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# TRANSNATIONAL COMPANIES AND CHANGES IN COMPARATIVE ADVANTAGES IN BRAZIL\*

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The paper examines the impact of Transnational Company (TNC) affiliates upon the slow transition from import substitution to export expansion in Brazil from 1967 to 1988. Relying on general equilibrium approaches to TNCs and international trade, we propose a regression model in which the change in revealed comparative advantage is explained by a set of trade theory variables together with a variable standing for TNCs. The idea is to control for sectors performance through their common causes, instead of completely disregard firms' location patterns. The variables are in *panel data* form: twenty manufacture sectors in four periods. Besides some revealing results associated with the traditional trade theory variables, analysis showed that foreign affiliates contributed to the slow export expansion in manufacture. Additional analyses managed to uncover their causes: the anti-trade location pattern of these companies that outweighed their positive effect on exports conferred by ownership advantages.

Key words: Transnational companies, comparative advantages, exports, import substitution, and Brazil.

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\* I wish to thank the comments and suggestions from Maria C. Terra, Luciana T. de Almeida, participants at seminars in UFSCAR and FEA-USP, as well as discussions with Larry Willmore, William Green, and Maria A. Franco, Ricardo G. Silva, Aquiles G. Kalatzis and the superb supporting assistance from Carolina L dos Santos. The usual disclaims apply. I also want to acknowledge the following institutions and persons for help with data: UNIDO; ECLAC; FUNCEX; SEBRAE; Bart Verspagen; Larry Willmore; Ricardo Bielschowsky; José Mauro Moraes; and Walter Roncada. Financial supports from Fapesp and CNPq are greatly acknowledged.

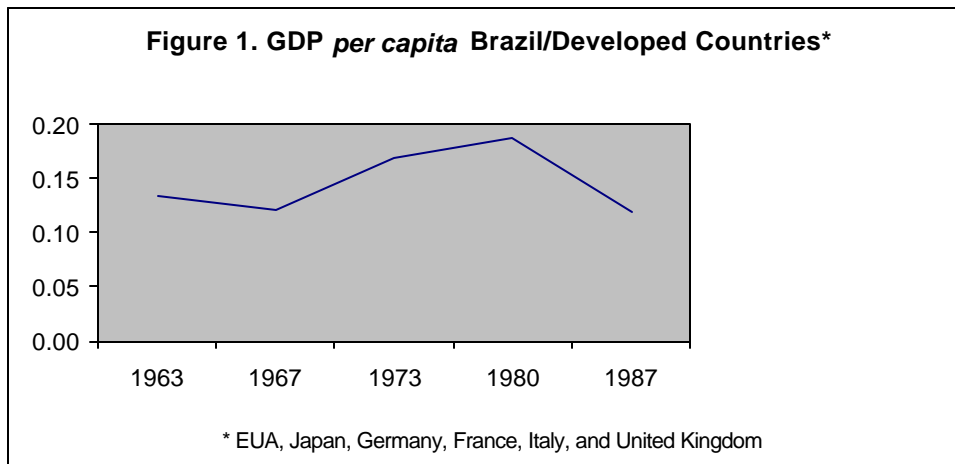
# TRANSNATIONAL COMPANIES AND CHANGES IN COMPARATIVE ADVANTAGES IN BRAZIL

## 1. Introduction

Two extreme treaties featured the Brazilian economy during the classic period of import substitution industrialization (ISI): trade protectionism and foreign capital (in the form of direct investment) liberalism. Import restrictions were high and generalized (Tyler, 1985), even though varying during certain cycles (Pinto, 1983, Teitel & Thoumi, 1986), which led to a steady and severe sharp drop in import share of domestic product. At the same time, the liberal posture towards foreign direct investments (see Fritsch & Franco, 1994), in addition to the country's structural characteristics, made Brazil the world's largest receptor of foreign direct investment among developing economies for decades.

Naturally, trade policy turned out to be a central issue about Brazil's *slow transition from import substitution to export substitution*, as couched by Shapiro & Taylor (1990). More to the point, despite the predominance of manufacture in the Brazilian GDP since the early 1950s, Brazilian exports of nontraditional manufactured goods began to occur only by the end of the 60s, more noticeably in the 70s (Teitel & Thoumi, 1986, CEPAL, 1992) and even so, due to strong import restrictions and export-incentives. According to the quoted authors, tariffs showed an anti-trade allocation bias, and the country's specialization strategy did not correspond to the optimum dynamic for changing comparative advantage, let alone the effects of safe monopoly rents on easing the push on productivity changes.

As a result, the burden of pushing a sector without comparative advantage became more and more costly as industry grew relatively larger in Brazil's GDP, and advanced towards more dynamic and capital intensive sectors. The reversion in the international market during the 1980s aggravated such costs, driving Brazilian industrialization to a collapse, and so the country's *catching up*, as shown in Figure 1 below.



A parallel question to many researchers was: had foreign companies also contributed to this anti-trade growth? The pioneer study by Fajnzylber (1971) pointed out that, at the end of the 1960s, export expansion in manufacture was higher in those sectors featured by stronger presence of transnational companies (TNCs). Yet, in the wider and more detailed samples by Doellinger & Cavalcanti (1975) and CEPAL (1983) for the 1970s, no definite indications of export superiority of foreign firms appear, even though they are clearly superior in import propensity (CEPAL, 1983). Nonetheless, only the studies carried out by Willmore (1985, 1992) and CEPAL (1985)<sup>1</sup>, based on extensive samples of various manufacturing sectors to either 1978 or 1980, applied econometric models to test hypotheses regarding “foreign firms and export”. In short, these are the only studies whose samples and methods allow generalizations, and their estimates show that subsidiaries have higher export propensities together with a higher import propensity. More recently, analyzing the 1990s, after the end of import substitution, Moreira (1999) arrived at similar conclusions regarding TNC’s contributions for exports.

Summarizing, transnational companies would not have contributed to the slow transition from import substitution to export substitution in Brazil. The seemingly anti-trade orientation of the TNCs stemmed from price distortion and competition, which pushed firms to domestic market.

The truth is that Willmore (1985, 1992) and CEPAL (1985) do not test multinational firms, but rather only their *ownership advantages*, taking both location and capital size as external to these firms. In other words, these researches are based on a partial equilibrium perspective that evaluates the differential impact of plant propriety (domestic or foreign) on the export performance of each sector, apart from company’s distribution over sectors, in contrast with recent theoretical studies on multinationals and international trade in which the geographic distribution of multinational companies, around the world and industries as well, is an endogenous variable, and thus part of their impact on countries’ comparative advantage.

In the present paper, we examine the impact of TNCs on Brazil exports in accordance with the theoretical studies on international trade with multinational firms. This is done by means of a modeling in which comparative advantages, in terms of exports, are explained by industries and firms, simultaneously, and in such a way that the singular contribution of foreign firms takes into account their microeconomic location pattern. The more general goal is, actually, to investigate the role of the foreign affiliates in the slow transition from import substitution to export substitution. This entails taking repeated observations of each over a period ranging from the 1960s to the 1980s, as well as a modeling based on dynamic comparative advantage variable at different periods and relying on dynamic general equilibrium approaches.

All variables of our model, i.e., foreign firms and a set of variables representing factors that condition sector’s trade performance, exhibit statistical significance in explaining manufacturing exports. The coefficient of *foreign firms* is negative, confirming the view that an empiric model to evaluate TNCs as a whole may differ from those for evaluating ownership advantages alone. Additional analyses succeed in identifying the causes of this anti-trade pattern of foreign subsidiaries in Brazil, which are: their location advantages<sup>2</sup> in sectors in which the country does not present comparative advantages, and their effect on industry’s competition pressures. In reality, evidence of the latter effect was obtained indirectly, impeding its separation from certain forms of externalities. Other important findings refer to the market determinants of export performance, as comparative productivity, tariffs, and international income elasticity of products, which shed new light on the nature of Brazilian industrialization.

The structure of this work is as follows: we start with a survey of econometric researches on export performance by transnational companies in Brazil, next we present our model, test it, and comment on the main results. Conclusions follow in the last section.

## II. Transnational Companies and the Origin of Capital

The dominant paradigm on foreign direct investment states that international production by firm is determined by *ownership advantages* of firms, *location advantage* of countries, and *internalization advantages* of transactions with subsidiaries (Dunning, 1977; Williamson, 1975, 1985). In other words, the decision to service a foreign market through a subsidiary, instead of exporting, supposes both firm's holding ownership advantages over its foreign competitors and the existence of *internalization advantages* of undertaking this project internally, instead of licensing its international technology to an oversea foreign company. Lastly, the location of these subsidiaries is related to the country's comparative advantages. There lies the reason for an "eclectic approach" articulating the theories of international trade and of firms (Markusen, 1984, Ethier, 1986, Caves, 1996).

Several empiric studies demonstrate how TNCs specific advantages (e.g., managerial capacity, technology generation, international network, and financial leverage) contribute towards exports. Bauman (1995) emphasizes the advantage of participating in the same international group for the total and intra-industry exports in Brazil, though its net effect is greatly minimized when considering affiliates-matrix imports (see Hiratuka, 2000). Terra (2000), in turn, shows the importance of credit access to trade performance of capital-intensive sectors, and consequent advantages gained by transnational companies. The study carried out by CEPAL (1985) also shows factors, explicitly related to exports, more typical of foreign companies. Not forgetting Katz's (1984) findings, based on episodic Argentinean cases, that foreign subsidiaries are not much agile in exploiting export opportunities related to local market characteristics, as well as Bedê's (1992) study on auto-parts industry, in which the local firms' exports overcame the foreign ones – and this industry overcame, in turn, the auto-assembling industry, dominated by TNCs. These cases stand out the inefficiencies of large hierarchical organization, reinforced by distance among the units, as well as by the differences in factor endowments between source and host countries.

In any case, apart from peculiarities of one or another sector, the above studies and those cited in the previous section leave no doubts as to the superiority of TNCs, in terms of exports, over their local rivals within the same sector. Thus, the ownership advantages compensate for the possible hierarchical organization inefficiencies. Notwithstanding, it may happen that TNCs are concentrated in those sectors where the host country presents no comparative advantages, independently of tariffs. That is a possibility we can draw from recent theoretical studies on horizontal FDI, where distance (transport cost) and size of the host economy are included among their location advantages (Markusen & Venables, 1997). Accordingly, we should take into account the distribution of multinational companies across sector for evaluating their impact on host country's trade performance, as in Kojima's (1985) comparison of American and Japanese FDI in Southeast Asia.

It is worth stressing that the horizontal FDI, associated with monopolistic (or oligopolistic) competition, prevailed during the import substitution period in Brazil, as can easily be seen in Figure 2 at the end of this section.

From these observations, we can make a qualified analysis of previous econometric research on foreign affiliates and exports in Brazil, mentioned before. On the whole, these researches are guided by the following question: does capital origin (domestic or foreign) alter a firm's production performance? For this to happen, attributes other than ownership, such as firms' size, the sector of activity, etc., must be set aside in order to isolate the particular effect of ownership. Willmore (1985), for instance, adopts a methodology of grouping data for pair of similar (domestic and foreign) firms, i.e., those belonging to the same productive sector and having similar sizes. Justification for such a procedure is quite coherent: to control for other factors that alter export chances, since the objective is to gauge if a plant operated by an TNC affects export chances in relation to a local firm. The resulting estimates indicate that foreign control positively affects exports.

CEPAL (1985) does not use the ordered pairs method, but a regression model with dummies for the sectors, which also clears away sectors attributes from the foreign firm variable. Willmore (1992) works with neither similar pairs nor dummies in his econometric models, but introduces a qualitative dependent variable for the firm's export (1, when it exported and 0 when it did not export). Here the idea is to measure export probability, being that this omits the information of export level. This informs the TNC's performance in the sectors holding to the criteria of having some exports other than zero, and not by the relative value of such exports.

The fundamental issue regarding ordered pairs, or models that control for sectors, is that by removing information on the sector's relative performance, the analysis by ordered pairs leaves us with something that barely characterizes TNCs: their ownership advantages<sup>3</sup>. *Location advantages* and other fundamental attributes of foreign affiliates that characterize export contribution of these companies are ignored<sup>4</sup>. For the sake of clarity, if foreign affiliates had a low export propensity precisely for moving towards sectors with comparative disadvantages, in Brazil, this information would be overseen provided that their performance was not inferior to the local firm match of the same sector and size.

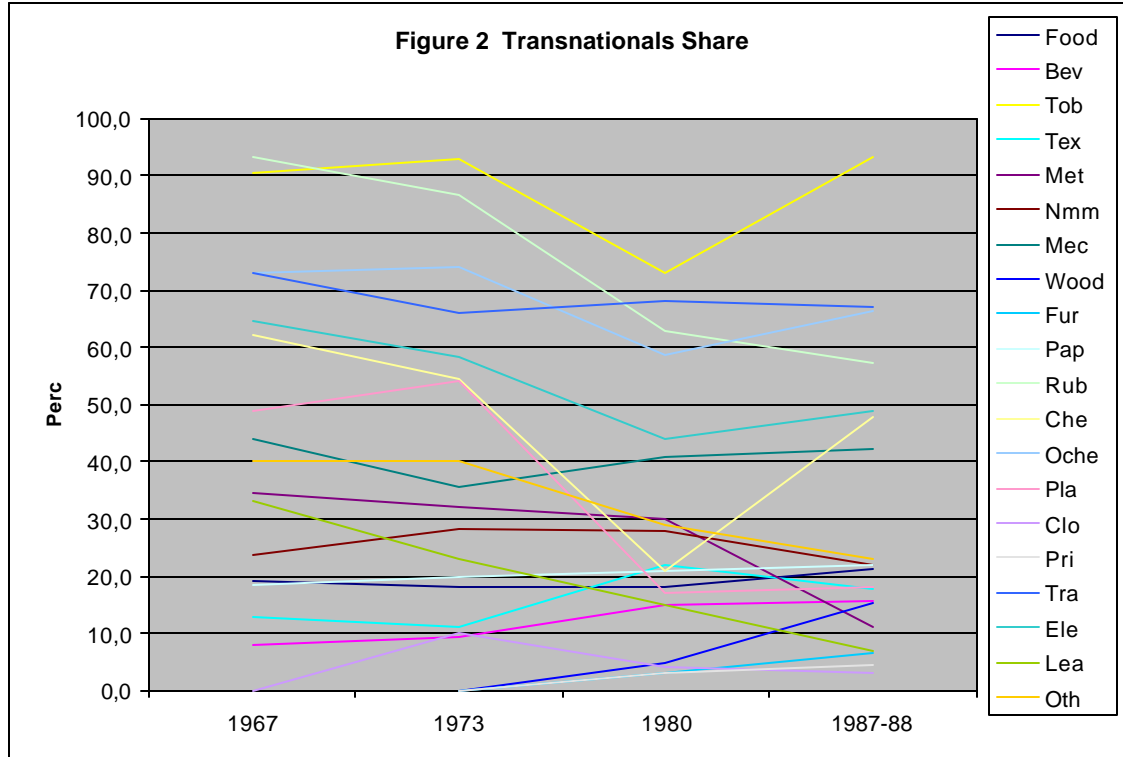
In short, it deals of a partial equilibrium analysis where the foreign/local firms performances are treated isolated in each sector. Differently, in the theoretical studies that tried to incorporate the multinational firms into the study of international trade study, the TNC's location pattern is an important point in general equilibrium analysis, and the resulting impact of those companies upon the pattern and gains from trade shows up in the sector's relative performance (see Markusen, 1995, Ethier, 1986, and Markusen, 1984).

Lastly, all of the commented works analyze a specific year, something deemed inexorable when trying to make an exhaustive sample survey on firms. However, our objective is to examine if TNCs assist in explaining the lack of success of Brazilian import substitution policies, as perceived by the slow export substitutions. Effectively, a sample solely based on a year of this period will not bring such information. We would have to rely on repeated measure of different sectors over time, of the several relevant variables. In short, with *longitudinal (or panel) data*.

However, this temporal scrutiny has a price, regarding the sampling quality and details. A typical problem with longitudinal data is that observations may be collected under different conditions and methods over time (Diggle *et al.*, 1996) - quite characteristic of some of the variables we work with. Another problem with repeated observations is the non-availability of an ampler roll of data throughout

the analyzed period. For example, we do not have data on exports and production discriminated by firms, but only the share of TNC in the sectors' activity. In reality, this does not pose a serious problem to our analysis, since it aims at analyzing the TNCs' trade impact or profile through the sectors relative performance, as in Kojima's (1985) work as well as in the more recent theoretical studies, and not with respect to its local rival in the same sector.

Figure 2 exhibits data on TNCs' presence in twenty manufacturing sectors in four years (1967, 1973, 1980, and 1987-88), which will be the reference to the remaining variables in the model. Except for the pronounced variations in Tobacco and Chemicals in 1980, surely due to Willmore's (1987) classification criteria, the remaining time variations match with the changes experienced by the Brazilian economy. For instance, the slight fall of TNCs presence, after 1973, in Chemicals, Plastics, Non Metallic Minerals and Other Manufactures conforms with FDI reflux in Brazil after the petroleum shock, in 1973, together with the impact of the II PND (National Development Plan) and other policies targeting high technology sectors that accelerated local firms' (public and private) investments, beginning in 1974.



Sources: 1967 and 1973: Calabi *et al.* (1981); 1980: Willmore (1985); 1987-88: Zockun (1987).

Notes: **Bev**: Beverages; **Tob**: Tobacco; **Tex**: Textiles; **Met**: Metals; **Nmm**: Non metallic minerals; **Mec**: Mechanical equipment; **Fur**: Furniture; **Pap**: Paper and paperboard; **Rub**: Rubber; **Che**: Chemical products; **Oche**: Other Chemicals; **Pla**: Plastics; **Clo**: Clothing and shoes; **Pri**: Printing and publishing; **Tra**: Transport equipment; **Ele**: Electrical material; **Lea**: Leather and furs; e **Oth**: Other sectors.

For further details see Appendix I



### III. Transnational Companies and Comparative Advantage Changes

The fundamental idea of the empiric model we are pursuing is to explain the position and dynamics of sectors' relative export based on markets' invisible hand and on firms' visible hand, as in the modern literature on international trade and multinational firms. More to the point, given country's characteristics (e.g., relative abundance of factors, technological development, domestic market size), the relative export performance of its manufacturing sectors is determined by supply and demand characteristics of the corresponding industries' market, from one side, and of the firms, from the other side (Markusen, 1995).

Our first step, is to define the notions of technology, demand and the very economic dynamics underlying our model. The distinct features of the multinational firms refer us to international trade theories based on imperfect competition, but, as noted by Ethier & Markusen (1996), these theories point out the advantage of a single plant firm and are somewhat irrespective to comparative advantages, both contradicting the nature and operation of a multinational firm. From the increasing returns of *knowledge capital* – intangible assets – centralized in a single unit, together with the transportation costs of exports, Markusen (1984) deduced the superiority of multi-plant firms. On the other hand, exploring the internalization advantages of transactions with technologies, accounting for uncertainty and risks in contracts, Ethier & Markusen drew the role of factor's endowments on TNCs's presence across countries. Besides explaining some key facts about multinational firms, these models show that a variety of technologies are at place, presenting constant and other increasing returns to scale.

Even at industry level, the importance of economies of scale varies among sectors (Antweiler & Tefler, 2002). At the same time, the most recent empirical researches on international trade (Trefler, 1995; Trefler & Chu-Zhu, 2000; Davis et al., 1997) show that the notion of an integrated economy, underlying the Heckscher-Ohlin theorem, does not hold good; technology differences among countries is systematic and pervasive. That said, we should adopt more flexible hypothesis about technologies and, definitely, steer away from the idea that they would be readily available, presenting constant returns to scale, so that factor endowments alone would dictate comparative advantages among countries.

In reality, the lack of data on capital stocks and different types of labor, for the analyzed period and countries – Brazil namely – prevented us from even considering factor endowments. The sole information on technology we will count with is the relative labor productivity and costs, which may express not only the countries' exclusive possession of technologies, but also their relative factor endowments<sup>5</sup>.

*Comparative productivity-change and structural changes in demand* made up, in turn, the dynamics of *trade and development* in our analysis. World's demand is supposed to affect countries' specialization pattern in non-neoclassical general equilibrium analyses (Grossman & Helpman, 1991: Caps. 7 e 9), and we take the *Engl's law* as the systematic form linking growth in world income and changes in world demand for products, as in Pasinetti's (1981, 1993) structuralist analysis<sup>6</sup>. Accounting for this relationship is also important for it underpinned the strategy of import substitution in Latin America, allowing us to test it.

For the sake of brevity, we will start with a simple model of international trade, built on industries' (and countries) features, and next introduce multinational firms. Our starting point is that, in a closed

economy, relative sales of each industry,  $x_i = X_i/X$ , are determined by relative prices and consumer's income level – preferences are non-homothetic. That is,

$$x_i = z_i \left( \frac{1}{p_i} \right)^b \quad (1)$$

with  $b < 0$ , standing price-elasticity, taken as identical among sectors, as in Dixit & Stiglitz (1977), while  $z_i > 0$ , standing for the portion of the income assigned to consumption of product  $i$ , is specific to each industry, and independent of prices. Although expressive of many trade theory models with economies of scales (Krugman, 1990), equation (1) differs from them by assuming non-homothetic demand, driven by *Engl's law*, as.

From this definition of  $z_i$ , and considering that prices are given by a mark up on labor cost, (1) can be re-written as:

$$x_i = Y^{h_i} \left\{ \left[ \frac{1}{(1 + \boldsymbol{\tau}_i) a_i} \right]^b \right\} \quad (2)$$

Where  $a_i$  is the labor cost coefficient (to value added), and  $\tau$  the mark up, associated with both capital average revenue and monopoly rent. We substituted  $z_i$  for  $Y$ , consumers' average income raised to  $\mathbf{h}_i$ , the income-elastic of demand for industry  $i$ 's products.

From the autarchy equilibrium sales, in equation (2), to the international trade equilibrium, it only takes incorporating the relative production of and demand for international competitors, which shall be a set of industrialized countries – the main reference to evaluate the advancement of manufacturing exports of the local economy (Brazil). Writing variables in logarithmic form, and making some transformations, gives us the following stochastic form for equation of relative external sales of the local economy:

$$\log(x_{i,t} / x_{i,t}^*) = \mathbf{a}_i + (\mathbf{d}_i - \mathbf{d}_i^*) \mathbf{h}_i \log Y_i^w - b \log \left( \frac{a_{i,t}}{a_{i,t}^*} \right) - \log(1 + \boldsymbol{\tau}_{i,t}) + \mathbf{e}_{i,t} \quad (3)$$

or:

$$\log(x_{i,t} / x_{i,t}^*) = \mathbf{a}_i + (\mathbf{d}_i - \mathbf{d}_i^*) \log z_{i,t}^w - b \log \left( \frac{a_{i,t}}{a_{i,t}^*} \right) - \log[1 + \boldsymbol{\tau}_{i,t}(t, \mathbf{q})] + \mathbf{e}_{i,t} \quad (3.1)$$

The superscripts\* indicate foreign economy and the subscripts  $i$  and  $t$  indicate sectors and years, respectively. Sectors are the same twenty that appear in Figure 2, while the years are 1967, 1973, 1980, and 1987-88, with slight deviations for some variables (see Appendix I and II). World income,  $Y_i^w$ , was placed in lieu of domestic income, for reasons explained below. The mark up,  $\boldsymbol{\tau}$ , was set as a function of tariff protection,  $t$ . Since we do not have information on tariffs of the foreign economy, we will eliminate the term  $(1 + \boldsymbol{\tau}^*)$ . An alternative reading is that developed countries' manufacturing sectors are assumed to operate under free trade, as compared to the Brazilian economy of that time.

A set of the six largest industrialized economies (US, Japan, Germany, United Kingdom, France and Italy) stands for foreign economy in (3) or (3.1). Hence, all variables of the equation are expressed in

relative terms to those economies, except world's income elasticity and domestic tariffs. The dependent variable of the equation is *revealed comparative advantage* (RCA), given by:

$$RCA_{i,t} = \frac{x_{it}}{x_{it}^*} = \frac{X_{i,t} / X_t}{X_{i,t}^* / X_t^*} \quad (4)$$

where  $X_{i,t}$  and  $X_t$  are sector's  $i$  exports and total exports, respectively, in period  $t$ . We substituted the log form of equation (3) by the fractional form of the numerator and denominator, because a log of fractional size near "1,0" would compress too much its variation, and also because (4) is the conventional form of *revealed comparative advantage*. The sources of this and the remaining variables are presented in Appendix III.

We can refer the impact of the comparative productivity of labor,  $a_i/a_i^*$ , to the *Ricardian* one factor model with  $n$  goods (Dornbusch *et al.*, 1977), in which the regions' relative wages is the threshold for comparative advantage. That is:

$$\frac{a_1}{a_1^*} < \dots < \frac{a_i}{a_i^*} < \frac{w^*}{w} < \frac{a_j}{a_j^*} < \dots < \frac{a_m}{a_m^*} \quad (5)$$

To the left of  $w^*/w$  the local economy has comparative advantages, with is higher the smaller is  $a_i/a_i^*$ , configuring a negative relationship with RCA, the dependent variable. As wage values would not come into a series built on (6), we may divide the entire series by  $w^*/w$ , obtaining:

$$\frac{wa_1}{w^*a_1^*} < \dots < \frac{wa_i}{w^*a_i^*} < 1 < \frac{wa_j}{w^*a_j^*} < \dots < \frac{wa_m}{w^*a_m^*} \quad (6)$$

a more consistent indicator of comparative advantages in costs. The time variation of each of these values can be thought as determined by the relative capacity of the South to innovate and imitate North's technology, as modeled by Currie *et al* (1999).

We did not find the average wages of manufacture in both regions in a homogenous form for all those years and countries, so that we take the GDP *per capita*, as in the *Ricardian* one factor model. The low reliability of this income indicator for labor in manufacture, compels us to consider both forms of comparative costs, (5) and (6).

The new form of income-elasticity term, in equation (3), comes from the substitution of world's income for domestic income, raised to  $\mathbf{d}$ .

$$\mathbf{h} \log(Y_t^w)^{\mathbf{d}}$$

with  $\mathbf{d}$  signing the economy's capacity to meet that demand. As proposed by Pasinetti (1993), international trade, by opening up the possibility of serving foreign markets, melts down the local differences of demand between developed and developing economies, stemming from their structural difference in income levels. Thus our option for taking a common world's income-elasticity,  $\mathbf{h}$ , but

weighted by countries' capacity to meet this expanding market, given by the term  $(\mathbf{d}_i - \mathbf{d}^*)$ . The latter, as written in equation (3), is the coefficient value of the corresponding variable, which, in a time dimension, boils down to  $\mathbf{h}_i$  solely – i.e., industry's  $i$  worldwide sales expansion to income variation:

$$\mathbf{h}_{i,t} = \frac{X_{i,t}^w / X_{i,t-1}^w}{Y_t^w / Y_{t-1}^w} \quad (7)$$

where  $X_{i,t}^w$  stands for world's export of industry  $i$  at period  $t$  and  $Y_t^w$  for the world income at period  $t$ <sup>7</sup>. It would be better taking the world income of the tradable sector only, following Feenstra (1998), but we did not find such a data.

Underlying the term  $(\mathbf{d}_i - \mathbf{d}^*)$  is a correspondence between demand dynamism (or size) and product innovation, as in Ethier & Markusen (1995), but it can be referred, instead, to a “center periphery” model, as in Krugman (1991: Appendix A), in which the larger (more expanding) an industry, the harder it is for the periphery to challenge the center. The crucial point is the periphery's capacity to capture larger or more expanding market, a preferred cleavage for *superior specialization* than one based on sectors' value added.

Regarding tariffs, since what matters mostly is their effect on value added, we work with effective tariffs. Their static effect, as specified in equation (3), is to push local industries into relative export disadvantage, for driving local resources toward the high cost sectors, as can be grasped by tracing back to equations (1) and (2). Their dynamic effects, on the other hand, can be twofold: to ease firms' innovation strive (Helpman & Krugman, 1985; Kaldor, 1958), or to promote infant industries (Krugman, 1984). Estimates will show whether the anti or pro-export effect prevailed.

Introducing tariffs is also important for they supposedly affected FDI orientation – normally towards the least competitive sectors. It, thus, isolate industry location factor from TNCs' location pattern. Besides, according to Moreira (1999, import protection had had some specific effects on foreign companies in Brazil, which are: 1) slow change in their product innovation, and 2) an excessive increase in product diversification, preventing firms from reaping the highest returns to scale (Moreira, 1999). Even though Moreira does not provide empirical proofs of that tariffs had these differentiated effects on foreign firms, as compared to domestic firms.

So much for the industry's part of comparative advantage. We must, now, tackle firms' part. As seen above, previous researches demonstrate the ownership and internalizing advantages of foreign firms in the Brazilian manufacture, for the period at stake, so that the higher the relative presence of TNCs in industries the higher would be the latter's comparative advantage. This one-to-one partial equilibrium analysis, however, does not take into account how TNCs' microeconomic profile may affect their location advantage, given host economy's characteristics. Provided they are biased toward the least competitive industries, foreign firms would count negatively to comparative advantage.

According to Markusen (1995) and Markusen & Venables (1998), the direction of horizontal FDI worldwide is determined by the following factors – all referring to the relative position of host to source country: factor endowments ( $f_j/f_j^*$ ), in terms of skilled labor, technological development ( $\mathbf{I}/\mathbf{I}^*$ ), size of domestic market times import tariffs [ $z_i/z_i^m(1+t)$ ], and distance to source countries,  $T$ , on account of transport cost. Accordingly, relative presence of multinationals in relation to local firms,  $X_j/X_i$ , in each industry of the local economy sectors can be resumed to:

$$X_f / X_l = F \left( \underset{+}{f_j / f_j^*}, \underset{+}{\mathbf{I} / \mathbf{I}^*}, \underset{+}{\left[ \frac{S_i}{S_i^m} (1+t) \right]}, \underset{+}{T} \right) \quad (8)$$

Signs below variables indicate their qualitative relationship with the dependent variable. Hence, the more similar the factor endowments (in skilled labor) and technological level of the host country, in relation to the source country, the more attractive the former is to inward FDI. This because the typical multinational firm operate in high technology activities. Equally, the larger the relative domestic sales and distance (transportation cost), the larger the incoming FDI, which is related to scale economies. Arguments in (8) are, then, related to either resource endowments or scale economies. Markusen & Venables explore the effect of each argument on  $X_f/X_l$  per time, because of the mathematical difficulty of doing otherwise. We can go a step forward, and figure out the result of their simultaneous action, of a varying combination of them.

For the case of Brazil, the first two independent variables would take very low values, pushing inward FDI down, while the last two assume medium to high values, pushing inward FDI up. A good explanation for why the country hosted a moderate volume of inward FDI, as compared to developed countries, though a very sizeable one, as compared to developing countries. A good explanation too for why incoming foreign firms might have presented an anti-trade location pattern: the typical sectors in which they operated required (technology) development and relative factor endowments which the country did not posse. This, independent of tariffs, whose importance to explain the direction of FDI worldwide is empirically dubious (Markussen, 1995).

Algebraic substitution of these antagonistic elements of incoming TNCs, from equation (8), into comparative cost, in equation (3), accounting for the empiric form of the variables, results in:

$$\frac{x_{i,t} / x_t}{x_{i,t}^* / x_t^*} = \mathbf{a}_i + \mathbf{b}_1 \mathbf{h}_{it} - \mathbf{b}_2 \left( \frac{a_{it}}{a_{it}} \right) + (\mathbf{b}_3 - \mathbf{b}_4) t_{it} + (\mathbf{b}_5 - \mathbf{b}_6) F_{it} + \mathbf{e}_{it} \quad (9)$$

where  $\hat{a}_3$  e  $\hat{a}_4$  collect the two possible effects from tariffs, commented above, and the two coefficients associated with variable  $F$ , foreign firms, account for their mentioned opposite impact on relative export performance. As the coefficient of  $F$  is unique, given by  $(\hat{a}_5 - \hat{a}_6)$ , it will tell us only if the TNCs had a positive, negative, or null effect on manufacturing exports, without discriminating the contribution of each of the possible causes. This discrimination will be pursued next, with a different statistical analysis.

The  $\mathbf{a}_i$ 's intercept terms, in equation (9), isolate unobserved components related to either technology or market structure specific to each of the 20 industries, contributing to precise the impact of each independent variable<sup>8</sup>. In this sense, the  $\mathbf{a}_i$ 's are not randomly distributed, but rather given by groups' (industries) features, so that equation (9) would take the fixed effects form (see Hsiao, 1986; Baltagi, 1995, Greene, 2000, Hsiao, 1986, Verbeek, 2000)<sup>9</sup>. Firstly, the significance of the "fixed effects" model was tested against the null hypothesis of no effects, which was rejected with 1.0% significance. Next, White test for residual homoskedasticity rejected it with 1.0% of significance. We, then, applied the generalized least squares estimator (i.e., weighted least squares) with White's robust covariance matrix (see Greene, 2000). The whole model shows an exceptional goodness of fit (see the P values in the last line of Table 1, below), with all independent variables exhibiting statistically significance. Hausman's test of the fixed against the random effects model could not be performed because the

estimated covariance matrix of variable coefficients is not positive definite, a not so rare event in small samples. Indeed, this sample nature of our panel, a small  $T$  (time = 4), far inferior of a not so large  $N$  (groups = 20), together with many sample-based variations in the groups, compels us to the fixed effect model (Greene, 2000). The dramatic increase in the variance of the beta coefficients, in the random effects model – just one remained statistically significant<sup>10</sup> – corroborates our evaluation that individual's effects are not randomly drawn, but rather given by industries' specific characteristics.

As already told, all beta coefficients show statistical significance of 1,0% at least - see Table 1. Of those, the most disturbing result is the positive sign of the coefficients of relative productivity and comparative cost, which means that sectors with the high  $a_i/a_i^*$  and  $wa_i/wa_i^*$  - i.e., without comparative advantages in costs – presented the best export performance. A result somewhat similar to Daniel Trefler's (1995) finding that developing country under-export their most abundant factors – the so-called mystery of *missing trade*. Here, though, what we have is that Brazil's most productive sectors under-export, an even more striking phenomenon, since we are working with direct evidence of cost differences across countries, rather than with theoretical predictions of them – although limited to labor cost. On the other hand, as compared to previous empirical work in Brazil, the most likely reason for our new finding is that the former take all variables in absolute terms, while we take them all (cost, productivity, as well as of export performance) in relative terms, compared to international competitors, in accordance with trade theories.

Table 1 – Changes in Revealed Comparative Advantages

Dependent Variables	Equations			
	1	2	3	4
Rel. Productivity	0.29 (25.61)		0.27 (31.75)	
Comp. Advantage		0.30 (3.82)		0.49 (8.38)
Income Elasticity	-0.10 (-10.90)	-0.08 (-4.94)	-0.14 (-9.91)	-0.14 (-6.13)
Tariffs	-0.17 (-15.24)	-0.21 (-13.12)	-0.15 (-16.25)	-0.19 (-10.51)
TNC90	-0.89 (-23.25)	-1.13 (-12.30)		
TNC85			-0.58 (-15.09)	-1.15 (-29.87)
Tamanho Amostra	77	77	77	77
R –squared	0.74	0.54	0.74	0.72
F	50.28	20.85	51.92	45.93
P-value (statistic F)	0.00	0.00	0.00	0.00

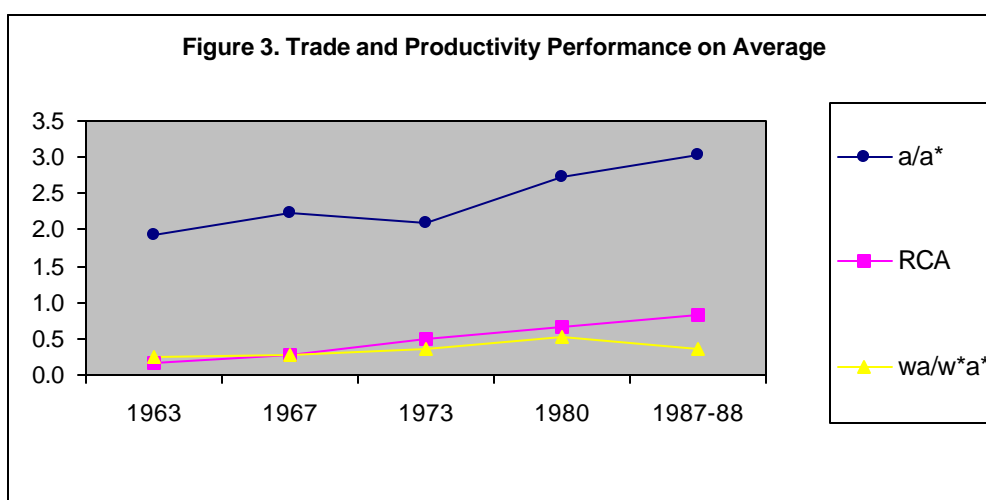
statistics  $t$  in parentheses. Regarding data source see Appendix I and III.

**Comp. Productiv.:** expression (5). **Comp. Advtg:** of cost (expression 6). **TNC90** e **TNC85:** share of TNCs in sectors in the sample from 1990 and 1985, respectively – see Appendix I.

Estimates and the programming for obtaining some test statistics were made with Eviews 3.1.

Untangling the relative contribution of cross-section and time series variations could give us some hints about the **b** coefficients, but pushing such an analysis with industry's variables is beyond our goal with them, which is to control for the impact of multinational companies on sectors. Important clues, though, can be obtained by analyzing the average values of these variables over time. Figure 3, below, shows that the average RCA of Brazilian manufacture had a firm ascendancy throughout the entire period, from 0.16 to 0.82, while the quantity “labor to product” was increasing – i.e., productivity was falling – both with respect to developed countries. Only in the 1967-73 period productivity increased.

Falling wages is a possible explanation for this paradoxical stride in manufacturing exports. However, as shown in Figure 3, the comparative cost variable had a similar advance – ascending - except for the period between 1980 and 1987-88, when it dropped due to fall in wages. This latter change may explain the lower statistical significance of this variable's positive coefficient of this variable<sup>11</sup>.



Hence, export performance went on despite of the relative productivity and costs. That certainly explains Brazil's incapacity to survive the downward change in international market after 1974 and, more steeply, after 1980. On the same ground, it uncovers why Brazil's overall export ratio to GDP did not expand over this period - it fell from 2.3% to 2.1%, from 1963 to 1987-88 - contrariwise to what happened in the world economy (Bhagwati, 1991), and thanks to manufacturing exports dynamism. In Brazil, though, export substitution towards manufacturing products was not tantamount to export expansion.

Indeed, the negative relationship between Brazil's manufacturing exports and the world's income elasticity for these products – third line in Table 1 – is a further evidence on this direction; that export substitution was not associated with a move towards the most expanding sectors in the world economy. More to the point, this negative coefficient indicates that the country did not succeed in obtaining competitiveness in sectors with stronger sales dynamism. Together with the result that resource allocation in the country was the furthest away from the statistic efficiency criteria, this dynamic inefficiency reveals a disheartening depiction of Brazilian import substitution policies.

The negative sign of tariffs – see Table 1, fourth line – indicating that  $\mathbf{b}_4 > \mathbf{b}_3$  – indicates that their anti-trade effects were superior to the intended pro-trade effect (export substitution and expansion). We may reckon, then, that import protection may help to explain this odd behavior of Brazil's manufacture exports. However, the positive coefficients of relative productivity and cost are controlled for the correlation with tariffs. Export incentives, can be an ultimate answer, provided that they benefited mostly the least productive sectors. The available data does not allow us testing this hypothesis for the period at stake here, but Braga (1981) shows that the largest enterprises and the multinationals – those with the largest team of rent-seeking unproductive jobs – were those that most captured such incentives, in the 1970s.

The statistical significance and the coefficient signs of these so far analyzed variables, related to market's part of comparative export advantage, help us to both better understand the overall behavior of the economy, and to isolate the specific contribution of foreign firms. In all estimated models, the relative share of transnational companies, in the sectors, is statistically significant and have negative value – using Zockun's (1992) or Bielschowsky's (1994) sample for TNCs' presence in the 1980s does not bring out any important change. With  $(\hat{a}_5 - \hat{a}_6) < 0$ , it follows that TNCs' *ownership advantages* is more than compensated by the opposite effects of their *location advantages*. Furthermore, the negative sign demonstrates how a general equilibrium analysis, contemplating TNCs' location advantages, may lead to results quite different from previous econometric works, which solely focused on TNCs' ownership advantages.

However, model (9) does not single out the source of this anti-trade of multinational firms in the manufacturing sectors; i.e., the values of  $\hat{a}_5$  and  $\hat{a}_6$ . Because based on sectors' data, our analysis can only determine  $\mathbf{b}_6$ , their location advantage. Regarding TNCs' ownership advantages, we can rely on evidences from previous researches that, as exposed, demonstrate that they do exist. That means that TNCs' overall negative contribution to revealed comparative advantage can only stem from their anti-trade allocation, which can be single out by further analysis of our data.

As told before, the fixed effect coefficients of equation (9) isolate industry's specific contribution to RCA, related to unobserved components, as technology, market structure, and country's features (i.e., factor endowments, and development level) as well. More to the point, while the coefficient of the regressors indicate the average effect of their respective variation, the fixed effect coefficients indicate the intercept position of each industry's (Hsiao, 1986); that is, their relative position in terms of comparative advantages. Accordingly, TNCs' location advantage can be checked by confronting these firms' average position in sectors, from 1967 to 1988, with these latter comparative advantages.

The values are arranged in Table 2, below. The non-linear relation between the fixed effects and TNCs presence prevents significance to linear correlation test, while small sample size prevents significance to some non-linear tests. We must, then, resort to visual inspection of the contingency table. To start with, the five best exporting industries, in order position (column 1), are characterized by very low TNCs' presence, column 3. They are more present in the following five sectors, but still the inverse relation prevails in so far that foreign affiliates are ahead in the presence (second, third, fourth, and fifth) of those with inferior exporting performance. On the other hand, TNCs had a very low presence in the five worst exporting industries, except in Tobacco, the same applying to the eleventh and twelfth sectors. Looking, instead, at the values of the fixed effects (column 2), we can notice that the first ten are far larger than the last ones -, which means that the position in the former counts more. Hence, TNCs' good



performance, in the last ten sectors, does not counterweight their low profile, in the first ten – the correlation between these two variables is  $-0.13$ , though not significant.

	Export Position (Fixed Effects)		Presence of TNC	
	Position	Value	Position	%
	(1)	(2)	(3)	(4)
Food Products	1	6.477681	14	0.191
Wood	2	2.210876	17	0.051
Leather and Furs	3	1.736891	13	0.196
Clothing and Shoes	4	1.059134	18	0.043
Paper and paperboard	5	0.906535	12	0.204
Rubber	6	0.780219	2	0.875
Chemical products	7	0.492867	7	0.464
Transport materials	8	0.483682	3	0.685
Other Chemicals	9	0.472328	4	0.68
Electrical materials	10	0.328314	5	0.54
Textiles	11	0.306235	15	0.159
Metals	12	0.295852	10	0.269
Plastics	13	0.098428	8	0.346
Mechanical	14	0.075416	6	0.478
Others	15	-0.21574	9	0.298
Tobacco	16	-0.25283	1	0.875
Non-metallic Minerals	17	-0.36112	11	0.254
Printing and publishing	18	-0.5448	20	0.019
Furniture	19	-0.55099	19	0.024
Beverages	20	-0.59968	16	0.121

It is possible to notice too, that the sectors with the best performance are not those featured by high technology dynamism, where brands and marketing are also fundamental, exactly where the TNCs presence is the most remarkable. Hence, Table 2 not only confirms the hypotheses that TNCs' location advantage lay in sectors where the country had comparative disadvantages, helping to explain the negative coefficient sign of variable  $F$  for exports, in model (9), but also help to characterize the nature of this disconnection between the TNCs and the country's advantages. This fact, at the same time, coincides with our model's prediction, regarding horizontal FDI on large and distance economies, featured by quite different factor endowments and development level as to source countries.

Attributing TNCs' low export performance to domestic price distortions solely – i.e., to import barrier -, as Moreira (1999), without empirical proof, is a misconception that is unaware of general equilibrium models on this subject. Should it be true, then the introduction of tariffs in model (9) would turn the coefficient sign of variable  $F$  (foreign) either positive, or statistically insignificant. None of these have been observed, remaining only the sector-specific effect of tariffs. True, the anti-trade growth impact

of this imported capital depends, ultimately, on these firms being either more investing or more innovating than the domestic ones (Johnson, 1967).

#### IV. Conclusions

General equilibrium econometric analysis about multinational firms and exports in Brazil, articulating theories of “industrial organization” and international trade, produced quite different results from previous partial equilibrium analysis. These latter focused on the “ownership factor”, examining whether or not foreign companies performed better than competing domestic firms in the same sectors – the addition of several just serving for statistical inference. Therefore, while these estimates show that TNCs have superior export performance, demonstrating their ownership advantages, ours shows that these companies contributes negatively to comparative advantage, demonstrating the stronger effects of other factors, such as their location advantage.

In order to single out TNCs’ impact on industries’ comparative advantage, we introduced a set or market’s causes for industries’ comparative advantage. All this within a dynamic perspective, taking the classic period of import substitution in Brazil for reference. On this respect, our estimates show that import substitution policy, as expressed by tariffs on imports, contributed negatively to the slow manufacturing exports expansion. More strikingly, we also found out that the latter advanced in opposition to both comparative productivity (and labor cost), as well as to worldwide demand dynamism. All these shed new and invaluable lights about the Brazilian development strategy, and helped to our goal of isolating foreign firms’ effect.

Having singled out the impact of TNC on sectors’ comparative advantage, we moved to investigate its causes. Regarding multinationals’ ownership advantages, we took for granted the evidences from previous researches, both because of their reliability and of the impossibility of analyzing it with our data. A telling case of the complementary between the previous and the present researches, the partial and general equilibrium analyses. It is not to be overlooked that earlier studies, because based on one period only, incorporate a wider set of information about the economic activity.

We managed to identify that TNCs' localization advantages lay in sectors where the country does not present comparative advantages. We also managed to determine the production's nature of the latter: technology intensive sectors, demanding resources and a development level the country lacks, in relative terms.

It is difficult to extrapolate these results to the next periods of trade openness. Other structural elements, besides tariffs, define the FDI trade pattern in Brazil – size and stability of the local economy, as well as its distance from international headquarters. Notwithstanding that, we cannot disregard the potential efficiency gains of tariff reduction to foreign affiliates. Even so, based on the proved sector-specific effect of tariffs, with the coefficient sign of multinationals remaining significant and negative, the most we can say is that such an efficiency lost does not differ from that experienced by local firms. Hence, the sole prediction we can make, based on our estimations, is that the change in the relative export profile of TNCs – as to local firms - depends on Brazil's relative factor endowments.

This conclusion matches Bruton's (1989, 1998) analysis on the poor performance of import substitution policies like the Brazilian one: they downplayed microeconomic efficiency to the extremes, and relied too much on FDI, aiming at an *spontaneous technology learning*, instead of pursuing active *catching up* strategy, based on increasing human and scientific resources. Actually, a macroeconomic perspective of bringing in foreign savings (Pack & Westphall, 1986) mainly drove the FDI policy in Brazil and Latin America. In summary, likewise trade nationalism, business internationalism (strong support to foreign firms) did not work as planned<sup>12</sup>.

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## Appendix I. Data on the Share of Multinationals

Several samples were examined in order to compose our panel of TNCs' presence in industries, which are: Calabi et al.: Fajnzylber (1971); Jaspersen (1970, quoted em Evans, 1979); Newfarmer & Mueller (1975); Doellinger & Cavalcanti (1975); CEPAL (1983); Willmore (1987); Cepal (1989); Zockun (1992); Bielschowsky (1994). Except for Calabi et al., each of them covers just one year.

The following criteria dictated the choice of which sample would represent TNCs' share in each one of the four years: (a) sample size – the greater the better; (b) industry classification criterion (i.e., its compatibility with the criterion of the remaining variables); (c) the definition of foreign enterprise, preferring those in which foreign ownership is given by more than or equal to 25% of total equity; and (d) the proximity with the reference year of remaining variables. The comparison of samples confirms the greater consistency of larger samples, as well as the ownership criterion we followed - evidently, no sample fulfilled all the above criteria simultaneously<sup>13</sup>. Accordingly, the choice fell on: Calabi et al. (1981: sample based on 1969 and 1975), for 1967 and 1973; Willmore (1987: sample based on 1980), for 1980; and Bielschowsky (1994: based on 1990), for 1987-88. In the regressions, we altered the latter, with Zockun (1992), based on 1985, which we evaluated as less representative, because its criterion for foreign ownership ( $\geq 50\%$  of total equity) underestimates TNCs' shares. Selecting Calabi et al.'s (idem) for the two initial periods aimed at attaining homogeneity, besides other virtues of this sampling.

Data for the Tobacco and Plastics industries, not available in Calabi et al., were substituted by the weighted average from Newfarmer & Mueller (1975) and Cepal (1983), whose samples are based on 1972 and 1977, respectively, with the weights given by the time proximity with the reference year. Other particularity of Calabi *et al.*'s is that firms' size is measured in terms of equity holding, while in the remaining ones are in terms of sales. Comparing the data from Calabi *et al.* with those from other samples, mainly those as large as the former, revealed that the neither level nor their ordering differ significantly, which might be explained by the fact that TNCs' productivity change matched with the respective industry they were in, along 1968/1973/1980 (see Gonçalves, 1986). The analysis of data shows that only sample size and the classification criterion of foreign firms alter the data significantly, as already observed by Willmore (1987).

## Appendix II – Source of Data of Product, Income and Exports

The classification of manufacturing sectors followed previous researches on TNCs in Brazil, shown in Figure 2<sup>14</sup>, with slight alteration to accommodate all variables. With respect to sources, data of *RCA* are from United Nations (*Handbook of International Trade and Development Statistics*, various issues, and *International Trade Statistics Yearbook*, several issues) and IBGE (*Anuário Estatístico do Brasil*, several issues), all in current dollar values.

Regarding world's income-elasticity of demand, as given by expression (7), data are from United Nations (UN), Commodity Trade Statistics Database; UN, *Handbook of International Trade and Development Statistics (several issues)*, UN, *International Trade Statistics Yearbook (several issues)*, and IBGE, *Anuário Estatístico do Brasil (several issues)*. Regarding, labor relative productivity and cost, as given by expressions (5) and (6), referring to “employees in production/value added”, data are from UNIDO, *Industrial Statistics Database*, and IBGE, *Anuário Estatístico do Brasil*, several issues. Value added are in constant prices, deflated by USA's consumer price index. Finally, with respect to Effective tariffs on imports, data are from: Bergsman & Malan (1971) for 1967; Neuhauss and Lobato (1978) for 1973; Tyler (1983) for 1980; and Kume (1989) for 1988.



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<sup>1</sup> Willmore is really the author of this work, based on Helson Braga's (1981) data.

<sup>2</sup> Below we define more precisely this notion.

<sup>3</sup> Furthermore, many foreign companies were removed – two entire sectors – from Willmore's (1985) sample in order to meet the criterion of similar pairs.

<sup>4</sup> Location advantage, as originally defined by Dunning (1977), is a country's characteristic for international production. Markusen and Venables (1998) framed it as the share of TNCs in each industry across countries. Accordingly, when focusing on a single country, we can think of TNCs' location advantage (over domestic firms) across industries. This is the meaning we shall be thinking of many times.

<sup>5</sup> Short endowment of human capital limits the absorption of worldwide available technology in the South, as in Currie et al. (1999). T. Paul Schultz held, in a conference, that "more educated farmers are more productive .. because they use different production techniques", quoted by Kodrzycki (2002).

<sup>6</sup> In which factor endowments do not matter for technology definition, as granted by the *non-substitution theorem*, formalized by Georgescu-Roegen and K. Arrow (apud Kurz & Salvadori, 1995). That is, with only one production factor – vertically integrated labor, accounting for machine and equipment value – comparative advantage is only given by production costs, with no place for substitution of factors responding to prices. We are departing from this assumption, though.

<sup>7</sup> Close to David & Nonnemberg (1998). We could work with time variation of RCA as well, but this would be inconvenient, for it would eliminate its static form. Keeping to the static form of RCA, we explore its time variation too, since we are working with panel data.

<sup>8</sup> In cross-country studies about FDI, fixed effects models isolate countries' features (de Mello, 1999; Olofsdotter, 1999).

<sup>9</sup> Discussions with William Greene, on problems not cleared up in textbooks treating panel form models, were very useful.

<sup>10</sup> These are the random effects model statistics:

$$VCR_{it} = \alpha + \beta_1 a_{it} - \beta_2 h_{it} - \beta_3 T_{it} - \beta_4 F_{it} + \epsilon_{it}$$

(1.79)	(-.74)	(-1.32)	(-1.71)
0.50	0.19	0.22	0.82

The values in parenthesis are coefficient standard-errors. Only  $h_{it}$  and  $F_{it}$  are statistically significant at 10.0% of significance only. In the model where  $a_{it}$  represents comparative costs, only the coefficient of this variable is significant.

<sup>11</sup> An ultimate hypothesis is product innovation, crucial in monopolist competition. That is, that the most productive industries were producing outdated products. This is something very likely in an inward development pattern, as the Brazilian one.

<sup>12</sup> Reinhardt (2000) shows that the slow advance of exports in technology intensive sectors, in Malaysia and Thailand, is related to the lacking of bolder policy of labor qualification. Other fundamental issue is the strategy of technology capability acquisition, which guides, *inter alia*, the transition from imitation to innovation. According to Albuquerque (2001), the Brazilian strategy was not a good one (see also Currie et al., 1999).

<sup>13</sup> Willmore (1987) also makes good remarks on the sample effects of changing each one of these criteria.

<sup>14</sup> About 3 digits in the ISIC and 2 digits in the SITC – the classification system adopted by United Nations.