



# Knowledge spillovers from FDI in China: The role of educated labor in multinational enterprises

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## ABSTRACT

This paper employs a firm-level panel data set for a high-tech cluster in China to examine knowledge spillovers from multinational enterprises (MNEs) to domestic firms, focusing on the role of MNEs' employment of educated workers. We find that knowledge of MNEs spills over to domestic firms in the same industry through MNEs' employment of workers with graduate-level or overseas education. We also find that Japanese MNEs contribute less to knowledge spillovers than US MNEs. This is likely due to the fact that Japanese MNEs in China do not employ much educated labor.

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## 1. Introduction

Knowledge diffusion from developed countries has long been recognized as a critical source of productivity growth of less developed countries (LDCs). A potential channel of such diffusion is knowledge spillovers from foreign direct investment (FDI) to domestically owned firms (hereafter, domestic firms). A large number of empirical studies using firm-level data have examined FDI spillovers, typically estimating the effect of the size of multinational enterprises (MNEs) in a particular industry on the productivity of domestic firms in the same industry. However, in the first wave of the literature, results were mixed: while some studies found positive effects of FDI on the productivity of domestic firms (Blomström & Sjöholm, 1999; Chuang & Lin, 1999; Kokko, 1994; Sjöholm, 1999; Takii, 2005, among many others), others failed to find any significant spillover effects from FDI (Aitken & Harrison, 1999; Haddad & Harrison, 1993; Kinoshita, 2001).<sup>1</sup>

Therefore, more recent studies have tried to uncover the possible channels underlying the knowledge diffusion via FDI. These channels include technical training provided by MNEs (Larrain, Lopez-Calva, & Rodriguez-Clare, 2000), social interactions between MNEs and domestic firms including employee mobility (Fosfuri, Motta, & Ronde, 2001; Hale & Long, 2006), R&D activities of MNEs in the host country (Todo, 2006; Todo & Miyamoto, 2006; Todo, Zhang, & Zhou, 2006), inter-industry linkages such as backward linkages (Blalock & Gertler, 2008; Javorcik & Spatareanu, 2008; Javorcik, 2004; Kugler,

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<sup>1</sup> See Saggi (2002), Keller (2004), Görg and Greenaway (2004), and Lipsey and Sjöholm (2005) for excellent surveys on this issue.

2006; Liu, 2008). Others find that whether or not knowledge spills over from FDI may depend on the technology gap between MNEs and domestic firms as well as the absorptive capacity of domestic firms (Girma, 2005; Girma, Gong, & Görg, 2005; Hale & Long, 2006; Takii, 2005).

Following the literature examining more specific channels of FDI spillovers, this study, using firm-level panel data for a Chinese science park, focuses on the role of MNEs' employment of educated workers in generating knowledge spillover to domestic firms. This focus is based on two important observations. First, according to the field interviews conducted by the authors of this paper in the science park, engineers and managers of MNEs often change their jobs and work for domestic firms or start up their own firms, after they learn advanced knowledge and skills from their experiences in MNEs. These observations suggest that knowledge of MNEs indeed spills over to the local economy particularly through labor mobility of educated workers. Second, a large number of Chinese educated overseas have recently returned to China. According to Zweig (2008), the number of returned students drastically rose from less than 10,000 in 2000 to 25,000 in 2004. The multicultural background and linguistic advantage of the returnees should promote interactions between MNEs and the local economy and hence facilitate knowledge spillovers from MNEs.

The science park examined in this study, the Zhongguancun Science Park (hereafter the Z-Park), provides an ideal context for examining MNEs' employment of educated workers as a source of FDI spillovers. As a cluster of high-technology industries, the Z-Park is known as China's "Silicon Valley" and characterized by the utilization of highly educated workers. Among the total of 400,000 workers in the Z-Park in 2003, 220,000, or more than 50%, had a bachelor's or higher degree, 42,000, more than 10%, had a master's or higher degree, and 3600, about 1%, were educated abroad. The geographical concentration of firms in the park facilitates interpersonal interactions and turnover of those educated workers between MNEs and domestic firms, and thereby stimulates knowledge spillover from MNEs to domestic firms.<sup>2</sup>

To preview our results, we find that the industry aggregate of MNEs' total employment has no significant effect on the productivity of domestic firms, concluding that MNEs' production activities do not unconditionally lead to knowledge spillovers to domestic firms.<sup>3</sup> By contrast, the industry aggregate of MNEs' educated workers, in particular, those with graduate-level or overseas education, has a positive and statistically significant effect on domestic productivity. We interpret this evidence as showing that MNEs' employment of educated workers results in spillovers from MNEs to domestic firms.

In addition, this study examines differences in the size of spillover effects across home countries of FDI, in particular between the two largest home countries in the Z-Park, Japan and the United States. This examination is possible since our firm-level data set contains information on the nationality of major shareholders of each firm, which is rarely available in firm-level data sets. We find that the industry employment of Japanese MNEs does not improve domestic firms' productivity, while the industry employment of US MNEs positively affects it. We further find that Japanese MNEs employ educated labor substantially less than US MNEs. Therefore, it is likely that the absence of spillovers from Japanese MNEs is due to the small size of educated labor in Japanese MNEs.

Contributions of this study are twofold. First, besides several channels of FDI spillovers found in the existing studies mentioned earlier, we find MNEs' employment of highly educated workers as its additional channel. Second, few existing studies have found that the size of FDI spillovers differs substantially across home countries of FDI. This study suggests that such differences stem from variations in firm characteristics of MNEs, such as the degree of utilization of educated labor, across home countries.

The remainder of the paper is organized as follows. Section 2 discusses the econometric procedure employed in the analysis. Section 3 presents the data set and the variables used in the regression, while the results of the estimation are discussed in Section 4. Section 5 concludes.

## 2. Institutional background of China's "Silicon Valley"

### 2.1. Description of the Z-Park

The Zhongguancun Science Park was established in Beijing in late 1980s as the first national-level high-technology district and has been the largest science park in China since its establishment. The total revenue of firms in the Z-Park was about 600 billion yuan or \$80 billion in 2006, contributing to one-seventh of the total revenue of all science parks combined in China and 5% of the total revenue of the industrial sector in China (Zhongguancun Science Park, 2009).

The Chinese government has supported the Z-Park with the view that development of the Z-Park can be the engine of domestic innovation and the model for China's high-tech industries. To boost entry of domestic and foreign firms, the government offers several preferential benefits to firms located in the Z-Park. The most notable is tax incentives. For all eligible firms, the corporate income tax rate is 15%, less than half of the normal corporate income tax rate of 33%. New entrants additionally enjoy tax a waiver for the first three years. In 1999, additional preferential policies were granted by the government, such as enlarging the scope of the tax waiver and deductions (e.g., reduction of sales taxes on technological

<sup>2</sup> Jaffe, Trajtenberg, and Henderson (1993) and Keller (2002) have shown that due to the tacit nature of knowledge, face-to-face interaction is probably the most effective way of transferring knowledge, and thus knowledge diffusion tends to be geographically localized within regions and countries.

<sup>3</sup> This result is consistent with Todo et al. (2006).

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