval identified for some of the estimated thresholds is the estimated threshold itself, for e.g. if the estimated threshold identified is 4.396013, then the estimates confidence region identified for the threshold estimate is also 4.396013 4.396013. The precisely estimated criterion for some of the estimated thresholds indicates that the threshold is very precisely estimated which is in itself spurious. This is because a threshold model can be viewed as an approximation to a general non-parametric model and if the underlying function is not a simple threshold, but highly nonlinear, the data may try to fit a model with a large number of thresholds in order to capture the underlying nonlinearity. Hence, the distribution theory behind the endogenous threshold model proposed by Hansen (1999) might not provide useful guidance when the data is highly non-linear.

Hence, we conclude that when advanced econometric technique is applied, the conditioning role of provincial economic development in ascertaining the nature and extent of FDI spillovers becomes uncertain, and this holds for both Province-FDI and Industry-Province-FDI.

Heterogeneity of FDI Spillovers

Given that host province's level of economic development does not provide any consistent support for determining the nature and extent of FDI spillovers, we explore whether or not productivity spillovers from FDI significantly differ not only across the 29 provinces, municipalities and autonomous regions of China but also across the 10 industries within each of the 29 provinces, municipalities and autonomous regions in China. The results are discussed at length in turn below.

Across the 29 province, municipalities, and autonomous regions of China.

The estimated coefficients for FDI_OC [13]reported in table 4 suggests that, for both the scenarios, the existence, sign and magnitude of productivity spillovers from FDI_OC substantially differs across the 29 provinces, municipalities

[12]The model was estimated using the algorithm given in Matlab by Hansen (1999). Both the exogenous sample splitting and continuous linear interaction term were also conducted on a balanced panel. However, the patterns of results (on the balanced panel) are similar to the pattern of results reported in this article on an unbalanced panel. All the results can be obtained from the author.

[13]To obtain the estimated coefficients on FDI_OC for each of the 29 provinces, municipalities and autonomous regions in China for both the scenarios, test of the following linear combination is performed:

$$log(FDI_{pt/jpt}) + log(FDI_{pt/jpt} * D_p) \tag{5}$$

and autonomous regions in China.

For example, consider scenario 1, the results of which are reported in column 1. It is seen that, with an increase in FDI_OC by 10%, domestic firms in Zhejiang, Shanghai, Tianjin and Beijing in the coastal region, and Xinjiang in the western region, experience a decline in their productivity by 1.12%, 1.43%, 4.4%, 3.03% and 1.57% respectively. On the contrary, domestic firms in Shandong, Liaoning in the coastal region, Anhui and Hubei in the central region, and Sichuan, Guangxi, Neimenggu, and Ningxia in the western region, experience an increase in their productivity by 0.5%, 2.77%, 3.03%, 1.4% 4.9%, 8.5%, 1.9%, 1.04%, and 1.53% respectively when FDI_OC in these provinces increases by 10%.

Now consider scenario 2, the results of which are reported in column 2. It is seen that, with an increase in foreign presence by 10% in the same sector and province, domestic firms in Zhejiang in the coastal region, and Sichuan and Ningxia in the western region, experience a decline in their productivity by 0.6%, 0.05% and 3.94% respectively. On the contrary, domestic firms in Hebei and Liaoning in the coastal region, Anhui and Jiangxi in the central region, and Guangxi and Neimenggu in the western region, experience an increase in their productivity by 0.9%, 1.6%, 0.4%, 2%, 1%, 1.8% respectively when the foreign presence in the same sector and province increases from by 10% respectively.

Moreover, the estimated spillovers from FDI_OC for each of the 29 provinces, municipalities and autonomous regions are also statistically different from each other.[14]

Across the 10 industries within each of the 29 provinces, municipalities and autonomous regions.

The estimated coefficients for FDI_OC [15] reported in table A.1 in the appendix suggests that the existence, sign and magnitude of FDI spillovers substantially differs across the 10 manufacturing sectors within each of the 29 provinces, municipalities and autonomous regions in China. For example, domestic firms in the food, drink and tobacco industry in the Shandong province enjoy positive spillover benefits from foreign investment when compared to their counterparts in the remaining industries in the province. Similarly, domestic firms in the food, drink and tobacco sector and electrical, machinery and computer equipment sector in the Shanxi province receive negative spillovers from the presence of FDI_OC when compared to their counterparts in the remaining industries in the province.

Moreover, the estimated productivity spillovers from FDI for each of the 10 manufacturing sectors within each of the 29 provinces, municipalities and autonomous regions are also statistically different from each other.[16]

This spillover heterogeneity observed across the sectors within each province may not solely be because of the

where D_p=1,2,,29.

[14]The results can be obtained from the author.

[15]To obtain the estimated coefficients on FDI_OC for each of the 10 manufacturing sectors, test of the following linear combination is performed for each of the 29 provinces, municipalities and autonomous regions in China:

$$log(FDI_{jpt}) + log(FDI_{jpt} * D_j) \tag{6}$$

Where D_j=1,2,,10.

[16]The results can be obtained from the author.

Table 4: Estimates of FDI Spillovers for each of the 29 province, municipalities and autonomous regions

Dependent Variable: Log of Value Added of Domestic Firms only				
	Scenario 1 (Province-FDI)		**Scenario 2 (Industry-Province-FDI)**	
Coastal Region				
Shandong	**0.0596***	**(0.033)**	0.0390	(0.024)
Zhejiang	**-0.112*****	**(0.043)**	**-0.0572*****	**(0.019)**
Jiangsu	-0.0148	(0.041)	-0.00515	(0.032)
Guangdong	-0.0423	(0.059)	-0.0162	(0.042)
Hebei	0.0202	(0.036)	**0.0923*****	**(0.028)**
Shanghai	**-0.143***	**(0.081)**	-0.0549	(0.074)
Liaoning	**0.277*****	**(0.105)**	**0.162*****	**(0.060)**
Tianjin	**-0.440****	**(0.190)**	-0.0618	(0.103)
Fujian	0.139	(0.086)	0.0823	(0.060)
Beijing	**-0.303****	**(0.126)**	0.000155	(0.065)
Hainan	0.242	(0.236)	0.0768	(0.096)
Central Region				
Henan	0.106	(0.071)	0.0320	(0.020)
Hubei	0.0696	(0.074)	-0.0193	(0.028)
Shanxi	0.0274	(0.105)	0.00446	(0.030)
Anhui	**0.147***	**(0.080)**	**0.0416*****	**(0.015)**
Hunan	**0.495*****	**(0.159)**	0.0235	(0.056)
Heilongjiang	-0.0502	(0.092)	-0.0435	(0.062)
Jilin	-0.0936	(0.130)	0.0491	(0.053)
Jiangxi	0.457	(0.296)	**0.203*****	**(0.063)**
Western Region				
Sichuan	**0.852*****	**(0.134)**	**-0.0505***	**(0.028)**
Shaanxi	0.0975	(0.159)	0.0343	(0.049)
Guangxi	**0.195****	**(0.089)**	**0.104***	**(0.062)**
Chongqing	0.0713	(0.095)	0.0543	(0.046)
Yunnan	-0.192	(0.156)	0.0416	(0.032)
Guizhou	0.00282	(0.054)	-0.0421	(0.035)
Gansu	0.0719	(0.049)	0.0602	(0.055)
Neimenggu	**0.104*****	**(0.025)**	**0.108***	**(0.064)**
Xinjiang	**-0.157***	**(0.083)**	-0.414	(0.269)
Ningxia	**0.153*****	**(0.054)**	**-0.394***	**(0.224)**
Qinghai	-	-	-	-

Note: (1) *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$. (2) Standard Errors, shown in parenthesis, are clustered at the firm-level.

characteristics of the province such as the level of economic development, etc, or the characteristics of the sector within a province such as government policies towards the sector in a province, sectoral agglomeration within a province, etc, but it may be affected by a combination of both the characteristics of the sector within a province and the characteristics of the province itself. This proposed argument also finds partial support in the arguments proposed by Chen (2008) who also emphasizes the need to consider institutional factors in a province to determine why specific foreign investment are attracted to certain specific provinces in China and not just China. To do so he proposes to examine how province-based assets are organized historically by various agencies in the province so as to understand how and why the co-development between MNEs global innovation networks and local knowledge economies occurs.

For instance, take Beijing. Chen (2008) shows that Beijing not only ranks number one in the concentration of higher education facilities, teachers and student enrollment but also ranks number one in the concentration of R&D personnel, including teachers, researchers and R&D staff. This has led to the emergence of a highly skilled workforce in Beijing whose technological expertise spans a wide spectrum. Chen (2008) emphasizes that it is this availability of high quality specialized engineers and not just the abundant quantity of generic engineers that differentiates Beijing from the rest of China, and for that matter from the rest of the world. For example, excerpts from an interview with the manager at Agilent by Chen (2008) reveals that the decision to locate Agilent Labs in Beijing was strongly influenced

by the presence of the existing Agilent development team and also the availability of high-caliber optical scientists and engineers. Moreover, Chen (2008) emphasizes that it is Beijing's high entrepreneurial culture that differentiates Beijing from the rest of China. Interviews conducted by Chen (2008) shows that it is the entrepreneurial spirit in Beijing over the last two decades that has played the most important role in cultivating a highly motivated and risk-taking culture among the motivated engineers and scientist in Beijing. Moreover, given the economic structure of Beijing, FDI involving high quality levels are attracted to the municipality. Since the highly motivated and skilled workforce in Beijing are excellent in basic research but have little or no experience and knowledge about industrial production, Beijing has seen an emergence of global and domestic R&D centres along with high-tech production, and most of the mundane manufacturing activities have departed from Beijing to the southern coastal provinces such as Guangdong and Fujian. Moreover, given the economic structure of Beijing, most of the domestic also have their R&D centres in Beijing or probably are into those manufacturing sectors that require advanced production techniques. Hence, it is seen that domestic firms in Beijing do not benefit from the presence of foreign firms even though Beijing is one of the *highest developed provinces for the period 2001-2005* as the economic and industrial structure of Beijing is such that it is not anymore conducive for conducting mundane manufacturing activities.

6 CONCLUSIONS

The paper examines whether and how provincial economic development, measured in terms of GDP per capita, affects the nature and extent of FDI spillovers in China by using a panel of 20,460 Chinese firms between 2001 and 2005.

First, we find that provincial economic development, measured in terms of GDP per capita, does not systematically influence FDI spillovers. This conclusion is based on the evidence that despite of there being an apparent inverse relationship evident from an exogenous sample splitting and interaction term methodology, the role of provincial economic development in ascertaining the existence, sign and magnitude of domestic productivity associated with the presence of foreign presence from other countries is very uncertain when the endogenous threshold model is applied. This conclusion is in contrast to the findings reported by Meyer and Sinani (2009) who find that host country's level of development influences FDI spillovers in a non-linear way, taking a U-shaped form. Nevertheless, these findings should be interpreted with caution as we have shown that results reported from parametric estimation techniques can be misleading and hence studies should advance from parametric estimation techniques to non-parametric ones as it might give a more accurate explanation on why firms in the lower developed provinces benefit more from foreign presence as compared to their counterparts in the higher developed province.

Second, we show that spillover heterogeneity observed across the sectors within a province may not solely be because of the characteristics of the province such as the economic development level, etc, or the characteristics of the sector within the province such as government policies towards the sector in a province, sectoral agglomeration within a province, etc, but it may be affected by a combination of both the characteristics of the sector within a province and the characteristics of the province itself. Hence, one can conclude that both the industrial composition at the provincial level and province-specific characteristics does dictate the benefits which domestic firms enjoy from the entry and presence of MNEs and MNE-related activities. However, the average spillover effect reported by previous studies should be interpreted with caution as it might be misleading for a diverse country like China. In this context, the study shows that there exists substantial spillover heterogeneity not only across the 30 provinces of China but also across the

10 sectors within a province.

Policy makers in China could pay more attention to understanding the disaggregated drivers of the level of economic development of a province, which, in this context, would mean identifying the level and growth of foreign investment in sectors within a province rather than identifying the level and growth of foreign investment in just a province. This is essential as it would signal the changing industrial and economic structure within a province which might facilitate the diversion of those sectors that may prove beneficial in the long run. Hence policies should be such that they meet this changing economic and industrial composition of a province so that they benefit from the entry and presence of MNE and MNE-related activities within a province.

Given that the economic development path for each of the 30 provinces, municipalities and autonomous regions in China has been very diverse since the opening up of the economy in 1978, policy makers need to understand that the economic and industrial transformation for each province might differ significantly. This would mean that the changing economic and industrial structure for say Beijing might differ from the changing economic and industrial structure for say Shanxi. Therefore, policy makers in China could consider this changing difference in the economic and industrial structure across the provinces and design policies to attract those industries within a province such that they meet the requirements of both sector-specific provincial characteristics and characteristics of the province itself. Although there are some policies such as 'Catalogue of Priority Industries for Foreign Investment in the Central-Western region (Amended in 2004)', also amended in 2008, which provides details of specific sectors that are encouraged in specific provinces, for instance, the policy encourages the plantation of forage grass, feed stuff and crops and deep processing thereof in Shanxi province while it encourages the development, breeding and processing of Changbaishan ecological edible resources in Jilin province; and other policies such as 'Catalogue of Priority Industries for Foreign Investment in Liaoning (2006), such policies designed should be such that they meet the requirements of both the changing economic and industrial transformation of the province as well as the historical economic and industrial structure of the province.

There is some room for future research. First, a systematic empirical evaluation of other dimensions of economic development other than the income level of a host province such as human and institutional developments of a province can be undertaken. Second, if more data is made available concerning foreign participation in other industries, besides the manufacturing industry, then future research can be directed in determining the impact of foreign presence on domestic productivity gain in these industries. Third, future research can incorporate the findings of recent empirical research which shows that ownership structure of domestic firms in China is also very important in determining the existence, sign and magnitude of domestic productivity gain from foreign investment. Fourth, more flexible production functions such as constant elasticity of substitution (CES) can be explored in the future. Fifth, dynamic behaviour of firms can be taken into consideration and future research can move from estimating a one-period model to estimating a two-period model.

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APPENDIX

Table A.1: Estimates of FDI Spillovers for each of 10 manufacturing industries within each of the 29 province, municipalities and autonomous regions

Dependent Variable: Log of Value Added of Domestic Firms only											
					Coastal Region						
Sector	Shandong	Zhejiang	Jiangsu	Guangdong	Hebei	Shanghai	Liaoning	Tianjin	Fujian	Beijing	Hainan
1	**-0.230*****	0.206	-0.087	0.050	**0.177***	**0.853****	0.323	0.156	-0.482	-0.038	0.111
	(0.089)	(0.185)	(0.115)	(0.152)	**(0.092)**	**(0.331)**	(0.249)	(0.422)	(0.659)	(0.193)	(0.211)
2	-0.142	**-0.063***	-0.090	-0.034	-0.076	0.311	0.369	-0.478	0.159	-0.004	-
	(0.135)	**(0.038)**	(0.080)	(0.130)	(0.127)	(0.235)	(0.342)	(0.837)	(0.115)	(0.133)	-
3	0.016	0.054	0.222	0.046	**1.036*****	0.291	-0.114	-0.553	0.511	0.041	-
	(0.142)	(0.091)	(0.161)	(0.177)	**(0.391)**	(0.193)	(0.085)	(0.628)	(0.615)	(0.148)	-
4	-0.215	0.071	0.126	0.267	-0.137	**-0.520****	**3.213*****	-0.020	**-0.643****	0.112	-
	(0.172)	(0.048)	(0.147)	(0.213)	(0.090)	**(0.246)**	**(0.386)**	(0.312)	**(0.258)**	(0.215)	-
5	0.108	-0.033	0.181	-0.167	-0.077	-0.203	0.063	-0.352	**-0.424***	-0.398	-
	(0.078)	(0.086)	(0.117)	(0.278)	(0.141)	(0.205)	(0.284)	(0.308)	**(0.236)**	(0.496)	-
6	-0.079	-0.027	0.149	-0.048	**0.220****	**0.306***	0.344*	-0.123	-0.119	0.063	-
	(0.071)	(0.042)	(0.104)	(0.138)	**(0.101)**	**(0.170)**	(0.187)	(0.423)	(0.176)	(0.206)	-
7	0.035	0.036	**0.412*****	**0.298****	0.262	0.199	0.254	**-0.132****	0.213	0.161	-
	(0.055)	(0.090)	**(0.125)**	**(0.116)**	(0.179)	(0.505)	(0.157)	**(0.064)**	(0.197)	(0.594)	-
8	-0.030	0.155	**0.343*****	0.118	**0.180*****	0.124	0.162	0.124	0.267	0.279	-
	(0.075)	(0.142)	**(0.079)**	(0.096)	**(0.048)**	(0.194)	(0.108)	(0.189)	(0.319)	(0.322)	-
9	0.053	0.049	-0.189	-0.133	0.143	**0.330***	-0.017	0.249	0.424	0.170	-
	(0.051)	(0.055)	(0.180)	(0.113)	(0.111)	**(0.198)**	(0.226)	(0.224)	(0.778)	(0.148)	-
10	-0.107	**-0.172****	0.049	-0.000	-0.008	-0.346	0.267	0.233	**-0.360***	0.292	-
	(0.290)	**(0.075)**	(0.141)	(0.174)	(0.039)	(0.292)	(0.729)	(0.383)	**(0.184)**	(0.182)	-

Note: (1) $*p < 0.10$, $**p < 0.05$, $***p < 0.01$. (2) Standard Errors, shown in parenthesis, are clustered at the firm-level. (3) Sector 1=Food, Drink and Tobacco; Sector 2=Textiles, Clothing and Leather; Sector 3=Wood and Furniture; Sector 4=Paper, Printing and Publishing, Sector 5=Chemicals, Petroleum and Man-Made Fibres; Sector 6= Electrical Machinery and Computer Equipment; Sector 7= Stone, Clay and Glass Products; Sector 8= Metals and Metal Goods; Sector 9= Transportation Equipment; Sector 10= Others.

Table A.1: Contd.

Dependent Variable: Log of Value Added of Domestic Firms only								
			Central Region					
Sector	Henan	Hubei	Shanxi	Anhui	Hunan	Heilongjiang	Jilin	Jiangxi
1	0.009	-0.497	**-10.748****	0.022	-0.007	**-0.878****	0.160	-0.390
	(0.056)	(0.610)	**(4.727)**	(0.020)	(0.155)	**(0.425)**	(0.235)	(0.676)
2	0.090	0.0004	-	0.031	-	-	0.023	0.219
	(0.084)	(0.066)	-	(0.043)	-	-	(0.601)	(0.142)
3	-	-	-	-0.004	-	0.155	**0.110****	1.761
	-	-	-	(0.532)	-	(0.187)	**(0.055)**	(2.181)
4	-	-	-0.309	-	0.048	0.242	-	-0.075
	-	-	(0.223)	-	(0.088)	(0.235)	-	(0.565)
5	0.022	-0.004	**-0.208***	-0.015	-0.181	-0.318	-0.073	-
	(0.037)	(0.162)	**(0.119)**	(0.161)	(0.137)	(0.279)	(0.257)	-
6	0.218	0.014	-	0.129	0.286	0.442	0.069	-0.021
	(0.227)	(0.042)	-	(0.229)	(0.300)	(0.313)	(0.220)	(0.133)
7	0.018	-0.082	-	-	-	-	-0.021	-
	(0.047)	(0.186)	-	-	-	-	(0.128)	-
8	0.036	-0.068	-0.011	0.079	-	0.021	-1.393	-0.347
	(0.039)	(0.081)	(0.042)	(0.087)	-	(0.272)	(2.279)	(0.440)
9	0.126	**-0.241****	0.192	0.314	-0.059	**-0.152****	-0.423	**0.914*****
	(0.132)	**(0.121)**	(0.154)	(0.483)	(0.116)	**(0.068)**	(0.400)	**(0.278)**
10	-0.192	-	-	0.217	-	**0.475*****	0.049	0.075
	(0.378)	-	-	(0.371)	-	**(0.065)**	(0.175)	(0.220)

Note: (1) $*p < 0.10$, $**p < 0.05$, $***p < 0.01$. (2) Standard Errors, shown in parenthesis, are clustered at the firm-level. (3) Name of the sectors remain the same as above

Table A.1: Contd.

Dependent Variable: Log of Value Added of Domestic Firms only											
						Western Region					
Sector	Guizhou	Gansu	Neimenggu	Xinjiang	Ningxia	Qinghai	Shaanxi	Sichuan	Guangxi	Chongqing	Yunnan
1	-0.179	-	-0.085	-0.481	-	-	-0.007	-0.093	-0.011	0.126	0.055
	(0.212)	-	(0.128)	(0.559)	-	-	(0.061)	(0.092)	(0.135)	(0.130)	(0.041)
2	-	-	-0.631	-	-0.189	-	-	0.012	0.034	**0.169****	-
	-	-	(0.395)	-	(0.289)	-	-	(0.105)	(0.120)	**(0.080)**	-
3	-	-	-	-	-	-	-	-0.155	**3.177****	-	0.005
	-	-	-	-	-	-	-	(0.171)	**(1.553)**	-	(0.137)
4	-	-	-	-	2.358	-	-	-0.021	-0.157	-	**-0.640***
	-	-	-	-	(1.713)	-	-	(0.242)	(0.148)	-	**(0.385)**
5	-0.005	-	-	4.088	-	-	-0.362	-0.042	**-0.343***	0.049	-0.082
	(0.087)	-	-	(5.719)	-	-	(0.585)	(0.051)	**(0.206)**	(0.125)	(0.183)
6	-0.125	-0.012	-	-	-	-	-0.250	0.020	-0.216	0.258	-0.230
	(0.087)	(0.049)	-	-	-	-	(0.214)	(0.104)	(0.163)	(0.228)	(0.204)
7	**-0.219****	-	-2.207	-	-0.610	-	0.511	-0.115	-0.310	**-0.674*****	-
	(0.093)	-	(1.384)	-	(0.433)	-	(0.608)	(0.077)	(0.221)	**(0.232)**	-
8	0.038	-	-	-	-	-	0.186	-	0.107	-0.029	-
	(0.187)	-	-	-	-	-	(0.186)	-	(0.195)	(0.080)	-
9	-	-	-	-	-	-	-	-0.046	0.831*	0.057	-
	-	-	-	-	-	-	-	(0.065)	(0.452)	(0.261)	-
10	-	-	-	-	-	-	-	-	0.032	-0.185	-
	-	-	-	-	-	-	-	-	(0.254)	(0.146)	-

Note: (1) $*p < 0.10$, $**p < 0.05$, $***p < 0.01$. (2) Standard Errors, shown in parenthesis, are clustered at the firm-level. (3) Name of the sectors remain the same as above