

# An Analysis on Technology Spillover Effect of Foreign Direct Investment and Its Countermeasures

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## Abstract

Due to the reform and opening-up policy, China has become one of the most attractive recipients of FDI, attributing a lot to the economic boom in the last three decades. The inflow of foreign investment has not only brought a package of capital, management expertise and production technology but also significantly spurred industrial development through technology spillover. Such a diffusion effect can impose beneficial influence on domestic economy through various channels: forward and backward linkages, demonstration or imitation effect and mobility of human resources. But since the occurrence of technology spillover is also conditional and restricted by many factors, it is meaningful to understand what these constraints are, and propose correspondent approaches to facilitate better utilization of FDI and technology spillover effect, both for domestic enterprises and macro-economic operations.

**Keywords:** FDI, Technology spillover, Absorbing capacity, Indigenous innovation, Human Resources

## 1. Introduction

One of the significant global features in the last two decades is the steady rise in foreign direct investment (FDI) in line with globalization largely facilitated by technological development. The increase of FDI has brought a package of capital, management expertise and production technology (Johnson, 1972), which can not only help boost host country's economic growth rate by supplying capital and facilities but also spur industrial development through positive spillover occurrence. Multinational (MNC) spillover effect is divided as productivity spillover and technological spillover, which can be realized by breaking monopoly, demonstration and local imitation (Caves, 1974). Thereafter, Kokko (1998) systematically induced FDI technology spillover theory and categorized its occurrence into four circumstances including quality and marketing pressure to indigenous counterparts, inward and backward linkages to suppliers, and highly-skilled human capital turnover. A study of FDI by the Organization for Economic Cooperation and Development (OECD) found that foreign investors invested considerable amounts of capital in R&D in receiving countries, thus not only transferring but also upgrading or creating new technology in those countries. Therefore, in the era of globalization when technology competitiveness becomes a vital determinant for economic growth, we should pay more attention to its beneficial technological spin-off effects when introducing foreign investment than merely its capital resources.

## 2. The Situation of Technology Spillover Effect via FDI in China

Due to the reform and opening-up policy, China has become one of the most attractive recipients of FDI. Abundant capital as well as advanced managerial and technological resources have attributed a lot to the economic boom in the last three decades.

<Insert graph here>

<Insert table 1 here>

The utilization efficiency of FDI inflows, therefore, is of considerable significance to our local economy and counterparts. From the report by Ministry of Commerce, multinational subsidiaries in China have formed a product value chain with local companies. MNCs, through purchasing and supplying, have greatly advanced the technology-level of both upstream and downstream corporations in local areas. US-funded GE Healthcare subsidiary in China, for instance, has about 200 suppliers including state-owned, joint ventures and private companies, who provide both mechanical components and electronic parts. In an objective term, GE Healthcare's high standards and strict selecting procedures impose positive impact on the development of these

enterprises, making their products more competitive in global market. A survey indicates that, by 2002, nearly 90 % MNE subsidiaries had adopted their core technology in local production and more than 60% achieved a component localization rate of over 50%.

Aside from technology transfer, many MNCs also establish R&D campaigns to localize their products and appeal to Chinese customers, by which they can maintain core competitive edge and to some extent, give positive technology diffusion to host economy. As of September, 2008, there were about 1200 R&D centers set up in China by MNCs, 33 of which were sorted as world-class and 13 the biggest overseas centers for parent companies. By the end of 2006, GE had invested a total value of \$100 million for research and development. China R&D Group, Microsoft, in 2007 alone, invested \$200 million in its product innovation activities. German-funded international company, Bosch established its engineering center (Suzhou) in 2005, and plans to inject \$60 million every year to develop high-quality automotive devices. Employee training and staff turnover, on the other hand, also increase the possibility for technology spillover.

It is interesting to note that FDI from Hong Kong, Macao, and Taiwan is generally less inclined to impose technology spillover effect on indigenous economy than FDI from other sources. Furthermore, this diffusion effect tends to be more significant in technological intensive sectors than in labor intensive ones. Since east regions receive more FDI due to its relatively high degree of openness, these areas can benefit more from technology spillovers than central and west regions.

<Insert table 2 here>

### **3. The Influence of Technology Spillover on Domestic Counterparts and Indigenous Innovation**

#### *3.1 Inward and backward linkages in local economy*

To ensure high quality products or services, foreign companies place great emphasis on raw materials or upstream services. Through purchasing process, they are closely linked to upstream businesses. And in order to achieve the goal, they often provide valuable advice and professional assistance, both technologically and managerially, to suppliers, and select best ones among them. Thus, all those strict standards and guidance will accelerate the development of local upstream enterprises and stimulate healthy competition among relevant industry. Therefore, inward linkages impose positive effect to local economy and a long-term value chain is formed. Panasonic transferred its microwave manufacturing base from United States to China and at present, has 2800 Chinese enterprises to provide components for it. Through business cooperation with Panasonic, these companies have not only grasped relevant technology but also advanced operations management of whole production process. As for backward linkages, MNCs often built stable relationships with local intermediates and provide management advice on quality supervision and logistics. Wal-Mart, for instance, has driven Chinese logistics industry to a higher level since its strategic entry and fast expansion in this big market.

#### *3.2 Demonstration and imitation effect*

Due to the relatively low level of technology and management in China, when entering this market, many established companies will break original state of market balance and intensify competition, thus making a demonstration effect on local counterparts. On the one hand, they will imitate the advanced technologies from those famous brands. On the other hand, the establishment of some high-class R&D centers here will provide good opportunities for local businesses to learn and facilitate their innovation ability or experiences, thus creating a positive divergence system. Additionally, the market competition will also raise the developing momentum of local economy.

#### *3.3 Mobility of human resources from MNCs to local companies*

An important channel for technology spillover is by employee training and turnover. Multinational companies generally attach vast importance to training and staff orientation. A survey based on data from Beijing, Shanghai, Nanjing and Suzhou in 2007 suggests that nearly half of investigated MNEs had a percentage of over 80% in staff training, making technology spillover possible through human resources mobility (Xiaoneng Yuan, Jie Song, 2007). After systematic training, when these highly-skilled employees leave foreign companies and enter local businesses, it is inevitable that technology transfer and extension will occur, enhancing domestic enterprises' managerial and innovative ability.

Nevertheless, those beneficial spin-off impacts are to some extent conditional. To hold control of its monopolistic edge, many MNCs tend to keep secrecy of its core technology and transfer its second-class or non-critical technologies to host countries, instead. Moreover, since FDI in China aims to take advantage of cheap labor and land more than professional human resources, most fundamental research and development processes are, therefore, carried out in parent countries. And at present, such high standard R&D cooperative

campaigns between China and developed home countries are really few due to this cause. More importantly, the current scale, technological and managerial level as well as property right structure of Chinese companies have largely confined the absorbing capacity of technology diffused by MNCs, which should be paid more attention to when utilizing FDI in the near future.

#### **4. The Countermeasures for Better Utilization of Technology Spillovers and FDI in China**

##### *4.1 To cultivate better climate for market competition*

In an environment where market competition is adequate, multinational corporations will strengthen its technology transfer for huge profits. China has done a good job in terms of attracting FDI, since it reformed economic mechanism and began to build free market system. Big market potential, stable political environment as well as preferential policies serves as favorable stimulus for foreign investment. Still, there exist many constraints on overseas businesses like redundant administrative regulation and market defective operations. Also, to avoid conflicts from culture, language differences, local partners and market contingencies, many MNCs resorts to sole proprietorship when entering China, making technology spillover, to some extent, blocked to local economy. China should speed up its economic reform and build a freer market than at present. Such an objective can be achieved by simplifying administrative procedures, encouraging perfect competition and implementing appropriate macro-economic control. In addition, the government should grant more favorable terms to joint ventures or mergers between local and foreign companies than wholly-owned ones, as to create more channels for domestic firms to benefit from know-how diffusion.

<Insert Table 3 here>

##### *4.2 To perfect relevant laws and regulations on protection for self intellectual property and supervision on foreign investors' behavior*

The sound legal system is fundamental to a healthy market economy. Especially in information age, effective protection for self intellectual property through legislation can mostly determine the structure of FDI inflows, i.e. whether international firms are willing to introduce high-tech industries or only obsolete ones. To ensure this kind of protection, China has a long way to go since coping with intellectual piracy is by now a harsh issue in our economy. The domestic enterprises as well as policy makers should observe or reinforce relevant laws strictly and have a visionary plan when deciding development pattern in the long run. On the other hand, Chinese government should also update original preferential policies to FDI and avoid foreign monopoly in domestic market, which will have a squeeze-out impact on domestic companies and hurt overall economy.

##### *4.3 To enhance correspondent absorbing ability and indigenous innovation*

Even though Chinese economic boom attributed considerably to foreign capital and technology transfer in the last three decades, it is imperative that we form our own competitive edge now. Firstly, we should enhance correspondent absorbing ability to better learn from advanced technology brought by FDI, which will realize the leaping development on a backward basis. But in such a dynamic world, merely relying on foreign technology can not boost our economy in the long term. Therefore, domestic companies must develop their self-innovation capacity and obtain core technological patents. Meanwhile, the government should also differentiate relevant guidance on the location basis. In east regions where FDI is quite adequate and developed, more technology-intensive MNCs should be encouraged, whereas in middle and west regions, openness to all sorts of FDI takes precedence now.

##### *4.4 To improve overall competence of domestic workforce and encourage human resource localization*

As is analyzed before, the mobility of human resources from FDI to local firms is a major channel to technology transfer. Panasonic's branches in China have 66000 Chinese employees and offer various training courses to them on a regular basis. PriceWaterhouseCoopers, Deloitte, Ernst&Young and KPMG, which are the four biggest accountant firms in the world, recruit a large number of Chinese graduates every year and provide professional CPA training courses to them. Once when these local staff members gain a lot of experience as well as technological expertise and join local counterparts or even set up their own firms, valuable know-how is inevitably introduced and will influence many aspects of operations in indigenous firms. To facilitate MNEs' human resource localization strategy, better education and career training is needed for the improvement of overall competency of domestic workforce. Thus, more investment on relevant education for cultivating highly-qualified talents shall be prioritized by the government now, which might transfer large numbers of cheap labor force to abundant professional human capital in future.

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Table 1. Share of FDI in National Economy (2000-2005)

| Year | Percentage in GDP % | Percentage in the National Fixed Assets Investment % | Industrial Added Value of Foreign Invested Enterprises in the National Total % |
|------|---------------------|------------------------------------------------------|--------------------------------------------------------------------------------|
| 2000 | 3.8                 | 10.3                                                 | 22.5                                                                           |
| 2001 | 4.0                 | 10.5                                                 | 24.6                                                                           |
| 2002 | 4.3                 | 10.1                                                 | 25.7                                                                           |
| 2003 | 3.8                 | 8.0                                                  | 27.2                                                                           |
| 2004 | 3.7                 | 7.2                                                  | 27.8                                                                           |
| 2005 | 2.7                 | 5.6                                                  | 28.6                                                                           |

Data source: Report of *Invest in China Serials* by Investment Promotion Agency of Ministry of Commerce, 2007.

Table 2. FDI Attracted by East, Central and West Regions

Unit: USD 100 million, %

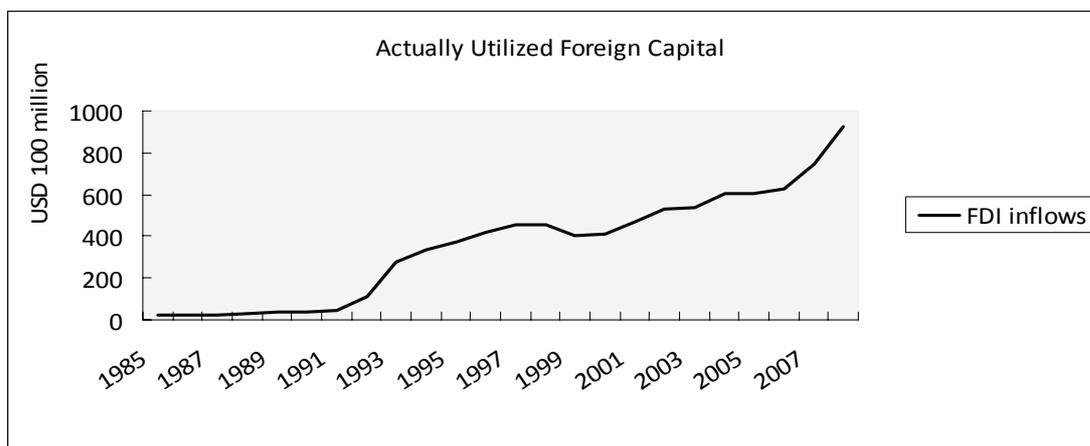
| Year | East   |            | Central |            | West   |            |
|------|--------|------------|---------|------------|--------|------------|
|      | volume | proportion | volume  | proportion | volume | proportion |
| 2002 | 457.3  | 86.7       | 50.1    | 9.5        | 20.1   | 3.8        |
| 2003 | 459.5  | 85.9       | 58.3    | 10.9       | 17.2   | 3.2        |
| 2004 | 522.1  | 86.1       | 66.8    | 11.0       | 17.4   | 2.9        |
| 2005 | 535.6  | 88.8       | 48.3    | 8.0        | 19.4   | 3.2        |
| 2006 | 569.2  | 90.3       | 39.2    | 6.2        | 21.8   | 3.5        |

Data source: Report of *Invest in China Serials* by Investment Promotion Agency of Ministry of Commerce, 2007.

Table 3. Foreign Capital Utilization Approach Analysis in China in 2006

| Utilization Approach                  | Foreign Capital Approved in 2006             |                           |                                              |                           |
|---------------------------------------|----------------------------------------------|---------------------------|----------------------------------------------|---------------------------|
|                                       | Number of Projects                           |                           | Actually Utilized Foreign Capital (100m USD) |                           |
|                                       | Volume of this Year on an Accumulative Basis | Year on Year Comparison % | Volume of this Year on an Accumulative Basis | Year on Year Comparison % |
| Total                                 | 41485                                        | -5.76                     | 735.23                                       | -3.11                     |
| FDI                                   | 41485                                        | -5.76                     | 694.68                                       | -4.06                     |
| Joint Ventures                        | 10223                                        | -2.45                     | 143.78                                       | -1.62                     |
| China-foreign Cooperative Enterprises | 1036                                         | -11.15                    | 9.4                                          | 5.92                      |
| Wholly-foreign Owned Enterprises      | 30164                                        | -6.64                     | 462.81                                       | 7.73                      |
| Corporations                          | 50                                           | 6.38                      | 4.22                                         | -5.4                      |
| Other Investment                      | 0                                            | 0                         | 40.55                                        | 16.52                     |

Data source: Report of *Invest in China Serials* by Investment Promotion Agency of Ministry of Commerce, 2007.



Data source: Ministry of Commerce.

Graph 1.