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Abstract

A developing country will derive long-lasting development benefits from FDI only, if there is the right coincidence between its location-specific assets and TNCs' global interests, and the right match between the country's national linkage capability and TNCs' strategic interest in domestic sourcing. We argue that Costa Rica and Mexico have been very successful in attracting high-tech FDI due to the cumulative results of past development policies, proximity to the U.S., and trade arrangements. However, a combination of pervasive market failures, government inaction, and changes in TNC strategies explains why the two countries have not been able to reap lasting benefits from high-tech FDI. We conclude that pro-active government policies have to be an integral part of any FDI-linked development strategy. Pro-action is needed to attract FDI, to promote indigenous linkage capability, and to enhance key location-specific assets on an on-going basis in the context of a coordinated policy framework.

Introduction

At the beginning of the twenty-first century, policy makers in developing countries are competing fiercely for foreign direct investment (FDI). They hope that FDI will provide a major impetus for economic development. At the macro level, they expect FDI to increase investment, employment, foreign exchange, and tax revenue. And at the micro level, they envision FDI to generate positive spillovers through competition and the transfer of technological know how, marketing and business practices.

Helas, there is a wide schism between the expectations and the reality of the FDI-development nexus. Some developing countries are unable to attract FDI at all, and for many of those that do, the anticipated benefits do not materialize. The empirical evidence on the development benefits of FDI is inconclusive, with respect to both the macro and the micro impact. Lipsey and Sjöholm (2005) and Blomstroem, Kokko, and Globerman (2001) provide excellent surveys of the heterogeneity of econometric results.

The widespread belief in a quasi-automatic FDI-development sequence is based on an erroneous understanding of real market conditions at the national and the global level. Contrary to the neoclassical model-theoretic assumption that markets are perfect and complete, markets in developing countries are often riddled with imperfections. In the context of pervasive market failures without corrective government action it is

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unlikely that developing countries will create the indigenous capabilities necessary to benefit from potential FDI spillovers. Cross-country variations in market failures and government inaction map onto differences in national linkage capability. They are an important explanation for the mixed empirical results on the link between FDI and economic growth and industrial upgrading.

In this article we focus on a detailed comparative case analysis to tease out the complex interactions between global and national, economic and institutional factors that determine the links between FDI and development, a complexity that cannot be captured by econometric analysis. We analyze the FDI-development nexus in Costa Rica and Mexico, two countries which have been able to attract considerable amounts of high-tech FDI over the past ten years, yet without reaping lasting development benefits from it. We concentrate our analysis on high-tech FDI and its impact on indigenous knowledge-based assets because of the singular ability of high-tech production to advance indigenous technological capabilities through linkages and human capital spillovers. And the advancement of knowledge-based assets is the key factor behind a developing country's ability to upgrade industrial production and move up the value chain.

Costa Rica and Mexico had the right location-specific assets to attract high-tech FDI. These assets were not created overnight, but were the cumulative result of past investments in education and infrastructure, and the specifics of the countries' political economy. The pursuit of Washington Consensus polices with their emphasis on a hands-off government approach to economic development is one important reason why high-tech FDI has not provided a major impetus for the expansion of indigenous knowledge-based assets. In the early 1980s, the foreign debt crisis bestowed extraordinary power on international organizations like the International Monetary Fund and the World Bank to influence economic policies in highly indebted developing countries. It was in that context that Costa Rica and Mexico – like many other developing countries – put much greater emphasis on free market policies, opening up the economy to more international trade and investment, and reducing significantly the role of the government in the economy. Adherents of the Washington Consensus see government failures at the root of development problems, and so rather than reforming the active role that government played under import substituting industrialization (ISI), they eliminated it expecting that the market left to its own devices would generate the necessary momentum for growth and development.

But Washington Consensus policies can pose serious obstacles for the realization of the potential link between FDI and the advancement of indigenous knowledge-based assets. When indigenous producers have imperfect information and face high financing costs, risk, or barriers to entry, they are not likely to compete successfully with TNCs. National and local governments ignored the importance and pervasiveness of market failures. They did not support the private sector – directly and pro-actively – in competing effectively with foreign investors and developing the national capability necessary to benefit from positive spillover effects. Furthermore, the drastic reduction of the role of the state in the economy reduced the very state administrative capacity that is

needed for the conceptualization and implementation of effective pro-active capability-promoting policies.

The analysis in this paper is based on aggregate data from Costa Rica and Mexico, as well as numerous in-depth interviews in TNCs and domestic firms, government officials, experts, and members of non-governmental negotiations. The paper is organized as follows. We next present an analytical framework, based on Paus (2005), which lays out the contingencies that determine developing countries' ability to attract high-tech FDI, and that shape the translation of FDI into an advancement of the host country's knowledge-based assets. We use that framework to analyze why Costa Rica and Mexico were able to attract high-tech FDI (section three) and why that investment has not generated significant positive spillovers to date (section four). We conclude with the lessons from the Costa Rican and Mexican experiences for policies to translate high-tech FDI into lasting development benefits.

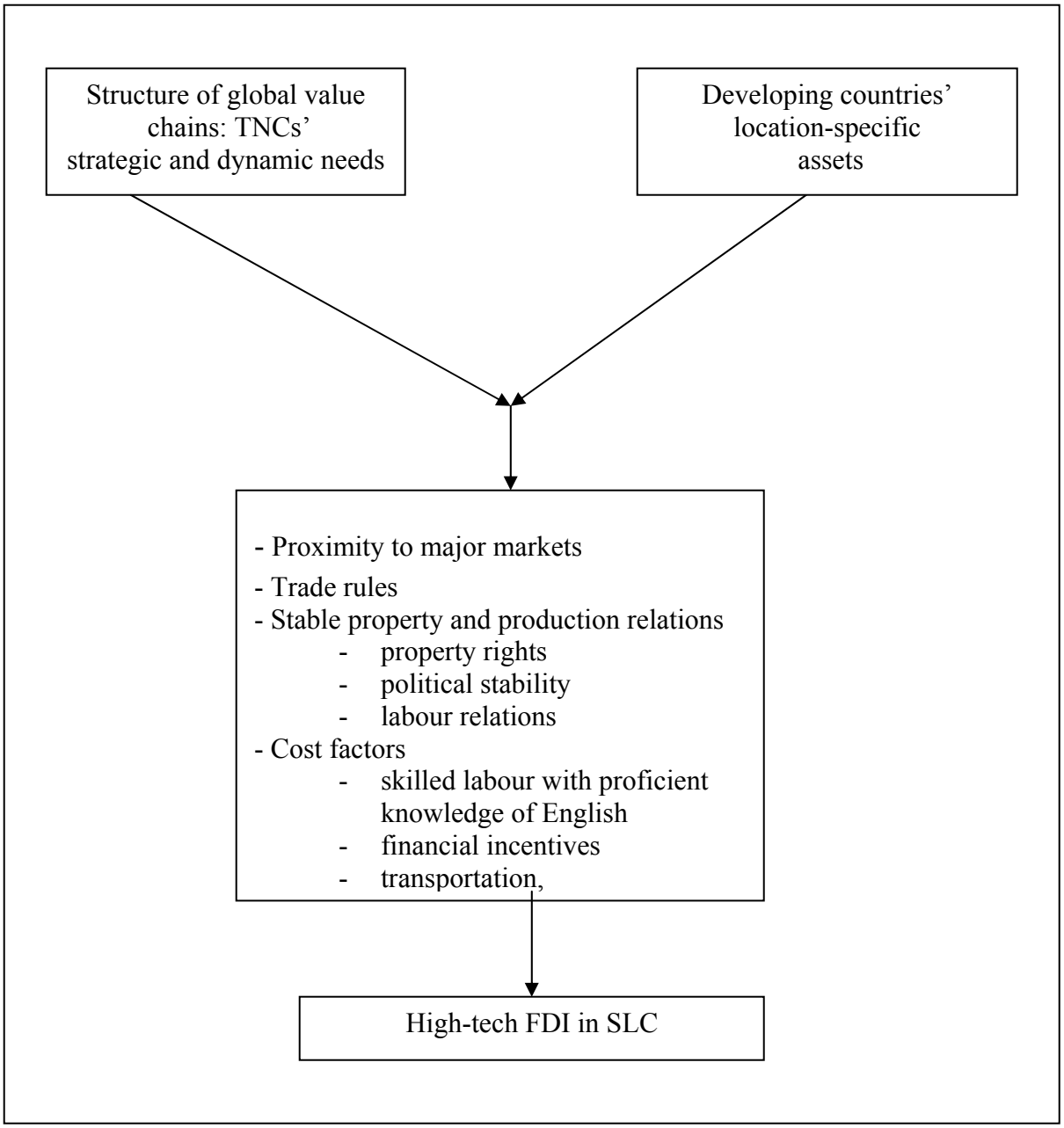
Analytical Framework

If free market policies and an open arms approach to FDI were sufficient to generate an inflow of productive capital, then many developing countries should have seen a surge in FDI inflows during the 1980s and 1990s. But that did not happen. A developing country will only attract FDI if its location-specific advantages at a particular point in time match the strategic interests of TNCs. Figure 1 summarizes the most important contingencies, which determine such a match.

Generally speaking, stable property rights, political stability, peaceful labour relations, cost advantages (wages, taxes, utilities, transportation, grants), and appropriate infrastructure (especially transportation and telecommunications) are critical location-specific assets. Proximity to major markets is an important advantage, especially for small host countries, where FDI is – by definition – efficiency-seeking and not market-seeking. In the case of high-tech FDI, a sufficient supply of the right human capital at competitive prices is of critical importance. The production of high-tech goods requires a labour force with the right technical skills and a fairly good command of English, even if the particular production process in the developing country is at the lower end of the technology intensity for the high-tech good. Many of these location-specific assets are the result of the cumulative impact of past government policies, and not of policy changes that bear fruit overnight.

Whether a transnational corporation will invest in a country with the generally right location-specific assets depends on the strategic global interests of the TNCs. Those, in turn, are shaped by global market dynamics, industry-specific characteristics and trade rules. A potential host country's membership in a free trade area is an important consideration in a TNC's investment decisions, as is global risk management through geographic diversification of production sites.

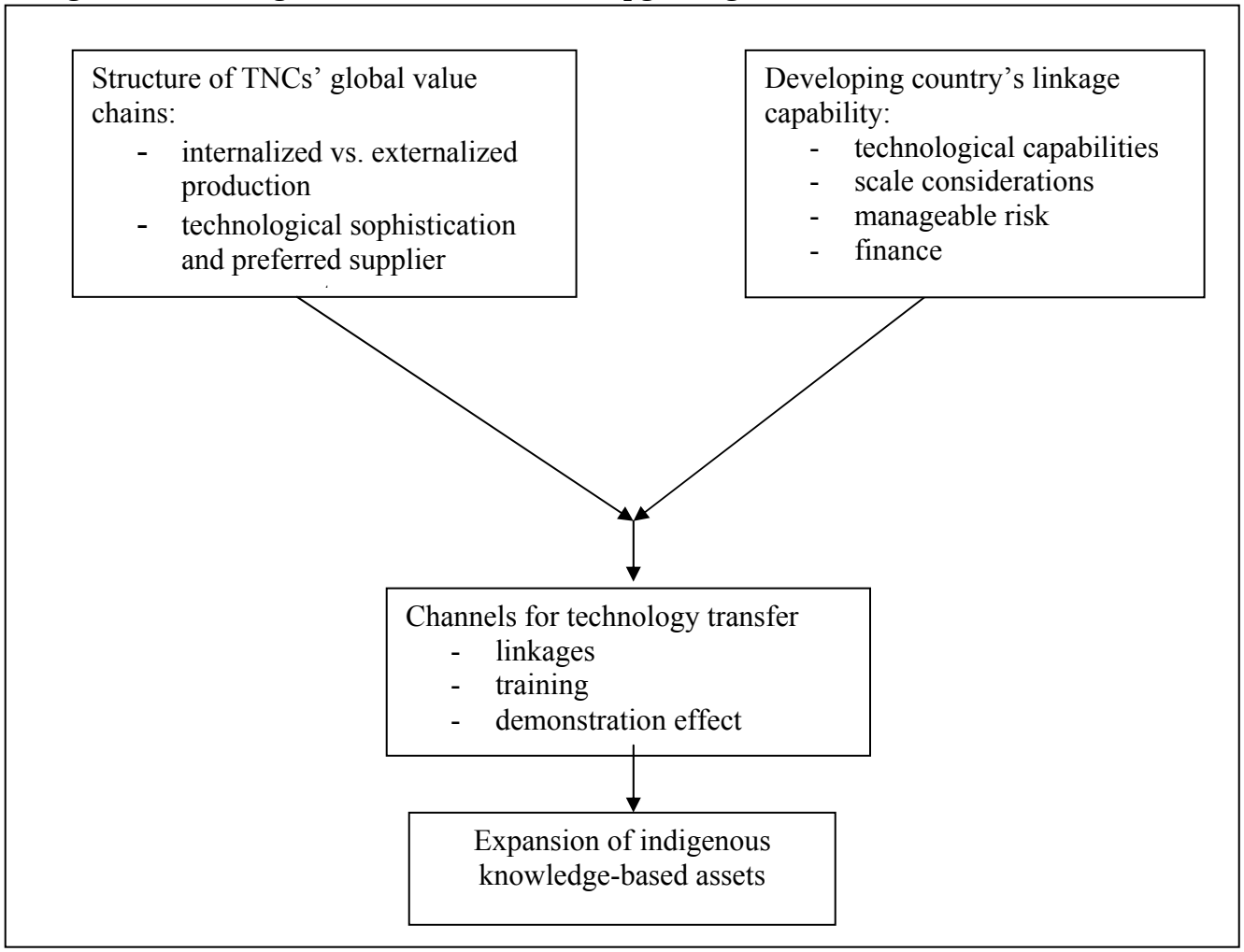
Figure 1. High-tech FDI in Developing Countries: Critical Contingencies



Source: Paus (2005: 21).

Just as an open-arms approach to foreign investment does not automatically generate an inflow of foreign direct investment, success in attracting high-tech FDI does not automatically lead to the generation of development spillovers. The realization of such spillovers depends on national companies' ability to compete in the output market, their ability to become competitive suppliers in the input market, as well as TNCs' interest in sourcing inputs in the host country. Figure 2 summarizes the key contingencies.

Figure 2. From High-tech FDI to Industrial Upgrading



Source: Paus (2005: 23)

High-tech FDI can impact the development of indigenous knowledge-based assets mainly through two different channels: the competition effect and spillovers. Most of the theoretical and empirical literature focuses on the competition channel, where the presence of foreign corporations forces domestic producers of the same final goods to become more competitive. As indigenous companies reduce X-inefficiencies and incorporate new technology, they raise their productivity and that of the industry as a whole.

There are two types of spillover effects, which can potentially work at the horizontal as well as the vertical level: the human capital effect and the demonstration effect. TNCs might train workers and provide them with new knowledge and skills, which workers take with them if they work for an indigenous company or establish their own business. And the demonstration effect might generate spillovers as well, as domestic producers are exposed to TNCs' products, marketing strategies, and different production processes.

The most important vertical spillovers happen through the supply chain linkage. Potential indigenous input suppliers for TNCs become actual input suppliers, as they learn to meet international quality standards, and on-time delivery and technological efficiencies that allow for competitive pricing. TNC affiliates may help indigenous producers to upgrade their technological capabilities, directly through assistance with technology acquisition and sharing of relevant production knowledge or indirectly through the expectation of high quality standards and feedback on technical specifications of suppliers' output. In the best-case scenario, the newly acquired competitiveness will form the basis for supplier-oriented upgrading. Over time, indigenous input producers should aim to move from being original equipment manufacturers (OEMs) to becoming original design manufacturers (ODMs) and finally original brand name manufacturers (OBMs), where they design, manufacturer and sell products under their own brand name. A number of analysts attribute the success of the smaller East Asian latecomers to their ability to become competitive input suppliers and move up the value chain over time, e.g. Ernst (2003a and b) and Yusuf (2003). The emphasis on supplier-oriented upgrading highlights the importance of FDI for the dynamic development of indigenous technological capabilities, in contrast to the more standard neoclassical approach, where the existence of such capabilities is taken for granted and the benefits of FDI linkages are seen in efficiency and price effects.[1]

But the existence or development of domestic input supply capability cannot be taken for granted. Indigenous input producers may not be in a position to respond to latent demand from TNCs, because the technology gap may be too big for them to meet TNC demand in terms of cost, product quality, or on-time delivery. National firms will not become input suppliers for TNCs, if the technological gap between the average host country firm and the average TNC is too large, if national producers do not have access to financing to upgrade their production facilities, or if they consider the risk too high. In such cases, national producers will not become input suppliers for high-tech TNCs, and the latter's production will not become embedded in the domestic production structure.

Although some economists have begun to highlight the lack of indigenous linkage capability as a factor that inhibits FDI spillovers, they tend not to discuss how the development of such a capability is supposed to happen if market failures are widespread. For example, in a recent survey article on FDI and development, Lipsey and Sjöholm (2005, 40) conclude that it seems plausible that "countries and firms within countries might differ in their ability to benefit from the presence of foreign-owned firms and their superior technology. But the word 'market failure' is not mentioned once. The article is part of a book, which investigates the impact of foreign investment on development (Moran et al., 2005), and the index for the whole book does not include 'market failure' either.

[1] Markusen and Venables (1999), for example, develop a model where FDI generates two effects in the host country: a competition effect for the final good and a linkage effect where the increased demand for the output of intermediate goods' producers makes entry into that sector more attractive for domestic producers. As the supply of inputs increases, their price falls thus making final goods producers more competitive.

National linkage capability is, however, not a sufficient condition for the development and sustainability of backward linkages. The other critical element is TNCs' interest in domestic sourcing, which is shaped by the structure and changes of global value chains of particular products and TNC's global strategies. Technological developments during the last thirty some years have made it possible for companies to divide the value chain of their products into distinct parts and to produce each part where it is most cost-efficient given the corporation's overall strategic considerations. More than ever before, TNCs are developing and managing global networks where key business functions (design, technology development, manufacturing, and marketing) are executed around the globe, and re-allocated, when required by the competitive dynamics of the industry.

Generally speaking, TNCs consider research and development (R&D), product design, and marketing under the company's brand name as their core competencies and thus generate them internally. In contrast, the manufacturing of standardized products is often outsourced to other companies. During the last two decades, the lead companies in some high-tech sectors (e.g. the computer industry) have abandoned the manufacturing process altogether leaving it to so-called contract manufacturers (CMs). The latter can achieve much lower unit costs by pooling production orders from many clients, while subcontracting themselves to the lowest-cost producers in the world economy. Some analysts argue that off-shoring is also becoming more important in different aspects of design, marketing, and overall co-ordination (Dicken, 1998; Sturgeon and Lester, 2003; UNCTAD, 2005 and 2002; Yusuf, 2003). Increased competitive pressures on TNCs have fostered the growing trend towards de-verticalization beyond the manufacturing process proper, as product life cycles have become shorter, and the complexity and costs of new products have risen.

Developing countries have become increasingly important participants in these global production chains. Their share in world exports of parts and components rose from four percent in 1981 to twenty-one percent in 2000. Most of this increase has been concentrated in a small number of countries: China, Mexico, South Korea, Malaysia and Thailand accounted for seventy-eight percent of developing countries' exports in parts and components in 2000, while the next five largest countries made up around fourteen percent (World Bank, 2003: 61).

If production is highly internalized, the TNC affiliate will have little interest in sourcing in the developing host country beyond non-tradable services and very standardized inputs like packaging materials. The degree of internalization is partially influenced by domestic linkage capability. Where such capability exists, the likelihood of sourcing may increase. But if the production of inputs requires a high degree of technological sophistication, a TNC may opt for inputs from suppliers with whom it has already developed a long-standing relationship and who have a track record of high quality production.

In sum, a country will derive long-lasting development benefits from high-tech FDI only, if there is the right coincidence between its location-specific assets and TNCs' global interests, and the right match between national linkage capability and TNCs' strategic interest in domestic sourcing. The missing links between FDI and development can be found in the different reasons for why these conjunctures may not materialize, at a particular point in time and in a dynamic context.

When Location-specific Assets Match TNCs' Strategic Interests: Costa Rica and Mexico

Costa Rica and Mexico are two middle-income developing countries in the Middle American isthmus, which have been successful in attracting high-tech FDI in recent years, particularly in the high-tech sector. Even though the two countries have roughly the same GNI p.c. of $6,000 (PPP), they are vastly different in size (see Table 1). Until the early 1980s, both had pursued and ISI strategy, which had been rather successful in terms of economic growth and diversification of the manufacturing sector, though not with respect to achieving international competitiveness.

Table 1. GNI and Population in Costa Rica and Mexico, 2004

	Costa Rica	**Mexico**
GNI p.c.*	$ 5,930	$ 5,990
GDP*	$ 38.1 billion	$ 623 billion
Population	4 million	104 million

*: in international $ (PPP)
Source: World Bank, World Development Indicators, on-line.

Both countries had the right location-specific assets to attract high-tech FDI at a time of globalizing production. Proximity to the US, and in the case of Mexico the signing of the NAFTA (North American Free Trade Agreement) in 1994, were critical pull factors for TNCs. The countries' location-specific assets were in many ways the result of development policies over the previous decades, especially in education, infrastructure, and industrial development. Figure 3 summarizes the key factors behind the confluence of TNCs' interests and the two countries' location-specific assets, which we will discuss in detail below.

Figure 3. Why High-tech TNCs Invested in Costa Rica and Mexico

	Costa Rica	Mexico
Stability		
Macro-economic	X	X
Political	X	X
Property rights	X	X
Capital-labour relations	X	X
Infrastructure		
Physical infrastructure	X	X
Low unit labour cost for skilled human capital	X	X
Government policies and institutions		
Tax incentives	0 % profit tax in free zones	Zero municipal taxes, duty free imports through PITEX
Host country promotion efforts	Institutions: CINDE, PROCOMER	Institutions: CANIETI and CADELEC
Preferential trade agreements	None with major market, but proximity to US	NAFTA
TNCs' strategic needs		
Agents	Regional expansion for big TNCs, first-time transnational production for smaller and medium-sized foreign companies	Regional expansion for big TNCs and opportunity to serve US market with lower wage assembly workers. First time opportunity for new TNC contract manufacturers
Goals	Efficiency-seeking	Efficiency-seeking

Costa Rica

Costa Rica has traditionally depended on the export of bananas and coffee, and later clothing, as the main force behind economic growth. In the course of the 1990s, FDI inflows to Costa Rica increased steadily (see Table 2). But Intel's decision in 1996 to establish a microchip factory outside of San José marked a quantitative and qualitative change in foreign direct investment, given the nature of the investment and the demonstration effect it had for other potential foreign investors. It highlighted and opened up the potential for profound structural change towards high-tech FDI-assisted growth and development. While the largest share of FDI had gone to agriculture and services in the 1980s and early 1990s, the manufacturing sector became the main destination for FDI in the later 1990s. Between 1997 and 2003, sixty-five percent of FDI inflows went to industry, with about a third of the latter in electronics (Paus 2005: 144).

Although there had been foreign investments in the electronics industry before, the big jump in FDI in electronic equipment came with Intel's $300 million investment. In the medical device industry, Abbot was the biggest investor in the late 1990s. Even though Baxter had been in Costa Rica since 1987, it was only with Abbot's investment and the publicity following Intel's investment that FDI in Costa Rica's medical supply sector surged. While the majority of workers in the medical supply sectors assemble components at the low end of the production chain, all workers in Intel are required to have a technical degree.

Table 2. FDI Inflows into Costa Rica and Mexico

	Costa Rica		**Mexico**	
	Net FDI Inflows		Net FDI Inflows	
	Millions of Current US $	% of GDP	Millions of Current US $	% of GDP
Average 1970s	44	2.3	602	0.8
Average 1980s	70	1.8	2,080	1.1
1990	163	2.8	2,549	1.0
1991	178	2.5	4,742	1.5
1992	226	2.6	4,393	1.2
1993	247	2.6	4,389	1.1
1994	298	2.8	10,973	2.6
1995	337	2.9	9,526	3.3
1996	427	3.6	9,186	2.8
1997	408	3.2	12,830	3.2
1998	613	4.4	12,316	2.9
1999	629	3.9	13,190	2.7
Average 1990s	*352*	*3.0*	8,412	2.2
2000	409	2.6	16,589	2.9
2001	454	2.8	26,843	4.3
2002	662	3.9	14,775	2.3
2003	577	3.3	10,783	1.7

Source: World Bank, *World Development Indicators*, on-line, Retrieved 22 December 2005 and 6 January 2006.

TNCs' Strategic Interests

Several characteristics of the ongoing internationalization of production help explain why Costa Rica became a possible investment location for high-tech FDI. First, transnational corporations with global production and distribution networks, like Intel and Abbot, are always on the lookout for new investment sites.[2] The search for new

[2] Spar (1998) points out that Intel is establishing a new production facility somewhere in the world about every eighteen months.

profitable sites is an integral part of their global expansion and restructuring strategies, as risk diversification and global commodity chain management change over time. Thus it becomes important for a country to be on the radar screen of these corporations. The second important trait of the ongoing internationalization process is that small and medium-sized companies from the industrialized countries are also increasingly looking to relocate production to countries with lower labour costs. In the case of technologically more sophisticated production that means lower wages for higher-skilled workers. A good number of the high-tech foreign companies, which have invested in Costa Rica in the last few years, are indeed small or medium-sized. And for many of them, the investment in Costa Rica was their first or second investment abroad.

For small and medium-sized potential foreign investors, the demonstration effect of large TNC investments is particularly important, since their more limited resources translate into more limited knowledge of the pros and cons of potential production locations abroad. Intel's investment played a critical role for many of the other high-tech foreign companies, which came afterwards. Abbot's subsequent investment had a signalling function as well, and it made some investors in the medical field remember that Baxter had already been there for a long time. The tourist boom in the 1990s also raised Costa Rica's visibility as a potential investment site.[3]

Location-specific Assets

It is, of course, a huge step from being on the radar screen of a TNC to actually becoming the foreign investor's final choice of site. The former is a necessary condition to attract FDI, but the latter will only be achieved, if the country has the right location-specific assets. And Costa Rica did, as a result of past development policies (especially in the area of education and infrastructure), its proximity to the US market, the specific formation and dynamics of the country's political economy which resulted in weak company unions and overall political stability, macroeconomic stability (not least due to the help of US balance of payments support in the first half of the 1980s), an institution in charge of pursuing FDI (CINDE, the Costa Rican Coalition for Development Initiatives), and zero profit taxes in the free zones.

Human capital is the single most important factor in attracting high-tech FDI to a small latecomer. Costa Rica has had a long tradition of broadening access to education, from obligatory and free primary education in the nineteenth century to mandated secondary education in the 1940s to an expansion of third-level education in the 1970s.[4]

[3] Between 1987 and 1997, the number of foreign tourists in Costa Rica increased at an annual rate of eight percent (Ulate Quiros, 2000: 39). In one of the small high-tech companies Paus visited in Costa Rica, the general manager explained that they had explored Costa Rica as a potential site when their lawyer brought it to their attention after having spent his vacation in the country.

[4] That meant not only an increase in the number of universities and technical schools, but--equally importantly--the establishment of a loan fund to support students of lesser means in higher-level education In 1977, the Figueres Administration established the National Loan Commission for Education (Comisión Nacional de Prestamos para Educación).

Costa Rica's adult literacy rate is close to 100 percent, and primary school enrolment is nearly universal. Net enrolment in secondary schools has been increasing from thirty-seven to fifty-one percent in the course of the 1990s, and gross tertiary enrolment was twenty-one percent in 2001 (World Development Indicators, on-line). In 1987, the Omar Denge Foundation was established to promote the introduction of computer instruction in elementary schools, an initiative that has been considered rather successful. A fair number of people have some knowledge of English, the result of the introduction of English language teaching in primary schools in 1994 and of the prevalence of English-speaking tourists.[5]

While labour in Costa Rica is relatively expensive compared to competitor countries for high-tech FDI at similar income levels, it is also considered to be more productive. The social insurance contributions, which support the relatively high social services in Costa Rica, are a main reason for the relatively high wages, but also for the relatively higher productivity. In author interviews, managers of high-tech TNC affiliates stressed that Costa Rican workers learn new production processes quickly and that the training periods had been substantially shorter than they had planned for, making the cost of labour training considerably lower in Costa Rica. And some stated explicitly that higher productivity at their Costa Rican plants compensated for wages that were higher than in other affiliate plants in Asian countries.

Path dependency has not only been important with respect to the relatively high level of human capital in Costa Rica. The country also has been able to offer the needed infrastructure regarding telecommunications and transportation, another result of past investments in development and infrastructure. In the case of infrastructure deficiencies, government agencies have shown considerable adaptability and flexibility to overcome them.[6] Nonetheless, the preferential treatment of TNCs in the Free Zones with respect to telecommunications and electricity has made it more difficult for indigenous companies to compete. And at this juncture, there are growing deficiencies in infrastructure, broadly defined, which need to be addressed if the country's location-specific assets are to remain attractive.

The transparency of rules for foreign investors and the relative absence of special deals have sent strong signals about respect for laws and willingness to enforce them. However, the bribery scandals of 2004 involving foreign companies and Costa Rican officials at the highest level cast a potentially long shadow on Costa Rica's image of a country with no backroom deals.

As a developing country with a tax ratio of only thirteen percent, Costa Rica is in no position to offer outright grants to foreign investors in order to sway their investment decision. However, like many other countries, Costa Rica has Free Zones (FZs) with

[5] Nonetheless, school completion and repetition rates are a matter of concern at both the primary and secondary level. According to IADB (2003b: 14) "Sixteen percent of students repeat a grade between first and seventh grade, and only thirty-three percent of twenty-year-olds have made it through high-school."
[6] See Paus (2005: 167) for details on how the Costa Rican government responded to Intel's concerns about Costa Rica's infrastructure and human capital supply.

attractive conditions for production. Companies producing for export can import inputs duty-free and enjoy a 100 percent exemption from profit taxes for eight years, and a 50 percent exemption for another four years.

Costa Rica's two main institutions dealing with transnational corporations have played an important role in attracting TNCs. They are CINDE, which is charged with marketing the country to potential foreign investors, and PROCOMER, the Foreign Trade Promotion Agency, which provides technical and strategic information and one-stop services for national and foreign exporters and importers. PROCOMER has improved logistics through greater speed and flexibility for exports and imports, and has tended to give preferential treatment to foreign corporations. For example, while it can take up to eight hours for a local company to retrieve imported inputs from customs at the airport, it takes one hour for a company in the Free Zones.[7]

Established and funded by US-AID in 1982, CINDE has been a non-governmental organization since its inception, with no funding from the government, and no accountability to it either. CINDE's non-governmental status freed it from the potential vicissitudes of a change in agendas from one government to the next. But private sector status has also become a problem, as it has meant that the responsibility for FDI attraction has been located outside of existing government institutions.

At the height of its operations, CINDE had an annual budget between $4 million and $8 million, seven international offices in Europe, Asia, and the US, and 300-400 employees. Initially, the organization went after any investment it could attract, which turned out to be primarily in clothing, driven by the preferential tariff treatment in the US under the Caribbean Basin Initiative and the US tariff provisions HTS 9802. But when the other Central American countries became more peaceful and thus attractive sites for maquila clothing operations in the first half of the Nineties, CINDE began to focus more on potential foreign investors in the electronics sector.[8] It played a critical role in interesting Intel in Costa Rica as a potential investment site.

CINDE's status as a non-governmental organization became problematic though when US-AID funding stopped in the early 1990s, as Costa Rica had surpassed the agency's funding threshold. The Costa Rican government did not compensate for the cut in funding, and CINDE's budget plummeted. It was $1.5 million in 2002, not enough to do effectively the job the organization is charged to do. The absence of government action in this case is but one example of the general lack of a development strategy; a strategy in which FDI would play one part, and where it was the government's role to ensure that all the parts were complementing each other well and moving forward in a coordinated fashion.

[7] Based on an interview with the director of export development and logistics at PROCOMER, May 2002.
[8] That was especially the case after a commissioned study (FIAS, 1996) identified electronics as an area where Costa Rica had the requisite location-specific assets. The study concluded that Costa Rica had a comparative advantage in electronics products that required small runs and skilled labour for set-ups and testing.

Costa Rica's ability to entice Intel to invest was the result of very close collaboration among all relevant agencies, a cooperation demanded and supervised by then President Figueres. But individual initiatives, which do not become institutionalized and wither away with the individual's move out of office do not constitute the needed institutional base to anchor a high-tech FDI-assisted strategy. A lot of individual actions by different institutions, public or non-public, do not add up to a coherent strategy, unless they are articulated and executed and coordinated in the context of a larger development strategy.

Mexico

In contrast to Costa Rica, Mexico's larger size allowed it to promote the development of an indigenous high-tech sector during the ISI period, a sector that became relatively vibrant by the 1980s. Like Costa Rica, however, the turning point for the high-tech FDI boom starting in the 1990s came after a single large TNC invested in the country. In Mexico's case that was IBM's investment in 1985. Indeed, the recent boom in high-tech FDI in Mexico was the result of a confluence of TNCs' strategic interests and Mexico's location-specific assets. In the Mexican case, the emergence of contract manufacturing as a new mode in the global electronics commodity chain occurred almost simultaneously with the establishment of the NAFTA, which integrated Mexico with the largest economy in the world.

Mexico's high-tech antecedents date as far back as the 1940s, when – under ISI protection - national companies began to manufacture radios and radio components. From the 1950s until 1980 Mexican firms manufactured televisions and related parts as well. The government targeted the computer industry in the late 1970s as part of the strategy of the National Council on Science and Technology (CONACYT) to increase Mexico's national self-sufficiency in technology. According to Dedrick, Kraemer, and Palacios (2001) CONACYT set forth the "Programme to Promote the Manufacture of Electronic computing Systems, their Central Processing Units, and their Peripheral Equipment," that became commonly referred to as the PC Programme (Programa de Computadoras). The programme's stated goal was to develop a domestic computer industry (supported by the surrounding electronics industry) that could not only serve the domestic market but also emerge as a key exporter for Mexico.

Access to the domestic computer market was strictly limited to firms that would meet the goals of the programme. TNCs were limited to forty-nine percent foreign ownership of firms in the sector. They had to invest between three and six percent of gross sales into R&D and create research centres and training programmes. Foreign firms were also subject to domestic content rules. Domestic parts and components had to account for at least forty-five percent of value added for personal computers and thirty-five percent for mini-computers. New Mexican-owned firms could receive fiscal credits and low interest loans from government development banks.

The programme was a remarkable success, especially considering the economic crises during the 1980s. In search of domestic markets and export platforms, the foreign firms that came were IBM, Hewlett Packard, Digital, NCR, Tandem and Wang. IBM and Hewlett Packard were the leaders and accounted for sixty-three percent of all computer production. The other foreign firms were responsible for approximately eighteen percent, and wholly-owned Mexican firms made up another eighteen percent. By 1986, Mexico's domestic computer market was second only to Brazil's in Latin America (Whiting, 1991). Remarkably, Mexico came only fourteen percentage points short of its goal of having seventy percent of domestic demand met by domestic supply. Although the country was shaken by the 1982 debt crisis, domestic supply was fifty-six percent of domestic demand by 1987. Half of that demand was met by the joint ventures and the other half was met by fully owned Mexican firms. In addition to developing the ability to serve the domestic market, the sector also built an export potential. By 1987, about half of all production was exported, namely to the United States and Canada (Peres, 1990). Beginning in 1988 with the election of Mexican President Carlos Salinas, these policies were replaced by a liberalization strategy that culminated in the NAFTA in 1994.

TNCs' Strategic Interests

TNCs largely went along with Mexico's initial PC Programme because they saw it as a ticket to the Mexican and Latin American markets in addition to considering Mexico a strategic spot for assembly and re-export to the United States. However, the high-tech sector became much more dynamic in the late 1980s and early 1990s and TNCs began to push for liberalization so that they could better organize their commodity chains.

By the late 1980s, Mexico's strategy did not mesh with the strategic interests of TNCs. In 1985, IBM requested 100 percent ownership of a state of the art plant it planned to build in Guadalajara, Mexico's second largest city in the western state of Jalisco. Mexico agreed to the demand in exchange for an $11 million Centre for Semiconductor Technology in Guadalajara that over the course of five years (1988 to 1994) would train a number of Mexican engineers and developers. This was a watershed event. The IBM investment had a demonstration effect for other firms in ways quite similar to Intel and Abbot in Costa Rica. After IBM was granted 100 percent ownership Hewlett-Packard demanded and received an exemption as well, but without any commitments toward local development. By 1987, other foreign firms were also allowed to work outside of the PC programme (Dedrick, Kramer et.al. 2001). The IBM exemption laid the groundwork for full-blown liberalization and subsequently large inflows of TNCs in the 1990s.

HP and IBM remain the leading firms in the region. Not too long after their arrival, however, there was a shift in the global industry where flagship firms began to outsource much of the production process to contract equipment manufacturers (CMs). Solectron, SCI-Sanmina, and Flextronics are the key foreign-owned CMs that are now operating in Mexico and conducting the majority of assembly. All these firms were largely engaged in semi--skilled assembly work of computers, components, and

peripherals and other IT products such as cell phones and electronic games (Gallagher and Zarsky, 2006).

By 2001, Mexico had had emerged as the eleventh leading exporter of high-tech products in the world economy. The country's share in world electronics exports went from eight-tenths of one percent in 1985 to three percent in 2000. Foreign investment, exports, and employment have surged in Guadalajara, Mexico's high-tech hub that has been deemed 'the Silicon Valley of Mexico.' In 2002, high-tech exports made up sixty-one-point-three percent of all exports from Jalisco. Indeed, in 1999 Jalisco's $9.3 billion in high-tech exports surpassed the value of Mexico's entire crude oil production, which was $8.86 billion (Alba, 1999). Foreign investment in Jalisco's high-tech sector sky-rocketed between 1995 and 1998 when it reached $742 million, but dropped off severely between 1998 and 2004 because of overall declines in emerging markets and the attractiveness of Chinese high tech firms (Gallagher and Zarsky, 2006).

Location-specific Assets

As summarized in Figure 3, Mexico enjoyed many of the same location-specific assets that Costa Rica had—with one big exception. Mexico shares a border with the largest economy with the fastest growing high-tech market in the world. What's more, Mexico signed a free trade agreement with its northern neighbours in 1993. The proximity to the US, NAFTA, and the results of path dependency attributed to past policies outlined above were the determining factors that brought many firms to Mexico in general, and to Guadalajara in particular.

Proximity to the US was of paramount importance. High-tech shipments from China, Japan, and Malaysia take fifteen, twelve, and twenty-three days respectively to reach the Long Beach, California port in the United States. Shipments from Guadalajara to that port take less than one day (CANIETI, 2003). NAFTA further increased Mexico's closeness to the US in many ways, while also alleviating some of the fears about Mexico's macro-economic and political stability.

Tariffs for high-tech imports which were over twenty percent in the 1980s under the PC programme were lowered to zero under the NAFTA (Dedrick et al., 2001). For non-NAFTA countries the tariff on the high-tech sector remains twenty percent. In addition, for Mexico the US reduced its import tariff on high-tech products to zero (Dussel, 2003). Based on author interviews with plant managers in Mexico, NAFTA also helped allay fears about macroeconomic instability. With Mexico's economy increasingly integrated with the US economy, it would be even more in the U.S. interest to see to it that Mexico's economy was stable. When Mexico experienced a severe economic crisis right after NAFTA was signed, the US stepped in with billions of dollars to keep the economy going.

The Mexican high-tech sector was also characterized by weak labour unions and low wages. Unions were seen as "easy to handle and even hands off" and wages in Guadalajara's high-tech sector were one seventh of those in the US (Palacios, 2001, CANIETI, 2003). By 2001, Mexico's hourly wages averaged $2.96, compared to $2.58 in Hungary, $2.17 in Malaysia, and $.72 in China. Data for 2005 put even more countries ahead of Mexico, even though wages had declined to $2.40. Hourly wages were $2.15 in Taiwan, $1.10 in India, and $.95 in China (Gallagher and Zarsky, 2006).

In terms of human capital and infrastructure, Guadalajara was the ideal region for high-tech FDI. The Guadalajara area has five major universities and numerous technical schools and industrial parks that can host research activity and graduate an adequately skilled workforce (Palacios, 2001). According to the World Bank, Mexico is ahead of Costa Rica in the percentage of the labour force with a secondary education. In Costa Rica the percentage is fifteen and is twenty-nine in Mexico (World Bank, 2006). However, the human capital needs for Mexico are not necessarily so sophisticated because Mexican high-tech plants are involved in final assembly. As we discuss later in the paper, only six-point-nine percent of employees in Mexico's high-tech firms have graduated from high school and point-fifty-two percent of them have graduate training. In terms of infrastructure, Guadalajara is quite close to Puerto Vallarta which has quick supply routes to the US.

Numerous government policies were deployed to attract TNCs to Mexico. One programme called PITEX allows firms to import their inputs duty-free as long as more than sixty-five percent of their output was exported (Dussel, 2003). The Jalisco government supplemented these federal programmes with a regional plan to attract firms and suppliers. The state government provided numerous incentives and FDI promotion programmes, and helped set up organizations that seek to build a supplier base for the TNCs. In terms of incentives, the Economic Promotion Law reduced or eliminated state and municipal taxes for firms that located to the region. In addition, there is a Guadalajara branch of the national chamber of commerce for the IT industry, CANIETI (Camara Nacional de la Industria, Electronica, de Telecomunicaciones e Informatica). CANIETI works to attract large TNCs to the region and puts on numerous trade shows and workshops on the industry. A more regional organization named CADELEC (Cadena Productiva de la Electronica) was founded in 1998 with funding from CANIETI, the United Nations Development Programme, and two other federal agencies. CADELEC's mission is to match suppliers with the large TNCs (though they do not differentiate between national or domestic suppliers and TNC suppliers). They compile data on the sector in Jalisco and globally, and serve as a resource and promotion organization for foreign investment, hosting conferences and workshops (CADELEC, 2004; Palacios, 2001).

FDI and Industrial Advancement: The Missing Links

While TNCs can affect the macro economy in numerous ways their most valuable potential contribution to the advancement of industry in developing countries

lies in the promotion of the host country's knowledge-based assets. Through linkages and spillovers, high-tech FDI can expand the technological, production, and marketing capabilities of national producers thus allowing them to become more competitive over time, expand and export their own production, and move up the value chain in their respective areas of production. There have been some positive spillovers in Costa Rica and Mexico through the education and demonstration channels, but spillovers via backward linkages have been extremely limited.

Costa Rica

In the second half of the 1990s, the structure of the Costa Rican manufacturing sector changed considerably towards more high-tech production. Electrical machinery, which includes most of the high-tech electronic and medical instruments products, increased its share in total exports from one-point-four percent in 1997 to twenty-four-point-six percent in 2003 (Paus 2005: 151).[9] Unfortunately, this structural change is not a reflection of increased indigenous technological capabilities, but rather of the growth of TNC production in high-tech areas. In the nationally-owned manufacturing sector output has been stagnating, and employment and exports have been declining (Paus 2005: 153). The stagnation is the result of rising competitive pressures that came with tariff liberalization and the abolition of export subsidies, stagnation in internal demand, difficult access to finance capital, and most importantly, lack of government support. It is also a reflection of the absence of national linkage capability. That absence, more than TNC global sourcing strategies, is at the core of the minimal development of backward linkages from high-tech FDI in Costa Rica, and thus of the limited links between FDI and an enhancement of national knowledge-based assets.

Lack of Backward Linkages

The same factors that made it so difficult for domestic producers to compete in the aftermath of tariff liberalization have made it difficult for them to become input suppliers to the high-tech transnational corporations. Between 1998 and 2002, the value of TNC sourcing of Costa Rican inputs remained basically unchanged. In 2002, TNCs bought domestic inputs worth $54.6 million, the equivalent of around two percent of the value of their output, and around two-point-five percent of the value of their inputs (see Table 3).

The high-tech sectors, electronics and medical instruments, are even less connected with the domestic economy than the clothing sector, which is noted for the scant use of local inputs, as foreign producers operate under HTS 9802. Outside the services, packaging, and printing industries only a few national firms have succeeded in becoming competitive suppliers to high-tech TNCs, and only a small number of international input suppliers have followed their TNC clients to Costa Rica.

[9] Electrical machinery registered the most dramatic growth among all export categories, rising from $45 million in 1997 to $1.4 billion in 2003.

Table 3. Use of Domestic Inputs in Costa Rica's Free Zones, 1998-2002 (in Millions of US $)

All companies	1998	1999	2000	2001	2002
Exports	1,960.6	3,624.9	2,998	2,376.7	2,657.3
Imports	1,539.11	1,858.7	1,794.2	2,014.7	2,210.3
Local purchases	67.5	54.9	72.2	56.6	51.6
Purchases from FZ companies	6.5	6.6	3.9	3.4	3.0
Electronics (HS 84-85)					
Exports	1,300.9	2,795	2,021.8	1,204.9	1,286.8
Imports	919.5	1,213.9	1081.15	1,305.2	1,459.2
Local purchases	n.a.	14.1	16	15.7	4.1
Purchases from FZ companies	0.1	0.9	1.0	2.2	0.4
Medical instruments (HS 90)					
Exports	83.9	117.7	200.7	329.6	401.3
Imports	67.5	42.9	35	40.7	74.9
Local purchases	n.a.	2.7	2.6	3.8	1.6
Purchases from FZ companies	0	0	0	0.3	0
Clothing (HS 50-63)					
Exports	320.9	372.2	387	372.4	399.2
Imports	310.2	333.8	330.9	310.2	276.6
Local purchases	n.a.	3.9	6.2	4.3	2.7
Purchases from FZ companies	1.1	0.7	2.4	0.9	2.6

Source: Paus (2005, 175 based on PROCOMER) n.a.: not available

The limited degree of domestic sourcing is primarily the result of lack of indigenous linkage capability and capacity and only secondarily of TNC sourcing strategies. The large TNCs (Intel, Abbot, Baxter) source the major inputs from the company-internal global network, i.e. a lot of the production is internalized among the affiliates spanning the globe. In addition, many of the key inputs simply cannot be produced in Costa Rica at this juncture, either because the requisite scale is too large or the technology is too sophisticated. Most important for some TNCs, however, is the fact that Costa Rica's manufacturing sector does not have the linkage capability necessary to supply high-tech TNCs, even with lower-tech material inputs, where scale is not an issue.

Many of the small and medium-sized TNCs in Costa Rica are very eager to buy inputs domestically. Smaller TNCs, by definition, do not have the global reach to internalize production across many borders. Thus, they either import from independent suppliers abroad or buy the inputs domestically. The absence of a global network together with a smaller absolute demand for inputs means that smaller TNC have much less clout to bargain for reduced input prices internationally. Consequently, they have a greater interest in achieving cost reductions through local sourcing, as long as technological sophistication, quality, and scale permit it.

But even though smaller TNCs have a greater motivation to source in Costa Rica, extensive anecdotal evidence, from author interviews and otherwise, indicates that they have encountered considerable difficulties in finding local suppliers. One small foreign company, which took the initiative to seek local suppliers for six machine shop parts, started out with the Yellow Pages. It eventually identified three suppliers willing to take on the job. But only one of them mastered the technical side of the production process, and it did not deliver on time. At that juncture, and after a process that had lasted eighteen months, US headquarters told them to abandon all attempts at local sourcing. The operations manager who had been so keen on developing his company's supply chain in Costa Rica summed up the experience with the comment "in the end, we are not responsible for making technical suppliers in this country."[10]

Not all attempts at backward linkages have ended in failure though. Another small foreign company has been producing specialty equipment for film cameras and is very determined to source as much as possible domestically, since labour costs are so much lower than in Europe, where the company is headquartered. The company estimates that the costs of producing parts locally is forty percent lower, and they have had an excellent experience so far in finding local producers who adopted ISO 9000 quality standards and learned the requisite technology.[11]

Some companies have indeed become successful material input suppliers to high-tech TNCs, producing specialty mouldings and parts of metal and plastics. But they are the exception rather than representative examples of the state of competitiveness of the indigenous manufacturing sector. Where there are success stories, TNCs have often played an important role in raising the technological capabilities of their Costa Rican suppliers. In interviews with the author, successful domestic input suppliers highlighted TNC support for the installation of quality control systems (e.g. ISO 9000), assistance with the acquisition of specialized machinery, and trouble shooting over production problems as they arose.

Most potential domestic input suppliers have been unable to provide the requisite quality; they do not have ISO certification or the technological know-how. Some may lack the drive of the Schumpeterian entrepreneur.[12] Others have not attempted to become TNC input suppliers, as it is a high-risk undertaking in a Catch-22 context. In order to become actual input suppliers, national producers need to invest in ISO certification and new machinery. But finance capital is expensive in Costa Rica, and the manufacturer will not know for certain whether a contract from a TNC will indeed be forthcoming if he goes through with the investment. On the other hand, a TNC is rarely willing to commit to a contract, without knowing that the Costa Rican producer can deliver the requisite quality, consistently and in the time frame required.

[10] Author interview with company's CEO in San Jose, May 2002.
[11] Author interview, June 2003.
[12] That was a frequently voiced concern in response to the interview question why national manufacturers were having difficulties in becoming competitive input suppliers. The common Spanish phrase that was used in this context was 'tienen otra cultura."

Over the years, there has been no a shortage of calls for pro-active linkage creation policies in Costa Rica, as well as incipient moves in that direction.[13] At one point in the second half of the 1990s, there were at least three programmes. But since these programmes were partly competing with one another, not coordinated, and certainly not integrated into a larger development strategy (which did not exist), they did not last very long.

The launching of Costa Rica Provee (CRP) in 2001 is the latest attempt at institutionalizing the promotion of indigenous linkage capability. A pilot project co-funded by the Inter-American Development Bank, CINDE and PROCOMER, CRP's charge was to turn potential national input suppliers into actual input suppliers of high-tech TNCs in the Free Zones. In 2004, the agency became formally integrated into the export promotion-agency PROCOMER, a critical step towards grounding the programme institutionally. It remains to be seen whether the programme will bring about a qualitative jump in domestic linkage capability, as it is grossly understaffed and underfunded.

The process of developing linkages is slow and gradual, as the experience of Ireland and other countries shows.[14] But for such a process to be successful requires that the promotion of linkage capability moves to centre stage, financially and institutionally. The creation of linkage capability has to be taken as seriously as the attraction of FDI, and both goals have to be pursued in tandem. On the one hand, that means increased funding, as a handful of people in the programme are insufficient to generate a critical mass of competitive input suppliers. On the other hand, creation of linkage capability requires synergetic, institutionalized cooperation among all the relevant players in the areas of technical training, financing, and market information.

Knowledge Spillovers

Although high-tech FDI in Costa Rica has not induced many knowledge spillovers through backward linkages, it has generated some spillovers through training and education. In 2001, fifty-five percent of exporters reported to have a training system, compared to sixteen percent of companies producing for the domestic market only. And among exporters, the percentage of foreign companies with a training system was nearly twenty percentage points larger than for national companies, sixty-eight percent versus fifty-one percent (Paus 2005: 182; IICE, 2001).

[13] Mortimore and Zamora (1999: 34) describe how the Arias Administration (1986-1990) tried to put an industrial reconversion program in place. It was not geared towards linkage development specifically, but more broadly towards increasing the competitiveness of the national manufacturing sector, as tariffs were reduced and import competition increased. Workgroups in three sectors were to identify problems and propose solutions. But there never were any proposals for concrete actions, and the funds were eventually used for other purposes.

[14] For details on Ireland see Paus (2005).

High-tech producers in Costa Rica employ a larger percentage of skilled workers which offers the potential for greater knowledge spillovers. In 2000, skilled labour constituted thirteen-point-four percent of employment in the Free Zones without Intel, and twenty-point-one percent, when Intel is included. In metal manufacturing, where most high-tech FDI is concentrated, the percentage of skilled labour was eighteen-point-seven percent without Intel and twenty-nine-point-six percent with Intel (Larudee et al., 2001). At times, foreign companies provide training in skill areas that not widely available in the host country. A foreign producer of precision instruments in Costa Rica, for example, emphasized that his company is one of the few in the country which uses CNC (computer numerical control). A 2004 survey of local input suppliers to TNCs showed that six-point-two percent of their managers, twenty-seven-point-six percent of their engineers, and thirty-one percent of their technicians had previously worked for a transnational corporation (Monge et al., 2004).

In addition to the accumulation of skills and knowledge in the production process and the positive spillovers that come with labour mobility, foreign high-tech companies have had an important impact on upgrading the technical curriculum at Costa Rica's universities. That is particularly true for Intel. Both the engineering school at the University of Costa Rica and the Technological Institute of Costa Rica have contracts with Intel to collaborate on the development of curricula for technical careers. The goal is to provide the most up-to-date skills and knowledge needed at different levels, from technicians to engineers, which would support an expansion of the sector and--potentially--a move up the value chain within the sector as well.

Technical training in Costa Rica, especially in computer technology, has given rise to a growing national software industry. Its origin predates the arrival of Intel and other high-tech TNCs, but its subsequent development was aided by the presence of high-tech TNCs, as these corporations expanded the availability of trained personnel. It is not coincidental that the software industry in Costa Rica has developed primarily on its own. With no barriers to entry and plenty of opportunities for niche production, it is easier to establish oneself on a small scale, given requisite training and access to funding. The lack of venture capital has been a major problem though, as it has been for other companies in Costa Rica.

Mexico

As in the case of Costa Rica, Mexico attracted a significant amount of FDI into the IT sector, but FDI generated very few spillovers. The numerous TNCs that came did not see it in their strategic interests to contract with local Mexican firms. Rather, large TNCs invited TNC contract manufacturing firms to co-locate in Mexico. Mexican firms, which could potentially have grown into contract manufacturers themselves, lost out on the opportunity to develop into suppliers to the TNCs which came. This is largely due to the highly concentrated nature of the global IT industry and the failure of the Mexican government to see the need to develop linkage capabilities between national and foreign firms in the presence of the pervasive market failures that faced domestic firms.

In the case of Mexico the most significant market failures were imperfect competition, lack of information, and weak credit markets. TNCs in the high-tech sector are highly oligopolistic and therefore have the market power to pick and choose suppliers with whom they have already developed a long-standing relationship and who have a track record of high quality production. Most of the high-tech TNCs operating in Mexico import their supplies from Asia where they have long-established relationships. Furthermore, Mexico's weak banking system falls far short of providing necessary credit to domestic firms for R&D, increasing scale and so forth—all necessary ingredients to make such linkages possible.

Lack of Backward Linkages

Mexico had a significant number of indigenous high-tech firms when the influx of foreign firms that occurred in the 1990s. However, the TNCs did not see it as in their strategic interest to establish linkages. The TNCs are oligopolies with supplier networks located in other parts of the globe, namely Asia. As mentioned earlier, TNCs opted for inputs from suppliers with whom it already had developed a long-standing relationship and who have a track record of high quality production. In addition to the bias toward TNCs and their Asian suppliers in the marketplace, indigenous firms lacked the technical capabilities and the scale necessary to be attractive to new TNCs that came to Mexico.

The Mexican government failed to "correct" market failures with pro-active government policies. In Taiwan, a nation that was able to become a true Latecomer in the high tech sector, the government helped to facilitate the development of productive capabilities and scale economies. R&D in Taiwan was conducted with government labs, and indigenous firms were able to "ramp up" scale to meet global demand because the Taiwanese government provided access to capital (Amsden and Chu, 2003). Mexico provided none of these policies. Instead, the government's liberalization and tax policies accentuated the bias toward importing inputs by TNCs.

Unlike Costa Rica, Mexico had numerous indigenous high-tech firms prior to the high-tech FDI boom in the 1990s. The region had indigenous firms that manufactured their own computers, such as Scale and Electron Computers. It also had wholly owned or joint-venture assembly manufacturers that such as Unisys, Cumex, and Mexel. Below these two tiers of firms were numerous niche suppliers such as Electronica Pantera, Microtron, and others (Palacios, 2001; Rivera Vargas, 2002; Wilson, 1992). These indigenous firms worked alongside TNCs and some supplied global firms such as IBM, Motorola, Hewlett Packard, and Kodak.

In the 1980s when Hewlett Packard, IBM and other TNCs were manufacturing in Guadalajara, the majority of the assembly work occurred in the subsidiary plants themselves. Hewlett Packard was manufacturing inkjet and laser printers and doing final assembly. IBM was assembling PCs and hard disks in house. When the global industry began to ramp up and increase specialization in the 1990s (and in the absence of local

input requirements), the big companies started to focus almost all their efforts on R&D and marketing (at developed country headquarters) and began contracting out the manufacturing.

Looking back, the move by the leading multinationals to shift toward contracting-out their assembly operations presented a real opportunity for the Guadalajara region. Indeed, in the early 1990s there were a handful of local firms involved in some kind of electronics manufacturing—a number of whom were already CM assemblers (Wilson, 1992). This is exactly the opportunity that Taiwanese firms had seized years earlier. Existing indigenous CMs were able to scale up their activities and directly contract with the leading tier flagship firms, thus capturing the market and opportunity to serve as CMs. Many Taiwanese firms are now among the leading global CMs. Others went on to a further graduation to become OEMs and ODMs as well (Amsden and Chu, 2003).

Yet as the global high-tech commodity chain began to shift in the mid-1990s, HP and IBM literally "invited" US headquartered CMs to Guadalajara rather than attempt to work with local or national firms. Oligopolistic firms like HP and IBM opted for inputs from suppliers with whom they had already developed a long-standing relationship and who had a track record of high quality production. By the mid 1990s, US-based CM giants Jabil Circuit, SCI-Sanmina, Flextronics, and Solectron (along with NatSteel from Singapore) had established plants in Guadalajara that conducted virtually all of the manufacturing for HP and IBM. For HP's part, they have also moved a significant portion of the manufacturing to Asia.

Between 1994 and 2002, ninety-seven percent of all investment in Guadalajara's electronics sector was foreign (CADELEC, 2004). The effect of the bias towards foreign CMs has been to crowd out many of the local suppliers, assemblers, and producers that had thrived there. The loss of that market and the inability to compete with the new foreign CMs spelled the end for many of Guadalajara's indigenous firms. Rivera Vargas (2002) found that there was a seventy-one percent decline in the number of indigenous firms between 1985 and 1997. Based on author interviews, we learned that thirteen of the twenty-five indigenous electronics firms that had still been in existence at the end of 1997 had closed by 2005 (Gallagher and Zarsky, 2006).

With the top two tiers (OBMs and CMs) occupied by TNCs, there are very few linkage opportunities for national firms that have survived. This is the case for the Mexican export and electronics sectors as a whole and for Mexico's Silicon Valley in particular. Table 4 shows the use of domestic inputs for Mexico's export sector before and after NAFTA. While the share of domestic inputs in total inputs almost doubled from one-point-five to two-point-eight percent of the inputs of foreign firms, domestic inputs form a minuscule amount of inputs to foreign firms, at less than three percent of all inputs. The electronics sector has even fewer linkages than the average in manufacturing, with the national input share at one-point-nine percent in 2002.

Table 4. Use of Domestic Inputs in Mexico's Export Sector, 1990 and 2002 (Thousands of Current Mexican Pesos).

Sector		***1990-1995***	***1996-2002***
All Industries			
	Total Inputs	57,230,582	363,755,127
	Domestic Inputs	864,960	11,027,186
	Domestic Share	1.5%	2.8%
Electronics			
	Total Inputs	29,998,845	216,295,479
	Domestic Inputs	218,372	4,390,352
	Domestic Share	0.8%	1.9%

Source: INEGI, 2003

Our interviews with the bulk of the high-tech firms in Guadalajara confirm this trend and help deepen the understanding of the dynamics behind it. All of the CMs that we interviewed told us that that they import over ninety-five percent of their inputs from overseas; official statistics say the average for the region is ninety-six-point-three percent.[15] Most of the CMs are working with local firms that supply cardboard boxes, shipping labels, cables, wires, and disposal services. This finding suggests that although the share of national inputs has increased (though still remains very small) the composition of those inputs has changed from national high-tech firms to national shipping and disposal firms. In an interview with one engineer from Flextronics we were told "even the trucking companies are foreign."

Anticipating that NAFTA would bring increased investment into the high tech sector may have led the Mexican government to seize such an opportunity and help build linkages from new TNCs that would come to the country and the domestic firms that had the capabilities to serve as suppliers. Instead, the liberalization strategy provided increased incentives for oligopolistic TNCs to source outside of Mexico. Tariffs and local content standards, though imperfect, implicitly had served as "second best" policies to put indigenous firms on a more level playing field with oligopolistic TNCs. Liberalization policies which let go of these instruments threw national firms into a competitive context in a highly concentrated market where they could never compete because domestic firms lacked the technical capabilities and scale needed to be core suppliers for TNCs. This was accentuated by the fact that under oligopolistic conditions TNCs could source inputs from suppliers with whom it had already developed ties with in

[15] Based on a comprehensive study on the learning levels of sub-contractors in Jalisco during the peak period of 1996-97 Dussel (1999) found similar results: he estimated that the value added by Mexican firms to total production is only about five percent.

Asia. National tax policies that gave TNCs further tax breaks and incentives to import inputs if the product was re-exported (PITEX and Maquila Programas) also steered TNCs to look abroad for inputs.

Knowledge Spillovers

Although high-tech FDI in Mexico has not led to many knowledge spillovers through backward linkages, like in Costa Rica it has generated a modest amount of spillovers through training and education, research and development and spin-offs. Mexico is a low link in the global electronics commodity chain. The CMs in the region are conducting the final assembly and sub-assembly of high-tech products. The firms employ thousands of workers who work on assembly lines; they receive initial training for their part of the process and little else throughout the rest of their tenure at the plant. This becomes evident when looking at the educational distribution of work in Guadalajara electronics firms discussed in the previous section. A recent study estimates that seventy-three percent of employees have a high school education or below; sixty-six-point-one percent of all workers in the plants have the equivalent of a middle school education or less; only six-point-nine percent of employees have graduated from high school and point-fifty-two percent have graduate training. However, 100 percent of all employees in Guadalajara's plants are Mexican (Partida and Moreno, 2003).

Another aspect of the employment process in Guadalajara that makes spillovers more difficult is the shift toward sub-contracted employment. Because wages in the region began to creep up relative to foreign competitors, the majority of workers in the sector (seventy-two percent) are hired and paid by the more than twenty-five employment firms in the region. Sixty-eight percent of the sub-contracted workers receive all their training at the employment firm, not from the high-tech firm itself. The nature of these sub-contracts is very temporary, which increases turnover rates. Sixty-four percent of all workers are women, and eighty percent of all workers are under thirty.[16] Sixty-five percent of all sub-contracted workers have one to three month contracts, seventeen percent have contracts that last three months to one year, and only eighteen percent have contracts that last over a year (Partida, 2004). And our interviews suggest that the higher-skilled workers are most likely to move from one high-tech TNC to another. The thought of working with a local firm does not cross their mind. Rivera Vargas (2003) found that some of the CMs provided quality control training to carton and packaging suppliers. One indigenous supplier of cables and wires that we interviewed had been trained to meet ISO 9000 standards.

We also found that a limited amount of R&D is being conducted in Guadalajara by the foreign firms, the local suppliers, or between TNCs, local suppliers, and local universities. In all of our interviews with the large multinationals and CMs we were told that no R&D is conducted in Guadalajara, though at times in the past it had been. In the case of IBM and HP, R&D is conducted in the US.

[16] In California's Silicon Valley, sixty-seven percent of workers are older than thirty.

Rivera Vargas (2002) conducted a large study on industry-university relationships in Guadalajara's electronics industry. She found that eight of the close to sixty electronics firms in the Guadalajara region were involved in some type of collaboration with area universities. In each of these cases, foreign firms were working with universities to conduct quality control efforts and perfect assembly procedures for existing plants.

Although the general trends suggest a paucity of knowledge spillovers, a small but burgeoning software and design industry has emerged in Jalisco. Much of this movement traces back to when IBM first established operations in the region. Remember that in 1985, Mexico granted IBM full ownership of its Guadalajara plant in exchange for a commitment to set up a training facility that would boost local technological capacities (the *Centro de Technologia de Semicontuctores* (CTS)). Although IBM no longer continues to be part of CTS, the centre has led to a handful of spin-offs that continue to spawn interesting developments twenty years later.

According to an Intel official, the key benefit of CTS was the exposure of Mexican engineers to technology—specifically how to develop integrated circuits and computers. With IBM's involvement, CTS trained about sixty engineers in total. At its peak, there were thirty-two people, but there were generally twenty-five engineers in training at a given time. Many engineers left CTS to seek engineering jobs in the United States. However, three firms spun off from CTS: TDCOMM, Mixval and DDTEC. In 2004, only Mixval was still in operation, TDCOMM had been acquired by Intel Venture Capital in 2000 (Gallagher and Zarsky, 2006).[17]

Lessons from the Costa Rican and Mexican Experiences

Foreign investment remains an attractive option for developing nations who wish to change the structure of their economies away from primary products and toward higher value-added economic activity. If nations are able to attract FDI, the most important contribution high-tech FDI can make to the development of a host country is through technological and marketing spillovers that lead to the eventual advancement of indigenous knowledge-based assets. High-tech FDI in combination with domestic linkage capability provides a shot at the high road to development. The low road of insufficient productivity growth and declining wages is not a road to development, but it is *de facto* the default option.

One of the main lessons from the Costa Rican and Mexican experiences is that the pursuit of the high road demands pro-active policies from the beginning, and not as an aside or afterthought. Pro-action is needed to attract FDI, to promote indigenous linkage

[17] Based on an interview with Jesus Palomino Echartea, the general manager of Intel Tecnologia de Mexico's Guadalajara Design Centre.

capabilities, and to enhance key location-specific assets on an on-going basis in the context of a coordinated policy framework.

Successful recipients of FDI have gone after high-tech FDI in a very deliberate fashion, to counter TNCs' imperfect information about the host country and to help shape the niche of specialization within the high-tech field. Through the targeted pursuit of particular companies governments can also foster the development of clusters in areas that hold out high promise of successful niche specialization. Clusters can be particularly conducive to development, as the geographical proximity of companies producing similar or complimentary products generates economies of scope and agglomeration (Krugman, 1995; Krugman and Venables, 1996; Porter, 1998). Governments must maximize the benefits of their limited resources and target those industries and companies, which hold out the greatest promise of positive spillovers.[18]

A targeted pursuit of potential foreign investors also raises the probability of attracting a well-known TNC which will put the country on the radar screen of other potential foreign investors and help set it apart from other countries vying for high-tech foreign investment. TNCs' limited information about any particular developing country as a possible investment site will be expanded considerably by the demonstration effect of the investment of an internationally known TNC.

Both Costa Rica and Mexico have institutions charged with attracting FDI, CINDE and CANIETI, respectively. It is critical that these institutions are firmly embedded institutionally in the context of a larger development strategy, and that they have the resources needed to do their jobs. CINDE's lack of embeddedness in a larger strategy and its very limited resources impose great limitations on its effectiveness.

A second area where markets cannot be relied upon to lead to the desired outcome is achievement of competitiveness and linkage capability of the national industrial sector. When the gap between domestic linkage capability and TNC expectations regarding input quality and price is too large, the possibilities for spillovers via linkages are very small. One expression of the size of the gap between linkage capability and TNC expectations is the extent of market failures under which indigenous producers operate. Imperfect information, high risk, barriers to entry, and perhaps insufficient Schumpeterian animal spirits are huge obstacles to the development of a competitive indigenous supply sector, notwithstanding the occasional successful local supplier.

The potential for backward linkages from high-tech FDI is obviously lower in a small economy like Costa Rica compared to a larger economy like Mexico. Yet in spite of size differences neither country has seen many backward linkages to date, an indication of lacking linkage capability in both economies.

Why is it that governments, which have pursued free-market policies, recognize more easily the need to counter market imperfections when it comes to foreign

[18] Lall (2005) provides an excellent and detailed discussion of these issues.

companies than when they pertain to national industry? Costa Rica and Mexico are not alone in the neglect of national producers. Based on an analysis of twelve clusters in Latin America, Pietrobelli and Rabellotti (2004) argue, "The major shortcoming of the current policy approach in most countries is the lack of an integrated and consistent vision of local SME [small and medium-sized enterprise] development and upgrading." Preferential treatment for foreign investors, whether through quicker customs' procedures, imports of tariff free inputs, exemption from profit taxes, are justified with the argument that the benefits from FDI outweigh the costs. But the development of spillovers, which are at the core of such benefits, depends strongly on the existence of national linkage capability. When that capability does not exist due to widespread market failures, when market liberalization generates a dual industrial sector, with a stagnating or declining nationally-owned part and a thriving foreign-owned part, then pro-active policies are needed to establish a level playing field for national producers, and to harness the potential benefits of high-tech FDI for development.

The promotion of indigenous linkage capability has to be an integral part of industrial policies more generally. The very same market failures which prevent the automatic development of national linkage capability are also the ones which prevent advancement and diversification of indigenous economic activity more generally, in the manufacturing sector and otherwise. Adopting pro-active policies to overcome market failures does not mean that governments have a better understanding than the private sector of the economic areas of profitable engagement. Rather, it is about public-private cooperation in identifying where the key obstacles lie, in our case with respect to linkage formation and integration into clusters. The policies to address these obstacles need to have built-in control mechanisms, with clear rules of accountability, reciprocity, and enforcement. There is a growing literature on how best to structure such policies to increase the likelihood of their success (Amsden, 2001; Mortimore and Peres, 1998; Rodrik, 2004). The specifics depend on the particular country context, i.e. available resources and institutional capabilities.

Adopting state policies to make FDI work for development rests on sound economic grounds. However, it is important to avoid mistakes from the past. Governments, which are embedded in the private sector, while maintaining relative autonomy from sectoral rent-seeking elites, have a much greater likelihood at being successful promoters of development (Evans, 1995; 2005). It is essential for governments to understand the many market failures that exist for the private sector and to play an effective role in correcting them (Rodrik, 2004). With the proper embedded autonomy, government subsidies can be balanced by control mechanisms that measure and reward the performance of the receiving sector or firm. Such mechanisms have taken the form of R&D and patent goals, linkages with local industry, and so forth (Kumar, 2005). But a government's relative autonomy and embeddedness in the market is primarily the result of the country's political economy, and not of policy choice.

This paper has also shown that the match between a country's location-specific assets and TNCs' strategic needs is not written in stone, but contingent upon changes in the global market place. The increased competitive pressures in the global economy

heighten the need for countries like Costa Rica and Mexico to upgrade their location-specific assets, in a continuing attempt to keep attracting higher value-added FDI. There is great need for continuing investment in education and infrastructure, as well as access to finance capital. In the case of Mexico and Costa Rica, the requisite public investments are thwarted by very low tax ratios: tax revenue as a percentage of GDP was twelve percent in both countries in 2000.

The challenges to raising the tax ratio are profound. On the one hand, they have to do with the power constellations within the countries. On the other hand, the mobility of capital across national borders has given TNCs enormous bargaining power, especially as developing countries are competing for their attention. And as countries adopt preferential tax-related policies that do not violate WTO regulations (e.g. tax credits for R&D for whom all producers are eligible, but which *de facto* will benefit primarily TNCs), they reduce tax revenues further.

Finally, firms in developing countries need time to respond to the competition from transnational corporations (TNCs) and to reap the benefits from spillovers. That time has been shortened considerably by the dynamic forces behind the current globalization process. The entry of India, China, and Eastern and Central European countries on the global stage has intensified competitive pressures for producers worldwide. And the growing ease and speed with which transnational corporations reorganize their value chains across national borders leaves developing countries with less time to reap the potential benefits from FDI, increases TNCs' expectations of what host country firms need to be able to do to become integrated into their supply chains, and increases the pressure on indigenous companies for constant upgrading.

In sum, the bar for participation in a TNC's global production network has been rising, and the time period during which spillovers can be absorbed has been shrinking. Both factors make it more difficult for indigenous producers to pursue an input supplier-based upgrading model. And both ratchet up the urgency of pro-active policies to overcome market failures and support the development of indigenous technological capabilities.

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