

Productivity Spillovers from Foreign Direct Investment: Firm-Level Evidence from China

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Summary. — Using firm-level census data, this paper examines the spillover effects of foreign direct investment (FDI) on domestic firms in the Chinese manufacturing industry between 2000 and 2003. Our analysis takes into account the endogeneity of input choices, simultaneity bias, and clustering errors that are known to cause biased and inefficient estimations. Our results suggest that positive spillovers from FDI arise from forward linkages where domestic firms purchase high-quality intermediate goods or equipment from foreign firms in the upstream sectors. Our results also show that domestic firms differ significantly in the extent to which they benefit from FDI.
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Keywords — foreign direct investment, spillover effects, Asia, China

1. INTRODUCTION

Over the past two decades, cross-border flows of foreign direct investment (FDI) have taken center stage in the globalization process, with increasing numbers of firms (usually based in developed countries) investing in foreign countries (either developed or developing countries). According to UNCTAD (2008), the global flows of FDI increased from US\$324 billion in 1995 to US\$1.3 trillion in 2006. In 2006 inflows of FDI to developed countries amounted to US\$857 billion, while inflows to developing countries rose to a record US\$379 billion. The global stock of FDI has thus more than quadrupled from US\$2.76 trillion in 1995 to \$12 trillion in 2006.

A commonly-held belief among policy makers is that FDI benefits recipient countries through knowledge transfer from multinational firms, which helps improve the productivity of domestic firms. As such, governments around the world provide policy incentives to attract multinational firms. There are several channels through which FDI may affect domestic productivity. First, domestic firms may benefit by observing and imitating multinational firms in the same industry; however, it is also possible that the presence of foreign firms increases competition and reduces the market share of domestic firms, which may lower domestic firms' productivity (horizontal spillovers). Second, productivity spillovers may occur through labor turnover, as former employees of multinationals who have acquired managerial expertise, production or marketing skills, resurface in domestic firms or set up their own firms to which they can transfer that knowledge (horizontal spillovers). Third, domestic firms may also benefit through backward linkages, by being a supplier to multinational firms and thereby obtaining some free technology transfer, or through forward linkages, by having a foreign supplier and gaining access to better machinery equipment or intermediate inputs, which may lower costs and increase productivity (vertical spillovers). However, it is important to note that horizontal and vertical spillovers from FDI may be positive or

negative. For example, being a supplier to a multinational firm does not necessarily lead to positive benefits. If the market for supplying inputs to foreign firms is competitive, it is possible that foreign firms in downstream sector will undercut prices to take advantage of the competitive market in the upstream sector.

Empirical evidence of the benefits of FDI spillovers is limited (Rodrik, 1999). Due to a lack of detailed firm-level data, researchers have focused mainly on developed countries such as the United Kingdom (Haskel, Pereira, & Slaughter, 2007), where firms, as technological leaders, may have little to gain from FDI spillovers. Other studies focus on small developing countries where the amount of FDI is relatively small and domestic industries are not sufficiently diversified to reap significant benefits from FDI. For example, Aitken and Harrison (1999) estimate the productivity effects of FDI to a sample of Venezuelan manufacturing plants during 1976–89, and find that plants in industries with a higher foreign presence actually had *lower* productivity than those in other industries. Javorcik (2004) finds that domestic firms in Lithuania only benefit from FDI when they are the suppliers to foreign firms. Blalock and Gertler (2007) find positive vertical spillover effects from FDI in Indonesian manufacturing firms. Lopez (2008) examines the effect of foreign technology licensing in Chile and finds that licensing in upstream sectors increases the productivity of plants that purchase intermediate inputs from them while

* We are grateful to the Editor of this journal, four anonymous reviewers, Ann Harrison, Gary Jefferson, Hongbin Li, Kuijs Louis, Dong He, participants at the conference "Investments, Technology Spillovers, and East Asian FTA" organized by Fudan and Brandeis Universities (Shanghai, October 2008) as well as at "First Annual International Conference on the Chinese Economy" organized by the Hong Kong Institute for Monetary Research in 2010 for comments. Financial support from the Hong Kong Polytechnic University (G-U685) is gratefully acknowledged. All remaining errors are our own. Final revision accepted: April 8, 2011.

licensing in downstream sectors has a negative effect on the productivity of suppliers of intermediate inputs. Recently, [Suyanto, Salim, and Bloch \(2009\)](#) have shown that there are positive productivity spillovers to FDI in the Indonesian chemical and pharmaceutical industry.

However, there is a lack of firm-level study on a large FDI recipient country in the developing world, such as China, where any spillover effects may be most important.¹ The case of China is of interest for several reasons. First, China is the largest recipient of FDI in the developing world, recording US\$ 106 billion of inflows in 2010 and a total FDI stock of US\$ 384 billion at the end of 2010, and accounting for about 7% of fixed asset investment in China each year in the past decade.² This level of FDI appears sufficiently large for China to reap horizontal benefits. Second, China's history under centralized planning led to unique industry development. As the economy has opened to foreign direct investment, the existence of a wide spectrum of industries provides domestic firms with opportunities to benefit through backward and forward linkages with foreign firms. Third, as a developing economy, China's distance from the technology-and-management frontier may place it in an ideal position to exploit the potential benefits of FDI, relative to more advanced industrialized countries ([Findlay, 1978](#)). Finally, over the years Chinese governments at various levels have provided substantial amounts of subsidies to foreign firms, ranging from land at price that is much lower than the market price to tax exemptions on corporate income for the first few years of their investment in China. An important question is whether these policy incentives to foreign multinationals are justified, which depends on whether there are spillovers from FDI in China.

Although there have been many studies of FDI spillovers in China, most studies use industry-level data (see the reference to [Hale and Long \(2007\)](#)). For example, [Wang and Zhao \(2008\)](#) use a panel dataset for Chinese industry over the period from 2000 to 2002 and find both positive horizontal and vertical spillovers. However, industry-level studies suffer from problems such as aggregation bias and endogeneity, as discussed in [Hale and Long \(2007\)](#) and [Haskel et al. \(2007, footnote 2\)](#). There are also a few firm-level studies using small sample dataset with mixed results. For example, [Hu and Jefferson \(2002\)](#) study FDI spillovers in China's electronic and textile industries while [Hale and Long \(2007\)](#) use a sample of 1500 firms in five Chinese cities in 2000. [Fleisher, Li, and Zhao \(2010\)](#) examine province-level data and find that FDI had positive productivity spillovers before 1994 but not after. [Sun \(2009\)](#) analyzes how FDI affects domestic firms' exports using firm-level data in one industry. [Wei and Liu \(2006\)](#) use a panel of more than 10,000 domestic and foreign-invested firms for the period from 1998 to 2001 in China and find spillovers occur within regions. More recently, [Lin, Liu, and Zhang \(2009\)](#) examine productivity spillovers using value-added production function (instead of gross output value production function as in our paper and many others) and find positive vertical linkage effects but negative horizontal spillovers.

This paper uses a comprehensive micro dataset—the Chinese manufacturing census data of firms (including all state-owned enterprises and non-state-owned firms with annual sales of more than 5 million renminbi (about US\$600,000)) for the years 2000 to 2003 (with about US\$500,000 firms each year)—to study the effects of FDI on domestic-firm productivity. We contribute to the literature in several ways. First, by using census data, instead of a sample survey for an industry or a region, we are able to undertake a full-scale examination of firm-level FDI spillovers in China. Second, our empirical

analysis overcomes a variety of problems typically associated with this type of analysis, including endogeneity of input choices, simultaneity bias, and clustering effects in standard errors. In particular, we differ from the literature by dealing with clustering effects through a new approach recently proposed by [Woodridge \(2006\)](#), and using first-differencing and the instrumental variables approaches to deal with simultaneity bias. Third, we find negative backward spillovers in the case of China, which is in contrast to [Javorcik \(2004\)](#), who finds positive backward spillovers in the case of Lithuania. Our further analysis suggests that the presence of negative backward spillovers may be due to the fact that many FDI firms in China are export-oriented. We believe we are the first to explore the issue as to why in the case of China there exist negative backward spillovers. Finally, we explore the role of heterogeneity in firms to see whether certain firm characteristics (such as ownership structure and export orientation) have implications for FDI benefits.

Our results indicate that positive spillovers from FDI operate through forward linkages where domestic firms purchase high-quality intermediate goods with lower input prices, or equipment from FDI firms in the upstream industry. With high FDI presence in their upstream industry, Chinese domestic firms in an industry can produce a greater output (for a given level of inputs) than otherwise similar firms in industries with lower upstream FDI. Furthermore, the expected positive knowledge spillovers of FDI firms in the same industry as domestic firms are counterbalanced by competition effects arising from the entry of FDI firms, resulting in negative horizontal spillovers after controlling for a firm's market power. The finding of negative backward spillovers may be a bit puzzling. Our further investigation suggests that this may be the result of a set of unique Chinese FDI policies that encourage foreign firms to import raw materials and equipment from the international market. We do find support that more export-oriented firms have weaker vertical linkages. Finally, we also find that domestic firms differ significantly in the extent to which they benefit from FDI, with large and medium-sized, non-state-owned enterprises, and exporting firms accruing the greatest benefits from foreign firms in China.

The rest of the paper is organized as follows. The next section briefly provides a background to FDI in China. Section 3 discusses the construction of our dataset and provides basic statistics, as well as the parameter-identification strategy implemented. Section 4 discusses the results. Section 5 concludes.

2. OVERVIEW OF FOREIGN DIRECT INVESTMENT IN CHINA

Although China's first experience with FDI came after the reforms of 1978, it was not until 1992 that high levels of FDI started to flow into the country. Between 1992 and 2006, FDI inflows increased from US\$1.1 billion to \$73 billion. In particular, after its entry into the WTO in 2001, China's commitment to broader and deeper liberalization in trade and investment further accelerated FDI inflows and increased the share of foreign ownership of Chinese assets. In 2006, the share of FDI inflow in total fixed-asset investment reached 5.28%, with the manufacturing sector having the largest recipient of FDI in China, accounting for 63.6% of the total FDI.²

China's policy objectives in attracting FDI are to advance China's technology and to promote exports, as articulated in Article 3 of the *Law of the People's Republic of China on*

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