The Role of Intellectual Property Rights in Encouraging Foreign Direct Investment and Technology Transfer

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1. Introduction

The global system of intellectual property rights (IPRs) is undergoing profound change as we approach the next century. Numerous developing countries recently have undertaken significant strengthening of their IPRs regimes. Regional trading arrangements, such as the North American Free Trade Agreement and a series of Partnership Agreements under negotiation between the European Union and various Eastern European and Middle Eastern nations, now pay significant attention to issues of regulatory convergence, with particular emphasis on intellectual property rights. Most important is the introduction of the multilateral agreement on trade-related intellectual property rights, or TRIPs, within the World Trade Organization (WTO). Under the terms of TRIPs, discussed further below, current and future WTO members must adopt and enforce strong and non-discriminatory minimum standards of protection for intellectual property. Finally, while considerable controversy persists over international means of protecting key information technologies, including databases and electronic information transfer, there is an evident commitment to achieving strong protection in these areas.

That the international system is moving toward markedly stronger IPRs is not a surprise when viewed in the context of economic globalization, which is the transcendent commercial and political force of this era. Globalization is the process in which national and regional markets are more tightly integrated through the reduction of government and natural barriers to trade, investment, and technology flows. In this global economy, the creation of knowledge and its adaptation to product designs and production techniques are increasingly essential for commercial competitiveness and economic growth. This situation acquires growing political saliency in light of the fact that the international mobility of capital and technology have risen markedly relative to that of most types of labor. Accordingly, globalization tends to invest its largest rewards in creative and technically skilled workers and to place its largest pressures on lower-skilled workers.

To clarify discussion, it is important to distinguish various concepts associated with globalization. First, the *mechanisms* by which markets become more integrated include changes in both natural forces and government policies. Key trends in natural forces, associated with various forms of technological changes, consist of reductions in international transportation costs, improvements in global communications, and massive increases in computational power permitted by the microprocessor. Equally important are changes in government policies that allow international firms greater access to domestic markets. Expansions in market access come through trade liberalization, deregulation of investment and licensing restrictions, provision of establishment rights in services, privatization of state-owned enterprises, adoption of freely-traded currencies, and tax reform. The central feature of policy making in many emerging economies in the 1990s has been a sharp shift toward improving market access, through both unilateral policy reform and adherence to regional and multilateral trade agreements.

Second, the *channels* through which globalization affects economies include expanded trade in merchandise and services, greater international portfolio investment and

foreign direct investment (FDI), and formal product and technology licensing. Foreign direct investment -- the establishment or acquisition of producing subsidiaries abroad by multinational enterprises (MNEs) sufficient to afford an important degree of management control -- is particularly important because it is both a source of capital and a provider of knowledge about production techniques.

In truth, these channels are responses to globalization but, at least in the public eye, are generally viewed as determinants of the ultimate *outcomes* of the process. These outcomes include, in the first instance, stronger tendencies toward arbitrage of international prices of goods and tradable services and greater access by consumers and firms in each liberalizing country to new and more varied products and technologies on international markets. In turn, such economies experience strong increases in competition, reductions in domestic market power of formerly concentrated industrial concerns, re-allocations of economic resources into areas of greatest comparative advantage, declining production costs in sectors with increasing returns to scale, and contraction or elimination of uncompetitive firms. This last possibility, what economists label firm exit, is a key source of efficiency gains in liberalizing economies but poses a strong political force against deregulation.

Over the long term, stronger competitive pressures also tend to encourage adoption of frontier technologies and development of high-quality, differentiated products for both domestic production and export. Indeed, recent experiences in Chile, Mexico, Korea, and Taiwan point toward the need for meeting rigorous quality demands in order to break into export markets as a key component of innovation and product adaptation. The stronger markets encouraged by liberalization could lead to a permanently higher growth rate. This process explains why countries with outward-oriented commercial policies have outperformed other developing economies in recent decades.

While there is now considerable evidence to support this optimistic view of globalization, such gains do not come without potential costs. Foremost among these is that greater competition changes demands for labor in each country, with unskilled workers bearing the brunt of competitive pressures through declining real wages or rising unemployment. Also important are potential abuses of market power to the extent that larger international firms are placed into a position of market dominance by virtue of their marketing advantages or technological superiority, though the likelihood of such abuses occurring diminishes with stronger international competition.

This brief review of globalization suggests that emerging countries have strong and growing interests in attracting trade, FDI, and technological expertise, although such encouragements must be tempered by accompanying programs to build local skills and ensure that the benefits of competition actually arise. In this context, intellectual property rights are an important element in a broader policy package that governments in developing economies should design with a view toward maximizing the benefits of expanded market access and promoting dynamic competition in which local firms take part meaningfully. This broad package would include promoting political stability and

economic growth, encouraging flexible labor markets and building labor skills, continuing to liberalize markets, and developing forward-looking regulatory regimes in services, investment, intellectual property, and competition policy.

It is beyond the scope of this paper to consider each of these issues in detail and their complex interrelationships. Rather, I focus here on issues of attracting FDI and technology, with a particular emphasis on the role of IPRs in this process. In the next section I overview recent trends in international investment and licensing, using U.S. data as a particular illustration. I then analyze the main determinants of FDI, both in theory and according to the available economic evidence. A similar treatment is provided for licensing. In the third section I discuss, from the standpoint of an emerging economy, the potential benefits and costs of incoming FDI and technology transfer, focusing on issues of information spillovers and diffusion. Throughout, the impact of IPRs is considered. With this background, in the fourth section I present the broad outlines of a pro-competitive strategy for attracting investment and technology. Inevitably, such strategies vary somewhat across countries by level of economic development and technological capability but there are important common denominators. In a final section I conclude with observations on the role of IPRs in linking developing countries to an information-based global economy.

2. Determinants of Foreign Direct Investment and Technology Transfer

Multinational enterprises make multifaceted decisions regarding means by which they can serve foreign markets. Firms may choose simply to export at arm's-length to a particular country or region. Alternatively, they may decide to undertake FDI, which requires selecting where to invest, in what kind of facilities, whether to purchase existing operations or construct new plants (so-called "greenfield investments"), which production techniques to pursue, and how large an equity position to take with potential local partners. Firms may prefer a joint venture with some defined share of input costs, technology provision, and profits or losses. Finally, MNEs may opt to license a technology, product, or service, leading to complicated issues of bargaining over license fees and royalty payments.

These decisions are jointly determined and, for any firm, the outcome depends on a host of complex factors regarding local markets and regulations. In this section I discuss the most significant of these factors for attracting FDI, licensing, and technology transfer, and review the available economic evidence. Intellectual property rights clearly play an important role in these processes, though its importance varies by industry and market structure.

2a. A Brief Overview of Recent Data

It is helpful to begin with a glance at recent international data on FDI and licensing. Reliable and comprehensive data on these flows are not compiled by many countries, so the overview is constrained by limited data availability.

In Table 1 I list aggregate figures on FDI inflows and outflows, in millions of dollars, for representative nations from the IMF's *Balance of Payments Statistics*. One immediate observation is that reported FDI data are quite volatile. For example, while inward FDI into the United States remained fairly steady at between $48 billion and $60 billion between 1987 and 1995, outward FDI more than tripled from 1990 to 1995. Japan's outward FDI rose sharply in the late 1980s but fell by more than half between 1990 and 1995. This volatility suggests that one should be cautious about making inferences on the basis of a single year of data. Further, it indicates that FDI flows are strongly influenced in the short term by macroeconomic factors, such as fluctuations in the business cycle and shifts in exchange rates. While this fact should be kept in mind, I am more concerned here with microeconomic determinants of FDI.

Despite the volatility in these figures, it is clear that the last decade has seen sharply rising FDI flows in both the developed countries and most of these key developing countries.[1] Spain experienced a dramatic increase in inward FDI in the late 1980s after its accession to the European Union but this inflow has since moderated. The United Kingdom continues to be a net supplier of FDI, but annual investment in that country has doubled over the period. Japan remains, in relation to its GNP, a very small recipient of inward FDI but a large supplier of outward FDI. Indeed, it is this feature -- Japan's remarkable effective closure to FDI -- that continues to characterize it as unique among developed economies. Poland's rapid liberalization and deregulation program and its increasing commercial ties with Western Europe led to a 40-fold increase in inward FDI in the early 1990s.

As is well-known, FDI in China has mushroomed in recent years, rising by a factor of ten between 1990 and 1995 according to the IMF's figures. Its receipt of nearly $36 billion in FDI in 1995 marks China as easily the largest destination for investment in the developing world. It received 52% of the inward FDI in 1995 among the developing countries listed here, a share that rose dramatically from 15% in 1990. Malaysia, Indonesia, and Thailand have all received rising inward FDI flows, while Thailand's investment abroad rose sharply in the 1990s. Singapore became a significant supplier of FDI in this decade as well.

There are two African countries listed, Kenya and Egypt. Both display declining trends in inward FDI over the last decade, indicative of severe economic problems in that continent. In contrast, Mexico experienced a sharp rise in FDI in the 1990s, some of it undoubtedly related to negotiation and passage of NAFTA. Brazil and Chile received similar large increases in FDI since 1990.

From this review it appears that the last decade has been a period of substantially rising FDI, with a larger proportion of investment flowing to the emerging economies.

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[1] These figures are in nominal dollars and are not adjusted for inflation or changes in real exchange rates.

China is particularly noteworthy in this context. The one dark spot on this trend is the declining ability of very poor and inward-looking economies, such as those in Africa, to attract investment. Overall, the summary points to rapid growth and increasing openness as key encouraging factors.

In Table 2 I provide figures, taken from the same source, on net receipts (credits less debits) for royalties and licensing fees, other business services, and direct investment income. Royalties and license fees are the most direct measure available of international earnings on patents, trademarks, copyrights, and trade secrets. Note that these fees could be imperfect measures of the value of technology exchange. Within the multinational firm, the fees charged a subsidiary may be dependent on international tax structures. Further, optimal pricing of information is a complex problem and receipts of license fees and investment income may be poor indicators of the economic value of intellectual assets. Nonetheless, these data are worth considering.

The United States remains, by far, the largest recipient of such fees, earning a net $20.7 billion in 1995. The United Kingdom is also a net recipient. However, Japan, Germany, and Spain pay out more in royalties and fees than they take in, indicating that they are net purchasers of technologies and product designs. It is no surprise that all of the developing economies for which such data are reported are also net payers of royalties and license fees, as befits their status as technology importers. The interesting fact is that for every such country (except, perhaps, India) there was a marked rise in such net payments over the last decade. Thus, it appears that the international exploitation of intellectual property is becoming increasingly important in the process of globalization.

The United States publishes the most extensive data on FDI by country and industry. Thus, in Table 3 I list the stock of U.S.-owned foreign capital (foreign investment position at historical cost) for key countries. The foreign investment position is a more informative measure of investment activity than is current FDI, because the latter flow is so variable. The top row demonstrates that U.S. ownership of foreign direct capital nearly tripled from 1985 to 1994.[2] Thus, again we find that FDI has grown remarkably in recent years.

Despite the increasing attractiveness of developing economies as destination countries, the bulk of U.S. investment remains in the developed countries. The European Union (12 countries) actually increased its share of U.S. investment stock from 36% to 41% over the period, while Japan's share rose from four percent to six percent. It is surprising to note that by 1994 the United Kingdom had supplanted Canada as the host of the largest U.S. foreign investment position, with Canada's share falling considerably over the period. The combined shares of Europe, Canada, and Japan sum to 66.9% of the global American foreign capital stock in 1994.

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[2] Because these data are in nominal dollars at historical cost, they should be viewed with caution.

It is likely that recent relative increases in investment will change these shares over time in favor of the emerging economies. As it is, each country or region listed except Africa saw a large increase in the U.S.-owned capital stock. China's share of the U.S. FDI position tripled and the investment stock in Hong Kong doubled in the 1990s. Mexico's share also rose sharply, which likely is partly a result of NAFTA, as did Chile's. As a continent, Africa experienced an absolute decline in the investment stock (indicating a sizable disinvestment) over the period, with its share falling from 2.6% to 0.9%.

The African experience points out that the distribution of FDI in developing countries remains uneven. This trend was particularly acute in the 1980s, as documented in Amirahmadi and Wu (1994). In that decade, a total of 15 countries received 80% of all FDI inflows to the developing areas. These flows were highly concentrated within regions as well. For example, Singapore, China, Hong Kong, Malaysia, Indonesia, China, Korea, Taiwan, and Thailand absorbed over 90% of investment in Asian developing countries over the decade. While this concentration has moderated somewhat in the 1990s, it is still in evidence.

Listed in Table 4 are data on the U.S. foreign investment position in 1994 for major industries in selected nations. The global stock of capital in banking and finance is nearly as large as that in total manufacturing, pointing out the importance of financial services in the globalization process. Also significant are investments in wholesale trade, which amounted to $67.3 billion. These figures point out an important feature of FDI in today's economy: much investment is complementary across sectors. That is, a strong manufacturing presence in a foreign economy typically goes hand-in-hand with investments in finance and distribution in order to help with local marketing efforts and in financing further expansion of facilities. Such investments also are strongly complementary with merchandise trade flows, particularly those within MNEs. Thus, the traditional view that FDI tends to substitute for trade in goods (that is, that trade falls as FDI and local production rise) is outdated and largely inaccurate today.

It would be tedious to discuss these figures in detail. A convenient summary is in the bottom two rows, in which I indicate crudely the breakdown of the sectoral investment into stocks in developed countries (Europe, Canada, and Japan) in the table and developing countries. The manufacturing sector with the highest representation in emerging economies is electrical equipment, followed by food and kindred products and other manufacturing goods. These are industries in which comparative advantage in important subsectors could be expected to lie in developing economies with low-wage labor and abundant agricultural endowments. Thus, FDI between the United States and developing countries does tend to follow comparative advantages based on factor costs.[3] The chemicals sector also has a fairly high presence in emerging economies, which is particularly true of the pharmaceuticals sub-sector (Maskus and Penubarti, 1995). Indeed, in the data in Table 4, chemicals has the largest stock among sectors investing in China and is also prominent in Latin America.

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[3] A similar finding for U.K. investment was detected in Maskus and Webster (1995).

The banking and finance sectors have a large presence in developing economies, with some 38% of their FDI stocks there. Much of this investment is in Panama and Bermuda because of special tax and operating advantages, which indicates that some forms of FDI are sensitive to regulatory regimes. Netting out investment in those two countries yields the percentage distribution in parentheses, suggesting that 77% of FDI in these sectors that is based more on long-term microeconomic factors exists in the developed countries. Investment in services sectors (largely hotels and engineering and business services) is heavily located in developed economies. However, a substantial portion (25%) of investment in wholesale trade activities exists in developing economies. Again, this reflects the complementarities between finance and distribution, on the one hand, and trade and FDI in goods, on the other hand. It should be noted that services bear the particular characteristic that their provision often physically requires the local presence of either the facility itself (hotels, hospitals) or of professionals (engineers, consultants). Thus, rights of establishment are especially important in attracting FDI in services.

Further perspective on the sectoral characteristics of FDI is available in Table 5, which lists data on U.S. investment abroad by high-technology manufacturing and service industries in 1989. Note first that there is significant variation across industries in the number of foreign affiliates per U.S. parent, which indicates the relative importance of investing in either numerous foreign subsidiaries of fairly small size or fewer foreign facilities of larger size. The pharmaceuticals industry tops this list with 33.8 affiliates per firm. Pharmaceuticals are characterized by having large numbers of foreign affiliates producing under license. Advertising and industrial chemicals are next, with other industries trailing behind. Second, the stock of foreign assets owned by U.S. firms is shown again to be sparsely located in emerging countries (EC's). The highest proportions of investment in EC's are in electric components and circuits and telecommunications equipment. Each of these sectors includes considerable electronics production that is fairly standardized and labor-intensive. Health services are unusually high in this context among the service sectors. Third, the proportion of intrafirm sales, which are largely between the parent and its affiliates, differs considerably across industries. In comparison to the stock of foreign assets, intrafirm trade is quite high in electronic components, office machines and computers, and motor vehicles and parts. This situation reflects substantial trade in inputs among vertically differentiated firms. Intrafirm trade is much smaller in chemicals, pharmaceuticals, and printing and publishing, in which MNEs tend to be horizontally integrated. Unsurprisingly, there is virtually no intrafirm trade in high-technology services, which essentially require direct contact between supplier and customer.

2b. Factors Influencing Foreign Direct Investment Flows

Begin with some definitions. Foreign direct investment is the act of establishing or acquiring a foreign subsidiary over which the investing firm has substantial management control. By definition, firms that engage in FDI operate in more than one country and are

called multinational enterprises. The location of an MNE's headquarters is called the home or source country, in that the decision to invest is made there, while the location of the subsidiary is called the host or recipient country. Clearly, there are difficulties in interpreting such concepts. It has become increasingly difficult to identify major MNEs with a particular host country, since they may establish facilities in several countries that each undertake "headquarters operations" (such as research and development, marketing, and organizational design) for local markets and tax jurisdictions.

Multinational enterprises may undertake horizontal FDI, in which the subsidiary produces products and services that are similar to those produced at home, or vertical FDI, in which the subsidiary produces inputs or undertakes assembly from components. In the latter case, international production is fragmented across borders, taking advantage of locational considerations and input costs (especially wage differences) at various stages of production. Incentives for horizontal FDI and vertical FDI are different, as further explained below. Horizontal FDI tends to characterize investment decisions of MNEs operating across borders within the industrialized nations, while vertical FDI is more prevalent among MNEs that invest in developing (low-wage) economies. Horizontal subsidiaries tend to produce for local or regional markets only, without exporting much output to the host country. In contrast, the output of vertical subsidiaries is more likely to be exported within the MNE, both to the host country and to other countries with similar demand characteristics.

It is also important to note that FDI embodies two distinctive assets: first, capital and second, technology or some intangible advantage. While the capital for financing FDI may come from the host country or from global financial markets, it may also be raised on the local capital markets of the recipient nation. Indeed, this is far the most common approach for financing horizontal investments among industrialized nations. Thus, FDI may or may not be associated with a net external addition to the local capital stock, although in economic terms this is of little consequence since it is investment itself that matters, whether raised from domestic or foreign sources. External financing more commonly characterizes FDI in emerging countries.

In this light, FDI should be viewed less as a source of finance (global FDI flows are small in relation to flows of portfolio capital in any case) and more as a source of investment in capital and technology or related assets. These variables are capable of improving productivity and wages in a recipient economy.

With these comments in mind, consider the underlying determinants of a firm's decision to engage in FDI. Economists begin by noting that, for a firm to become a MNE, it must have a sufficient cost advantage or technical product superiority over firms in the host country to overcome the disadvantages it faces in international management, including language and cultural barriers, jurisdiction-specific tax treatments, distance from headquarters, and monitoring local operations. Thus, MNEs must enjoy some efficiency advantages, meaning that they bring potential gains to host countries, and economic theories of FDI begin with a description of such advantages.

OLI Framework

A convenient framework for thinking about this question is the ownership-location-internalization (OLI) paradigm developed by Dunning (1981). In this approach, MNEs are characterized by some *ownership advantage*, which could be a tangible asset, such as a proprietary claim in facilities producing key natural resources. Far more commonly, however, the advantage is an intangible asset, such as a trademark or reputation for quality, or a product or production process to which other firms do not have access, such as a patent or trade secret. Such advantages confer market power and cost efficiencies that provide sufficient incentives to undertake multinational organization and operation.

That ownership advantages are strongly associated with technology development, information management, and marketing strategies is borne out by key characteristics that describe MNEs. Such firms tend to be important in industries with high R&D intensities, large employment of professional and technical workers, significant reliance on introduction of new and technically sophisticated products, and considerable amounts of product differentiation and advertising.[4]

Thus, FDI is more likely to be important in industries in which intangible, knowledge-based assets (KBAs) specific to each firm are significant. There are two key reasons for this fact. First, informational advantages can be transferred easily across borders at low cost. Second, knowledge is similar to a public good, in that a particular technology or trade secret can be used in several production facilities without reducing its availability for others, as is the case with labor and capital. Such knowledge is embodied in blueprints, software, chemical formulas, and managerial or engineering manuals, which may be used numerous times at low marginal cost.

The important implication of this characteristic of knowledge is that MNEs enjoy scale economies from multiplant production, sometimes called economies of scope. A multinational firm can produce its technical knowledge in one location and use it in several plants in different countries, spreading the investment cost of technology development and marketing across numerous facilities (Markusen, 1984). In contrast, two independent firms, each of which must make this investment, operate at a cost disadvantage. Thus, we should observe significant multinational activity in industries in which the development of transferable knowledge and product quality is a key focus of strategy. Indeed, this is consistent with available evidence and possibilities for exploiting multiplant economies are now considered perhaps the most important determinant of a firm's decision to undertake FDI.

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[4] Considerable evidence supporting these points may be found in Caves (1982), Morck and Yeung (1992), Grubaugh (1987), Brainard (1993), and Markusen(1995)

Note that this argument is particularly relevant for horizontal FDI, in which firms base strategies for penetrating markets on the economic value of their KBAs, such as superior production processes, reputations for quality, performance, and service, and even life-style images. It also points out that MNEs find it crucial to be able to support their investments with complementary operations, including service contracts. Economic value is increasingly related to performance of systems, including products, services, information, maintenance, technical upgrades, and close relations between producers and clients. As amplified below, this means that, in today's world, FDI is far less attracted by protectionist tariff walls and far more attracted by economies with open access to global markets. It also means that strong IPRs are taking on increasing importance as a determinant of inward FDI.

To summarize, MNEs are essentially exporters of KBAs, including technology, engineering, management, marketing, and financial services. The importance of human capital skills in generating these KBAs is evident. Multinational firms also sell the services of devices that protect the value of their KBAs, including patents, trademarks, trade secrets, and copyrights; indeed, it is common for economists to refer to owned IPRs themselves as the relevant knowledge-based assets. Local subsidiaries pay for these services with royalties, license fees, shared outputs, and profit repatriations.

Even given some ownership advantage, MNEs still must decide on investment destinations. These decisions depend on characteristics of particular countries, called *location advantages*. Such advantages make it profitable for the firm to produce abroad rather than at home and export the good. Obvious examples of location advantages include market size and growth, local demand patterns, transport costs and distance from markets, low wage costs in relation to labor productivity, abundant endowments of natural resources, and (declining in importance over time) trade protection that could encourage some kinds of "tariff-jumping" investment. Also important are an adequate and modern infrastructure and transparent government regulatory procedures. Recently, location characteristics that enhance the value of KBAs have taken on crucial importance. Among these are an adequate supply of high-skilled labor in order to facilitate absorption and use of technology and management techniques, close proximity to customers and unimpeded ability to build supplier-customer networks, and a vibrant business-services sector that can handle localized needs for marketing and finance. Further, the strength of each country's IPRs is a locational factor of growing importance, as discussed further below.

Notice that location advantages matter for both vertical and horizontal FDI. They are especially important for vertical FDI, in which firms build production networks across borders, with engineering, design, and marketing operations in the headquarters country, and resource extraction, assembly, and data processing in host countries. Indeed, the most significant recent trend in vertical FDI has been the construction of such vertically integrated networks, a process also referred to as "production fragmentation" or "delocalization" or "outsourcing" (Hanson, 1996). This process underlies the rapid expansion of intrafirm trade in goods and services between developed and developing economies. Investment of this kind is most attractive in low-wage, high-growth

economies with sufficiently large market sizes to take advantage of scale economies in assembly. While outsourcing is of concern to low-skilled workers in the high-wage economies, it generates overall efficiency gains in both the source and host countries and is a critical component of modern competitive strategies.

In this context, it is interesting to observe that the volume and character of inward FDI change dramatically as countries develop (Zhang, 1996). The least-developed countries of the world attract virtually no FDI (except in extractive sectors) due to extremely low levels of productivity, education, and skills. Further, such countries tend to have underdeveloped infrastructures, are relatively closed to trade, and maintain poorly designed, intrusive, and non-transparent government regulations that encourage corruption. To the extent that such countries can marshal effective investments in infrastructure, capital, and education and skill, their per-capita income levels rise over time. As this happens, MNEs find these economies attractive locations for vertical FDI for labor-intensive assembly operations and intrafirm trade grows. This process expands until real wages rise sufficiently that the economies lose their competitive advantages in assembly production (the FDI itself plays a positive role in raising wages). As vertical FDI falls off, however, horizontal FDI tends to move in because such countries achieve income levels that make them attractive markets for producing high-quality differentiated consumer and capital goods and even for undertaking local R&D programs. Indeed, these countries may well become sources of FDI. Interestingly, as horizontal FDI grows it tends to displace both inter-firm and intrafirm trade (Markusen, 1995). Thus, so-called "North-South" investment tends to be vertical while "North-North" investment is horizontal. Rapidly developing economies, such as Korea, Singapore, and Mexico, may move through this investment cycle in a single generation. This process is summarized schematically in Figure 1. Notice that as market size grows and human capital accumulates with higher levels of income, horizontal FDI displaces vertical FDI, but, as shown in the bottom panel, the cumulative stock of FDI should rise over time. Thus, there is an important dynamic element to growth and investment.

Regarding horizontal MNEs, key location characteristics include market size, income levels and growth, transport costs, complementary business services and regulations, and market openness. As noted earlier, IPRs take on increasing importance as investment becomes more horizontal in nature. In this sense, it is not surprising that countries moving up the FDI cycle find a growing economic interest in adopting stronger IPRs, an interest congruent with their own expanding abilities to develop new products and technologies.

Finally, ownership and location advantages together may not be sufficient fully to explain FDI because they do not account for the advantages of internal organization over selling goods and licensing technologies on the open market. Rather, MNEs also have *internalization advantages*, which relate to gains from exploiting their KBAs within the confines of their international operations (Rugman, 1986). It is this aspect of the process that explains the decision to acquire a subsidiary rather than to license an asset with an independent foreign firm.

There are numerous reasons why the costs of international transactions may be lower if performed within the confines of a single firm rather than at arm's-length. Most of these relate to difficulties involved in writing and enforcing contracts between independent firms when licensing is costly and information is imperfect. For example, because the KBA that is the potential subject of a licensing contract is valuable, but (perhaps) easily copied, the original firm may not wish to reveal its technology to an unrelated licensee during contract negotiations for fear that the latter could decline the contract and copy the technology for its own purposes. The licensee, on the other hand, would be unwilling to sign a contract and agree to royalty terms unless it knows the particulars and value of the technology. In such cases, it may be impossible to develop a satisfactory and enforceable contract, forcing the original firm to acquire a subsidiary to which it transfers the KBA (Teece, 1986). This is an informational imperfection in the market for technology actually implies, other things equal, that firms would be more likely to engage in FDI in countries with weaker IPRs and contract-enforcement procedures. An implication is that as IPRs in a particular nation become stronger, firms would tend to choose more technology licensing and joint ventures and less FDI. This is the one identifiable theoretical case in which the strength of IPRs would be negatively associated with FDI flows. It applies most readily to firms that have proprietary technologies that have been expensive to develop but are easily copied, such as pharmaceuticals, agricultural chemicals, and computerized processes. A similar phenomenon is that MNEs may be more willing to train and retain technical and managerial employees who learn the technology and who might otherwise defect from a licensee and form their own competing firms.

An additional contracting problem is that a potential independent licensee may attempt to convince the MNE that the market is smaller than it really is, or will grow to be, thereby limiting its royalties and fees. If there is wide uncertainty on this point, the MNE may prefer to avoid having to share any potential profits by engaging in FDI and controlling local management and sales. This situation also helps explain why some firms set up complementary foreign distribution and servicing facilities (Zeile, 1993).

Multinational enterprises usually experience higher costs of transferring technology through arm's-length transactions because aspects of the technology that are tied up in the firm's human capital, management, know-how, and corporate culture are not easily transmitted (Teece, 1977, 1986). This factor becomes more important the more complicated is the technology or management process, helping to explain the prevalence of MNEs in high-technology industries. Transfer costs also depend on the recipient country's ability to absorb the technology efficiently, indicating that more technology licensing in complicated products and processes would emerge as the human capital base of the economy rises. Also important are the transparency and certainty of the legal and regulatory systems.

In cases where the firm's KBA is a reputation for high quality, an additional incentive for FDI arises. Once a contract is signed, local licensees may not have sufficient

incentives in an independent contract to maintain quality of the product or service, tarnishing the original firm's reputation and profitability. Similarly, there may arise problems with licensees who shirk their marketing or distribution efforts, degrade the product's quality, or sign contracts with competing firms to whose products they devote more attention. These problems are most significant in economies in which monitoring is costly and difficult, the supply of technologies and products to licensees is highly competitive, and contracts are not well enforced. While many contracts are designed to deter such behavior, firms may find it easier to exercise control through FDI.

This analysis suggests strongly that internalization issues favor the development of MNEs in industries where knowledge-based assets are important. Thus, MNEs tend to be associated with intensive R&D programs, advertising efforts, and frequent introduction of complex products. In such sectors, technology transfers are likely to be made internally within the firm, especially when there are contracting, monitoring, and enforcement difficulties. Thus, internalization issues characterize horizontal MNEs.

There are also internalization advantages for vertically integrated MNEs. Largely, these relate to difficulties in setting contract prices when a single buyer (the MNE) proposes to purchase inputs or services, such as a natural resource or assembly operation, from a single seller. In markets where oligopolistic markets may exist on both sides of the transaction, firms are likely to find it advantageous to integrate the activities and establish profit-maximizing internal pricing.

2c. The Role of Intellectual Property Rights

This review of the determinants of FDI leaves much room for IPRs to affect investment flows and the operations of MNEs. The various means by which IPRs influence FDI are subtle and complex. Moreover, it must be emphasized that strong IPRs alone are insufficient for generating strong incentives for firms to invest in a country. If that were the case, recent FDI flows to developing economies would have gone largely to sub-Saharan Africa and Eastern Europe. In contrast, China, Brazil, and other high-growth, large-market developing economies with weak protection would not have attracted nearly as much FDI if investment were heavily dependent solely on IPRs.

Seen in the proper policy context, IPRs are an important component of the general regulatory system, including taxes, investment regulations, production incentives, trade policies, and competition rules. As such, it is joint implementation of a pro-competitive business environment that matters overall for FDI, which I discuss further in Section 4. In this section, I focus strictly on mechanisms by which the strength of IPRs could affect FDI decisions, as seen by economists, in light of our theories of why investment takes place.

Begin with the obvious point that FDI is a forward-looking decision, in that it commits an MNE to long-term operations in a host nation. Therefore, what matters ultimately to the firm is the likelihood that an investment will raise its expected profits.

While there are numerous factors that influence profitability, the issue regarding IPRs is the extent to which the regime affects the firm's perception that it will be able to earn a higher return on its protected KBAs through FDI, relative to other means of earning such returns.

This is a complex subject that permits few definitive conclusions, at least in theory. To sketch an idea of this complexity, consider that a firm with a knowledge-based asset (reputation for quality, new technology, or new product) has several choices in deciding how to service a particular foreign market. First, it can export the good there through standard, arm's-length trade channels. Second, it can choose to produce locally within the firm by undertaking FDI and controlling the production process. Third, it can choose to license or franchise its KBA to an unrelated firm in the host country and allow local production in return for royalties and fees. Finally, it could undertake a joint venture involving some joint production or technology-sharing agreement.[5] These decisions are not made independently and it is possible to observe more than one mode of supply in certain circumstances.

Exports are likely to be the primary mode of supply when transport costs and tariffs are low in comparison to the costs of FDI and licensing. That the volume of exports could depend on the strength of local IPRs has been discussed most fully by Maskus and Penubarti (1995). Strong IPRs in all forms -- patents, trademarks, copyrights, and trade secrets -- provide protection for exporting firms against local copying of the product, suggesting that they would increase the market size facing exporters and induce them to sell more. This "market-expansion effect" is likely to be strongest in countries with large markets (either in absolute size or in terms of per-capita GNP) that have significant technical capabilities for imitating products and technologies. At the same time, such firms enjoy greater market power, allowing them to charge higher prices, though concerns about this "monopoly effect" are often overstated in light of competitive realities (Maskus and Eby-Konan, 1994). It is more likely to be important in countries with small markets and limited technological abilities. Overall, empirical evidence indicates that, other things equal, countries with stronger IPRs do attract more imports, though the effect varies across industries (Maskus and Penubarti, 1995). It is interesting to note that the effect of stronger trademarks seems particularly strong in increasing imports of relatively low-technology goods, such as clothing and other consumer goods, because the ease of knocking off such products under weak trademarks limits foreign firms' incentives to sell them locally. Effectively, stronger trademarks lower the costs of exporting because a firm faces a smaller need to discipline local imitators (through lower prices). This is true also of pharmaceuticals, though they are more likely to be produced under local license, as discussed earlier, than extensively imported. Trade in goods that are difficult to imitate, such as certain kinds of machinery, or for which trademarks are not as significant, such as basic metal manufactures, is less sensitive to

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[5] A further option -- not supplying the market at all -- may pertain in small, poor markets with limited IPRs but I do not consider it further.

variations in IPRs since there is little threat of losing market share to local infringing firms. These results have been refined and strengthened by Smith (1998).

Foreign direct investment is likely to supplant direct exports of a good where trade and transport costs are high,[6] the fixed costs of building foreign plants is low, local productivity is high relative to wage costs, the size of the host market is large, and the R&D or marketing intensity of the product is substantial. As discussed earlier, the last factor is critical for horizontal FDI in differentiated goods and advanced technologies in that it is the knowledge basis -- or intellectual component -- of the firm's advantage that induces it to become an MNE.

Again, FDI exists because firms with some ownership advantage prefer to exploit it through internal organization of multinational activity, with the location of activity depending on local market characteristics. This analysis suggests first that IPRs should take on different levels of importance in different sectors with respect to encouraging FDI. Investment in lower-technology goods and services, such as textiles and apparel, electronic assembly, distribution, and hotels, depends relatively little on the strength of IPRs and relatively much on input costs and market opportunities. Investors with a product or technology that is costly to imitate may also pay little attention to local IPRs in their decision making, though the fact that imitation has become markedly easier over time in many sectors points to the rising importance of IPRs. Firms with easily copyable products and technologies, such as pharmaceuticals, chemicals, food additives, and software, are more concerned with the ability of the local IPRs system to deter imitation. Firms considering investing in a local R&D facility would pay particular attention to local patent protection.

This perspective is consistent with results reported in Mansfield (1994), who surveyed 100 major U.S. firms with international operations in 1991. Intellectual-property executives in firms representing six industries were asked their opinions of the importance of IPRs in their FDI and licensing decisions and to provide their assessments of the adequacy of IPRs in 16 countries. Table 6 reproduces his results regarding type of investment facility. In no industry is there much concern about IPRs protecting the operation of sales and distribution outlets. In the chemical industry, which includes pharmaceuticals, 46% of firms are concerned about protection for basic production and assembly facilities, 71% for components manufacture, 87% for complete products manufacture, and 100% for R&D facilities. This tendency to be more concerned with IPRs, the higher the stage of production, carries over to all sectors. Overall, the chemical industry is the most affected in its decisions to invest, while in all sectors there is a strong concern about local IPRs in siting R&D operations. In a companion paper, Mansfield

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[6] This is a relative comparison only. I do not mean that raising trade barriers would attract FDI, but rather that high tariffs in relation to fixed costs are associated with FDI. In general, however, significant trade liberalization tends to attract FDI for reasons discussed elsewhere.

(1995) demonstrated that these findings hold also for Japanese and German firms considering foreign investments.

Table 7 presents additional results for selected countries with weak IPRs at the time of the survey. India elicits the greatest concern about IPRs; fully 80% of the chemical firms surveyed indicated they could not engage in joint ventures or transfer new technologies to subsidiaries or unrelated firms due to weak protection. Interestingly, in chemicals there is little difference between joint ventures and subsidiaries in this regard. Both investments evidently provide foreign firms with approximately the same level of security about their technologies (though there is more concern about joint ventures in Mexico and Indonesia). However, across all countries licensing to unrelated firms is seen as riskier because of weak IPRs. This situation seems to be true as well in machinery. In the other sectors, however, there is little difference in the willingness to transfer technology through various modes according to weakness in intellectual property rights.

That licensing is seen as insecure relative to investment in the high-technology sectors in countries with weak IPRs points up a subtle aspect of intellectual property protection. Recalling our theory, firms are more likely to undertake FDI than licensing when they have a complex technology and highly differentiated products and when costs of transferring technology through licensing are high (Teece, 1986; Davidson and McFetridge, 1984, 1985; Horstmann and Markusen, 1986). Under these circumstances, it is efficient to internalize the costs of technology transfer through FDI in a wholly-owned or majority-owned subsidiary. As IPRs improve, licensing costs should fall because it becomes easier to discipline licensees against revelation or appropriation of proprietary technology and against misuse of a trademark. Thus, for a given level of complexity of innovations, we would expect to see licensing displace FDI as IPRs are strengthened.

It is useful to summarize the predictions about IPRs, FDI, and technology transfer. First, investment and technology transfer are relatively insensitive to international differences in IPRs in sectors with old products and standardized, labor-intensive technologies. Here, FDI is influenced by factor costs, market sizes, trade costs, and other location advantages. Second, other things equal, FDI representing complex but easily copied technologies is likely to increase as IPRs are strengthened because patents, copyrights, and trademarks increase the value of KBAs, which may be efficiently exploited through internalized organization. Third, to the extent that stronger IPRs reduce licensing costs, FDI could be displaced over time by efficient licensing. Finally, whatever the mode, the likelihood that the most advanced technologies will be transferred rises with the strength of IPRs.

One interesting implication of this analysis is that rapidly growing developing countries should develop a natural interest in improving their IPRs regime over time as they move up the "technology ladder" to an ability to absorb and even develop more sophisticated innovations. This is perhaps the strongest argument to make in favor of adopting stronger protection in nations such as Korea, Brazil, Mexico, and Malaysia. In the early stages of their industrial growth, such countries have an interest in being able

freely to imitate imported technologies, calling for limited protection. As they develop, however, they should become increasingly interested in tightening IPRs, both in order to attract the most modern technologies and to encourage their own innovation. Indeed, this prediction is borne out by the pattern of patent protection across countries, as shown in Figure 2.

Economists cannot be entirely optimistic about the implications of stronger IPRs for technology transfer, however. Technological information is diffused from one firm to another, or from one country to another, through numerous channels. Patents themselves have potentially ambiguous effects. They directly facilitate additional information transfer (if not know-how diffusion) by disclosing the details of inventions in application materials. This information then is available for use by local firms to develop follow-on products that do not violate the scope of the original patent. As more countries provide and enforce patents, there should be additional global innovation and patenting, with a positive impact on follow-on innovation. On the other hand, patents could slow down technology diffusion by limiting the use of key technologies through restrictive licensing arrangements. This view of patents has long been held in numerous developing nations and still commands widespread respect in some quarters.

In fact, recent theoretical treatments of the impacts of IPRs on technology diffusion in growth models bear mixed messages. In some models, technology is transferred through imitation by firms in developing countries. When the global IPRs system is strengthened by the adoption of minimum standards, imitation becomes harder as foreign patents are enforced. The rate of imitation declines and, contrary to what might be expected, this slows down the global rate of innovation also. This is because if innovative firms expect slower loss of their technological advantages they can earn higher profits per innovation, reducing the need to engage in R&D (Helpman, 1993; Glass and Saggi, 1995).

This result is sensitive to model assumptions and may not hold up to alternative specifications. Indeed, Lai (1998) finds that product innovation and technology diffusion are strengthened under tighter IPRs if production is transferred through FDI, rather than through imitation. This points clearly to the need for developing economies to remove impediments to inward FDI as they strengthen their intellectual property systems. Vishwasrao (1994) demonstrates in a game-theoretic setting that, while the mode of technology transfer is affected by IPRs protection, with internalization through FDI the preferred mechanism in countries with weak patents, the quality of technologies transferred rises with stronger IPRs. Taylor (1994) also shows theoretically that technology transfer expands with stronger patents when there is competition between a foreign innovator and a domestic innovator. A failure to provide patents removes the incentive for the foreign firm to license its best-practice technologies. Rockett (1990) finds that in cases where local imitation requires knowledge that is available only through the licensed use of technology, the foreign licensors make available lower-quality technologies. This reduces the licensee's incentive to imitate the technology, reducing both the quality and extent of knowledge transfer.

Furthermore, an optimistic view comes from studies of international patenting behavior (Eaton and Kortum, 1996). The value of patent rights varies across countries and technology fields, but is typically significant in important developing countries, suggesting that stronger patents would induce further R&D, patent applications, and patent working. There appear to be considerable spillovers of technological knowledge through patenting and trade in patented products. Indeed, Eaton and Kortum claim that, except for the United States, the OECD countries have derived substantial productivity growth from importing knowledge through patents.

The importance of technology transfer through trade in technologically advanced inputs (machinery, chemicals, software, producer services, and so on) should also be emphasized. There is evidence that such trade is responsible for significant amounts of productivity gains across borders and a crucial part of the technology convergence that has emerged among the developed economies in recent decades (Coe and Helpman, 1995). This suggests that emerging economies have a joint interest in trade liberalization and linking their IPRs systems with those of the developed countries. The resulting gains in productivity spillovers could easily outweigh costs associated with additional market power.

Before leaving this theoretical section, a final comment about the emerging system of global IPRs should be mentioned because it is little appreciated in the policy arena. To the extent that *different* levels of IPRs across nations acts as a locational determinant of FDI and technology transfer, the trend toward harmonization of IPRs within the TRIPs agreement will offset such advantages. That is, it will increase the attractiveness of countries that are strengthening their IPRs, but reduce the *relative* attractiveness of those with strong IPRs already in existence. This harmonization of global minimum standards presents great opportunities for firms that develop technologies and products because they will no longer have to pay as much attention to localized protection and enforcement problems in safeguarding their proprietary information. In turn, they can focus their R&D programs on those areas with the highest global payoffs. Ultimately, however, it means that IPRs no longer will play much role in determining locational choice.

2d. Intellectual Property Rights in a Broader Context

The discussion so far has focused on a narrow interpretation of how IPRs interact with incentives for FDI and technology transfer. Many analysts, however, claim that strong IPRs play a much larger role in signaling to potential investors that a particular country recognizes and protects the rights of foreign firms to make strategic business decisions with few government impediments (Sherwood, 1990). In this view, trade liberalization, or the removal of market restrictions at the border, is insufficient to provide assurances that an economy is becoming more open to international commerce. Market access could remain blocked by inefficient investment regulations, limited rights of establishment, domestic credit, production and marketing controls, arbitrary or punitive taxes, licensing restrictions, and weak IPRs. Indeed, the issue of attaining market access

through rationalization of these internal barriers to competition is now at the top of the international trade-policy agenda (Hoekman, 1997). Some also consider stronger IPRs to convey a commitment to move from opaque to transparent legal systems, from arbitrary pronouncements to unbiased enforcement of commercial laws, and from corruption to professionalism in public management.

Because intellectual property protection has taken on increasing importance to MNEs, the adoption of stronger regimes has become a primary signaling device that governments in emerging economies use to indicate a shift toward a more business-friendly environment. The objective is to attract more FDI through this signal, whatever the particular incentives that may be generated in various sectors by stronger IPRs. To date, there is little evidence supporting the responsiveness of investment to this signal, but there is a widespread and growing belief in its importance in emerging economies. This phenomenon explains why several poor countries with limited technical capabilities unilaterally have strengthened their IPRs laws and enforcement in the 1990s, despite serious questions about the wisdom of doing so. They prefer not to be left behind in the global competition for capital and technology. It also helps explain the universal acceptance of the TRIPs agreement.

3. The Econometric Evidence on FDI, Technology Transfer, and Growth

Despite the apparent importance that IPRs could play in FDI decisions, until recently they have not been incorporated into empirical work by economists on the determinants of investment. This oversight reflects both skepticism about the significance of IPRs and the difficulty of measuring both IPRs and their impacts. Rather, economists have focused on variables capturing the influence of macroeconomic factors, risk, wage costs, trade impediments, industrial structures, and taxes, infrastructure, and other incentives or disincentives to investment. As may be expected, there is considerable diversity in the findings. This is an enormous literature that cannot be reviewed here in any detail. However, a brief overview of a few key results is useful in order to place IPRs into some perspective.

3a. Main Determinants of FDI

It is most convenient to list the major influences on an MNE's decision to invest in various countries by grouping them into types. Within each type, I attempt to assess the relative importance of each factor, though it is impossible to do this in general terms because the factors are interrelated and they vary across countries and time periods. In interpreting these factors, recall the simple point that a decision to invest depends positively on the investment's expected future profitability and negatively on its expected profit variability, or risk. The discussion here relies on results taken from Wheeler and Mody (1992), Barrell and Pain (1996), Kravis and Lipsey (1982), Culem (1988), Grubert and Mutti (1991), and Amirahmadi and Wu (1994).

Macroeconomic Factors

All studies agree that a major factor attracting FDI is market size in the recipient country. Market size is measured first by real GNP or GDP. The larger is the market, the greater is the incentive to enter through FDI in order to take advantage of scale economies. For example, Wheeler and Mody estimate that the elasticity of incoming manufacturing FDI with respect to real GDP is 1.24 and this coefficient is highly significant. Thus, a one-percent increase in real GDP could be expected to increase FDI by more than one percent. This elasticity rises sharply with the level of development; for poor countries the elasticity of FDI with respect to market size is 0.24 Note that the importance of market size favors regional trade agreements as a means of encouraging inward FDI to the extent that such agreements expand the size of the region that local production can service without restrictions.

In a related vein, the rate of growth of real GDP has a strong positive effect on incoming FDI. This is because of an acceleration principle; as the economy grows additional investment (including FDI) is required to meet its needs. This fact is consistent with the concentration of FDI going to developing economies in East Asia and Latin America in the last ten years.

As indicated in the theoretical discussion earlier, the level of GNP per capita affects both the amount of investment and its nature. Total investment rises with the level of economic development because such increases shift preferences toward goods with a higher technology content or with more product differentiation and higher quality. This factor also causes FDI to become more horizontal as development proceeds.

Finally, some analysts emphasize the role of exchange rate changes in influencing FDI flows. Barrell and Pain (1996) find that a current real appreciation of the dollar induces U.S. firms to bring forward their planned FDI in OECD countries because of cheaper local acquisition costs, affecting the temporal pattern of investment if not its stock in the long run. However, an expected future real appreciation of the dollar tends to postpone U.S. investment. Finally, considerable riskiness in real exchange rates tends to increase FDI because MNEs find it profitable to reduce exports but offset this reduction by increasing foreign production (Cushman, 1985). Overall, however, there is relatively little agreement among economists that such exchange-rate factors are systematic and important in the long run.

Relative Input Costs

A consistent finding is that differences in real unit labor costs between the source and host countries are an important determinant of locational decisions. Wheeler and Mody (1992) find that this is the most significant variable in explaining U.S. investment in the electronics industry, with an average elasticity of 1.99. That is, a fall in relative labor costs of one percent raises FDI by 1.99% in electronics. This elasticity is even higher in the poorest countries. The relative-wage effect is much smaller, though significant, in explaining total manufacturing investment. Thus, vertical investment (proxied by electronics FDI) is more sensitive to wage differences than is horizontal investment.

Several studies include relative costs of capital (interest rates or user costs of capital) in the host and source countries in order to account for the decisions of MNEs on where to finance the investment. While these costs do influence the location of financing, they seem to have relatively little impact on the extent of FDI.

Finally, it is clear that much vertical investment in extractive sectors is driven by the abundant local availability and low cost of natural resources. This has some effect on decisions to locate assembly operations that rely on resource inputs, such as processed foods.

Agglomeration Effects

Economists have spent considerable effort recently analyzing the importance of agglomeration processes. Agglomeration occurs if, as the number of firms in a particular location rises, the costs of production for all firms fall together. A primary reason for this is that concentrated activity encourages the development of higher quality, differentiated producer inputs (such as engineering skills and finance). As the pool of specialized labor expands, new firms find it advantageous to locate in the area (Markusen, 1989; Krugman, 1991). Hanson (1996) finds considerable evidence of such effects in the Mexican apparel sector. That it is significant in FDI decisions has been shown by Wheeler and Mody (1992), among others.

It is clear that the effectiveness of agglomeration in attracting FDI depends on the amount and quality of supporting infrastructure in the economy. Infrastructure refers to facilities for trade, transportation, communication, and energy use. It also depends on market size. Thus, if a country is interested in industrial development through attracting investment into a particular region, it must pay attention to developing infrastructure and establishing a large and vibrant market (even if exported) for the output.

Policy Variables

There is evidence that FDI is sensitive to differences across countries in corporate tax rates (Grubert and Mutti, 1991). These authors find that a reduction in the host-country tax rate from 20% to 10% could increase the stock of plant and equipment owned

by U.S. affiliates in a particular country by 65%. These findings are controversial among economists and await further testing, but taxes are potentially important in attracting FDI.

The same authors find that discincentives to investment, as proxied by dummy variables for countries that do not allow more than 50% equity ownership for foreign investors, have a strong negative effect on inward FDI. Wheeler and Mody (1992) also show that a variable relying on investment regulations, such as local content requirements, ownership limits, and profit repatriation controls, have a negative impact on FDI. Thus, such policies are effective in limiting investment, if that is their goal. In contrast, tax breaks and other production incentives, such as those found in Export Processing Zones, have variable effectiveness at encouraging FDI across countries (Amirahmadi and Wu, 1994). They seem to have been particularly effective in China, with over 12% of FDI going to such zones in the 1980s, though this finding does not control for other Chinese influences.

Trade policy also strongly affects incentives for FDI. The traditional view is that high tariffs would encourage incoming FDI in order to produce behind the tariff walls what could not be exported to a protectionist country. A number of studies of OECD data from the 1970s and early 1980s were consistent with this theory. Such protection rarely attracted much investment into developing countries, however, as their governments also tended to impose significant investment barriers in order to reserve local markets for domestic firms. The issue has become more ambiguous as globalization has proceeded in the last decade, however. On the one hand, trade barriers provide a protected market for firms, which encourages location of final goods production. However, they also restrict access of MNEs to the latest international technologies available through importing machinery, chemicals, and other key inputs. International firms place increasing importance on the ability to buy producer inputs at cheapest cost and highest quality, suggesting that closed economies are likely to attract less investment today than they may have in the past. This observation is consistent with the findings in Wheeler and Mody (1992). Indeed, high tariff rates appear to reduce FDI in China markedly (Wang and Swain, 1994). Moreover, it is increasingly apparent that FDI flows and merchandise trade increase together, rather than substitute for one another, in rapidly growing economies. Thus, trade liberalization is now an important complement to programs to encourage investment.

Finally, both FDI and technology transfer through licensing are likely to rise as an economy's technological capacities improve. Key in this process is the development of an abundant human capital stock, because labor skills are required for absorbing, using, and improving incoming technology. Thus, educational competence, particularly in technical and managerial areas, is significant (Teece, 1986). Also important are professional support programs for technology transfer and technology diffusion.

Risk Factors

A final set of determinants that economists analyze relates to economic and political risks facing particular investors. Numerous studies demonstrate that MNEs are less likely to invest in countries with risks of expropriation, limited and variable profit repatriation rules, terrorism and violence, corruption, bureaucracy and red tape, ineffective legal systems, and considerable income inequality. Thus, both macroeconomic certainty and political stability are important to MNEs. How significant this factor is in relation to others depends on the type and duration of investment.

One related finding worth mentioning is that countries that repress labor organization rights, in the hope that a stable, quiescent, and low-wage labor force will attract FDI, do not receive more investment as a result (OECD, 1996). In this context, it is far less important to provide firms with artificial advantages and far more important to develop a stable and transparent set of rules for business operation.

3b. Evidence on Intellectual Property Rights

A few studies have included the strength of IPRs in different countries as a potential determinant of FDI. Recall from our theoretical discussion that this is essentially an empirical question. While the weight of theory lies on the side of a positive impact, it is ambiguous overall.

Three early studies (Ferrantino, 1993; Mansfield, 1993; Maskus and Eby-Konan, 1994) could not find any relationship between crude measures of intellectual property protection and the international distribution of FDI by U.S. multinational enterprises. These articles suffered from limited specification of models and poor measurements of IPRs and their results should be largely discounted.

Two recent studies are more noteworthy. Lee and Mansfield (1996) used survey results to develop an index of perceived weakness of IPRs in destination countries on the part of U.S. firms. They regressed the volume of U.S. direct investment in various countries over the period 1990-1992 on this index, along with measures of market size, the past investment stock, the degree of industrialization, a measure of openness, and a dummy variable for Mexico to control for its special investment relationship with the United States. They find that weakness of IPRs has a significant negative impact on the location of American FDI. Further, in a sample of chemical firms the proportion of FDI devoted to final production or R&D facilities is negatively and significantly associated with weakness of protection. Moreover, the weakness of IPRs had much less impact on the decisions of firms with limited ownership (less than 50%) of local affiliates because such firms would be unlikely to transfer their frontier technologies in any case. From these results, it appears that both the volume and quality of investment are diminished in countries with limited property rights.

An extended approach is taken by Maskus (1998). He argues that the prior literature is incorrectly specified in that it does not recognize the joint decisions made by MNEs. In particular, multinational firms may choose to export, raise sales from existing foreign operations, increase investment, or transfer technology directly in response to stronger patent rights. He estimates a simultaneous set of equations to capture these joint impacts, controlling for market size, tariff protection, the level of local R&D by affiliates, distance from the United States, and investment incentives and disincentives provided by local authorities. This is done for a panel of 46 destination countries, using annual data from 1989-1992. The index of patent strength is taken from Maskus and Penubarti (1995).

Table 8 lists the results from the preferred specifications, with coefficients expressed as elasticities. It appears from these calculations that FDI, as measured by the asset stock, reacts positively to patent strength in developing countries. These are elasticities, so that the data suggest that a one percent rise in the extent of patent protection would expand the stock of U.S. investment in that country by 0.45%, other things equal. This is a significantly positive elasticity and, indeed, trails only the responsiveness of FDI to policy incentives. While these results await considerable further testing for their robustness, they suggest that FDI is sensitive to patent rights, consistent with Mansfield's work.

3c. Other Empirical Work on the Effects of IPRs

There is evidence that a policy of weak IPRs in technology-recipient nations reduces the quality of technology transferred. Drawing on a study of collaboration agreements between British and Indian firms, Davies (1977) concludes that difficulties in securing property rights over the profits accruing to technical information raise powerful barriers to information trades between developed and developing economies. Contractor (1980) studies a sample of 102 technology licenses provided by U.S. firms and his regression results support the hypothesis that returns to a technology supplier increase with patent protection in the recipient nation. He finds that technologies transferred to developing countries tend to be significantly older than those transferred to industrialized economies. While these findings are dated, they point to the significance of patent regimes in attracting technology through licensing.

Evidence also exists that the effectiveness of IPRs protection in inducing technical innovation and technology transfer depends on the trade orientation of an economy. In a survey of more than 3000 Brazilian companies, Braga and Wilmore (1991) find that firms' propensities to develop their own technologies or to purchase them from foreign sources are both negatively related to the degree of trade protection they enjoyed. Thus, in closed economies, protecting IPRs may not expand innovation much because the competitive conditions are inadequate to stimulate it. Gould and Gruben (1996) performed cross-country growth regressions using data on patent protection, openness of trade regimes, and country-specific characteristics. They find that patent strength is an important

determinant of economic growth across countries and that this effect is stronger in relatively open economies. In their preferred specification, estimates suggest that growth induced by IPRs protection (at moderate levels of protection among developing countries) is approximately 0.66 percent higher per year in open economies than in closed economies. This finding bears the important implication that as countries liberalize their trade regimes, accompanying strengthening of IPRs provides a more affirmative path to economic growth.

4. Policies to Attract Beneficial FDI and Technology Transfer

This extensive review indicates that, in theory, investment and licensing flows do not necessarily increase with a strengthening of intellectual property rights, but there is emerging empirical evidence in favor of that hypothesis. It seems increasingly to be taken for granted that foreign direct investment and the acquisition of new technologies through FDI and licensing are beneficial for the recipient country. As discussed in this section, there is a strong presumption in this direction but it is not a necessary outcome in all situations. Rather, it is important that such flows result in stronger competition in order to ensure these gains for the long term. After a brief review of the potential benefits and costs of these activities, I discuss components of a coherent policy approach to enhance the likelihood that stronger IPRs in an emerging economy will contribute to more dynamic competition.

4a. Benefits and Costs of Inward FDI and Licensing

Although their impacts vary across countries and over time, FDI and licensing bear considerable promise for improving efficiency and growth in developing countries, particularly those that are scarce in capital, are far from the efficient production frontier, and have limited managerial and entrepreneurial talents. These flows provide access to the technological and managerial assets of foreign MNEs, which provide both a direct spur to productivity and significant spillover benefits as they diffuse throughout the economy. This diffusion comes through numerous channels, including the movement of newly trained labor among enterprises, the laying out of patents, product innovation through the legitimate "inventing around" of patents and copyrights, and the adoption of newer and more efficient specialized inputs that reduce production costs (software is particularly important in this context). Further, the introduction of efficient and competitive international enterprises can stimulate local entrepreneurship and innovation by increasing competition and raising demands for sub-contracting. There could also be a beneficial demonstration effect for local firms.

Thus, successful adoption of competition-enhancing FDI and licensing should materially improve the knowledge base of the economy and move it toward the globally efficient production frontier. There is undeniable evidence that developing countries suffer from significantly lagging labor productivity and managerial efficiency, related in part to a failure to adopt newest technologies (Trefler, 1995; Baumol, *et al*, 1992). Recent

experiences in numerous developing economies indicate that liberalization of trade policies and investment regimes can have significantly positive growth impacts in the medium term, even if there is some initial economic adjustment period. Further, there is little doubt that a major determinant of relatively rapid economic growth and industrial restructuring in East Asia has been access to foreign technologies through both licensing and FDI in addition to importation of advanced machinery and other technical inputs (World Bank, 1993). There are good reasons to expect these growth effects to be long-lasting because wider access to knowledge allows economic expansion to continue without necessarily running into diminishing returns. Additional benefits include access to a wider variety of specialized products, inputs, and technologies, a deeper and better-trained skilled labor pool, and rising real wages.

These beneficial impacts of inward FDI and technology transfer do not come without costs. If there are only insignificant linkages to other economic sectors, FDI may operate in enclaves, with limited spillovers into technologies adopted and wages earned by local firms and workers.[7] This limited diffusion could be insufficient to compensate the economy for the profits taken out by the MNE. That is, because profit repatriation and license fees are the payments emerging countries make for incoming capital, technology, and advanced producer services, the terms of this exchange could be unfavorable in a social sense, if not in a private sense. This situation is aggravated to the extent that MNEs engage in abusive practices of their protected market positions in exploiting stronger IPRs. Such abuses could emerge in setting restrictive licensing conditions, requiring technology grant-backs, engaging in tied sales, tying up technology fields through cross-licensing agreements, establishing vertical controls through distribution outlets that prevent product competition, price discrimination, and predation against local firms. Thus, countries could find certain sectors of their economies coming under increasing control of MNEs through exploitation of their specific advantages, including brand names, patented technology, marketing skills, and economies of scale.

While these are possible and real costs, there is little evidence that they are systematic problems in many countries. More fundamentally, they relate to the failure of an economy to erect a policy system that promotes the maximum gains from FDI. Enclave production, for example, makes sense only when the subsidiary is encouraged to produce only for export rather than to compete locally as well. Firms that are provided full access to local and regional markets are more likely to erect complementary business systems (production, distribution, and services) that compete more widely in the economy and generate greater spillover benefits. Abusive practices are possible only to the extent that monopoly positions are protected and tolerated. Many developing economies have not yet developed appropriate competition rules to deal with these issues, preferring instead to forego the benefits of FDI and licensing by claiming an unwillingness to suffer such abuses, at least at the hands of foreign firms.

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[7] For example, Aitken, *et al*, (1996) provide evidence that U.S. multinationals operating in Mexico and Venezuela pay significantly higher wages than average to their own employees but these wage impacts have not spread to other parts of the economy.

4b. Intellectual Property Rights

Seen properly, IPRs do not necessarily generate monopoly market positions that result in high prices, limited access, and exclusive use of technologies. They are more similar to standard property rights, in that they define the conditions within which a right owner competes with rivals (UNCTAD, 1996). Except in particular sectors, cases are infrequent in which a patent holder or copyright owner becomes a strong monopolist. Rather, there are likely to be competing products and technologies, including new ones that do not infringe the property right. Much depends on the scope of the product and process claims protected and on the technical characteristics of the invention. For example, narrow patent claims are relatively easy to invent around in generating follow-on innovation.

Thus, IPRs may encourage dynamic competition, even if they sometimes diminish competition among existing products. Advocates of strong IPRs maintain that they create competition with long-run consumer benefits. For example, survey evidence indicates that patent disclosure requirements are significant mechanisms for diffusing technical information to competitors within a short period (Mansfield, 1985). The information may then be used to develop a new product or process that competes with the original. This incremental nature of innovation is a key fact in most technical progress and generally builds dynamic competition rather than investing unassailable market power. Thus, patents, copyrights, and other IPRs can raise the costs of imitation but likely do not materially retard competing product introduction. Moreover, patents and trademarks provide greater certainty to firms, lower the costs of transferring technology, and facilitate monitoring of licensee operations. Additional licensing could then result in greater adaptive innovation in user firms.

In this view, stronger IPRs in developing economies promise long-term growth and efficiency benefits as they attract additional FDI and licensing and spur further follow-on innovation and technology spillovers. This outcome is far more likely, however, if the implementation of stronger IPRs is accompanied by complementary policies that promote dynamic competition.

4c. Broader Policy Approaches

Overall, it is wider market access to the local economy, in conjunction with sensible competition rules and related regulatory systems, that promise to procure the greatest net benefits from incoming investment. Thus, emerging economies that wish to increase their attractiveness to foreign investors would be advised first to proceed with significant market liberalization. While the Uruguay Round committed most countries to cutting trade barriers, further reduction of tariffs and removal of NTBs on a credible and irrevocable schedule would provide an important signal of openness to foreign investors. Regional trade integration, particularly with developed economies that could be the source of additional FDI, could assist in this process. However, such agreements also bear

potential for trade and investment diversion and should be considered carefully in each instance.

Developing countries need also to expand rights of establishment in services, in light of the complementary nature of FDI in production and services with merchandise trade. Removal or rationalization of various investment regulations, such as local content requirements, equity restrictions, and limitations on profit repatriation, would expand incentives to invest. It is likely that such regulations generate net welfare losses for the countries imposing them, in any case. Finally, continued privatization of state-owned enterprises could attract further capital as it raises domestic competition.

Recalling the econometric work on determinants of FDI, it is important for emerging economies to pursue sound and stable macroeconomic policies. Development of modern and efficient infrastructure is also important and could be instrumental in promoting agglomeration gains that attract cumulatively higher amounts of both domestic and foreign investment. There is also evidence that FDI flows are sensitive to international variations in taxes and incentives. While this provides some argument for fiscal advantages, such as tax holidays, accelerated depreciation allowances, tariff exemptions, and EPZs, it suggests more powerfully the gains from establishing relatively low tax rates and uniform tax treatment of all investors, domestic and foreign. Certainty and stability in taxes are more effective in promoting investment than are discriminatory and arbitrary policies, while uniform tax schedules can generate considerable efficiencies in resource usage (Konan and Maskus, 1997). Similarly, there is no evidence that repression of labor rights aids in attracting FDI or promoting exports. Rather, firms are more interested in market size, stability, and growth. In any case, the technical superiority of any investments that would be so attracted in labor-intensive sectors is likely to be quite limited.

An important component of any program to attract high-quality FDI and technology transfer is the development of a competent indigenous technological capacity. In the first instance, this calls for public and private investments in education and training and the removal of impediments to the acquisition of human capital. It also points toward the development of national innovation systems that promote dynamic competition (UNCTAD, 1996). This involves supporting basic research capabilities, removing disincentives for applied R&D and its commercialization, instituting incentive structures that help stimulate local innovation, and taking greater advantage of access to scientific and technical information that exists within the global information infrastructure. To date, governments and firms in many developing countries have made inadequate progress in this regard.

Intellectual property rights are an important component of any technology development program. In implementing stronger IPRs as required by the TRIPs Agreement or in other policy initiatives, emerging economies will need to strike a balance between needs for technology acquisition, market access, and diffusion. Most nations will wish to adopt a set of IPRs regulations that do not significantly disadvantage follow-on

inventors and creators, making use of sensible fair-use exemptions, compensated compulsory licensing under tightly defined conditions, and carefully defining the scope of protection. Furthermore, it will be important to implement effective competition rules to ensure that IPRs systems are used advantageously. Each of these policy initiatives requires the development of considerable administrative and judicial expertise. For example, countries may wish to monitor the terms of key technology licensing agreements or to intervene in contracts for the development of indigenous public resources.

5. Concluding Remarks

This paper has reviewed recent trends in FDI and licensing, along with considering the available evidence on what factors are most important in making these decisions. The fundamental message here is that, while there are indications that strengthening intellectual property rights can be an effective means of inducing additional inward FDI, it is only a component of a far broader set of important influences. Emerging economies should recognize the strong complementarities among IPRs, market liberalization and deregulation, technology development policies, and competition regimes. These are complicated issues, leading to complex tradeoffs for market participants. Governments in emerging economies would do well to devote considerable attention and analysis to means for assuring they will achieve net gains from stronger IPRs and additional IPRs and licensing over time.

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Table 1. Total Foreign Direct Investment Flows, Selected Countries ($ million)

Country	1987 Inward	1987 Outward	1990 Inward	1990 Outward	1995 Inward	1995 Outward
United States	58220	28360	47920	29950	60230	95530
Canada	8040	8540	7855	4725	10786	5761
Japan	1170	19520	1760	48050	60	22660
Germany	1820	9760	2530	24210	8940	34890
United Kingdom	15696	31335	32430	19320	32210	40330
Spain	4571	745	13987	3522	6250	3574
Poland	12	8	89	na	3659	42
China	2314	645	3487	830	35849	2000
Korea	616	540	788	1056	1776	3529
Malaysia	423	na	2332	na	4348	na
Indonesia	385	na	1093	na	4348	603
Singapore	2836	206	5575	2034	6912	3906
Thailand	352	170	2444	140	2068	886
Egypt	948	19	734	12	598	93
Kenya	39	31	57	na	33	na
Turkey	115	9	684	16	885	113
Mexico	2621	na	2634	na	6963	na
Argentina	-19	na	1836	na	1319	155
Brazil	1169	138	989	665	4859	1384
Chile	891	6	590	8	1695	687

Source: International Monetary Fund, *Balance of Payments Statistics*

Table 2. Net Receipts on Royalties, License Fees, Business Services, and Direct Investment Income, Selected Countries ($ million)

Country	1987 R & LF	1987 Bus Serv	1987 DII	1990 R&LF	1990 Bus Serv	1990 DII	1995 R&LF	1995 Bus Serv	1995 DII
United States	8320	10200	32190	13500	14810	55600	20660	12870	57480
Japan	-2520	-6630	2000	-3550	-11200	2550	-3350	-7500	6850
Germany	-1290	-1670	-1400	-1810	-1980	-510	-2660	-5270	-640
United Kingdom	16	14334	6373	-450	7010	15460	1710	7160	20270
Spain	-350	661	-1482	-932	-670	-2098	-1073	-1407	-1179
Poland	na	178	na	na	-22	na	-40	-231	-1028
China	na	630	8	na	575	na	na	-3190	-9952
Korea	-47	-65	-88	-99	-892	-145	-2086	830	-242
Malaysia	na	-318	-1077	na	-527	-1863	na	-1492	-3785
India	-40	-144	na	-71	252	na	-68[a]	-256[a]	na
Egypt	na	-482	43	na	-322	233	-50	694	-149
Turkey	na	827	-80	na	1622	-161	na	2883	-272
Mexico	-212	-371	-794	-307	-636	-2304	-370	-749	-2664
Brazil	-36	-560	-1527	-42	-1151	-1865	-497	-370	-2044
Chile	-30	0	-218	-37	-142	-333	-49	22	-890

Source: International Monetary Fund, *Balance of Payments Statistics*
Note: [a]Data for 1992

Table 3. U.S. Foreign Direct Investment Position in Selected Countries ($million)

Country	1985	%Total	1990	%Total	1994	%Total
World	230250	100.0	426958	100.0	612109	100.0
Europe	105171	45.7	213368	50.0	300177	49.0
EU-12	83898	36.4	179102	41.9	251149	41.0
Germany	16764	7.3	27480	6.4	39886	6.5
U.K.	33024	14.3	72343	16.9	102244	16.7
Spain	2281	1.0	7802	1.8	8048	1.3
Turkey	234	0.1	515	0.1	1084	0.2
Canada	46909	20.4	69106	16.2	72808	11.9
Asia-Pacific	33983	14.8	63585	14.9	108402	17.7
Japan	9235	4.0	22511	5.3	37027	6.0
China	na	na	356	0.1	1699	0.3
Hong Kong	3295	1.4	5994	1.4	11988	2.0
Korea	743	0.3	2677	0.6	3612	0.6
Malaysia	1140	0.5	1513	0.4	2382	0.4
India	383	0.2	368	0.1	818	0.1
Latin America	28261	12.3	70752	16.6	114985	18.8
Mexico	5088	2.2	10255	2.4	16375	2.7
Brazil	8893	3.9	14268	3.3	18977	3.1
Chile	88	0.0	1876	0.4	4457	0.7
Africa	5891	2.6	3592	0.8	5472	0.9

Source: U.S. Department of Commerce, *Survey of Current Business*
Data are on Historical Cost Basis

Table 4. U.S. Foreign Direct Investment Position by Major Sector in Selected Countries, 1994 ($ million)

Country	TMF	F&K	CHEM	MET	MAC	EEQ	TREQ	OMF	TRD	B&FIN	SVC
World	220328	28796	51638	10974	30425	20922	28057	49516	67303	204574	22994
Europe	108655	13678	29239	5481	16773	8631	11731	23121	36435	107384	14813
EU-12 101009	11453	28328	5105	15527	7671	11042	21883	23584	86595	12825	
Germany	22131	2103	4152	1469	4359	1306	5180	3562	4049	8999	946
U.K. 27247	3327	4560	1656	5022	2941	3201	6539	5564	47477	5034	
Spain	4512	775	754	171	444	441	1104	821	824	2014	413
Turkey	693	139	130	na	na	4	133	86	19	110	na
Canada	35037	3600	5856	2822	2024	1820	8548	10369	7006	12951	3509
Asia-Pacific	41577	4205	8870	1189	9019	7915	2875	7504	16829	20685	3259
Japan	15844	1121	3634	298	4425	1665	1842	2860	6844	6820	496
China	765	128	188	10	29	na	na	89	131	na	na
Hong Kong	1902	na	99	na	435	492	na	652	4209	4107	698
Korea	1391	261	291	66	40	195	78	460	422	1630	29
Malaysia	1582	5	66	na	na	1209	0	208	142	210	0
India	308	25	166	9	84	5	5	14	37	442	23
Latin America	31932	6949	6534	1237	2436	1989	4819	7968	6574	61019	885
Mexico	10697	2792	2169	na	na	579	1949	2390	994	1982	261
Brazil	13681	1794	2268	732	1904	935	2271	3777	402	3657	129
Chile	376	56	154	na	2	na	na	190	262	1954	na
Africa	1274	292	na	207	na	47	82	266	248	922	86
% Developed	72	64	75	78	76	58	79	73	75	62 (77)	82
% Developing	28	36	25	22	24	42	21	27	25	38 (23)	18

Source: U.S. Department of Commerce, *Survey of Current Business*. Abbreviations: TMF = total manufacturing; F&K = food and kindred products; CHEM = chemicals and allied products; MET = primary and fabricated metals; MAC = industrial machinery; EEQ = electrical equipment; TREQ = transport equipment; OMF = other manufacturing; TRD = wholesale trade; B&FIN = banking and finance; SVC = services.

Table 5. Indicators of Multinational Activity in U.S. High Technology Industries, 1989[a]

Sector	Affiliates per Parent	Total Assets Abroad ($bil.)	Assets in EC's (%)[b]	Intrafirm Sales (%)[c]	Intrafirm Trade with U.S. ($bil.)
Industrial Chemicals and Polymers	14.3	63.9	10.6	31.8	5.9
Pharmaceuticals	33.8	40.5	11.0	21.9	2.2
Industrial Machinery	6.4	22.4	19.2	29.4	6.4
Office Machines and Computers	11.1	86.8	23.3	49.8	16.1
Telecommunications Equipment	11.3	20.0	34.3	30.1	1.9
Electronic Components and Circuits	5.2	10.1	41.3	49.4	11.4
Electrical Machinery	9.1	11.0	22.9	18.5	2.2
Motor Vehicles and Parts; Aircraft	10.5	122.3	12.2	19.4	50.6
Printing, Publishing, Recordings	5.3	5.7	5.5	4.4	0.1
Precision Instruments	5.8	21.9	12.0	33.1	4.8
All Manufacturing	8.5	593.8	15.6	30.8	114.8
Advertising	14.9	4.4	15.9	0.1	0.0
Motion Pictures	8.9	5.0	10.0	0.1	0.0
Health Services	2.9	1.6	31.7	0.0	0.0
Engineering, Architectural Services	4.6	2.0	18.4	8.5	0.01
Finance, except banking	6.0	171.6	24.6	23.8	0.0
All Services[d]	5.0	219.9	21.2	17.7	31.8

Source: U.S. Department of Commerce, *Benchmark Survey: U.S. Direct Investment Abroad, 1989*.

Notes: [a]Data are for majority-owned non-bank affiliates of non-bank U.S. parents; [b]Percentage of assets not located in Canada, Europe, Japan, or Australia; [c]Intrafirm sales as a percentage of total sales; [d]Wholesale trade, finance (except banking), and services.

Table 6. Percentage of Firms Claiming that the Strength or Weakness of Intellectual Property Rights Has a Strong Effect on Whether Direct Investments Will Be Made, by Type of Facility, 1991

Sector	Sales and D Distribution	Basic Production and Assembly	Components Manufacture	Complete Products Manufacture	R&D Facilities	Average
Chemicals	19	46	71	87	100	65
Transport Equipment	17	17	33	33	80	36
Electrical Equipment	15	40	57	74	80	53
Food Products	29	29	25	43	60	37
Metals	20	40	50	50	80	48
Machinery	23	23	50	65	77	48
Average	20	32	48	59	80	48

Source: Mansfield (1994)

Table 7. Percentage of Firms Claiming that Intellectual Property Protection Is Too Weak to Permit Types of Investment, 1991

Country	Chemicals	Transport Equip.	Electrical Equip.	Food Products	Metals	Machinery	Average
Panel A: Joint Ventures with Local Partners							
Argentina	40	0	29	12	0	27	18
Brazil	47	40	31	12	0	65	32
India	80	40	39	38	20	48	44
Indonesia	50	40	29	25	0	25	28
Mexico	47	20	30	25	0	17	22
Korea	33	20	21	12	25	26	23
Thailand	43	80	32	12	0	20	31
Average[a]	49	34	30	19	6	33	
Panel B: Transfer of Newest or Most Effective Technology to Wholly Owned Subsidiaries							
Argentina	44	20	21	12	0	14	18
Brazil	50	40	24	12	0	39	28
India	81	40	38	38	20	41	43
Indonesia	40	20	31	25	0	23	23
Mexico	31	20	21	25	0	22	20
Korea	31	20	28	12	40	22	26
Thailand	60	80	31	12	0	18	20
Average[a]	48	34	28	19	9	26	
Panel C: Licensing of Newest or Most Effective Technology to Unrelated Firms							
Argentina	62	0	26	12	0	29	22
Brazil	69	40	29	25	0	73	39
India	81	40	38	38	20	50	44
Indonesia	73	20	33	25	0	37	31
Mexico	56	20	28	25	0	36	28
Korea	38	20	34	12	40	29	29
Thailand	73	80	36	12	0	25	38
Average[a]	65	31	32	21	9	40	

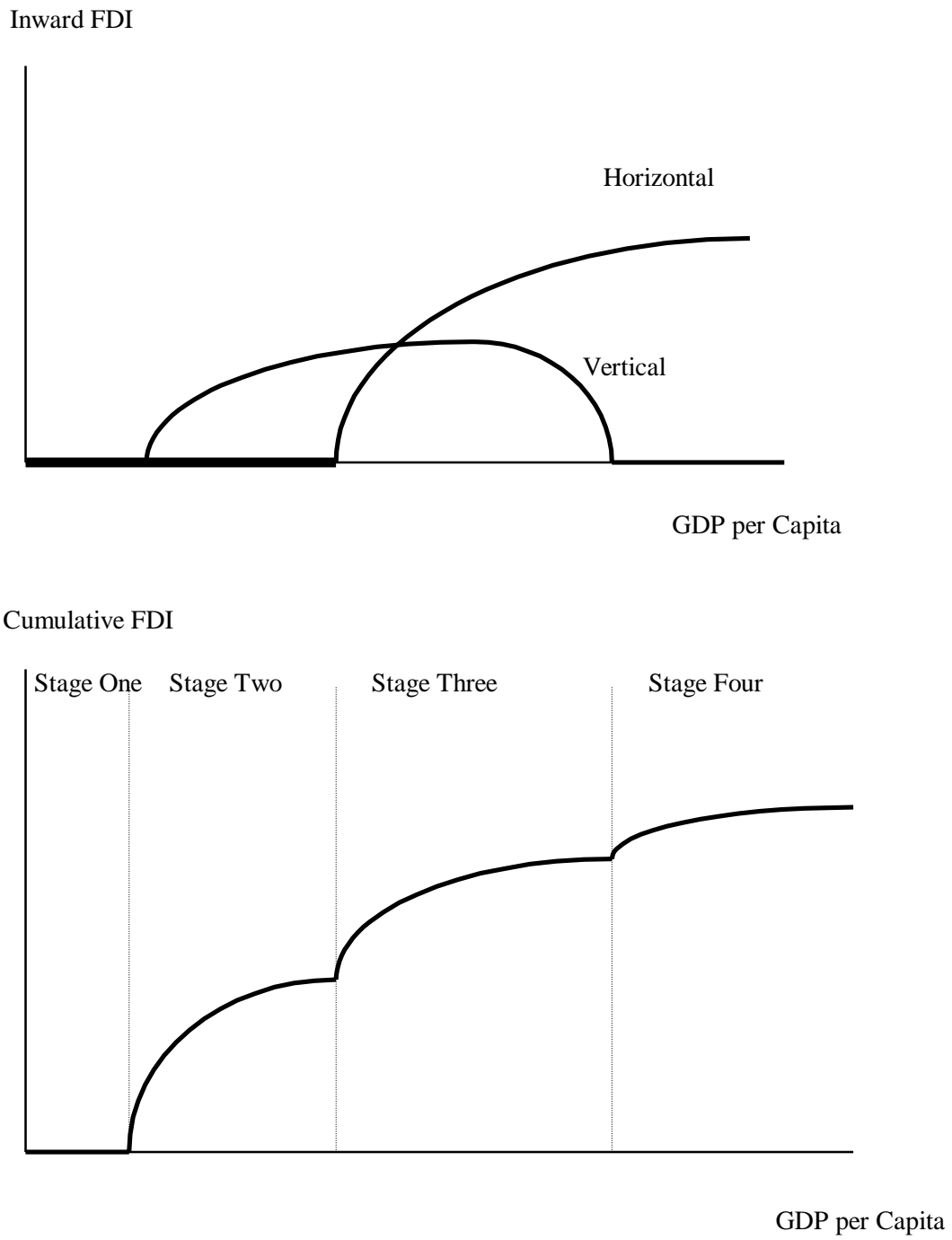Source: Mansfield (1994). Note: [a]Average over the seven countries listed.

Table 8. Elasticities of Modes of Supply with respect to Domestic Characteristics and Policies

Variable	Asset Stock	Affiliate Sales	Intrafirm Exports to Aff.	Patent Apps.
Real GDP	0.25	0.30	0.13	0.19
Tariff Level	-0.02	-0.00[a]	-0.01	-0.01
Affiliate R&D	0.27	0.29	0.15	0.07
Distance	-0.25	-0.02	-0.03	0.02
Incentives	0.97	0.24	0.13	0.17
Disincentives	-0.25	-0.02	0.02	-0.01
Patent Strength in Developing Countries	0.45	0.05	-0.02	0.69

Source: Adapted from Maskus (1998)

Note: [a]Coefficient is not significantly different from zero. Asset stock is total assets of foreign non-bank affiliates of U.S. parents in $ millions; Affiliate sales is total sales of foreign affiliates in $ millions; Intrafirm exports to affiliate is U.S. exports shipped to affiliates in $ millions; Patent applications is number filed in the host country; Real GDP in the host country is in $ billions; Tariff level is tariff revenues divided by total imports; Affiliate R&D is expenditure on R&D by foreign affiliates in $ millions; Distance is kilometers of capital city from Washington, DC; Incentives is the number of affiliates that received tax concessions in the host country divided by the number that received tax concessions in all the sample countries; Disincentives is number of affiliates required to employ a minimum amount of local personnel divided by the number of affiliates that are so constrained in all the sample countries; Patent strength is an endogeneity-corrected index of patent laws and enforcement.

Figure 1. Inward Vertical and Horizontal FDI Flows as an Economy Develops

Inward FDI

Horizontal

Vertical

GDP per Capita

Cumulative FDI

Stage One   Stage Two   Stage Three   Stage Four

GDP per Capita

Source: Zhang (1996)