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Industrial Success And Failure In A Globalizing World

Sanjaya Lall *

Globalization is a pervasive influence on industrialization in the developing world. As the embodiment of technological progress and more open markets, it offers huge productive benefits to developing countries. However, its effects are very uneven. It is driving a growing wedge between the (relatively few) successful countries and the (large mass of) others. The wedge is not a temporary one, a 'J-curve' that will reverse itself if countries persist with liberalization. It reflects underlying structural factors that are very difficult to alter in the short to medium term. Because of cumulativeness in these structural factors, divergences are likely to carry on growing unless measures are undertaken to reverse them. Development policy has to address these growing structural gaps and to reverse or relax the stringent rules of the game that constrain the use of (previously successful) industrial policy. Such successful industrial policies have taken many different forms and countries have to choose combinations that suit the demands of current globalization.

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* University of Oxford, Queen Elizabeth House

1. INTRODUCTION

Globalization is perhaps the most pervasive and powerful influence on industrialization today. As the embodiment of technological progress and more open markets, it offers enormous productive benefits to developing countries. Indeed, the current advocacy of 'openness' is premised on such productive potential. That the potential is real is not in doubt. What is in doubt is how best developing countries can best exploit it. One strand of globalization advocacy argues that this is done best by neoliberal policies, a withdrawal of the state from all economic activity apart from the fundamental provision of law and order and basic public goods. In a more moderate version, this strand admits a larger role for the government, but a 'market friendly' one where it does not influence the allocation of resources at the activity level (it does not, in the jargon, exercise selectivity). The underlying assumptions of both approaches are that markets are efficient and governments inefficient and that technology flows across countries most rapidly and effectively (in terms of its absorption and use) via free market channels.

Neither assumption is justified. There is a large literature on this that I do not intend to review here. My purpose is to describe the recent evolution of the industrial economy in the developing world and show that while globalization is catalyzing rapid growth in some countries it is also driving a growing wedge between the (relatively few) successful countries and the (large mass of) others. The wedge is not a temporary one, a 'J-curve' that will reverse itself if countries persist in liberalising and globalising. On the contrary, it is cumulative and structural, and is likely to carry on growing unless strong policy measures are undertaken to reverse it.

This paper is based on work by the present author (in collaboration with Manuel Albaladejo) for the United Nations Industrial Development Organization in the context of its new *Industrial Development Report 2003/2003* (UNIDO, 2002). This 'flagship' report presented a new Scoreboard of industrial performance and capabilities, benchmarking 87 countries at all stages of development. The full report is available on the Internet at www.unido.org/idr.

2. FEATURES OF CURRENT GLOBALIZATION

Globalization has many different meanings and manifestations. Here it is taken to refer only to the aspects relevant to industrialization in the developing world.

- Economic distance is, as noted, shrinking rapidly due to technical progress in information processing, transport and communications. The impact of this is that the 'natural protection' countries have enjoyed through history has been sharply reduced: international competition now appears far more quickly and intensely. In combination with trade liberalization (below), this changes completely the setting in which developing countries can build up new industries. At the same time, it opens up new market opportunities. With some well-known exceptions, markets in developed countries are more open than before, and shrinking distance allows exporters to reach international markets more efficiently. It also allows importers in developing countries to access foreign products, services and technologies more cheaply and consumers to collect information at very low cost. There are clearly mixed implications for employment: larger exports promote it while intensified competition can lower it unless local enterprises can raise their efficiency.
- There is rapid technical change in all activities, forcing enterprises in all countries, regardless of the level of development, to adopt new technologies to be viable (new 'technologies' include not just products and processes but also new methods of organising

firms, managing inter-firm relations and supply chains, linking to innovation and so on). Analysts talk of a new 'revolution' or 'paradigm shift' in technology, so widespread and dramatic are its effects on economic life. This revolution calls for new skills, production structures, infrastructure and institutions, in particular those related to emerging information and communication technologies (ICTs). In this setting, the ability to generate and sustain employment depends on the ability of countries and firms to promptly gain access to, efficiently use, and then keep up with new technologies. This needs, in turn, new sets of skills, organizational relations and infrastructure.

- Every country, regardless of its level of development, has to engage in constant technological effort. Industrial leaders have to invest in technology generation; followers have to invest in absorbing and adapting technologies, which is also difficult and demanding. The pace, complexity and skill needs of technology make participation increasingly demanding but they also allow countries to specialize more narrowly in particular processes and functions within globalized production systems.

- Technical change affects all activities, but it benefits some more than others. There are enormous structural changes under way, with innovation-based manufacturing activities gaining at the expense of others. In particular, primary products and resource based manufactures are losing shares to other activities, while high technology products are gaining at the expense of all others.

- Patterns of competitive advantage are changing as exports grow in response to two forces: *innovation* and *relocation* (of activities, processes or functions to lower cost areas). Both are seen in most industries, but their importance differs by technology and physical characteristics. Some products (like pharmaceuticals) grow rapidly mainly because of innovation; there is little relocation to take advantage of low wages. Some (like electronics) benefit from both innovation and relocation – they have low-technology assembly processes that can be placed in poor countries. Some (like apparel) are driven primarily by relocation. Some (like automobiles) undergo some relocation, but their technological complexity and 'weight' (critical components are, unlike electronics, heavy in relation to their value) means that distances have to be small (NAFTA is a good example). Exports in which neither innovation nor relocation are relevant tend to grow slowly. Clearly, these differences are important, as a major driver of employment in a globalizing world is the relocation of export-oriented activities to poorer countries. However, note also that the process of relocation is very dynamic, and new forms are appearing constantly. In the service area, in particular, there is a veritable surge of functions like data entry, call centres and so on being sent to low wage countries.

- Productive resources – goods, inputs, capital, technology and high-level skills – move around the globe more easily and rapidly. A great deal of mobility does not involve ownership, but in general it does: thus, the role of transnational companies (TNCs) with affiliates under their control is growing. New organisational techniques and ICTs allow TNCs to grow larger and spread their activities efficiently across greater distances. Their growth is accompanied by a growing trend to internalise more tightly the most valuable technologies, so that entering these activities necessarily involves entry by TNCs. Employment generation in such activities thus needs FDI attraction and targeting strategies by developing countries. At the same time, competitive pressures force them to specialise more narrowly and hive off non-core activities and functions to other firms. The process is very dynamic and yields some unexpected results. An excellent example is the use of contract manufacturers by leading electronics firms: many firms are moving to innovation and marketing, leaving all production, procurement and logistic functions to unrelated firms. It also opens up new opportunities for external suppliers and subcontractors with the capabilities needed to meet the needs of technology-intensive TNCs.

- However, FDI in the developing world remains highly concentrated, and is growing more so over time. The share of the leading five and ten recipients of FDI in the developing world has grown, while declining in the world as a whole.
- International industrial value chains are more tightly coordinated than before, both within firms (by TNCs[1]) and externally (by contractual or informal relationships[2]). As noted, functions and processes are being subdivided and located across the globe to take advantage of fine differences in costs, logistics, markets and innovation.[3] The process is cumulative and path-dependent, with first movers building up greater advantages based on learning and agglomeration.
- Locations that have been able to plug into dynamic value chains have seen large, sustained increases in employment. A large part has been in relatively low-skill assembly activities, but in the high technology end, like electronics, activities have tended to 'stick' rather than move on as wages rise. It is low technology activities like clothing that have been relatively footloose. However, only a few countries have become part of global supply chains to a significant extent, even in low technology activities (and here one of the main drivers, the Multi-Fibre Arrangement, is about to expire). There are large numbers of low wage countries that have been effectively marginalized.
- The changing nature of global value chains also means that strategies to benefit from globalization have to change. The more autonomous strategies that countries pursued some 3-4 decades ago are less feasible and more risky. This does not mean that local capabilities cease to matter – quite the contrary. Moreover, entering into global sourcing activities also needs assiduous targeting and attraction of the international players involved.
- The determinants of competitive advantage (for export-oriented and other activities) are changing. Mobile resources increasingly need strong complementary immobile resources in host economies, and these are far more than primary resources or cheap unskilled labour; they also need sophisticated strategies of attraction, targeting and leveraging. Technological competence, skills, work discipline and trainability, competitive supplier clusters, strong support institutions, good infrastructure and well-honed administrative capabilities are the new tools of comparative advantage. In sum, developing countries that are able to develop these immobile assets are the ones best placed to generate employment growth. However, the evidence suggests that such immobile assets are unevenly distributed over the developing world, and are growing more so as globalization proceeds and first movers get onto a virtuous circle of growth and development of more advanced capabilities. However, even several first movers face severe challenges in

[1] Thus, some 30-40 percent of the trade handled by TNCs is actually within the firm (between different affiliated companies) and is not transacted on open markets (UNCTAD, 1999).

[2] There is a tendency for lead firms to rely on a smaller number of 'first tier' suppliers, which in turn deal with and coordinate second and third tier suppliers. The first tier suppliers are major TNCs in their own right.

[3] In some low technology activities like apparel, lead coordinators are international buyers rather than TNCs. The role of direct ownership (i.e. of FDI) in coordinating globalised activities depends on the nature and pace of change of the technology and the availability of specialised suppliers; it is also changing rapidly over time as systems become more open.

sustaining employment growth, while the 'outsiders' are in danger of continued marginalization from the mainsprings of growth.

- Global value chains, particularly integrated production systems, cannot spread evenly over developing countries because of inherent technological features. Many advanced activities have strong economies of scale and agglomeration, and so tend to concentrate in the few locations that can provide the minimum critical mass of skills, suppliers, services and institutions they need. There is therefore unlikely to be continuous cascading of production facilities as wages rise: on the contrary, there may be large discontinuities in the relocation process. Once established in particular developing countries, TNCs are likely to 'stick' for long periods, at least until wage and congestion costs rise to uneconomic levels or the supply of relevant skills run out.[4] The main drivers of recent export growth in medium to high technology industries – electronics and automobiles – are therefore unlikely to reproduce their benefits in new developing regions. Other production systems may arise, of course, but whether they provide the same dynamism as seen in the past two decades remains to be seen. In the low technology area, the main activity – clothing and apparel – may carry on spreading to new locations, but the factor that drove its relocation earlier, the Multi-Fibre Arrangement, will end in 2005 and the future is unclear thereafter. There is a risk that much of the industry will relocate to Asia, from which quota restrictions drove it out.

3. TECHNOLOGICAL PATTERNS OF TRADE

Rapid technological progress is causing significant long-term shifts in the structure of industrial activity. As noted above, activities with higher "technological intensity" — those with higher than average expenditures on R&D — are growing faster than other activities. While every activity makes use of new technologies, differences in innovative potential, the speed of application of new innovations and different rates of demand expansion affect relative growth rates. The data in Table 1 show that high technology activities the world over are expanding in both production and trade much faster than other manufacturing activities; moreover, trade is growing faster than production, indicating the 'globalization' of all economies.

Not only do technology-intensive industrial activities lead in dynamism, they also generally offer greater learning potential and greater spillover benefits for other activities. Such activities have become the most active field for international investment. This has important implications for developing countries. First is the "market positioning' argument. A country that wants to locate its production and exports in the fastest- growing markets has to move into technology-intensive activities and upgrade its technology structure. Second, countries that want to deepen technological development and gain from the spillover effects of learning in lead sectors again have to focus on technology-intensive activities. Third, those that wish to share in the most dynamic segments of world trade—the international production systems of transnational companies—have to build the capabilities for technology-intensive activities. They can enter the assembly stage, but later have to upgrade, moving into deeper manufacturing, design, development and regional service activities.

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[4] This is in fact a real danger for countries without strong local industrial bases that have benefited greatly from TNC relocation. Examples are Malaysia, Thailand and the Philippines, where there is a strong challenge emerging from China, with lower wages, more low-level skilled labour, a large supply of technical manpower and a developed supplier base. See Lall (2001).

Table 1: Rates of growth of high technology and other manufacturing, 1985–1997 (percent)

	All Production	All Exports	High-Tech Production	High-Tech Exports
68 countries	2.7	7.3	5.9	10.8
China	11.70	20.50	14.90	30.20
Korea	10.20	10.60	15.40	18.70
Singapore	8.00	15.00	13.10	21.70
Taiwan	4.70	12.00	11.60	18.90
Hong Kong	-0.20	13.50	3.50	18.10
United States	2.90	8.80	4.70	10.10
Germany	2.20	4.10	3.80	5.80
UK	1.70	6.30	3.30	8.00
Japan	1.70	2.40	5.20	4.40
France	1.20	5.80	3.60	10.80

Source: NSF (1999).

Now consider detailed technological breakdown of exports, divided between primary and manufactures, with the latter sub-divided into four categories: resource-based; low-technology (such as textiles, clothing, footwear, simple engineering products); medium-technology (industrial machinery, automobiles, chemicals, and so on); and high-technology (with ICT shown as a sub-category). The medium-technology group is the largest — the heartland of heavy industry — but the high-technology group, with only 18 products at the 3-digit SITC level, is driving world trade and may soon be the single largest category.

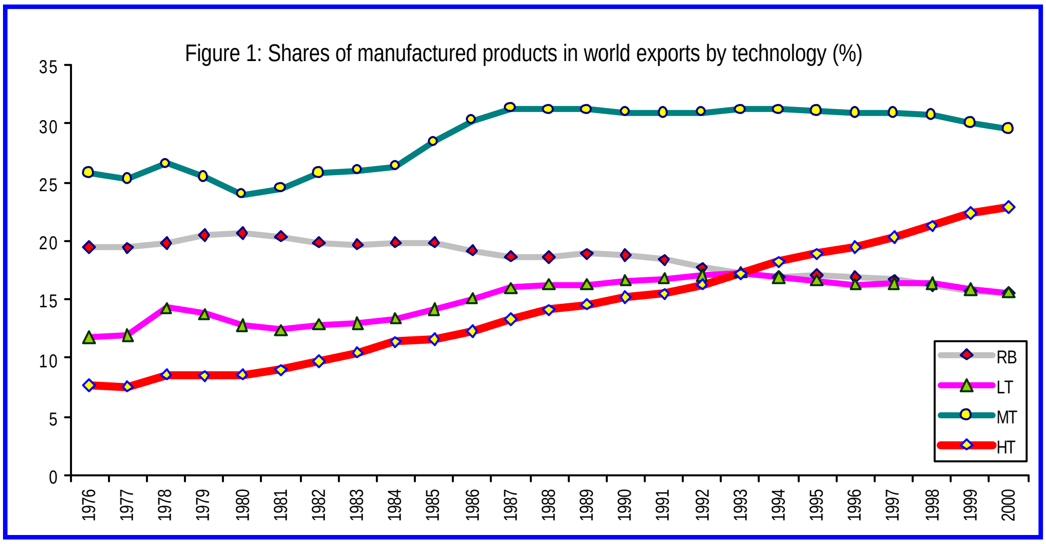
Table 2: Structure of world exports, 1985-2000 ($ million and %)

Products	1985	2000	Annual growth rate	Distribution 1985	Distribution 2000
All sectors	1,703,582,494	5,534,008,649	8.17%	100%	100%
Primary Products	394,190,554	684,751,141	3.75%	23.1%	12.4%
Manufactures	1,252,573,675	4,620,266,770	9.09%	73.5%	83.5%
Resource based	330,863,869	863,503,545	6.60%	19.4%	15.6%
Low Technology	241,796,065	862,998,972	8.85%	14.2%	15.6%
Medium Technology	485,784,011	1,639,871,870	8.45%	28.5%	29.6%
High Technology	198,029,682	1,269,587,194	13.19%	11.6%	22.9%
(of which, ICT)	90,151,843	773,119,244	15.40%	5.3%	14.0%

Source: Based on UNCTAD (2002).

Table 2 shows growth rates for the period 1985-2000. Primary products grew the slowest, and nearly halved their share of total exports. Resource-based manufactures followed. Low and medium-technology manufactures grew at more or less the same rate, and both slightly raised their market shares (in a more detailed calculation, not shown here, MT products grew faster than LT after 1995). The fastest-growing group was high-technology products. At the start of the period, in 1985, the 18 high-technology products comprised about 10 percent of total world trade; by 1998, they accounted for nearly a quarter. At current rates, these few products (at the 3-digit SITC, rev 2, classification used here, there are 45 primary products, 65 RB, 44 LT and 58 MT products) will soon account for the largest share of exports. Of the 20 fastest growing products in world trade (with export values of $5 billion or more) in 1990-2000, the five leaders are all high technology products. Of these, four are electronic or electrical products and one is pharmaceuticals.

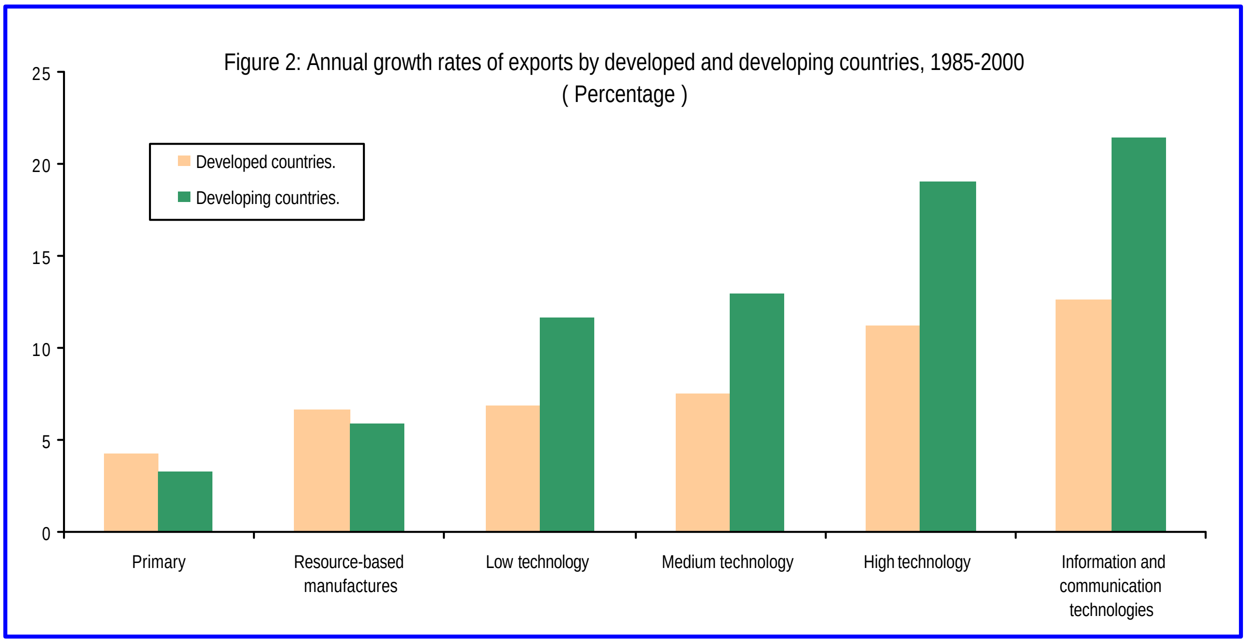
In terms of market shares, primary products have been losing ground steadily since 1976. Within manufactured products, RB products have lost shares since the early 1980s, LT since 1993 and MT since 1998 (Figure 1). The only group to steadily raise its market share is HT. While these may not capture real long-term trends, they do suggest that the conclusion drawn earlier about the dynamism of technology-intensive products is well-founded.



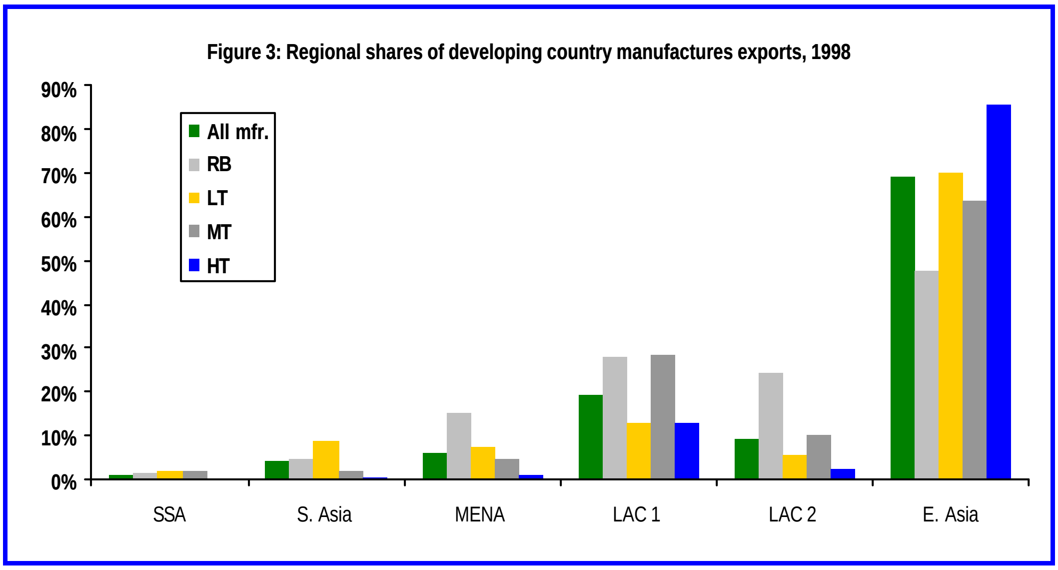
4. COMPETITIVENESS OF DEVELOPING COUNTRIES

Developing countries as a group are doing well in this export scene. To start with, their total manufactured exports are growing faster than those of developed countries. This is to be expected, since they started from a lower base. However, the technological patterns of their growth are interesting, and somewhat unexpected. Developing countries grew more slowly than developed countries in primary products and resource-based manufactures (Figure 2), presumably because of the faster application of new technology or because of trade barriers and subsidies in the industrial world. Within other manufactures, their relative lead over industrial countries rose with technology levels.

At first sight, this is counterintuitive: theory leads us to expect that developing countries would grow fastest relative to developed countries in low technology, less in medium technology, and least in high technology, products. The data show the reverse. Moreover, it is not just rates of growth that show this trend (caused by the small initial base in high-tech exports); the values involved are also very large. High-technology exports are now the largest single component of developing country manufactured exports. In 2000, at $445 billion, they were $60 billion larger than developing country primary exports, $210 billion larger than resource-based manufactured exports, $39 billion larger than low technology exports and $140 billion larger than medium technology exports.



This pattern suggests that developing countries are doing very well under globalization, raising their competitiveness overall and also moving rapidly into dynamic technology-based exports. Unfortunately this is only partially true. Export dynamism and success in technology-intensive exports are *highly concentrated*, both by region and by country. Moreover, the local depth and "rooting" of high-technology activity vary greatly among the successful exporters; those with shallow roots may find it difficult to sustain their recent growth of competitive production. Consider first the concentration at the regional level (Figure 3).



Notes: SSA = Sub-Saharan Africa; MENA = Middle East/North Africa, including Turkey; LAC 1 = Latin America and the Caribbean including Mexico, LAC 2 = LAC excluding Mexico.

East Asia now accounts for about 75 percent of total manufactured exports, and about 90 percent of high-technology exports. What is more, its dominance has increased in practically all categories since 1985. At the other end, Sub-Saharan Africa (even including South Africa, which accounts for over 40 percent of industrial production and even more of manufactured exports) is very weak, and is losing its small shares over time. Its virtual absence in high-technology exports is one sign of its marginalization in the dynamics of world trade. South Asia does well in low-technology products, basically clothing, but greatly under-performs other categories (this excludes Indian exports of software, which are not captured by these data).

Latin America and the Caribbean (LAC) are shown twice: LAC 1 includes Mexico and LAC 2 excludes it. The reason for this distinction is the massive effect on exports of NAFTA, which has given Mexico privileged access to the US and Canadian markets. Without this large trade 'distortion', LAC 2 does rather poorly in dynamic products in world trade—surprising in view of the size and industrial traditions of Brazil, Argentina and Chile. In Mexico, by contrast, assembly activity in *maquiladoras* aimed at the US market is driving medium-technology exports like automobiles and high-technology exports like electronics.

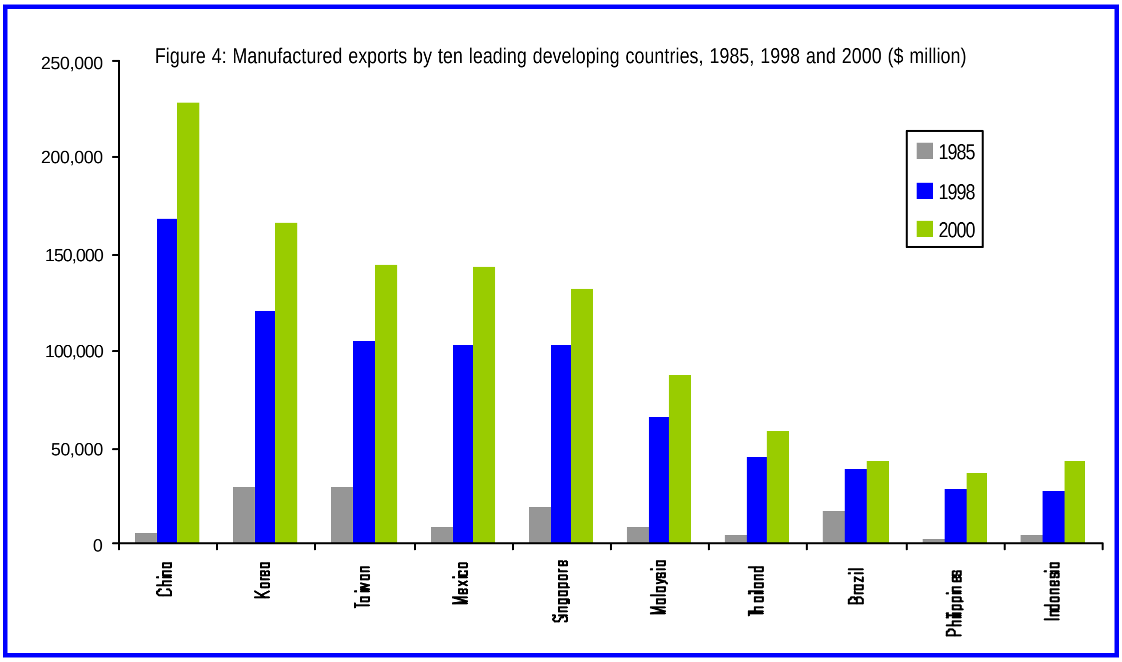


Figure 4: Manufactured exports by ten leading developing countries, 1985, 1998 and 2000 ($ million)

Now take concentration at the country level. Figure 4 shows the 10 largest developing world exporters of manufactures in 1985, 1998 and 2000. These countries now account for over 80 percent of developing country exports and their dominance has been rising over time. Levels of concentration rise by technology levels, being highest for technology-intensive products. Thus, it would appear that liberalization and globalization are leading to higher rather than lower barriers to entry for new competitors in advanced activities. The four figures in the annex show the leading developing country exporters of resource-based, low-technology, medium-technology and high-technology products: the most noteworthy feature is the staggering rise of China as the main exporter in *all* these technological categories.

5. THE COMPETITIVE PERFORMANCE (CIP) INDEX

This section shows the UNIDO (2002) CIP Index, which focuses on the *national ability to produce manufactures competitively*. This is clearly relevant to the analysis of globalization and its role in industrial performance (the impact on employment has to be taken as an unobserved outcome). Since no single indicator can capture all dimensions of competitive production, the performance index is constructed from four components on which data are available.

1. *MVA*: The base indicator of industrial performance is the (dollar) value of *manufacturing value added (MVA) per capita* in each country. MVA is deflated by population to account for country size.
2. *Manufactured exports: Manufactured exports per capita* take account of the competitiveness of industrial activity. If all industrial production were fully and equally exposed to international competition, MVA would automatically capture the competitive element. However, it is not. Trade and other policies limit exposure of domestic industry to international competition. So do 'natural' barriers to trade like high transport costs, access to natural resources, taste differences, legal and institutional variations and information gaps. Production for home markets (particularly in countries with large markets or with strong import substitution policies) faces less intense competition than production for export. The export measure helps to overcome part of this lacuna, indicating how competitive industrial activity is in one set of markets. This variable also captures another important aspect of industrial performance. It shows the ability of national industry to keep pace with technical change, at least in exported products: exports can be taken to demonstrate that producers are using competitive (i.e. modern) technologies. This is important because the technology measures below do not capture technological upgrading *within* broad product groups; the export indicator partially offsets this inability.
3. *Technological structure of MVA:* The *share of medium and high technology activities in MVA (MHT)* is the third component of CIP. The higher the MHT share – the more technologically complex the industrial structure – the better is competitive industrial performance taken to be. This is not just because industrial development generally entails moving up from low technology and RB activities, but also because technology-intensive structures are structurally better for growth, development or competitiveness.[5] Because of the slow, incremental and path-dependent nature of learning, structural change is not automatic or easy; thus, structures with more complex activities are considered 'better'. This is, of course, a simplification. Many LT and RB industries can have bursts of rapid growth. Individual activities within them can have high technology segments. Industries can shift between the categories over time. All this granted, the technological complexity measure offers useful insights into the ability of countries to sustain growth.
4. *Technological structure of manufactured exports:* Similar arguments on technological complexity apply to export structures, leading to the final component of CIP: the *share of medium and high technology products (MHT) in manufactured exports*. It is useful to consider export structures separately from MVA structures because in certain circumstances the two differ significantly. In the developing world, for instance, large import-substituting economies tend to have more complex MVA than export structures.

The values for each variable are standardized to range from zero (worst performers) to one (best performers). The final index is the *average of the four standardised values*. No weights are attached to any of the components, as there is no *a priori* case for giving different weights. However, the results are shown step-wise so that the effect on the rank of each component is clear.

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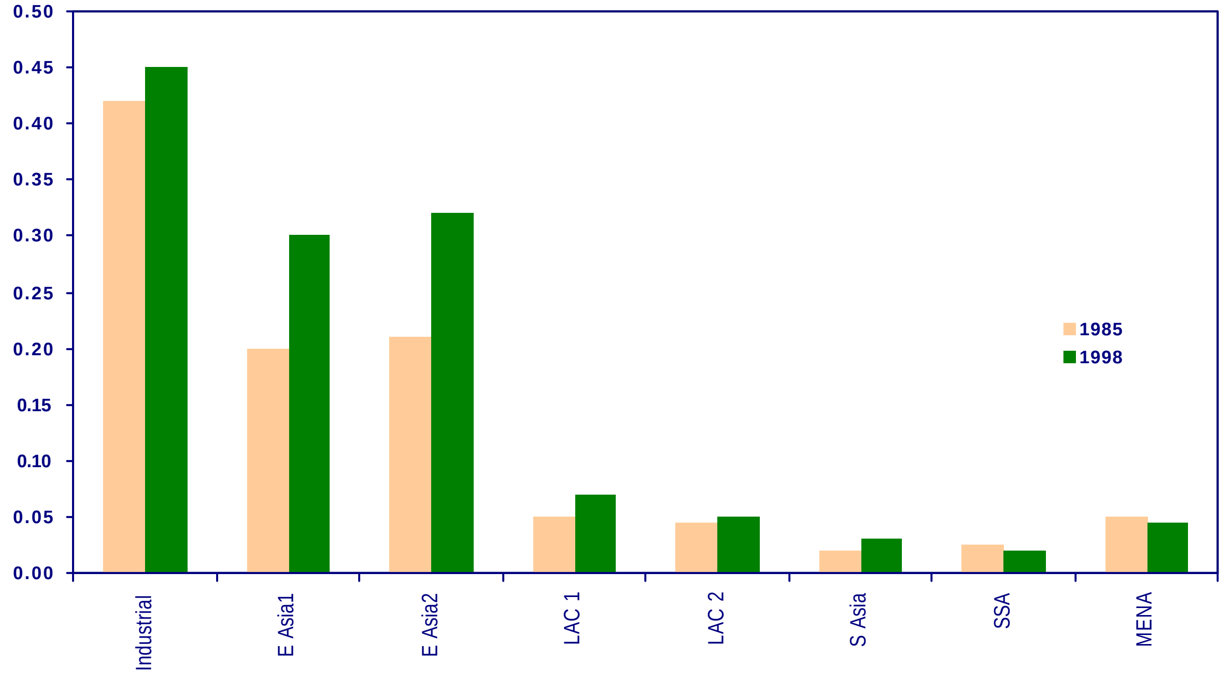
[5] Technologically complex structures offer greater learning potential and lend themselves more to sustained productivity increase over time (because of the greater potential for applying new scientific knowledge). Many have stronger spillover benefits, especially those in 'hub' activities that disseminate technology across different activities. High technology activities enjoy better growth prospects in production and trade, and are the areas frequented by dynamic international production systems.

The average value of the CIP index for each region is shown in Figure 5 (note that since CIP is not a share it can go up for every region). Industrial countries raise their performance and, not surprisingly, retain a significant lead over the rest of the world. In the developing world, East Asia with or without China (East Asia 1 and 2, respectively) are by far the best performers, both in terms of their absolute levels of the index and improvements over time. Latin America with Mexico (LAC 1) shows some improvement in performance but without (LAC 2) it stays almost stagnant.

Figure 5: UNIDO CIP index by region



Note two features of the CIP index. First, there is *considerable stability in CIP ranks* over 1985-98. The correlation coefficient between the two index values for the two years is 0.940, suggesting that performance reflects slow and incremental processes. Second, *leaps in the rankings are nevertheless possible*. Over the period, 22 countries change ranks by 10 or more places. Countries near the top and bottom tend to be relatively stable, while those in the middle are more mobile.

The main cause of the large upward leaps between 1985 and 1998 is one form of globalization: *increasing participation in integrated production networks*. This raises the share of complex products in exports (and in MVA over a longer period) for several countries. In the top 40 countries, the largest improvements are in Ireland, Philippines, China, Thailand, Malaysia, Costa Rica and Hungary, with Mexico, Korea, Taiwan and Singapore close behind.

However, there are *different modes of participation* in global networks. Two countries, Korea and Taiwan, have done so, not by significant increases in MNC presence in export activity, but by non-equity arrangements like OEM (original equipment manufacture), subcontracting to buyers and, of course, directly establishing export channels. This has entailed a massive development of technological and other capabilities on the part of local firms, sustained by extensive government intervention in all markets, including selective infant industry promotion.

The other successful countries have relied more heavily on FDI (see below), but with different sub-strategies. Singapore, for instance, has relied heavily on industrial policy to target and attract hi-tech MNCs, build local skills and institutions and develop specialised infrastructure. As a result, it has moved to the top of the technological ladder, and is now targeting R&D and high value service activities by MNCs.

Malaysia, Thailand, Indonesia and Philippines have been less proactive on FDI and the development of local skills and institutions (though they have used industrial policy in other ways). As a result they are much lower than Singapore on the technology spectrum. However, they are now acutely conscious of the need to upgrade capabilities and supplier networks to retain a competitive edge as wages rise and cheaper competitors emerge. As shown later, their capabilities lag well behind Korea and Taiwan.

China is a case on its own, because of its size, industrial tradition, political background and ethnic linkages. It can combine elements from all the other successful strategies with its own set of policies to restructure and develop domestic enterprises, large and small (Nolan, 2001). While its base of skills and technological effort is low by international standards, it has enough to have caused a spectacular surge in exports across the technological spectrum. And it is building its capability base rapidly while bringing its 'surplus' human capacity into modern industrial activity, suggesting that the surge still has a considerable way to go.

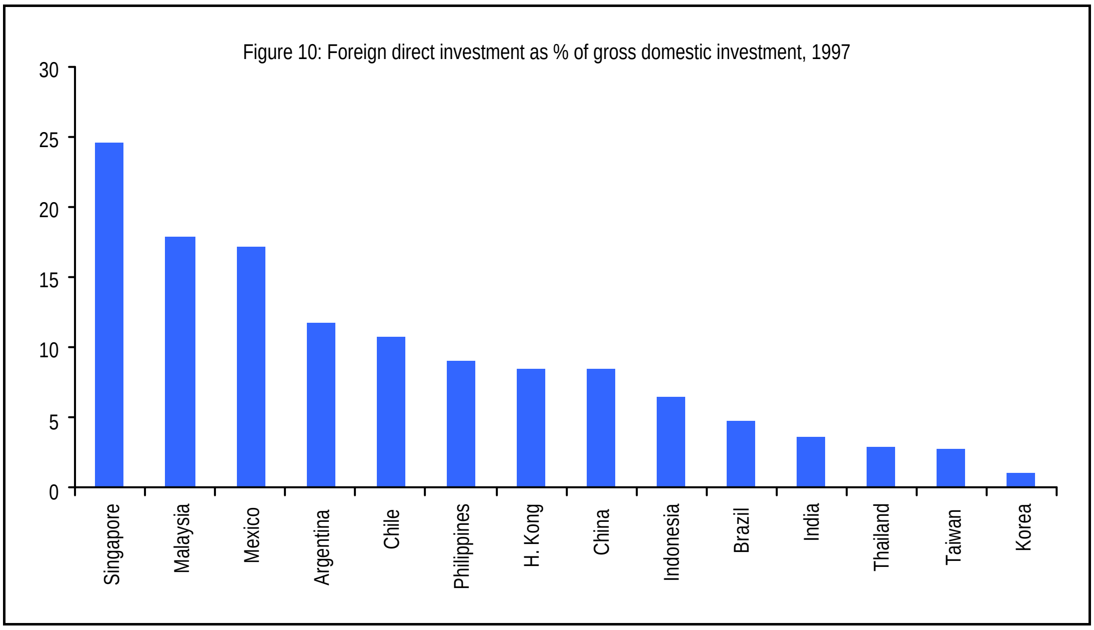
None of these dynamic countries conform to the 'ideal' model propagated by the Washington Consensus. The ones that have upgraded their capabilities most rapidly have broken practically every rule in the neoclassical book, using selective intervention in most markets to guide resource allocation, develop national capabilities and dynamise comparative advantage. It is their strategies that form the template on which other developing countries have to base their industrial strategies to build competitiveness today.

6. THE STRUCTURAL DRIVERS OF COMPETITIVENESS

Let us look now at the structural drivers of competitiveness. For benchmarking purposes, these were *FDI, skills, domestic R&D, licensing* and *physical infrastructure* (UNIDO, 2002). This is not, of course, a comprehensive 'explanation' of industrial performance, since it leaves out of account policies, institutions, governance and other factors that are difficult to quantify across a large number of countries. It does, nevertheless, provide a plausible picture of the structural factors in industrial success, and the 'drivers' correlate quite nicely with performance as measured above.

The first driver is directly relevant to our interest in globalization, *foreign direct investment* (FDI). Figure 10 shows FDI as a percentage of gross domestic investment in 1997 (but the picture is more or less the same over the longer term). Reliance on FDI differs sharply among the NIEs, as noted, with very high reliance in Malaysia and Singapore in East Asia and in most of Latin America. There is low reliance in the Republic of Korea and Taipei, China, which deliberately restricted inward FDI to build up their innovative capabilities. This suggests a trade-off between deepening technological capabilities and relying on ready-made technology from TNCs.

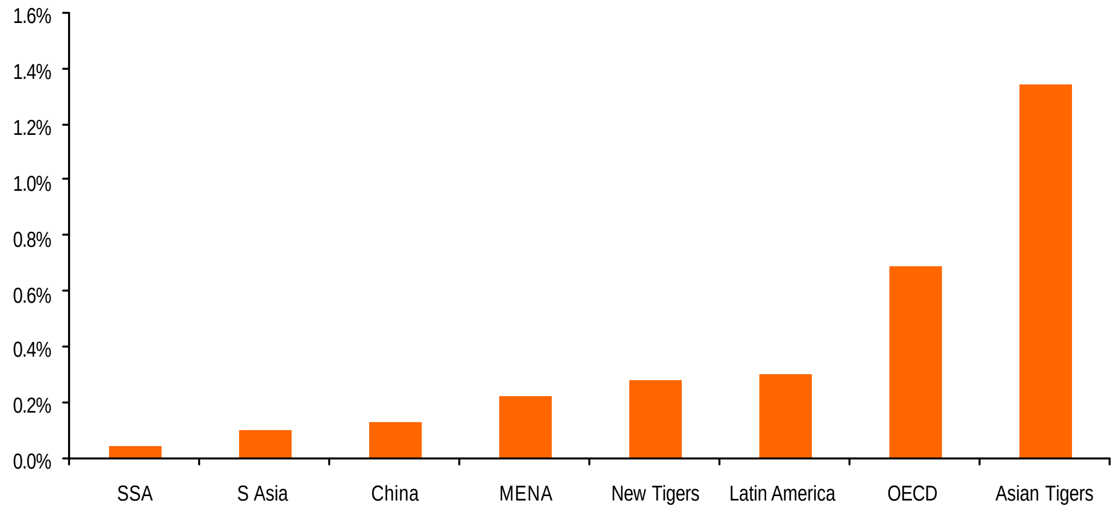
One factor to note about Latin America is that much of recent FDI, with the exceptions of Mexico and Costa Rica, has gone not into export-oriented manufacturing but into resource based activities and into services. *This means that the region has not integrated into dynamic value chains, and its lag in electronics is particularly striking.* With local firms unable to mount the effort to become competitive in hi-tech activities, this has given the region a low-growth export structure with low spillover and learning benefits. One major plank of future strategy to cope with globalisation has to be to target export-oriented FDI in technology intensive activities. But, given relatively high wages, this needs better human capital, to which we now turn.



Now let us take *human capital*. There are sharp disparities in the base of skills that countries have to compete on in technology-based global markets. The figures are only a rough guide to skill formation, since they only deal with formal school and university enrolments, ignoring quality and other differences in the education provided. But these are the only comparable data available, and do show the main form of skill formation. The focus here is on high-level technical skills, as measured by tertiary enrolments in core technical subjects (pure science, mathematics, and computing and engineering) as a percentage of the population. Statistical analysis shows that this measure is the best variable for human capital in explaining export dynamism (Figure 11).

The most striking fact about the chart is the enormous lead established by the four mature Asian Tigers (Hong Kong; Republic of Korea; Taiwan and Singapore) far outpacing even the industrialized countries. They lead the "New Tigers" (Malaysia, Philippines, Thailand, Indonesia) and the main industrial powers in Latin America (Argentina, Brazil, Mexico) by an even higher margin. Sub-Saharan Africa lags the most in skill creation, reinforcing the picture of marginalization.

Figure 11: Tertiary enrolments in technical subjects as % population, 1995

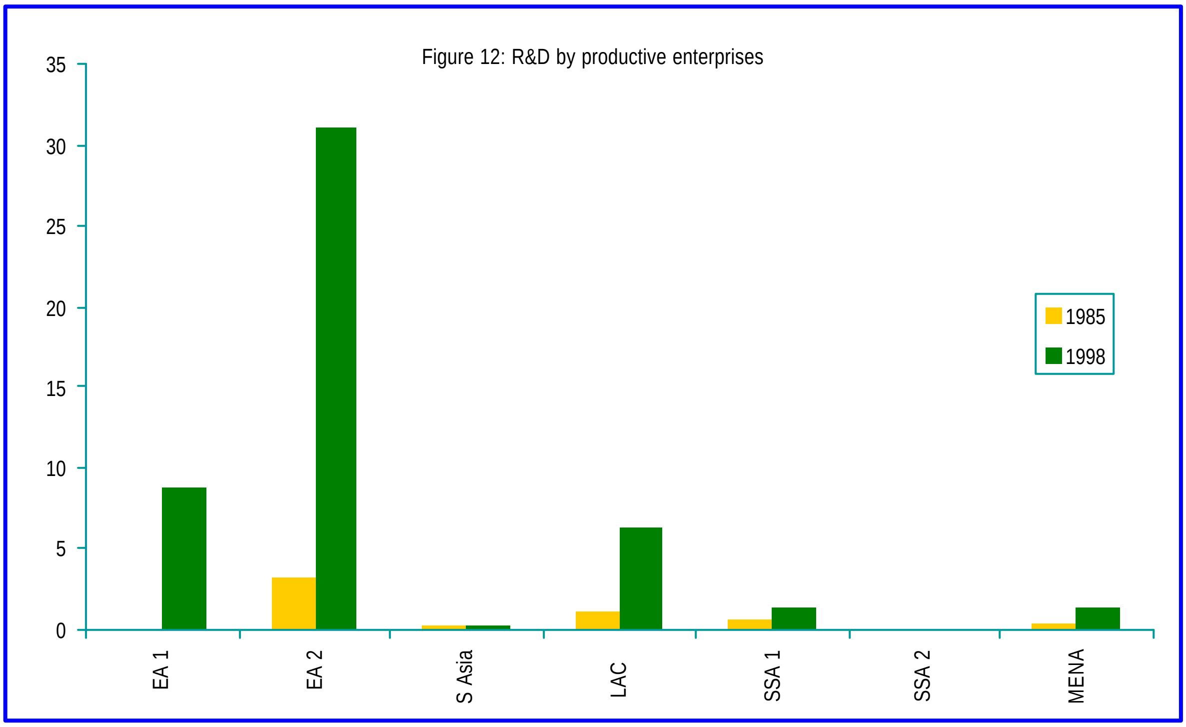


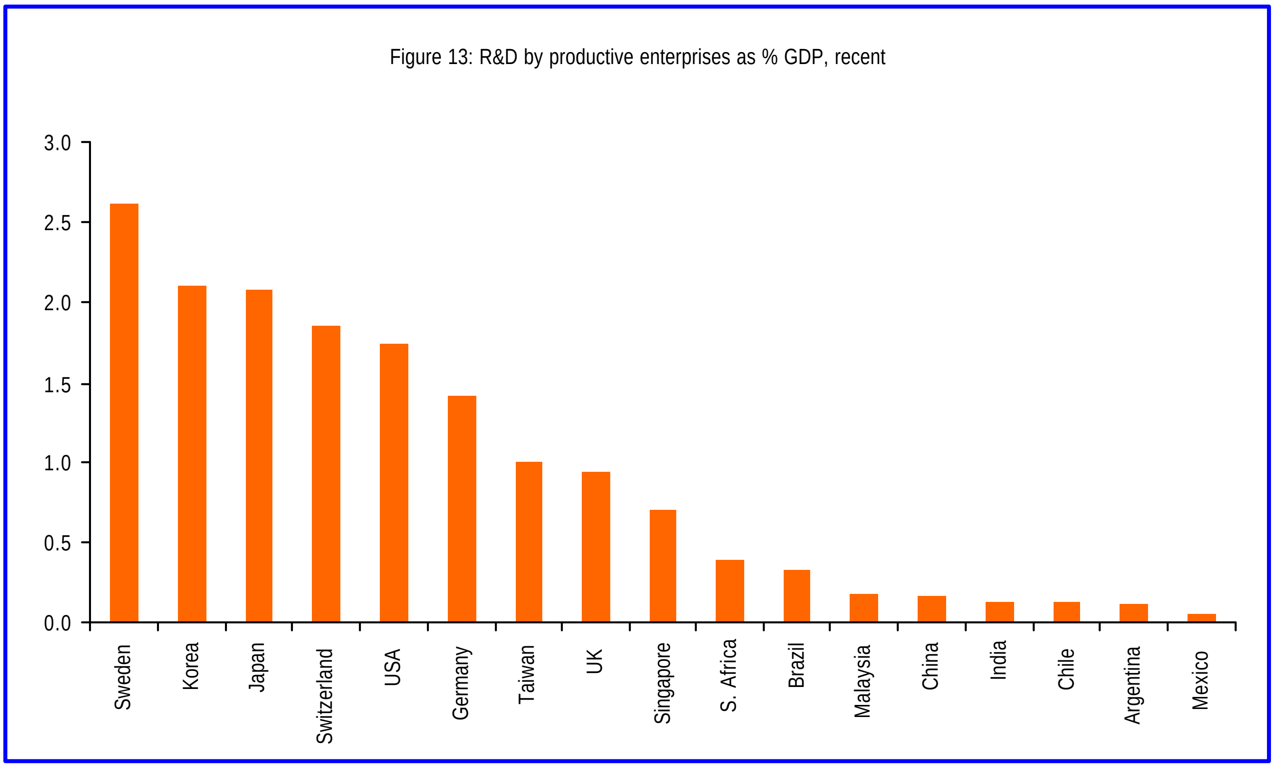
Notes: Asian Tigers = Hong Kong, China, Singapore, Korea, Taiwan; New Tigers = Malaysia, Philippines, Thailand, Indonesia; OECD = Organization for European Cooperation and development (industrialized countries); SSA = Sub-Saharan Africa.

Let us now look at *R&D spending*, taking not total R&D (which can be misleading for analyzing industrial technological activity) but that *financed by productive enterprises* (Figures 12 and 13). The leaders in the world in this activity as a percentage of GDP are Japan and Korea. Yet only some 20 years ago, Korea was a typical developing country, with about 0.2 percent of GNP going into research and development and 80 percent of that coming from the public sector. Today, total R&D is over 3 percent of GDP, with over 80 percent coming from the private sector.

These data show highly differentiated responses among developing countries. The three mature Tigers lead the rest, with other industrializing countries in Latin American and Asia lagging. While the New Tigers like Malaysia, the Philippines, or Thailand do well in technology-intensive exports, their capability base remains weak and shallow. The discrepancy between the technology intensity of their exports and skills and technological capabilities made up by MNC assembly activities has to be rectified if they are to maintain their performance. Otherwise, technical change and the entry of rivals with stronger skill bases will lead dynamic activities to locate elsewhere.

China is in an intermediate position, with a combination of capabilities and strategies from each of the leading Tigers. Latin American countries come fairly low on the R&D scale in comparison to East Asia, but it does much better than other developing regions. At the national level, Brazil is the leader in Latin America, and ranks fourth in the developing world after Korea, Taiwan and Singapore.





There is no need to reproduce data on the other drivers (they are available in the UNIDO report). The picture for licensing is very similar, with East Asia leading the regions by far. In ICT infrastructure, however, Latin America compares well with East Asia.

7. R&D, FDI AND HIGH-TECH EXPORTS

It is interesting to explore the relationships between R&D, FDI and high technology exports. Differences between these modes of acquiring technology show up more clearly here than they do in overall industrial performance. Moreover, given the role of high-tech exports in industrial performance, it is instructive to analyse its technological drivers separately.

Competitiveness in high technology exports (particularly electronics) is due either to innovation within exporting countries or to the relocation of facilities by TNCs from innovating countries. It is possible to get an indication of these alternative drivers by comparing national R&D and FDI intensities with HT export performance. Table 3 shows two sets of relationships: R&D per unit of HT exports and R&D per unit of inward FDI.[6] The analysis is conducted for all the major exporters of HT products (with exports over $5 billion in 1998). The group includes nine developing countries – all the East Asian economies except Indonesia and Mexico.

[6] The two ratios – for R&D per unit of high technology exports and R&D per unit of inward FDI – are strongly correlated, with a coefficient of 0.745 in 1998.

Table 3: Relationships between R&D and FDI in major HT exporters

Ranking		**Country**	**R&D per unit of HT exports ($)**		**R&D per unit of inward FDI ($)**		**HT exports ($ b.)**		**Share of HT in total exports (%)**	
1998	1985		1998	1985	1998	1985	1998	1985	1998	1985
1	3	Japan	0.937	0.635	100.40	62.42	114.9	36.6	29.6%	20.8%
2	2	USA	0.622	0.686	1.75	1.68	196.9	53.3	31.0%	25.8%
3	1	Germany	0.368	0.816	5.01	13.09	92.7	24.3	17.1%	13.2%
4	6	Switzerland	0.331	0.282	1.35	2.33	18.3	4.7	23.2%	17.0%
5	9	Sweden	0.283	0.231	0.71	3.33	20.4	4.1	24.7%	13.4%
6	8	France	0.266	0.245	0.76	1.67	65.1	14.3	21.6%	14.6%
7	18	S Korea	0.264	0.119	5.90	3.50	36.0	3.7	27.2%	12.2%
8	5	Austria	0.233	0.284	0.65	2.19	7.4	1.6	12.2%	9.2%
9	11	Denmark	0.225	0.228	0.57	5.50	7.6	1.8	16.0%	10.9%
10	10	Spain	0.213	0.229	0.28	0.20	10.2	1.5	9.3%	6.0%
11	15	Italy	0.210	0.141	1.45	0.97	24.5	7.5	10.1%	9.5%
12	4	Finland	0.200	0.342	1.45	2.95	10.5	0.8	24.4%	5.7%
13	7	Canada	0.177	0.278	0.52	0.98	23.8	6.2	11.1%	7.1%
14	19	Belgium	0.159	0.105	0.26	0.20	17.4	3.5	9.7%	6.4%
15	13	UK	0.134	0.167	0.49	0.72	76.3	17.9	28.2%	17.6%
16	12	Israel	0.113	0.211	0.67	2.76	6.6	1.1	28.3%	17.0%
17	14	Netherlands	0.098	0.164	0.34	0.78	40.8	6.9	24.3%	10.2%
18	17	Taiwan	0.068	0.131	1.50	1.37	38.6	4.7	35.0%	15.4%
19	26	China	0.033	0.000	0.03	0.00	33.5	0.3	18.2%	1.2%
20	21	Ireland	0.022	0.019	0.38	0.31	25.2	2.7	39.3%	25.8%
21	23	Singapore	0.010	0.008	0.07	0.02	62.3	4.7	56.7%	20.4%
22	16	Mexico	0.004	0.134	0.02	0.28	31.3	1.9	26.6%	8.6%
23	25	Malaysia	0.004	0.001	0.03	0.00	34.3	2.3	46.9%	14.8%
24	24	H Kong	0.002	0.003	0.00	0.00	6.0	2.4	24.5%	14.2%
25	20	Thailand	0.001	0.043	0.01	0.03	15.6	0.2	28.3%	2.4%
26	22	Philippines	0.000	0.014	0.01	0.07	19.0	0.3	64.3%	5.8%

Note: Includes only countries with HT exports above $5 billion in 1998. Rankings are based on R&D per unit of HT exports in 1998.

The table ranks countries by the value of R&D per unit of HT exports in 1998. It seems a reasonable presumption that countries with *high R&D in relation to HT exports and FDI have strong local technology bases*. The top countries in the table comprise, not surprisingly, the major industrial and technological powers; these are also generally the main HT exporters by value. The bottom ones are developing countries specialised in assembly and testing operations. Clearly, this method of distinguishing competitive strategies has some merit. There are interesting aspects in the table:

> Japan is now the most 'autonomous' country in the world in terms of R&D per unit of HT exports. In 1985, however, Germany held this place, followed by the US. Clearly, TNC production systems have spread faster to Western countries than to Japan. The degree to which Japan relies on R&D rather than on FDI is strikingly illustrated by the figures for R&D per unit of FDI: in 1998, this figure for Japan ($100) is 20 times higher than in the next developed country, Germany ($5).

Among the other highly industrialised countries, the US maintains a fairly stable profile in terms of both sets of ratios. Germany, by contrast, shows a sharp decrease in R&D per unit of both HT exports and FDI, indicating a rapid growth in the role of TNC systems. The UK, the fourth largest HT exporter in the world in 1998, has a surprisingly low R&D ratio, indicating its growing role as a base for the operations of foreign TNCs in electronics.

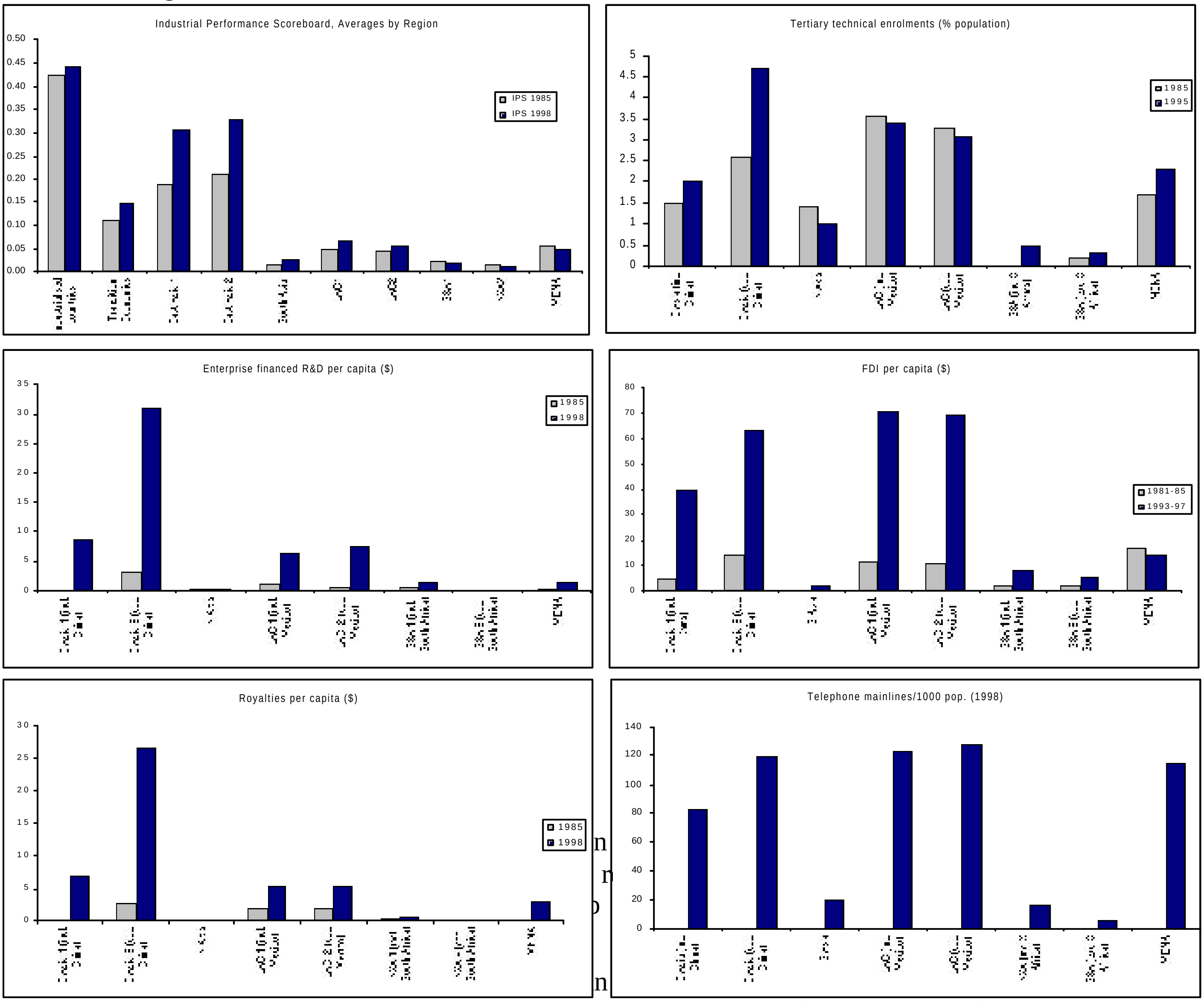
The lowest ranking country in the industrial world in R&D per unit of HT exports is Ireland, bearing out the dominant role of TNCs in building its competitiveness.

In the developing world, the most 'autonomous' strategy is by Korea, which, after Japan, has the second highest value of R&D spending per unit of FDI in the world. Note, however, the enormous difference in the *value* of R&D between it and Japan, $5.9 compared to $100.4 in per capita terms. Next comes Taiwan, also with a relatively high value of R&D per unit of FDI, followed by China (with very low values of R&D per unit of FDI, only $0.03 in 1998).

The other countries in the list are all highly dependent on TNCs for their HT exports, though Singapore has a relatively strong R&D base compared to the others. Each of the four countries with an increase in the share of HT in total exports of over 20 percentage points (Singapore, Malaysia, Thailand and Philippines) is producing and selling within international integrated production systems.

8. DO THE 'DRIVERS' EXPLAIN INDUSTRIAL PERFORMANCE?

The CIP index and the various drivers of performance are shown for each of the main regions in the figure below.



are per capita R&D, FDI and royalty payments, and the indices for skills and infrastructure, in the appropriate years.[7] To control for differences arising from levels of development not captured by other variables, a dummy variable is added taking the value 0 for industrial and transition, and 1 for developing, countries. Regressions are conducted for performance and drivers for the two years separately. Performance in 1998 is also regressed on drivers in 1985 to capture the impact of the initial stock of capabilities on subsequent performance. Table 4 shows the three sets of results.

1985: The equation 'explains' 93 percent of the variation in the performance index. R&D per capita shows up as the most important influence, followed by royalties and infrastructure. The skill variable is significant at the 10 per cent level. FDI is not significant in this year and

[7] All the necessary econometric tests for collinearity, functionality and heteoskedasticity are satisfied. The potential problem raised by the high correlation between the capabilities does not affect the result.

has a negative sign. The dummy variable for developing countries has a significant and negative effect. This suggests that, taking the structural drivers into account, being part of the developing world has an independent negative effect (capturing a range of other potential factors) on industrial performance.

1998: All independent variables with the exception of the income dummy are now positive and significant, 'explaining' 88 percent of the variation in the CIP index. The dummy variable for developing countries is no longer significant, suggesting that the level of development as such does not affect performance: the only significant effects, in other words, arise from the drivers. R&D again has the highest coefficient of all the drivers, followed by royalties. FDI is now significant and positive; this suggests that the contribution of TNCs to industrial performance has grown over the period. The skills index is also significant and positive and its coefficient is higher than in 1985, suggesting the rising importance of high-level skills to industrial competitiveness.

1985-98: The results are broadly similar to those for 1985, with interesting variations. Skills are far more important and significant – the base in 1985 seems to have a strong positive influence on performance in 1998. R&D remains very significant and important, suggesting continuity and cumulativeness. FDI is insignificant; clearly its positive impact rises over the period. Infrastructure loses significance, suggesting that current patterns of infrastructure investment are more related to industrial performance. The dummy variable has a significant negative effect; being a developing country in 1985 held back industrial performance in 1998.

What does this mean in terms of industrial performance and its drivers?

'Technology' in the generic sense – local R&D as well as access to foreign technology via FDI and licensing – clearly has a powerful influence on industrial performance.

Of the technology drivers, R&D is statistically the most important, in each year and over time. This highlights the need for domestic technological effort even at low levels of industrial development. While it is possible that the causation runs in both directions (i.e. more industrialised countries invest more in R&D), theory does suggest that the one running from R&D to industrial performance is likely to be predominant. The capability literature shows that (formal and informal) technological effort is a critical input into competitive industrial performance in developing as much as in developed countries. Crude as the R&D measure admittedly is when it comes to informal technological effort, there is likely to be a real correlation between R&D and the intensity and quality of informal effort.

Table 4: Regression results for drivers of industrial performance on the CIP index

Dependent variable: **CIP 1985** (75 countries)		
Independent variables	Standardised Coefficient	T statistic
Skills 85	0.090*	1.832
R&D 85	0.443***	9.300
FDI 85	-0.112	-1.575
Royalties 85	0.384***	5.228
Infrastructure 85	0.204**	2.240
Development dummy	-0.203***	-3.188
Adjusted R Square = 0.928		

Dependent variable: **CIP 1998** (85 countries)		
Independent variables	Standardised Coefficient	T statistic
Skills 98	0.130*	1.822
R&D 98	0.466 ***	8.846
FDI 98	0.183***	3.379
Royalties 98	0.253***	5.986
Infrastructure 98	0.196**	2.018
Development dummy	-0.024	-0.401
Adjusted R Square = 0.881		

Dependent variable: **CIP 1998** (75 countries)		
Independent variables	Standardised Coefficient	T statistic
Skills 85	0.261***	2.911
R&D 85	0.493***	5.270
FDI 85	0.074	0.651
Royalties 85	0.342**	2.902
Infrastructure 85	- 0.125	-0.851
Development dummy	-0.299**	-2.922
Adjusted R Square = 0.809		

Significance: *** 1% level, ** 5% level, *10% level. All statistical tests for functionality, heteoskedasticity and collinearity are satisfied.

Licensing foreign technology is also significant in all the equations, but its coefficient falls over time perhaps indicating a diminishing role.

FDI, by contrast, grows in significance over time. This corresponds with other evidence that the role of 'international production' is growing in the world economy, that technology transfer within TNCs is of rising importance, and that TNC export activity is a very dynamic element in industrial competitiveness of developing countries. Within such export activity, it captures the growth of international production systems.

The significance of skills also grows, again entirely in line with the conventional wisdom on human capital, technology and competitiveness. It is, however, reassuring to see the finding confirmed for such a broad sample.

Infrastructure remains important in all periods.

The unmeasured influences captured by the developing country dummy grow less important over time. Thus, 'being a developing country' has a negative effect in 1985 but this effect vanishes by 1998, when structural drivers explain much of the variance in performance.

9. CONCLUSIONS

The strongest impression conveyed by this analysis is of *growing diversity and divergence* in manufacturing performance. A few developing countries have done very well in this fast-changing industrial scene, while others, a disturbingly large number, have done badly. This is, of course, hardly news. It is now well known that economic, and in particular industrial, performance is highly variable in the developing world. The tendency for inequalities to perpetuate themselves – cumulative causation and path dependence – is accepted as part of the hard reality of development and globalisation. Early models of inevitable convergence, based on simple neoclassical growth models, have given way to more diffuse analyses that stress that endogenous structural, institutional and social factors may carry on driving economies apart.

This paper shows how wide dispersion is in the industrial sector, how it has grown and how it reflects *structural factors*. Such factors are notoriously difficult to alter in the short to medium term, and, because of cumulativeness, cannot be left to reverse themselves by further liberalization. Thus, they raise strong policy implications. The international community and national governments together have to address the growing structural gaps that drive divergence. And they have to reverse or relax the stringent rules of the game that constrain the use of (previously successful) industrial policy. If they do not, there will be continued marginalisation of many countries from the dynamics of industrial development.

The other important lesson is that there are 'many roads to heaven'. Successful developing countries have used widely differing strategies to build capabilities. Some, but relatively few, have succeeded with 'autonomous' strategies, drawing in foreign technology largely at arm's length while building strong technological and innovative capabilities in local firms. Others, a larger number, have gone some way by plugging into TNC production systems by becoming suppliers of labour-intensive products and components, without having strong domestic capabilities. Of these economies, a few have managed to combine their reliance on FDI with strong industrial policy, targeting the activities they wish to enter and the functions they wish to upgrade into. Others have tapped the potential of FDI by passive policies, benefiting from sound economic management, pro-business attitudes, attractive locations and good luck. The less successful developing countries have not followed any of these strategies effectively.

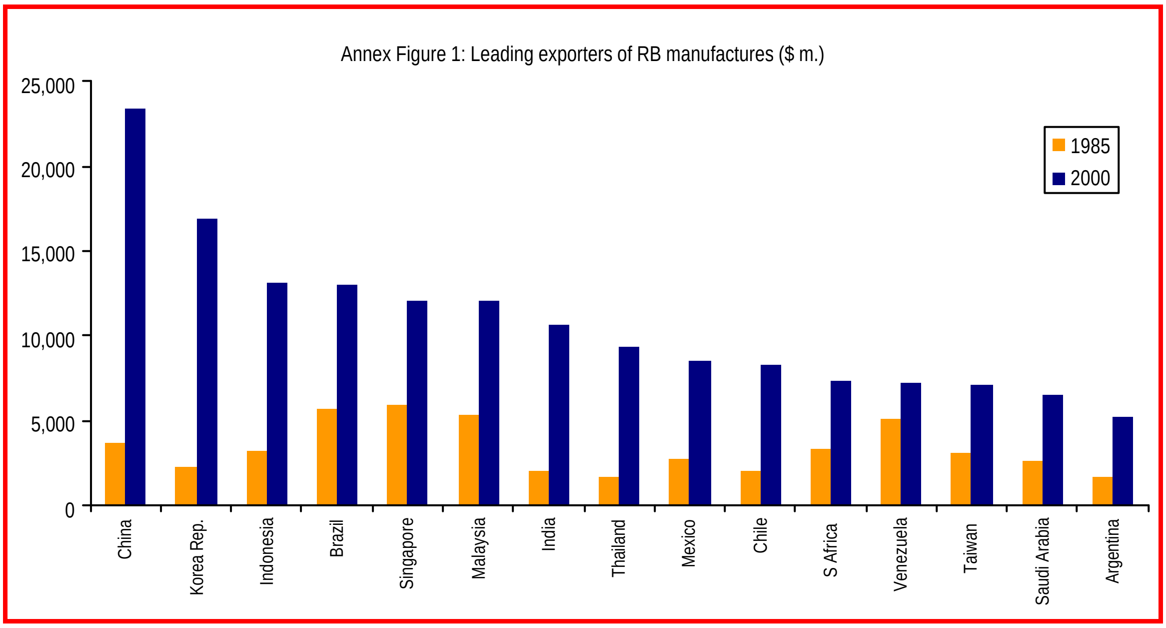
The distinction between the autonomous and FDI-reliant strategies cannot, however, be pushed too far. Most countries have had mixed strategies. *Strategies are also converging*, partly from natural evolution and partly as a result of changing rules of the game. Autonomous countries are opening up to FDI to access new and expensive technologies, while FDI-reliant countries are trying to build local R&D capabilities, often by inducing TNC to upgrade technological activity. In a world increasingly bound in tight production, knowledge and trade networks it makes less and less sense to draw sharp distinctions between these traditional strategies. This does not, however, mean that strategies as such are not needed. Quite the contrary: as resources become more mobile, attracting the most valuable ones and rooting them becomes more difficult. Local capabilities become more important to link with international resources and leverage them, and building capabilities is a difficult strategic challenge.

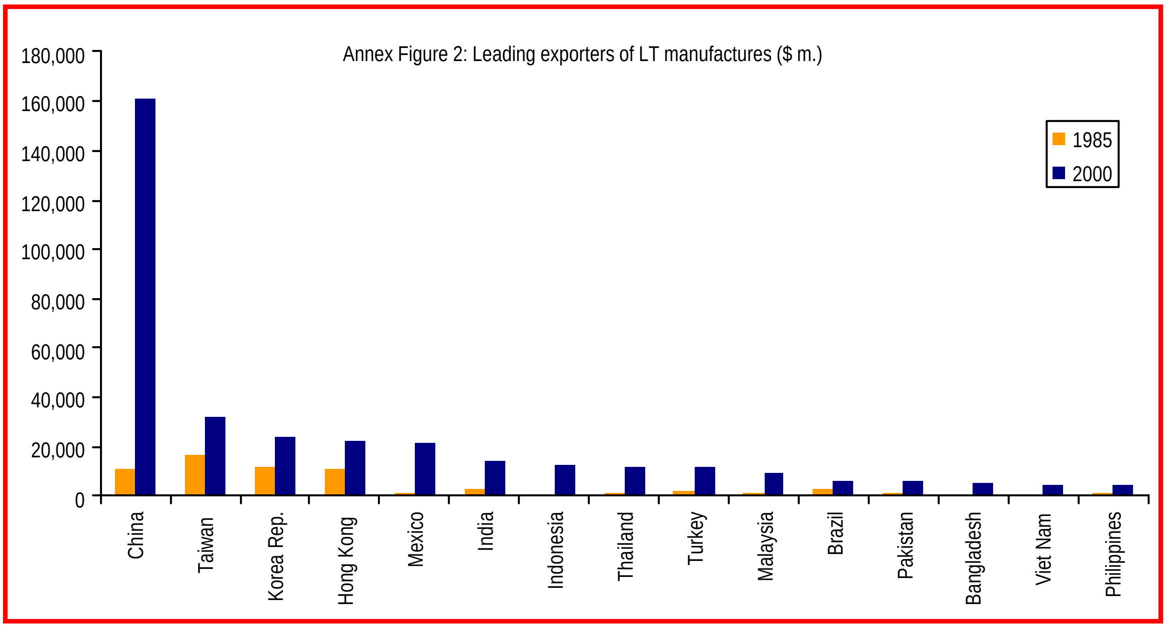
The industrial world also shows similar strategic differences in reliance on R&D and FDI. These sometimes reflect deliberate policy (say, Japan as compared to Ireland). More often, they show different patterns of historic evolution of industry and technology. For advanced economies, the difference between the two strategies is of little practical significance today. FDI and domestic R&D are for them largely complementary: technological leaders draw upon foreign firms to provide specialised forms of technology and foreign firms draw upon and feed into domestic innovation. Technological followers are integrated into larger systems; some establish independent areas of technological competence while others remain as production bases.

At first sight, the best strategy for latecomers without strong technological capabilities appears to be to battle their way into TNC production systems and let local capabilities develop slowly. This may not be true in the future. Industrial latecomers entering integrated production systems may find it difficult to *sustain* growth as wages rise unless they raise their skill and technological bases. Insertion into TNC systems does not ensure that participants will upgrade their drivers, yet such upgrading is essential. Integrated production systems are also highly concentrated and the level of concentration rises with the sophistication of the technology. There are strong first mover advantages, and while some systems will spread and new ones will evolve, it is unlikely that the South East Asian experience will be repeated in many other developing countries. Economies of scale may lead to a very small number of production and innovation sites in each region. Economies of clustering and agglomeration may lead these facilities to be sited in established locations with advanced capabilities and infrastructure. There is bound to be some 'trickle down' as the initial sites suffer rising costs and congestion, but this may take a long time and may not ultimately involve many other locations.

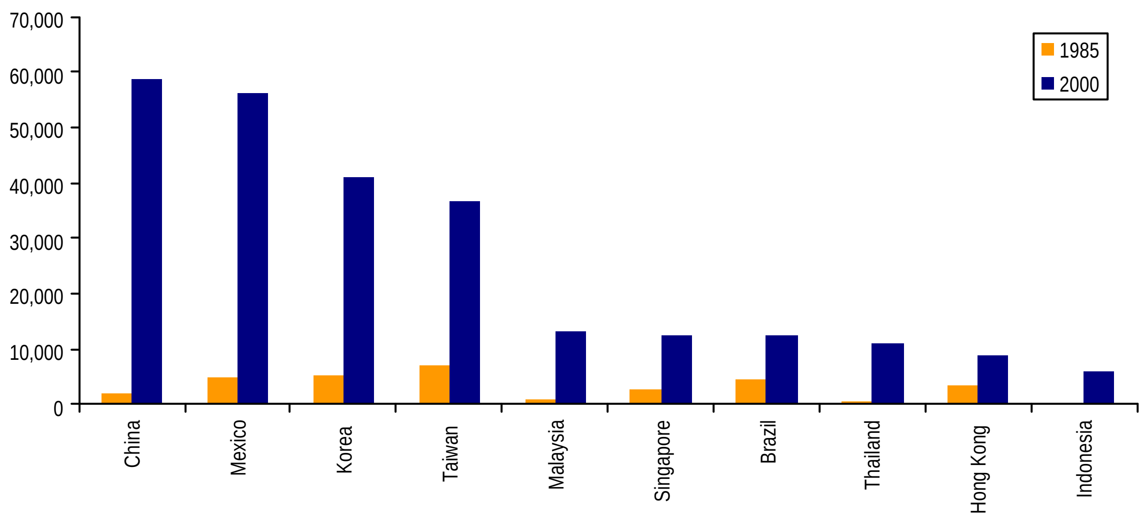
In general, developing countries need new, focused and 'intelligent' strategies for linking to global markets, leveraging foreign technologies and skills and learning from their links. The value of strong linking and leveraging strategies is illustrated by the experience of the Asian NIEs; these can be adapted to the needs of the rest of the developing world. However, strategy also has to be industry specific. Each industrial value chain differs in its organisational, technological, logistical and institutional needs. As local value chains become integrated into global chains, the nature, structure and strategies of the key player in each becomes important.

ANNEX FIGURES

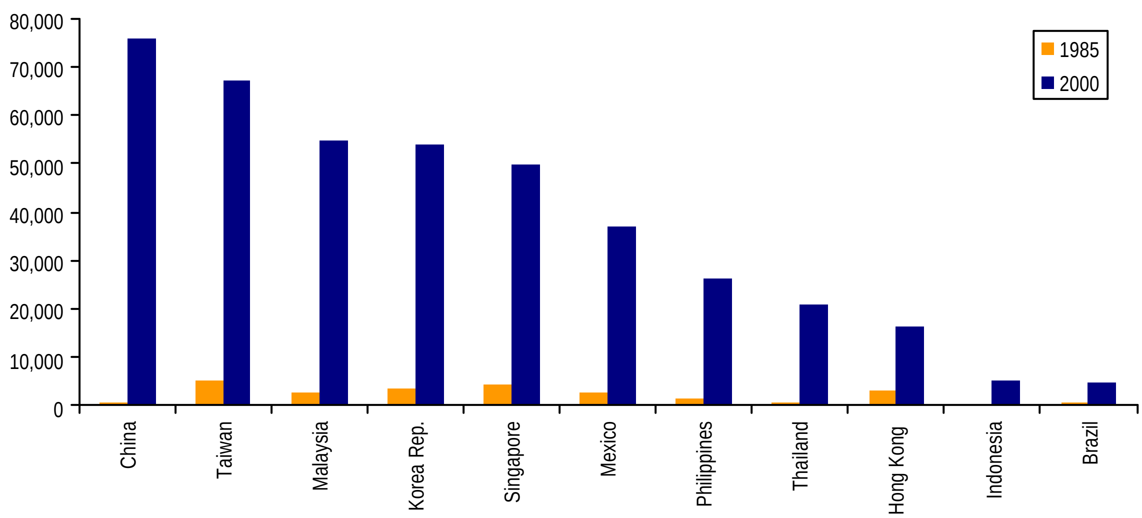




Annex Figure 3: Leading exporters of MT manufactures ($ m.)



Annex Figure 4: Leading exporters of HT manufactures ($ m.)



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