# 17. China's Overseas Direct Investment and Reverse Knowledge Spillovers

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## Introduction

Since the launch of its 'go global' strategy in 2001, China's outward foreign direct investment (OFDI) has increased dramatically. China's global OFDI stock increased from US$32.69 billion in 2001 (UNCTAD 2003) to US$1.01 trillion in 2005 (UNCTAD 2016). Drivers of outbound investment by Chinese multinational enterprises (MNEs) are diverse. Alongside market-seeking, efficiency-seeking and resource-seeking, one of the main motives of Chinese MNEs is strategic asset–seeking, the aim of which is the acquisition of advanced technology, production knowhow, modern management skills and internationally recognised brands in support of the long-term economic development of China (e.g. Buckley et al. 2007; Liu and Scott-Kennel 2011).

A growing body of literature explores China's OFDI; however, previous studies have focused mainly on either the motivations of Chinese MNEs to conduct OFDI or the location determinants of host countries that make them attractive to Chinese investors (e.g. Liu et al. 2005; Buckley et al. 2007; Cheung and Qian 2009; Tolentino 2010; Wei and Alon 2010; Cheung et al. 2012; Kolstad and Wiig 2012; Amighini et al. 2014; Chen 2015a). Unfortunately, empirical studies of the impact on China's economy of this rising OFDI are limited. Moreover, empirical studies of the impact of reverse knowledge spillovers from OFDI on China's economic growth are rare. It therefore remains unknown whether OFDI flows from China have generated any reverse knowledge spillovers for the Chinese economy, thus contributing via this channel to China's economic growth.

This chapter aims to investigate empirically the impact of reverse knowledge spillovers from OFDI on China's economic growth. It specifically seeks to investigate whether there are reverse knowledge spillovers from OFDI arising from provincial firms and from central government–controlled state-owned enterprises (SOEs) impacting on provincial economic growth.

Analysis of a panel dataset of China's 30 provinces over the years 2004–14 finds that, after controlling for the impact of knowledge spillovers from inward foreign direct investment (IFDI) on provincial economic growth, OFDI from both provincial

firms and SOEs is associated with a positive and statistically significant effect on China's provincial economic growth through reverse knowledge spillovers to China's economy. Overall, the study provides strong empirical evidence that OFDI contributes to China's economic growth.

The chapter makes two contributions to the literature. First, this study investigates the impact of both IFDI and OFDI on provincial economic growth in China, adding to the empirical evidence on their impact on economic growth in host and home countries. Second, this study explores how China's OFDI from provincial firms and SOEs affects provincial economic growth. These findings are important for policymakers, especially in developing economies, in designing and implementing policies to facilitate and enhance the diffusion of knowledge spillovers from IFDI and OFDI to host and home economies.

The rest of this chapter is structured as follows: the next section refers to the literature to discuss the theories and channels of reverse knowledge spillovers from OFDI; section three presents the framework for our analysis and empirical model, describes the data and specifies the variables; section four presents the regression results, while section five provides the conclusion and policy implications.

## Reverse knowledge spillovers from OFDI: Theory and literature

The term knowledge spillover refers to the flow of knowledge that takes place without any business transactions occurring (Griliches 1992). FDI is one of the most important means by which international knowledge spillovers take place (e.g. Dunning 1993; Dunning and Lundan 2008). Spillovers from IFDI are regarded as an important source of knowledge in developing countries (e.g. Javorcik 2004; Kneller and Pisu 2007; Sheng et al. 2011; Chen et al. 2013).

In the theoretical literature (e.g. Hymer 1976; Dunning 1977, 1980, 1988, 1993, 2000; Caves 1996), through ownership advantages and firm-specific intangible assets, IFDI can bring to host countries a package of capital, advanced technology and knowhow, modern enterprise management and mature marketing skills, well-organised international distribution channels, coordinated relationships with suppliers and clients, good reputation and other intangible assets. IFDI can therefore generate knowledge spillovers to the host country's domestic firms. Knowledge spillovers arising from IFDI can be horizontal—within the same industry and arising through demonstration effects, labour movement and information flows. But IFDI can also impose competition on domestic firms. On the one hand, competition can force local firms to increase their adoption of advanced technology and to be more innovative so as to use existing resources more efficiently, thus increasing efficiency

and productivity. On the other hand, it can crowd local firms out of the product market, and also offers completion in local labour and resources markets (e.g. Aitken and Harrison 1999; Hu et al. 2005; Chen 2011, 2015b; Fu 2011; Sheng et al. 2011; Chen et al. 2013). The net effects of horizontal knowledge spillovers from IFDI on domestic firms are inconclusive (Gorg and Greenaway 2004).

Knowledge spillovers arising from IFDI can also be vertical, via forward and backward industrial linkages within the supply chain (e.g. Javorcik 2004; Kneller and Pisu 2007; Sheng et al. 2011; Chen et al. 2013). When IFDI firms supply better intermediate inputs for their customers, or when they transfer knowledge to their suppliers for better quality inputs and on-time delivery, the positive spillovers from IFDI will contribute to domestic firm productivity in downstream and upstream industries.

What about the potential for reverse knowledge spillovers from OFDI back to home-country economies? Theoretically, reverse knowledge spillovers from OFDI can take place in three phases. In the first phase, a subsidiary acquires and absorbs host-country-specific knowledge either directly through cross-border mergers and acquisitions (M&As) or indirectly through reverse knowledge spillovers, such as demonstration effects, labour mobility, vertical industrial linkages and external network linkages with universities, research institutions and business associations in the host country. During the second phase, the acquired knowledge is transferred from the subsidiary to the parent company directly and through intra-firm labour mobility. During the third phase, the acquired foreign knowledge spills over or is transferred to home-country domestic firms or other knowledge recipients and is indirectly absorbed by the home economy.

It is reasonable to assume that the channels for reverse knowledge spillovers and knowledge spillovers from IFDI to host-country domestic firms are similar. The discussion below focuses on the key channels for reverse knowledge spillovers from home-country MNEs to home-country domestic firms, the first two of which are demonstration effects and imitation. If home-country MNEs acquire advanced knowledge abroad, transfer it back to their headquarters and apply the new techniques in their production at home, other domestic firms may also benefit by learning from and imitating that knowledge through demonstration effects. However, if home-country MNEs and other domestic firms are in the same industry, demonstration effects can also create competition between them. This increased competition not only will induce home-country domestic firms to imitate the advanced technology and production techniques of home-country MNEs to ensure their own survival, but will also force the domestic firms to undertake innovation to improve their performance and use existing technology more efficiently (e.g. Blomström and Kokko 1998; Aitken and Harrison 1999; Chen et al. 2013).

A second channel for reverse knowledge spillovers from MNEs to their home economy is labour mobility. Returnees who were employed in subsidiaries abroad and acquired advanced foreign knowledge during those assignments may contribute to the knowledge creation and innovation of their parent MNEs and home economy. Returnees may also bring important external networks that facilitate the continuation of knowledge exchange. Thus, home-country domestic firms profit not only from product or process-related information, but also from the employee's country-specific knowledge, which can be used to open up new export markets. Therefore, the labour mobility of returning employees of home-country MNEs can also add to the aggregate knowledge stock in the home economy. Filatotchev et al. (2011) find that the reverse flows of highly skilled Chinese labour provide an important channel of knowledge transfer to the Chinese economy. Dai and Liu (2009) use a dataset of Chinese small and medium enterprises (SMEs) and find that returnee entrepreneurs are able to develop a competitive advantage by applying the intangible assets they acquired abroad. More importantly, they also find that local entrepreneurs can benefit from returnee entrepreneurs through the establishment of close business linkages.

The third channel for reverse knowledge spillovers from home-country MNEs to the home economy comprises backward (from home-country MNEs to home-country suppliers) and forward (from home-country MNEs to home-country customers) linkages.

Backward linkages of home-country MNEs may benefit the home economy in several ways. First, home-country MNEs may increase the efficiency and product quality of their home-country suppliers by imposing higher requirements for quality and on-time delivery. If home-country MNEs are willing to provide assistance to their home-country suppliers to upgrade production management or technology, the latter may be able to enhance their production and management techniques, and may receive support towards the improvement of product quality or the introduction of innovations (e.g. Lall 1980; Humphrey and Schmitz 2002; Javorcik 2004; Kneller and Pisu 2007). Second, the competition among home-country domestic firms to become suppliers for the home-country MNEs may further increase their efficiency—for example, if they are urged to use their resources more efficiently or to adopt new technologies or production processes (Crespo and Fontoura 2007; Herzer 2009). Third, the business linkages with export-oriented home-country MNEs may provide home-country suppliers with information about foreign market conditions—for example, consumer tastes, design, packaging, product quality requirements and the regulatory environment (Blomström and Kokko 1998). This knowledge in turn may help home-country suppliers to establish their own direct exports to foreign markets. Fourth, by increasing the efficiency and product quality of their home-country suppliers, home-country MNEs may extend

the benefits to other home-country downstream producers, who produce end-user consumer goods, as cheaper and more technologically advanced intermediate inputs become available (Kugler 2006; Blalock and Gertler 2008).

Home-country MNEs can also diffuse the acquired foreign knowledge to the home economy through forward linkages if they are suppliers of intermediate goods in their home economy and if they sell their advanced intermediate goods to downstream home-country firms. First, such downstream firms may become more productive as a result of gaining access to new, improved or less costly intermediate inputs produced by home-country MNEs in the upstream sector (Javorcik 2004). Second, the purchase of intermediate goods from home-country MNEs may be accompanied by provision of complementary services that may not be available in connection with imports (Javorcik 2004). Overall, home-country MNE suppliers may increase the home-country pool of knowledge by providing new intermediate goods that were not previously available in their economy.

Therefore, at a theoretical level, OFDI can generate reverse knowledge spillovers on home-country economies, thus increasing productivity and promoting economic growth. However, empirical studies of the impact of reverse knowledge spillovers from OFDI on home-country productivity and economic growth have been limited, especially for developing countries.

Among the existing empirical studies, van Pottelsberghe de la Potterie and Lichtenberg (2001), using country-level data, analyse the impact of OFDI—in particular, technology-sourcing FDI—on the home-country productivity of 13 industrialised economies. They find that total factor productivity (TFP) is increased in cases where OFDI is directed towards research and development (R&D) intensive countries. Herzer (2010), using cross-country data for 50 countries, finds that OFDI positively affects economic growth in the home economies.

Driffield et al. (2009), using industry-level data on OFDI from the United Kingdom to a heterogeneous sample of host locations with varying labour costs and R&D intensity, find that OFDI in high-cost and high R&D-intensive host countries as well as in low-cost and low R&D-intensive locations increases TFP in the United Kingdom. Therefore, they conclude that not only technology-sourcing FDI but also efficiency-seeking FDI positively influences home-country domestic TFP. Similar evidence is also found in Driffield and Chiang (2009), who, using industry-level data, explore the productivity effect of Taiwan's OFDI in Mainland China between 1995 and 2005. They find that Taiwan's labour productivity is positively influenced by OFDI flows to Mainland China and conclude that the productivity gains are due to vertical or efficiency-seeking FDI, which relocates low value-added activities to Mainland China, which has lower labour costs than Taiwan. Therefore, both studies—Driffield et al. (2009) and Driffield and Chiang (2009)—show that productivity gains do not necessarily depend on technology-sourcing FDI.

Given that firms also relocate fewer value-added activities to low-cost locations and retain high value-added activities at home, home-country productivity may also be increased through efficiency-seeking FDI even without reverse knowledge transfers taking place.

A number of studies used firm-level data to investigate the impact of the reverse knowledge spillovers from OFDI on the productivity of home-country domestic firms but reached mixed results. An empirical study based on firm-level data for Irish OFDI, conducted by Copenhagen Economics (2007), finds that OFDI has positive productivity effects for Irish MNEs; however, there is no evidence of productivity spillovers to domestic firms in the Irish economy, regardless of whether these are direct competitors or whether they belong to the MNE's vertical value chain. One of the reasons only the investing MNEs benefit may be the fact that productivity gains stem from cost reduction due to the access to cheaper inputs, which are, however, accessible only to the MNEs and are not transferable back to the home economy (Copenhagen Economics 2007). Vahter and Masso (2007) found a similar result. Based on firm-level data from Estonia, Vahter and Masso find that OFDI has a positive impact on Estonian MNEs' productivity; however, they reveal a lack of general statistical evidence of productivity spillovers via OFDI to other firms in the home economy. In contrast, Castellani and Zanfei (2006), using firm-level data from Italy, find that Italian domestic firms significantly benefit from spillovers from Italian MNEs in the form of increased productivity.

Unfortunately, empirical studies analysing the impact of reverse knowledge spillovers from OFDI on home-country productivity and economic growth from developing countries are very limited. Among the few studies, Herzer (2011), using a sample of 33 developing countries for the period 1980–2005, finds a positive and long-run relationship between OFDI and TFP in the home economy. In the case of China, Zhao and Liu (2008), using national-level data, investigate China's OFDI and reverse R&D spillovers and find that OFDI promotes productivity increases in China by transferring technological spillovers from host countries to the home base. Zhao et al. (2010), using data for Chinese OFDI directed to developed countries for the period 1991–2007, investigate the impact on China's productivity of technology-sourcing OFDI. The findings show that Chinese OFDI in developed economies has a significant effect on China's TFP, and increased efficiency induced by OFDI through demonstration and imitation channels is a greater source of productivity growth than technology change.

The empirical studies mentioned above deliver interesting insights into the dynamics between OFDI activity and home-country economic development. However, there are some shortcomings. For example, previous studies of the impact of OFDI on China's economy do not control for the impact of IFDI in the empirical models when investigating reverse knowledge spillovers from OFDI on home-country productivity and economic growth, which could produce biased

estimates. Therefore, studies of reverse knowledge spillovers from OFDI are far from conclusive and more are needed, especially for developing countries, to provide a comprehensive understanding of the impact of OFDI on the economic growth of home countries.

# Framework of analysis and empirical model

## The basic model

We estimate the impact of OFDI on China's provincial economic growth by specifying an aggregate production function as follows (Equation 17.1).

Equation 17.1

$$Y_{it} = A_{it} LB_{it}^{\beta_1} DK_{it}^{\beta_2} FK_{it}^{\beta_3}$$

In Equation 17.1, $Y_{it}$ is the real gross domestic product (GDP) of province $i$ in year $t$; $A_{it}$ is the TFP level of province $i$ in year $t$; $LB_{it}$ is the total labour input of province $i$ in year $t$; $DK_{it}$ is the domestic capital stock of province $i$ in year $t$; and $FK_{it}$ is foreign capital stock (IFDI) of province $i$ in year $t$, which captures the contribution of IFDI as capital input to provincial economic growth.

To investigate the impact of reverse knowledge spillovers from OFDI on provincial economic growth, we need to control for the impact of knowledge spillovers from IFDI. As noted in section two, since IFDI brings to the host country a package of firm-specific intangible assets, it could also generate knowledge spillovers that increase the productivity and efficiency of local firms, thus contributing to the host country's economic growth. Following Chen (2011, 2013), we assume that the higher the share of IFDI stock in a province's total capital stock (*IFDIS/PTK*), the higher will be the spillover effects from IFDI on the economic growth of that province.

OFDI can also increase the home country's economic growth through reverse knowledge spillovers, such as demonstration and imitation effects, labour movement and vertical industrial linkages. Chinese MNEs undertaking OFDI can be categorised into two groups: central government–controlled SOEs and provincial firms. SOEs dominate China's OFDI, accounting for 68.4 per cent of China's total OFDI stock by the end of 2014. However, since 2010, provincial firms have rapidly increased their OFDI flows and, in 2014, surpassed the OFDI flows from SOEs (MOFCOM 2014). Although China's OFDI stock is still dominated by SOEs, the importance of provincial firms in China's OFDI has been increasing. To investigate the impact of OFDI on provincial economic growth, we investigate the impact of

OFDI by provincial firms and by SOEs. We assume that each province has equal opportunity to receive reverse knowledge spillovers from the OFDI of SOEs. We expect also that the higher the share of provincial OFDI stock in provincial total capital stock (*POFDIS/PTK*), and the higher the share of SOEs' OFDI stock in national total capital stock (*SOEOFDIS/NTK*), the higher will be the impact on provincial economic growth of reverse knowledge spillovers from provincial OFDI and SOEs' OFDI.

With the above propositions, $A_{it}$ can be defined as Equation 17.2.

Equation 17.2

$$A_{it} = B_{it} e^{g(IFDIS/PTK_{it-1}, POFDIS/PTK_{it-1}, SOEOFDIS/NTK_{t-1})}$$

In Equation 17.2, $A_{it}$ is the TFP level of province *i* in year *t*; $B_{it}$ is the residual TFP level of province *i* in year *t*; $IFDIS/PTK_{it-1}$ is the share of IFDI stock in provincial total capital stock in province *i* in year *t*–1, which captures the impact on provincial economic growth of knowledge spillovers from IFDI; $POFDIS/PTK_{it-1}$ is the share of provincial OFDI stock in provincial total capital stock of province *i* in year *t*–1, which captures the impact on provincial economic growth of reverse knowledge spillovers from provincial OFDI; $SOEOFDIS/NTK_{t-1}$ is the share of SOEs' OFDI stock in national total capital stock in year *t*–1, which captures the impact on provincial economic growth of reverse knowledge spillovers from SOEs' OFDI.

Incorporating Equation 17.2 into the aggregate production function Equation 17.1—by taking the natural logarithm of the variables of labour (*LB*), domestic capital (*DK*) and foreign capital (*FK*) and rearranging the items on the right-hand side, with the addition of a constant term ($\beta_0$) and an error term ($\varepsilon_{it}$)—we obtain empirical regression Equation 17.3.

Equation 17.3

$$LnY_{it} = \beta_0 + \beta_1 LnLB_{it} + \beta_2 LnDK_{it} + \beta_3 LnFK_{it} + \beta_4 IFDIS/PTK_{it-1} + \beta_5 POFDIS/PTK_{it-1} + \beta_6 SOEOFDIS/NTK_{t-1} + e_{it}$$

This empirical model allows us to test the impact on provincial economic growth of knowledge spillovers from IFDI as well as the reverse knowledge spillovers from OFDI. First, if the coefficient $\beta_4$ is positive and statistically significant, there is evidence that IFDI is correlated with positive impacts from knowledge spillovers on the home country's provincial economic growth. Second, if the coefficient $\beta_5$ is positive and statistically significant, there is evidence that provincial OFDI is correlated with impacts from reverse knowledge spillovers on the home country's provincial economic growth. Third, if the coefficient $\beta_6$ is positive and statistically significant, there is evidence that SOEs' OFDI is correlated with impacts on the home country's provincial economic growth from reverse knowledge spillovers.

Equation 17.3 is the form of an augmented production function model that we will use to estimate the impact on China's provincial economic growth of knowledge spillovers from IFDI and reverse knowledge spillovers from OFDI.

## Data and variable specification

The data for provincial GDP (*Y*) and provincial total capital stock (*PTK*) measured in RMB1 billion at 1978 prices are from Wu (2009).[1] The data for China's national total capital stock are calculated by summing provincial total capital stock measured in RMB1 billion at 1978 prices. Labour (*LB*) is the total number of employed persons in each province measured in one million persons.[2]

### *Calculating the IFDI stock and the share of IFDI stock in provincial total capital stock*

Foreign capital stock (*FK*) is measured as the IFDI stock of each province, which is calculated in several steps. First, the US dollar value of annual FDI inflows[3] is converted into renminbi (RMB) value by using the annual average official exchange rate. Second, the RMB value of annual FDI inflows is deflated into the real value in 1978 prices. Third, a 5 per cent depreciation rate is assumed for IFDI stock. Finally, IFDI stock is accumulated successively at year's end measured in RMB1 billion in 1978 prices.

The domestic capital stock (*DK*) of each province is obtained by deducting the IFDI stock (*FK*) from the provincial total capital stock.

Given the IFDI stock and total provincial capital stock, the share of IFDI stock in provincial total capital stock (*IFDIS/PTK*) for each province is calculated and is used to capture the knowledge spillover effects from IFDI on provincial economic growth. It is reasonable to assume that FDI inflows and knowledge spillover effects from IFDI on the local economy have a time lag, so a one-year lag is applied to *IFDIS/PTK* in the model.

1 Wu uses the conventional perpetual inventory method by employing the recently released national accounts figures to derive a capital stock series for China's 31 provinces and three economic sectors for the period 1977–2009, updated to 2014.

2 Data for labour are collected from NBS (various issues).

3 Data for FDI inflows are from, before and including 2005, NBS (various issues); after 2005, PBS (various issues).

### *Calculating the OFDI stock and the share of OFDI stock in total capital stock*

Methods for calculating the provincial OFDI stock (*POFDIS*) and SOEs' OFDI stock (*SOEOFDIS*) are the same as those for calculating the IFDI stock (*IFDIS*) discussed previously. Data for OFDI flows from provincial firms and from SOEs are taken from the *Statistical Bulletin of China's Outward Foreign Investment* (MOFCOM 2003–14).

Given the provincial OFDI stock (*POFDIS*) and the provincial total capital stock, the share of provincial OFDI stock in provincial total capital stock (*POFDIS/PTK*) is calculated. It is thereafter used to capture the impact on provincial economic growth of reverse knowledge spillovers from provincial OFDI. The share of SOEs' OFDI stock (*SOEOFDIS*) in national total capital stock (*SOEOFDIS/NTK*) is similarly calculated and used to capture the impact on provincial economic growth of reverse knowledge spillovers from SOEs' OFDI. We also assume that OFDI flows and the reverse knowledge spillovers attributed to OFDI experience a time lag, so the value of *POFDIS/PTK* and *SOEOFDIS/NTK* is lagged by one year in the model.

In our estimations, we use the provincial OFDI stock (*POFDIS*) and the SOEs' OFDI stock (*SOEOFDIS*) as alternative measures of OFDI as a robustness check to investigate the impact on China's provincial economic growth of reverse knowledge spillovers from OFDI.

## Regression results and explanations

The empirical study in this chapter utilises a province-level panel dataset of China's 30 provinces[4] covering the period from 2004 to 2014.[5] First, we study the impact on provincial economic growth of reverse knowledge spillovers from OFDI using the share of provincial OFDI stock in provincial total capital stock (*POFDIS/PTK*) and the share of SOEs' OFDI stock in national total capital stock (*SOEOFDIS/NTK*) to capture OFDI. For robustness, we also investigate the impact on provincial economic growth of reverse knowledge spillovers from OFDI using provincial OFDI stock (*POFDIS*) and the SOEs' OFDI stock (*OSEOFDIS*) as the variables of OFDI.

Table 17.1 presents the estimation results from Equation 17.3 by using the share of provincial OFDI stock in provincial total capital stock (*POFDIS/PTK*) and the share of SOEs' OFDI stock in national total capital stock (*SOEOFDIS/NTK*) as the independent variables of OFDI. Column 1 reports the random-effects model

4 Tibet is excluded from the dataset because of a lack of data.

5 Data for provincial outward FDI flows are available only after 2003.

estimation and column 2 reports the fixed-effects model estimation. The Hausman test results suggest that a fixed-effects approach is preferred. The estimation results of both models reveal that IFDI and OFDI are associated with positive and statistically significant impacts from knowledge spillovers on provincial economic growth. Because the fixed-effects model has eliminated the province-specific and time-invariant factors that may have impacts on provincial economic growth, our interpretation is based on the results from the fixed-effects model estimation.

Table 17.1 Estimation results of the impact on provincial economic growth of IFDI and OFDI

| Independent variables | Random-effects model | Fixed-effects model |
|---|---|---|
| Constant | 0.1936<br>(1.36) | 1.0751<br>(6.13)*** |
| *LnLB* | 0.2696<br>(8.52)*** | 0.0111<br>(0.22) |
| *LnDK* | 0.6181<br>(23.05)*** | 0.6051<br>(23.65)*** |
| *LnFK* | 0.0826<br>(4.80)*** | 0.0500<br>(2.89)*** |
| $IFDIS/PTK_{t-1}$ | 0.0201<br>(4.00)*** | 0.0172<br>(3.60)*** |
| $POFDIS/PTK_{t-1}$ | 0.0944<br>(2.00)** | 0.1235<br>(2.79)*** |
| $SOEOFDIS/NTK_{t-1}$ | 0.2397<br>(5.23)*** | 0.4257<br>(8.89)*** |
| No. of observations<br>No. of groups<br>$R^2$<br>Wald $chi^2$<br>F-statistics | 322<br>30<br>0.98<br>13,712*** | 322<br>30<br>0.93<br><br>2,522*** |

*** $p < 0.01$

** $p < 0.05$

Notes: Numbers in parentheses are t-statistics. The share of OFDI stock in total capital stock is used as the OFDI variable. Hausman test: $Chi^2$ (6) = 70.35 and Prob > $chi^2$ = 0.0000, preferring the fixed-effects model.

Source: Author's estimation.

The regression results from the fixed-effects model estimation show that domestic capital input (*DK*) is positive and statistically significant at the 1 per cent level while labour input (*LB*) is positive but not significant. This suggests that domestic capital is important to economic growth relative to labour in China's provinces. The variable of foreign capital (*FK*) is positive and statistically significant at the 1 per cent level, which provides empirical evidence that FDI as a capital input has directly contributed to host-province economic growth.

Turning to the main variables of interest: first, the variable of the share of IFDI stock in provincial total capital stock (*IFDIS/PTK*)—the knowledge spillovers from IFDI—is positive and statistically significant at the 1 per cent level. This finding offers some empirical evidence that IFDI has contributed to China's economic growth through positive knowledge spillovers to the local economy. This finding is consistent with the results of previous empirical studies (e.g. Chen 2011, 2013, 2014).

Second, the variable of *POFDIS/PTK*—the reverse knowledge spillovers from provincial OFDI—is positive and statistically significant at the 1 per cent level. This implies that provincial OFDI is positively associated with knowledge spillovers to the home-province economy, thus promoting provincial economic growth.

Third, the variable of *SOEOFDIS/NTK*—the reverse knowledge spillovers from SOEs' OFDI—is positive and statistically significant at the 1 per cent level, which implies that SOEs' OFDI is associated with positive knowledge spillovers to the home country's economy, thus promoting economic growth across all provinces in China.

For a robustness check, we replace the variables of *POFDIS/PTK* and *SOEOFDIS/NTK* with the variables of *POFDIS* and *SOEOFDIS*, respectively, in Equation 17.3 and rerun the regressions. Table 17.2 reports the estimation results. Column 1 reports the random-effects model estimation and column 2 reports the fixed-effects model estimation. The Hausman test results suggest a fixed-effects model is preferred.

The estimation results of both models suggest that IFDI and OFDI are associated with positive and statistically significant knowledge spillover effects on provincial economic growth. Again, because the fixed-effects model has eliminated the province-specific and time-invariant factors that may have impacts on provincial economic growth, our interpretation will be based on the results from the fixed-effects model estimation.

The regression results from the fixed-effects model estimation show that capital input (*DK*) is positive and statistically significant at the 1 per cent level while labour input (*LB*) is positive but not significant. The variable of foreign capital (*FK*) is positive and statistically significant at the 1 per cent level. These results are consistent with the regression results reported in Table 17.1.

The variable of *IFDIS/PTK* is positive and statistically significant at the 1 per cent level, supporting our earlier finding that IFDI is associated with positive knowledge spillover effects on the local economy, thus promoting host-province economic growth.

Table 17.2 Estimation results of the impact on provincial economic growth of IFDI and OFDI (OFDI stock)

| Independent variables | Random-effects model | Fixed-effects model |
|---|---|---|
| Constant | 0.5169<br>(3.63)*** | 1.0683<br>(6.67)*** |
| *LnLB* | 0.2884<br>(9.62)*** | 0.0726<br>(1.48) |
| *LnDK* | 0.5730<br>(22.72)*** | 0.5852<br>(23.91)*** |
| *LnFK* | 0.0840<br>(5.15)*** | 0.0532<br>(3.20)*** |
| $IFDIS/PTK_{t-1}$ | 0.0165<br>(3.54)*** | 0.0143<br>(3.19)*** |
| $LnPOFDIS_{t-1}$ | 0.0292<br>(6.19)*** | 0.0257<br>(5.75)*** |
| $LnSOEOFDIS_{t-1}$ | 0.0160<br>(2.34)** | 0.0383<br>(5.44)*** |
| No. of observations<br>No. of groups<br>$R^2$<br>Wald $chi^2$<br>F-statistics | 322<br>30<br>0.98<br>15,586*** | 322<br>30<br>0.95<br><br>2,784*** |

*** $p < 0.01$

** $p < 0.05$

Notes: Numbers in parentheses are t-statistics. The OFDI stock is used as the OFDI variable. Hausman test: $Chi^2$ (6) = 56.67 and Prob > $chi^2$ = 0.0000, preferring the fixed-effects model.

Source: Author's estimation.

Now, turning to the variables of main interest, the regression results find that the variables *POFDIS* and *SOEOFDIS* are positive and statistically significant at the 1 per cent level. The results reveal that both OFDI from provincial firms and OFDI from SOEs are correlated with positive reverse knowledge spillover effects on the local economy, thus contributing to provincial economic growth. These results are consistent with the regression results reported in Table 17.1, which suggest that our estimation results are robust.

Referring to the discussion in section two of this chapter, the positive impact of provincial OFDI and SOEs' OFDI on China's provincial economic growth could be the result of reverse knowledge spillovers from home-country MNEs to the home-country economy. These reverse knowledge spillovers may come from demonstration and imitation effects, the movement of labour, vertical industrial linkages, information flows, promotion of local firms' exports and the facilitation of industrial restructuring and technological upgrading of home-country economies, thus increasing the productivity and efficiency of local firms and promoting growth of the home-country economy. This finding provides strong empirical evidence that OFDI has contributed to China's economic growth through positive impacts on the

local economy from reverse knowledge spillovers. OFDI could be a new source of economic growth in China in the current environment of deepening globalisation and accelerating industrial restructuring and technological upgrading at home.

## Conclusion

The main aim of this study is an empirical investigation of the impacts of reverse knowledge spillovers from OFDI on China's provincial economic growth. The study finds that OFDI from both provincial firms and SOEs has generated positive and statistically significant impacts on provincial economic growth. This positive impact could be the result of reverse knowledge spillovers from OFDI to the home country's provincial economy through demonstration and imitation effects, labour movement, backward and forward industrial linkages, information flows, promotion of local firms' exports and the facilitation of industrial restructuring and technological upgrading in the home-country economies, thus increasing the productivity and efficiency of local firms and promoting growth of the home economy. The study also finds that IFDI has generated positive and significant impacts on the local economy from knowledge spillovers, thus promoting provincial economic growth.

The findings of this study imply that China can gain a lot from OFDI. Given that OFDI brings benefits to the home-country economy through reverse knowledge spillovers, facilitation of exports and acceleration of industrial restructuring and technological upgrading, thus contributing to economic growth, the Chinese Government should consider implementing policies to encourage and facilitate OFDI and to enhance knowledge spillovers from OFDI to China's economy. This includes policies to develop a more open and market-oriented OFDI regime, policies to encourage R&D and technological development to increase the ownership advantages of Chinese domestic firms and policies to encourage interaction between Chinese MNEs and domestic firms to enhance and accelerate the diffusion of positive reverse knowledge spillovers from OFDI to China's economy.

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