Labor Mobility, Knowledge Transfer and Productivity Spillover:

Evidence from Indian Firms

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Abstract

Potential productivity spillovers from foreign direct investment (FDI) often provide a rationale for the active recruitment of multinational enterprises (MNEs) by policymakers in developing economies. To explore the existence and size of such spillovers, we develop a model in which productivity spillovers depend on industry-specific characteristics. It suggests that high skilled mobile labor, such as in the IT sector, may transfer knowledge, skills and techniques developed within a local MNE operation from that firm to others, potentially increasing productivity in an entire industry. In sectors without high skilled mobile labor these effects may not exist. To test the model we estimate spillover effects in the information technology sector and the textile sector in India with a firm level panel from 2000-2006. We find that direct recipients of FDI experience an increase in productivity in both sectors. However, importantly, we find that other firms in the IT sector, those which are not direct FDI recipients, also experience an increase in productivity, even controlling for other factors. In addition, this horizontal spillover is not found in the textile sector where labor is less skilled and less mobile.

Keywords: foreign direct investment, multinational enterprise, knowledge spillover

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1. Introduction

FDI in India has steadily increased: from $237 million in 1990 to $5,335million in 2004[1]. The increase owes much to the liberalization policies adopted by the Indian government since 1991 (*World Investment Report*, 2003). Such policies have reinforced investor confidence and increased FDI flows into telecommunications, pharmaceutical and information technology, in particular. Indian companies are expected to benefit from deregulation in key sectors and opening up to foreign competition is further expected to increase productivity. Productivity spillovers due to the dispersion of knowledge from multinational activities might be a key channel by which domestic firms become more productive and competitive, but the extent and nature of these spillovers is often questioned.

Since World War II most economies have become more internationalized. Many countries offered incentives such as tax holidays, tax reduction and tax rebates to attract multinational enterprises (MNEs). These are justified by the argument that FDI increases the productivity of local firms by offering advanced knowledge and technology; it enhances the country's infrastructure for private investment; and it compels local firms to improve their business practices. Though MNEs do not formulate deliberate strategies to strengthen local competitors, spillovers to host country firms may occur naturally. While differences in capabilities, knowledge and market scope between an MNE and local firms may be perceived as a threat to the local firm, offering benefits to local industry help the MNE to maintain a good

[1] Nasscom report 2007

relationship with its host government (Meyer, 2004). In addition, as Liebeskind (1996) illustrated, overprotection of a firm's knowledge assets can be as costly as under protection and is undesirable. Initially, the domestic firms have to face stiff competition from the MNEs and their market share may be reduced (the "market stealing effect" of the MNEs; Aitken and Harrison, 1999). However, over the long run local firms benefit as they are exposed to the MNE's advanced technologies and modern operations management and strategy. With time, local firms, to the extent possible, adopt these technologies and strategies. The past experience of the East Asian Tigers (Hong Kong, Taiwan, Singapore and Korea), and the recent experience of China and India clearly suggests that FDI inflow has helped to generate economic growth.

Nonetheless, the nature and magnitude of the effects of FDI inflow on the host country's economy is debatable and the issue has received much critical attention from researchers (Jiang, 2003; Tian, et al., 2004). The theoretical debate was overwhelmingly dominated by arguments in favor of the positive effects of technology spillovers from FDI (Gorg and Strobl (2001)). However, the empirical results of firm and industry level studies that deal with spillovers and multinational activities are mixed. Caves (1974) and Globerman (1979) and later Blomstrom and Persson (1983), Blomstrom (1986), Blomstrom and Wolff (1994), and Kokko (1994, 1996) found evidence of positive spillover effects of FDI on the productivity of domestic firms of developed countries. Other studies, particularly the most recent by Aitken and Harrison (1999) for Venuzela, Djankov and Hoekman (2000) for the Czech Republic, and Kathuria (2000), for India found that FDI negatively affects the productivity of domestically owned firms. Girma and Wakelin (2000) found evidence of positive spillovers from multinational activities to domestic firms in the same sector in UK industries. Gorg and Strobl (2001) in a study of manufacturing industries in Ireland show the presence of a vertical linkage of MNE activities in

both downstream and upstream activities. More recently, Javorcik (2004) estimates the linkages for a variety of Lithuanian industries and shows that there are positive spillovers from MNE activities to domestic firms in sectors downstream, but not within same sector. Furthermore, linkages appear stronger in a localized setting, e.g. proximity between users and producers affects the strength of the spillover. The study also finds that MNEs that cater to the needs of the domestic market may have stronger linkage effects than more export oriented multinational firms.

Insert Table 1 about here.

The knowledge spillover literature typically examines more aggregate data, [2] e.g. focusing on a diverse set of firms drawn from total manufacturing, even though the spillovers are most likely taking place among similar firms in the same industry. . As a result the empirical results are wide-ranging. To explain knowledge spillover more precisely we develop a theoretical model with firm specific inputs, domestic or "home" capital and "foreign" capital, to show how turnover of labor with different qualities can change the productivity of the entire sector. We test the model using firm level data to estimate and compare productivity spillover in two sectors with quite different labor force characteristics, and therefore different abilities to transfer knowledge horizontally: information technology and textiles in India.

The Indian IT sector differs from other sectors in three ways. First, it has enjoyed very high levels of foreign direct investment resulting in phenomenal growth rates and has attained global status in a process that is interesting in its own right. Second, being a knowledge based

[2] With few exceptions, e.g., Majumdar, et al. (2002), which focuses on the pharmaceutical industry in India

sector, IT attracts high quality FDI with larger potential spillover effects. "Structuralist" economists like Singer, (1950) first noted that FDI in knowledge intensive industries constitutes a higher quality FDI than that in primary sectors. Kumar (2002) argued that since developing countries typically have a relatively weak base in knowledge intensive sectors, entry of FDI has greater potential for vertical inter-firm linkages, diffusion of new knowledge and other spillovers within the host economy. In contrast, for low skilled labor intensive manufacturing industries, developing countries often already have a well-developed production base and FDI may crowd out domestic enterprises (a "competition effect," Aitken and Harrison, 1999). As a result, the potential for FDI-led spillovers to domestic firms will likely be higher in the knowledge based IT sector and lower in the case of mature manufacturing sectors. And third, the labor turnover rate in the Indian IT sector is high, almost 40% per year (Nasscomm Report, 2007). Since labor embodies knowledge and is very mobile in the IT sector, the model suggests that not only will there be typical vertical FDI spillovers, but that horizontal spillovers will be more likely in the IT industry as well. Alternatively, a mature industry with a lower share of skilled labor and lower labor turnover will likely experience lower productivity spillover.

An ideal candidate for a mature sector for purposes of comparison is the textile sector. Like the IT sector, textiles in India is also an export oriented sector. However, unlike IT sector, the textile sector is not dependent on human capital, but primarily relies on physical capital such as advanced weaving machinery. It is also very large, contributing 4% of India's gross domestic product in 2007-08, and accounting for 13.5% of Indian exports, bringing in $17.6 billion. Second, textiles is a labor intensive sector that requires a low skilled labor force. Employment in

this sector is the second largest, after agriculture, reaching 35 million workers in 2007-08[3]. But, because labor is low skilled, labor as a messenger of knowledge would be less effective in this sector than a sector with high skilled labor force like the IT sector.

This study is unique in two ways. First, the analysis compares two specific sectors, rather than manufacturing in general. Previous studies considered either primary sectors or manufacturing, in general, to analyze such potential effects, whereas we focus on two sectors, one with high skilled knowledge oriented labor and another with low skilled labor. We estimate and compare the possible spillover effect from foreign firms to domestic firms in each sector. Second, previous empirical studies have treated the specific mechanisms by which the spillover occurs as a ''black box" (Gorg and Strobl, 2005). We suggest that sectors with high labor turnover and a skilled labor force may exhibit horizontal spillovers as labor embodied knowledge is more rapidly transferred among firms and in particular from MNE's to domestic firms in the same industry. The educational level and the extent of labor turnover in a particular industry are important for the existence of positive spillover effect and change the nature of the spillovers from vertical to horizontal. Our empirical results confirm this, that indeed horizontal spillovers exist in the IT industry, but not the textile industry. In addition, we find threshold effects with respect to FDI, i.e., it is FDI that reaches a point of "ownership and control" that matters.

In section 2 of the paper we develop a specific factor model with foreign and domestic capital, which suggests labor turnover may be a source of productivity growth differentials

[3] Website of Department of Commerce for the Government of India http://commerce.nic.in/

among sectors. The hypotheses are described in section 3, while section 4 discusses the data and section 5 describes the empirical results. Finally, section 6 concludes the study.

2. Theoretical Framework

2.1 MNEs and host country productivity

Previous literature identifies four mechanisms by which MNEs can affect domestic firms' productivity. : 1) demonstration effects, 2) linkage effects, 3) labor turnover effects, and 4) competition effects

Multinational entry may provide positive knowledge externalities to local competitors through a number of channels. First, the local firm may be able to learn simply by observing and imitating the multinationals (Demonstration effect). Second, employees may leave multinationals to create or join local firms (Labor turnover effect). Third, multinational investment may encourage the entry of international trade brokers, accounting firms, consultant companies, and other professional services, which then may become available to local firms as well (competition effect). These are essentially horizontal spillovers. Fourth, there may be direct links between the MNE and suppliers or distributors. These would be vertical spillovers. (See Gorg and Strobl, 2001 for an extensive review).[4] Although we do not have data that allow us to distinguish among these particular channels, we can identify if there has been productivity increases in the recipient firm and/or other non-recipient firms within the same industry – horizontal spillovers. Let us consider how this may happen.

2.2. Model

[4] For completeness we provide the detailed description of these effects in Appendix 1.

We combine all of the above effects in a simplifying framework, which allows us to explore the effect of FDI on the productivity of the entire industry in the host country. For this purpose, we construct a partial equilibrium, factor-specific model with FDI. The model takes the perspective of a small open economy, Home, which is a recipient of FDI. The rest of the world is defined as Foreign. Home's labor is a mobile factor and Foreign's and Home's capital are industry-specific factors. To capture the positive effects of FDI on Home's productivity, Home's amount of efficient units of labor per worker is assumed to increase in Foreign's capital.

2.2.1 Assumptions

Assume that a world representative consumer has utility function:

(1) $$U = q_0 + q_H^{\frac{\sigma-1}{\sigma}} + q_F^{\frac{\sigma-1}{\sigma}},$$

where q_0 is a numeraire good produced in Foreign, while goods q_H and q_F are produced by Home's industries H and F, respectively. We normalize the price of the numeraire and the number of world consumers to be equal to one.

Production of q_H requires Home's labor, L_H, and capital, K_H, while production of q_F requires Home's labor, L_F, and Foreign's capital, K_F. Both goods are produced by perfectly competitive industries with constant returns to scale technologies:

(2) $$q_H = L_H^{\alpha} K_H^{1-\alpha} \qquad q_F = L_F^{\alpha} K_F^{1-\alpha} \qquad 0 < \alpha < 1.$$

Home's and Foreign's capital are supplied inelastically and are industry-specific. Labor, on the other hand, can move freely between industries H and F, and is supplied inelastically with the total endowment of efficient units of labor in Home being $\bar{L}$.

We assume that Foreign's capital increases Home's labor productivity. In particular, if K_F units of foreign capital are employed in Home's production, the endowment of efficient units of labor increases by K_F^{γ}:

(3) $L_H + L_F = K_F^{\gamma}\bar{L}$

Both q_H and q_F can be traded at zero cost.

Equilibrium

Due to labor mobility, all workers in Home earn the same wage *w,* which, for each industry, is equal to a constant share α of the revenue over the corresponding amount of efficient units of labor:

(4) $w = \alpha p_H q_H / L_H$ $\qquad$ $w = \alpha p_F q_F / L_F$.

The demand function for each good can be derived from the utility function, equation (1):

(5) $q_H = p_H^{-1/\sigma}$ $\qquad$ $q_F = p_F^{-1/\sigma}$

Next we substitute for prices with quantities from (5), and for quantities with factors of production from (2) to express wages in (4) as:

$$w = \frac{\alpha}{L_H}\left(L_H^{\alpha}K_H^{1-\alpha}\right)^{\frac{\sigma-1}{\sigma}} \qquad w = \frac{\alpha}{L_F}\left(L_F^{\alpha}K_F^{1-\alpha}\right)^{\frac{\sigma-1}{\sigma}}$$

By substituting for L_F from (3) and noticing that wages are the same across industries we re-write the above equation as

$$L_H^{\frac{\alpha\sigma-\alpha-\sigma}{\sigma}}\left(K_H^{1-\alpha}\right)^{\frac{\sigma-1}{\sigma}}=\left(K_F^{\gamma}\bar{L}-L_H\right)^{\frac{\alpha\sigma-\alpha-\sigma}{\sigma}}\left(K_F^{1-\alpha}\right)^{\frac{\sigma-1}{\sigma}},$$

from which we get the equilibrium amount of labor employed in the production of q_H:

$$L_H=\bar{L}\left[K_F^{-\frac{(1-\alpha)(\sigma-1)}{\alpha+\sigma-\alpha\sigma}\gamma}K_H^{-\frac{(1-\alpha)(\sigma-1)}{\alpha+\sigma-\alpha\sigma}}+K_F^{-\gamma}\right]^{-1} \tag{6}$$

from which we can solve for the total sales of q_H:

$$p_Hq_H=\left(L_H^{\alpha}K_H^{1-\alpha}\right)^{\frac{\sigma-1}{\sigma}}=\left(\bar{L}^{\alpha}K_H^{1-\alpha}\right)^{\frac{\sigma-1}{\sigma}}\left[K_F^{-\frac{(1-\alpha)(\sigma-1)}{\alpha+\sigma-\alpha\sigma}\gamma}K_H^{-\frac{(1-\alpha)(\sigma-1)}{\alpha+\sigma-\alpha\sigma}}+K_F^{-\gamma}\right]^{-\alpha\frac{\sigma-1}{\sigma}}. \tag{7}$$

Comparative Statics

From (7) Foreign's capital has an ambiguous effect on the amount of labor employed in q_H industry: on the one hand a larger amount of K_F increases the productivity of labor in q_F industry and corresponding shift of labor from q_H to q_F, on the other hand Foreign's capital increases the total endowment of efficient units of labor through an externality effect. Due to the functional form of production function, this ambiguity is also transferred to the effect of Foreign's capital on the output and total sales of q_H. The elasticity of total sales of q_H with respect to K_F is given by:

$$\frac{d\ln\left(p_Hq_H\right)}{d\ln K_F}=\left(\frac{\alpha\left(\sigma-1\right)}{\sigma}\right)\left[\gamma-\frac{\frac{\left(1-\alpha\right)\left(\sigma-1\right)}{\sigma-\alpha\left(\sigma-1\right)}\left(K_F/K_H\right)^{\frac{(1-\alpha)(\sigma-1)}{\alpha+\sigma-\alpha\sigma}}}{\left(K_F/K_H\right)^{\frac{(1-\alpha)(\sigma-1)}{\alpha+\sigma-\alpha\sigma}}+1}\right]. \tag{8}$$

From this we have Proposition 1: In a factor-specific model with labor being a mobile factor and domestic and foreign capital being industry-specific factors, larger FDI increases sales of firms-non-recipients of FDI if FDI has a sufficiently large positive effect on labor productivity. Otherwise, larger FDI decreases sales of firms-non-recipients of FDI. The proof follows directly from (8).

There are two factors which affect this elasticity. First, the size of the externality effect of Foreign's capital, γ, positively affects the elasticity. This is by assumption, but with the magnitude unknown. Second, labor intensity, or the share of labor earnings in output, α, negatively affects the elasticity. Here, larger α indicates higher labor intensive production and changes in capital have less effect on labor productivity. Consequently, the competitive effect of Foreign's capital will be weaker and there will be a smaller shift in labor from q_H to q_F.

3. Empirical Analysis

In this section, we explore the effect of FDI on firms, both those that receive FDI and those with no or very limited amounts of FDI in textile and information technology industries. The IT industry is more knowledge intensive, with much higher R&D expenditures as a share of output (10-20 times higher than that of the textile sector, see Table 2). Thus, we assume that FDI's effect on labor productivity is larger in IT. Following Proposition 1, we formulate two testable hypotheses:

Hypothesis 1: Foreign equity participation increases sales of all firms in the IT sector, and

Hypothesis 2: In textile industry, foreign equity participation increases the firm-recipient's sales, but decreases sales of all other firms.

Consistent with recent research (e.g., Javorcik, 2004), we assume that the production function for IT firms can be approximated by a Cobb-Douglas production function with explicit knowledge externalities:

(9) $$Y_t=Ae^{\lambda t}.e^{\beta 1 Fe\_firm_t}.e^{\beta 2 Fe\_sector_t}.K_t^{\beta 3.}L_t^{\beta 4}e^{\varepsilon t}$$

where Y_t, K and L are measures of output, capital and labor in year *t,* A is a productivity index, λ is the rate of growth of disembodied technical change; FE_firm_{it} is the percentage foreign equity in an IT firm. FE_sector_t is the share of foreign equity firms' outputof the total sector output. Taking the logarithm of equation (9) and adding a vector of regional dummies, D_{jt}, and regional time trends, we have the following estimation equation:

(10) $$\ln Y_{it} = c + \sum_{j=1}^{4} \lambda_j t + \beta_1 FE\_firm_{it} + \beta_2 FE\_sector_t + \beta_3 \ln K_{it} + \beta_4 \ln L_{it} + \sum_{j=2}^{4} \gamma_j D_{jt} + \varepsilon_{it}$$

In addition we control for R&D expenditure and export share of total output. Specific data are discussed in the next section. Tests of the statistical significance of β_1 and β_2 then are tests of the above spillover hypotheses.

In a second specification we employ a measure of "foreign control" rather than the share of ownership. The IMF defines foreign control as owning 10% or more of the ordinary shares or voting power of an incorporated firm, or its equivalent for an unincorporated firm.[5] Thus, we

[5] Lower ownership shares are simply recorded as portfolio investment. (International Monetary Fund (IMF), 1993. Balance of Payments Manual, fifth edition (Washington, DC))

construct a dummy variable, FE_D, that takes the value 1 if the foreign equity ownership is greater than 10% and zero otherwise. We then estimate:

$$(11) \qquad \ln Y_{it} = c + \sum_{j=1}^{4} \lambda_j t_i + \beta_1 FE\_D_{it} + \beta_2 FE\_sector_t + \beta_3 \ln K_{it} + \beta_4 \ln L_{it} + \sum_{j=2}^{4} \gamma_j D_{jt} + \varepsilon_{it}$$

It should also be noted that there may be firm specific and time specific factors that are idiosyncratic to the firms, not captured by the time trend or the regional dummies, and these factors might influence the correlation between firm productivity and foreign ownership. For instance, foreign investment may flow to firms that might have high-quality management or towards the region that provides better infrastructure. To address such problems we followed Haskel, et al. (2002) and take the first difference of each variable. This controls for any firm specific or time invariant fixed effects. In addition, the time trend and regional dummy variables still control for changes in other unobservables. The first difference form of the model specified in equation (10) is then:

$$(12) \qquad \Delta \ln Y_{it} = c + \sum_{j=1}^{4} \lambda_j t + \beta_1 FE\_firm_{it} + \beta_2 FE\_indry_t + \beta_3 \Delta \ln K_{it} + \beta_4 \Delta \ln L_{it} + \sum_{j=2}^{4} \gamma_j D_{jt} + \varepsilon_{it}$$

where all variables are defined as above. Equation (12) is estimated in first and second differences. We also estimate the first difference specification of equation (11), using the foreign control dummy as the measure of foreign ownership:

$$(13) \qquad \Delta \ln Y_{it} = c + \sum_{j=1}^{4} \lambda_j t_i + \beta_1 FE\_D_{it} + \beta_2 FE\_indry_t + \beta_3 \Delta \ln K_{it} + \beta_4 \Delta \ln L_{it} + \sum_{j=2}^{4} \gamma_j D_{jt} + \varepsilon_{it}$$

4. Data

The Prowess data from the Centre for Monitoring the Indian Economy (CMIE) is a large database often employed for large sample studies of India (e.g, Khanna and Palepu, 2000; Khanna and Rivkin, (2001); Chacar and Vissa, 2005). It contains detailed financial, structural and organizational data on 15,000 Indian firms and comprises all companies traded on India's major stock exchanges and numerous other firms including central public sector enterprises. The companies covered in the Prowess database account for 75 per cent of all corporate taxes and over 95 per cent of excise duty collected by the government of India. We use a panel data set for the years 2000-2006. Table 2 presents descriptive statistics for key variables for 2006 for the IT sector and the textile sector

In both industries, Indian firms with foreign ownership (>10%) are larger in size (measured in levels of sales) than firms without foreign ownership.. For example, in the IT industry, firms with foreign capital have mean income of Rs. 551.38 (in 10 millions), while that for the domestic firms is Rs.134.26 (in 10 millions). In addition, firms with foreign capital are more export oriented and invest more in research & development both in relative and absolute terms.

Insert Table 2 about here.

In the regression equations above Y_{it} is income from sales deflated by the wholesale price index. K_{it}, is net fixed assets deflated by the industrial price index. Since the data set does not distinguish between skilled and unskilled labor, we express labor in terms of efficiency units. We compute the efficiency unit by dividing the wage bill, W, by the minimum wage, s

$L_{it} = W_{it}/(\text{minimum } W_{it})$. FE_sector_{it} is designed to capture possible spillover effects of foreign equity participation on the productivity of the entire sector. Several previous studies used either the share of employment or output of the foreign firms as a proxy to measure horizontal

spillover. We follow Blalock and Gertler (2008), and Kathuria (2001) and use the share of foreign firms' output in total industry output:

(14) $FE\_sector_{it} = \sum y_{it} | \sum Y_{it}$

where y_i is output of only foreign firms' and Y_{it} is total output for the respective sectors (that includes both the domestic firms as well as the foreign firms) at time t. In addition we control for the export behavior of the firm and R&D expenditures of the firm. There is empirical research that suggests exporting firms have higher productivity than non-exporters (Aw and Hwang 1995; Bernard and Jenson 2001). Further, existing literature also shows that firms with higher R&D expenditures have a higher capacity of absorbing knowledge (Hall, Jaffe and Trajtenberg, 2000; Gayle, 2001). To capture these effects we constructed the export ratio, XR, exports as a proportion of total income, and the R&D ratio, Rd, R&D expenditure as a proportion of total expense. We expect the estimated coefficients of both these variables to be positive and significant. Foreign firms are aware of the presence of regional disparities in terms of resources and infrastructure and tend to invest in preferred regions in the host country (Smeets, 2007). Therefore, we also include regional time trends and regional dummy variables to discern possible regional effects.

5. Estimation Results

5.1. Results from the IT sector

The estimation results for equation (10) and (11) are presented in Tables 3 and 4. Coefficients of lnK and lnL have the expected positive signs and the coefficient estimates are robust across specifications. We have added the control variables each one by one to examine the robustness of our findings. In Table 3 for all the specifications, estimated coefficients on

share of FE_firm and FE_sector have the expected signs, but are statistically insignificant. On the other hand, in Table 4, the coefficient of FE_D is highly significant across all specifications, indicating a threshold effect for the impact of foreign ownership with a controlling interest, a level higher than 10%. Firms with controlling foreign ownership tend to be more productive than purely domestic firms. However, the coefficient on FE_sector is insignificant in both the equations. Thus, the findings indicate that foreign ownership of IT firms significantly increases the firms output only if the foreign equity share is greater than ten percent of total equity. In addition, here when the production function is estimated in levels, we find no evidence of horizontal knowledge spillover of foreign firms. Also of interest, research and devolpment expenditures are significant and there are regional differences as well.

Insert Tables 3 and 4 about here.

The estimation results for equation (12) and (13) in first differences are presented in Table 5 and 6. In Table 5, across all specifications, the estimated coefficient of FE_firm is statistically insignificant. Similarly, in Table 6 the coefficient on FE_D is insignificant as well. This is consistent with the literature (Aitken and Harrison, 1999; Javorcik, 2004). The findings from Table 3 to 6 for FE_firm indicate that foreign control is positively correlated with output levels, but not with output growth. It may imply selection bias on the part of foreign investors, suggesting that foreign capital is flowing to the most productive domestic firms. However, the estimated coefficient of FE_sector is statistically significant in both Table 5 and 6 indicating that changes in horizontal spillover over time are positively associated with firms' output growth.

Insert Tables 5 and 6 about here.

The FE_sector variable captures horizontal spillover, i.e. productivity spillover in the IT sector due to the foreign presence in that sector. The coefficient estimate is positive and statistically significant in all specifications of Tables 5 and 6 indicating there exists horizontal spillover from foreign firms in the IT sector, i.e. productivity increases even in firms which are not direct recipients. This is contrary to other studies of manufacturing firms in developing economies which typically find that such horizontal spillover is negative or statistically insignificant (Aitken and Harrison, 1999; Javorcik, 2004; Kathuria, 2001). They concluded that the lack of horizontal spillover may be due to the foreign firms' ability to prevent the leakage of technology to its competitors in the same industry. However, the Indian IT industry is driven by two important features. First, it is a technology-intensive industry and second it has a very high labor turnover rate. The first characteristic is crucial since the previous studies mainly dealt with manufacturing firms where capital is predominately limited to physical capital. Here, for the IT firms knowledge capital is high and the high labor turnover rate (almost 40% in 2007, Nasscom report). This high mobility of knowledge capital may may explain our finding. It is our conjecture that such factor mobility increases the horizontal spillover in the industry and therefore even FDI non-recipient domestic firms are generally better off with the foreign presence in the IT sector. Another example of this phenomenon, labor turnover as a means of disseminating MNE technologies to local firms may be found in The World Investment Report of 1992, which discusses the case of Bangladesh's garment industry in this regard. Korea's Daewoo supplied Desh (the first Bangladeshi firm to manufacture and export garments) with technology and credit. Eventually, a majority of the initial workers left Desh to set up their own

firms, or to join other newly established garment companies. The remarkable speed with which the former Desh workers transmitted their know-how to newly established factories clearly demonstrates the role labor turnover can play in knowledge diffusion.

5.2. The Textile Sector

For the textile sector we use the same specifications in first differences to test for the presence of horizontal spillover in this sector. The results are presented in tables 7 and 8.

Insert Tables 7 and 8 about here.

First note that the coefficient estimates of $\Delta \ln K$ and $\Delta \ln L$ are of the correct size and statistically significant. Also note that the labor elasticity or labor's share of income is much greater than that in the IT sector, as expected. We find that the estimated coefficient of FE_sector is statistically significant, but negative. This result is consistent with previous findings for manufacturing. Aitken and Harrison (1999) suggested that maybe the 'market stealing effect' of foreign firms is the primary reason of such negative spillover within mature manufacturing sectors. We argue that the low skilled labor force makes labor less likely to act as the messenger of knowledge.

6. Conclusion

Government policies thatenhance the ability of a sector to attract foreign investments are often justified if these activities provide broader spillovers to the domestic economy as FDI directly generates additional output and employment. In addition, another potential contribution

is to upgrade the level of knowledge and technical expertise in the local economy. This is especially important for economies behind the technological frontier because the entrance of technologically superior foreign companies may help close the international productivity gap.

We find there exists horizontal spillover effects from the activities of foreign firms to local firms. Our findings have several policy implications. Our first hypothesis was whether foreign ownership, in terms of foreign equity participation, increases firm productivity or not. We find that a controlling foreign ownership through equity holdings of greater than 10% significantly increases the productive performance of IT firms, but not textile firms.. The average share of foreign ownership by itself has no statistically significant effect in either industry. Our second hypothesis was whether the foreign presence results in some degree of horizontal productivity spillover to domestic firms. We found that there are positive spillover effects within the IT industry, a result not found for the textile industry. Our findings support the policy to attract more FDI in the knowledge based IT sector as such FDI significantly increases the productivity of the entire sector.

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Table1: Summary of previous findings

Author	Industry	Country	Data set	Spillover
Blomstrom and Persson (1983)	Manufacturing	Mexico	cross section	+
Caves (1974)	Manufacturing	Australia	cross section	+
Globerman (1979)	Manufacturing	Canada	cross section	+
Kokko (1994)	Manufacturing	Mexico	cross section	+
Blomstrom and Sjoholm (1999)	Manufacturing	Indonesia	cross section	+
Aitken and Harrison (1999)	Manufacturing	Venezuela	panel	-
Djankov and Hoekman (2000)	Manufacturing	Czech Republic	panel	-
Javorcik (2004)	Manufacturing	Lithuania	panel	-
Kathuria (2001)	Manufacturing	India	panel	-
Sasidharan & Ramanathan (2008)	Manufacturing	India	panel	-

Table 2: Descriptive Statistics for the IT and textile sectors (2006)

IT Sector:

	Firms with Foreign Ownership n=55		Firms without Foreign Ownership n=407	
	Mean	Coefficient of Variation	Mean	Coefficient of Variation
Y, Rs 10 Million	551.39	2.57	134.26	7.33
K, Rs 10 Million	137.62	2.30	26.65	5.52
L, Rs 10 Million	234.90	2.77	52.85	7.78
Export Ratio, %	69.33	0.49	41.35	1.32
R&D Ratio, %	1.11	2.74	0.61	6.61

Textile sector

	Firms with Foreign Ownership n=71		Firms without Foreign Ownership n=652	
	Mean	Coefficient of Variation	Mean	Coefficient of Variation
Y (Rs 10 Million)	238.3394	2.2790	98.1178	2.038205
K (Rs 10 Million)	159.9018	2.2770	62.3152	3.050561
L (Rs 10 Million)	9.0717	1.6665	5.5009	2.417495
Export Ratio	0.1822	1.3117	0.1754	2.1881
RD Ratio	0.0013	2.5384	0.0002	5.000

Table 3: Production Function Estimates with Foreign Ownership Share in IT

Dependent Variable:	lnY	lnY	lnY	lnY	lnY
lnK	0.412***	0.412***	0.411***	0.409***	0.407***
	(0.018)	(0.018)	(0.02)	(0.02)	(0.02)
lnL	0.545***	0.543***	0.543***	0.543***	0.543***
	(0.018)	(0.018)	(0.019)	(0.019)	(0.019)
FE_firm	0.001	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
FE_sector	-1.687	4.201	6.014	6.066	6.13
	(1.38)	(4.281)	(4.556)	(4.552)	(4.538)
t_1		0.080*	0.091*	0.092*	0.074
		(0.048)	(0.051)	(0.051)	(0.055)
t_2		0.025	0.026	0.025	0.077
		(0.047)	(0.05)	(0.05)	(0.051)
t_3		0.096**	0.101*	0.101*	0.002
		(0.049)	(0.052)	(0.052)	(0.065)
t_4		0.220***	0.232***	0.233***	0.094
		(0.054)	(0.057)	(0.057)	(0.08)
XR			0.023	0.024	0.025
			(0.032)	(0.032)	(0.031)
Rd				1.220*	1.277*
				(0.635)	(0.663)
D_2					-0.360**
					(0.168)
D_3					0.407
					(0.255)
D_4					0.655*
					(0.357)
constant	-3.573***	-5.796***	-6.399***	-6.427***	-6.365***
	(0.513)	(1.62)	(1.721)	(1.72)	(1.719)
R^2	0.752	0.76	0.77	0.77	0.773
N	2111	2111	1853	1853	1853

Note: Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Table 4: Production Function Estimates with Foreign Control Dummy in IT

Dependent Variable:	lnY	lnY	lnY	lnY	lnY
lnK	0.404***	0.404***	0.404***	0.402***	0.400***
	(0.019)	(0.019)	(0.02)	(0.02)	(0.02)
lnL	0.538***	0.537***	0.537***	0.537***	0.537***
	(0.018)	(0.018)	(0.02)	(0.019)	(0.019)
FE_D	0.204**	0.245***	0.185**	0.183**	0.195**
	(0.081)	(0.083)	(0.082)	(0.082)	(0.081)
FE_sector	-1.526	4.212	6.098	6.147	6.223
	(1.377)	(4.162)	(4.548)	(4.545)	(4.531)
t_1		0.078	0.090*	0.091*	0.076
		(0.048)	(0.051)	(0.051)	(0.055)
t_2		0.023	0.025	0.024	0.076
		(0.047)	(0.05)	(0.05)	(0.051)
t_3		0.096**	0.102**	0.102**	0.002
		(0.048)	(0.052)	(0.052)	(0.065)
t_4		0.221***	0.234***	0.235***	0.093
		(0.054)	(0.057)	(0.057)	(0.08)
XR			0.02	0.022	0.023
			(0.033)	(0.033)	(0.032)
Rd				1.184*	1.239*
				(0.634)	(0.662)
D_2					-0.345**
					(0.168)
D_3					0.427*
					(0.256)
D_4					0.683*
					(0.354)
Constant	-3.641***	-5.809***	-6.441***	-6.467***	-6.422***
	(0.512)	(1.610)	(1.717)	(1.716)	(1.715)
R^2	0.753	0.761	0.77	0.77	0.773
n	2107	2107	1851	1851	1851

Note: Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Table 5: First Difference Production Function Estimates with Percentage Share of Foreign Ownership in IT

Dependent variable:	Δ.lnY	Δ.lnY	Δ.lnY
Δ.lnK	0.501***	0.443***	0.443***
	(0.061)	(0.063)	(0.063)
Δ.lnL	0.459***	0.451***	0.452***
	(0.077)	(0.08)	(0.08)
Δ.FE_firm	0.002*	0.001	0.001
	(0.001)	(0.001)	(0.001)
Δ.FE_sector	4.569**	6.537***	6.564***
	(1.864)	(2.164)	(2.167)
Δ.XR		0.005	0.005
		(0.013)	(0.013)
ΔRd			0.57
			(0.751)
constant	0.112***	0.146***	0.146***
	(0.027)	(0.031)	(0.031)
R^2	0.224	0.198	0.198
n	1704	1405	1405

Note: Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Table 6: First Difference Production Function Estimates with Foreign Control Dummy in IT

	Δ.lnY	Δ.lnY	Δ.lnY
Δ.lnK	0.502***	0.444***	0.444***
	(0.061)	(0.063)	(0.063)
Δ.lnL	0.462***	0.453***	0.454***
	(0.078)	(0.08)	(0.081)
FE_D	0.015	-0.022	-0.022
	(0.045)	(0.047)	(0.047)
Δ.FE_sector	4.622**	6.589***	6.616***
	(1.863)	(2.162)	(2.165)
Δ.XR		0.005	0.005
		(0.013)	(0.013)
Δ.Rd			0.573
			(0.751)
Constant	0.115***	0.151***	0.150***
	(0.028)	(0.033)	(0.033)
R^2	0.224	0.198	0.198
N	1704	1405	1405

Note: Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Table7: First Difference Production Function with Percentage Share of Foreign Ownership in Textiles

Dependent Variable:	Δ.lnY	Δ.lnY	Δ.lnY
Δ.lnK	0.261***	0.247***	0.250***
	(0.081)	(0.078)	(0.078)
Δ.lnL	0.740***	0.730***	0.731***
	(0.128)	(0.122)	(0.122)
Δ.FE_firm	0.002	0.002	0.002
	(0.003)	(0.003)	(0.003)
Δ.FE_sector	-1.965**	-1.873**	-1.875**
	(0.943)	(0.948)	(0.951)
Δ.Rd		0.477**	0.482**
		(0.214)	(0.213)
Δ.XR			-2.739
			(3.48)
constant	-0.015	-0.01	-0.01
	(0.013)	(0.013)	(0.013)
R^2	0.286	0.294	0.296
n	3304	3304	3304

Note: Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Table 8: First Difference Production Function Estimates with Foreign Control Dummy for Textiles

Dependent variable:	Δ.lnY	Δ.lnY	Δ.lnY
Δ.lnK	0.196***	0.199***	0.200***
	(0.052)	(0.052)	(0.052)
Δ.lnL	0.810***	0.809***	0.809***
	(0.061)	(0.061)	(0.061)
FE_D	0.009	0.006	0.007
	(0.035)	(0.035)	(0.035)
Δ.FE_sector	-1.277**	-1.314**	-1.319**
	(0.58)	(0.582)	(0.581)
Δ.Rd		-0.174	-0.173
		(0.268)	(0.269)
Δ.XR			-2.294
			(3.444)
constant	-0.034***	-0.034***	-0.034***
	(0.009)	(0.009)	(0.009)
R^2	0.339	0.341	0.341
n	3951	3951	3951

Note: Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Appendix 1. Definition and description of the link through which MNEs affect the productivity of the host country firms.

*Demonstration Effects (*Blomstrom and Kokko; 1998)

The presence of MNE's in a domestic industry enables local entrepreneurs from that industry to observe and emulate organizational practices and strategies and replicate them in their own operations. For instance, through exposure to MNEs' activities, local firms may adopt new technologies, innovative marketing approaches, methods and procedures to motivate the employees, or other organizational behaviors that enhance organizational efficiency. Such activities by the local firms then help in increasing local firms' productivity.

Linkage Effects

The presence of local linkages (Spencer, 2008) produces both positive spillover and crowding out effects for the local firms operating in the same industry with the MNE. Local linkages are narrowly defined as business transactions between foreign affiliates and domestic firms that go beyond arm's length, one-off relations and involve longer-term relations between the parties (UNCTAD, 2001)[6]. MNEs with better capabilities than the local firms attract inputs, such as high skilled workers in that industry by offering higher wages or other benefits. Thus, the entry of MNEs in an industry raises the price of vital inputs and high quality inputs relocate from domestic firms to MNEs. Local firms are crowded out of input markets and often they opt for inferior strategies, including purchasing lower quality inputs. Marginal firms may be forced to close.

However, MNEs also have an incentive to transfer specific knowledge or technologies to their intermediate input suppliers in the host country. MNEs arrange various training programs that push local suppliers and distributors to raise their quality and service standards (Brash, 1966). Such transfers of knowledge establish backward linkages from the MNE to suppliers in the host economy (Markusen & Venables, 1998; Rodriguez -Clare, 1996). In addition, these improvements should benefit all customers of such suppliers and not only the original MNE (Blalock and Gartler, 2008). Therefore, such linkages not only create vertical spillover, but also horizontal spillovers, to firms operating in the same industry, buying the new higher quality inputs.

Labor Turnover Effects

Knowledge spillovers take place when employees from the MNEs take new jobs in local enterprises. Such labor turnover implies that details about an MNE's strategy, operations and processes can be diffused to local firms, even potential competing firms, a horizontal spillover. In addition, Meyer (2004) noted that even for the countries where labor mobility from MNEs is less frequent, the overall impact may be large when an employee who holds a key position like the manager leaves the MNE and engages in entrepreneurial activities in the host economy. High labor turnover rates then might be a significant source of positive externality in an industry like IT where knowledge and skills are often developed within the firm.

Competition Effect

The increased competition that accompanies MNE entry can increase the productivity of local firms. MNEs exhibit higher productivity than their local counterpart in general and this in turn compels the local firms to shed slack resources and adopt more efficient production techniques to meet this competitive challenge. Such competition generally increases firms' productivity in that industry. However, it is not always the case that the domestic firms' benefit from the activities of foreign firms, as the relative backwardness of the industrial structure and the institutional characteristics of the domestic economy significantly determine the relative size and extent of these spillovers (Glass and Saggi, 1998; Grima et al, 2001).

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[6] A broader definition of linkages includes transactions between foreign affiliates and local non-business entities like universities, training centers, research and technology institutes, export promotion agencies and other official or private institutions. In this study we use the narrow definition.