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The Impact of Inward FDI on Host Countries: Why Such Different Answers?

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A substantial body of literature has grown around the question of how inward foreign direct investment (FDI) affects host countries. On almost every aspect of this question there is a wide range of empirical results in academic literature with little sign of convergence. At the same time, policymakers seem to have made their own judgments that inward FDI is valuable to their countries. The United Nations Conference on Trade and Development (UNCTAD) publishes annual data on "changes in national regulations of FDI" and reports that from 1991 through 2002, over 1,500 changes making regulations more favorable and fewer than 100 making regulations less favorable to FDI were made (UNCTAD 2003, 21, table 1.8). The same document reports that "the use of locational incentives to attract FDI has considerably expanded in frequency and value" (UNCTAD 2003, 124). Given the amount of academic literature on the issue, why has it made so little impression on policymaking? Are all these countries foolishly pursuing an ephemeral fad? Are the questions asked in academic literature irrelevant to policy? Are the relevant questions answerable? For that matter, what are the relevant questions?

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There are many possible effects of FDI inflow on a host country. Since it is generally taken for granted that investing firms possess some technology superior to that of host country firms, higher-quality goods and services could be produced at either lower prices or in greater volume than previously available, resulting in higher consumer welfare. Another possible effect would be that inward investment adds to the host country capital stock, thereby raising output levels. Although this issue has been explored, especially in earlier literature determining whether inward investment or aid supplements or displaces local investment, it is not specific to direct investment. Specific attention to direct investment has been devoted to the question of whether inward investments do involve superior technology and, if they do, whether it "spills over" to domestically owned firms rather than being retained entirely by the foreign-owned firms. A related set of questions is whether the foreign-owned firms pay higher wages for domestic labor, whether those higher wages raise the average wage level in the host country, and whether these higher wages spill over to domestically owned firms. For both wages and productivity, the spillovers to domestically owned firms or establishments could be either positive or negative. Wage spillovers could be negative if, for example, the foreign-owned firms hired the best workers, at their going—or higher—wages, leaving only lower-quality workers at the domestically owned firms. Productivity spillovers could be negative if foreign-owned firms took market shares from domestically owned firms, leaving the latter to produce at lower, less economical production levels.

Survey articles have found inconclusive evidence in the literature regarding the most important effects of inward FDI, especially with respect to spillovers. For example, on wage spillovers, Görg and Greenaway (2001) reported that panel data showed negative spillovers, while cross-sectional data reported positive spillovers. The same research paper found, with respect to productivity spillovers from foreign-owned to domestically owned firms," only limited evidence in support of positive spillovers. . . . Most work fails to find positive spillovers, with some even reporting negative spillovers . . ." (Görg and Greenaway 2001, 23). Görg and Strobl (2001) concluded that the crucial determinant of the findings in 21 studies was whether cross-section or time-series data had been used, with the former typically finding positive spillovers and the latter often negative ones. Lipsey stated that "the evidence for positive spillovers is not strong" (2003, 304) and concluded a review of the literature by saying that "the evidence on spillovers is mixed. No universal relationships are evident" (2004, 365). With respect to effects on host country economic growth, Carkovic and Levine (2002) found no significant effect of FDI inflows over the entire 1960–95 period and only irregularly significant effects in five-year intervals. None of the variables found in other studies *consistently* determine the effect of FDI on growth, although some are significant in some combination of conditioning variables. For instance, Lipsey found it "safe to

conclude that there is no universal relationship between the ratio of inward FDI flows to GDP and the rate of growth of a country" (2003, 297).

A crucial feature of these surveys is that the summarized studies do not individually find that wage or productivity spillovers do not exist. Mostly, they find evidence for either positive or negative spillovers. In this chapter, we try to understand why different investigators find contradictory results. Is it that the statistical techniques are different? Are the countries they examine different? Are they asking different questions under the same labels of wages, productivity, or spillovers? We try to answer these questions in two ways. One is to review the individual studies themselves to clarify the questions asked and the data used. The other is to survey studies on data for Indonesia, which cover a long period and are both detailed and accessible, in order to test the implications of different definitions and methods. The studies we review in this chapter examine the effects of FDI on firms and their workers. They are all producer oriented. However, future statistical studies could look at consumption effects. For example, has FDI growth in retailing reduced the price of food and other consumer goods? Has FDI growth in utilities reduced the price of telephone service or home heating and lighting? These possible effects of FDI are almost totally absent from the literature but should be studied.

Wage Spillovers

We begin with the studies of wage spillovers, which are not as numerous as those on productivity. There are several general issues that run through almost all the wage studies. One issue is that wage levels are calculated as total wages or total compensation per worker, but the only measure of skill is a division between production and nonproduction or blue-collar and white-collar workers. Within those categories, almost no studies can distinguish between differences in skill or education level or between employees of foreign-owned and domestically owned plants from differences in wages for identical workers. Similarly, they cannot distinguish between differential changes in skills between the two ownership groups and differential changes in wages for identical and unchanging workers in plants owned by the two ownership groups. A second issue is whether wage comparisons should take account of characteristics that are correlated with foreign ownership but not intrinsically related to it. For example, foreign-owned firms or establishments are typically much larger on average than domestically owned ones, even in developed countries. Especially in developing countries, foreign-owned firms or establishments are more capital intensive and use more purchased materials or components for their production than domestically owned firms. The question is whether these characteristics should be treated as con-

trols—and their influence eliminated—or are they so bound up with foreign ownership that they should not be controlled for? As Aitken, Harrison, and Lipsey (1996, 368) point out, a host country may not care whether higher employee wages in foreign-owned plants result from the fact that they are foreign owned or from the fact that they are large and use capital-intensive technology and/or import-intensive technology. Size, capital intensity, and import intensity may all be elements of the foreign-owned firm's technology.

Empirical studies provide strong evidence of a wage premium in foreign-owned firms (Lipsey 2004). Foreign firms pay higher employee wages in both developed and developing countries, after controlling for firm-specific characteristics. It is of course possible that high employee wages in foreign-owned firms are caused, or at least biased, by foreign takeovers of high-wage domestic firms. In a recent study (Lipsey and Sjöholm 2002)—using a 25-year panel of Indonesian manufacturing establishment data and lacking la-bor force education data, but including most of the typical independent variables—we were able to lay this issue to rest, at least for this one country. Foreign-owned firms did tend to acquire domestic plants with higher than average blue-collar wages for their industries, but the margins over the averages were far too small to account for the wage differential between domestically owned and foreign-owned plants. Thus, selectivity in take-overs could not account for the wage gap. Further evidence included the discovery that after a foreign takeover of a domestically owned plant, both blue-collar and white-collar wages rose strongly, in absolute terms and relative to their industries. Takeovers of foreign-owned plants by domestic firms had the opposite effect on wages, illustrating that foreign takeovers, rather than takeovers in general, produced wage increases. Econometric analyses using the whole panel of establishments found large wage differences in favor of foreign firms at every level of industry and geographical detail, and the differentials remained large even when plant characteristics, such as size and the use of purchased inputs, were introduced into the wage equations. The finding that employee wages were higher in foreign-owned plants and became higher when domestically owned plants became foreign owned was not dependent on the use of cross-section rather than panel data.

Although the literature on wage comparisons between foreign- and domestically owned firms is large, relatively few studies examine the effect of FDI on wages in domestically owned firms. Görg and Greenway (2001) review six studies on wage spillovers and report that of those with conclusions, three panel studies found negative spillovers and two cross-section studies found positive ones. They do not include the information that some of the cross-section estimates for Mexico and Venezuela also give negative coefficients for spillovers, suggesting that the choice of cross-section or panel estimation may not be so crucial.

Other subsequent studies have reported more evidence that wage spillovers occur. Figlio and Blonigen (2000) concluded that the effect of a large new foreign investment in South Carolina on aggregate wage levels was so large that it could not have been solely the result of the high employee wages in the foreign-owned plants but must have involved spillovers to domestically owned plants. Their study differed from most others because it concentrated on geographical effects, rather than the effects within the industry of the investment. Indeed, in the only wage study we know of that uses education as a measurement of the quality of the labor force (Lipsey and Sjöholm 2004b), we made a variety of calculations of spillovers in a cross section of Indonesian manufacturing establishments. Assuming national labor markets within broad industry groups, we found significant wage spillovers to domestically owned plants. Assuming national labor markets within narrower industry groups also revealed significant spillovers, albeit smaller ones. In addition, assuming that an industry within an individual province represented a labor market still revealed that spillovers to domestically owned establishments occur. The combination of higher wages in foreign-owned plants and spillovers to domestically owned plants meant that higher overall wages were associated with foreign ownership. Further evidence that the distinction between cross-section and panel data studies is not the crucial determinant of results on wage spillovers can be found in Driffield and Girma (2002), which uses a panel of establishments in the UK electronics industry from the Annual Respondents Database (ARD) from 1980 to 1992. Driffield and Girma found intraindustry and intraregion wage spillovers from FDI on wages in general, and the effect was larger for skilled than for unskilled workers. A study by Girma, Greenaway, and Wakelin (2001), using firm, rather than establishment, panel data for almost 4,000 firms in the United Kingdom from 1991 to 1996, also found some evidence of wage spillovers. On average, when spillovers were assumed to be identical across industries and firms, Girma, Greenaway, and Wakelin found no significant evidence for them. However, when the effects were permitted to vary across industries, wage spillovers were found and were higher in industries where the productivity gap between foreign and domestic firms was lower. One way this study differs from our earlier research (Lipsey and Sjöholm 2002) is that it excludes firms that changed ownership, thereby eliminating one way in which foreign ownership affects wages. The effects of shifts to foreign ownership had been found in an earlier study to be positive in the United Kingdom, as they were in Indonesia.

The accumulation of studies since the earlier surveys seems to have put to rest the suspicion that the findings of wage spillovers were solely the result of ignoring firm differences in cross-section studies, since the spillovers did appear in panel studies. Something else must account for the negative spillovers or lack of spillovers found in some developing countries. Aside from Indonesia, the positive spillovers have been found most frequently in

developed countries. Even in the United Kingdom, large differences in productivity between foreign-owned and domestically owned firms reduced or eliminated spillovers. One possible cause for the negative results in some developing countries is that the gap between foreign-owned and domestically owned firms is too large for one group to influence the other. Another possibility is that the labor markets in some developing countries are too segmented for wages in one group to influence the other. If we compare Mexico and Venezuela, two countries reported to show negative wage spillovers from foreign firms, with Indonesia, the United Kingdom, and the United States, for which positive spillovers were found, labor market conditions do seem different. An "employment laws index" produced by the World Bank (2003), and based upon the work of Botero et al. (2003), had a range in which a high number indicated very restrictive labor laws on hiring, firing, and conditions of employment. On the basis of this index, Mexico and Venezuela were ranked among the most restrictive countries, with index numbers of 77 and 75, respectively. The United Kingdom was rated at 28 and the United States at 22. Indonesia was in between at 57, not flexible by developed-country standards, but relatively flexible for a developing country.

Another topic not always considered is how the relevant labor market is defined. Most studies implicitly define a labor market as an industry—at whatever level of detail industry is reported. Some define the market as an industry within the narrowest geographical area at which industry data are available. That may be appropriate for some countries or industries, but there may also be national labor markets within an industry, or local labor markets that straddle many industries (national labor markets may also straddle many industries). These differences in defining the labor market may affect findings on spillovers. Therefore, consideration of the industry and geographic construction of FDI measures is needed, and the conclusion might be different for wages from what it is for productivity. For wages, the appropriate definition depends on the range of a labor market within which wages tend to be equalized, or at least within which one firm's wages influence those in other firms. The answers might be different in different countries or industries and at different times. In a recent study (Lipsey and Sjöholm 2004b), we tested the effect of different definitions of a labor market by using different industry and geographic classifications to examine the sensitivity of the results. They used FDI measures at two-, three-, and five-digit industry levels and at both the national and province levels to examine the effect of foreign presence on the wages in locally owned Indonesian plants. The results for these various definitions of a labor market are shown in table 2.1. The coefficients vary substantially, but they remain statistically significant in all specifications.[1] The largest coefficients are for

1. See Lipsey and Sjöholm (2004b) for the complete empirical specifications and results.

Table 2.1 Wage spillovers in Indonesian manufacturing

FDI variable	Blue-collar wage	White-collar wage
Two-digit national	1.07 (21.83)***	1.04 (16.42)***
Three-digit national	0.28 (6.20)***	0.34 (5.43)***
Five-digit national	0.16 (7.48)***	0.35 (11.46)***
All sectors province	1.05 (32.81)***	1.22 (28.27)***
Two-digit province	0.47 (13.85)***	0.53 (12.26)***
Three-digit province	0.39 (12.93)***	0.44 (12.12)***
Five-digit province	0.24 (11.34)***	0.38 (13.12)***

*** = significance at the 1 percent level

Note: t-statistics are in parentheses.

Source: Lipsey and Sjöholm (2004b).

definitions of the relevant market as either national, at the two-digit industry level, or provincial, for all manufacturing industries combined. However, there is concern that these coefficients may represent the tendency of foreign firms to move into either high-wage geographical locations or high-wage industries. Those possible biases are reduced by further geographical breakdown—by province—and by successively greater industry detail, culminating in breakdowns by five-digit industry and province. The coefficients are greatly reduced in size, but remain strongly significant, showing margins of a quarter for blue-collar and over a third for white-collar workers. The most detailed breakdown does not necessarily give the most accurate estimate of the effect of foreign firms' presence, however. It may miss the effect of higher wages and increased employment in foreign-owned establishments in one industry or province on wages in other industries and provinces—possibly a more important effect than any within the same industry and province. Even the more aggregate measures may understate the wage effect because they are confined to manufacturing, ignoring any impacts on agriculture, services, and trade.

Productivity Spillovers

Many of the same issues that affect studies of wage spillovers occur in the much larger body of literature studying productivity spillovers. In addition, there are broader problems with the productivity measurements. The

objective is often described as measuring the spillovers of technology, or knowledge, from foreign-owned to domestically owned firms. In order to simplify measurement, technology is narrowly defined to measure labor productivity, total factor productivity, or differences in production functions. All three are reflections of technology, but they may be both too broad and too narrow. The comparison of production functions, often cited as an ideal method, assumes that there are no differences in technological knowledge involved in choices about factor combinations or plant size. Thus, the operation of a large plant, as opposed to operation of a small plant, requires no different technological mastery. The operation of a capital-intensive plant requires no technological skill beyond that required for a labor-intensive plant. The use of intermediate inputs from abroad or from a parent company involves no technology beyond that of using locally available inputs. These are all assumptions implicit in production function comparisons, but if they are invalid, and locally owned plants do not have the technological skill to operate at the scale and factor combinations of foreign-owned plants, true technological differences between foreign-owned and domestically owned plants are hidden, disguised as differences in scale of production or factor combination choices.

There is another respect in which the definitions of technology are too narrow. For example, if foreign investors' technological superiority consists of knowledge about consumers' tastes in foreign markets, or about marketing a product in local or foreign markets, this knowledge will not be visible in productivity or production function comparisons. Rather, it will be seen in comparisons of export performance, but those are a different set of literature not usually characterized as technology. A very different type of study that takes a broad view of technology is exemplified by Dobson and Chia's (1997) country studies for Asia, Rhee and Belot's (1990) country- and industry-specific case studies of "the critical role of transnational corporations (TNCs) in the transfer of technical, marketing, managerial know-how to developing countries," and Moran's (2001, 2002) many examples of technology transfer. All of these are basically case studies of particular transfers of technology, but not confined to either intra-industry or interindustry transfers and not confined to specific measures of technology. All of them find evidence for transfers of technology, but it is difficult to confront their evidence with the statistical studies described later in this chapter because the questions are so different. The case studies ask whether there are examples in which technology was transferred from foreign-owned to domestically owned firms, and the answer is "yes." In contrast, the statistical studies ask whether *on average* domestically owned firms gain in a particular measure of technology because foreign-owned firms operate in the same industry and the same country or the same region, and the answer is "not universally." Both of these answers could be accurate; neither one contradicts the other, because they are answers to different questions.

Case studies offer great flexibility. The exact nature of the technology transfer can differ from example to example, from industry to industry, and from country to country. The length of time for the transfer to occur and be measured need not be specified in advance and can vary widely. The transfer can be within an industry, to supplying industries, or to consuming industries. This flexibility is an advantage of the case study method, but it comes at a cost: Firms that do not receive foreign technology are often omitted from case studies measuring the effect of transfers. Thus, the universe for measuring effects is not always delineated, and the universe from which the case studies are drawn is not always defined. In contrast, statistical studies tend to be rigid in specifying the length of time over which effects are measured (whether it is a year or a set number of years). They specify some particular definition of a technology transfer (perhaps ignoring other important dimensions), and whether differences among countries or industries are to be studied. Statistical studies assume the relevance of some particular measure of FDI and some functional form for its effects. The studies' greatest advantage is that they tend to examine effects on whole industries, including the unlucky or less competent losers, as well as the successes. With microdata, they can look at the characteristics of firms changing ownership as well as those forced out of an industry, those entering, and those remaining. A goal for case studies might be to assemble a collection of unsuccessful ventures and to compare them with successful ones, not only with respect to their own characteristics but also, even more importantly, with respect to country and industry environments. Baranson's (1967) book on Cummins' experience in India, for example, contains an analysis of the effects of import-substitution policies that can be compared with experiences under more liberal trade regimes.

A general problem with productivity comparisons and spillover studies, compared to wage studies, is their greater need for data. Productivity studies require output measures, usually sales or value added. Sales by foreign-owned firms, particularly exports, are frequently intracompany transactions. The values may not be the same as market values, because there are many incentives to alter them to minimize tax liabilities, and the incentives may be very different for foreign-owned firms from any that domestically owned firms face. Any manipulation of sales values would affect value added even more, and there are incentives to manipulate the profit portion of value added in addition to those affecting sales values. Furthermore, since value added includes profits, it may fluctuate far more over time than any physical measure of production. The use of production functions requires measures of capital input, which are often missing from census data. If measures of capital input are present, their meaning is often questionable, especially in countries that have suffered major inflations, because it is uncertain if and how historical values have been adjusted to current price levels. As with wage spillovers, the Görg

and Strobl (2001) and Görg and Greenaway (2001) surveys conclude that the negative results from panel data studies are more reliable than those for cross-sections, and that there is therefore little evidence of positive spillovers from FDI. However, a number of new studies of productivity spillovers based on panel data have appeared. As is true for wage spillovers, these find more evidence for positive spillovers than the earlier ones. For example, Haskel, Pereira, and Slaughter (2002) use a panel of UK manufacturing plants between 1973 and 1992 and find a positive and robust spillover effect of inward FDI on productivity in local plants. Keller and Yeaple (2003) also find positive and robust effects of inward FDI in the United States on productivity in US manufacturing plants between 1987 and 1996. Girma, Greenaway, and Wakelin (2001), using the firm data described above, find that there are spillovers and that they are greater for firms in sectors in which local firms are technologically comparable to the foreign firms. Labor productivity and total factor productivity spillovers are similar in size. As with wage spillovers, the accumulation of studies has eroded the basis for the hypothesis that the distinction between cross-section and panel data studies explains the wide range of findings.

In their panel data study of Venezuela, Aitken and Harrison (1999) show what is probably the strongest evidence for negative productivity spillovers. A rise in the foreign share of ownership in a sector reduced the output of individual domestically owned establishments and reduced their total factor productivity over one- to three-year periods. The first-year negative effect was particularly severe for small domestically owned plants, suggesting that they were the least efficient and most vulnerable to competition from the increasing efficiency associated with rises in foreign ownership. Since Venezuela had been a relatively closed economy to both trade and inward direct investment in manufacturing during this period, it might have accumulated a larger than average stock of small, competitively weak firms.

In another panel study of a relatively closed economy Kathuria (2000) used data for large firms in India from 1975–76 to 1988–89, before the country's period of liberalization. Technical efficiency was measured from a function with value added as the production measure and labor and capital as inputs, and was calculated as the distance between the firm and the most efficient firm in its industry. Spillovers were deemed to have occurred if the dispersion of efficiency levels among domestically owned firms in the industries studied—in which foreign-owned firms were the efficiency leaders—were reduced. The foreign source of the spillovers was measured in two ways: the extent of foreign participation in the industry, which was represented by the foreign-owned firms' share of sales, and the stock of cumulated purchases of foreign technology by local firms. Foreign participation had a negative effect on the dispersion of efficiency among domestically owned firms. This effect was inter-

preted by the author as indicating negative spillovers. Kathuria points out, however, that a negative spillover in these terms could result if both the foreign firms and the domestically owned firms gained in efficiency but the foreign-owned firms gained more—a result that would have been interpreted as a positive spillover in the Aitken and Harrison framework. The stock of foreign technological capital of the local firms was positively related to their gains in efficiency. When the sample was split between "scientific" and "nonscientific" industries, the spillover effects were confined to the "scientific" group but were offset by a positive coefficient for the cross-product of foreign presence and the local firm's research and development (R&D) effort. The interpretation was that R&D-intensive local firms might have gained, or lost less, from the foreign presence than firms that did less R&D.

Productivity Spillovers in Indonesia

One way of understanding the variety of results would be to apply the same techniques to the identical types of data in different countries. Since we do not have access to data from many countries, we instead review studies of Indonesia and test alternative methods on that country's data. One advantage of using Indonesian data for experimentation is that Indonesia collects consistent microdata on its manufacturing industry and these data have been increasingly used by a number of authors for plant-level studies. A number of studies on Indonesia show that foreign plants have higher productivity than locally owned plants (Takii and Ramstetter 2003; Okamoto and Sjöholm 2005) and that plants that change ownership from local to foreign ownership increase their level of productivity (Anderson 2000). In addition, there are several plant-level studies on productivity spillovers from FDI in Indonesian manufacturing, which are summarized in table 2.2. The first three studies on spillovers from FDI in Indonesia used cross-section analysis (see table 2.2). For instance, Sjöholm (1999a) examined plants in 1980 and 1991 and found both the level and growth of labor productivity to be higher for locally owned plants in sectors with a high foreign share of output. There was no evidence of regional intraindustry spillovers from FDI, but some indications of regional interindustry spillovers.

Sjöholm (1999b) used the same data as his earlier study to examine possible determinants of spillovers. The results suggested that spillovers were positively affected by the technology gap between domestic and foreign plants and by the degree of competition within the sector. Blomström and Sjöholm (1999) examined spillovers from FDI in 1991. Their study differed in design from the previous two mainly in the use of capital stocks rather than investment ratios to control for capital intensity. There were positive spillovers from FDI, and no differences in the spillovers from joint ventures with minority or majority foreign ownership.

Table 2.2 Studies on productivity spillovers from FDI in Indonesian manufacturing

Author(s)	Year(s)	Dependent variable	Measure of foreign presence	Independent variables	t-statistics for foreign share
Blomström and Sjöholm (1999)	1991	Value added per employee	Output (five-digit level)	Capital White/blue Capital utilization Scale Independent dummies	+ ***
Sjöholm (1999a)	1980, 1991	Growth in value added; value added per employee	Output (five-digit level)	Employment Investment Industry and regional characteristics	+ ***
Sjöholm (1999b)	1980, 1991	Growth in value added; value added per employee	Output (five-digit level)	Employment Investment Scale	+ ***
Takii (2001)	1990–95	Value added	Employment (three-digit level)	(translog) Employment Capital Plant-specific effect	+ ***
Todo and Miyamoto (2002)	1995–97	Value added per employee	Absolute amount of FDI output (two-digit level)	Capital Capacity utilization Plant-specific effect	+ ***
Blalock and Gertler (2002)	1988–96	Output	Output (four-digit level; region-industry)	(translog) Employment Capital Raw materials Plant-specific effect	+ ***
Blalock and Gertler (2003)	1988–96	Output	Output (four-digit level; region-industry)	(translog) Employment Capital Raw materials Energy Downstream FDI Plant-specific effect	?

*** = significance at the 1 percent level
+ = positive
? = not statistically significant

Takii (2001) was the first study on spillovers in Indonesia that used panel data, which allowed him to control for plant-specific effects. He examined spillovers during 1990–95 using a translog production function and found positive effects on value added in local firms from the share of foreign employment in the same three-digit International Standard Industrial Classification (ISIC) industry. Moreover, the results suggested that spillovers were relatively large in sectors with relatively new foreign plants and with low gaps in labor productivity between foreign and domestic plants. Takii also found that R&D positively affected spillover in locally owned plants.

The study by Todo and Miyamoto (2002) differs from most of the others by defining the FDI variable as the absolute amount of FDI in a sector. They argued that this measure is more strongly related to the foreign knowledge stock and therefore preferred over the foreign share of a sector. The result showed a positive effect of FDI on local firms' labor productivity after controlling for R&D and training of the workforce.

Blalock and Gertler (2002) also used a translog production function to examine spillovers between 1988 and 1996. Local firms in sectors within regions with a high foreign share of output had high levels of productivity. Moreover, they found a positive effect on spillovers from the technology gap between domestic and foreign plants; spillovers were also positively affected by local firms' R&D and by high levels of education of workers in local firms.

In a second study, Blalock and Gertler (2003), using the same data and a very similar translog production function, found no evidence of positive intraindustry spillovers from FDI. A second measure of FDI in this study is the main difference between the two: Blalock and Gertler (2003) measured FDI in upstream markets to capture spillovers from FDI to local suppliers. They found that downstream FDI was highly significant in the econometric estimations. This variable was constructed by using an input-output table at a sector level, which also includes purchases from its own sector. Therefore, one possibility is that the variable on downstream FDI also captured the effect of horizontal spillovers.

To summarize the results from these seven production spillover studies on Indonesian manufacturing, all cross-section studies and three out of four panel data studies found statistically significant intraindustry spillovers. The one study that failed to find intraindustry spillovers found interindustry spillovers from FDI instead. Judging by these studies of Indonesia, we conclude that the design of econometric studies does not cause the different results found in the literature. Therefore, differences between countries or firms may explain the extent of spillovers. The studies on Indonesia might shed some further light on what these differences could be. Previous literature suggests that competition, the technology gap, and local firms' absorptive capacity will affect the extent of spillovers. Starting with competition, the studies by Sjöholm (1999b) and by Blalock and Gertler (2003) show that spillovers are highest in sectors with high competition. The former study sug-

gests that it is domestic competition, as captured by a Herfindahl index, rather than the degree of protection from imports that affects spillovers. The second study suggests that competition will benefit upstream local suppliers.

The effects of technology gaps on the extent of spillovers is unclear. Takii (2001) found a negative effect on spillovers from the technology gap between local and foreign-owned plants, which has also been found in other countries (Kokko 1994, 1996). Sjöholm (1999b) and Blalock and Gertler (2002) find a positive relation between the technology gap and the degree of spillovers. One explanation for the different results could be that the measure of technology gap differs between studies. Takii measured the technology gap as the difference in labor productivity between domestically owned and foreign-owned plants.[2] Sjöholm used the difference in labor productivity between domestically owned and foreign-owned plants after controlling for the scale of operation and the investment per worker ratio.[3] Finally, Blalock and Gertler used the plant's fixed effect in comparison to the mean fixed effect in the same industry. Another reason why these, and other studies, produce such varying results could be that the relationship is nonlinear. Some technology gap is presumably required for any useful technology spillover to occur. However, it is also plausible that if the gap is too large, the technology in foreign plants will be of little practical use in locally owned plants pursuing very different types of operations.

Differences in spillovers between countries may also be caused by differences in sectors' and plants' absorptive capacity. The studies on Indonesia confirm that such capacity might be important if a firm is to benefit from spillovers. Takii (2001) and Todo and Miyamoto (2002) as well as Blalock and Gertler (2002) found that a firm's own R&D positively affected its ability to benefit from spillovers. The last study also found that plants with more highly educated employees benefit more from the presence of foreign multinational corporations (MNCs). A related question is whether the type of activities pursued by the foreign subsidiaries affects spillovers to domestically owned firms. This issue has been rather neglected in the spillover literature but Todo and Miyamoto (2002) find a positive effect on spillovers from R&D and human resource development in the foreign subsidiaries.

As evident from the earlier discussion, considerable attention has been devoted to differences between econometric methodologies as one possible explanation for the different effects of spillovers among countries. A related, but so far rather neglected, issue is how one should construct measures of FDI. Most studies use the foreign share of a sector's economic

2. Takii also used the difference in capital labor ratios and the difference in size as alternative measures of technology gaps. These measures gave inconclusive results.

3. The difference in investment ratios was used as an alternative measure but provided no clear results.

activity as a measure of FDI.[4] One problem with this measure is that the foreign share of a sector might be endogenously determined if productivity spillovers expand activity in local firms. Moreover, this measure assumes that increases of foreign and aggregate activity in the same proportion have no effect on local firms. Castellani and Zanfei (2002) argue that this assumption might produce a downward bias on the estimate of spillovers from FDI. Finally, it is not clear why we would assume the effect from FDI to be linear in the foreign share of an industry's economic activity: spillovers are not obviously maximized at a 100 percent foreign ownership share (Lipsey 2004).

Although the foreign share is widely used as an FDI measure, productivity spillover studies still differ in how this share is constructed. Some measure it as the foreign share of employment, while others measure it as a share of value added or output. Moreover, the foreign share is calculated at different sector levels, ranging from two-digit to five-digit levels of ISIC. Finally, some studies use the foreign industry share at a national level, while others use it at a regional level.

The more narrow the definition of an industry, the more restrictive is our assumption of how widely applicable knowledge from FDI can be for local firms, and our assumption of which domestically owned plants face increased competition from FDI. If we construct the FDI measure on a two-digit level of ISIC, it implies that productivity spillovers might be present between industries at a three- and five-digit level of ISIC but not from one two-digit industry to another. If we construct our measure of FDI at a five-digit level of ISIC, it implies that productivity spillovers can only be captured if they occur within these industries but not if they cross from one five-digit industry to another. It is unclear what a properly defined industry is for an analysis of productivity spillovers. It seems that most studies favor a disaggregated definition of FDI, possibly to increase the variance in the FDI variable. However, this might come at a cost if we miss out on spillovers across narrowly defined industries. Some technologies, such as computer use in tracking sales and inventories, may be very general and easily transmitted across industries, while others may be specific to particular production processes. Clearly, the industry definition will also have implications for what we attribute to interindustry versus intraindustry spillovers.

The choice to construct the FDI measure at a national level or at a regional level might also be important. Choosing the most appropriate level to use depends on whether the spillover has a spatial dimension—for example, if it primarily benefits plants within the same region. The Jaffe, Trajtenberg, and Henderson (1993) study is often referred to when a regional measure

4. There are exceptions, see, for example, the previously discussed study by Todo and Miyamoto (2002). See also Barrell and Pain (1997), who use aggregate FDI in a constant elasticity of substitution (CES) production function and find positive effects from FDI on technical progress in EU countries.

of FDI is used (Sjöholm 1999a, Blalock and Gertler 2002, Lipsey and Sjöholm 2004b). Their study shows that university R&D primarily benefits other inventors within the same geographic area. Hence, their study relates to innovation, and it is possible, but not certain, that the same result also exists for spillovers. Whether or not spillovers are geographically concentrated depends on, for instance, whether imitation, competition, or supply of linkage industries are enhanced by geographic proximity to the foreign firms.

If we believe that technology spillovers are geographically concentrated, the next question will be: What is an appropriate geographic aggregation level? Studies on Indonesia have used both districts (Sjöholm 1999a) and provinces (Sjöholm 1999a; Blalock and Gertler 2002, 2003). One methodological problem is that spillovers are not likely to follow administrative units even if they are localized. For instance, the largest share of Indonesian manufacturing is located in the province of Western Java. This is largely because the industry sector has grown out of its original base in Jakarta. Jakarta and the West Java cities of Bogor, Tanggerang, and Berakasi constitute one industrial cluster, the Jabotabek area (Henderson, Kuncoro, and Nasution 1996). If technology spillovers from FDI exist, and even if such spillovers are only effective with geographic proximity, a foreign firm in Jakarta is likely to have positive effects on local firms within the whole Jabotabek area. However, Jabotabek spreads out over two provinces and about ten districts, which indicates the problem of using administrative geographic units in constructing measures of regional FDI.

Spatial concentration of FDI may be another obstacle to analyzing regional FDI measures. However, such concentration is common in most countries, including Indonesia. For instance, about 80 percent of all FDI in Indonesian manufacturing is located in 3 out of 27 provinces (East Java, West Java, and Jakarta), which is a higher concentration than for manufacturing in general (Sjöholm 2002, Sjöberg and Sjöholm 2004). If, for instance, we construct our FDI measure at a province level and at a five-digit level of ISIC—including about 300 industries—less than 25 percent of the region-industry combinations will have FDI. Thus, it may be desirable to take account of the selection of locations in analyzing the effects of FDI.

An experiment with different industry and geographical definitions of the relevant scope for productivity spillovers is described in table 2.3. Spillovers are estimated at the national level and the province level for all sectors combined and at two-, three-, and five-digit industrial breakdowns. More specifically, we used Indonesian plant level data for 1996 to estimate the following expression:

$$\text{Laborprod}_{ij} = \text{constant} + \text{FDI} + \text{Education}_{ij} + \text{Capital}_{ij} + \text{Size}_{ij} + \text{Public}_{ij}$$

where *Laborprod* is value added per employee, *Capital* is energy consumption per employee, *Size* is the total number of workers, *Public* is a dummy variable

Table 2.3 Productivity spillovers in Indonesian manufacturing (dependent variable: value added per employee)

FDI variable	Coefficient of FDI
Two-digit/national	0.28 (3.94)***
Three-digit/national	0.44 (5.55)***
Five-digit/national	0.19 (5.25)***
All sectors/province	0.94 (19.05)***
Two-digit/province	0.27 (5.44)***
Three-digit/province	0.44 (9.79)***
Five-digit/province	0.23 (6.44)***

*** = significance at the 1 percent level

Note: t-statistics are in parentheses.

Source: Authors' calculations.

for public ownership, and *Education* is the share of employees with primary, junior, senior, and university education for both blue- and white-collar workers. For the sake of clarity, we show only the coefficients of the different FDI variables in table 2.3.

The main impression from the results in table 2.3 is that geographical influences are minor; the spillover coefficients at the national level are almost identical to those at the province level at each level of industry detail. The industry level does make a difference. The coefficient is highest at the all-sector level, indicating a greater influence of foreign presence on domestic establishment productivity for manufacturing as a whole than within two-, three-, or five-digit industries. The coefficient is higher at the three-digit level than at the two-digit level, as one would expect if spillovers tended to be largest within a narrow industry. However, the effect becomes smaller when we move to the five-digit industries. The behavior of productivity spillovers contrasts with that of wage spillovers (table 2.1), where going from the national to the province level raised the spillover coefficient at the three-digit and five-digit industry levels. The difference between the wage and productivity spillovers is mostly, although not entirely, consistent with the idea that wage spillovers come through competition for labor in geographically narrow labor markets, while productivity spillovers result from competition in countrywide product markets.

Conclusions

Why do studies of spillovers reach such diverse conclusions? With respect to wage spillovers, the use of cross-section or panel data does not seem to determine the result. As far as we can judge from Indonesia, the tendency of foreign-owned firms to gravitate to high-wage industries, while it exists, does not explain the apparent spillovers and neither does any tendency of foreign firms to take over high-wage local firms within industries. Aside from Indonesia, most of the evidence for wage spillovers comes from developed countries, particularly the United States and the United Kingdom. One hint that differences in labor market institutions might be important for the degree of wage spillovers is that two countries found to have negative spillovers were countries with very restrictive labor laws, while the United States and the United Kingdom were among the least restrictive. With respect to productivity spillovers, an accumulation of panel data studies has erased the previous unanimity of panel data results in showing negative or no spillovers. As with wages, firm-specific characteristics do not explain all the higher productivity found for domestic firms in industries where foreign-owned firms were important. The econometric method does not seem to be the crucial determinant of the result.

An explanation that seems plausible at this point is that countries and firms within countries might differ in their ability to benefit from the presence of foreign-owned firms and their superior technology. There might be countries or industries in which the domestically owned sector is too small or unable to learn from foreign-owned firms. In those cases, the domestic sector may be crowded out by competition from the more efficient foreign-owned firms. The state of the domestically owned sector might depend not only on the stage of development of the economy, but also on the type of trade regime. A heavily protected domestically owned sector might be inefficient and lacking in entrepreneurship. It makes sense that the arrival of foreign firms with technology greatly superior to that of domestically owned firms should inflict damage on at least some domestic firms. The least efficient, perhaps often the smallest, might become unprofitable or be forced out of the industry. One might view that outcome as favorable for the host country as a whole if the average productivity of foreign-owned and domestically owned firms together increased. Few studies take account of both the exit and the entrance of new firms, both of which are important for assessing the overall impact of inward FDI.

If country and industry differences are important to the impact of inward FDI on host countries, the main lesson might be that the search for universal relationships is futile. In that case, the question shifts from how inward FDI affects every host country and industry to which types of industries and host countries are affected, and what the impact is on each. It is in identifying the characteristics of firms, industries, and countries that promote the transfer of technology that case studies can be most

valuable. Their flexibility with respect to assumptions regarding timing and types of technology transfer suggests what statistical studies should look for and how the variables should be defined, especially if they encompass a wide range of both successful and unsuccessful ventures.

Why has academic skepticism about the impact of FDI not influenced policy more strongly? One reason is probably the diversity of findings. Another is the narrow scope of technology in the statistical tests. It relies on the assumption that the scale of operations and the import of components from abroad, and particularly from other related firms, do not constitute part of affiliate technology, but are simple inputs, accessible to local as well as foreign firms. Policymakers may have found these assumptions implausible.

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