
The Product Cycle Model of Foreign Direct Investment, Multinational Corporate Strategy, and Parent Control

For Raymond Vernon, foreign direct investment takes place as part of the parent corporation's effort to defend or extend its ability to extract profits from quasi-oligopolistic control over intangible assets, in the face of ongoing competitive challenges at home and abroad. The product cycle model emerged in the midst of the fertile burst of insight, led by Stephen Hymer ([1959] 1976), Charles Kindleberger (1969), and John Dunning (1958), that tried to make sense of what seemed to be anomalies in multinational corporate behavior.

Why did foreign direct investment take place at all (within the neo-classical framework one would always predict that indigenous entrepreneurs closest to an economic opportunity and most easily able to judge its dimensions would seize the chance to earn momentary supranormal profits before distant foreigners could)?

Why would foreign direct investment outside of natural resources and infrastructure take place most strongly among capital-abundant and high-wage regions, such as US investment in Europe, rather than from capital-abundant, high-wage to capital-scarce, low-wage regions (and what could account for simultaneous cross-investments among capital-abundant, high-wage regions)?

Finally, why would firms choose the cumbersome form of direct control of foreign operations, rather than simply licensing their technology or know-how to others more familiar with any given locale outside of the home country of the parent?

The key ingredients for the product cycle are "innovations" (which Vernon defined much more broadly than new technologies, to include

new products, processes, and business techniques), “some kind of monopoly windfall for the early starter,” and transitory barriers to entry (Vernon 1966). The entrepreneur responds to opportunities in his home market to satisfy new wants associated (in the case of US firms) with high income levels and high unit labor costs. If the innovation is successful, demand expands and production becomes more standardized. Uncertainty is lowered for competitors in the home market and imitation becomes possible.

The first contact with foreign markets comes via exports to countries with similar high income levels and high unit labor costs. But indigenous entrepreneurs with lower transport costs and possibly job-creating support from their governments challenge the market position of the exporters, as they observe and again imitate the success of the external producers. This threat to the established position of the exporting firm galvanizes the latter to undertake the often-painful decision to actually move operations abroad (a move that provides more security for the oligopolistic position of the parent than the risky alternative of licensing the techniques associated with the “innovation” to potential competitors), resulting in foreign direct investment. The first locales for foreign direct investment in manufacturing would be, therefore, countries with high income levels and high unit labor costs (Canada, United Kingdom, and the then European countries for US firms; with the reverse process occurring simultaneously for European companies).

Developing countries emerge on the scene in the later stages of the product cycle, as firms set up component manufacturing facilities (Vernon himself used the phrase “captive facilities”) in developing country economies in an attempt to fortify their competitive position in international markets, including the home market (Vernon 1966). “Firms in this category . . . have a strong need to integrate their global production facilities,” argued Vernon (1979, 416), an observation soon confirmed empirically by Vernon’s associates John Stopford and Louis T. Wells Jr. (1972). International firms whose activities involved rapid technological innovation, a large degree of brand recognition, and an organizational proxy to represent close coordination of production, revealed a strong preference for establishing wholly owned subsidiaries with a high degree of freedom to select inputs and dispose of outputs as they wish. They placed a high value on “unambiguous control.”

But this creates tension with host governments in the developing world who themselves want to exercise some control over the foreign investors’ operations, fearing that the “captive facilities” described in the product cycle model would consist of mere “screwdriver” operations with small and weak backward linkages into the local economy and few spillovers or externalities to assist local development. This “historic tension” was strongest during the period of widespread efforts at import-substituting growth but is likely to persist, Vernon predicted in his last work, even in the more recent era of outward-oriented development (Vernon 1998, chapter 3).

From the point of view of multinational corporate strategy, this has led to something of a bifurcation among types of operations in less developed countries: (1) those that do fit within the product cycle model of parental supervision and control, whose operations contribute integrally to the international competitive position of the global firm; and (2) those that do not, whose operations at best serve as a more disconnected kind of “cash cow” (often in protected markets) to fund the needs of the parent but not contribute directly to the competitive position of the multinational’s products in international markets.

What opportunities and what dangers does this bifurcation pose for host authorities in their design of policies toward foreign investment? Is the “captive” status of affiliates portrayed in the product cycle model to be avoided, or desired?

Operations That Fit into the Product Cycle Model of Control and Supervision

What is the contribution of foreign direct investment operations that fit into the product cycle model to the development prospects of the host countries where they are found, and how does this potential contribution compare to the impact of operations that are not part of the parent's central competitive strategy? In particular, does the parent's desire for control stifle the contribution to host country development, or, somewhat counter-intuitively, might it enhance the contribution to host country development?

This chapter surveys the evidence from the industrial sectors where the spread of foreign direct investment has been the largest—automobiles and auto parts, and computers/electronics—and then, to avoid selection bias, compares the results with what is known from other manufacturing and agribusiness industries to check whether the first two sectors seem fairly representative or clearly unrepresentative.¹ To the extent possible, the investigation includes cases from both large and small host countries. It examines the operations of the affiliates themselves, the backward linkages from the affiliates, and the possible spillovers and externalities from the foreign investors to firms and workers in the host economy.

Characteristics of the Affiliates Themselves

The evidence suggests that affiliates integrated into the parent's strategy to maintain or advance the firm's position in world markets incorporate

1. This study draws on the analysis undertaken for Moran (1998), but includes almost half again as many case materials.

full economies of scale, export a large fraction of their output, utilize contemporary best practices in management, quality control, and production technology, and are almost always wholly owned. There is more human resource training, including rotation of managers outside the country, than in other kinds of foreign investor operations. From a dynamic point of view, there are indications that management practices, quality control procedures, and production technology are upgraded more rapidly than in other kinds of foreign investor operations. Some subsidiaries are given responsibility for design as well as manufacture of subcomponents, and for experimentation with novel forms of administration or human resource management.

The Automotive Sector

The advent of international sourcing from the developing countries in the automotive industry can be traced to the decision of General Motors in 1979 to build four new wholly owned, full-scale-sized, export-oriented plants in Mexico to supply engines for its US automobiles (Samuels 1990; Shapiro 1993, 1994; see also Bennett and Sharpe 1985). These, and the wholly owned, export-oriented plants that Ford, Chrysler, Volkswagen, and Nissan launched within 18 months of the GM decision, were the first facilities within Mexico that approached the ability to capture all economies of scale in production. The total capacity from this single round of investment was approximately 1 million engines per year, with 80 to 90 percent destined for integration in parents' assembly operations outside of Mexico (Peres Nuñez 1990).²

Shortly thereafter, General Motors expanded the process of international sourcing by designating Brazil as a second offshore site for the production of engines, again with wholly owned, full-scale-sized plants. Ford followed suit. The GM and Ford operations in Brazil show the parent taking pains to place the affiliate as close as possible to the frontier of most advanced technology, quality control, and best business/management practices, and, further, to invest in keeping the affiliate at the cutting edge (Shapiro 1993). The output of the GM plants was designed to be interchangeable with the two-cylinder engines produced at the Pontiac operations in upstate New York. Following intensive plant-level training in quality control, one of the GM affiliates built during this initial period of external sourcing received an award for the lowest number of quality-related rejects of all GM worldwide operations. The new Ford

2. Salaries and benefits for the 121,000 jobs created in Mexico in the first five years after the external reorientation of the automotive sectors in 1979 were among the highest in the country, second only to those of workers in the large state-owned enterprises such as Pemex.

plants in Brazil were likewise designed to complement the family of four-cylinder engines being built at Lima, Ohio. Over the course of the 1980s the Ford export engine from Brazil attained the parent company's highest quality rating.

The US parent companies have subsequently used Latin American operations as the launching pad for new operational techniques, and the training ground for executives later promoted to the senior ranks of parent operations in the United States.³ While not as extensive as will be found in the computer/electronics sector in Southeast Asia, examined next, the US auto companies, like Motorola, Compaq, and Hewlett-Packard, have assigned certain engineering design activities to their Latin American plants.⁴

In Thailand, the decision of the international automobile investors to turn to international sourcing came after 1985, when the Thai authorities stimulated competition among four investor groups (three Japanese and one European) to build export-oriented plants for diesel engines for one-ton trucks (Doner 1991). All four proposed, and had accepted, full-scale production plants that together generated an 800-percent increase in automotive exports, to an annual level of approximately \$2.5 billion, in the five years after the projects were launched. With these decisions to incorporate Thai-built motors in trucks destined for international markets came intensive efforts at quality control but the details are less well recorded than in the case studies of US investors in Latin America.

Turning to more contemporary evidence about the effort to keep integrated operations continuously near the cutting edge of management and technology in the industry, GM's plant at Szentgotthard in Hungary—launched in 1992 to supply 200,000 1.6- and 1.4-liter engines per year to Opel assembly facilities in Spain, Germany, Belgium, and the United Kingdom—was designed to use computerized machining and cylinder head equipment that could accept continuous real-time changes to upgrade and improve output without rebuilding the production line (Klein 1995).

3. "G.M.'s operations in Brazil have copied Japanese manufacturing practices and have become the company's most profitable, efficient and flexible. . . . The last two presidents of G.M.'s Brazilian operations, G. Richard Wagoner Jr. and Mark T. Hogan, now run G.M.'s North American operations and are trying to apply Brazil's lessons here. 'We can take what we've learned in the manufacturing and technology in Brazil and apply that in the United States, and that's every bit my intention,' said Mr. Hogan, G.M.'s vice president for small cars, in an interview last year in Sao Paulo" (*New York Times*, 17 June 1999, 1). Ford used the expertise in lean production it had learned in its alliance with Mazda to build a greenfield plant at Hermosillo in Mexico in the mid-1980s to assemble the Mercury Tracer for export to the United States. Adding engines and transmissions produced in Mexico, the plant became a model within the Ford family for quality and productivity (Womack et al. 1991, chapter 10).

4. For evidence from GM's Delphi Automotive Systems division in Ciudad Juarez, see Ramirez de la O (1998, 83).

The operational plan for the Hungarian engine plant required workers to pass a 12-week training cycle of team-work exercises that emphasized quality control as well as enhancement of productivity; managers were rotated through other GM plants in Europe in order to be exposed to best practices elsewhere.⁵ To protect Opel's reputation in Europe, the decision to expand the operation to full-scale production (460,000 units per year) in 1996 was taken only after internal audits showed quality control at Szentgotthard to be consistently comparable to engines produced in Germany or the United Kingdom.⁶

Volkswagen requires that plants producing the four components of the "basic vehicle platform" (engines, axles, chassis, and gear boxes), which the parent manufactures separately from assembly sites in Brazil, Mexico, Argentina, and Eastern Europe, be designed to receive simultaneous engineering improvements online within 16 hours of each other (Ehinger 1999).

When GM chose Thailand in 1996 as the site of its first Southeast Asian, full-scale-assembly operation, with a capacity to produce 100,000 to 150,000 finished vehicles per year (80 percent destined for export markets), the rationale for insisting upon 100-percent ownership and freedom from all local content requirements as preconditions from the Thai authorities sprang in part from the desire to ensure the parent's ability to incorporate product and process changes as rapidly and continuously as possible (*Far Eastern Economic Review*, 13 June 1996).

The Computer/Electronics Sector

Turning to the evidence about the characteristics of affiliates in the computer/electronics industry that fit within the product cycle model of parental control and supervision, the geographical spread of foreign direct investment was the reverse of the automotive sector, with the appearance of global sourcing from Latin America lagging far behind Southeast Asia.

The most detailed evidence of the intensity of the parent-subsidiary relationship, and of the effort devoted to rapid upgrading of host country capabilities, comes from the evolution of the disk drive industry (McKendrick et al. 2000). Disk drives are magnetic platters, driven by highly efficient motors at speeds up to 15,000 revolutions per minute. The disk head,

5. In 1992 seven of the top nine managers were foreign. In 1995, six of these top nine managers were Hungarian. Wages for line workers at Szentgotthard came to approximately twice the national average (Klein 1995).

6. Started as a joint venture with Raba, a state-owned truck axle manufacturer, the General Motors affiliate terminated the relationship with the Hungarian partner, reestablishing its operation with wholly owned status, before deciding to bring the engine export plant up to full scale.

attached to a suspension that holds it in position above or below the disk, retrieves information from the proper micro-inch (millionth of an inch) on the surface, and transfers it to the central processing unit. In 1984, two years after Seagate Technology developed the first hard disk drive for use in desktop computers, the Seagate parent in Silicon Valley began to assemble disk drive components in Singapore.

In the first five years after Seagate built its initial plant in Singapore, 11 other US disk drive producers followed. By 1990, Singapore had become the largest producer of hard disk drives in the world, accounting for 55 percent of all units shipped.

Plant-level studies of the relationship between product designers in the United States and their wholly owned assemblers in Singapore show the headquarters organizing “new product transfer teams,” with 15 process engineers and managers from the volume manufacturing facility offshore coming to the home country to work with product developers and manufacturing specialists approximately 50 days prior to the scheduled transfer day, followed two weeks later by 24 operators from the offshore site to be trained on the pilot line (Terwiesch et al. 1999). Shortly before the transfer date, all host country members of the team would return home, accompanied by 11 headquarter managers and engineers to test the offshore production line. After the official transfer, another 10 home country experts would join them until targets for yields, downtime, and process-induced failures had been met.

In developing each new generation of disk drives, assemblers and parts manufacturers in the home country would jointly design the new products, but not be able to discover all the manufacturing flaws until high volume output had been attained. After fashioning a novel suspension arm with a US-based supplier, for example, Seagate or Read-Rite might experience yield problems in their offshore assembly plants attributable to the suspension (McKendrick et al. 2000, 203). With several weeks of deficient assemblies already in the pipeline, it was imperative to have engineers in each other’s plants to devise a modification within days or hours, putting a premium on colocation. Beset by coordination problems in ramping up new generations of disk drives, while minimizing early rejection rates and downtime, Seagate, Read-Rite, and other assemblers began to insist that home country suppliers follow them offshore, as indicated in the discussion of backward linkages that follows.

With rising wage rates in Singapore, the international disk drive industry began in the late 1980s to set up more labor-intensive segments in lower-cost Malaysia (heads and printed circuit boards) and Thailand (heads, motors, and more mature 20-megabyte, as opposed to 168.5-megabyte, disk drives). Twice a day, head disks produced in Thai plants, for example, were flown to Singapore for final drive assembly and testing (McKendrick et al. 2000, 144). Disk drive-related exports from Thailand grew from \$2.6 million in 1985 to \$1.3 billion in 1990.

By 1995, 70 percent of the world's disk drives originated in Southeast Asia. Eighty-six percent of the firms that produced heads or head assemblies anywhere in the world had plants there, with a growing number of sites being added in the Philippines, Indonesia, and China. Other locations included Mexico, Brazil, and Puerto Rico.

The foreign assemblers assigned increasingly more sophisticated tasks to some of these countries. Seagate gave its Malaysian operation responsibility for new desktop drive launches in 1998 (McKendrick et al. 2000, 134). IBM made Thailand its principal disk drive assembly site, accounting for approximately two-thirds of the company's production in 1999 (McKendrick et al. 2000, 136). Seagate alone became the largest private employer in Malaysia and Thailand, as it already was in Singapore.

The evidence from investors outside of the disk-drive sector shows a similar pattern. A study of seven foreign investors in telecommunications and semiconductors in Malaysia, which included two months on the factory floor in four subsidiaries of one US firm, records the incorporation of state-of-the-art production techniques (quality control circles, "integrated materials requirement planning" procedures, and statistical process control methods) from the mid-1980s to the early 1990s, with a steady shift toward high-precision, computer-driven systems for large-scale assembly and testing of assemblies. The process required frequent machinery modifications, and rapid retraining of workers to meet changes in the skill requirements (Rasiah 1993, 1994, 1995). Reflecting on the evolution of Texas Instruments in Malaysia, an executive observed, "We came for the cheap labor and the tax advantages, but we are staying because of the expertise we have built up here. As far as assembly and testing are concerned we have more expertise here than we have in the US. We sometimes have to send our Malaysian engineers to the States to solve their problems" (Lim and Pang 1991, 115).

A second study that traces the evolution of individual US companies throughout Southeast Asia, from the early 1980s through the mid-1990s, shows the subsidiaries moving steadily up the technological ladder, from hand assembly of printed circuit boards, to automated assembly of complex computer subsystems for incorporation in their global product lines (Borris 1994). Over the course of this evolution toward increasing technological sophistication, Motorola assigned responsibility to its Southeast Asian affiliates for design and development as well as manufacture of circuit boards, disk drives, and other peripherals. Hewlett-Packard awarded similar responsibility for tooling development, process design, and even some chip design for portable printers, desktop personal computers, and servers. Compaq entrusted architectural as well as manufacturing tasks for notebook and portable personal computers.

Starting somewhat later, Japanese parent firms in the electronics industry have similarly transferred design activities to their subsidiaries in Southeast Asia (Baba and Hatashima 1995). Matsushita Electric and Seiko

Epson, for example, have shifted die-making capabilities to the region, with the twin goals of lowering costs and reducing the time period from design to delivery of new models of televisions (for the first company) and computer printers (for the second) (Belderbos et al. 2000, 16).

Given the pace of technological obsolescence in the microprocessor industry, Intel describes its production strategy as an attempt to build semiconductor assembly and testing facilities “before we have products to run in them” (Spar 1998, 4). Then, once a plant is in place, the company has discovered that continuously modernizing existing sites is far less expensive than “ramping up new production capacity.” This has driven the parent’s pattern of foreign investment, followed by reinvestment, in Malaysia, the Philippines, and Costa Rica, as well as Israel and Ireland.

In Latin America, the process of incorporating foreign subsidiary output into the parents’ sourcing networks has been less complete than in Southeast Asia, due to residual host country desires to maintain informatics policies that protect indigenous producers, but the available evidence shows similar features.

The most thoroughly studied case involves IBM’s proposal to the Mexican government in 1985 to produce microcomputers and typewriter assemblies for integration into the parent’s hemispheric production system, in return for exemption from Mexico’s requirements for majority domestic ownership and 25 to 60 percent domestic content. The new IBM operation was designed to be five times larger than Mexican estimates of the minimum economies of scale in the industry and 10 times larger than any other existing microcomputer plant in the protected Mexican market (Harvard Business School 1990; Cline 1987; Peres Nuñez 1990, chapter 5).

Once Mexico accepted the IBM proposal, and adopted the principle of allowing foreign computer/electronics manufacturers wholly owned status and greater freedom over decisions about where to buy inputs in exchange for commitments to export, Hewlett-Packard and Apple immediately followed the IBM lead in shifting from boutique to full-scale plants (although Apple later withdrew). Exports grew by a factor of 12 in the first four years after the reorientation of production toward external markets, from \$21 million to \$252 million. While information about production techniques in the foreign plants is not as detailed as in the earlier Southeast Asian cases, the output of the new plants was considerably more sophisticated (minicomputers, microcomputers, workstations, disk units, and printer and typewriter components) than in the earlier import-substitution regime, with new designs introduced to suit successive generations of final products in the international markets. And, as discussed more thoroughly in the next section on “backward linkages,” the degree of integration of production operations within Mexico actually increased despite the abandonment of domestic-content requirements (Peres Nuñez 1990).

With the change in informatics policy in Mexico, Ericsson began to use the country as an export platform from a wholly owned subsidiary in 1986 (interview with Roland Nordgren, president of Ericsson Mexico, 2 April 2001). Over the course of the next decade, the machinery and manufacturing techniques became indistinguishable from those used in Sweden for high-volume applications. In 1991, Ericsson moved the small software engineering group that its affiliate had formed around the manufacturing unit from Mexico City to Saltillo, and expanded it to full-scale size (500 Mexican engineers). The Saltillo facility joined the ranks of 23 such “software centers” worldwide, performing both generic software development and specialized applications (such as electronic funds transfer) for incorporation in Ericsson’s global product lines.

Other Evidence

Are there any indications of selection bias in examining these industries for which the process of globalization of production has been the most extensive? Are the characteristics of affiliates that fit into the product cycle model of parental control and supervision in these two sectors—automotive and computer/electronics—exceptional, or are there data that support these findings more generally?

While most aggregate studies do not try to examine how particular subsidiaries contribute to the headquarters’ strategy for positioning the company in international markets, the evidence on utilizing relatively advanced technology, business practices, and human resource investments in those affiliates the parent can control most directly is reinforced by Vijaya Ramachandran’s (1993) findings about parent treatment of wholly owned affiliates in 14 industries.⁷

Ramachandran shows that foreign investors systematically devote more resources to what she labels as “technology transfer” to wholly owned subsidiaries than to partially owned affiliates, licensees, or independent firms. Ramachandran operationalizes the measurement of resources devoted to technology transfer in terms of the number of parent-company employees sent to the host country to bring a given technology on line and the number of host country employees sent to the parent country for training. Both measures are significantly higher for wholly owned subsidiaries than for the other, more distant forms of parent activity in the host economy.

Similarly, Edwin Mansfield and Anthony Romero (1980) observe that the transfer of new technology and production innovations takes place within wholly owned corporate networks more rapidly, in general, than

7. The industries include food, textiles, transport equipment, chemicals (industrial, medical, and other), electrical goods, machinery, metals and metal products, rubber, services, and a miscellaneous group.

among joint ventures or licensees. They report that the mean age of technology at the time of first transfer to wholly owned subsidiaries in developing countries is 3.3 years, or one-third, newer than to joint ventures and license holders.⁸

The significance of providing conditions in which parent investors can protect whatever cutting-edge technological practices they provide to their subsidiaries is also reflected in data about intellectual property rights enforcement and the location of foreign activities (Maskus 2000). Here too, however, the type of ownership relationship between the parent and the subsidiary stands out: if host countries do not allow foreign investors to operate with wholly owned status, the strength or weakness of intellectual property rights protection appears to have little impact on the volume or quality of foreign investment (Lee and Mansfield 1996, 185).⁹

Evidence from the garment and footwear industries, however, provides something of an anomaly.¹⁰ The typical assembly plant in the developing world involves contracting and licensing of production rather than direct investment on the part of the multinational corporate parent. Some companies, Nike in particular, require almost all their contractors to produce exclusively for the Nike brand, in order both to maintain corporate secrets and to facilitate communication of design and quality issues (Nike also concentrates production with one Taiwanese and two Korean subcontractors). Some companies, led by Levi Strauss, prefer to own plants directly. But the predominant relationship between multinational marketer and developing country plant does not involve a wholly owned link, despite the continuous near-real-time interaction about style and design, assembly techniques, and quality control procedures.

Backward Linkages

Looking beyond the operations of the foreign affiliates themselves, what kinds of backward linkages to suppliers within the host economy do foreign investors provide when they set up local plants that are closely integrated into the parents' overall competitive structure?

In particular, do they engage only in "screwdriver" operations with minimal use of host country inputs, as some hosts have worried might occur in the absence of domestic-content, joint-venture, or technology-sharing requirements being imposed on the foreign investors?

8. For more recent evidence, see Wilson (1994).

9. This observation comes from tests on the behavior of 14 chemical firms.

10. Given the extreme vulnerabilities of workers in the garment and footwear industries to economic, physical, and sexual abuse, the relationship between foreign entry in these sectors and host development prospects requires special attention. See Moran (forthcoming); Varley (1998); and Jacobson (1998).

In fact, the evidence from the automotive and computer/electronics sectors suggests that backward linkages are often *more extensive* for integrated operations than for other kinds of foreign investments, in part because the size of the foreign plants leads to larger local demand, because the foreign investors help the local suppliers achieve scale economies, and because the growth rate of production is geared to international as well as domestic market demand.

But how *robust* are the backward linkages from these thoroughly integrated kinds of operations?

Given the preoccupation of foreign direct investors for control over “captive” plants, as highlighted in Vernon’s writings, might the transfer of technology and other business practices be particularly weak and grudgingly imparted?

Indeed, some hosts have wondered whether the term “technology transfer” might not be an oxymoron when the decision-making processes are left up to the foreign parent. This suspicion has led to the conclusion that technology transfer must be forced out of the parent, through pressure from local joint owners or from host-government, technology-sharing mandates.

But theory and evidence in recent studies point, somewhat counter-intuitively, in just the opposite direction. The relationship between the foreign plant and domestic suppliers appears to be particularly robust, containing dynamic transfers of many kinds, when the parent’s own competitive position in international markets depends upon the quality, reliability, timeliness, and up-to-date characteristics of the inputs that flow through the affiliate.

To help explain the subtleties of foreign investor behavior in the realm of “technology transfer” (and transfer of other managerial expertise), Richard Caves (1999) distinguishes between *horizontal* and *vertical* relationships between multinational corporations and other firms. With regard to the former, the parent corporation is assiduous in trying to prevent leakage of technology and best-business practices to potential rivals; with regard to the latter, however, the parent corporation may in fact be willing to devote its own resources to develop intimate, valuable, and continuously upgraded ties with suppliers.

There is extensive evidence of the latter phenomenon—the parent’s readiness to invest in high-quality vertical relationships, extending backward from its own affiliates to suppliers in the host country—in the automotive and computer/electronics industries, with supporting data from other sectors as well.

The Automotive Sector

The first five years after the advent of global sourcing in the automotive sector from Mexico witnessed the growth of some 310 local producers of

parts and accessories in the domestic economy, of which 40 firms had annual sales over \$10 million, and 75 firms had annual sales between \$1 million and \$10 million. Slightly less than half of the gross value of production in the auto parts sector was accounted for by local firms with foreign ownership; 51 percent of the gross value of production was accounted for by local firms without any foreign ownership.¹¹ Exports of auto parts from Mexico had been \$78 million prior to the construction of export-oriented engine plants, and rose to \$364 million (exclusive of engines) in the first five years afterward. Of the 30 largest auto parts exporters (again excluding engines) at the end of the five-year period, 21 firms reported operating with foreign technology, and of these 14 had foreign shareholders; 9 of the 30 firms were entirely indigenous.

The performance of the Mexican auto parts industry was enhanced, according to their own testimony, by production audits, weekly coordination meetings, and technical training in zero-defects and just-in-time procedures, as well as by the team spirit such sessions encouraged (Peres Nuñez 1990, 129-30). This assistance, and “pressure” to make appropriate adjustments, was extended to suppliers without foreign participation of any kind as well as to those operating with foreign partners.

In Southeast Asia, the turn toward offshore sourcing on the part of the major Japanese auto firms also induced their suppliers from the home market to accompany them abroad. Twice as many Japanese investors in auto parts and components (79) followed the major assemblers into Thailand after the establishment of export-oriented truck engine plants than were present during the same period in countries that maintained an inward-looking orientation (Indonesia, Malaysia, and the Philippines) (Doner 1995).

As for the impact of the foreign investors on local Thai firms, the Japanese assemblers took an active role in organizing “cooperation clubs” of the kind that were characteristic of supplier relations in the home country to assist with quality control, cost reduction, scheduling and delivery, and product improvement (Institute of Developing Economies 1995). Within the first 10 years after the turn toward offshore sourcing by the Japanese parents, some 150 local firms qualified for original equipment manufacturer (OEM) status; of these, 67 had some Japanese ownership, 42 reported receiving technical assistance from Japanese buyers in the course of achieving OEM certification (but had no Japanese ownership), and 41 received OEM certification on their own. An additional 200 to 250 Thai

11. A survey conducted by the consulting firm Booz, Allen, and Hamilton in 1987 indicated that more international auto parts firms would have been willing to follow the major car companies into Mexico had it not been for the Mexican requirement that these firms take on majority-holding Mexican partners (the major auto firms were allowed to operate from wholly owned subsidiaries whereas the auto parts firms faced a ceiling of 40-percent ownership) (cited in Peres Nuñez 1990).

firms received replacement equipment manufacturer (REM) certification. These suppliers, like the foreign affiliates themselves, were able to capture economies of scale, and to use different and more sophisticated production techniques, than local firms elsewhere in Asia whose function was to help put together semi-knocked-down (SKD) and completely knocked-down (CKD) kits for protected local assembly operations (Ngo and Conklin 1996, appendix 3, note on automobile assembly process).

The Computer/Electronics Sector

As the operations of the Asian affiliates of US computer and electronics firms advanced from printed circuit board (PCB) fabrication to the manufacture of higher value-added subassemblies and whole systems (desktops, personal computers, notebook computers) described earlier, there is evidence that they spun off earlier tasks to indigenous suppliers. Apple, for example, opened its own printed circuit board assembly plant for the Apple II PC in 1981 in Singapore, but by 1983 had nine local companies engaging in contract manufacturing of PCBs for the Apple IIe and Lisa. As Apple-Singapore was assigned by the Apple parent to assume assembly responsibility for two of three new Macintosh PCs in 1990, it had accumulated 130 major suppliers for monitors, power supplies, mechanical parts, and some chips from the region (Borrus 1994). There are indications that Hewlett-Packard went through a similar evolution in developing local suppliers for computer assembly operations; ATT for telecommunications products; and Texas Instruments, Intel, and National Semiconductor for semiconductors.¹²

In Malaysia, seven semiconductor and telecommunications investors helped their local subcontractors keep pace as their own volume of exports increased, in particular by assigning technicians to the suppliers' plants to help set up and supervise large-volume automated production and associated testing procedures. In some cases, the foreign investors contracted out for design as well as manufacture of components, parts, and subassemblies, with engineers from the foreign affiliate and the supplier company working on the project together (Rasiah 1994).

There are some signs that American and European multinationals tended to provide more cultivation of indigenous suppliers than Japanese multinationals. One investigation compared the backward linkages from US, European, and Japanese investors in the electronics sector in Singapore (Lim and Pang 1982). All exported at least 90 percent of their output. "Company A," the subsidiary of a US semiconductor manufacturer, had more than 200 local suppliers. Of the top 10, by value of purchases, six

12. Borrus (1994) cites the unpublished BRIE Asia FDI Database in making this assertion, but does not provide further details.

were the affiliates of Japanese, US, or European investors; and four were local Singaporean firms. This American semiconductor investor provided the latter with detailed specifications and technical write-ups for parts, reinforced by injections of outside expert help, from the subsidiary or the parent, to ensure the quality and reliability of locally produced parts. For "Company B," the subsidiary of a European consumer electronics manufacturer, four of the eight largest suppliers were foreign affiliates, and four were local firms. Besides assistance in quality-control practices, the subsidiary helped the local suppliers automate their domestic operations.¹³

In the case of "Company C," the electronics subsidiary of a Japanese conglomerate, 16 of the 24 largest suppliers were Japanese affiliates, four were other foreign affiliates, and four were local firms. Other than insisting that the latter steadily lower the reject rates for their parts, "Company C" showed itself to be "less aggressive" in promoting the establishment of locally owned supplier firms, according to the researchers, than the other two (Lim and Pang 1982, 589).

As in the automotive industry, the data from Japanese multinationals in the electronics sector reveal a propensity for Japanese firms to bring their own suppliers into the host country as investors. But there is evidence of coaching and technology transfer to local firms as well.

A study of buyer-supplier relations and technology transfer within nine wholly owned Japanese multinationals in the electronics sector in Malaysia in 1995 found that the share of local procurement was 37 percent of total output, with Japanese firms accounting for 60 percent of the number of suppliers and 83 percent of the value of procurement, Malaysian firms accounting for 24 percent of the number of suppliers and 6 percent of the value of procurement, and other firms accounting for 17 percent of the number of suppliers and 10 percent of the value of procurement. "Deliberate transfers of technology" were focused, as one would expect, on the indigenous Malaysian firms, and included new product and process technologies, product-design specifications, advice on the use of equipment, and help with the solution of specific technical problems (Capanelli 1997).

Membership of a Japanese affiliate in a vertical *keiretsu* (company group) with intensive supplier-assembly relationships was shown, in one study of 157 subsidiaries of Japanese parents in the electronics industry in Asia, to have a significant positive impact on the extent of local content produced in the host country (defined as the sum of local procurement and

13. Both "Company A" and "Company B" helped the indigenous supplier firms to export to regional sister plants of the parent. Both also helped the indigenous supplier firms to export to independent buyers, with the justification that such efforts helped the suppliers to achieve economies of scale, with more automated production lines, better quality control, and lower prices for themselves as well as for other purchasers. This "export coaching" and sales to nonrelated parties will be treated under the next category of "externalities."

local value added). This study was not able to determine, however, whether this higher proportion of local content was due to a higher presence of Japanese suppliers in the host economy or to greater reliance on indigenous firms. The analysis also found that the proportion of local content was directly related to the length of operating experience in the host economy. Subsidiaries of R&D-intensive parents relied more strongly on imports of components, and had lower local-content ratios (Belderbos et al. 2000).

In the disk drive industry, the generation of backward linkages came in the first instance from the insistence on the part of the international assemblers that component producers collocate plants in proximity to their overseas plants, so as to facilitate production coordination and troubleshooting, discussed earlier (McKendrick et al. 2000).

Host country development agencies pushed the foreign investors to identify local indigenous suppliers as well. The Economic Development Board of Singapore paid the salary of a design manager on the foreign companies' staff who had responsibility for identifying potential indigenous suppliers and recommending equipment purchases, for which the Small Industry Finance agency supplied capital. The Penang Development Corporation of Malaysia laid out local industrial areas next to the export processing zones (EPZs), assembled directories of firms that might meet the needs of the EPZ manufacturers, funded skill training for their workers and managers, and organized vendor exhibitions.

Host country efforts to foster backward linkages to local firms in the disk drive sector were aided by the same dynamics requiring short and readily adjustable supply chains that brought in overseas suppliers as investors (McKendrick et al. 2000, 168-69, 171, 179, 193, 200). Seagate, Conner Peripherals, Tandon, and Maxtor launched "vendor development programs" to procure printed circuit boards, precision-engineered mechanical parts, actuator arms, and motor assemblies in Singapore in the late 1980s. IBM awarded a manufacturing contract for head-stack assemblies to the Saha Union business group in Thailand in 1989. Some foreign assemblers sent their engineers to visit their principal local suppliers on a daily basis. Some local suppliers made deliveries of specially engineered inputs two or three times per day.

Conner Peripherals hired Eng Hardware, a Malaysian engineering firm that had grown up as a supplier to the semiconductor industry, to enter the new business of manufacturing actuators for disk drives in the early 1990s to achieve "easier problem solving and communication" without having to source from outside Malaysia (McKendrick et al. 2000, 213-14). Conner also brought two Singaporean firms (NatSteel Electronics and Tri-M) across the border to Penang to provide a local source of printed circuit boards.

The movement from locally owned national producer of printed circuit boards to multinational producer of electronic products was a more

general phenomenon. Three firms that originated as domestically owned printed circuit board producers in Singapore (Flextronics and Venture, along with NatSteel Electronics) came to rank among the largest 10 contract manufacturers in electronics in the world, with the first duplicating its Southeast Asian successes in Mexico in the second half of the 1990s.

As in the case of autos, the OEM channel has proved to be an important incubator for suppliers in electronics. Michael Hobday (1995, 2000) shows how OEM relationships and other subcontractor arrangements have provided technology, design, and production know-how to indigenous electronics firms across East and Southeast Asia.¹⁴

Among the countries studied, Hobday's research highlights the role of OEM relationships in the development of the Korean electronics industry. Rather than following the conventional characterization of Korea as simply hostile to multinational investors, he provides a more subtle demonstration of the importance of external coaching and external procurement from US and Japanese companies in establishing Korean firms as internationally competitive OEM suppliers, and in helping them to advance to original design manufacturing (ODM), from which they moved themselves into original brand manufacturing (OBM).

The entry of the Korean *chaebol* (company groups) into electronics production began as subcontract manufacturing for wholly owned subsidiaries of foreign investors in Korea in the 1960s and 1970s. These foreign investors accounted for 70 percent of all electronics exports from Korea at the end of the 1960s, and still amounted to 40 percent of all electronics exports at the end of the 1970s. As Korea constrained the ability of foreign direct investors to operate there, the OEM relationship with the multinational electronics firms remained the vehicle for ensuring the quality of chaebol products and the channel for securing chaebol penetration of international markets. At the end of the 1980s, 60 to 70 percent of all Korean electronics exports exited the country under OEM contracts to foreign multinationals. Even in the case of the most successful chaebol—Samsung, Lucky Goldstar, and Hyundai—the proportion of OEM exports was 60 percent (Hobday 1995, 67).

In Taiwan, the large computer and electronics companies from the United States, Europe, and Japan dominated export production into the 1980s, and still accounted for more than a third of export sales in 1989 (Hobday 1995, 99). The growth of Taiwanese producers—Acer, Wyse, Tatung, and Mitac, for example—took the path from selling subassemblies and assemblies to the foreigners, to learning production design from fulfilling contract manufacturing specifications, to producing their own PCs for sale under the foreigner's label.

14. Hobday (1995, 2000) lumps OEM (and other subcontracting) relationships with joint venture mandates as a channel for multinationals to transfer "substantial amounts of technology" to host country economies, overlooking the drawbacks associated with the latter.

The significance of the OEM channel for the growth of indigenous firms has led to a kind of revisionism about the sources of success in the development strategies of the Four Dragons in Asia. Instead of simply contrasting the experiences of Korea, Taiwan, Singapore, and Hong Kong in terms of the degree of public intervention in the economy (or even the degree of overall openness to trade and investment offered by each), there is a new appreciation of the *common* use of OEM and other subcontracting relations with external multinationals as the institutional vehicle to fortify the national industrial base.¹⁵

In the computer/electronics sector in Latin America, the reorientation of Mexico's informatics policy—once the host accepted IBM's demand for freedom from domestic-content requirements along with 100-percent foreign ownership, discussed earlier, in return for integration into the parent's regional production network—led not only to larger aggregate purchases of Mexican components but also to a higher proportion of output coming from suppliers in the domestic economy than had been present in the prior import substitution regime. The country's imports as a percentage of production dropped, and the degree of integration within the Mexican domestic industry actually increased (Peres Nuñez 1990, table 5-3, 96, 98).

Moreover, whereas production oriented toward the relatively small domestic market had precluded many Mexican suppliers from achieving economies of scale, the larger batch production runs associated with exports of computer components and finished equipment (PCs, workstations, printers, and electronic typewriters) allowed Mexican suppliers to use newer, lighter materials, and more automated, precise production methods. Cabinets and cases, for example, had been made of fiberglass or aluminum, soldering was done by hand; the use of plastics and the initiation of high-volume machine soldering by Mexican companies became feasible only after the large-scale operations associated with integration into the regional sourcing network began.¹⁶

With the shift toward using Mexico as an export platform after 1986, international systems producers like Ericsson divided manufacturing operations into strategic sectors, such as cell phones and processors, which they produced themselves, and other components, which they could outsource (interview with Roland Nordgren, president of Ericsson Mexico,

15. For the growing appreciation of OEM relationships with external multinationals as a key to the growth experience in East and Southeast Asia, including Korea, see the selections by Frédérique Sachwald, Luis Miotti, Marc Lautier, Kong-Rae Lee, Alice Amsden, Rene Belderbos, Bruce Kogut, and Lynn Mytelka, in Sachwald (forthcoming).

16. The evidence of scale economies when foreign investors and their local suppliers shift from import substitution to export production, in Latin America as well as in Asia, runs contrary to the contention that "there do not appear to be major potential gains from better exploitation of scale economies" in less developed countries (Tybout 2000, 38).

2 April 2001). In this process, the three largest contract manufacturers—Selectron, SCI, and Flextronics—followed them to Mexico, building full-scale, wholly owned plants to supply their needs.

Other Evidence

Are the findings about the extent and quality of backward linkages from subsidiaries tightly linked into the parent's sourcing network in the automotive and computer/electronics sectors unusual, or are there indications of similar patterns in other areas of foreign investment as well?

There are fewer detailed studies of foreign investor-local supplier relationships in other industries, but the process of parent companies investing in the performance of their suppliers does not seem to be unique to autos and computer/electronics.

In the agribusiness sector, when Gerber acquired the Polish food processor Alima to reorient the venture from selling processed foods in East European markets to stocking French supermarket shelves, local suppliers enjoyed access to a market projected to be four times larger than ever before (Harvard Business School 1994). To bring this to fruition, the new affiliate launched a program to provide technical assistance to Polish fruit and vegetable producers. The program had three objectives: increase the suppliers' productivity, alter the flavor of the suppliers' output to meet French tastes, and ensure continuity of quality control (and protect Gerber's brand name) in the production of baby food.

A survey of foreign firms in Indonesia, Mexico, the Philippines, and Thailand by the Foreign Investment Advisory Service (FIAS) of the World Bank Group identified the provision of designs and specifications for the parts required and the assignment of engineers to help troubleshoot special problems in quality control as the main areas in which investors came to the aid of local suppliers (Battat et al. 1996). In a number of cases, according to FIAS, foreign companies helped their subcontractors with tooling and material testing that were unfamiliar, not available locally, or appeared too expensive to the latter. Several foreign firms provided suppliers with management training when this was needed for quality control purposes. These arrangements worked best when there were no "forced partnerships" or restrictions on the extent of foreign ownership (International Finance Corporation and FIAS 1997).

The generation of backward linkages can be severely inhibited, however, by *home* country regulations that prohibit the importation of products that make extensive use of host country inputs. Such regulations have plagued the garment and footwear industries; more broadly, they have greatly retarded the contribution of *maquiladora* (export-oriented assembly) investments to Mexican development (Madani 1999; also Moran forthcoming).

To summarize the evidence thus far, foreign investors whose local operations comprise an integral part of the parent's global or regional sourcing network introduce state-of-the-art technology and business practices into the host economy *both* via the investment that the parent makes in the performance of its own subsidiary *and* via the supervision that the parent and subsidiary exercise over the performance of local suppliers.

The potent interaction in each of these relationships discredits a popular metaphor for the behavior of foreign firms—that the foreign investors are engaged in “outsourcing,” as if the parents were simply shopping around for sources of cheap inputs. Instead, as a by-product of their own efforts to strengthen their competitive position in international markets, the foreign firms develop a major stake in the level of accomplishment of both the subsidiary and the suppliers upon which the subsidiary depends.

But there is a third channel through which the host economy may benefit from the presence of foreign investors as well: potential spillovers and externalities.

Spillovers and Externalities

Spillovers and externalities (i.e., positive spillovers and externalities) are benefits generated by an economic activity that are greater than those captured within the activity itself and greater than those captured by users of the activity's output.

The examples of vertical teaching and training incorporated in the evidence about backward linkages above are likely to include some effects that genuinely qualify as spillovers and externalities, and some effects that do not. Combing through these cases to separate just exactly which benefits fit the technical criteria for positive spillovers and externalities, and which do not, is an exacting task.

In the automotive sector, for example, when General Motors set up weekly meetings of suppliers in Mexico or Brazil, or when Toyota established “cooperation clubs” in Thailand, to provide instruction in quality control or to instill team spirit, the benefits to the parent corporation in the form of higher profits and the benefits to consumers in the form of lower prices and better performance from GM and Toyota products *do not* technically qualify as externalities.

To the extent that the suppliers became certified as original equipment manufacturers (OEMs) or replacement equipment manufacturers (REMs) to buyers at large in the domestic economy, or broke into external markets via the reputation they acquired through the original relationship with GM or Toyota, the benefits to other producers and consumers in the host economy *do* qualify as externalities.

Similarly, when General Motors or Toyota provided training to workers or managers within their overseas operations, the benefits *do not* qualify as externalities. When workers or managers who had been trained within the GM or Toyota networks left and successfully set up their own businesses on the basis of the education and experience they had acquired from the foreign companies, the benefits to the host economy *do* qualify as externalities.

In the computer/electronics industry, there has been some careful investigation that shows in detail how some benefits to the host economy that would not actually qualify as externalities mix with and lead to other benefits that do.

Rajah Rasiah (1993, 1994, 1995) traces the development over two decades of nine of the most prominent machine tool firms in Malaysia that originated as suppliers to seven foreign electronics firms (one Japanese, one Canadian, and five American firms involved in semiconductors and telecommunications).

The founders of seven of the nine machine tool manufacturers had prior work experience at one or another of the foreign firms before starting up on their own. Ten percent of the workers at the nine indigenous firms had been employees with one or another of the foreign firms as well. These would constitute externalities in human resource development derived from the presence of the foreign investors.

The initial products of the local supplier firms consisted of simple machining and stamping, reproducing prototypes of parts and components designed by the foreigners and often carried out under the supervision and monitoring of the latter's engineers. The foreign affiliates supplied molds and dies to the local supplier firms. This led over time to engineers from both sides drafting plans for products together, with the local firms carrying out more advanced precision tooling and fabrication. Later, the local firms began designing and producing specialized kinds of machine tools involved in the mounting of semiconductor wafers on their own (in one case reproducing the production process from a video of the process supplied by the purchaser), while subcontracting simple production tasks to second- and third-tier indigenous companies.

The first-tier machine tools producers gradually began to market products and services to independent buyers as well as to their original foreign sponsors. What started as a straightforward backward linkage (valuable for domestic development but not technically qualifying as an externality) took on the character of a genuine externality.

All nine of the indigenous machine tool firms entered export markets via channels provided by the foreign firms. Seven of the nine Malaysian companies limited their overseas sales to sister plants of the foreign investors outside of Malaysia; two of the nine added orders to independent buyers as well, winning sales in competition with established machine tool companies from Germany, Japan, and Taiwan. Again, the movement

was from straightforward backward linkage via close relationship to foreign investor integrated into the parent's worldwide strategy, to authentic externality for the host economy.

Eric Linden (1996) extends the documentation of this cycle through company-based case studies of vertical spillovers in technology and marketing. In one case, Motorola subcontracted for "flex circuits" to a Malaysian-owned firm, QDOS Microcircuits. From what began as an exclusive supplier relationship with Motorola, QDOS subsequently grew to become a contractor to the nearby affiliates of Siemens and Hewlett-Packard in Penang, and, from this base, became a supplier to 10 international companies abroad.¹⁷

In a variation that involves introducing an indigenous firm not just into the world of international sales but also into the world of foreign direct investment, Linden (1996) traces a Malaysian metal stamping firm, Atlan Industries, that began as a supplier to Sharp, added sales to Sony, NEC, Toshiba, and Casio, and began to export to these and other off-shore buyers. In the course of its new relationship with Sony, one Atlan subsidiary, Cirrus, was taught to master the use of automated transfer-press technology. Sony then provided financial and administrative assistance to Cirrus to build a plant near Jakarta to supply Sony's Indonesian operations.

In another study, Linda Y. C. Lim and Pang Eng Fong (1982) show how three electronics investors in Singapore helped their local suppliers become exporters to regional sister plants and to unaffiliated buyers, as part of an effort to enable them to achieve economies of scale, more automation, better quality control, and lower prices.¹⁸ Investigating the same phenomenon from the supplier's point of view, Lim and Pang (1991) track two Malaysian engineering firms, Eng Hardware Engineering and Loh Kim Teow Engineering, as the firms progressed from making simple jigs, fixtures, and machine parts for multinational semiconductor investors, to providing precision jigs, computer-numeric grinding machines,

17. In a second case, also involving Motorola, the foreign investor provided its own surface-mount techniques for printed circuit boards to a Malaysian-owned company, Bakti Comintel, to use in supplying the parent's Malaysian affiliate. Over time, Bakti Comintel expanded its operations to supply printed circuit boards to 11 Motorola plants abroad (Linden 1996). This second case would not technically qualify as containing externalities until the Malaysian firm began to sell its output to independent firms in the domestic and international marketplace.

18. In an assessment of the analytics of a multinational investing in its own suppliers, Caves (1999) points out that the incentive for a foreign firm to promote vertical spillovers to local firms is greater if the foreigner can recapture all of the benefits for itself, and prevent the local firms from offering those benefits to the foreigner's competitors. The interesting observation in many of the above cases is that the spillovers took place even in the absence of such exclusive recapture mechanisms. The principal motive, as reported by the foreign firms, was to allow the suppliers to gain sufficiently large production runs to capture all economies of scale.

stamping machines, and high-precision inspection equipment to semiconductor companies abroad as well as at home.

In the disk drive industry, David McKendrick, Richard Doner, and Stephan Haggard (2000) record instances of each of these kinds of externalities: the spread of managers, engineers, and workers throughout the host economy (in Thailand, for example, close to 100 engineers left National Semiconductor to join other companies or start up their own firms); the diffusion of technology as contract manufacturers applied the skills gained from servicing one supplier to new buyers; the penetration of external markets as suppliers moved from selling to sister subsidiaries of their initial contractors to acquiring orders from foreign arms-length purchasers; and the movement of local firms into becoming internationally competitive multinational investors themselves. They also argue that the host countries gained agglomeration advantages of scale, scope, and specialization, as well.

Hobday's (1995, 2000) analysis of the evolution of indigenous electronics firms in the Four Dragons suggests a progression in the likelihood of finding externalities as the local companies moved from original equipment manufacturers for external multinationals (no externalities), to original design manufacturers for external multinationals and other buyers (some externalities), to original brand manufacturers selling products worldwide under their own names (many externalities).

To what extent are spillovers and externalities in the form of human resource preparation, productivity enhancement, and export coaching as found in the automotive and computer/electronics industries illustrative of dynamics that might be present more broadly in association with foreign direct investment?

With regard to human resource preparation, Jorge Katz (1987) provides information from Latin America that managers of indigenous firms frequently launched their operations after receiving training within affiliates of foreign investors. McKendrick (1994) notes that the alumni of Citibank's training programs dispersed widely within Indonesian banking.

With regard to export coaching, D. B. Keesing and Sanjaya Lall (1992) show how knowledge about design, packaging, and product quality that foreign investors provide to their suppliers can come to pervade all of the latter's operations. Similarly, Marcus Blomström and Hakan Persson (1983) suggest that foreign firms may help developing country firms to enter world markets by providing links to final buyers outside their own country. Helena Johansson and Lars Nilsson (1997) find that the establishment of export processing zones (EPZs) filled with foreign investors had a strong statistical impact on the 1980-90 period in expanding Malaysian exports outside of the special EPZs beyond what would otherwise be expected. They interpret this as a "catalytic effect".

In a different kind of test, Brian Aitken, Gordon Hanson, and Ann Harrison (1997) demonstrate that the presence of outward-oriented for-

ign investors helps to trigger exports on the part of domestic firms in the Mexican market. They show that the probability of an indigenous Mexican plant engaging in exports is positively correlated with the proximity of that plant to multinational investors but uncorrelated with the concentration of exporters in the region in general (and hence cannot be attributed to some local comparative advantage that favors all export activity).¹⁹

While the evidence surveyed here is far from definitive, it does suggest a large potential for indigenous businesses to grow up around export-oriented operations established by foreigners. Robert Lipsey (2000) documents a pattern across five of seven industry groups in which foreign investors begin by being responsible for the early surge in exports, but then find their proportion of exports (although still growing in absolute terms) being overtaken by exports from indigenous firms, in Hong Kong, Indonesia, Singapore, Malaysia, Thailand, the Philippines, Taiwan, and South Korea. In the electrical machinery classification (primarily consumer electronics and parts) in these eight countries, for example, US and Japanese affiliates accounted for over half of exports in 1977 but only 22 percent of exports in the mid-1990s, indicating, in Lipsey's view, some "maturing of the domestic industry." In nonelectrical machinery (primarily computers, accessories, and parts), where the pace of technological change remained high, US and Japanese affiliates accounted for more than 20 percent of exports at the end of the 1980s and stayed at that level through the 1990s.²⁰

On the other hand, there may be absolute skill levels for local workers or the managers below which spillovers and externalities of the kind documented here, and backward linkages of the kind examined previously, are highly unlikely to be found. Ari Kokko (1994) found that spillovers between foreign affiliates and local firms in Mexico varied as a function of the productivity difference between the two sets of actors: if the local firms had much lower productivity, there was little evidence of spillovers. Kokko, Ruben Tansini, and Mario Zejan (1996) report a similar relationship in the Uruguayan manufacturing industry.

Similarly, EPZs are more likely to develop backward linkages and generate ties with local businesses if they are colocated with the more advanced industrial complexes of the host economy, and positioned in proximity to skilled labor, than if they are situated as truly distinct "zones" in the poorest sections of the country. Export processing zones that are used as vehicles for job creation in the midst of the most poverty-stricken regions, often isolated geographically from more sophisticated indigenous

19. Aitken et al. (1997) find that the link between the presence of foreign plants and exports on the part of domestic plants is independent of proximity to national borders, and independent of proximity to the capital city.

20. Blomström (1990) finds similarly provocative data in Latin America.

economic actors, tend to suffer the fate of creating only “dead-end jobs” and “dead-end operations,” with minimal procurement from local suppliers and minimal interaction with local businesses (if indeed such EPZs are successful at all) (Madani 1999).

More broadly, in a study showing inward flows of foreign direct investment contributing positively to domestic growth in 69 developing countries over the period 1970-89, E. Borensztein, J. De Gregorio, and J. W. Lee (1998) found that the favorable impact of foreign direct investment was related to the level of educational attainment in the sample and did not register for countries with human capital levels at the lower end. Confirming this result for Japanese investment, Shujiro Urata and Hiroki Kawai (2000) found that the extent of intrafirm technology transfer has been quite sensitive to the level of education in the host country, falling off as educational achievement and experience in industrial activities drop.

Operations That Do Not Fit into the Product Cycle Model of Control and Supervision: Investments with Domestic-Content, Joint-Venture, and Technology-Sharing Mandates Imposed by the Host

Host governments in developing countries have been concerned that foreign direct investors who exercise the kind of “unambiguous control” over their affiliates found in the product cycle model might offer fewer advantages for the domestic economy than affiliates whose operations were subjected to explicit mandates dictated by host countries themselves.

Some hosts have asserted, and continue to assert, that the imposition of domestic-content, joint-venture, and technology-sharing requirements on foreign investors will augment the prospects for indigenous business and economic development (WTO ministerial text, revised draft, Seattle, 19 October 1999). This has led to a reluctance on the part of various countries, for example, to reaffirm the Agreement on Trade-Related Investment Measures (TRIMs) that banned domestic-content and trade-balancing requirements in the Uruguay Round, and resulted in a refusal to agree to expanded liberalization in the treatment of foreign direct investors in the Multilateral Agreement on Investment (MAI) exercise.

How do the operations of foreign firms that are so shaped and constrained by hosts compare to the previous findings about the impact of foreign direct investments that are not?

To a large extent the answer may already be apparent, growing out of the implicit contrast with the evidence of superior performance in the operations of foreign affiliates, the creation of backward linkages, and the generation of spillovers and externalities observed in the preceding chapter.

But might there be a bright side to the use of domestic-content, joint-venture, and technology-sharing requirements that comes from launching

domestic sectors along a path of infant industry development? Might the operations of the affiliates, the backward linkages to indigenous suppliers, and the spillovers and externalities provide the building blocks, and the dynamic learning, needed to lay the base for competitive domestic industries?

Characteristics of the Affiliates Themselves

The evidence shows that, except in occasional cases in the largest markets, foreign direct investment projects with domestic-content requirements imposed do not capture all economies of scale (UN Centre on Transnational Corporations 1991; Battat et al. 1996). To make them profitable, they require trade protection, or some other form of market exclusivity. The combination of subscale size and protection from competition generates relatively inefficient, high-cost operations.

The implications for the development prospects of the host are not favorable. Resources are wasted. Not only are host country consumers penalized, but so too are host country producers that rely on the use of the resulting goods and services to establish their own competitive positions in the marketplace.

The incentive structure between the parent and the affiliate differs substantially from operations in which the plant is thoroughly integrated into the effort to strengthen the multinational's position in international markets: the plants utilize older technology, and suffer lags in the introduction of newer processes and products in comparison to wholly owned subsidiaries without such requirements.

At considerable variance with the dynamic infant industry perspective, the plants are locked systematically into a position well behind the cutting edge of the industry. And the demonstration effects from small, low-productivity activities do not offer much of a positive inducement for the parent to adopt the child and raise it to full adult status. For technical engineering reasons, too, such operations often do not fit as building blocks in a full-scale operation.

The delays and lags are reinforced for affiliates that are subject to joint-venture or technology-sharing mandates.

The Automotive Sector

In the automotive industry, in a survey of 17 countries requiring domestic content ranging from a low of 18 percent to a high of 100 percent, the average size of operations was less than half of what would be required to capture full economies of scale, and the effective rate of protection required to keep the companies in operations exceeded 50 percent (UN

Centre on Transnational Corporations 1991; Klein 1995; Ngo and Conklin 1996). Prices ranged from 20 percent to 60 percent higher for models whose features typically trailed what was available in the international marketplace.¹ The protected operations created employment, but, in those cases where there is sufficient detail to make the calculation, the cost to host country consumers approached \$300,000 per job created.

According to an assessment by Volkswagen, delays in the introduction of new auto models (and accessories) and in the use of latest production technology are inherent for subsidiaries engaged in boutique assembly operations under high domestic content investment regimes. The foreign investors import semi-knocked-down (SKD) or completely knocked-down (CKD) “kits,” and then engage in what might genuinely be called “screw-driver” operations, installing engines, transmissions, seats, and other interior parts by hand. The “car-in-a-box” models are older than contemporary versions and the production processes are both older and different. In response to Vietnam’s “localization program” of 1995, which compelled foreign investors to add 5 percent of local content each year until domestic inputs equaled 30 percent of total content, foreign firms promised to try to use leading-edge techniques to produce the most modern cars and trucks, but found they simply could not introduce recent models or incorporate world-scale production techniques into plants that were one-tenth of world-scale size (Ngo and Conklin 1996).²

The production operations in assembling kits do not lend themselves, moreover, to becoming modular components for full-scale assembly: automobile bodies are assembled individually using hand welding, with parts temporarily held together with jigs, in place of the highly automated and capital-intensive assembly lines in modern plants. Import substitution, in fact, consigns the foreign plants to operations well behind best practices in the industry, requiring new plant scale, new plant design, and new worker and managerial skills to move to world-class production. The demonstration effect is the opposite of what infant industry strategy envisions, providing negative inducement for further nurturing by the parent (output peaking at eight vehicles per hour in one new, but small, protected GM plant, in comparison to 90 vehicles per hour in world-scale plants elsewhere) (Klein 1995). Both dynamic learning and positive feedbacks, hallmarks of the infant industry strategy, are absent.

Joint-venture requirements further inhibit the use of the most advanced production techniques. In China, for example, where there is at least the

1. Most famous is the case of Ford in Argentina, where the company continued to produce the Falcon from the 1960s to 1991 with very few design changes, with 80 percent to 90 percent domestic content, behind ad valorem tariffs of more than 50 percent (*New York Times*, 16 May 1997, C1).

2. The “localization plan” required tariffs of 200 percent while still not rendering foreign producers profitable.

potential for foreign automobile assemblers to reach full-scale operation, the requirement to operate with a designated Chinese partner has led to manufacturing methods that lag behind industry standards by 10 years on average, because the major international firms have been reluctant, according to Chrysler, to supply their most up-to-date production technology (*Wall Street Journal*, 11 February 1998, 1).³ Lack of enforcement of protection for trade secrets, trademarks, and intellectual property rights more broadly impedes investment by both foreign firms and domestic Chinese companies (Maskus 2000, chapter 5).

The Computer/Electronics Sector

In the computer industry, in Latin America and South/Southeast Asia, the penalty from producing at less than full scale behind trade walls with limited external inputs has led to prices 150 percent to 300 percent higher than international levels, and to systematic lags in the introduction of new product and new capabilities.

In India, the interval between the appearance of a new system in the developed countries and its adoption in India was highest when the host insisted on joint-venture requirements and mandatory domestic content, dropping steadily as the country liberalized trade and investment restrictions (Grieco 1984). In Mexico, prices for computers fell from 161 percent to 174 percent of the US level for a comparable model to 115 percent to 120 percent, while the gap between introduction of new models in the US market and deployment in Mexico narrowed or disappeared completely as the country allowed wholly owned foreign production, liberalized sourcing of inputs, and reduced tariffs (Peres Nuñez 1990, 99).

In both regions, the penalty in price and performance from domestic-production and technology-sharing requirements in computers has reduced the competitiveness of the host country's high-tech users, including aerospace, petroleum exploration, and advanced industrial operations. In Mexico, one major computer purchaser emphasized that the technology lag was even more burdensome than the excess cost (citing the need for the latest CAD-CAM equipment) (Cline 1987, 101-02). In Brazil,

3. Foreign automobile investors cite the case of Audi-First Automobile Works (FAW), in which the Chinese partner "expropriated" the production technology after Audi's license expired in 1997, as reason to be wary of introducing the most advanced techniques into a designated joint venture. For similar concerns in the photography sector in China, see the case of Kodak later in this chapter. Concerns about appropriation of knowledge and leakage of technology are primary causes for foreign investors to shun joint-venture arrangements, or to terminate them once started. Joint ventures have a useful role to play for foreign direct investors when the ownership arrangement is voluntary and the foreigner needs the indigenous partner's expertise and contacts to penetrate the local market, but not when foreign direct investors want the subsidiary to play an integral role in the parent's global strategy (Beamish 1988).

Embraer and Petrobras have been consistent critics of the country's infomatics policy.

In consumer electronics, foreign investors subject to domestic-content requirements were able to reach levels of local inputs approaching 60 percent for cassette recorders, tuners, small televisions, some VCR models, and microwave ovens within Southeast Asian economies. But affiliate operations were limited to final assembly and design adjustments to accommodate local tastes, in contrast to the responsibilities for design and manufacture of the most advanced components and products among affiliates integrated into global markets (Borrus 1994).⁴

For both computers and electronics, the "infant industry" success stories of turning initial processing operations into cutting-edge competitors have been associated in Southeast Asia with the "special" treatment afforded in free trade zones, in which foreign investors were exempted from joint-venture, domestic-content, and technology-sharing requirements. In contrast, in the case of foreign investor operations oriented toward protected internal markets, required to meet domestic-content and (often) joint-venture mandates, the pace of integrating technology and advanced production practices has been much slower (Harvard Business School 1990; Peres Nuñez 1990, chapter 5). In Mexico, joint-venture and domestic-content requirements imposed with the rationale of producing dynamic learning of the infant industry variety kept the affiliates of Hewlett-Packard and Apple trailing the technology frontier rather than propelling them toward it.

Other Evidence

Are these findings in the automotive and computer/electronics sector replicated elsewhere?

The evidence that the imposition of domestic-content requirements on foreign investors requires trade protection or other insulation from competition in order to render the subsidiaries profitable, leading in turn to multiple subscale and inefficient plants, is pervasive (UN Centre on Transnational Corporations 1991).⁵

The number of detailed industry studies of the phenomenon is not large, but cases from other sectors point in the same direction.

In petrochemicals, Peter Gray and Ingo Walter (1984) found that scale of operations and access to internationally competitive sources of feedstocks were decisive to avoid high-priced output and ongoing trade

4. Borrus (1994) describes the operations of Japanese firms that produced consumer electronics to meet high domestic-content requirements in protected domestic markets in Southeast Asia as assembling "kits" imported from the home market in Japan for hand assembly in the host country, similar to what takes place in boutique automobile plants.

5. For a theoretical exposition of why this occurs, see Eastman and Stykolt (1970).

protection. Two of six foreign investment projects built for import substitution in the host domestic market were subsequently considered failures by the parent companies, with one (a mandatory joint venture in Korea) ultimately being sold to the indigenous partners as the foreigner withdrew completely. The other required ongoing trade protection to remain viable. As in the automotive sector, the idea of using foreign petrochemical investors to create import-substituting “building blocks” to move along an infant industry ascent to mature competitive status has not proved successful.

With regard to joint-venture mandates and “technology transfer,” the inclination of foreign investors to devote only older technologies, older practices, and older products to joint-venture operations, while reserving the most advanced activities for wholly owned subsidiaries is well documented. Edwin Mansfield and Anthony Romero (1980) found that technology introduced into joint ventures in developing countries was on average one-third older (three to four years older) than technology introduced into wholly owned subsidiaries.⁶ Unless host governments allow foreign investors to operate with wholly owned subsidiaries, the strength or weakness of intellectual property rights protection has been shown not to have much impact, by itself, on the locational decisions of international firms (Lee and Mansfield 1996, 185; Maskus 2000).

A contemporary illustration of the importance of wholly owned status to protect the most advanced technologies and business practices is found in Eastman Kodak’s 1998 investment in China. The Kodak parent agreed to set up joint ventures with three designated Chinese partners but only after being allowed to establish a wholly owned parallel operation at the same time, with the joint ventures producing conventional films under the Kodak name and the wholly owned affiliate enjoying complete control over the latest digitalized film and camera products.⁷

Foreign affiliates with domestic-content and joint-venture requirements do not exhibit strong export records in general, nor close involvement with the parent’s strategy to meet competition in international markets in particular. John Stopford and Louis T. Wells Jr. (1972), found a negative correlation between the joint-venture structure and the integration of a subsidiary’s production into regional or global sourcing networks.⁸ Nathan Fagre and Wells (1982) examined 54 foreign affiliates in Latin America that exported half or more of their output, and discovered that

6. Mansfield and Romero (1980) lumped joint ventures and licensees together. Grant Reuber (1973) also recorded that joint ventures had less input of parent technology (as well as smaller scale and narrower product lines) than did wholly owned ventures.

7. Eastman Kodak’s investment in the three joint ventures averaged a little over \$100 million apiece. Its investment in its wholly owned operation was in excess of \$600 million (Deng 1999).

8. See also Helleiner (1981).

only three of these affiliates were less than wholly owned.⁹ Benjamin Gomes-Casseres (1989) observed disputes about exports constituting one of the main sources of conflict within joint ventures.¹⁰

In its experience with more than 500 foreign investment projects, the International Finance Corporation of the World Bank Group has found that restrictions on the share of equity that foreign firms could own constitute an important barrier to attracting investment, that “forced partnerships” are particularly difficult to implement, and that joint ventures are quite fragile in general (International Finance Corporation and Foreign Investment Advisory Service 1997).

As for other technology transfer mandates (often imposed in conjunction with joint-venture requirements), Ari Kokko and Marcus Blomström (1995) show that the imposition of obligations on foreign investors to transfer skills to local personnel, to have access to the parent’s patents, to perform research and development locally, and to use the most advanced technology available, was in each case negatively associated with technology inflows into the host economy. In the case of Japanese firms, Shujiro Urata and Hiroki Kawai (2000) find that a technology requirement imposed by the host country as a condition for obtaining approval to set up local operations leads to a negative coefficient for intrafirm technology transfer.

Impediments to the use of imported technology, in turn, have a negative impact on the efforts of local firms to upgrade their own products, processes, and quality control mechanisms. Helson Braga and Larry Willmore (1991) test whether the use of technology from abroad complements or substitutes for technological effort on the part of host country firms. In a survey of 4,342 Brazilian establishments (of which 3,903 were owned by national private firms, 48 by state enterprises, and 391 by foreign enterprises), they find that the greater the extent of a firm’s use of technology imports, the greater the firm’s own domestic exertions to improve production processes and develop new products. This is the opposite of the contention that the deployment of foreign technology may induce recipients to slack off in their own R&D endeavors. Braga and Willmore also find that technological imports, local technology development, and use of modern quality control methods are all significantly associated with producing for external markets. Not surprisingly, the presence of foreign ownership increases the odds that a firm uses imported technology by 8 to 10 times.¹¹

9. Three of the 54 firms were joint ventures, and all had majority foreign investor ownership.

10. The other primary sources of conflict include quality control and the pricing of goods and services when either the parent or the local partner buys from or sells to the joint venture.

11. Lall (1983), Katrak (1985), and Siddharthan (1988) also find that complementarity between use of foreign technology and stimulation of domestic technological effort

Backward Linkages

The evidence on backward linkages from foreign investor operations with high domestic-content, joint-venture, and/or technology-sharing requirements is the opposite of what was reported earlier in the case of wholly owned subsidiaries. Backward linkages are often more limited in cases where specific targets of local input must be met, a finding that may seem somewhat surprising until one takes into account the typical subscale size of foreign investor operations. Those backward linkages that are present tend to be less robust, with fewer efforts on the part of the investor to provide coaching to domestic suppliers in the newest or most sophisticated business practices. At the same time, the shelter from competition afforded to local suppliers as part of domestic-content arrangements sometimes leads to a “general deterioration of technological and management skills,” in the experience of the Foreign Investment Advisory Service of the World Bank, and makes those suppliers “unresponsive to requests that they improve the quality and prices of what they offer” (Battat et al. 1996, 2, 15).

In the automotive sector, host country policies that harnessed foreign auto assemblers to meeting high domestic-content levels offered a relatively weak magnet to attract other foreign firms to invest as suppliers to the assemblers. In Southeast Asia, the number of foreign parts firms that followed international assemblers whose operations were oriented to import substitution in protected markets was half that of the corresponding number associated with full-scale integrated operations (Doner 1995).

Host country policies that require foreign parts investors to take local partners, even when the final assemblers have established full-scale, export-oriented operations, inhibit the willingness of those foreign parts investors to participate. In Latin America, the “Mexicanization” policy that limited international parts producers to 40-percent ownership shares was reported by the companies to be a disincentive to investment.¹²

Turning from backward linkages via investment on the part of foreign parts suppliers to backward linkages via the development of indigenous parts suppliers, the possibilities for growth and development through satisfying high domestic-content requirements are quite limited. The role of local firms in supporting the assembly of knocked-down automobile

dominates substitution of the former for the latter. The investigation by Braga and Willmore (1991) suggests, however, that many researchers may underestimate how strong the complementary relationship might be, since in their sample from Brazil more than two-thirds of the firms reported active development of new products (one measure), but less than 10 percent of the firms registered R&D expenses on their balance sheets (a second measure).

12. Report by the consulting firm Booz, Allen, and Hamilton, 1987, cited in Peres Nuñez (1990).

kits from abroad is relegated, perforce, to comparatively low-end operations (Ngo and Conklin 1996, appendix 3). In the case of CKDs, some components require finishing and painting. The technology transfer from farming tasks out to local companies, while real (e.g., contemporary automotive painting), nonetheless still brings local suppliers only up to the level of a modern body shop.¹³

The auto parts that can be easily substituted for imports include springs; coils; windows; harness gear; and smelted, stamped, or molded plastic articles. Even here economies of scale are reported to be important, however, and small batch production places local suppliers at a disadvantage (Peres Nuñez 1990; Institute of Developing Economies 1995). For complicated items such as axles, transmissions, catalytic converters, and fuel injection and exhaust systems, technological sophistication and quality control procedures must be combined with full-sized plants to have a chance at creating fully competitive local firms. For this reason, as indicated earlier, coaching from foreign assemblers who are themselves trying to produce for external (as well as internal) markets is an ingredient closely associated with the successful cases in which domestic parts firms qualify for OEM or REM status.

Similarly, in the computer/electronics industry, foreign investors operating under domestic-content or joint-venture mandates in Latin America and Southeast Asia also imported “kits” of mature products that were ready for labor-intensive assembly, with some inputs and finishing that could be provided by indigenous firms. As noted previously, the backward linkages from the high-domestic-content joint ventures utilized hand soldering, which are quite distinct from the more precise, automated production methods, embodying newer, lighter materials, and large-batch quality testing, that local firms were trained to supply to successive generations of computers, printers, and typewriters bound for external markets from wholly owned subsidiaries.

One study of 157 Japanese affiliates in the electronics industry in Southeast Asia found that affiliates that sold a high percentage of manufactured output in the host market reached higher ratios of local content to final sales than export-oriented operations, but the data do not indicate whether the absolute amounts of local content were greater or whether the local market-oriented affiliates were able to capture full economies of scale.¹⁴

13. Even in protected markets with highly restrictive local purchase regimes, such as India in the late 1970s, a certain degree of technical and business assistance from foreign investors to local suppliers can be observed, especially in helping to ensure quality control and reliable delivery of parts. See Lall (1980).

14. Nor did this study look at differences in kinds of technology, production processes, or quality control procedures in affiliates producing for vertical purchase within the keiretsu as opposed to local sales (Belderbos et al. 2000).

Overall, the faster pace of technological change in the contemporary era, in the judgment of Urata and Kawai (2000), is likely to preclude host countries today from whatever gains Japan may have reaped from the earlier combination of forced licensing and restrictions on foreign direct investment (helpful in the case of automobiles, hurtful in the case of chemicals, in their opinion).

Externalities

The observation that managers of indigenous firms in Latin America often emerged from the ranks of those whose careers started with training within foreign companies included examples of the latter that were joint ventures and that were oriented toward meeting domestic-content requirements in local markets. So some externalities, in the form of human resource development, appear to derive from foreign operations that do not fit into the product cycle model of parental control and supervision.

But, as reported previously, Vijaya Ramachandran finds a systematic difference between the number of host country employees sent to the parent country for training when the affiliate is wholly owned and when it is a joint venture (Ramachandran 1993). Across a sample of 14 industries, parent company efforts to invest in the human resources in the affiliate were significantly less in the latter case than in the former.

As for export coaching, the data that showed foreign investors helping indigenous suppliers to move into international markets originated almost entirely from examples in which the affiliate was wholly owned and integrated into the international sourcing network of the parent rather than either jointly owned or focused on meeting domestic-content requirements in a protected local market. Because the latter two categories of foreign affiliates show a systematic tendency not to be strong exporters themselves (Stopford and Wells 1972; Fagre and Wells 1982; Helleiner 1981), there would likely be a low probability of them providing export coaching to local suppliers.

Jorge Katz argues that the increased competition that accompanied the entry of multinational corporations into host country markets in Latin America stimulated domestic firms to improve their own engineering and business processes, even during the period of import-substituting industrialization. He concludes however that the pressures for catch-up (leading to higher productivity growth among local companies that are either competitors with, or suppliers to, the multinational investors) have been much stronger as trade liberalization and market deregulation have progressed (Katz 2000).

Implications for Measuring the Impact of Foreign Direct Investment on Development

What are the implications of these case study findings—of a dynamic positive contribution from close integration into the parent’s global sourcing strategy, and of a much less positive and possibly negative impact from domestic-content, joint-venture, and technology-sharing requirements that prevent such integration—for efforts to compute the impact of foreign direct investment on host countries? What refinements do these results suggest for measurement techniques? How does the evidence reported here alter the estimation of the benefits from trade-and-investment liberalization, on the one hand, and the calculation of the costs of trade-and-investment restrictions, on the other?

This chapter first addresses the dangers of mismeasuring the impact of foreign direct investment through poorly structured research design. It then turns to calculating the contribution of foreign direct investment to development within the context of endogenous growth theory, estimating the impact of foreign direct investment with computable general equilibrium models that allow for rationalization of multinational production across borders, and assessing the spread of backward linkages from foreign affiliates to local suppliers. It concludes with attempts to gauge the size of spillovers and externalities that foreign investors may bring to the host economy.

The Dangers of Mismeasuring the Impact of Foreign Direct Investment

The first implication of the case study findings in the earlier chapters is that analysis that overlooks the degree of intimacy and vibrancy between

parent investors and local affiliates, or ignores the nature of the investment regulations in the host country, is likely to mismeasure the impact of foreign direct investment, both positive and negative.

The mismeasurement springs from failure to control for variables that reflect parent strategy and parent motivation in setting up the foreign affiliate; that is, failure to separate the data according to wholly owned/joint-venture status, unrestricted/domestic-content input selection, export/local market orientation, and full-scale/subscale size.

Without introducing such controls, it is difficult to understand what aggregate measurements of the contribution of foreign direct investment to total factor productivity mean, for example, or what aggregate estimates of spillovers to the domestic economy represent.

The absence of such controls has demonstrable power to mislead. "Today's policy literature," declares Dani Rodrik (1999, 37), for example, "is filled with extravagant claims about positive spillovers from DFI [direct foreign investment]. These spillovers include technology transfer, marketing channels, superior management, and labor training. Once again, the hard evidence is sobering. Systematic plant-level studies from countries such as Morocco and Venezuela find little in the way of positive spillovers (see Harrison 1996)."

The work Rodrik cites by Ann Harrison (drawing on earlier work with Mona Haddad, Haddad and Harrison 1993) shows that plants with foreign equity participation in Morocco and Venezuela demonstrate higher levels of total factor productivity than domestic firms. But in testing for spillovers from foreign investment to domestic firms, Harrison finds it impossible to distinguish the possibility that foreign investment has a positive impact on productivity in domestic firms from the possibility that foreign firms simply locate in relatively more productive industries. In several specifications, Harrison (1996, 179) observes that an increase in the share of foreign direct investment is accompanied by a decline in total factor productivity in the industry. Overall, Harrison infers that "at the local level, foreign investment generally has no positive spillover on domestic firms."¹

From this, Rodrik (1999, 37) asserts that "much, if not most, of the correlation between the presence of DFI and superior performance seems to be driven by reverse causality: multinational enterprises tend to locate in the more productive and profitable economies (or niches thereof)."

On the basis of this analysis, concludes Rodrik, the possibility of gaining especially positive benefits from foreign direct investment is no more than wishful thinking: "[O]ne dollar of DFI is worth no more (and no less) than a dollar of any other kind of investment" (Rodrik 1999, 37).

1. Haddad and Harrison (1993) find that the higher the trade protection the more plants depart from industry best practices. They also find a positive and significant correlation between plant size and level of productivity.

But the studies on which Rodrik relies did not separate the data into wholly owned/joint-venture samples, into export/domestic orientation, or into production with unrestricted inputs and production with high domestic-content requirements. The studies did not distinguish between foreign-owned plants serving global sourcing networks of the parents and foreign-owned plants producing for protected local markets.² The studies did not differentiate between potential spillovers in a vertical direction, in which foreigner investors might be upgrading the performance of suppliers, and potential spillovers (or absence thereof) in a horizontal direction, in which foreign investors might be trying to prevent technology leakage to competitors.

Given the differences in parent-subsidiary relationship as a function of the presence or absence of joint-venture, domestic-content, technology-sharing requirements, and the differences in subsidiary performance (and local-supplier performance) as a function of how the plant fits or does not fit into the parent investor's global strategy, this is worse than mixing apples and oranges; it is like mixing apples and crab apples, and (not infrequently) gravel.³ It is difficult to imagine what might be learned from such a jumble.

Few economic investigators or policy strategists who analyze sectors where host country production is integral to the international competitive position of the parent multinationals—such as the automotive and computer/electronics sectors examined earlier—are likely to find the “which-came-first-the-chicken-or-the-egg?” arrow of causation from foreign presence to domestic performance so confounding.

Successful cases (such as the reversal in the status of the Mexican automotive industry—once multinational automotive firms initiated the strategy of global sourcing, from a small, protected, and largely inefficient set

2. In addition to the work by Harrison and Haddad cited by Rodrik, there are similar problems in Aitken and Harrison (1999). Aitken and Harrison do note adverse aspects of Venezuelan foreign investment regulations during the period from which the data were drawn, 1975-89, 69.

3. Three independent attempts to perform cost-benefit analysis on foreign investor operations in the manufacturing sector, valuing all inputs and outputs at world market prices, covering 183 projects in 30 countries over a period roughly comparable to the Harrison/Haddad/Aitken observations, (reassessed in Encarnation and Wells 1986), found a majority of the projects (from 55 percent to 75 percent, depending upon variations in shadow price calculations) producing an increase in national income, with the remainder (a sizable 25 percent to 45 percent) actually reducing national income. In all three studies, most of the results were not a close call; they were clearly positive, or clearly negative. The key variable appeared to be whether the projects were export oriented and probably majority or wholly owned by the foreign parent, or import substitution oriented and probably burdened with domestic-content and joint-venture requirements. Unfortunately, according to Louis T. Wells Jr. (personal communication), this difference in orientation was not systematically documented for each project in the research, preventing a definitive conclusion.

of operations to a leading sector with exports of \$14 billion and employment of 364,000, in less than two decades—or the explosive growth of the Malaysian computer/electronics industry from literally nothing to the largest source of employment, fixed assets, output, and exports in the country today, in response to the competitive needs of US, European, and Japanese parent investors) makes the bewilderment about whether foreign investors simply happened to locate in already more productive sectors like asking which came first, the chicken or the solar system?

For unsuccessful cases, the analytical challenge is not more complicated: over the past 10 years, as automotive investments in Southeast Asia have boomed, the automotive sector in Vietnam (Ngo and Conklin 1996) has remained a notable disappointment. Should one conclude that the automotive sector in Vietnam simply happens to be a niche not favored by comparative advantage, or might the outcome have something to do with the high domestic-content and joint-venture requirements of the Vietnamese investment regime, surrounded by domestic trade barriers (an investment regime not unlike Morocco, Venezuela, and Cote d'Ivoire during much of the period of examination by Haddad and Harrison 1993, Harrison 1996, and Aitken and Harrison 1999)?

Dispelling concerns about selection bias, the evidence reported here from foreign direct investment in industries other than the automotive and computer/electronics sectors points in the same direction. In the early 1990s, Polish agriculture was an economic backwater. In the contemporary period, however, after investments by Gerber, high-quality baby food originating in Poland can be found stocking French supermarket shelves on a regular basis (despite EU trade barriers) (Harvard Business School 1994).⁴ It would be odd to conclude that here was a high productivity niche where foreign investors (with no special advantages over indigenous producers) simply happened to end up.

If such misdesign can be avoided, however, what methods of analysis might best be able to capture the benefits from allowing a tight relationship between foreign parent investor and local affiliate, or, conversely, to estimate the costs from imposing investment restrictions that hinder intimate interaction? And what light might the preceding case study findings be able to shed on the dimensions of trade-and-investment liberalization, or trade-and-investment restrictions?

Appraising the Impact of Foreign Direct Investment on Host Countries Within the Context of Endogenous Growth Theory

The emergence of endogenous growth theory over the past decade and a half has provided a fresh context for the examination of foreign direct

4. Gerber is now owned by Novartis.

investment, by increasing analytic attention to the role of “new ideas” in the development process.⁵ “New ideas” are defined broadly to include innovative production, management, and marketing techniques that allow a country to engage in completely novel activities rather than simply improve on what the country has already been doing (Romer 1993a, 1993b, 1994; de Mello 1997).

The predominant tradition in assessing the benefits from trade-and-investment liberalization, argues Paul Romer, has been to measure how a given country will perform with more, or with less, access to goods and services produced at lowest prices throughout the world. Liberalization allows the country to do more of what comparative advantages dictate that it can do best. But this approach does not allow the set of production practices, managerial techniques, and quality control procedures available for deployment in the economy to vary as a function of restrictions on trade and investment.

Yet, as Bradford DeLong and Lawrence Summers (1991), David Coe and Elhanan Helpman (1995), and Coe, Helpman, and Alexander Hoffmaister (1997) have found, imports of machinery are positively correlated with growth rates across countries, not because they represent additions to physical capital but because they embody innovative conceptualizations about the production and assembly of goods. Restrictions on such imports deny the host country the ability to take full advantage of production and assembly techniques being created and put into practice abroad. The high social product of equipment imports, reflecting technology transfer mediated through capital goods, appears to be larger for poorer countries that have more of a “technology gap” to fill.

To these restrictions on machinery imports and other traded goods and services must be added restrictions on foreign investment that serve to perpetuate what Romer (1993a) calls “idea gaps” among countries.

5. Endogenous growth theory grew out of the attempt to create growth models that allowed for the creation and diffusion of new technologies and production processes within economies, in place of requiring innovation to parachute exogenously into conditions of perfect competition as earlier growth models typically demanded. In dealing with the contribution of foreign direct investment to developing country growth, “endogenous” is something of a misnomer, however, since foreign firms serve as a conduit for introducing new technologies and production processes into the local economy from abroad, thus allowing innovative practices once again to parachute exogenously into the host economy. This leads paradoxically to a kind of exogenously driven “endogenous growth theory.” The more recent models do allow for market imperfections in both home and host countries where the international companies operate, however, rather than requiring the earlier assumptions of perfect competition. Robert J. Barro and Xavier Sala-i-Martin (1995, chapter 8) construct a model of direct foreign investment in which innovators in one country provide a pool of discoveries for use in a second country from which they receive a flow of profits. Their model does not acknowledge that the external investment in the second country can enhance the firms’ ability to collect oligopoly rents in the initial country or in third countries.

“Idea gaps” include many of the contributions potentially carried into the host economy by foreign investors that were found in the cases examined earlier: they extend beyond technology per se to include management insights about packaging, marketing, distribution, inventory control, payments systems, information systems, transactions processing, quality control, worker motivation, and on-the-job training that create economic value in the host country. The measurement of the impact of trade-and-investment liberalization on development, within the endogenous growth theory framework, requires that assessment techniques be modified to account for how host government policies promote or hinder the new types of productive activities that spring from these external “ideas” being introduced into the economy.

Romer (1994, 34) compares conventional calculations of the welfare losses from restrictions that make the host country do less of what the economy already does, or do it less efficiently, with the welfare losses from restrictions that prevent many kinds of techniques and activities from being tried out and deployed in the host country. The estimate of the welfare loss from the first is relatively small (the square of the tax or tariff rate equivalent of the restriction). The estimate of the welfare loss from the second—that lets the set of goods and productive processes vary in the face of restrictions—is roughly *20 times greater*.

The magnitude of the impact of restrictions derives not from the effect they have on the static allocation of resources among the activities that already exist in the host economy, but from the stifling effect they have on the adoption of new technologies, on the provision of new types of services, on the exploitation of new productive activities, and on deployment of new types of capital goods and intermediate inputs. This accounts for the large difference between the two estimates.

To the extent that there are complementarities between goods and productive processes that are subjected to restrictions, or freed from restrictions, the calculation could be higher yet (Romer 1994, 34-35).

The remedy, according to Romer (1994), is for developing countries to provide foreign firms with sufficient profit incentives (and with sufficient macroeconomic and institutional stability) to be willing to invest.

Three examples help illustrate, according to Romer (1993a, 1993b), the large magnitude of gains that accrue to host countries from filling in “idea gaps” through the operations of foreign investors. The first example is found in Mauritius’s decision to shift from import substitution to export promotion via attracting foreign investment into a duty-free export processing zone. Accompanying a period of macroeconomic restraint, lowered tax rates, and simplification of permit and certification procedures, foreign direct investment in the export processing zone grew rapidly: by the end of the 1980s, employment in the zone accounted for one-third of all employment on the island and two-thirds of the total increase in demand for labor from 1970 and 1990. The benefits of liberalization to

Mauritius, in Romer's analysis, did not come primarily through the increase in physical capital (domestic savings ultimately accounted for most of the new investment) nor through the increase in human capital in the workforce, but through the "crucial array of ideas" about technology, business management, and export market penetration carried by the foreign entrepreneurs.⁶

A second example for Romer comes from the entry of foreign firms into the bicycle industry in China (a case already considered in earlier chapters). Foreign investors from the United States, Hong Kong, and Taiwan transformed bicycle production in China from a low-technology, low-quality industry oriented toward the domestic market into the world's largest exporter of bicycles in less than a decade. The new ventures used modern manufacturing techniques to create high-quality, top-of-the-line bikes. Providing added benefits to the host country, component producers from Taiwan also moved onto the mainland to set up operations that produce bicycle chains and derailleurs.⁷

The third example for Romer derives from the contribution of foreign automobile assembly in Mexico (also examined in earlier chapters). Under pressure from international competitors, Ford designed an export-oriented plant in Hermosillo that achieved the highest quality of any high-volume assembly plant in the world, better than the best performing Japanese plants and the best indigenous or transplants in North America.⁸ Once again, the value of what the foreign firm brought to Mexico, from the perspective of endogenous growth theory, came not so much from its addition to the host country's capital stock or to the demand for labor in the host economy, but from the transmission of fundamental discoveries about production techniques across national boundaries.

What light does the evidence from the preceding sections shed on this argument? Is Romer's estimate that the impact of trade-and-investment liberalization may be 20 times as large as conventional calculations of trade restrictions too large, too small, or about right? Do the earlier findings suggest that modifications or extensions might be needed to integrate foreign direct investment into endogenous growth models?

The evidence in the preceding sections of this study does not provide an answer to whether "20 times" is the appropriate number. But a cross-country comparison of the "engine of growth" that the international automotive sector has provided to Mexican or Brazilian or Thai development under comparatively liberal conditions, with the inefficiency, high costs, and stagnant behavior that the international automotive sector has offered to India or Vietnam within a regime of domestic content, joint

6. Romer draws on Gulhati and Nallari (1990).

7. Romer cites Mody et al. (1991).

8. Romer relies on Womack et al. (1991).

venture, and trade protection does not make the calculation seem outlandish. (See the studies of the automotive sector in chapters 2 and 3.)⁹

Similarly, a longitudinal analysis of the infomatics industry in a single country (e.g., Mexico), comparing the performance of foreign investors and indigenous suppliers complying with domestic-content and joint-venture requirements within a trade-protected environment, with the performance of foreign investors and indigenous suppliers after the requirements were lifted and the trade-and-investment regime liberalized would attest to large differences in impact (Harvard Business School 1990; Cline 1987; Peres Nuñez 1990, chapter 5). (Again see the studies of the computer/electronics sector in chapters 2 and 3.)

Even for small countries, such as the example of the successful export zone in Mauritius that Romer highlights, or comparably powerful export zone-driven growth in the Dominican Republic (80 percent of all exports and 5 percent of total employment in the late 1990s), the results from lifting restrictions on trade and investment together would appear to be rather sizable (Radelet 1999; Madani 1998).¹⁰ But much more work is needed to produce detailed sectoral studies and measurements of positive and negative impacts of foreign direct investments with different structures.

Thus, Romer's suggestion that the true impact of trade-and-investment restrictions may be 20 times the size of conventional estimates does not appear farfetched in light of the evidence examined here. On the contrary, the cases examined earlier suggest that the reconceptualization of the impact of restrictions of trade and investment and of the benefits from trade-and-investment liberalization, offered by analysts such as Romer, may be, if anything, *too limited*.

This is because, from a dynamic point of view, the benefit to the host country from the high-productivity auto assembly plant (or bicycle factory) comes not simply from the one-time insertion of a cutting-edge operation into the economy, but from the integration of local operations into a sourcing network in which the parent provides continuous upgrades to meet the demands of international competition. As the preceding empirical sections show, the calculation of the benefits from foreign direct investment must include not simply the advantages from placing the host country on the frontier of best practices in the industry, but also the advantages from propelling the host country continuously outward as that frontier advances in response to innovative pressures around the world.¹¹

9. For more details, see Moran (1998).

10. See the discussion in chapter 2 of when export processing zones generate much smaller benefits, or fail altogether.

11. This process may be better captured in Grossman and Helpman's (1991b) model of repeated product improvements up a "quality ladder" in distinct sectors, than in the more common approach that views R&D competition as a once-and-for-all race for technological supremacy. In the Grossman-Helpman model, new products (and intermediates) enjoy a limited run at the technological frontier, but may find themselves supplanted

On the other hand, however, Romer's (1994) upbeat assessment of the potential contribution from multinational corporate activities does not acknowledge the dark side of foreign direct investment observed earlier. The examination in chapter 3 of foreign investors operating under joint-venture, domestic-content, and technology-sharing requirements, typically sheltered from competition by trade protection or promises of local monopoly and oriented toward the domestic market rather than exports, included many instances in which their operations resulted in negative value added to the host economy.

Romer's policy recommendations require more nuance as well. His proposed solution to the "idea gap" is for developing countries to provide more profit incentive to potential foreign investors. But there is no lack of profit accruing to the foreign owners of many boutique plants that employ outdated technology to assemble kits behind protective walls: Chrysler's Mexican plants were a "cash cow" for the parent corporation during Mexico's import-substitution period, and GM's sheltered Hungarian assembly facility occupies the same position today. In fact, the high profits from small, protected operations may induce foreign investors to join domestic interest groups in lobbying against further liberalization. Former Indian Minister of Commerce A. V. Ganesan reports that foreign investors who enjoy a comfortable position within his country's traditional import-substitution regime have pressured host authorities to slow the schedule for phasing out domestic-content requirements required in the TRIMs Agreement, or oppose compliance altogether (Moran 2000).¹²

The enthusiasm of endogenous growth theory for foreign direct investment must be tempered therefore by closer attention to the design of the host country investment regime, a subject that receives more detailed attention in the calculations of the next section.

Estimating the Impact of Rationalization and "Derationalization" of Production by Multinational Firms Across Borders

Using computable general equilibrium models to assess the effects of trade-and-investment liberalization, James Markusen and others have attempted

as other products (and intermediates) push the frontier outward. Solow (2000, chapter 11) identifies two kinds of uncertainty that drive firms in Schumpeter's cycle of "creative destruction." Multinational firms (like entrepreneurs in general) may invest in new production processes because, as Aghion and Howitt (1998) point out, the rents from previous R&D are temporary and have to be replaced. Alternatively, argues Solow, new R&D may be complementary to previous innovation and extend the profitability of earlier processes.

12. For the "perverse political economy" that results from protecting foreign investors who subsequently become rent-seeking opponents of any policy changes that may expose them to new competition, see Moran (1998).

to estimate the impact of foreign direct investment on host country welfare when multinational firms are allowed to unify production possibilities across borders in industries with increasing returns to scale. What are the implications of the earlier case study analysis for this kind of assessment effort?

Building on the work of Wilfred Ethier (1982), Markusen (1989, 1990) begins by examining the “derationalization effect” that can result from imposing trade restrictions on differentiated goods that are complements for domestic inputs produced with increasing returns and/or that are intermediates used in a domestic industry with increasing returns to scale. To the extent that imported and domestic differentiated intermediates may be complementary (imported machinery, components, and engineering or managerial services may be complements for domestic inputs), argues Markusen, higher prices for the imported intermediates due to trade restrictions may reduce the output of the final good(s). If the intermediates are inputs into a final good produced with increasing returns, host country welfare is likely to be reduced even in the face of possibly favorable terms-of-trade effects. The host country industry ends up underproducing for the domestic market, and perhaps underexporting as well. The “derationalization” of production caused by even small levels of trade protection can have a substantial negative impact on domestic welfare.

Florencio Lopez-de-Silanes, Markusen, and Thomas Rutherford (1994) then take these insights one step further to estimate the benefits to host countries from allowing multinational corporations to rationalize production across borders, and to assess the costs to host countries of imposing trade/investment restrictions on domestic industries that have increasing returns to scale. Employing applied general equilibrium analysis to simulate the impact of Mexican protection against imported auto parts (in this iteration, engines are included as parts), they show that host country protection does reduce the output and exports of the increasing-returns, foreign-firm dominated auto sector, and also reduces the output of the increasing-returns, domestic auto parts sector. These negative effects far surpass whatever small terms-of-trade benefit such protection might offer to Mexico.

The calculation of the impact of a removal of all protection on autos and auto parts within North America leads to major gains (0.9 percent increase in economic welfare) for Mexico, all the more impressive in their view since the sector accounts for less than 3 percent of GNP and the initial level of US protection is quite low. Mexico experiences a large increase in auto production (147 percent), accompanied by a strong “rationalization” effect of a 114-percent rise in output per firm. The auto parts industry in Mexico grows by 24 percent, even though it remains a net import industry.

Lopez-de-Silanes et al.’s simulation of unilateral liberalization by Mexico alone, eliminating all protection against US and Canadian auto parts,

also yields significant gains to Mexico. Output per firm in Mexico expands by 70 percent as the country captures the benefits of decreasing average cost and increasing productivity. Auto exports from Mexico grow 226 percent, indicating that the product was underexported initially. The output of auto parts production rises by 12 percent, showing that domestic parts had previously been undersupplied.

This demonstration of rather sizable gains from market integration in industries in which there is multinational ownership of plants across borders with increasing returns to scale is reinforced in a subsequent study by Markusen, Rutherford, and Linda Hunter (1995). Here however the authors explore differences between free trade for producers (markets remain segmented) and free trade for consumers (market integration). They compare the outcome when trade and investment are liberalized simultaneously with the outcome when the “Big Three” US auto firms¹³ are allowed to segment markets as in the original US-Canada Auto Pact, which explicitly permitted free trade for producers only. Looking again at the entire North American automobile market, they assume multinational firms do not want cars arbitrated from high production-cost locations to low production-cost locations when the low-cost producer (Mexico) is the high-price market; instead, the multinational corporations want to maintain restrictions on consumers shopping across borders for the cheapest products.

The welfare effects that the Markusen team finds when trade and investment are liberalized simultaneously are “extremely large,” especially in comparison to liberalization that allows market segmentation to remain: *The two differ by a factor of 12, almost all accruing to Mexico* (Markusen et al. 1995, 111).¹⁴

The Mexican economy gets a strong boost in production from market integration, nearly double what the country gets if markets remain segmented. Output per firm increases by 98 percent as the companies move down a steep average-cost curve. There is substantial consumer surplus gain in addition, with the markup for autos falling by over one-half as the North American firms price to prevent arbitrage.

What perspective do the case studies in the previous chapters have to offer on calculations such as these?

For calculating the gains from liberalization, the industry materials examined earlier do not offer a precise confirmation of whether the benefits from simultaneous trade-and-investment liberalization in multinational-dominated markets might reach this magnitude. For calculating the losses from restrictions, however, the evidence from both the automotive and the computer/electronics sectors provides reason to conclude that this approach to estimating the costs of trade-and-investment restrictions may

13. They made their calculations prior to the acquisition of Chrysler by Daimler Benz.

14. The authors caution against taking their exact numerical results too literally.

not capture all of the disadvantages such restrictions impose on the host country.

In the most detailed attempt to estimate the negative impact from imposing domestic-content requirements on multinational investors, Lopez-de-Silanes, Markusen, and Rutherford (1994a) model three scenarios for production and trade in automotive parts, engines, and finished automobiles: (1) a free trade area in which there are no domestic-content provisions and in which Mexico's trade balance requirements are eliminated; (2) a free trade area in which a North American Free Trade Agreement (NAFTA) domestic-content provision replaces the separate domestic-content provisions of Mexico and of the US-Canada auto pact; and (3) a free trade area similar to (2) in which Mexico is allowed to maintain its trade balance requirements.

As specified in their model, there are two types of auto firms: the "Big Three" US auto firms, and all other foreign auto firms, differentiated by their import and export behavior external to the NAFTA area and hence by their North American domestic content. A high domestic-content, North American rule of origin can therefore discriminate against foreign firms.

Similar to their other exercises, Lopez-de-Silanes et al. find a large effect from the ability of the US firms to rationalize production among the three countries, enjoying increasing returns to scale in the process. As before, the major impact is on Mexico. Under all three scenarios, Mexico receives a significant, positive welfare benefit of 0.5 percent. Consumer prices for cars fall, providing a consumer surplus gain. Auto parts prices fall, contributing to increased efficiency in auto production. The increased production of and lower prices for autos and parts in Mexico again reflect an ability to capture scale economies, and lead to a real-wage effect as well as the consumer-surplus effect.

The NAFTA content rule of origin makes Mexico a relatively less attractive location for foreign auto firms, however. Whereas Mexico gains employment in parts, in engines, and in auto assembly production by US firms (the "Big Three"), these gains are outweighed by losses in employment in engine and assembly production there by Japanese and European firms.

But, as seen earlier, the impact from domestic-content requirements is likely to extend beyond scale effects. The evidence in chapters 2 and 3 showed that in automotive assembly—and in computer/electronics, and perhaps in other industries—there are often systematic differences in the kinds of plants, kinds of technology, and kinds of quality control utilized by foreign investors when they have domestic-content (or joint-venture) requirements imposed upon them. The production methods and business practices are 3 to 10 years older at such plants, and often employ noncomparable techniques (hand welding versus automated welding, individual inspection versus large-batch quality control procedures, and knocked-down kit assembly versus integrated component assembly).

These differences are not captured in the applied general equilibrium analysis of the Mexican automotive market. If Lopez-de-Silanes et al. were to compare the benefits to Thailand, for example, from liberalizing Thai automotive trade-and-investment rules to allow international sourcing by foreign firms, with the costs to Vietnam of maintaining a regime of high domestic-content and joint-venture requirements, backed by trade restrictions to protect boutique plants assembling kits for the domestic market, the differential impact on the growth and welfare of the respective host countries is likely to be much larger than they observe in their analysis of Mexico.

Assessing the Spread of Backward Linkages from Foreign Affiliates to Local Suppliers

What are the dynamics that govern the creation of backward linkages from the foreign affiliate to local suppliers in the host economy? How large might these backward linkages be expected to be, and how might they evolve over time? What appears to limit or constrain the expansion of backward linkages?

The general equilibrium models of the previous section identified the ability of local suppliers to take advantage of economies of scale, as a result of trade-and-investment liberalization, to be the principal channel through foreign direct investment-generated backward linkages that contributed to the welfare of the host economy. Trade-and-investment restrictions, in contrast, reduce the output of indigenous suppliers whose production involves increasing returns to scale.

To examine the impact of multinational entry on the development of backward linkages to local firms in the host economy in more detail, James Markusen and Anthony Venables (1999) construct a partial equilibrium model that explores the interaction between final goods and intermediate goods producers in imperfectly competitive industries.¹⁵ Investment by multinational firms in this framework sets two forces at work. The first is a competition effect in which multinationals substitute for domestic final goods producers. The second is a linkage effect back to intermediate goods producers, creating complementarities that could benefit domestic final goods firms.

The necessary and sufficient condition for the linkage effect to outweigh the competitive effect, producing a welfare gain for the host economy, is that the ratio of the multinational's demand for intermediates to their impact on domestic supply exceeds this ratio for domestic firms (Markusen and Venables 1999, 345).

15. See also Rodriguez-Clare (1996).

When is this condition most likely to be satisfied? The probability that the linkage effect will outweigh the competitive effect increases when multinationals engage in hitherto nonexistent export activities (or expand current export operations), leading to demand for domestic intermediates that exceeds that of purely local firms. The magnitude of the effect should be relatively strong if the domestic final goods industries, or intermediates, or both, are increasing-returns industries.¹⁶

How close is this model to representing the impact of multinational entry in the real world?

The evidence from the automotive and computer/electronics sectors reviewed in chapters 2 and 3 shows dynamics such as these rather clearly. The initiation of global sourcing from Latin American and Southeast Asian sites on the part of multinational investors, accompanied by the elimination of domestic-content and joint-venture requirements by host countries in both of these industries, allowed local suppliers to capture economies of scale hitherto absent (and, as noted, to deploy more advanced production and quality-control procedures in the process). The operations of local producers within regimes of domestic content and trade protection, in contrast, suffered from subscale inefficiencies (and technological disadvantages).

Markusen and Venables push their model further to examine the circumstances in which multinational entry might propel the economy into an equilibrium with indigenous firms producing both intermediate and final goods. They explore the scenario in which multinational entry generates demand for intermediates, which generates forward linkages strong enough for domestic final goods production to start, which leads to further backward linkages. This could lead to a sequence of cumulative causation in which multinational entry acts as a catalyst for the development of national competitors to the multinational firms within the local industry.¹⁷

They cite case study examples from East Asia that support this scenario (from Hobday 1995). Initial foreign investments created demand conditions in which “hundreds” of local firms began to supply components or assembly services to multinational exporters. This in turn created forward-linkage effects, drawing domestic goods producers in to join the foreign participants. In some cases, they report, indigenous firms eventually displaced the original multinational investors.

The evidence reported in the earlier sections of this paper offer complementary examples, including much more sophisticated industries than

16. Markusen and Venables (1999) note that an analytical shift from a partial equilibrium framework to a general equilibrium model would build factor market competition into the calculus, adding the beneficial effects of industrial growth on real wages. The use of a multicountry rather than a single-country model would, at the same time, offer a richer story of export possibilities.

17. For imitation and competition among developed and developing country producers over the course of a product cycle, see also Grossman and Helpman (1991a, 1991b).

Markusen-Venables identify, such as computer-controlled, high-precision machine tools (see chapter 2). Suggestive of a broader pattern of indigenous entrepreneurs managing to overtake foreign investors, Robert Lipsey (2000) finds, as noted in chapter 2, that in five of seven industry groups from Hong Kong, Indonesia, Singapore, Malaysia, Thailand, the Philippines, Taiwan, and South Korea, foreign investors initiated export activities but then found themselves being surpassed by exports from indigenous companies.¹⁸ Detailed examination of foreign entry and local imitation in these five industry groups, and an assessment of how generalizable this process might be, however, remain to be done.

What is lacking in the Markusen-Venables analysis, however, is an appreciation of the insight from Richard Caves (1999) offered earlier. As noted, Caves introduces the notion that foreign investors may have strong self-interest in improving the performance of indigenous suppliers. He hypothesizes that the strength of this incentive should vary as a function of how completely the subsidiary is able to recapture the benefit from the spillover.

What stood out in the earlier data was evidence of foreign investors seeking to improve the production methods and quality control procedures of indigenous suppliers, and to introduce successful suppliers as exporters to sister affiliates of the same parent outside of the host country, even when recapture was far from complete. (A recurring explanation appeared to be that the foreign investors wanted suppliers to capture economies of scale in production even if this meant having some sales directed to competitors.)

Whatever magnitude one assigns to linkage effects from the “natural” dynamics of the Markusen-Venables model, therefore, the actual generation of backward linkages is likely to be larger due to the purposeful self-interested efforts on the part of foreign entrants to lower the costs and improve the reliability of local suppliers, thereby enhancing the competitiveness of the latter.

A full assessment of linkage effects, however, requires turning to the analysis of spillovers and externalities.

Evaluating Spillovers and Externalities from Foreign Investors to the Host Economy

What help might the earlier case study analysis be in estimating the extent of spillovers and genuine externalities from foreign investors to the host economy?

18. As noted earlier, the sequence in which local firms catch up and become competitors to the original multinational investors is less evident in sectors with rapidly changing technology.

There is a long history of testing for the existence of spillovers by examining whether the presence of foreign direct investors (expressed in terms of the share of a sector or an industry's employment or value added) has a discernable impact on labor productivity in local firms.¹⁹ Three studies, of Australia by Caves (1974), of Canada by Globerman (1979), and of Mexico by Blomström and Persson (1983), found that the foreign presence was a significant explanatory variable in multiple regression analysis. Conducting similar tests across France, Germany, Japan, and the United Kingdom for 1968-88, Nadiri (1997, cited in Blomström and Kokko 1997) concluded that increases in the capital stock owned by US multinationals seemed to stimulate new domestic investment in plant and equipment, leading to a rise in total factor productivity in the host countries' manufacturing sector.

How large might the impact of efficiency spillovers be?

The most detailed estimates come from the assessments involving developed host countries. Analyzing data from two developed countries, then-West Germany and the United Kingdom, between 1972 and 1995, Ray Barrell and Nigel Pain (1997) found significant effects from inward foreign direct investment for both economies: for West Germany, each 1-percent rise in the stock of foreign direct investment raised labor-augmenting efficiency by 0.27 percent; for the United Kingdom, each 1-percent rise in the stock of foreign direct investment raised labor-augmenting efficiency by 0.26 percent (manufacturing sector only). For the latter economy, this implies, Barrell and Pain assert, that inward investment in the decade after 1985 raised manufacturing output by 12.5 percent, or by approximately 1.2 percent per year, accounting for roughly 30 percent of the growth in UK manufacturing productivity over the 10-year period.

To investigate the robustness of this result in the case of the United Kingdom, Hubert and Pain (1999, in Gillespie et al. 2000) added databases and considered other determinants of the rate of labor-augmenting technical progress, such as imports, R&D expenditures, and human capital, allowing for the fact that in an aggregate sectoral equation, apparent efficiency gains might simply represent compositional effects. They considered the possibility that an increase in foreign direct investment might raise average productivity, without producing spillovers to indigenous firms. These modifications produced diverse alternative point estimates of efficiency effects, but sustained the finding of a statistically significant positive relationship between the stock of foreign direct investment and domestic manufacturing efficiency. In fact, direct tests using a disaggregated database that removed the services sector produced a common long-run elasticity of labor-augmenting efficiency to the output of foreign firms nearly four times larger than the original Barrell and Pain estimate (1.05 percent).

19. For a summary, see Blomström and Kokko (1997).

Building on these efforts, Gary Gillespie, Peter McGregor, J. Kim Swales, and Ya Ping Yin (2000) have attempted to model both the “supply-side shock” that might come from the efficiency spillover from foreign direct investment to the indigenous economy, and the “demand-side shock” that comes from the stimulus of additional foreign direct investment to local employment. They use an ownership-disaggregated computable general equilibrium model for Scotland to estimate the regional impact on the United Kingdom from a 20-percent increase in the stock of foreign direct investment in the base year (1989). This involves an augmentation of foreign-owned capacity of 3 percent and an employment injection of some 3,392 jobs. Inserting the smaller original relationship observed by Barrell and Pain between the stock of foreign direct investment and the increase in labor-augmenting efficiency in manufacturing, they calculate that the entire UK-owned manufacturing sector receives a five-year employment impact of 1.51, a five-year, value-added impact of 1.98, and a five-year, total output impact of 1.53.²⁰ In long-run equilibrium, they argue, the expansion of capacity in other sectors, and the dissemination and incorporation of efficiency gains, would mean that these multipliers would grow even larger.

Are gains of these magnitudes plausible in a developing country context?

The analysis in the preceding sections of this paper suggest that there are three distinct channels through which foreign investors might enhance the productivity of the local economy: (1) deliberate exertions on the part of foreign firms to lower the cost and improve the quality control of local suppliers; (2) inadvertent opportunities for local rivals to copy or imitate the behavior of the foreign firms under increased pressure from the latter; (3) other externalities as workers and managers and service providers associated with the foreign firms employ practices and procedures learned from the foreigners but beyond their capture. The studies of Scotland and the United Kingdom summarized above lump together the gains through these separate channels.

The earlier case-study analysis suggests that the potency of each of these channels may vary as a function of the degree of development of the host country under consideration. Some externalities in channel (3) above, especially the movement of workers and managers from employment by foreign firms into independent activities in which they use the on-the-job training they received in their prior job, may emerge even in the least developed countries, although the magnitudes may be small. Deliberate exertions on the part of foreign firms to lower the cost and improve the quality control of local suppliers in channel (1) may require

20. For modeling purposes, the authors assume that the additional foreign direct investment is entirely export oriented, counting sales from Scotland into the larger UK market as “exports,” and that there is free labor migration within the UK region.

Table 4.1 Alternative estimates of the impact of investment liberalization

Estimation technique	Estimated impact	Implications of parental supervision findings
Endogenous growth theory	Welfare losses from restrictions that prevent techniques from being deployed in the host economy are 20 times greater than welfare loss from restrictions that make the host economy do what it already does less efficiently.	Higher than estimated benefits from liberalization, higher than estimated costs from restriction
Computable general equilibrium model of simultaneous trade and investment liberalization in industries with scale economies	Welfare gains when trade and investment are liberalized simultaneously are 2 to 12 times greater than when market segmentation is allowed to remain.	Higher than estimated benefits from liberalization, higher than estimated costs from restriction
Computable general equilibrium model of spillovers from foreign direct investment	A 20-percent increase in stock of foreign direct investment has a total output impact on the manufacturing sector of 1.5, and a value-added impact of 2.0, over five years.	Smaller than estimated benefits from liberalization, smaller than estimated costs from restriction (varying as a function of education and development levels of the host)

some threshold of skill level in the local firm-and-worker population to come into being.²¹ Opportunities for local rivals to copy or imitate the behavior of the foreign firms in channel (2), and thus grow into competitors in some segments of the industry, may be a phenomenon found more readily in relatively advanced developing countries than in poorer ones.

The likelihood of discovering spillover effects of the magnitude estimated for Scotland, therefore, is likely to be greater for relatively advanced developing countries than for lesser-developed economies. But

21. As noted earlier, Kokko (1994) and Kokko et al. (1996) find that spillovers are greatest when local firms trail the productivity of the foreign subsidiaries in their economy somewhat, but not by too much. A large absolute gap may leave the foreign investors in an “enclave,” where neither the products nor the services available from local suppliers have much in common with the foreigners. As indicated previously, there are aggregate measurements showing that the benefits to the local economy trail off as measurements of host country development (especially educational levels) become lower (Borensztein et al. 1998; Urata and Kawai 2000).

the supplier-to-independent-international-competitor sequence observed in the case study materials from both Southeast Asia and Latin America (see chapter 2) suggests that even lesser-developed countries may find their prospects for spillovers from foreign direct investment growing larger over extended periods of time if macroeconomic conditions, commercial institutions, and human resource training are favorable to indigenous business development. (See table 4.1.)

Policy Implications for Host Authorities

What are the implications of the evidence reported here for host countries that want to maximize the benefits and minimize the costs from incorporating foreign direct investment into their development strategies? What are the implications for host countries as they reassess their approach to trade-and-investment negotiations?

Implications for Host Country Policies Toward Foreign Direct Investment

The comparison of foreign investor operations in chapters 2 and 3 shows that the impact of the foreign investment on the host economy differs systematically as a function of the relationship between the foreign affiliate and the parent company, which, in turn, depends directly upon the kind of investment regime offered by the host country.

- The decision on the part of the parent to establish a site to serve its strategy for maintaining a competitive position in international markets brings with it a far different set of plans about plant design, training, and quality control, and a far different incentive structure for upgrading technology and business practices, than a decision to penetrate a small (often protected) domestic market.
- Host investment rules that allow foreigners the ability to operate with wholly owned affiliates free from cumbersome regulations open the door, consequently, to far different outcomes than host investment rules that impose domestic-content, joint-venture, and technology-sharing requirements.

Table 5.1 Schematic comparison of foreign affiliates closely integrated into the parent's global sourcing network with foreign affiliates that are not

	Foreign affiliates closely integrated into parent's global sourcing network	Foreign affiliates not closely integrated into parent's global sourcing network
Predominant characteristics of foreign affiliate	Wholly owned, few domestic-content or technology-sharing requirements, full-scale size, largely export oriented	Subject to joint-venture, domestic-content, technology-sharing requirements, often boutique or less than full-scale size, largely domestic oriented
Foreign affiliate's position in relation to industry's competitive frontier	Cutting edge of technology, business practices, quality control; near real-time pace of upgrading	Older technology (3 to 10 years older), less advanced business practices and quality control; lags in pace of upgrading
Backward linkages	Highly variable, but often extensive with local suppliers enjoying economies of scale	Specified by domestic-content and joint-venture requirements, but limited by small scale
Local suppliers' position in relation to industry's competitive frontier	Extensive assistance on the part of foreign affiliate in enhancing efficiency and quality control of local suppliers	Less extensive assistance on the part of foreign affiliate in enhancing efficiency and quality control of local suppliers
Externalities	OEM and REM qualification and export coaching for local suppliers, movement of skilled workers and managers within host economy	Some movement of skilled workers and managers within host economy

OEM = original equipment manufacturer
 REM = replacement equipment manufacturer

This leads to a dramatic contrast in the contribution to host country welfare by foreign affiliates closely integrated into the parent's global sourcing network in comparison to foreign affiliates that are not (see table 5.1).

The intimate interaction with the parent that comes from being an integral part of the latter's global or regional sourcing network creates a particularly dynamic channel for bringing new technology and best business practices into the host economy. The benefits extend from the affiliate

itself to local suppliers, with a relatively strong likelihood of generating spillovers and externalities for the host economy more broadly.

These findings provide a new baseline against which to compare the impact of foreign direct investments that are burdened with domestic-content, joint-venture, and technology-sharing requirements, and to gauge the opportunity cost to the host country of imposing such requirements. As documented in chapter 3, domestic-content, joint-venture, and technology-sharing requirements create inefficiencies that slow growth, and generate, in many cases, a negative net contribution to host country welfare (especially if they are backed by trade protection or other kinds of market exclusivity). More important, however, by inhibiting the foreign affiliate's participation in the parent's strategy to meet global competition, they may prevent the host economy from joining other countries at the frontier of the most advanced practices in a given industry.

These discoveries are so striking that they do not simply justify host country policy adjustments at the margin. Instead they warrant nothing less than a "paradigm reversal" for authorities in developing countries.

To put the findings reported here in historical perspective, when developing country apprehensions about the "captive" subsidiaries of foreign multinationals became the norm during the early decades of industrial globalization, there was not sufficient information to judge whether concerns about screwdriver operations, minimal value added, and an absence of technological spillovers and externalities that might be associated with such subsidiaries were justified.

The preceding case studies show that sufficient evidence has now accumulated to demonstrate that this tradition of misgivings, while understandable, is misdirected. Looking to the future, host authorities will serve their own developmental self-interests best by actively seeking out and trying to attract these kinds of tightly integrated operations into their economies, and by decisively turning away from the imposition of domestic-content, joint-venture, and technology-sharing requirements.

Implications for Host Country Policies Toward Trade-and-Investment Negotiations

The results reported here have important implications for developing country approaches to trade-and-investment negotiations.

Earlier work undertaken at the Institute for International Economics in the period leading up to the Seattle WTO Ministerial in 1999, tried to turn the findings about the benefits of integrated foreign investor operations and the disadvantages of domestic-content and joint-venture requirements into a carefully calibrated set of negotiating packages (Moran 2000).

A *minimalist negotiating package* might address domestic content. Under the TRIMs Agreement of the Uruguay Round, developed and developing

countries pledged themselves to phase out domestic-content regulations imposed on international companies. But during the same period in which developing countries had accepted their responsibilities in eliminating this type of trade-and-investment distortion, the European Union and the NAFTA partners had been legislating high domestic-content rules of origin for their preferential trade agreements, later imitated by Mercosur, to accomplish the same objective. Within the minimalist negotiating package, both developed and developing countries might agree to meet their TRIMs obligations without undue delay while transforming the WTO work program on harmonization of nonpreferential rules of origin into an exercise on harmonization and reduction of high domestic-content preferential rules of origin.

A *medium-sized negotiating package* might add export performance requirements to the TRIMs Agreement as part of the built-in TRIMs review process. But if export performance requirements were brought under multilateral discipline, so too should locational subsidies that many developed countries have wielded effectively in attracting or holding on to the operations of multinational corporations. Members of the international trade community ought not to be able to claim disingenuously that the packages of locational incentives offered by Ireland or Alabama have no effect on patterns of trade and investment while the export performance requirements imposed by developing countries do.

Most ambitiously, a *maximalist negotiating package* might aim at a “grand bargain.” Developing countries would abandon not just domestic-content and export performance requirements, but joint-venture requirements as well, narrowing dramatically the margins within which they might deny national treatment or the right of establishment to foreign firms. Developed countries would draw down not just high domestic-content rules of origin and locational incentives, but also reform antidumping regulations to limit the use of antidumping to shift investment and protect internal producers.¹ The goal would be for developed and developing countries alike to bring the principal distortions to the location of international direct investment under multilateral discipline.

The rationales that underpin these negotiating packages have only strengthened since they were first proposed. Overlapping sets of high domestic-content rules of origin and competing packages of investment incentives have generated fierce competition for investment among developing countries themselves, as well as between developed and developing economies (Chudnovsky and Lopez 2000a, 2000b).² The use of

1. For the distortionary impact of contemporary methods on calculating dumping, see Greenspan (1999).

2. There is a long tradition of research that indicates multinational corporations do not fashion their global strategies on the basis of locational incentives. But case study evidence shows that once overall multinational corporate strategy is set, parent firms select

antidumping cases to alter the face of economic geography has found enthusiasm in the developing world to match the eagerness within which trade-and-investment distortions are pressed in the developed world.³

But there may be virtue in trying not to be overly ambitious, so as to avoid letting pursuit of the best become enemy of the good. The immediate agenda might therefore be limited to ensuring compliance with the obligations to phase out the domestic-content requirements imposed on foreign investors already specified in the TRIMs Agreement. The interests of all parties will be directly and unambiguously served by eliminating domestic-content mandates as promptly as possible.

As a practical matter, most developing countries will need an extension of time to accomplish this, which the world trade community should grant in return for an explicit schedule for elimination of domestic-content mandates.⁴ Adherence to an explicit schedule would send appropriate signals to firms and workers, and help in the undeniably painful adjustment process.

Over the longer term, however, both developed and developing countries will benefit from joining together to declare a cease-fire in the “investment wars” that are spreading across borders and among regions.⁵ They might then begin the larger task of creating a genuinely level playing field for foreign direct investment around the world.

the finalists from a list of almost-comparable production sites by generating “subsidy tournaments” among those on the roster. Recent econometric estimates demonstrate moreover that the responsiveness of foreign investors to tax breaks and other incentives is not small, and may be growing in magnitude over time. In addition to the materials summarized in Moran (2000), see Hines (2000) and Altschuler et al. (2001).

3. In a hitherto unprecedented move, Argentine producers initiated antidumping actions against imports of Brazilian steel. See “Brazilian Devaluation Changes the Trading Bloc Picture: Mercosur Tensions Old and New Flare-Up,” *New York Times*, 1 June 1999. For evidence of the role of antidumping barriers in determining the location of foreign direct investment by Korean multinationals, see Sachwald (forthcoming).

4. Along these lines, the chair of the WTO’s Goods Council proposed a two-year extension of the TRIMs deadline for each of nine countries requesting an extension as long as a specific implementation plan were followed (*Inside U.S. Trade*, 17 and 24 November 2000).

5. The idea that “trade wars” might be taking on the characteristics of “investment wars” was first proposed by Bergsten (1974).