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## The quest for efficient industrialization in a technologically dependent economy: The current Brazilian debate

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THE QUEST FOR EFFICIENT INDUSTRIALIZATION  
IN A TECHNOLOGICALLY DEPENDENT ECONOMY:  
THE CURRENT BRAZILIAN DEBATE

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### **Abstract**

The paper addresses issues related to competition policies in Brazil raised in connection with the likely reorientation of her industrial policies aimed at increasing outward orientation and the technological upgrade of the country's manufacturing sector. In this context, the paper discusses problems associated with trade liberalization and to alternative strategies of technology acquisition in industries where technological progress has been rapid and the degree of appropriability is low.

### **Sumário**

O ensaio discute questões relativas às políticas de competição no Brasil considerando a provável reorientação da política industrial nos anos 90 determinada pelo imperativo exportador e pela necessidade de se elevar a densidade tecnológica das exportações e da produção industrial brasileira. Nesse contexto, discute-se problemas relacionados com a liberalização comercial e com estratégias de aquisição de tecnologia em indústrias onde o progresso tecnológico é veloz e o grau de apropriabilidade é pequeno.

## **1. Introduction**

This paper addresses issues related to competition policies in Brazil raised in connection with the need to increase outward orientation and the technological upgrade of the country's manufacturing sector. The reader should be aware of the fact that competition policy, defined as a body of legislation against anti-competitive practices does not exist in Brazil. In fact, government action often actively promoted such practices as a means to accomplish industrial policy targets and help national firms compete with MNCs affiliates. However, over the last few years, the regulatory framework of industrial competition in Brazil has been increasingly under attack in view of the need to raise net exports as a strategy of adjustment to the debt crisis. This has introduced a concern with competitiveness and efficiency and a growing dissatisfaction with the low accountability and transparency surrounding government regulation determining the allocation of rents, direct unproductive subsidies and favours. This renewed emphasis on efficiency and competitiveness is likely to enhance the scope for the application of competition policies in Brazil as part of an effort to change or to calibrate crucial features of the Brazilian industrial organization in order to improve industrial performance.

The paper is organized as follows. Section 2 reviews the historical background of regulation of competition in the industrial sector against which the challenges associated with openness, efficiency and a sound manufactured export performance are to be met. Section 3 makes an assessment of the role of technology in shaping international trade in manufactures and the opportunities open to latecomers to the world industrial economy. Section 3 also considers the problems to be overcome for

efficient industrial promotion. Section 4 examines the policy issues related to liberalization and market structure with a focus on its effects upon dynamic efficiency and the propensity to innovate. Section 4 also considers some new issues raised in connection with competition policies in high tech industries by the externalities and opportunities for "free riding" open by the low appropriability of the fruits of new technological developments.

## **2. The genesis and stability of non-competitive industrial structures in Brazil**

The structure of Brazilian industry, the institutions connected with the practice of industrial promotion and the patterns of regulatory activity have been shaped during the period of rapid growth and structural transformation experienced by the Brazilian economy in the post war period up to the early 1980s. Between 1945 and 1980 Brazilian industrial production grew at yearly rates over 8 % on average, while world industrial production grew by approximately half this rate<sup>1</sup>. As a result Brazil's manufacturing value added (MVA) reached the 7th position in the world in 1980, representing nearly 3.0% of world total and 23% of MVA generated in LDCs<sup>2</sup>.

The active government promotion policies adopted to assure Brazil's rapid transition to the *status* of an industrial country shaped three important characteristics of the economy's market structure and competition policies: (i) the combination of stringent national content requirements and technological indivisibilities inherent in the heavier industrial segments

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<sup>1</sup> P. Dicken (1986, pp. 18-19).

<sup>2</sup> Ibid. p. 25 and R. E. Ballance (1987, p. 57).

being installed in the country from the late fifties - transport material, electrical and mechanic equipment, chemicals - resulted in high minimum efficient scale relative to market size. (ii) the sequential, or sectoral, character of investment spurts typical of import substitution implied a corresponding pattern of "waves" of sectoral agencies and "executive groups" designed to allocate subsidies and benefits, manage distorted prices and administer protection; (iii) the combination of an extremely protectionist trade regime - coupling high rates of effective protection with widely applied QRs - with a rather liberal treatment given to foreign direct investment resulted in an extraordinarily large inflow of foreign capital: in 1946-54 for example, Brazil received no less than 17% of all outward US FDI in manufacturing activities<sup>1</sup>, a proportion that would average about 4% for the late fifties and after. As a consequence of this significant foreign penetration foreign investment in manufacturing in Brazil came to represent nearly 30% of industrial capital formation.

Competition policies in Brazil must be seen in connection with these three fundamental elements. It is easy to see that, in view of (i) there were strong inducements for high initial levels of concentration in several segments of Brazilian industry, while the relative stability of non-competitive structures in a context of high market growth is to be explained by the overwhelming importance of government intervention regulating industrial competition in Brazil. Indeed, although there is no such a thing as "competition policy" in Brazil - in the usual sense of anti-trust or, more generally, of policies towards regulating unfair business practices - the competitive position of (especially the large) industrial firms is almost

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<sup>1</sup> S. B. Vianna (1987, p. 67).

entirely defined as the implicit result of the (largely uncoordinated) action of government agencies administering price ceilings in a wide array of price controlled sectors; import licensing; long term credit allocations; the supply price of some generalized inputs provided by state enterprises such as oil derivatives, steel and electricity; specific sectoral policies sometimes envisaging barriers to entry and so on. The symbiosis created in such a "rent sharing" system between the regulators - who hand the carrots and sticks - and the private sector - whose satisficing managers<sup>1</sup> can live an easier life - stifles competition and greatly increases firm survival rates.

The strong presence of MNCs, on the other hand, raised concerns not only with excessive denationalization but also with the occurrence of industrial "enclaves", or the existence of vertically integrated chains of foreign firms more or less isolated from the local economy, or from local suppliers and competitors. In this respect, the main concern of regulatory authorities came to be the protection of "young" national firms *vis à vis* foreign competitors. Project approval and regulation by sectoral development agencies often imposed measures towards fostering interdependence of foreign and national firms. This meant, for instance, the prohibition of foreign firms to integrate backwards, as in the celebrated example of the auto industry. This sometimes meant that suppliers should be national firms, but sometimes not, again as in the case of the auto industry and the auto parts segment.

What is more striking in the Brazilian experience, however, is that very little concern is perceived with the rise of big business *per se*, or with the occurrence of unfair business practices in the usual anti-trust sense. It

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<sup>1</sup> By this we mean entrepreneurial behavior not strictly geared at profit maximization as usually argued in the literature as prevalent in non-competitive market structure.



was only as late as 1945 that there was some agitation towards passing a national version of the Sherman Act in the last few months of the authoritarian and populist Vargas regime. A law created the CADE (Administrative Council of Economic Defense), but with Vargas' deposition a few months later, the law would be repealed only to be passed again in 1962, this time, however, in a much milder version.

More often than not regulatory authorities could be found enhancing market power possessed by national firms as a means of either supporting their competition with MNCs, or assuring the continuation of expansion programs of national and foreign firms firms agreed with the government. It is interesting to illustrate this with reference to the two main instances of government action affecting competition, namely price controls and import repression.

### 2.1. Price controls

The first cases of price control in the Republican period can be found in the 1930s in connection with rents and pricing of public utilities. During the war there were extensive price controls and, as inflationary pressures did not abate after the war, in the early fifties a new agency was created, CCP (Central Commission of Prices), with the purpose of practicing control of prices with a significant bearing to the cost of living. No mention was made of the use of the agency to control abuses of market power in manufacturing, except for the passing of some very strong legislation aimed at penalizing

"crimes against the people's economy" - mostly related to prices of food and other wage goods - and "dumping" against national firms<sup>1</sup>.

Over the years price control agencies worked solely in connection with the control of "sensitive" prices and paid no attention to market power or excess profits except for regulated public utilities. In the mid sixties, the sharp acceleration of inflation led to stiffer legislation. In 1965, a new price control agency was created - CONEP (National Council for the Support of Price Stabilization) - in the context of a comprehensive stabilization programme introduced by the newly formed military government, to administer price controls in manufacturing in exchange for the concession of subsidies<sup>2</sup>. Price controls started thus to be applied more broadly in manufacturing and for the first time with an explicit concern with market power and "fair" rates of profits - or with the idea of prices being readjusted according to variations in costs.

A Working Group under CONEP was created by Planning Minister Delfim Netto in 1967 which was to evolve towards the creation of CIP (Interministerial Council of Prices), the price control agency which is still in existence today. This new agency was also concerned with monitoring profit margins in manufacturing, but its orientation was not exactly toward restricting the excesses of firms with market power. Apparently CIP was meant to be an instrument of industrial policy, and in this respect it could very well work in the opposite direction of usual anti-trust policies, as an instrument for managing competition.

In this respect it is very interesting to observe that the Second National Development Plan launched in 1974, in response to the first oil

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<sup>1</sup> Law 1521 12/26/1951.

<sup>2</sup> See P. B de Moraes (1987).

shock, reserved an important role for the price control agencies in the promotion of industrial combines. The Plan argued that the most common pattern of competition in Brazil was one in which one foreign firm could be found together with several smaller national firms, so that fusions and acquisitions among national firms should be openly stimulated as a means of gaining scale, strengthening domestic entrepreneurship and stimulating competition<sup>1</sup>. When fusions and acquisitions could not be implemented the government would stimulate combines, and CIP would sponsor a number of such combines ("Sectoral Agreements", as they were called) through which many firms in a given productive chain would agree as a group with a given set of profit margins, receiving in exchange the blessings of CIP and the assurance of barriers to new entrants and to "new facts" disturbing this "equilibrium" of the industry. According to a recent study "the stimulus to fusions and to sectoral agreements may have created a circularity between industrial concentration, the formation of oligopolies and the demand for economic regulation"<sup>2</sup>.

## 2.2. Protection

The cristalization of sectoral agreements can also be seen in connection with another important instance of regulation in Brazil, namely import controls. Indeed, as in many developing countries, the role of tariffs as instruments of protection in Brazil is limited; protection is mostly practiced by *ad hoc* administrative controls managed by a very closed circle of policy making councils where government officials and industrial "guilds" interact

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<sup>1</sup> PND-II p. 44.

<sup>2</sup> R. M. D. Grandi (1989, p. 63).

to administer protection. Since the thirties, the main instrument of industrial policy in Brazil has been the rationing of imports effected by foreign exchange authorities. This process has many instances. On the one hand, CACEX, the agency that issues imports licenses, works in close consultation with sectoral business associations examining each import request on the basis of the "similarity" law: if the sectoral business representatives claim they can produce a "similar" product domestically, imports are blocked. For this to happen, however, it is necessary that a prototype be presented or an exam of the existing product be performed by the importer and industry experts chosen by CACEX. When there are many import requests connected with one large project, the procedure is basically to negotiate a "national content" proportion for the project as a whole - the so called "participation agreements" - and let imports in according to this rule. Superimposed on that, are a number of special regimes regulating industrial policy and protection in specific sectors, as for example in the computer and related industries under the powerful Special Secretary of Informatics - SEI.

But, the "similarity" law is but one of many mechanisms of protection to which regulators and business associations play a crucial role. Once the "similarity" issue is circumvented there remains the tariff issue. Since the official tariff schedule comprises very high rates, often prohibitive, it is usual for importers to apply for exemption under some "special import regime", which is examined on an *ad hoc* basis by specific sectoral agencies. Most Brazilian imports enter the country through such regimes. The crucial aspect of this system is that since imports allowance often represents a *sine qua non* for a project's viability, these agencies, which work in close association with sectoral business representatives, have the power to erect barriers to entry which are sometimes explicitly against MNCs affiliates - no matter if

there are other MNCs affiliates already in the industry - and sometimes also against national entrants.

Excessive protection coupled with high national content requirements are at the root of the extreme degree of (backward) vertical integration of the leading Brazilian firms. This, in turn, explains the absence of subcontracting networks of medium scale firms and the consequent lack of flexibility in responding to shifting demand patterns, the loss of economies of scope and low rate of technology diffusion characteristic of Brazilian industry.

### **3. Efficient industrialization in technologically dependent economies: a simple analytical framework**

The objective of advancing industrialization with a commitment to efficiency and sound export performance raises two important questions as to the influence of the competitive environment to be discussed in this section. The first has to do with exogenous factors affecting Brazil's access to technology and markets which affect her possibilities of positively adjusting to the evolving North-South division of labour accompanying the continuous change in global patterns of comparative advantage. The second relates to the domestic policies best suited to reducing the allocative inefficiencies created by the current policy regime and increasing technical efficiency over time.

#### **3.1. The technological gap and changing comparative advantage**

Technology is an important factor in the determination of the commodity patterns of trade between the OECD countries and NICs. The

several analyses of the R & D orientation of trade in manufactures for different countries suggests a very clear pattern of international specialization, and one consistent with the neo-factor proportions theory, namely that advanced (in terms of their R&D "endowment") countries export high tech and import low tech goods, and NICs, the ones with a low R&D "endowment" would do just the opposite, namely, import high tech and export low tech<sup>1</sup>. These patterns - the existence of a technology rich or "innovating" region and an "imitating" or "dependent" region - have been recurrently observed and were discussed by authors like Prebisch<sup>2</sup>, and much less recently by no less than Marshall<sup>3</sup>. Lately, several models have been advanced to rationalize these patterns, notably those characteristically "Ricardian"<sup>4</sup>, those centered on the notion of a persistent technological gap<sup>5</sup>, and also the "stages approach" to comparative advantage<sup>6</sup>.

Exploring the opportunities open by a fast growing volume of international trade in manufactures does not only require increasing competitiveness over time but also access conditions to OECD markets. The experience of the NICs shows, however, that super-competitiveness in a narrow range of products leads to market penetration rates which are not compatible with the politically feasible speed of structural adjustment in the

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<sup>1</sup> See for example UNIDO (1985, p. 114), W. Fritsch & G. H. B. Franco (1988b) and UNCTAD (1989).

<sup>2</sup> A discussion of this specific issue in Prebisch thought can be found in M. J. Flanders (1964).

<sup>3</sup> The origins of trade theories in which technology play a leading role, and in particular Marshall's views on the international division of labor engineered by different rates of innovation in different regions of the world, and the role of innovators and imitators can be found in G. Harberler (1977, appendix A).

<sup>4</sup> As in P. R. Krugman (1987a).

<sup>5</sup> As in M. Posner (1961), R. Vernon (1966) and L. Wells Jr. (1972). P. R. Krugman (1979) and D. Dollar (1986).

<sup>6</sup> B. Balassa (1979).

North Atlantic economies, giving rise to protectionist reactions frequently targeting specific product-country pairs. This access restriction stemming from protectionist pressures is much related to the nature of the product exported; as NICs progressively climb the skills ladder towards differentiated consumer goods or industrial parts and components and away from labour intensive and technologically unsophisticated products, one should naturally expect protectionist measures to lessen.

Success in terms of a development strategy which has to rely on manufactures export dynamism has, therefore, much to do with whether it is possible to promote a technological upgrade in exports and output over the years. Some evidence for the leading NICs in this respect is provided by Table 1 below.

Table 1: NICs<sup>†</sup>  
Foreign trade with OECD countries: technological intensity\*, 1964-1985

	1964	1973	1980	1985
NICs' share in OECD imports				
high	0.6	5.6	8.4	11.3
medium	1.4	1.8	2.9	5.0
low	4.6	7.1	8.3	12.1
composition of NICs' exports to OECD				
high	2.2	17.6	21.5	25.0
medium	15.9	13.9	18.5	21.6
low	81.6	68.4	59.8	53.2
total	100.0	100.0	100.0	100.0

<sup>†</sup> refers to the "gang of four" (South Korea, Singapore, Hong-Kong, and Taiwan) plus Brazil and Mexico. \* technological intensity classification based on average R&D intensity of specific industrial branches. Adapted from OECD (1988, pp. 23-24).

The table shows a very impressive penetration of NICs' exports in OECD markets and also a remarkable change in the composition of NICs' exports very clearly towards a higher technological content. One should note, however, that the technological classification in Table 1 provides little

information on whether NICs are effectively making inroads in the highest ends of the technological spectrum. Exports of simple aircraft, black and white TV sets, and old fashioned chips belong in the high tech classification in the table, but are clearly at the lower end of the technological spectrum considering broader definitions of the products under consideration. The evidence in Table 1 should not convey the idea of NICs trading at the technological frontier, yet it is significant that the absolute level of technological intensity of NICs trade has increased very substantially over time. NICs exports might be heavily dependent on "mature" products, as the simpler products just mentioned could almost certainly be included among NICs imports of a few years back, when these were high tech products, or at least had not yet "matured". However, this brings no implication as regards changes in the absolute level of technological intensity embodied in these products, which seems to be growing significantly as successive waves of newly matured products are transferred to NICs - either through a deliberate relocation decision or by an increased world market share of NICs' firms.

The above discussion suggests the existence of a pattern of international division of labor, especially in trade in manufactures, where differentiated access to technology plays a crucial role and of a technological upgrade in NICs exports, which has been an important element in facilitating global trade adjustment. It should be noted, however, that very little can be said *a priori* about the evolution of the technological gap over time which depends crucially on exogenous factors affecting the pace and character of technical progress in the innovating countries but which, as discussed below, has important implications for industrial policy design in technologically "dependent" economies.



### 3.2. Technological upgrading in the 1980s: the crucial trade-offs

The transfer of industrial capacity on successive waves of mature products to the South basically involves the development of comparative advantage in new sectors or industries, or to carry the policies of promotion of "infant industries" to the point newly matured industries play a leading role in an export drive. Indeed in latecomers all industries are "infants" by definition, so that it is hardly surprising that the recent discussion around industrial strategies in NICs has touched the very same issues the old "infant industries" debate has so exhaustively dwelled upon.

The successful promotion of infants, as it is well known, involves mechanisms to foster learning and technology acquisition, that is, to foster technological transfer and develop and support of a complex domestic technological and industrial base to allow replication, adaptation, and also the creation of indigenous technological capabilities. Government intervention is often necessary to overcome the externalities - thus providing investments in technological infra-structure (education, technical training, applied research, etc.)<sup>1</sup> - and the perverse incentives naturally created by protection and, obviously, to enforce the promotion schemes, that might be through the capital market or through fiscal or commercial policy. Of course, not all industries can be successfully promoted in this fashion, and very often government policies are trapped during the process of maturation by rent seeking motivations. As put by an authoritative review of the Korean

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<sup>1</sup> The importance of these elements to whatever path of technology acquisition a country chooses has been repeatedly emphasized in the relevant literature, as for example in several of the papers in the M. Fransman & K. King (1984) volume.

experience "a government's ability to intervene selectively in pursuit of dynamic efficiency cannot be taken for granted. Indeed most government's lack this ability. But it appears to be a critical factor in using selective intervention to achieve faster and more successful industrialization"<sup>1</sup>.

The record of the maturation of "infant industries", when considering the universe of LDCs, is sufficiently weak to invalidate a general case for protection, yet there is a high enough number of successful cases concentrated in the leading NICs to permit inferences on the policies and conditions conducive to the maturation of "infants"<sup>2</sup>. It might be argued *a priori* that success in an industrial promotion strategy is crucially affected by the interplay between the speed of learning and technological transfer in the import substituting country *vis-à-vis* the dynamism of the technological frontier, and the initial cost disadvantage, which is determined by relative wages and other factors, such as the levels of vertical integration to other relatively inefficient domestic sectors<sup>3</sup>.

The greatest challenge in the years to come as regards strategies of industrial promotion in Brazil is the sharp acceleration in the rates of technological innovation in the North, which is due to have far reaching implications to the prevailing global patterns of comparative advantage. The consequences of these developments for technologically "dependent" countries, in the sense used in the last section, may result crucial for their efforts of export upgrading. As the technological frontier jumps ahead, an increasingly sophisticated set of industries - the lower end of the technological spectrum in the North - is liable to relocate the South, and this

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<sup>1</sup> H. Pack & L. E. Westphal (1986, p. 104).

<sup>2</sup> M. Bell et al. (1984).

<sup>3</sup> A detailed discussion of the interplay of these elements is provided in the appendix.

provides indeed a big challenge to be faced since it demands an increasingly sophisticated set of locational requirements and supporting policies. Success in industrial promotion in these new industries depends on being alert to the peculiarities of technologically dynamic industries. Indeed, the appearance of new, high tech, industries should not be seen as a mere renewal of the import substitution agenda, but as an entirely new challenge requiring brand new solutions.

One of the most clear features of new high tech industries is that innovations take the form of the introduction of new higher quality products that very often represent a lethal demand shock to the existing products. Newer industries not only experience marked product cycles but it happens that these cycles are shown to be short and shortening. This represents a serious departure with respect to previous experience of industrial promotion in Brazil, where the conditions for success rested on a combination of prolonged protection, the operation of economies of scale and the fact that the global technological frontier has remained stable for some time<sup>1</sup>. The fact that the latter is no longer true endangers the feasibility of industrial promotion not only because international prices have been falling sharply by virtue of huge and continuous productivity gains but also because the shorter product cycles allows less time for "catching up" to world best practices to be accomplished. There is little doubt that "catching up" will eventually occur, but in new industries it is crucial that it should take place

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<sup>1</sup> According to a recent survey of technology acquisition efforts in LDCs: "when the size of the domestic market has led over time to the installation of large plants that do not exhibit static diseconomies *vis-à-vis* establishments in the developed world, and when the global technological frontier has remained stable for some time, protection policies systematically maintained for at least two decades seem to have induced the development of competitive enterprises in LDCs based upon sound indigenous technological capabilities". J. M. Katz (1984, p. 32) our emphasis.

before the termination of the product cycle, or before the product is turned obsolete.

This raises a number of important issues related to the forms of industrial promotion and the potential roles to be played by competition policies. An important one is the role of protection - either from imports or from domestic producers of a higher generation products. Usually it takes a while for a given product, originally introduced in the North, to be manufactured in the South. Generally it starts at some cost disadvantage that dwindles over the years. The introduction of a newer product in the North may be a serious shock to domestic producers of the old product if foreign products are allowed to penetrate in the country's market. Yet, protection may certainly restrict the exposition of consumers to the newer product, still only manufactured in the North, thus extending the old product's cycle in the domestic market a bit more. This is effective, however, just for a while since it would be senseless to prevent the introduction of domestically manufactured versions of the new product. At this point, established producers of the first generation products have no defense against competition from the new product, though the product cycle will terminate only when the price of the domestic version of the new product is close enough to the old one's price.

Another crucial issue related to the viability of industrial promotion is related to start up costs. Usually, many structural features account for the initial cost disadvantages plaguing infant industries in semi-industrialised economies including wage differentials, but a crucial one is the degree of vertical integration with other relatively inefficient domestic producers or, alternatively, the lack of access to imported inputs. The reason can be clearly seen by considering the limit situation where the country's industry is

entirely formed by "infants": the more it relies on itself as a source of inputs - as opposed to importing competitively priced inputs - the less competitive it becomes. Thus a high degree of vertical integration resulted in very high initial cost disadvantages, that would probably mean that the "catching up" may take a long time to be effected since there is much ground to cover.

A high degree of vertical integration may be especially troublesome for new industries now being established in Brazil especially in view of the change in emphasis from import substitution to manufactured export growth as the adjustment strategy to the foreign exchange constraint in the eighties leading to renewed emphasis on industrial efficiency and competitiveness. Under shortening product cycles, as argued above, there are much less degrees of freedom as regards the viability of industrial promotion: too much importance being given to vertical integration might push cost curves upward to a point that the "catching up" obtains too late, or that the economic desirability of infant industry promotion is simply destroyed.

A lively example of these considerations is provided by the Brazilian experience with the manufacturing of computers of the Apple II type. Local manufacturing started in July 1982, thus substantially later than the product's appearance in the US. At this time the cost differential between the local clone (considering only the CPU) and the original US model was estimated to be 215%<sup>1</sup>. In May 1984 the cost differential was virtually eliminated, but at this time the Apple II was an obsolete machine. Domestically manufactured IBM PCs clones were taking over the domestic market at this point, despite their incredibly high price(cost) differentials, estimated at 319% in July 1986<sup>2</sup>, damaging Apple II clones' sales very badly.

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<sup>1</sup> W. Fritsch & G. H. B. Franco (1988b, p. 156).

<sup>2</sup> Idem, *ibid.*

Apparently, therefore, efficiency was reached too late, yet a solution was found through the drastic reduction of "national content" requirements. In Brazil computers are manufactured with indexes of "nationalization" (value of imports/sales) around 90%, which obviously does not help the cause of successful industrial promotion, as it puts initial cost differentials too high even considering the large wage differentials favourable to Brazil. In the Apple II case, however, plants were allowed to be established in the Manaus Free Zone (MFZ) where import restrictions are very mild. The move to the MFZ was equivalent to a liberalization: it increased import content in the product's manufacturing and thus represented a significant downward shift in its cost curve that allowed competitiveness to be achieved shortly after.

The above considerations, and the example, are relevant to highlight the crucial trade-off between the viability of industrial promotion in industries with an increasing technological content and the degree of vertical integration in the industry. The message is very clear, namely that under faster technological progress the feasibility of the promotion of infant industries, especially in newer high tech industries, involves stiffer trade-offs between vertical integration - or the levels of "national content" - and the speed of domestic technological acquisition.

#### **4. Promoting industrial efficiency in Brazil: the policy issues**

The assessment of the effects of competition to the generation of dynamic efficiency plays a crucial role in the design of industrial policy. This section addresses two aspects of this question that are especially important in the Brazilian context: the relation between market structure and

innovation, and the fact that in industries experiencing fast technological progress, or in new high tech sectors, competition become closely connected with the issue of the appropriability of the fruits of innovations, which, on its turn, leads to a discussion of intellectual property rights.

#### 4.1. Industrial organization, trade liberalization and technical efficiency

The importance now attributed to international competitiveness has naturally brought the trade liberalization issue to the forefront of the on-going policy debate in Brazil. Although there is today a remarkable consensus among government officials and academic economists on the relevance of the negative impact of the current trade policy regime on manufacturing export performance, there remain important obstacles to fast trade liberalization. One sees the usual resistances to the costs of structural adjustment, as observed worldwide, and also fears that, given current macroeconomic instability and depending on the nature and speed of the liberalization experiment, it may generate import surges and destabilising payments disequilibria.

An interesting alternative cutting accross these problems was provided by the Brazilian BEFIEX program, under which a firm is granted free access to inputs, and even exemption from "similarity" examinations, for processing for sale either in foreign or domestic markets, in exchange for export commitments far in excess of the value of allowed imports. Its effectiveness in terms of increased efficiency can be gauged by the fact that exports under the program - which comprises only about 60 firms - accounted for nearly 40% of Brazilian exports of manufactures in 1986, a US\$

7.1 billion worth<sup>1</sup>. A quite similar posture prevails in Korea, where, according to an account, "exporters were placed under a virtual free trade regime such that they faced world (or border) prices for both tradable inputs and exported outputs"<sup>2</sup>. The success of these programs coupled with the ease with which they were enforced, does provide a promising avenue for achieving greater outward orientation, and eventually a fully fledged trade liberalization in NICs in the years to come.

The possibility of liberalization is also commonly discussed in connection with its effects on productivity growth and other dynamic factors affecting the slope of the learning curves, and not especially as regards start-up costs in new industries as suggested in the last section. Although it is admitted that trade restrictions introduce static allocative inefficiencies, and might surely affect start-up costs, the notion that trade liberalization leads to greater technical efficiency is not generally tenable. As noted by an extensive survey of exercises attempting to relate the trade regime with total factor productivity growth: "there is no clear cut confirmation of the hypothesis that countries with an external orientation benefit from greater growth in technical efficiency in the component sectors of manufacturing; combined with the relatively small static costs of protection, this finding leaves those with a predilection towards a neutral regime in a quandary"<sup>1</sup>. Thus, the importance normally attributed to the trade regime as a determinant of industrial efficiency should not be overemphasized. In fact, the literature on infant industry promotion stresses that the crucial elements

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<sup>1</sup> W. Fritsch & G. H. B. Franco (1988b, p. 116).

<sup>2</sup> H. Pack & L. Westphal (1986, p. 93).

<sup>1</sup> H. Pack (1986, p. 38). The fact that the empirical arguments for defending export promotion *vis-à-vis* import substitution on the grounds of technical efficiency are simply not there, was even admitted by J. Bhagwati (1988, pp. 39-40). An enlightening discussion of the issue is offered by D. Rodrik (1988).



for successful maturation are exactly those relating to the growth of technical efficiency over time<sup>2</sup>.

Increasing technical efficiency can result from the operation of two distinct causes. On the one hand, they are likely to be generated by positive externalities created along the time span of the industry's maturation. On the other, they stem from the existence of increasing returns due to economies internal to the firm, especially those resulting from the attainment of economies of scale - when they happen to be significant - and, especially in technologically dynamic sectors, from the firm's capacity to master the process of technological choice either through the development of R & D capability or through technology acquisition.

These two causes have different implications for public policy. The former quite clearly relates to circumventing market failures in generating public goods such as technical training, support to basic R & D and the like which, although still facing low priority in the allocation of public resources in the vast majority of developing countries, present little ambiguities as to their causal effect on the level of domestic technological capability. However, devising government stimuli to innovation and technical efficiency at the firm level implies the administration of instruments of competition policy to foster technical efficiency, which begs the much more complex issue of the relation between market structure and innovative behavior. In fact, although the traditional presumption is that high entry barriers stifle the stimulus to

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<sup>2</sup> As a recent survey of the record of infant industries aptly put it: "maturation is not automatic or instant: reaching and maintaining international competitiveness is not simply a matter of developing the right industry or industries given the existing (aggregate) relative factor endowment. It takes more than effortless learning by doing and requires capability to manage continuous technological change. Maturation takes conscious efforts to develop a technological strategy, to invest in resources for technological changes, and progressively to accumulate technological capability". Cf. M. Bell et al. (1984, p. 124).

innovation and thus are conducive to technological stagnation, the neo-Schumpeterian notion that R & D investments are part of the strategic behavior of firms in concentrated market structures aimed at generating technical progress and innovation, leads to altogether different conclusions.

Empirical findings are inconclusive in this respect<sup>1</sup>. Innovative activity is commonly related to perceived market opportunities<sup>2</sup>, which are often associated with market size and growth - and, especially in developing countries, to firm ownership - and far less clearly to other elements of the competitive environment, such as for example intra-firm rivalry and ease of entry and exit, as noted by H. Ergas (1984) in the context of contrasts in innovative activity in the OECD area, and by S. Teitel (1984), J. M. Katz (1984) and C. Dahlman et al. (1987) in the context of a discussion of infant industries and technology acquisition in the Third World. Protection in itself could hardly be taken as a powerful inducement towards innovation, as one could *a priori* expect, though it has been difficult, on the other hand, to prove its negative implication to the innovation effort, as suggested by the inconclusive results of studies relating total factor productivity growth and measures of protection or openness mentioned above.

In this regard, it is interesting to note that the assertions to be found in some "new trade theory" models which associate trade restrictions (or distortions) with eventual high export performance through the attainment of increasing returns internal to the firm, crucially depend on behavioral hypotheses explaining increasing technical efficiency as resulting from R & D or other efficiency improving investments made out of rents generated by

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<sup>1</sup> For a recent survey see F. M. Scherer (1984, chs. 9-13).

<sup>2</sup> See K. Pavitt (1988).

protection to firms operating in non-competitive environments<sup>1</sup>. However, until we improve our understanding of the relation between market structure and innovation in developing countries<sup>2</sup> it will be unwise to make normative generalizations as to the use of barriers to competition as a source of increasing efficiency over time.

Finally, it should be noted that recent empirical work asserts unambiguously that both size and foreign ownership have strong positive effects on technological activity in Brazilian firms<sup>3</sup>. However, to make general statements about the effects of the domestic competitive regime on the extent and pace of technology transfer by MNC subsidiaries operating in the country is a rather difficult exercise. One can find examples in the Brazilian experience where government interference with competition has increased technology activity by MNC affiliates: stringent "local content" requirements, in addition to the need to adapt to smaller market sizes and different factor endowments, have not unfrequently forced local affiliates to undertake extensive technology adaptation efforts. One can also find examples where government interference increased the spillovers of MNC's operations to national firms: concern with the appearance of industrial "enclaves" led government policies to force vertical links between MNC's and national firms which had clear positive effects on the technological upgrading of upstream national firms.

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<sup>1</sup> For a popular model in this class, see P. R. Krugman (1984). For lucid caveats related to the activist prescriptions of this class of models see G. Carliner (1986, pp. 164-167).

<sup>2</sup> On the state of the art regarding this issue see M. Kamien & Schwartz (1982).

<sup>3</sup> See H. Braga & L. Willmore (1988).

#### 4.2. Intellectual property, foreign ownership and technology transfer: old and new issues

The role of competition policies to foster technical efficiency of "infants" in newer and technologically dynamic industries is an issue perceived as extremely policy relevant in Brazil. These knowledge intensive industries are usually considered to be those in which the spill-overs and externalities particularly related to R&D and innovation are the most pronounced and, thus, of strategic importance in improving domestic technical efficiency and competitiveness in the more dynamic sectors of international trade. In order to organize the debate around these issues it is important to consider that the use of instruments of competition policy to increase the rate of technology absorption in "follower" countries such as Brazil varies according to the degree of appropriability of the fruits of R&D in the different industrial sectors.

Let us start with the questions arising in those sectors where R&D activity is subject to the problem of low appropriability. Patterns of global competition in such industries are, of course, heavily affected by the problems created by the velocity of technical progress and the opportunities for "free-riding" through imitation and emulation of clones created by low appropriability. "Unfair" practices in the anti-trust sense are usually discussed in the North with respect to issues such as the adoption of standards and interfaces, licensing fees and conditions, and pre-emptive patenting<sup>1</sup>. It is interesting, however, to transpose the discussion of these issues to the context of countries with a low R&D "endowment" such as

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<sup>1</sup> See J. Ordever & W. Baumol (1988) and OECD (1989).

Brazil<sup>1</sup>, where it is quite natural from both a business as well as a social point of view to economise on this scarce resource as much as possible by means of a heavy reliance on technologies previously developed abroad and absorbed through copying, reverse engineering, and adaptive imitation<sup>2</sup>.

Indeed, it is easily observable in Brazil that the incentive to imitate in low appropriability sectors is so overwhelming that the development of domestic technological capabilities - especially if it involves the high costs needed to leapfrog towards the industry's technology frontier - is not an interesting business proposition. R&D activity is risky and expensive and often altogether redundant when its fruits have already materialized into a marketed product. It is natural for domestic firms to shy away from R&D when the keys for successful manufacturing are easily accessible through copying, reverse engineering and even licensing, and the more so as the externalities stemming from the domestic science and technology infrastructure are very weak. So long as the "access codes" can be reached at low cost, the incentives to invest in the creation of new technologies are, of course, very low and this explain why Brazilian firms in some high tech segments spend so little in R&D.

The heavy reliance on copying, imitation and reverse engineering raises issues connected with the threats of increases in the appropriability of technologies - which may in principle be accomplished by international legislation on intellectual property rights - and also with the dangers of unfair practices involving licensing, patenting and interfaces leading to technological "protectionism". The fear of technological "neo-mercantilism"

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<sup>1</sup> For evidence on the dismal low rates of R & D expenditures in Brazil as compared to some OECD countries, see H. C. Braga & V. Matesco (1986).

<sup>2</sup> See D. Ernst & D. O'Connor (1989, pp. 81-82).

can be observed in Brazilian policy towards the computer industry<sup>1</sup> where licensing relationships are not generally allowed for it is seen as involving a continued dependence in relation to the licensor. By the same token, the specialization in the production of clones is seen as subject to the danger of the innovator's move towards closed architectures or new interfaces, thus changing or even blocking compatibility requirements<sup>2</sup>. As the asymmetries embodied in the "technological dependence" relationship boil down to the prevalence of "unfair" competition practices at the international level one should expect that "dependent economies" would be actively interested in discussions concerning international conventions regulating international property rights to prevent the practice of technological protectionism<sup>3</sup>.

However, countries like Brazil show little interest in strengthening the rights of innovators, as forcibly pursued by the leading developed countries in the current GATT negotiations and, especially, by the US government through the threat of unilateral application of trade sanctions under section 301 of the US Trade Act. The reason for this apparent contradiction is that for a country like Brazil, increasing the effectiveness of sanctions in international conventions regarding intellectual property involves the uncertain balance between the costs of technological protectionism and the benefits of free riding the technological innovations from the North, which would be precluded if increased appropriability on the part of innovators were to be enforced by effective sanctions. Indeed, the Brazilian negotiating

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<sup>1</sup> It has also been the concern of a recent OECD study focusing on a variety of anti-competitive practices related to international trade. See OECD (1984).

<sup>2</sup> For discussions on the "dangers of technological dependence" along these lines see F. S. Erber (1983) and P. B. Tigre (1988).

<sup>3</sup> As well as on initiatives resulting in greater surveillance of anti-competitive actions in international trade through export cartels or intra-firm trade, for example. See OECD (1989).

position on this issue, both in the multilateral context as well as in bilateral negotiations with the US, reflects this difficult balance between the aims of preventing technological protectionism and of assuring the continuation of low appropriability in new "strategic" technologies, as one would naturally expect from a NIC "riding in the backseat" of technological innovation.

It is interesting to observe, however, that the North-South discussion of intellectual property rights has been very active only in connection with a handful of sectors, notably pharmaceuticals, and computer software. In such sectors, it is natural that a country's willingness to protect intellectual property rights will depend on the potential rate of innovation of her firms. However, this will occur only when their technological capability increased to a threshold beyond which the absence of intellectual property rights would inhibit R & D expenditures and innovative effort, that is after national firms have effectively approached the technological frontier, which should be related to accumulated profits, adaptation research, externalities stemming from domestic science and technology base, and the like.

This explains the two different ways Brazil reacted to the application of section 301 sanctions in the cases of computer software copyright, on the one hand, and patents on pharmaceutical products and processes in the other. In the former case, Brazil enacted legislation to the satisfaction of the US government under the threat of trade sanctions, as many domestic firms were already in the position of developing marketable products. In the latter, however, Brazil refused to comply with the US demands to grant patents on pharmaceutical products even after a large list of items of great export interest was subjected to a 100% surcharge<sup>1</sup>. The rationale of the

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<sup>1</sup> The case is now placed, by a Brazilian demand, before a GATT panel.

Brazilian position is twofold. First, Brazilian firms in the industry are small - holding a share of only 15% of the domestic market - and far from the point in which the protection of their technological efforts would be justified on economic grounds, as discussed above. In fact, this is an industry in which the granting of patent protection came very late in many developed countries, as shown in table 2:

**Table 2: Year of Adoption of patent protection in pharmaceutical products and processes**

<u>country</u>	<u>process</u>	<u>product</u>
Italy	1978	1984
Japan	1976	1976
Switzerland	1977	1977
Spain	1986	1982

Source: INPI, National Institute of Industrial Property.

Second, a relevant element in the Brazilian government's decision on whether or not to maintain its position is the consumer. Table 3 resumes some information on price differentials between products manufactured and marketed by the owners of the patents and clones produced by national firms. Price differentials are significant, clones being consistently cheaper, which could easily provide a powerful justification for not granting patents in the industry.

It is also interesting to note that the pharmaceuticals case is illustrative of the coming debate on Brazilian policies in the late generation, high unit value, segment of the chemical industry - the so called "fine chemicals" - where appropriability is low and within which there is a discussion on whether a "market reserve" model, similar to the one enforced



in the computer industry, should also be adopted. Interestingly enough, in the 1988 congress of the producers' association in the *química fina* sector - ABIFINA - a resolution was passed rejecting the "market reserve" model so long as the government continued to refuse granting patents in the sector<sup>1</sup>.

Table 3: Price differentials in the pharmaceutical industry, selected products, 1987

trade mark	general denomination	dosage (mg.)	retailers' prices (US\$) <sup>1</sup>	
			trademark	clone
Amoxil	Amoxilina	250	21.46	15.29
Ativan	Lorazepam	1	31.99	17.99
Darvocet-N100	Propoxifeno	100	28.01	17.89
Dilantil	Fenotoina	100	7.49	5.79
EES 400	Eritomicina ES	400	17.99	14.97
Inderal	Propranolol HCL	40	19.56	10.49
Keflex	Cefalexina	250	77.34	48.99
Lasix	Furosemida	40	10.74	5.89
Motrin	Ibuprofeno	600	18.23	9.93
Tylenol 3	Acetaminofen	300	14.89	6.88
Valium	Diazepam	5	27.47	8.49

<sup>1</sup> for one hundred tablets or capsules. Source: INPI, National Institute of Industrial Property.

The reason why the intellectual property rights debate has been circumscribed to a few sectors is that in most other high tech sectors many factors and circumstances, in addition to the the intellectual property legislation, create a reasonable degree of "appropriability". According to a recent survey, "generally, lead time, learning curves, and sales and service efforts were regarded as substantially more effective than patents in protecting products"<sup>2</sup>. Indeed, by and large technology enjoys some "natural"

<sup>1</sup> Jornal do Brasil, August 17, 1988.

<sup>2</sup> R. C. Levin et al. (1987, p. 794).

appropriability once, as noted in a recent study, "technology is not in fact analogous to information, since it is firm specific, differentiated and often tacit. Whilst it is certainly costly to produce, it is also costly to difuse and to replicate. These costs are high even when replication is within the same organization"<sup>1</sup>. Besides, in order to enhance competitive advantages stemming from the possession of firm specific technologies it is natural to expect firms to invest in innovations enjoying greater appropriability<sup>2</sup>.

In such sectors where appropriability is high - that is, where foreign innovating firms are effectively able to prevent access to manufacturing without recourse to the legal framework - the crucial issue is how to increase the rate of technology transfer from the foreign innovator, usually MNCs, conspicuously present in the more technologically dynamic sectors of industry on a global scale. The question here is not that of whether MNCs are an effective vehicle of transmission of industrial efficiency. Incidentally, MNCs seem to have had, by and large, a positive impact on domestic efficiency not only for their overwhelming presence in the more technologically dynamic sectors of Brazilian industry, but also because, where they were prevented to integrate backwards, their relation with local suppliers and competitors tended to enhance technological and market complementarities prone to generate innovations and better quality standards. The crucial question in sectors where appropriability is high is whether access to technology by firms - national and foreign - located in Brazil is subject to competitive restrictions which are likely to hamper their technical efficiency over time or their ability to compete in international markets.

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<sup>1</sup> K. Pavitt (1988, p. 148).

<sup>2</sup> As argued in S. Maggee's (1977) classic paper.

In this regard, an important aspect of competition policy in Brazil has been the screening of technology contracts by the National Institute of Industrial Property (INPI) to prevent the occurrence of restrictive practices against national firms and clauses violating the priorities of industrial policy. A typical example of the latter are the clauses - present in around a third of contract screened - establishing export restrictions to the licensee. This "unfair" practice, on which the INPI has acted in some way or another, damages Brazil's exports prospects and hampers the process of global adjustment discussed in section 3.

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### Appendix

The interaction between the speed of learning and technological transfer in a country undertaking import substituting *vis-à-vis* the dynamism of the technological frontier, and the initial cost disadvantage, which is determined by relative wages and other factors, such as the levels of vertical integration to other relatively inefficient domestic sectors,  $V$ , is best seen if we write the evolution of an infant industry's costs over time,  $C(t)$ , and of the costs of "matured" competing industries in the North,  $C^*(t)$ , as follows:

$$C^*(t) = C^*_0(w^*) - \theta \cdot t \quad (1)$$

$$C(t) = C_0(w, V) - \beta \cdot t = C_0(w, V) - (\beta_0 + \beta_1 \theta) \cdot t \quad (2)$$

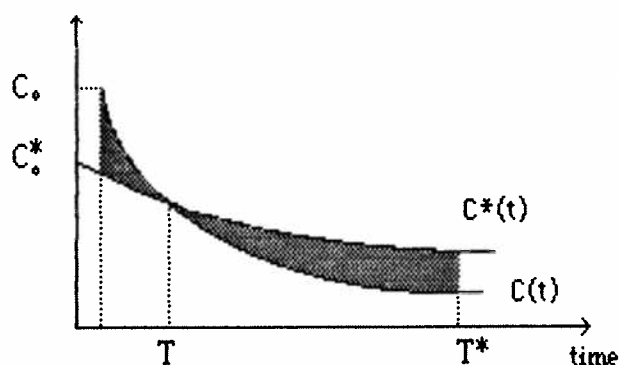
where initial costs depend on wages and vertical integration and the parameters  $\beta$  and  $\theta$  stand for the speed of productivity growth as translated

into average costs reductions in each industry. It is assumed in particular that  $\beta$  is partly autonomous ( $\beta_0$ ) but partly dependent on the speed of technological progress abroad  $\sigma$ , this meaning that  $\beta_1$  stands for the rate of technological transfer or spillover.

The desirability of industrial promotion schemes can be seen with the help of graph 2. Industrial promotion would be desirable if the discounted value of the strategy "gains", occurring when the infant industry's costs are lower than competing industries' and shown by grey area between  $T$  and  $T^*$ , are greater than "costs" endured by the economy at large occurring when the infant's costs are higher than the one of its competitors before the "catching up" moment at  $T$ . This condition is known in the economic literature as the Mill-Bastable criterion<sup>1</sup>. It is clearly satisfied as an equality, as seen in the graph, at the moment  $T^*$ , which is determined so as to satisfy the following relation:

$$\int_0^{T^*} \exp(-\delta.t) \cdot [C(t) - C^*(t)] dt \leq 0 \quad (3)$$

where  $\delta$  is a discount rate and the cost differential an undistorted measure of profitability.



<sup>1</sup> See R. E. Baldwin (1969).

It is easily seen from the graph that, for a given initial cost differential, the faster the infant's learning (or the more significant the occurrence of economies of scale as the infant industry grows), the slower the evolution of international prices/costs (the innovating country's technological frontier), the greater the chance of equation (3) be fulfilled. These *a priori* considerations provide a simple but powerful explanation for discussing the key policy issues in promoting efficient industrialization.

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