Trade Policy and Efficiency with Monopolistic Competition *

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Abstract

A comparative advantages model with monopolistic competition is developed to empirically examine the efficiency of protectionism. Based on Brazil's experience, the foreign economy is specified as a set of (integrated) developed countries, which amplifies the access to fixed (corporate and the plants) costs, and thus untangle variations in economies of scale. The spatial approach to monopolistic competition, having an endogenous markup, is essential for attaining an ample set of cost and pricing variables that ultimately enable us to identify three policy effects: international competition, productive and allocative efficiency, besides a non-cost competition term. Only the period under protection is considered, so that some comparative static analyses about policies draw on a variety of simulations and counterfactuals.

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1 Introduction

In the search for a comprehensive analysis about trade-policy effects under imperfect competition, a tenable alternative is considering allocative efficiency, together with effects related to economic of scales and market power. Here, when examining a protracted protectionism experience, we do so by means of a comparative advantages model, in which those effects are expressed through expanded or eroded relative exports.

It is a multi-country industry-level analysis – no pre-trade counterfactual as Bernhofen and Brown (2005) is thus necessary – framed into a three-country world, similarly to Balassa (1967), given that our focus is a home-protected market – Brazil, in the present case. Six developed countries, taken as an integrated economy, makes up the "foreign economy"; the most peculiar treat of this "multi-country" analysis. This construct yields a more reliable index for comparative advantages, but at the cost of erasing any meaningful exploration on geography, a much-debated new frontier on comparative advantages (Eaton and Kortum, 2002). On the other hand, our framework, which is not theoretical and empirically innocent about the unobserved non-policy barriers, makes ampler room to comparative advantages. And since the ensuing trade-openness period is not considered[1], much of this analysis is made by means of comparative statitics exercises with simulations and counterfactuals. Considering the whole "import substitution industrialization" (ISI) period also meant new rooms for simultaneously addressing some development issues.

Working with several industries assures the general law of comparative (Deardorff , 1980), even though the correlation between countries' characteristics and trade pattern (or performance) might be even inverted with policies and geographic barriers (Travis , 1972). This requires, besides accepting an industry basis for trade[2], working with a ampler cost structure, despite the data difficulties stemming from the backward movement around that policy (from late 1960s to late 1980s), and from the developing level of the analyzed country. In short, two marginal cost variables are considered: a comparative labor productivity (and cost) and a latent opportunity-cost variable[3], based on the expected differences in industry sizes across countries, given unobserved differences in factor-proportions.

These two variables grant a minimally reliable evidence on the allocative efficiency. Yet, since protectionism in Brazil was so pervasive, and featured by an extreme microeconomic inefficiency (Tyler, 1985; Bruton, 1989), additional statistically analysis is done by means of an adjusted index for revealed comparative advantages, grounded on the relationship between produced and traded output under free trade (Deardorff , 1980). It works as a robust procedure for checking allocative efficiency.

Two fixed costs are further considered, plant and corporate fixed costs, each one based on a single and distinct factor. Their empirical assessment is granted by the assumption of foreign as a set of (integrated) developed countries: this evidence, which was not available

[1]Mainly because (i) the tremendous policy swings in this protectionist experience, hampering its characterization by its final period alone, and (ii) that openness came with several simultaneous institutional changes (*e.g.*, unrelated to trade policy, which makes its isolation quite difficult (see Tyler and Gurgel , 2008).

[2]In opposition to Bernard et al (2003, p. 1727): "how little industry explains about exporting and productivity", an statement that themselves discharge before evidence of their Table 2 on differences of exporters conditional to industry.

[3]Different thus from Harrigan (1997), who has direct observation of factor proportions and indirect evidence of technology differences.

in all of them, can be based in only one country. This is another advantage of this foreign economy construct, besides the less biased index for home industries' comparative advantage.

Underlying the revealed comparative advantages index is an intra-industry trade, stemming from a monopolistic competition based on preferences for an *ideal variety* (Lancaster , 1979; Helpman , 1981), in which firms conduct make room for both the *pro-competitive and the productive effects* from protection. Melitz and Ottaviano (2008) reach an alternative comprehensiveness, but our spatially based monopolistic competition is more suitable to an industry-level analysis in so far as those two effects are compatible with homogenous firms.

Moreover, this market structure is integrated to a general equilibrium analysis, and from this very theoretical perspective, that is, from the preferences parameter of the upper utility function, we derive a non-cost component of comparative advantages that traces back to product differentiation, which precludes any direct evidence on firms (*i.e.*, their exclusive products). As will be detailed, this non-price competition term is particularly interesting for its correspondence with a target of the import-substitution.

Summarizing, three policy effects are examined: the pro-competitive, the allocative and the productive efficiency – the non-cost component has no definite relationship with policy. The absence of the *number of varieties effect* has to due with the spatial monopolistic competition, which can be deemed a disadvantage of the attempted framework, although we must bear in mind that firm-level analysis is hardly compatible with a multi-country comparative advantages model[4].

The paper is structured as follows. The models are worked out in Section 2, followed, in Section 3, by a description of the empirical variables. In Section 4, an exploratory statistical analysis briefly describes Brazil's experience, while the regression results are presented and discussed in Section 5. Conclusions follow.

2 Theory and Empirical Specification

The below analysis starts with a closed economy, focusing on both market conduct and the temporal change in industry sizes. With an international economy, the problem shifts to export sizes, which are analyzed with respect to both comparative cost and distorted prices, firstly, and then with respect to inefficient firm entry. The result is that preferences parameter (on assumed imperfect substitutes), market power and economies of scale, through their efficient adjustments to comparative advantages, enhance the latter cognitive range.

2.1 Industry Size in Autarky

Consider an autarkic economy with a competitive sector, g, produced with unskilled labor, and N manufacturing industries, m_i, produced with unskilled and skilled labor under increasing returns to scale. Given total income Y and consumers' preferences in the form of a Cobb-Douglas (C-D) utility function, the demand for each manufactured product i

[4]In the imperfectly competitive multi-country analysis by Bernard et al (2003), only the US firms are considered.

is:

$$X_i = S_i \left(\frac{1}{\theta_i c_i} \right), \qquad i = 1, \ldots, N, \tag{1}$$

where $S_i = \pi_i Y$ is the size of industry i, irrespective of prices, and π_i the C-D exponent of X_i, with $\pi = \sum^N \pi_i$. Within the brackets is, in the denominator, the optimum price (relatively to the numeraire g): marginal cost, c_i, times the markup, θ_i. Free entry drives profit to zero.

A subutility function describes preferences of the *heterogenous consumers for the ideal variety* of each X_{mi} (Lancaster , 1979; Helpman , 1981; Lancaster , 1984), leading to price-elasticity of demand dictated by the number of firms in the industry[5], $\sigma(n)$. Accordingly, $\theta_i = [1 - 1/\sigma_i(n_i)]^{-1}$.

Normalizing (1) by $X = \sum X_i$, which has a fixed proportion b to Y_t, yields:

$$x_i = \pi_i b \left[\theta_i(\mathbf{wa_i}(\mathbf{w}))\right]^{-1}, \tag{2}$$

where $x_i = X_i/X$ is the relative sales of manufacturing industry and $\mathbf{wa_i}$ are the price and input vectors of marginal cost. To cast (2) in a time dimension, we add subscript t to each variable and substitute π_i by $\eta_{it} = d\log \pi_{it}/d\log Y_t$, yielding:

$$x_{it} = \eta_{it} b \left[\theta_{it}(\mathbf{w_t a_{it}}(\mathbf{w_t}))\right]^{-1}. \tag{3}$$

As pointed out, the η_{it} comes from preferences change across periods.

2.2 Export Size

Assume that the above economy is partitioned in several countries, differentiated only by their size and the (competitive) factor prices, stemming from endowments, with an economic relationship remaining through a free (of policy or geographic barriers) and balanced trade. Equation (3) would still apply, but now x_i^k, the share of each country k in the world market of i, is adjusting to $\mathbf{w_t^k}$ (see Helpman and Krugman, 1985, ch. 7).

But how could we access these prices if we only have the technology evidence of total employees in the marginal costs? A theoretical clue is provided by the price derivative of the optimal resource-allocation rule in each country, $\Pi = \max \sum_i \theta_i^{-1} p_i X_i(v_i, \bar{v}_i)$, *viz*:

$$x_i = \Pi_{p_i}(p, v_i; \bar{v}_i), \qquad \forall \quad x_i \in [1, Z] \tag{4}$$

amounting to the reciprocal of each industry's opportunity cost. The restriction $x_i \geq 1$, after covering the fixed costs $\bar{v}_i$, gets rid of non-convexities in the production set, whose upper limit is Z. Hence, if v_i is intensive in those factors abundant in country k, then k will have a higher share in the world output of i and so in its world exports, (see Harrigan, 1997)[6] which implies the following correlation in a two-country (home and foreign, identified by an asterisk) economy:

$$corr[(x_i^T/x_i^{T*}), x_i(v)/x_i^*(v^*)] = \gamma, \qquad \gamma > 0 \tag{5}$$

In sum, this comparative performance of countries's relative exports in the N industries with respect to their relative outputs, γ (controlled for fixed costs), indirectly conveys the

[5] This simplest, once we assume an upper-level C-D function (see Helpman and Krugman, 1985, 6.3).

[6] In our two-country analysis, evidence of countries' endowment are of little statistical use, unlike Harrigan (1997), whereas evidence of technology difference is directly provided by the industries' marginal costs in each country, differently from his total factor productivity.

role of factor proportions, v/v^*, which can be referred to Deardorff (1980)[7].

Fixed costs comprise plant cost, $G_i(x_i)$, and corporate cost, $F_i(x_i)$, similarly to Markusen and Venables (2000), so that unit cost function is

$$C_i(w, x_i) = a_i^k(w^k).w^k + G_i(x_i, w^k).w^k + F_i(x_i, w_s^k).w_s^k, \tag{6}$$

where w and w_s are the prices of unskilled and skilled labor respectively. Since F_{it} is more closely related to technology designs that may serve different plants, is more reasonable to think that in a developing country it actually covers technology transfers, or else $F_i^h < F_i$[8], while G_i would be technically invariable internationally (see Markusen and Venables , 2000).

Before incorporating (6), we relax the hypothesis of zero profits, by allowing trade revenues stemming from trade-policy barriers in each country, T_i^k, so that $p_i \leq p_i^k(T_i^k)$. This means distinct market power in each country, θ_i^k, and that $\theta_i(T_i) > \psi_i$ (the technology measure of economies of scale (Varian, 1992). This new $\theta(T_i)$, based on home's T_i, is then associated with the pro-competitive effect (Markusen, 1981), under the assumption that policies act upon the product markets alone.

This new θ_i, together with (5) and (6), must be substituted into (3). Having this equation a correspondence with each country's world supply enables us to take both x_{it} and x_{it}^* in a comparable form, as relative exports to the world, thus introducing a third country: the rest of the world. Alongside this reasonings, S_{it} (and S_{it}^*) must be replaced by its international size: $S_{it} = \delta_i Y_t^{w\eta_i}$, where δ_i stands for the local economy share in the world sales of i and Y^w for the world income. We can then write the comparative form of (3), now standing for comparative exports, in the following linearized stochastic form:

$$x_{it}/x_{it}^* = \alpha_i + (\delta - \delta^*)\eta_{it} - \beta_2\left(\frac{w_t a_{it}}{w_t^* a_{it}^*}\right) + \beta_3\left(\frac{Y_{it}}{Y_{it}^*}\right) - \beta_4 G_{it} - \beta_5 F_{it} - \beta_6 T_{it} + \mu_{it}, \tag{7}$$

where α_i stands for unexplained industry-specific characteristics, μ_{it} for the random errors. The coefficient signs roughly follow the original non-stochastic equation.

Inasmuch as G_{it} and F_{it} are affected by factor prices, then β_4 and β_5 trace back to factor endowments as well, as in Markusen and Venables (2000), so that those variables are vehicles for both comparative advantages and economies of scale.

As formalized, the $\beta_1 = (\delta_i - \delta_i^*) \gtrless 0$ expresses comparative gains (losses) in the most-expansive international markets, η_{it}, a non-price competition term that can be referred product differentiation[9]. Should η_{it} be correlated with skilled-labor intensive activities,

[7] In the presence of externalities, (5) changes to $corr[(x_i^T/x_i^{T*}), x_i(y_i)/x_i^*(y_i^*)] = \gamma$, which underlines *infant-industry argument* in (Krugman, 1984), although his decreasing marginal costs contradict the prediction for a two(or more)-factor economy.

[8] Regardless of firms being domestic or multinationals, or if the technology is being paid or not.

[9] In $X_i^k = \delta_i^k \pi_i Y^w (\theta_i^k \mathbf{wa_i}^k)^{-1} = (\delta_i^k \pi_i Y^w)/p_i^k$. Supposing firms with a symmetric size z_i, so $X_i^k = n_i^k z_i$, this can be rearranged to

$$\delta_i^k = p_i^k n_i^k z_i (\pi_i Y^w)^{-1},$$

making clear the association between δ_i^k and n_i^k, once p_i^k has already been accounted for. Consider now the international form of the normalized temporal equation (3):

$$x_{it}^k = b\delta_i^k \eta_{it}[p_i^k]^{-1}.$$

If the changes in varieties between periods are uneven between countries (see Grossman and Helpman, 1991, ch. 9), then $\dot{n}_i \gtrless \dot{n}_i^*$ and thus $\delta_i^k(\eta_{it})$. Therefore, in the comparative equation (7), $\delta - \delta^* \lesseqgtr 0$ reflects countries' relative positions in this non-price competition.

then a $(\delta_i - \delta_i^*) > 0$ reflects a *catch up* effect, alongside Currie et al. (1999).

2.3 Protection and Productive Efficiency

Besides the *pro-competitive effect*, protection can also change the surplus income through inefficient firm entry (Horstmann and Markusen, 1986). One can relate this additional policy effect to unobservable, $\bar{T}$, given the myriad of trade-policy instruments (export subsidies, import tariffs, quotas, etc.) adopted by developing countries in the analyzed period (Santos-Paulino, 2002), among which T is only proxying the competition effect.

Plant fixed cost, G_{it}, is the most expressive vehicle of lower economies of scale, due to entry incentives, since corporate cost, F_{it}, is technically specific in a developing country. Hence, letting μ_i stands for all markup revenues, the whole trade-policy effect on it is thus decomposed:

$$\mu_i(T, \bar{T}) = \delta.G_i\{x_i[n_i(\bar{T}_i)]\} + (1 - \delta).\theta\{\sigma[N_i(Ti)]\}, \quad \delta \in (0, 1), \tag{8}$$

where $N_i = n_i + n_i^*$ stands for the numbers of market competitors (or varieties). The second term in the right-hand side of (8) is the market power, θ_i, which adjusts to the number of varieties in the market, N_i, given T_i, whereas the first term stands for economies of scale (or average costs), which, under the hypothesis of free entry, adjusts to the number of local firms, n_i, given unobserved instruments, $\bar{T}_i$.

For testing $\bar{T}$, we must further resort to a counterfactual, which consist of replacing the internationally equal G_i by the local G_i^n. Equation (7) then transforms:

$$x_{it}/x_{it}^* = \alpha'_i + (\delta - \delta^*)'\eta_{it} - \beta'_2\left(\frac{w_t a_{it}}{w_t^* a_{it}^*}\right) + \beta'_3\left(\frac{Y_{it}}{Y_{it}^*}\right) - \beta'_4 G_{it}^n - \beta'_5 F_{it} - \beta'_6 T_{it} + \varepsilon_{it}. \tag{9}$$

The inefficiency productive effect from entry pushes up $G_{it}^n > G_{it}$, reducing the export contribution from plant economies of scale, which implies the following parametric change: $|\beta_4| < |\beta'_4|$.

3 Variables and Data

To discuss the empirical specification, let us transform (7) and (9) to a nominal form:

$$\begin{aligned} RCA_{it} &= \alpha_i + \beta_1 WYEL_{it} - \beta_2 CPCOST_{it} + \beta_3 SIZE_{it} - \beta_4 PLANT_{it} - \beta_5 CORPO_{it} \\ &- \beta_6 FPROT_{it} + \epsilon_{it}, \quad i = 1, \ldots, 20 \quad \text{and} \quad t = 1, \ldots, 4 \end{aligned} \tag{10}$$

where RCA_{it} (revealed comparative advantages) = x_{it}/x_{it}^*, $WYEL_{it} = \eta_{it}$, $CPCOST_{it} = (w_t a_{it})/(w_t^* a_{it}^*)$, $SIZE_{it} = y_{it}/y_{it}^*$, $PLANT_{it} = G_{it}$, $CORPO_{it} = F_{it}$ and $FPROT_{it} = T_{it}$. Alternative to *CPCOST* is *CPROD* = (a/a^*) and to *PLANT* is *PLANTBR* = G^n. The three-digits twenty manufacturing industries – with some adjustments to available data – are described below, while the four time are 1967, 1973, 1980, and 1987-88 (average, due to the extreme disturbances of these two years), with slight deviations for some variables. Pre-1980 years rendered the dearth of international compatible data more stringent; sources are described in the Data Appendix.

The then six largest industrialized economies (USA, Japan, Germany, UK, France, and Italy) make up the foreign economy, which makes less biased Brazil's comparative costs and performance in manufacturing industry, in a comparison with a developed country –

given their large differences in market size and factor endowments[10]. Hence, in the RCA, $x^*_{it} = \Sigma_{it} X^j_{it}/X^j_t$, X^j_{it} stands for the jth foreign country's exports of i and X^j_t for its total manufactured exports at t.

Variation in i's world-market demand, $WYEL_{it}$, is given by:

$$\eta_{it} = \frac{X^w_{it}/X^w_{i,t-1}}{Y^w_t/Y^w_{t-1}},$$

where X^w_i is the world's exports of i, $Y^w_t = \Sigma_i X^w_t$ the world total exports of all products (i.e., not only manufactured), the $t-1$ obliges us to take 1963 data. Y^w_t can be thought as proxing the world output (income) of tradable-goods sectors.

Similarly to Helpman and Krugman's (1985) theoretical analysis, we extract marginal and fixed costs, which are not directly observable[11], as components of a total (labor) input. Marginal comparative labor costs is given by:

$$CPCOST_{it} = \frac{a_{it}w_t}{a^*_{it}w^*_{it}} = \frac{(l_{it}/y_{it}).w_t}{\left(\sum_j l^j_{it}/\sum_j y^j_{it}\right).w^*_{it}},$$

where l/y stands for "total employees/value added", and w and $w*$ are the manufacturing wages in constant US dollars of Brazil and foreign. A pure productive measure, $CPROD_{it}$, is obtained by dropping w_t/w^*_t. The social opportunity cost , $SIZE_{it} = y_{it}/y^*_{it}$, , makes room for some cross-time scale (or home-market) effects.

Plant fixed cost is given the "operative labor input", whereas corporate fixed cost is the technology ratio of "office labor", following Brainard (1997). However, in our analysis, the former varies internationally with firm's average output (scale), while the latter is technologically specific to each region, *i.e.*, the developed and the developing country. Hence, $PLANT_{it}$ and $PLANTBR_{it}$ must be such that their differences have a definitive relationship with inefficient entry, while the difference between $CORPO_{it}$ and $CORPBR_{it}$ only expresses that technology difference.

Hence, letting l^s_{it} and l_{it} stand for the office employment and total employee, respectively, then $CORPBR_{it} = l^s_{it}/l_{it}$, while $CORPO_{it} = l^{s*}_{it}/l^*_{it}$, standing for the foreign (integrated) economy, is based on the USA, since some countries did not have the data. Although having no direct component of economies of scale, for the reasons just stated, we must bear in mind that the intensity of skilled (office) employment is already associated with fixed cost and thus economies of scale.

G_{it} and G^n_{it} aims to express the average size (or scale) of firm plant in the corresponding industries, so the corresponding industry-level labor input is divided by the relative "number of firms". Moreover, a normalization is made so that $PLANT_{it}$ and $PLANTBR_{it}$ will only reflect the relative industry difference across the regions, leaving aside the general higher size of foreign firms. Hence:

$$PLANT_{it} = \frac{\left(\sum_j l^{u*}_{it}/y^*_{it}\right).N^*_{it}}{\bar{G}_t}$$

where l^{u*}_{it} and y^*_{it} stand, respectively, for operative workers employment and output in the corresponding US industries, and N^*_{it} is multiplying because we are taking $\left(\sum_j y^*_{it}/l^*_{it}\right)^{-1}$.

[10]In this sense, this framework is more robust than the multiple comparisons made by Golub and Hsieh (2000).

[11]Following the new empirical industrial organization (Bersnahan , 1989), as well as many empirical trade-policy analyses (Tybout et al , 1991; Harrison, 1994).

$\bar{G}_t^*$ is the yearly average of the numerator, which makes $PLANT_{it}$ a time-stationary variable with mean equals 1.0. The Brazilian economy adjusted plant fixed cost, $PLANTBR_{it}$, is similarly calculated.

Notices that both the corporate fixed cost and the normalized plant fixed cost get rid off neutral technology differences, or absolute advantages between the regions – patent in the data – as do the comparative marginal labor cost variable .

Market power, $FPROT_{it}$, which is related to tariff (and subsidies) revenue, is proxied by the effective rate of protection (ERP) in Brazil, as a derived variable of market structure (Schmalensee , 1989). That is, ERP, which indeed is based on local prices higher than the competitive (equal to cost) ones, is standing for prices rather costs distortions (the competitive approach to ERP); the latter are captured by the marginal variables. Disregarding the foreign economy, whose corresponding panel data was not available, amounts to assuming it as operating under free trade as compared to Brazil – quite reasonable for that period. For robustness, nominal tariffs in Brazil, $TNOM_{it}$, is also tested.

Given evidence that protection in Brazil was unrelated to sectors' comparative advantages (Gonzaga et al., 2006), policy endogeneity is dismissed in (9), which is additionally reinforced by the plot of $FPROT_{it}$ in the ensuing section. In fact, other exploratory and descriptive statistic analyses are performed to corroborate the proposed variables for costs, revenues, and non-price competition.

4 Trade Policy in Brazil

A brief overview of Brazil's policy experience is useful, and enables us to have a better grasp of some of our variables. We begin it with a graphical analysis of a centered RCA, as in Benedictis (2005) :

$$b_{it} = \frac{RCA_{it} - 1}{RCA_{it} + 1},$$

with $-1 \leq b \leq 1$, where a positive (negative) b, corresponding to $RCA > 1.0$ ($RCA < 1.0$), indicates comparative advantages (disadvantages).

The twenty industries are further classified into the four technology groups (Lall, 2000):

RB (resources-based): food products, beverages, paper & paperboard, rubber, non-metallic minerals, wood & cork,

LT (low technology): furniture, leather & furs, clothing & shoes, metals and textiles;

MT (medium technology): transport equipment, plastics, printing & publishing, mechanical equipment, chemicals and tobacco;

HT (high technology): other chemicals, electrical material and other sectors.

The scatter diagrams below exhibit the b_{it} data, with the original and final periods on the horizontal and the vertical axes, respectively. Points below the diagonal indicate industries whose initial RCAs were greater than the final ones. In 1967, Brazil had comparative advantages in only two manufacturing industries, although the concentration of points above the diagonal, in both figures, shows a steady upward trend in the RCAs. By

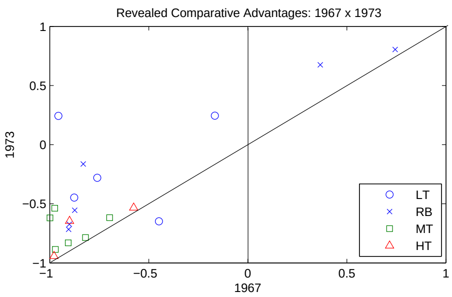

Figure 1

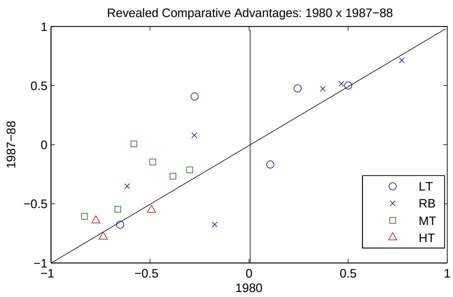

Figure 2

the end, 1987-88, the country had comparative advantages in seven sectors, all of them belonging to the *RB* and *LT* groups.

Export data says little about comparative costs, but once we recall that many of the *HT* and *MT* Brazilian industries were among those experiencing the highest output growth in this period, then the entailed allocative inefficiency becomes almost undeniable. The evolution of the country's factor endowments makes the whole picture clearer. As shown in Table 1 below, Brazil's proportion of skilled to unskilled labor, relative to the developed countries, did not change from 1967 to 1980, having even increased relative to arable land. This slow pace of human capital formation is a key difference between this industrialization strategy and that of the Asian NICs – see UN, *Human Development Report 1999* and World Bank, *World Development Indicators 1998*.

Table 1: Factor Endowments: Brazil/Developed Countries

	Skilled/Unskilled Labor*		Skilled Labor/Land**	
Countries	1967	1980	1967	1980
Brazil	0.07	0.12	57.2	59.8
Developed Countries	0.15	0.26	96.8	297

Source: for 1967: Bowen et al (1987); for 1980: The World Institute Resource (1998) and World Bank, *World Development Report* 1982.
*Skilled Labor: 1967, percentage of clerical and management in the economically active population; 1980, complete secondary education as % of relevant age group.
**Land: Arable in hectares.

Trade protection may have equally contributed to the disappointing progress of competitiveness in the medium e and high-tech industries. Curiously enough, both Brazil's GDP and total export (relative to world export) grew the most in the only period of a steady and general decrease in the effective rate of protection (*FPROT*), 1967-1973, as shown in Figure (3), below. After 1973, the ERP rose and became quite unsystematic, as shown by the zigzags, some of which can be credited to uncontrolled consequences of expanding trade barriers that led some industries to negative protection (Savasini, 1983). A huge export-subsidy program were also implemented after 1973, in some cases aimed at compensating the anti-export bias of the import-substitution policy (Bruton, 1989; Moreira, 1995). In a context of high and pervasive protectionism, policy coordination becomes a distant goal, amplifying their potential inefficiency.

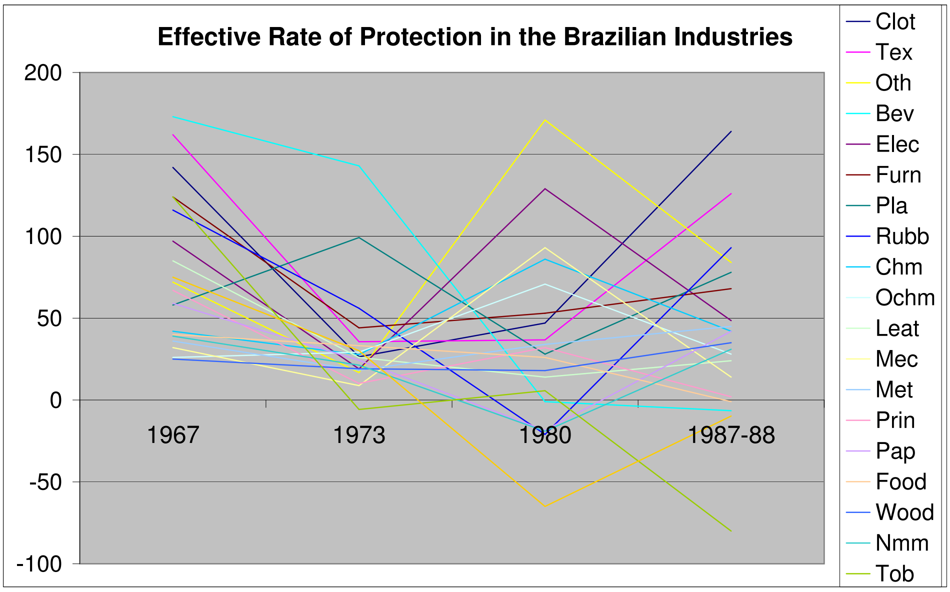

Figure 3

5 Estimation Results

Our main goal, in the ensuing regression analysis, is estimating the qualitative effects of trade policy. Accordingly, given the biases from some nominal variables, we preferred working with centered variables: $z_i - \bar{z}_i$, where the "within" mean is $\bar{z}_i = \sum_t z_{it} / \sum_i$, and estimate models (7) and (9) with a WGLS-White estimator, in which the α_i are fixed effects, as better explained in the Statistical Appendix.

In Table 2, with the results of the several specifications of the baseline model, the models with *TNOM* were left in the last columns. Notice that all variables are statistically significant in the models with *CORPBR* and *TAR*, while the ordered values of the fixed effects clearly characterize them as industries' components of the RCA_{it}. Despite the low $\bar{R}^2$, which might be assigned to the relatively small sample and high number of regressors, the *F-statistics* are sufficiently high.

The negative *WYEL* shows that the country did not thrive in the competition towards the world's most expansive markets; a failure in a dear dynamic target of the import substitution (ISI). Provided the demand expansive sectors are the high-tech intensive, this result can be referred to Brazil's sluggish human-capital formation in Brazil, which (Bruton, 1989) relates to a learning-by-doing oriented strategy.

The definitely surprising positive correlation of relative exports with marginal labor costs, *CPCOST* (and *CPROD*), agrees with previous findings of the "extreme microeconomic inefficiency" of Brazil's ISI (Tyler, 1985; Savasini, 1983; Bruton, 1989). On the other hand, the latent opportunity cost variable, *SIZE*, which broadens the characterization of comparative advantages, corroborates the efficient allocation hypothesis. Although these two coefficients cannot be measured by the same scale, their dimension suggest that Brazil's trade pattern is not inversely related to its comparative advantages, as could be verified in Figure (1). At the same time, the informed missallocation of the labor input provides a hint as to the sluggish *RCA*'s advance in the most high-tech intensive sectors, which outputs led industrialization in this period.

Two sets of unobserved variables are certainly behind these *CPCOST* and *CPROD* coefficients: (i) of other policy instruments, which would help to control this inverted allocation, and (ii) of other factor of production. Skilled labor is one that comes immediately to mind, whose higher prices (and cost) were pushed up by all incentives towards activities intensive in this scarce factor in Brazil. Other factors, like land, can also help to explain the quite higher impact of *SIZE*, specially for a sector such as food, whose tremendous weight in Brazil's *RCA* is witnessed by its fixed effect (in Table 2). Accordingly, two new specifications are tried: introducing a dummy cost for the food sector, and dropping this industry out. As shown in the last three columns of Table 2, the implied distortions in *CPCOST* was reduced but just marginally, while that of *CPROD* was increased, even when when dropping Food out [column (xi)]. Since the dummies were not statistically significant, nor dropping the most important sector of this economy has a tremendous impact in the representativeness of the sample, we maintain the benchmark model.

Given the form in which the empirical variables of corporate and plant fixed cost are built, the negative sign of *CORPBR* shows that Brazil's revealed comparative advantages were inversely related skilled-labor intensive sector, whereas that of PLANT shows the opposite: they were partially rested on plant-level economies of scale. At the same time, columns (i) and (ii) show that, should we consider the corporate (or technology) cost in the foreign (developed) economy, *KNOW*, instead of *CORPBR*, the opposite would be true. This difference helps to reinforce the structural technology difference between the capital knowledge used in a developed and in a developing country, and consequently that the former should be used when the goal is evaluating a developing economy.

Lastly, the negative impact of *FPROT* on comparative export performance fits to the *international competition effect*: higher wedges between prices and cost compete against the international sales. Although it acts through the "surplus (tariff) rent" over marginal cost, whereas in the competitive model would go through higher opportunity cost activities, it equally imparts on allocative efficiency. Nominal tariffs, *TNOM*, which is a less accurate measure of incentives on firm's revenue than FPROT, had the same qualitative impact (last line of Table 2).

Although the statistical significance of each variable proves the singular meaning of each one, we shall proceed to what has become a mandatory rule in the empirical IO literature: some exploratory analysis, now aimed to reinforce the claimed economic meanings attached to each of those independent variables. Given this goal, it seems that a good way of performing this robustness analysis is by means of stepwise regressions (Greene,

Table 2: Estimates of the Comparative Advantages Model

Independent Variables	Dependent Variable: RCA								
	(i)	(ii)	(iii)	(iv)	(vi)	(vii)	(viii)	(ix)	(ix)
WYEL	-0.063	-0.050	-0.043	-0.032	-0.087	-0.077	-0.047	-0.030	-0.047
	0.015	**0.013**	**0.011**	**0.011**	**0.018**	**0.019**	**0.012**	**0.010**	**0.013**
CPCOST	0.192		0.285		0.266		0.254		0.191
	0.045		**0.044**		**0.035**		**0.042**		**0.045**
CPROD		0.066		0.089		0.091		0.102	
		0.014		**0.013**		**0.013**		**0.014**	
DCPCOST							4.447		
							11.173		
DCPROD								-1.038	
								3.022	
SIZE	2.217	2.114	2.875	2.574	2.963	2.797	2.901	2.558	2.753
	0.278	0.286	0.254	0.240	0.266	0.273	0.257	0.241	0.297
PLANT	-0.770	-0.691	-0.685	-0.598	-0.570	-0.515	-0.602	-0.652	-0.343
	0.196	0.175	0.147	0.136	0.112	0.130	0.139	0.146	0.137
KNOW	1.632	1.299							
	0.221	0.195							
CORPBR			-0.397	-0.314	-0.233	-0.222	-0.305	-0.399	-0.125
			0.081	**0.073**	**0.070**	**0.076**	**0.078**	**0.079**	**0.082**
FPROT	-0.188	-0.193	-0.166	-0.189			-0.161	-0.190	-0.145
	0.025	**0.025**	**0.018**	**0.018**			0.017	0.019	0.018
TNOM					-0.083	-0.100			
					0.014	**0.021**			
N. Observations	77	77	77	77	77	77	77	77	74
Adjusted R2	0.644	0.635	0.632	0.622	0.564		0.650	0.621	0.520
F statistics	32.541	31.477	31.139	29.969	24.649		27.856	25.084	20.625
Ordered Fixed Effects									
FOOD	7.805	7.737	7.929	7.800	7.735	7.627	4.537	10.804	
WOOD	2.772	2.722	2.751	2.691	2.696	2.621	2.711	2.692	2.590
MATLEAT	2.284	2.175	2.141	2.035	1.871	1.784	1.985	2.128	1.537
CLOTHSH	1.437	1.487	1.442	1.509	1.430	1.457	1.428	1.510	1.449
PAPER	1.408	1.280	1.617	1.385	1.317	1.143	1.415	1.502	0.796
METAL	1.305	1.285	1.502	1.426	1.418	1.352	1.434	1.458	1.243
TEXT	1.266	1.179	1.308	1.176	1.074	0.962	1.155	1.262	0.719
RUBB	1.250	1.122	1.400	1.183	1.187	1.021	1.229	1.275	0.692
PLAST	1.071	0.985	1.369	1.176	1.078	0.936	1.194	1.283	0.660
ELETR	1.016	0.943	0.866	0.810	0.620	0.560	0.742	0.879	0.401
MECH	0.198	0.208	0.373	0.346	0.292	0.267	0.319	0.376	0.174
OTHCHM	0.037	0.025	0.522	0.380	0.393	0.264	0.445	0.399	0.192
EQTRANS	0.014	0.038	0.219	0.202	0.159	0.126	0.192	0.207	0.132
FURNIT	0.007	-0.027	0.031	-0.013	-0.061	-0.126	-0.004	-0.013	-0.105
BEVER	-0.270	-0.192	0.496	0.408	0.377	0.322	0.417	0.460	0.228
PRNTNG	-0.342	-0.345	-0.195	-0.228	-0.320	-0.379	-0.237	-0.219	-0.339
DIVERSES	-0.563	-0.549	-0.479	-0.483	-0.509	-0.548	-0.507	-0.488	-0.553
TOBAC	-0.645	-0.649	-0.468	-0.520	-0.326	-0.381	-0.462	-0.551	-0.425
NONM	-0.701	-0.610	-0.340	-0.308	-0.510	-0.503	-0.416	-0.260	-0.539
CHEM	-0.742	-0.645	0.005	-0.055	-0.016	-0.078	-0.015	-0.065	-0.045

Heteroskedasticity corrected models (cross-section weights and White covariance matrix). Number in brackets are standard errors.
Statistical significance: * stands for 10% level (above 5%) and bold letter for errors above this level.
†: Three industry observations for *WYEL* were not available for 1967, reducing the total to 77.
Description of Variables in Section 3. Data Source: Appendix I.

2000), which enables us to identify those variables by examining their interdependence with respect to their impact on trade pattern. The results of these simulations, shown in columns (ii) to (iv) of Table (3)[12], must be compared to the corresponding full model in Table 2.

Many interdependence among the regressors are not assured, let alone that their full analysis is endless, so that we will focus in three variables: *SIZE*, *WYEL* and *FPROT*. Insofar as *SIZE* is standing for opportunity cost (from the unobserved proportion of the factors of production), aimed at providing an ampler picture on marginal costs, and thus a sharper meaning to both *CPCOST* (and *CPROD*), then the elimination of this control, *SIZE*, was to have a great impact on these marginal cost. Indeed, as shown in column (ii), the coefficient of *CPCOST* dropped to half its value. In an extreme [column (iii)], with the dummy and using *KNOW* instead of *CORPBR*, the marginal labor cost even becomes negative, in the same direction as before, which then shows the misleading picture that may arise from a naive Ricardian formulation on technology.

Table 3: Stepwise Regression Estimates of the Comparative Advantages Model

Dependent Variable: RCA					
Independent	Pseudo-Stepwise Regressions				
Variables	(i)	(ii)	(iii)	(iv)	(v)
WYEL	-0.043	-0.102	-0.125		-0.077
	0.011	**0.027**	**0.011**		**0.019**
CPCOST	0.285	0.142	-0.038	0.319	0.271
	0.044	**0.070**	0.006	**0.052**	**0.037**
DCPCOST			4.508		
			8.627		
SIZE	2.875			2.797	2.902
	0.254			0.264	0.276
PLANT	-0.685	-0.719	-0.750	-0.704	-0.572
	0.147	0.273	0.234	0.170	0.119
CORPBR	-0.397	0.452	0.572	-0.530	-0.195
	0.081	0.081	0.071	0.098	0.078
CORPO			5.978		
			0.222		
FPROT	-0.166	-0.238	-0.196	-0.132	
	0.018	**0.023**	**0.026**	**0.016**	
N. Observations	77	77	77	77	77
R2	0.632	0.513	0.766	0.650	0.552
F statistics	31.139	54.733	24.712	42.621	29.436

Idem Table 2.

The bias in the coefficient of *WYEL* was also expressive, witnessing that this non-price competition is ultimately relative to countries' characteristics, which is expressed by *CPCOST* – which can trace back to factor proportions, as emphasized in the theoretical section. This insight is corroborate in the next simulation, eliminating *WYEL* [column (iv)], which mostly affected the coefficient of *CORPBR*, thus showing that performance on *WYEL* is indeed correlated with use or operation with skilled labor in the economy.

An ultimate restricted model simulation was eliminating *FPROT*, in column (v). As shown, it scantly affects the parameters of both *CPCOST* and *SIZE*, which corroborates

[12] We avoided the linear and the cross-section correlation matrices among the regressors because *inter allia* the immense outputs, which are also of little use for the stepwise analysis.

our associating *FPROT* with a pricing, rather than a cost variable, the traditional (competitive) reading on the effective ratio of protection. Actually, a moderate effect on both of those regressors, related to resource allocation, was not ruled out, on theoretical grounds. The strong effect on *CORPBR* goes in the same direction of connecting *FPROT* to a markup behavior mainly. rather than to a resource allocation.

We have not examined yet the "productive effect" from potential inefficient entry. Notice that testing *PLANTBR*, plant-fixed cost adjusted to firm size (or entry) in Brazil, after testing *PLANT*, freed from policy incentives, we are actually making the counterfactual experiment in the inverse sequence, since *PLANT* is an idealization on how the world would be if no policy distortions were present. However, this sequence, which agrees with the counterfactuals in theoretical computable general equilibrium analysis, is the most logical to our analysis, .

Before seeing the parametric shift in the *RCA* model, we must make sure that *PLANTBR* varies relatively to *PLANT* in proportion to the relative number of firms across industries in Brazil and the USA. Figure 4 plots the ratio "$PLANTBR_{it}/PLANT_{it}$" against number that of firms per industry $\frac{N_{it}/\bar{N}_t}{N^*_{it}/\bar{N}^*_t}$, also normalized by the early average. To avoid the large concentration of points in the [0,1] interval, both ratios were transform to log, making the scatter relationship more informative.

Allowing for neutral technical progress (or absolute advantages), the normalized distribution of plant fixed cost in Brazil across the *N* industries would closely follow that of foreign, so that log of the ratio $PLANTBR_{it}$PLANT$_{it}$ would lead to a concentration of points around "0" in Figure 4, or else the scatter deviation would have no correlation with $N_{it}/\bar{N}_{it}$, supposedly concentrated around "0" as well. However, what we see is that higher relative fixed cost in Brazil in Brazil is positively correlated with higher relative number of firms in the same industries, which definitely confirm the productive efficiency effect – lower economies of scale – from inefficient entry.

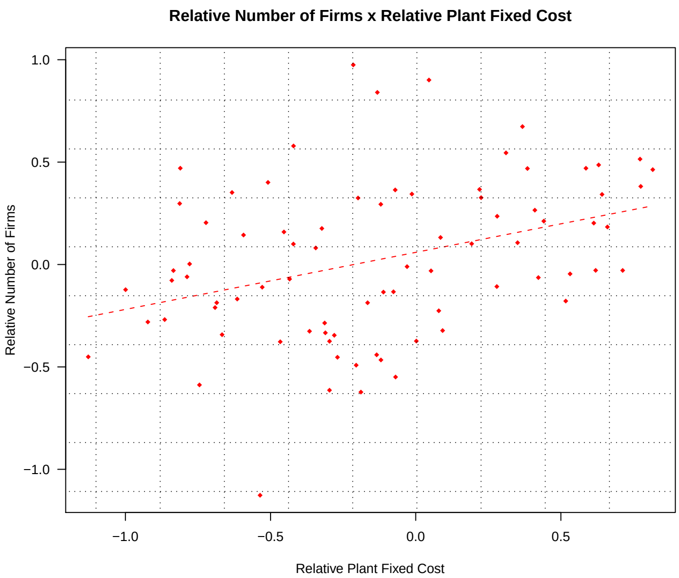

Figure 4: Scale *versus* Firms Number Comparison

But how can we relate the entry conditions to trade policy? Firstly, we have held that protection in Brazil comprises a set of trade and industrial policy instruments, the latter including Brazil's huge long term credit Bank, BNDES, as well as other local taxes and credit incentives. Without mentioning the wide range of unobserved quantitative trade-policy barriers. Lastly, our disregarding to the legal structure for entry (and exit) of firms is based on the fact that it has no sectorial bias within the manufacturing industry, necessary to explain the above profile of relative number of firms.

We now move to the *RCA* model with *PLANTBR*, whose results are displayed in Table 4. Its negative coefficients testify that the country trade pattern still relies on industries presenting higher plant-level economies of scales, but the expressive reduction in this inverse relationship, from *PLANTBR* as compared to corresponding models with *PLANT*, is consonant with a smaller contribution from plant-level economies of scales to relative exports. In other words, that same-industry Brazilian plants operated with lower economies of scale, comparatively to the developed countries, eroding the former relative exports advantages, reinforcing productive effect: that protectionism caused a reduction in the average size of plants that operates with fixed costs[13]..

Table 4: Estimates of the Comparative Advantages with Local Scale

Dep. Variable: RCA				
Independent Variables	(i)	(ii)	(iii)	(iv)
WYEL	-0.025	-0.105	-0.046	-0.108
	0.013	**0.018**	**0.021**	**0.029**
CPCOST	0.383	0.271	0.245	0.186
	0.036	**0.040**	**0.045**	**0.044**
SIZE	2.932	2.709	3.343	2.814
	0.254	0.334	0.352	0.431
PLANTBR	-0.452	-0.356	-0.195	-0.172
	0.057	**0.056**	**0.072**	**0.062**
CORPBR	-0.230		-0.030	
	0.063		**0.052**	
KNOW		1.287		1.501
		0.256		0.307
FPROT	-0.214	-0.210		
	0.010	**0.015**		
TNOM			0.027	0.044
			0.026	**0.036**
N. Observations	77	77	77	77
Adjusted R2	0.757	0.734	0.593	0.605
F statistics	52.321	46.889	27.181	28.247

Idem Table 2.

Unavoidable comparison may arise with respect to models based on firm-heterogeneity, in which the productive effect of protection goes through plant-selection – see (Fernandes, 2007), and (Feenstra, 2003, ch. 5). However, these two theoretical and empirical investigations are so different, and equally incomplete – the firm-level analysis based on TFP has no bearing on trade pattern (or international specialization) – that any well-grounded comparison is impossible. What is worth stressing, though, is both *productive efficiency*

[13]This is not a test about the minimum efficiency scale (*MES*), among others because monopolistic competition rules out the *MES* hypothesis.

effects, from either plant selection or plant-size reduction, are not exclusive. At the same time, our analysis may have contributed to check a growing skepticism toward the industry treat behind international trade.

Regarding, lastly, the normative exercise of measuring efficiency losses from trade policy, we will refrain from doing it, even about its qualitative changes, since transformations in the variables prevents a reliable level value. Yet, the direct association of the three main policy effects with income losses, from our positive trade pattern analysis, leaves few doubts about the effective losses - or the qualitative changes in the indirect utility function (see Feenstra, 1995)[14].

6 Alocative Efficiency: an additional analysis

Net exports, instead of *RCA*, could better characterize of the true relationship between trade pattern and country's characteristics, even in the present of extremely ample and distortions policies. But this alternative was not feasible here, without questioning the increased disturbance (errors) of sectoral **UN** (imprecise) data when import is added. So, our quest for a more accurate measure of allocative efficiency is turned to another direction, still grounded on international comparison.

Methodologically, this solution goes alongside the one we proposed with SIZE, so as to go beyond the sole opportunity cost indicator of CPCOST: drawing guidance from theory, since available evidence is binding. Now, however, as somewhat suggested, we will transform the RCA model in a way that improves its indication of allocative efficiency. More precisely, we want make a new counterfactual in which our revealed comparative advantages index, *RCA*, which is compatible with exporting more of the truly more costly sectors, is substitute by another indicator with a higher control against such a possibility.

Following the above reasoning, the best name for such an index, before even seen its content, its real form, would be the revealed comparative efficiency in the manufacturing, *RCEM*. Going straight to point, if we name, again, x_i^T and x_i for the exported and total output of i in an economy, respectively, the adjusted *RCA* is thus constructed:

$$RCEM_{it} = \frac{x_{it}^T / x_t^T}{x_{it}^{*T} / x_t^{*T}} . \frac{x_{it} / x_t}{x_{it}^* / x_t^*}$$

As it stands out, *RCEM* combines information of goods, the first fraction to the right in the above equality, and of production, which is not considered in the RCA index. These two terms and their relationship can be referred to the efficient partition of the produced and traded output under comparative advantages in Deardorff (1980). Probably, this transformation prevents us claiming *RCEM* as an trade pattern indicator.

The logic underlying *RCEM* is straigtforward: if two countries have the same relative share of exports in an industry i, the one owing it to higher policy incentive would draw a higher quantity of resource, which translates into higher total output[15]. Inasmuch as *RCEM* is a more complete index of allocative efficiency than *RCA*, all relationship con-

[14]The same applies to the ignored analysis of demand for varieties, inasmuch as their number do not increase with protection and that the possibility of income gains depends on either no-entry or a constant markup (Helpman and Krugman, 1989).

[15]Cinquetti and Silva (2008) applied a similar variable to access the relative efficiency of manufacturing industry among a set of developing countries in 1980, attaining decisive parametric and non-parametric proofs for the assigned meaning to *RCEM*.

cealing "resource misallocation" would become more salient. Particularly, in the case of *CPCOST*, a more positive (negative) coefficient would indicate that distortions were underestimated (overestimated) by its correlation with *RCA*.

Indeed, the results of this *RCEM* model, in Table 5, show that the coefficient of *CPCOST* moved significantly upward – two regressions with (the less informative) *CPROD* were done. For the sake of brevity, we ask the reader to search for the exact same models in Table 2 and 3, with *RCA* as dependent variables. Inasmuch as a negative sign of *CPCOST* in the baseline trade model was still compatible with the existence of allocative inefficiency, which indeed was extreme in the Brazilian case, the model with *RCEM* then turns out to be both necessary and sufficient for a final assessment about the information conveyed by the marginal labor as to allocative efficiency.

Table 5: Estimates of the Revealed Comparative Efficiency Model

Independent Variables	Dependent Variable: RCEM					
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
WYEL	-0.032	-0.084	-0.036	-0.061	-0.045	-0.082
	0.012	**0.013**	**0.011**	**0.022**	**0.014**	**0.011**
CPCOST	0.389	0.247		0.382	0.371	0.184
	0.041	**0.033**		**0.048**	**0.041**	0.059
CPROD			0.166			
			0.012			
SIZE	0.761	0.479	0.770	0.722	0.555	0.243
	0.083	0.105	0.096	0.160	0.074	0.110
PLANT					-0.331	-0.146
					0.109	0.154
PLANTBR	-0.00022	-0.00016	-0.00029	-0.00018		
	0.00002	**0.00003**	**0.00003**	**0.00006**		
CORPBR	0.106		-0.079	0.314	0.128	
	0.049		0.067	0.076	0.055	
KNOW		2.609				3.139
		0.308				0.466
FPROT			-0.213		-0.181	-0.209
			0.012		**0.016**	**0.018**
TNOM	-0.222	-0.243		0.115		
	0.014	**0.015**		**0.049**		
N. Observations	77	77	77	77	77	77
Adjusted R2	0.434	0.478	0.490	0.360	0.558	0.446
F statistics	16.649	18.912	19.583	13.564	24.222	17.232

Idem Table 2.

The same cannot be told about SIZE itself, since the transformation from *RCA* to *RCEM* involved the very used of this variable, which lead to a reduction in its impact. Yet, its explanatory power did not vanish. Similar reasoning, though less strongly, would apply to *PLANTBR* (and *PLANT*), yet its statistical remained and the coefficient shifted in a direction compatible with stronger inefficiency. The remaining coefficients must be read in this sense, or more precisely, considering that we no longer have a real trade model.

7 Conclusions

The attempted comparative advantages framework, combining features of integrated (for the foreign economy) and non-integrated economies, showed to be useful for analyzing trade policy in a developing economy over a long and more distant period. That is, given the unavoidable difficult with data, it was possible to identify a set of policy effects: allocative efficiency, productive efficiency and the pro-competitive effects.

The estimates strongly support the main hypotheses of the empirical model. Firstly, the finding of *allocative inefficiency*, manifest in the coefficient of comparative labor cost, the economic content of which was reinforced by the extra "opportunity cost" variable. Secondly, the *productive (average cost) inefficiency*: manifest in the lower contribution to comparative exports from local plant-level economies of scale, as compared to the international one. Thirdly, the *pro-competition effect*, manifest in the negative impact of the *ERP*, expressing the wedge between prices and costs. Lastly, the non-cost competition term showed that the country did not thrive in the most expanding industry, which, despite having no defined efficiency effect, manifest a failure in a key dynamic target of this ISI.

Finally, from the surrogate comparative efficient index, *RCEM*, aimed at singling out the portion of true allocative distortion in the comparative labor cost variable, corroborated the previous evidence of allocative inefficiency related to *CPCOST*.

A Data Appendix: Sources

RCA_{it}: UNCTAD, Handbook of International Trade and Development Statistics; Unite Nations, International Trade Statistics Yearbook; IBGE, Anuário Estatístico do Brasil. All in current US dollars.

$WYEL_{it}$: the same as RCA and also United Nations, *Commodity Trade Statistics Database*.

$CPROD_{it}$, $CPCOST_{it}$, $PLANT_{it}$, $PLANT_{it}$, $PLANTBR_{it}$ and $SIZE_{it}$, $CORPO_{it}$: UNIDO, *Industrial Statistics Database*; UN, *Yearbook of Industrial Statistics*; IBGE (idem), with valued added deflated by the US and Brazil's GDP deflator, respectively. Industries average wages were based on UN, Statistical Yearbook and ILO, LABORSTA Labour Statistics Database, IBGE, Estatísticas Históricas do Sec. XX, and FIESP (Sao Paulo State Industry Federation), a for Brazil in 1980. Lastly, number of firms in industries: for the USA, Country Business Patterns, and for Brazil, IBGE and from an autoregressive projection, for 1987-88, given the descontinuity in IBGE's series.

$FPROT_{it}$ and $TNOM_{it}$: Bergsman and Malan (1971); Neuhauss and Lobato (1978); Tyler (1985); Kume (1989).

MNF_{it}: Calabi et al. (1981), for 1967 and 1973, covering 3,167 firms; Wilmore (1987), for 1980, covering 49,760 firms; and Bielschowsky (1994) for 1987-88, covering 3,310 firms. Their selection, among the various examined samples, followed the criteria of: (a) sample size, (b) compatibility of industry classification with the remaining variables; (c) classification of foreign firms, preferring the criteria of 25% or more of firm equity.

B Statistical Appendix

Given the dimension of our panel data, there are two tenable specifications for the unexplained constant term α_i in the stochastic equations:

$$y_{it} = \alpha_i + \beta'\mathbf{x}_{it} + \epsilon_{it} \qquad \text{Fixed Effects Model (FE)} \qquad (11)$$

$$y_{it} = \alpha + \beta'\mathbf{x}_{it} + (\mu_i + \epsilon_{it}), \qquad \text{Random Effects Model (RE)} \qquad (12)$$

In (11), the α_i are group-specific constants, while in (12) they are group-specific disturbances (Greene, 2000, p. 615), similar to ϵ_{it}, each varies accross periods.

Besides the evidence (in Table 2) that the parametric differences between cross-sections are associated with industry characteristics (*i.e.*, fixed effects), the variance of the βs increase tremendously – most of them loose statistical significance – when running either (7) or (9) as RE, indicating that they are correlated with the X, rather than a random draw. A Hausmann test yielded a $\chi^2 = 4.79$ (p-value = 0.571), which does not reject the null hypothesis of the RE model, but this test is inadequate for small samples (Hsiao, 2003) like ours. We thus applied the test of redundance of the fixed effects, which gave a $\chi^2 = 174.55$ (p-value = 0.000), which strongly rejects the null hypothesis that the FE are redundant. In short, given the bias of the Hausmann test and the favorable evidence for the FE model, it emerges as the natural choice.

Lastly, given the sample size and the heterogeneity of the sources, both between periods and within periods (internationally), we used the WLS-White estimator, which can correct contemporaneous cross-equation correlation as well as different error variances in each cross-section (see Arellano, 1987).

References

Antweiler, W., Trefler, D., 2002. Increasing Returns and All That: A View From Trade. American Economic Review 92 (1), 93 –119.

Arellano, M., 1987. Computing robust standard errors for within-groups estimators. Oxford Bulletin of Economics and Statistics 49, 431–434.

Balassa, B., 1967. Trade Liberalisation and Revealed Comparative Advantage. Manchester School of Economics and Social Studies, 32 (2), 99-123.

Benedictis, L., 2005. Three decades of Italian comparative advantages. The World Economy 28 (1), 1679–1709.

Bergsman, J., Malan, P., 1971. The structure of protection in Brazil. In: Balassa, B. (Ed.), The Structure of Protection in Developing Countries. The Johns Hopkins Press, Baltimore, pp. 239–277.

Bernard, Andrew, Easton, Jonathan, Jensen, J. Bradford, and Kortum, Samuel. 2003. Plants and Productivity in International Trade. American Economic Review, 93 (4), 1268–1290.

Bernhofen, Daniel M., Brown, John C. 2005. An Empirical Assessment of the Comparative Advantage Gains from Trade: Evidence from Japan. The American Economic Review, 95 (1), 208–225.

Bielschowsky, R., 1994. Two studies on TNCs in the brazilian manufacturing sector: the 1980s and early 1990s. Desarollo Productivo 18, ECLAC, Chile.

Brainard, S. L., 1997. An empirical assessment of the proximity-concentration trade-off between multinational sales and trade. The American Economic Review 87 (4), 520–544.

Bresnahan, Timothy. 1989. Empirical Studies of Industries with market Power, in: Schmalensee, R. and Willig, R. D. (ed.), Handbook of Industrial Organization, Vol. II. Holland: Elsevier.

Bruton, H., 1989. Handbook of Development Economics. Vol. II. North-Holland, Amsterdam, Ch. Import Substitution, pp. 1–2.

Calabi, A., Reiss, G. D., Levy, P. M., 1981. Geração de Poupança e Estrutura de Capital das Empresas no Brasil. Instituto de Pesquisas Econômicas, São Paulo.

Cinquetti, C. A., Silva, R., 2008. Delays in Stabilization or in Reforms? The Debt Crisis. Developing Economies. , v.46, p.290 - 305.

Dornbusch, R., Fischer, S and Samuelson, P. A. 1977. Comparative Advantage, Trade, and Payments in a Ricardian Model with a Continuum of Goods. American Economic Review, 67 (5), 823-39.

Currie, D., Levine, P., Pearlman, J., Chui, M., 1999. Phase of imitation and innovation in a north-south endogenous growth model. Oxford Economic Papers 51, 60–88.

Deardorff, A. V., 1980. The General Validity of the Law of Comparative Advantage. Journal of Political Economy, 88 (5), 941–957.

Eaton, J., Kortum, S., 2002. Technology, geography and trade. Econometrica 70 (5), 1741–1779.

Feenstra, R., 1995 Estimating the effects of trade policy. In: Grossman, G., Rogoff, K. (Eds.), Handbook of International Economics. Vol. 3. North-Holland, Amsterdam, pp. 1553–1593.

Feenstra, R. C., 2003. Advanced International Trade: Theory and Evidence. Princeton University Press.

Fernandes, A. M., 2007. Trade policy, trade volumes and plant-level productitivy in Colombian manufacturing industries. Journal of International Economics 71, 52 – 71.

Flam, H., Helpman, E., 1987. Industrial policy under monopolistic competition. Journal of International Economics 22, 79–102.

Golub, S. S., Hsieh, C.-T., 2000. Classical ricardian theory of comparative advantage revisited. Review of International Economics 8 (2), 221–234.

Gonzaga, G., Menezes Filho, N., and Terra, M. C., 2006.Trade liberalization and the evolution of the skill earnings differentials in Brazil. Journal of International Economics, 68, 345 – 367.

Greene, W. H., 2000. Econometric Analysis. Prentice-Hall, New Jersey.

Grossman, G., Helpman, E., 1991. Innovation and Growth in the World Economy. The MIT Press, Cambridge, MA.

Hanson, G., Mataloni, R. J, and Slaughter, M. J, 2005. Vertical Production Network in Multinational Firms. Review of Economics and Statistics, 87: 664-78.

Harrigan, J., 1997. Technology, factor supplies and international specialization: Estimating the neoclassical model. American Economic Review 87 (4), 475–494.

Harris, R., 1984. Applied general equilibrium analysis of small open economies with scale economies and imperfect competition. The American Economic Review 74 (5), 1016–1032.

Harrison, A. E., 1994b. Productivity, imperfect competition and trade reform - theory and evidence. Journal of International Economics 36, 53–73.

Helpman, E. 1981. International Trade in the Presence of Product Differentiation, economies of scale, and monopolistic competition: a chaberlin-Heckscher-Ohlin Approach. Journal of International Economics, 11: 305–340.

Helpman, E. 2004. The Mystery of Economic Growth. Belknap/Harvard University Press, the USA.

Helpman, E., Krugman, P. R., 1985. Market Structure and Foreign Trade. The MIT Press, Cambridge, MA.

Helpman, E., Krugman, P. R., 1989. Trade Policy and Market Structure. The MIT Press, Cambridge, MA.

Horstmann, I. J., Markusen, J. R., 1986. Up the average cost curve: Inefficient entry and the new protectionism. Journal of International Economics 20, 225–247.

Hsiao, C., 2003. Analisys of Panel Data, 2nd Edition. Cambridge University Press, Cambridge: MA.

Krugman, P. R., 1984. Import protection as export promotion: international competition in the presence of oligopoly and economies of scale, pp. 180 – 194. Oxford University Press, United Kingdon.

Kume, H., 1989. A proteção efetiva proposta na reforma tarifária de 1988. Texto para Discussão Interna 21, Funcex, Rio de Janeiro.

Lall, S., 2000. The technology structure and performance of developing country manufactured exports, 1985-98. QEH Working Paper, University of Oxford (44).

. Lancaster, K. 1979. Variety, Equity, and Efficiency. New York: Columbia University Press.

Lancaster, K., 1980. Intra-industry trade under perfect monopolistic competition. *Journal of International Economics* , 10: 151-175.

Lancaster, K., 1984 Protection and product differentiation, In: KIERZKOWSKI, H. (ed), *Monopolistic competition and international trade*. Oxford: Claredon Press. 1984.

MacDougall, D. G., 1951. Britsh and American Exports: A Study Suggested by the theory of Comparative Costs. Economic Journal, 61, 697–724.

Markusen, James R., 1981. Trade and the gains from trade with imperfect Competition. Journal of International Economics, 11, 531-551.

Markusen, J. R., 2002. Multinational Firms and the Theory of International Trade. The MIT Press.

Markusen, J. R., Venables, A. J., 2000. The theory of endowment, intra-industry and multinational trade. Journal of International Trade 52, 209–235.

Melitz, M. J., 2003. The impact of trade on intra-industry reallocations and aggregate industry productivity. Econometrica 71 (6), 1695–1725.

Melitz, Marc J., and Gianmarco I. P. Ottaviano. 2008. Market size, trade, and productivity. Review of Economic Studies 75 (1), 295-316.

Moreira, M. M., 1995. Industrialization, Trade and Market Failures: the Role of Government Intervention in Brazil and South Korea. Macmillan Press, London.

Neuhauss, P., Lobato, H., 1978. Proteção efetiva da Indústria no Brasil, 1973-75. mimeo, Rio de Janeiro.

Riedel, J., Athukorala, P., 1995. Export growth and the terms of trade: the case of curious elasticities. Cambridge University Press, England, UK.

Samuelson, P. A., 2001. A Ricardo-Sraffa paradigm comparing gains from trade in inpust and finished goods. Journal of Economic Literature 39 (December), 1204–1214.

Santos-Paulino, A. U., 2002. Trade liberalisation and export performance in selected developing countries. Journal of Development Studies 39 (1), 140–164.

Savasini, J. A., 1983. Análise da Política de Promoção das Exportações. In: e Ibraim Eris, C. E. (Ed.), Finanças Públicas. FIPE:Pioneira, São Paulo, pp. 69–94.

Schmalensee, Richard. 1989. Inter-Industry Studies of Structure and Performance, in: Schmalensee, R. and Willig, R. D. (ed.), Handbook of Industrial Organization, Vol. II. Holland: Elsevier.

Travis, William P, 1972. Production, trade and protection when thre are many commodities and two factors. American Economic Review 62 (March), 87–106.

. Tybout, James, de Melo, Jamie and Corbo, Vittorio. 1991. The effects of trade reforms on scale and technical efficiency. Journal of International Economics, 31: 231–250.

Tyler, W. G., 1985. Effective incentives for domestic market sales and exports. Journal of Development Economics 18, 219–242.

Tyler, William P., Gurgel, Angelo C . 2008. Brazilian Trade Policies: Some Observed and Estimated Effects of the 1990s Liberalization. Estudos Econômicos, 39 (1), 59–88.

Varian, H. R., 1992. Microeconomic Analysis, 3rd Edition. W. W. Norton, New York.

Venables, A. J., 1987. Trade and trade policy with differentiated products: A chamberlinian-ricardian model. The Economic Journal 97 (387), 700–717.

Willmore, L., 1985. Market Structure, Firm Size and Brazilian Exports. Estudios e Informes de la CEPAL. United Nations, Brasilia, original author: ECLAC.

Willmore, L., 1987. Controle Estrangeiro e Concentração na Indústria Brasileira. Pesquisa e Planejamento Econômico, 17, 161–190.