

The impact of foreign direct investment on linkages and technology transfer

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I. Introduction

Today, intra-firm trade (i.e. trade between subsidiaries and headquarters of multinational firms) may account for one-third of total world trade and sales of subsidiaries of multinational firms now exceed worldwide exports of goods and services. Thus, foreign direct investment (FDI) is the dominant channel through which firms serve customers in foreign markets. While much of FDI occurs between industrial countries, developing countries are becoming increasingly important host countries for FDI. In fact, approximately 33% of the global stock of FDI today is in developing countries (UNCTAD, 2003). Latin America and the Caribbean hold a little less than 11% of the global stock of FDI with Brazil, Argentina, Chile, and Venezuela being the four largest recipients in descending order.

The effects of FDI on technology transfer, backward and forward linkages, local employment, and overall industrial development of host countries has always been an important policy concern in developing countries. In this sense, Latin American countries are no different. For example, Brazil, the biggest market in the region, has always been actively interventionist with respect to international trade and FDI with its overall model of economic development of import substitution being similar to that of India's. Before it became part of the North American Free Trade Agreement (NAFTA), Mexico pursued policies quite similar to that of Brazil.¹ The objective of this paper is to evaluate the existing analytical arguments and related empirical evidence regarding the effects of FDI on local industrial development (particularly with respect to linkages and technology transfer) with the ultimate goal of deriving implications for policy.

The paper argues that while substantial evidence supports the view that multinationals facilitate international technology transfer, the further diffusion of technologies introduced by them to local firms that compete with them is rather unlikely. However, the most recent empirical

¹ As is well known, trade restrictions create an incentive for tariff jumping FDI on the part of foreign firms seeking better access to the local market. Much FDI into Brazil was indeed driven by this incentive. Two points are worth noting about such FDI. First, since it is driven by a policy distortion, the welfare effects of such FDI are ambiguous. Second, such FDI is unlikely to occur when the size of the local market is small.

studies of FDI have shown convincingly that suppliers and buyers that interact with multinationals experience substantial improvements in technology and productivity. In doing so, such studies have established a strong connection between technology transfer and linkage effects of multinational firms – an insight that has begun to gain currency only in recent years.

The paper is organized as follows. The meat of the paper is in section II. This section discusses analytical arguments regarding the effects of FDI and the available empirical evidence on horizontal and vertical spillovers from FDI. Section III provides concluding remarks and implications for policy supported by the existing evidence.

II. Effects of FDI on linkages and technology transfer

A basic tenet of the theory of the multinational firm is that such firms rely heavily on intangible assets, such as superior technology and well established brand names to successfully compete with local firms that are better acquainted with the host country environment. Thus, multinational firms can potentially play a crucial role in the international diffusion of technology. But the question is: do they?

Casual evidence supports the view that multinationals are intimately involved in international technology transfer (ITT): for example, in 1995, over 80 percent of global royalty payments for international transfers of technology were made from subsidiaries to their parent firms (UNCTAD 1997).² Furthermore, the intra-firm share of technology flows has increased over time. Of course, royalty payments only record the *explicit* sale of technology and do not capture the full magnitude of technology transfer through FDI relative to technology transfer via imitation, trade in goods, and other channels.

By encouraging inward FDI, developing countries hope not only to import more efficient foreign technologies, but also to improve in productivity of local firms via technological spillovers to them. Not surprisingly, there exists a large literature that tries to determine whether

² There is nothing special about the year 1995 – the numbers for other years are of similar order of magnitude.

host countries enjoy spillovers (i.e. positive externalities) from FDI. Measurement of spillovers is a difficult task because, by definition, externalities are not taken into account by markets and therefore leave no paper trail. Nevertheless, several studies have attempted the difficult task of quantifying spillovers. Before turning to the evidence, it is useful to be clear about the potential channels through which such spillovers may arise. Any discussion of spillovers from FDI needs to tackle the difficult question of whether it is reasonable to *even expect* such spillovers to occur: multinationals have much to gain from preventing the diffusion of their technologies to local firms and one would expect them to take actions that help preserve their technological superiority. Of course, this argument does not apply when their technologies diffuse vertically to potential suppliers of inputs or buyers of goods and services sold by multinationals (see more on this below). In general, however, a skeptical a priori position on spillovers from multinationals to their local competitors seems appropriate.

At the micro level, the literature suggests the following potential channels of spillovers:

1. *Demonstration effects*: Local firms may adopt technologies introduced by multinational firms through imitation or reverse engineering;
2. *Labor turnover*: Workers trained or previously employed by the multinational may transfer important information to local firms by switching employers, or may contribute to technology diffusion by starting their own firms; and
3. *Vertical linkages*: Multinationals may transfer technology to firms that are potential suppliers of intermediate goods or buyers of their own products.

Demonstration Effects

The demonstration effect argument states that exposure to the superior technology of multinational firms may lead local firms to update their own production methods. The implicit assumption behind this argument is that it may be too costly for local firms to acquire the information required for adopting a new technology if it is not first introduced in the local economy by a multinational (and hence demonstrated to succeed in the local environment). Also, the payoff from the adoption of a foreign technology can be highly uncertain and the successful

application of such a technology in the local environment by a multinational can help resolve such uncertainty thereby generating an informational spillover for local firms.

Suppose FDI does lower the cost of technology adoption and leads to faster adoption of new technologies by local firms. Does that imply that, relative to trade (that is, a scenario where foreign firms export to the domestic or world market), inward FDI necessarily improves productivity in the local economy? As already noted before, technology diffusion may strengthen the competitors of the foreign firms. Foreseeing the consequences of such diffusion, foreign firms may alter the very terms of their original technology transfer. For example, a foreign firm may choose to transfer technologies of lower quality when there is a risk of leakage to local firms. Thus, while demonstration effects might exist in principle, their practical efficacy might be limited by strategies undertaken by multinational firms.

Labor Turnover

Although researchers have extensively studied direct imitation and reverse engineering as channels of inter-firm technology diffusion, the role of labor turnover has been somewhat neglected. Labor turnover differs from the other channels because knowledge embodied in the labor force moves across firms only through the physical movement of workers. The relative importance of labor turnover is difficult to establish because it would require tracking individuals who have worked for multinationals regarding their future job choices and then determining their impact on the productivity of new employers. Few empirical studies attempt to measure the magnitude of labor turnover from multinationals to local firms.

The available evidence on labor turnover itself is mixed. For example, although Gershenberg's (1987) study of Kenyan industries finds limited evidence of labor turnover from multinationals to local Kenyan firms, several other studies document substantial labor turnover from multinationals to local firms. Consider the case of the garment industry in Bangladesh (see Rhee 1990 for details). Korea's Daewoo supplied Dosh (the first Bangladeshi firm to manufacture and export garments) with technology and credit. Thus, Dosh was not a multinational firm in the

strict sense; rather, it was a domestic firm that benefited substantially from its connection with Daewoo. Eventually, 115 of the 130 initial workers left Dosh to set up their own firms or to join other newly established garment companies. The remarkable speed with which the former Dosh workers transmitted their know-how to other factories clearly demonstrates the role labor turnover can play in technology diffusion. Rodrik (2004) has argued that imitative entry through labor turnover drove industry growth in not only the case of garments in Bangladesh, but also information technology in India, and Salmon in Chile (where the first successful investment was actually made by the government).

Pack (1997) discusses evidence documenting the role of labor turnover in disseminating the technologies of multinationals to local firms. For example, in the mid 1980s, almost 50 percent of all engineers and approximately 63 percent of all skilled workers that left multinationals left to join local Taiwanese firms. By contrast, Gershenberg's study of Kenyan industry reports smaller figures; of the 91 job shifts studied, only 16 percent involved turnover from multinationals to local firms.

In order to synthesize these empirical findings the cross-country variation in labor turnover rates itself requires an explanation. One possible generalization is that in countries such as South Korea and Taiwan, local competitors are less disadvantaged relative to their counterparts in many African economies, thereby making labor turnover possible. Thus, the ability of local firms to absorb technologies introduced by multinationals may be a key determinant of whether labor turnover occurs as a means of technology diffusion in equilibrium (See Glass and Saggi, 2002 for a formal model). Furthermore, the local investment climate may be such that workers looking to leave multinationals in search of new opportunities (or other local entrepreneurs) find it unprofitable to start their own companies, implying that the only alternative opportunity is to join existing local firms. The presence of weak local competitors probably goes hand in hand with the lack of entrepreneurial efforts because both may result from the underlying structure of the economic environment.

Labor turnover rates may vary at the industry level as well. Casual observation suggests that industries with a fast pace of technological change (such as the computer industry in Silicon Valley) are characterized by very high turnover rates relative to more mature industries. Therefore, cross-country variation in labor turnover from multinationals could simply stem from the global composition of FDI: developing countries are unlikely to host FDI in sectors subject to rapid technological change.

Using firm level data from the manufacturing sector in Ghana, Gorg and Strobl (2002) provide recent evidence on labor turnover and its effect on productivity of local firms. They show that firms run by owners that worked for multinationals in the same industry prior to establishing their own firms have higher productivity growth than other domestic firms. This finding implies that entrepreneurs bring with them some of the knowledge accumulated in the multinational. However, they do not find any positive effects on firm level productivity if the owner had experience in multinationals in other industries, or received training by multinationals suggesting that the knowledge being imparted to workers may sometimes be of a very specific type with limited applicability to other industries.

Linkages and Vertical Technology Transfer

There exists a voluminous informal as well as empirical literature on backward linkages. For example, the 1996 issue of the World Investment Report was devoted entirely to the effects of FDI on backward linkages in host countries. However, analytical models that explore the relationship between multinationals and backward linkages in the host country are hard to come by. Two prominent examples of such models are Markusen and Venables (1999) and Rodriguez-Clare (1996). Both these studies provide important insights regarding the two-way relationship between multinationals and linkages. In the models of Rodriguez-Clare (1996) and Markusen and Venables (1999) the intermediate goods sector is monopolistically competitive so that the effects of foreign investment occur via altering the incentives for entry into such markets. In both models, Ethier's (1982) formulation of the so-called love-of-variety production function for final

goods is at the heart of the interaction between multinationals and local suppliers. These models emphasize the demand-side effects of multinationals' entry on the host economy.

In a recent paper, Barrios et. al. (2004) construct a model wherein the competition effect generated by a multinational is eventually dominated by the positive externalities it generates. Using plant level panel data from the manufacturing sector in Ireland (a country whose economic development has been influenced greatly by multinational firms) they show that such a model indeed describes the Irish experience with FDI. Alfaro and Rodriguez-Clare (2003) use plant level data from several Latin American countries to evaluate the linkage effects of multinationals. Their empirical work is motivated by a modified version of the model presented in Rodriguez-Clare (1996) and they make the important point that many empirical studies lack a tight link to existing theoretical models and often use inappropriate measures to evaluate the linkage effects of multinationals. More specifically, empirical studies often use the share of inputs purchased locally by a multinational to measure its impact on linkages. However, Alfaro and Rodriguez-Clare argue that the proper measure (as implied by theory) is the ratio of value of inputs bought domestically to the total workers hired by a multinational. The distinction between the two types of measures is important because multinationals typically source a lower percentage of their inputs locally relative to their local competitors. However, it does not imply that their linkage effects are necessarily negative since their production techniques might require more inputs in relation to the workers they hire. In their empirical work, Alfaro and Rodriguez-Clare find that the linkage coefficient of multinationals is actually higher than that of local firms in Brazil, Chile, and Venezuela where it is no different (statistically) in Mexico.

While existing models focus mostly on the demand-pulling effect of the entry of multinationals, Lin and Saggi (2004a and 2004b) consider how such entry might affect the supply-side of the intermediate good sector. In particular, Lin and Saggi (2004a) raise the following questions: What is the relationship between vertical technology transfer (VTT) from a multinational to its local suppliers and the equilibrium degree of backward linkages? How does

the nature of contractual relationships between multinationals and their local suppliers affect the degree of backward linkages in the local industry? To address these questions, they develop a two-tier model in which the production of a final good requires an intermediate good and market structure at both stages of production is oligopolistic. Upon entry, the multinational sources the intermediate good locally and also engages in VTT to its suppliers guided by a contractual agreement. Two types of contractual relationships are considered: one in which its suppliers must abide by an exclusivity condition that precludes them from serving its local rivals and another in which they face no such restriction. The major point of their paper is that the linkage effects that result from the multinational's entry depend crucially upon the nature of contractual agreement that emerges in equilibrium – under exclusivity, the multinational's entry can even lower linkages (and welfare) relative to autarky.

As Rodriguez Clare (1996) notes, multinationals improve welfare only if they generate linkages over and beyond those generated by the local firms they displace. Yet, the question of relevance here is whether the generation of linkages is expected to result in productivity improvements and/or technology diffusion. VTT has been documented to occur when firms from industrialized countries chose to buy the output of firms in many Asian economies in order to sell it under their own name (Hobday, 1995). For example, companies such as Radio Shack and Texas Instruments have commissioned firms in developing countries to produce components or entire products, which are then sold under the retailer's name. Rhee, Ross-Larson, and Pursell (1984), summarizing the results of extensive interviews in Korea in the late 1970s report that almost half of the firms said they had directly benefited from the technical information foreign buyers provided. The knowledge transfers involved were multi-faceted: not only manufacturing knowledge was transferred but exact sizes, colors, labels, packing materials and instructions to users. It has also been found that in the later 1970s, many importing firms from industrialized maintained very large staffs in countries such as Korea and Taiwan who spent considerable time with their local manufacturers assisting them in meeting their specifications (Keesing, 1982).

Motivated by this evidence, Pack and Saggi (2001) develop a model that explores the interdependence between production of manufactures in developing countries and their marketing into industrialized country markets. In their model, a buyer from an industrialized country can transfer technology to producers in a developing country in order to outsource production. Since firms in developing countries often lack the ability to successfully market their products internationally, technology leakage in the developing-country market actually *benefits* the industrial-country firm since it increases competition among the developing-country suppliers. An interesting implication of their analysis is that fully integrated multinational firms may be more averse to technology diffusion than firms that are involved in international arms length arrangements.

More recent evidence regarding VTT is provided by Mexico's experience with the *maquiladora* sector and its automobile industry. Mexico started the maquiladora sector as part of its Border Industrialization Programme designed to attract foreign manufacturing facilities along the US-Mexico border. Most maquiladoras began as subsidiaries of US firms that shifted labor-intensive assembly operations to Mexico because of its low wages relative to the US. However, the industry evolved over time and the maquiladoras now employ sophisticated production techniques, many of which have been imported from the US.

The development of the automobile industry in Mexico provides an excellent case study for learning about the pitfalls and benefits of policies that seek to maximize local benefits from FDI. Therefore, it is useful to take a close look at it. The Mexican auto industry has always received significant attention from the government. For example, between 1962 and 1989, it was the subject of five official decrees aimed at its development. More recently, the North American Free Trade Agreement (NAFTA) has come to play a crucial role in its success. As a result of NAFTA, Mexico now occupies an important place in the global strategies of multinational firms who are all keen to corner a piece of the large US market. Historically, Mexico's motivations for intervening in the automobile industry were similar to those of Brazil (and a host of other

developing countries): both intended to use trade policy to encourage industrial development. In fact, Mexico's policy interventions followed those of Brazil's and could therefore have benefited from the Brazilian experience.⁸

In certain key respects, Mexican experience in the automobile industry is quite representative of its overall industrial development. In keeping with the overall strategy of import substitution, during the 60s and 70s, Mexico imposed domestic content requirements on multinationals in the automobile industry. These requirements were less stringent than those imposed in Brazil: whereas Brazil required car manufacturers to have a domestic content of over 90%, Mexican policy imposed a domestic content requirement of only 60%. Incidentally, another important difference between Mexican and Brazilian policies was that Mexico did not allow foreign firms to vertically integrate with their local suppliers while Brazil did. The goal of this nationalistic stance was to ensure that domestic firms captured the benefits generated by the backward linkages of FDI.

In 1972, domestic content requirements were supplemented by a decree that required multinational firms to increase their exports; and in 1977, an explicit trade-balancing requirement was imposed that required imports by car manufacturers to be matched by exports. Strict rules of origin requirements were imposed under NAFTA: to receive preferential tariffs available to North American products, a product was required to have 62.5% 'domestic' content by the year 2002. While mainly domestic political pressures drove earlier policies, the existence of rules of origin requirements reflects, in part, the influence of US firms. The Big Three (GM, Ford, and Chrysler) were keen to limit Japanese access to the US market by using Mexico purely as an export platform and the rules of origin requirements were imposed to guard against this possibility.

An interesting aspect of Mexico's export performance requirement in the automobile industry (as noted by Moran, 1998) was that, unlike countries such as Malaysia, Mexico did not require that foreign firms export a particular product (such as a finished car) but only that value of exports be in some relation to imports. Clearly, such a policy let the car companies decide what to

export and what not, leaving them free to make their own calculations based on comparative advantage considerations. The export performance of the industry has improved remarkably in recent years: between 1990 and 1998, the share of exports in output has increased from a small 3.7% to a remarkable 68.6%.

Mexico's experience in the automobile industry is also illustrative of how FDI can contribute to industrial development in the host country. Initial investments by US car manufacturers into Mexico were followed by investments by not only by Japanese and European car manufacturers but also by firms who made automobile parts and components. As a result, competition in the automobile industry increases at multiple stages of production thereby improving efficiency.⁹ Such a pattern of FDI behavior (i.e. investment by one firm was followed by investment by others) probably reflects strategic considerations involved in FDI decisions. Most multinational firms compete in highly concentrated markets and are highly responsive to each other's decisions. An important implication of this interdependence between competing multinationals is that a host country may be able to unleash a sequence of investments by successfully inducing FDI from one or two major firms.

Extensive backward linkages resulted from FDI in the Mexican automobile industry: within five years of investments by major auto manufacturers, there were 300 domestic producers of parts and accessories, of which 110 had annual sales of more than a million dollars. As per Nunez (1990), multinationals in the Mexican automotive sector conducted production audits, held weekly coordination meetings, and provided technical training to their suppliers. Foreign producers also transferred technology to such domestic suppliers: industry best practices, zero defect procedures, production audits etc. were introduced to domestic suppliers thereby improving their productivity and the quality of their products.¹⁰ As a result of increased competition and efficiency, Mexican exports in the automobile industry boomed.

A recent comprehensive case-study of the effects of Intel's investment in Costa Rica by Larrain B. et. Al. (2000) finds evidence that local suppliers benefited substantially from Intel's investment. Similar evidence exists for other sectors and countries and such evidence is discussed in great detail in Moran (1998 and 2001). For example, in the electronics sector, Moran (2001) notes that in Malaysia, foreign investors helped their local subcontractors keep pace with modern technologies by assigning technicians to the suppliers' plants to help set up and supervise large-volume automated production and testing procedures. In a broader study, Batra and Ton (2002) use data from Malaysia's manufacturing sector to study effect of multinationals on inter-firm linkages and productivity growth during 1985-1995. Their results show that not only are foreign firms more involved in inter-firm linkages than domestic firms but also that such linkages are associated with technology transfer to local suppliers. Such technology transfers were found to have occurred through worker training and the transmission of knowledge that helped local suppliers improve the quality and timeliness of supply. Smarzynska (2002) examines backward linkages and technology spillovers using data from Lithuanian manufacturing sector during the period 1996-2000. She finds that firm productivity is positively affected by a sector's intensity of contacts with multinational customers but not by the presence of multinationals in the same industry. Thus, her results support vertical spillovers from FDI but not horizontal one's. Furthermore, she finds that vertical spillovers realize only when the technological gap between domestic and foreign firms is moderate. Blalock (2001) uses a panel dataset from Indonesian manufacturing establishments to check for the same effects. He finds strong evidence of a positive impact of FDI on productivity growth of local suppliers showing that technology

transfer from multinationals indeed takes place. He also plausibly suggests that since multinationals tend to source inputs that require relatively simple technologies relative to the final products they themselves produce, local firms that produce such intermediates maybe in a better position to learn from multinationals than those that compete with them.

While the evidence on VTT from multinationals to their suppliers is positive and robust (so long as local policies do not restrict multinationals from taking advantage of comparative advantage considerations while making their sourcing decisions), what do we know about the effects of multinationals on their local competitors? Of course, one should not expect the picture to be too rosy here from the perspective of host countries. A challenge facing the optimistic view regarding technology spillovers from FDI is to explain how such spillovers can ever be in the interest of the multinational firms. Clearly, under most circumstances, multinationals would rather limit diffusion in the local economy. In fact, the heart of the theory that seeks to explain the emergence of multinationals is that such firms can successfully compete with local firms precisely because they possess superior technologies, management, and marketing. Why, then, would multinationals not take actions to ensure that such advantages do not diffuse to local competitors? With that in mind, let us now turn to the empirical evidence.

Evidence on Horizontal Spillovers from FDI

Early efforts in search of horizontal spillovers from FDI proceeded by relating the inter-industry variation in productivity to the extent of FDI (Caves 1974; Globerman 1979; Blomström and Persson 1983; Blomström 1986). By and large, these studies find that sectors with a higher level of foreign involvement (as measured by the share of the labor force in the industry employed by foreign firms or the extent of foreign ownership) tend to have higher productivity, higher productivity growth, or both. The fact that these studies involve data from different countries (Australia for the Caves study, Canada for Globerman, and Mexico for Blomström)

lends a strong degree of robustness to this positive correlation between the level of foreign involvement and local productivity at the sector level.

Of course, correlation is not causation and, as noted by Aitken and Harrison (1999) this literature may overstate the positive impact of FDI on local productivity. Investment may have been attracted to the more productive sectors of the economy instead of being the cause of the high productivity in such sectors. In other words, the studies ignore an important self-selection problem. Both trade and FDI help ensure an efficient allocation of global resources by encouraging investment in those sectors in which an economy enjoys comparative advantage. In this sense, Aitken and Harrison's point is almost necessarily implied by traditional trade theory. However, if trade protection encourages investment in sectors in which a host economy does not enjoy comparative advantage, trade protection may be welfare reducing. This possibility was relevant for countries that sought to industrialize by following a strategy of import substitution.

Nevertheless, only plant-level studies can control for the self-selection problem that may plague industry-level studies. Taking the argument a step further, the self-selection problem may also arise in plant-level studies: the more productive plants may be the ones that attract foreign investment. However, if plant-level studies fail to find a significant relationship between foreign involvement and productivity, the self-selection problem might not be that important except if foreign firms seek out plants with low productivity and bring them up to par with the more efficient local plants. In this case, there might be no significant productivity differential between foreign and local firms. This argument seems far-fetched, but it could make sense as follows. Suppose local plants with low productivity are relatively undervalued by local agents because the skills (technology and modern management) needed to make them competitive are in short supply locally. In this scenario, such plants would be attractive to foreign investors who can, through their technology, generate productivity improvements that simply cannot be achieved by local agents.

What do empirical plant-level studies find with respect to spillovers from FDI? Haddad and Harrison's (1993) study was the first to employ a comprehensive data set at the level of the individual firm over several years. The data came from an annual survey of all manufacturing firms in Morocco. An important result of this study was that foreign firms exhibited higher levels of total factor productivity (TFP), but their rate of TFP growth was lower than that for domestic firms. As the authors note, at first glance, such a finding suggests that perhaps there was some sort of convergence between domestic and foreign firms. However, this was not the case. Although there was a level effect of foreign investment on the TFP of domestic firms, such an effect was missing for the growth rate of the TFP of domestic firms. In addition, when sectors were divided into high and low tech, the effect of FDI at the sector level was found to be more positive in low-tech sectors. The authors interpret this result as indicative of the lack of absorptive capacity on the part of local firms in the high-tech sector, where they may be further behind multinationals and unable to absorb foreign technology.

Aitken, Harrison, and Lipsey (1996) undertake a somewhat different approach to measuring spillovers from FDI. The idea behind this study is that technology spillovers should increase the marginal product of labor and this increased productivity should show up as higher wages. The study employs data from manufacturing firms in Venezuela, Mexico, and the United States. For both Mexico and Venezuela, a higher share of foreign employment is associated with higher overall wages for both skilled and unskilled workers. Furthermore, royalty payments to foreign firms from local firms are highly correlated with wages. Most importantly, the study finds no positive impact of FDI on the wages of workers employed by domestic firms. In fact, the authors report a small negative effect for domestic firms, whereas the overall effect for the entire industry is positive. These findings differ from those for the United States, where a larger share of foreign firms in employment is associated with both a higher average wage as well as higher wages in domestic establishments. Putting Aitken, Harrison, and Lipsey's (1996) findings into the context of previous work, it is clear that wage spillovers (from foreign to domestic firms) are

associated with higher productivity in domestic plants. Conversely, the absence of wage spillovers appears to accompany the existence of productivity differentials between domestic and foreign firms.

Using annual census data on more than 4,000 Venezuelan firms, Aitken and Harrison (1999) provide another recent test of the spillover hypothesis. Since each plant was observed over a period of time, the self-selection problem of past sector-level studies (that is, FDI goes to the more productive sectors) could be avoided in their study. The authors find a positive relationship between foreign equity participation and plant performance, implying that foreign participation does indeed benefit plants that receive such participation. However, this own-plant effect is robust for only small plants, that is, those plants that employ fewer than 50 employees. For larger plants, foreign participation results in no significant improvement in productivity relative to domestic plants. More interestingly, they find that productivity in domestic plants *declines* with an increase in foreign investment. In other words, the authors find evidence of *negative spillovers* from FDI and suggest that these could result from a market stealing effect. That is, foreign competition may have forced domestic firms to lower output and thereby forgo economies of scale. Note that if loss in output is large enough, local plants may have lower productivity despite enjoying some sort of technology spillovers. Nevertheless, on balance, Aitken and Harrison find that the effect of FDI on the productivity of the entire industry is weakly positive. They also note that similar results are obtained for Indonesia, except that the positive effect on own plants is stronger, whereas the negative effect on domestic plants is weaker, suggesting a stronger overall positive effect.

In a recent paper, Haskel et. al. (2002) use plant-level panel data for all U.K. manufacturing from 1973 through 1992 to re-examine the issue of spillovers from FDI. As the authors note, there can be little doubt that local firms in the U.K. possess sufficient absorptive capacity to benefit from the introduction of newer technologies by multinationals. So if spillovers do not materialize, they cannot be attributed to the limitations of domestic firms. Across a wide

range of specifications, the authors find that there are positive spillovers from FDI at the industry level.³ More precisely, they find that a 10% increase in foreign presence in a U.K. industry raises the total factor productivity of that industry's domestic plants by about 0.5%.⁴

To recapitulate, several studies have cast doubt on the view that FDI generates positive spillovers for local firms. But such findings need not imply that host countries have nothing significant to gain (or must lose) from FDI. Domestic firms should be expected to suffer from an increase in competition; in fact, part of the benefit of inward FDI is that it can help weed out relatively inefficient domestic firms. Resources released in this process will be put to better use by foreign firms with superior technologies, efficient new entrants (both domestic and foreign), or some other sectors of the economy. However, such reallocation of resources cannot take place instantaneously. Existing studies of spillovers may not cover a long enough period to be able to accurately determine how FDI affects turnover rates (entry and exit). Furthermore, their design limits such horizontal studies because they cannot clarify linkages and spillovers that may result from FDI in industries other than the one in which FDI occurs.

Moran (2004) argues that there is a substantial difference in operating characteristics between subsidiaries that are integrated into the international sourcing networks of the parent multinationals, and subsidiaries that serve protected domestic markets and are prevented by policy barriers such as (mandatory joint venture and domestic content requirements) from being so integrated. These different operating characteristics include size of plant, proximity of technology and quality control procedures to industry best practices, speed with which production processes are brought to the frontier, efficiency of operations, and cost of output. The former have a more positive impact on the host country, often accompanied by vertical backward

³ Incidentally, much of the literature has been preoccupied with the effect of FDI on technological capabilities of host firms and the industry whereas FDI can enhance productivity also via its effect on management practices (see Child et. al. 2000).

⁴ The authors also note that the large tax breaks and incentive packages given to multinationals seem out of proportion relative to the magnitude of spillovers they generate.

linkages and externalities. The latter have a much less positive – and sometimes demonstrably negative – impact on the local economy.

Drawing upon a wealth of case studies and econometric evidence, Moran argues this contrast in performance holds across different industries, countries, and time periods. He notes that failure to differentiate between export-oriented FDI and import-substitution FDI, or between foreign investors free to source from wherever they wish and foreign investors operating with domestic content requirements, or between foreign investors obliged to operate as minority shareholders and those with whole- or majority-ownership accounts for the inability of earlier studies to isolate the influence(s) of FDI on host country welfare.

It is worth emphasizing that the entry of multinationals may benefit host countries even if it fails to result in spillovers for local firms. First, the preceding discussion suggests that spillovers to local firms that directly compete with the multinationals would be the most elusive of benefits that host countries may expect to enjoy from FDI. Second, local agents other than domestic competitors of multinationals (for example local workers and local suppliers) may enjoy positive externalities from FDI. If so, the total effect of FDI on local welfare may be positive despite the lack of technology spillovers. Third, spillovers may be of an entirely different nature: local firms may enjoy positive externalities from foreign firms that make it easier for them to export. Such externalities may come about because better infrastructure (transportation, storage facilities, and ports) emerges in regions with a high concentration of foreign exporters. Aitken, Hanson, and Harrison (1997) provide direct evidence on this issue. They conducted a detailed study of 2,104 manufacturing plants in Mexico. In their sample, 28% of the firms had foreign ownership and 46% of the foreign plants exported. Their major finding is that the probability of a Mexican-owned plant exporting is positively correlated with its proximity to foreign-owned exporting plants. Such spillovers may result from informational externalities and may lower fixed costs of accessing foreign markets rather than marginal costs of exporting.

FDI and Economic Growth

Regardless of the channel through which technology spillovers occur, the fact that FDI often involves capital inflows along with technology transfer implies that one would expect a positive impact of FDI on growth in the host country. Yet, there are several important caveats to this assertion. First, a positive correlation between the extent of FDI and economic growth in cross-country regressions may simply reflect the fact that countries that grow faster attract more FDI. Thus, the causation could run from growth to FDI. Second, multinationals often raise the required capital in the host country, and in such a scenario capital inflows associated with FDI may not be substantial. An optimistic view of FDI would then look to technology transfer and/or spillovers as the mechanism through which FDI affects growth. Indeed, Romer (1993) argues that FDI can have a positive effect on growth in developing countries by helping them bridge the “idea gap” with respect to industrial countries.

In a comprehensive paper, Borensztein, De Gregorio, and Lee (1998) utilize data on FDI flows from industrial countries to 69 developing countries to test the effect of FDI on growth in a cross-country regression framework. Their findings are as follows. First, FDI contributes more to domestic growth than domestic investment, suggesting that it is indeed a vehicle of technology transfer. Second, FDI is more productive than domestic investment only when the host country has a minimum threshold stock of human capital. The latter finding is especially interesting because it clarifies when exactly FDI should be expected to effect growth.

In another empirical study, Balasubramanyam, Salisu, and Sapsford (1996) use cross-section data from 46 developing countries to investigate the effect of inward FDI on growth in such countries. They report two main findings. First, the growth-enhancing effects of FDI are stronger in countries that pursue a policy of export promotion rather than import substitution, suggesting that the trade policy regime is an important determinant of the effects of FDI. Second, they find that, in countries with export-promoting trade regimes, FDI has a stronger effect on growth than domestic investment. Both findings relate well to the results of Borensztein, De

Gregorio, and Lee (1998). The second finding may be viewed as a confirmation of the hypothesis that FDI results in technology transfer.

The findings of Borensztein, De Gregorio, and Lee (1998) relate well to those of Keller (1996), who argues that mere access to foreign technologies may not increase the growth rates of developing countries. In his model, if a country's absorptive capacity (as measured by the stock of human capital) remains unchanged, a switch to an outward orientation does not lead to a higher growth rate. Using a model quite different from Keller's, Glass and Saggi (1998) focus on the issue of the quality of technology transferred through FDI. They argue that investment in imitation targeting less advanced technologies improves the local knowledge (or skill) base of which then promotes inflows of higher-quality FDI. While Keller's model stresses that a country's stock of human capital effectively constrains its ability to take advantage of foreign technologies, Glass and Saggi (1998) emphasize that indigenous technological capability in an industry effectively constrains a country's ability to host foreign technology. Thus, they take a more micro-level view of the constraints on technology transfer relative to Keller (1996), although both papers make similar points. For example, a country may have a fair amount of human capital in the aggregate, but may lack the technological sophistication to be able to attract high-quality FDI in any particular industry.

Xu (2000) provides yet another confirmation of the argument that, in the absence of adequate human capital, technology transfer from FDI may fail to increase productivity growth in the host country. Using data on outward FDI from the United States to 40 countries, Xu measures the technology transfer intensity of affiliates of multinational firms by their spending on royalties and license fees as a share of their gross output. He finds that technology transfer from FDI contributes to productivity growth in more developed countries but not in less developed countries because the latter lack adequate human capital. Incidentally, as Xu notes, FDI may contribute to productivity growth due to reasons other than technology transfer. Thus, a statistically significant coefficient on some measure of FDI in a productivity growth equation

does not necessarily imply that technology transfer is the mechanism through which FDI contributes to productivity growth. Xu and estimates that, of the total effect of trade (through R&D spillovers) and FDI (through technology transfer) on productivity growth in industrial countries, 41% is due to technology transfer. Xu's results for industrial countries confirm the findings of Barrell and Pain (1997), who find that FDI has a positive impact on technological change in West Germany and the United Kingdom.

Xu and Wang (2000) find that although capital goods trade serves as a channel of technology transfer among industrial countries, bilateral flows of FDI do not. However, Xu and Wang raise questions regarding these results because of the poor quality of their FDI data. More encouraging results regarding the role of FDI in technology transfer have been found by Potterie and Lichtenberg (2001). Using data from US, Japan, and eleven European countries, they investigate the effect of FDI on total factor productivity of these countries. An attractive feature of their empirical approach is that they differentiate between inward and outward FDI and check whether FDI contributes to total factor productivity growth holding constant the role of trade. Their main result is that outward FDI flows and imports are simultaneous channels of ITT. However, they find that inward FDI does *not* contribute to the technological development of host economies. Their results lead to the provocative conclusion that FDI flows between developed countries are primarily means for firms to keep up with technological change (and perhaps demand shifts) in host countries while also serving local customers. It is important to note that Potterie and Lichtenberg do not study FDI flows developed to developing countries so their results cannot shed light on whether inward FDI into developing countries (from developed ones) serves as a channel of technology transfer.

III. Policy Implications and Concluding Remarks

There is no simple way of describing the policy environment that faces multinationals in developing countries. A roughly accurate statement is that while FDI in services markets faces a

multitude of restrictions, FDI into the manufacturing sector is confronted with both restrictions and incentives, often in the same country! In countries that historically emphasized import substituting industrialization—such as most of Africa, Latin America, and Southeast Asia—FDI was either completely prohibited or multinational firms had to operate under severe restrictions. In fact, even in countries where technology acquisition was a major policy objective, multinationals were rarely permitted to operate fully owned subsidiaries; Japan, Korea, and Taiwan all imposed restrictions on FDI at various points in time. In other words, “outward-oriented” economies were *not* particularly keen on allowing multinational firms into their markets.

Despite the prevalence of various types of restrictions on FDI, multinationals do not necessarily face an entirely hostile environment in developing countries. In fact, many countries try to lure in large multinational firms via the use of investment incentives. Interestingly enough, it is not unusual to find investment incentives being offered in conjunction with performance requirements and other restrictions on FDI, perhaps to partially offset the negative impact of the latter on the likelihood of investment by multinationals. Is there any case for the use of such incentives? In principle, a case for the use of tax incentives for FDI can be made on the basis of positive spillovers of FDI to local firms. Yet, this is a difficult argument to make. The evidence on this front is not sufficiently conclusive (at least not at present). On the other hand, the complicated restrictions and requirements that are often imposed by developing countries on multinational firms also seem counter-productive. While multinationals can possess significant market power, restrictive trade policies are likely to increase, and not reduce, such market power (once they are in the local market). A relatively open policy regime toward trade and FDI with adequate safety for those that are likely to be hurt by foreign competition seems the most reasonable way forward. As noted earlier, a restrictive trade regime coupled with an open FDI regime creates incentives for tariff-jumping FDI, the welfare effects of which are far from obvious.

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