Unilateral Liberalisation and Mercosul: Implications for Resource Allocation

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Using an applied multisectoral general equilibrium model, this paper aims to examine changes in output associated with distinct trade liberalisation strategies. The model distinguished between fifteen sectors and was based on data for 1990. Two scenarios representing the process of regional integration (Mercosul) and unilateral opening were simulated. Additionally, outcomes under perfect and imperfect competition were considered. After comparing the resource reallocation accruing from both simulations with revealed comparative advantage indices, the regional integration scenario is shown to provide a shift in resource allocation that is not related to Brazilian revealed comparative advantage. This leads to concerns regarding the implications of a "closed" Mercosul, and highlights the importance of open regionalism, which can foster regional integration together with the reduction of trade barriers on non-member imports.

Utilizando um modelo aplicado de equilíbrio geral, examinamos os impactos de uma estratégia de integração regional e de uma liberalização unilateral sobre a produção de 15 setores da economia brasileira. As simulações levam em consideração diferentes estruturas de mercado para setores manufatureiros, e o modelo é calibrado com dados referentes ao ano de 1990. O padrão de realocação de recursos decorrente de cada cenário de liberalização comercial é comparado com índices de vantagens comparativas reveladas. Dessa forma, verificou-se que as mudanças na produção relacionadas ao contexto de integração regional não são significativamente correlacionadas com os mencionados índices. Tais evidências apontam para possíveis ineficiências alocativas no caso de um Mercosul cerceado por altas barreiras alfandegárias. Por outro lado, os resultados destacam a importância de um regionalismo aberto, que promova a redução de barreiras ao comércio com países não-membros.

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1. Introduction

From the late 1980's, there has been a swing towards an outward-looking development strategy in Brazil. The rebirth of regionalism among the Southern Cone countries shaped a vigorous process of regional trade liberalisation which culminated in the creation of Mercosul. At the same time, trade policy reform encompassed a process of unilateral trade liberalisation, where tariffs and non-tariff barriers were reduced on a non-discriminatory basis.

This paper attempts at elucidating the implications for the Brazilian economy of both Mercosul and unilateral trade liberalisation. Using an applied multisectoral general equilibrium model, changes in output associated with both trade liberalisation events are investigated. The model distinguishes between fifteen sectors and is based on data for 1990. Two scenarios representing the process of regional integration (Mercosul) and unilateral opening are simulated. Additionally, outcomes under perfect and imperfect competition are considered.

The work is divided in five sections. Section 2 presents a recent profile of trade policy in Brazil. Section 3 examines the model main assumptions and equations. Section 4 sets up the scenarios and reports the results. Section 5 compares average sectoral revealed comparative advantage (RCA) indices to patterns of resource allocation emerging from the two trade liberalisation scenarios. Finally, section 6 contains concluding remarks.

2. Recent Trends in Brazilian Trade Policy

Since the start of the 1980's, Brazil and Argentina began a process of diplomatic and commercial approximation that culminated in the 1986's Programme of Economic Integration and Co-operation – Pice. Integration evolved around several protocols concerning sectoral agreements and proposals for gradual product by product trade liberalisation. The most important part of the programme was the liberalisation of trade in capital goods. By the end of 1980's, changes in domestic and external circumstances hastened the integration process. Across-the-board tariff reductions were introduced, and both countries started to envisage the formation of a common market. Having already close trade and investment links with Argentina and Brazil, Uruguay and Paraguay were incorporated into the integration process. In 1991, the Treaty of Asunción created the Mercosul and anticipated the establishment of

a common market among the four members by 1995. The agreement embodied the dismantling of tariff and non-tariff barriers and the elimination of all measures that hinder the circulation of goods and services. The harmonisation of national norms and standards was also put high on the agenda.

After the four years of transition, Mercosul reached an imperfect customs union. Free intra-regional trade in goods was accomplished for 80% of all goods, with exceptions included in the so-called adjustment lists. These lists accounted for approximately 20% of all product lines and were to be phased-out by 1999 for Brazil and Argentina and by the year 2000 in Uruguay and Paraguay. The common external tariff (CET) was agreed for 85% of all products, with countries retaining national tariffs for the remaining 15%. The CET ranged between 0% and 20%, and had an average of 12%. The scope for liberalisation has been substantial when compared with the poor results of previous attempts in the region. More important, the implementation of the CET has reduced both the average and the variance of tariffs when compared to levels prior to integration.[1]

At the same time, trade policy reform encompassed a process of unilateral trade liberalisation. The first meaningful attempt to rationalise trade policy instruments became known as the 1988 Reform. The reform proposal was elaborated by the Customs Policy Council – Comissão de Política Aduaneira.[2] Quantitative controls and subsidies were to be replaced by tariffs and the exchange rate, in an attempt to give the price system greater role in adjusting the balance of payments. Among the measures announced, there was the implementation of a new and transparent tariff schedule. A new tariff schedule was introduced with a significant reduction in nominal tariffs. Maximum and average tariffs declined from 105% and 85%, to 51.3% and 41% respectively.[3] Tariff dispersion was also considerably reduced. Some of the special import regimes, which exempted imports from paying the full tariff, were eliminated. The 1988 Reform could be better understood as an attempt towards rationalization rather than full trade liberalisation. For the most part, the fall in tariff was to offset tariff redundancy. What is more, the presence of some important non-tariff barriers curtailed the impact on imports.

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[1] *See Machado (1991, 1995a, 1995b).*

[2] *See Kume (1990) and World Bank (1990).*

[3] *In 1989, average tariffs were cut further to 35.5% – see World Bank (1990), p. 104.*

In March 1990, a new and deeper trade reform was launched by the newly elected government in Brazil. On the import side, the main objective of the reform was to consolidate the tariff mechanism as an effective policy tool. In this respect, several non-tariff barriers were eliminated, among them the prohibited import list.[4] Firms were no longer required to present a programme of intended imports. In addition, further restrictions were imposed upon the number of special import regimes.[5] The restructuring of the tariff schedule proceeded in two stages. First, owing to the dismantling of non-tariff controls, tariffs for consumer goods were increased. In a second stage, a calendar for tariff reductions was set up. Tariffs would be cut down over four successive years, starting in 1991, reaching an average tariff of 20% and a maximum level of 40% by 1994.[6] The bulk of items in the tariff schedule were subject to tariffs equal or below 20%. Higher tariffs of up to 40% were applied for some chemicals, food products (wheat), electronics, transport equipment, computers and related products. Tariff reductions were not across-the-board. Initially, between 1991-92, the reductions were concentrated on intermediate and capital goods and later, in 1993, on consumer goods.[7] In sum, between 1990 and 1995, average tariff and its standard deviation were reduced from 32.2% and 19.6% to around 14% and 9.5% respectively.[8]

The analysis of recent data for intra-Mercosul trade and trade with rest of the word (ROW) has revealed both a fast rise in total trade, especially a rapid expansion of imports, and a relative re-orientation of trade towards Mercosul. Intra-regional exports and imports have grown considerably faster than extra-regional trade flows.[9] This evidence has sparked fears that Mercosul might be predominantly trade-diverting, and harmful for the region and for the world as a whole. Since trade shares are affected by many elements apart from regional preferences, the examination of their shift cannot, however, serve

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[4] *Although the measures were announced in March, most restrictions were only effectively abolished after July. The compulsory financing requirements were, for instance, eliminated in September. A list of computers and computer-related products, for which imports were banned, was initially maintained as part of the market reserve for computer products. The latter list was revised, along with the market reserve, in 1992 (see Fritsch & Franco, 1991).*

[5] *However, the regimes related to export promotion, international agreements, industrial/regional promotion and to imports of oil and wheat were maintained.*

[6] *Note that the average and maximum tariffs were subsequently revised downwards, so as to follow the adoption of a common external tariff within Mercosul.*

[7] *See Hahn (1991) and Carvalho (1993).*

[8] *See Bonelli* et al. *(1993:98, table 3.10), and Kume (1996:9, table 2).*

[9] *Kume (1996) and Yeats (1996).*

the purpose of measuring trade diversion and trade creation. Although some more detailed assessments have been attempted, the analysis of the benefits of Mercosul has been controversial. For instance, Yeats (1996) compared a series of export based indices with factor intensity and regional preferences, to conclude that Mercosul was greatly trade diverting. However, looking at similar indices, based on the import side, Devlin (1996) did not find evidence of significant trade diversion.

The controversy relating to the impact of Mercosul can be portrayed within the broad debate concerning the benefit of new regionalism for world-wide trade liberalisation. The problems confronting Gatt negotiations in the early 1990's led many observers to regard the new attempts at regional integration as a faster and safer avenue to free trade than multilateral talks. Others, however, condemned the new regionalism as a dangerous threat to Gatt negotiations, and pointed out that such initiatives could undermine the world trade system. More recently, the controversy has dissipated to some extent, with the successful end of Gatt negotiations and the view that an "open regionalism" could be a complementary vehicle for multilateral trade liberalisation.[10] Given that regional schemes are second best options, their effects on the welfare of members and of the world as a whole cannot be judged *a priori*.[11] The debate is nevertheless far from settled.

3. Model Structure

3.1 The basic model

The structure of the model relies mainly on Melo and Tarr (1992) who investigated the impact of tariff and non-tariff barriers in the United States. Also, several insights into regional trade policy modelling were derived from Roland-Holst *et al.* (1994), Cox (1994) and Sobarzo (1994). The model comprises of fifteen sectors. There are two primary sectors: mining and agriculture, with the latter including forestry and fishing. Eleven are manufacturing

[10] *See WTO (1996) for an evaluation of the complementary role of regionalism and Bhagwati (1997) for its criticism.*

[11] *The impact of regional schemes is often presented as an application of the theory of the second best (see Lipsey & Lancaster, 1956).*

sectors, and two are services, distinguishable by their degree of tradability. A simplified social accounting matrix (SAM) was built, based on the original 42×42 input-output tables for 1990.[12] The model follows overall neo-classical assumptions. Producers maximise profits subject to technology, and a single consumer maximises utility subject to a budget constraint. For all sectors, prices vary freely to clear market excess demand. Concerning the foreign sector, we assume that domestic and imported goods are imperfect substitutes. The latter suggests, for instance, that Brazilian consumers and producers do not see Japanese cars as identical to Brazilian ones. This modelling procedure was first proposed by Armington (1969) and since then it has been called the Armington assumption.

In tables 1 and 2, the whole set of variables, parameters and equations are defined. The notation used is the following one; there is a set N that gathers all fifteen sectors, a subset T for tradables with fourteen elements and another subset NT with one element for non-tradable services. Endogenous variables are represented in upper case letters. Exogenous variables differ from the endogenous ones by means of a bar. Parameters are either shown as Greek or lowercase letters, and a single subscript indicates the sector. In the case double subscripts are applied, the first one relates to the sector of origin and the second to the sector of destination. The model is written using the dual forms of standard CES/CET aggregation functions. By minimising cost subject to technology, one obtains optimal values for factor demand that, if substituted again in the cost function, lead us to equation (1) – primary cost function. Equation (2) accounts for the primary and intermediate cost.

$$PVC_i = X_i\overline{AX}_i^{-1}\left[\alpha_i^{\sigma_i}W^{1-\sigma_i} + (1-\alpha_i)^{\sigma_i}R^{1-\sigma_i}\right]^{1/(1-\sigma_i)} \qquad (1)$$

$$CV_i = PCV_i(1+itr_i) + \sum_{j=1}^{n}\alpha_{ji}X_iPV_{ji} \qquad (2)$$

$$i \in N$$

[12] *Details on the data set and calibration procedures can be obtained from the author. On the Brazilian input-output table, see IBGE (1996).*

Table 1

Definition of endogenous variables

Variables	Definitions	Number of variables
CVi	Total cost	n
PVCi	Primary cost	n
Xi	Gross output of sector i	n
R	Capital rental rate	1
W	Wage rate	1
PVij	Price of composite intermediate product of sector i sold to sector j	n^2
Li	Sectoral employment	n
Ki	Sectoral capital stocks	n
Vji	Composite intermediate purchases of sector i from sector j	n^2
VDji	Domestic intermediate purchases of sector i from sector j	n^2
VMji	Intermediate purchases of sector i from sector j imported from Mercosul	n(n-1)
VWji	Intermediate purchases of sector i from sector j imported from ROW	n(n-1)
PDj	Price of domestically sold goods	n
PMj	Domestic price of imports from Mercosul	n-1
PWj	Domestic price of imports from ROW	n-1
EWi	Supply for export sales to ROW	n-1
EMi	Supply for export sales to Mercosul	n-1
Di	Supply for domestic sales	n
PEMi	Domestic prices of exports to Mercosul	n-1
PEWi	Domestic prices of exports to ROW	n-1
PCi	Price of composite consumption	n
PNi	Value-added price	n
PXi	Price of composite output	n
Ci	Composite final consumption	n
CDi	Consumption of domestically produced goods	n
CMi	Consumption of imports from Mercosul	n-1
CWi	Consumption of imports from ROW	n-1
VTDi	Demand for domestic intermediate	n

continuation

Variables	Definitions	Number of variables
VTMi	Demand for intermediate imports from Mercosul	n-1
VTWi	Demand for intermediate imports from ROW	n-1
IPEMi	Border price of exports to Mercosul	n-1
IPEWi	Border price of exports to ROW	n-1
GR	Government revenue	1
Y	Disposable income net of transfers	1
ER	Exchange rate	1
Total number of variables: $13n + 3n^2 + 2n(n-1) + 12(n-1) + 5$		

Table 2

Definition of exogenous variables and parameters

Variables/parameters	Definitions
$\overline{LS}, \overline{KS}$	Supply of labour and capital
$\overline{AX}_i$, $\overline{AV}_{ji}$, $\overline{AT}_i$, $\overline{AC}_i$	Normalising constants
α_i, γ_i, β_i, ω_i	Quasi-share parameters of various CES and CET functions
η_i, λ_i	LES parameters
σ_i, $\sigma\nu_i$,σt_i, σc_i	Elasticities of substitution between capital and labour, in intermediate demand, in transformation (CET) and substitution in final demand
ρ_i, $\rho\nu_i$, ρt_i, ρc_i	Elasticities parameters
σw_i, σm_i	Export demand elasticities
t_{bmi}, t_{bwi}	Brazilian tariffs on Mercosul and ROW imports
$\overline{IPM}_i$, $\overline{IPW}_i$	Border price of Brazilian imports from the ROW and Mercosul
t_{wbi}, t_{mbi}	ROW and Mercosul tariffs on Brazilian exports
$\prod_i^{row}$, $\prod_i^{mer}$	Export demand aggregate price parameters
E_0^{row}, E_0^{mer}	Initial export demand levels
WP_i, MP_i	Price of Brazilian export in Mercosul and ROW
itr_i	Value added tax rates
$\overline{B}$	Trade balance constraint

Producers combine value-added (capital and labour) and intermediate inputs in fixed proportions. Substitution among value-added components is allowed and represented by a CES function. Demand for factors – equations (3) and (4) – is obtained by applying Shepard's Lemma to a primary cost function. The supplies of labour and capital are fixed. Thus, factor payments vary to clear the market.

$$K_i = \left(\frac{X_i}{\overline{AX_i}}\right)^{(1-\sigma_i)} \left[PVC_i\left(\frac{1-\alpha_i}{R}\right)\right]^{\sigma_i} \tag{3}$$

$$L_i = \left(\frac{X_i}{\overline{AX_i}}\right)^{(1-\sigma_i)} \left[PVC_i\left(\frac{\alpha_i}{W}\right)\right]^{\sigma_i} \tag{4}$$

$$\sum_{i\in N} L_i = \overline{LS} \qquad \sum_{i\in N} K_i = \overline{KS} \qquad i \in N \tag{5}$$

The producer will choose among domestic, ROW and Mercosul commodities to minimise the cost of buying a fixed amount of a composite intermediate. For instance, given a fixed per unit requirement of coal, the entrepreneur will choose from the three sources, so as to minimise the total cost of coal. The first order conditions for cost minimisation provide relative intermediate demand functions. Equations (7) and (8) show how the relative quantities of different commodities are determined by their relative prices.

$$V_{ji} = \overline{AV}_{ji}\left[\gamma_{dj} VD_{ji}^{\rho vj} + \gamma_{mj} VM_{ji}^{\rho vj} + \gamma_{wj} VW_{ji}^{\rho vj}\right]^{1/\rho vj} \tag{6}$$
$$\rho v_j < 1,\ j \in T,\ i \in N$$

$$\frac{VD_{ji}}{VM_{ji}} = \left[\frac{\gamma_{dj}}{\gamma_{mj}}\frac{PM_j}{PD_j}\right]^{\sigma vj} \qquad j \in T,\ i \in N \tag{7}$$

$$\frac{VD_{ji}}{VW_{ji}} = \left[\frac{\gamma_{dj}}{\gamma_{wj}}\frac{PW_j}{PD_j}\right]^{\sigma vj} \qquad j \in T,\ i \in N \tag{8}$$

$$VM_{ji} = 0, \qquad VM_{ji} = 0, \qquad V_{ji} = VD_{ji} \qquad j \in NT,\ i \in N$$

$$V_{ji} = \alpha_{ji} X_i \qquad i, j \in N \tag{9}$$

The elasticity of substitution plays a vital role in these settings. A high elasticity value means that even a small price change will lead to significant changes in quantities. On the one hand, when elastiticies are infinite, an infinitesimal change in price will lead to such drastic shift in quantities that prices are likely to remain fixed. On the other hand, when elasticities are low, a large shift in prices is required to modify quantities. Again, when the value of elasticity approaches zero, domestic

and imported inputs turn out to be more complements than substitutes. Fluctuations in relative prices would not alter input proportions – as in Leontief's case. Thus, elasticity parameters are of the utmost importance in assessing the impact of trade liberalisation, which basically amounts to a change in relative prices, on the real side.

In relation to production, the CET function introduces a degree of differentiation between output for domestic and exports markets – equations (10) to (12). The key parameter here is the elasticity of transformation that determines flexibility in modifying the output mix. This specification of supply is particularly suitable for aggregate multisectoral models, where a single sector may include several different products – some even with a low degree of tradability. In this circumstance, if one regards exports as a perfect substitute for domestic supply, the outcome may be an unrealistic export supply response when prices in domestic markets change. The CET formulation corrects this problem by treating exports and domestic goods as qualitatively distinct.[13] In order to maximise total product revenue, the producer will opt to supply three distinct destinations: domestic, Mercosul or ROW markets.

$$X_i = \overline{AT}_i \left[\beta_{ewi} EW_i^{\rho ti} + \beta_{emi} EM_i^{\rho ti} + \beta_{di} D_i^{\rho ti}\right]^{1/\rho ti} \qquad \rho t_i > 1,\ i \in T \quad (10)$$

$$\frac{D_i}{EM_i} = \left(\frac{PD_i}{PEM_i}\,\frac{\beta em_i}{\beta d_i}\right)^{\sigma t} \qquad i \in T \quad (11)$$

$$\frac{D_i}{EW_i} = \left(\frac{PD_i}{PEW_i}\,\frac{\beta ew_i}{\beta d_i}\right)^{\sigma t} \qquad i \in T \quad (12)$$

$$X_i = D_i \qquad EM_i = 0 \qquad EW_i = 0 \qquad i \in NT$$

For consumption, a two-stage budgeting is adopted. In the first stage the consumer maximises a Stone-Geary utility function subject to income, and composite final demand functions – equation (13) – are then obtained. In the second stage, given expenditure in each composite, the consumer combines commodities from different sources to minimise the cost of obtaining a composite bundle. Equations (15) and (16) are relative consumer demand functions, which are derived from the first order conditions.

$$C_i = \lambda_i + \left(\frac{\eta_i}{PC_i}\right)(Y - COMIT), \qquad i \in N \quad (13)$$

[13] *See Melo and Robinson (1989) for a graphical presentation of equilibrium with national product differentiation for exports as well as imports.*

$$COMIT = \sum_{j \in N} \lambda_j PC_j \qquad \sum_{j \in N} \eta_j \equiv 1, \qquad \eta_j > 0$$

$$C_i = \overline{AC}_i \left[\omega_{mi} CM_i^{\rho ci} + \omega_{wi} CW_i^{\rho ci} + \omega_{di} CD_i^{\rho ci} \right]^{1/\rho ci}, \ \rho ci < 1, \ i \in T \quad (14)$$

$$\frac{CD_i}{CM_i} = \left[\frac{\omega_{di}}{\omega_{mi}} \frac{PM_i}{PD_i} \right]^{\sigma ci}, \qquad i \in T \quad (15)$$

$$\frac{CD_i}{CW_i} = \left[\frac{\omega_{di}}{\omega_{wi}} \frac{PW_i}{PD_i} \right]^{\sigma ci}, \qquad i \in T \quad (16)$$

Composite prices – equations (17) to (19) – are defined through the cost minimisation or total revenue maximisation – for the CET function.

$$PX_i = \overline{AT}_i^{-1} \left[\beta_{ewi}^{-\sigma ti} PEW_i^{1+\sigma ti} + \beta_{emi}^{-\sigma ti} PEM_i^{1+\sigma ti} + \right.$$
$$\left. + \beta_{di}^{-\sigma ti} PD_i^{1+\sigma ti} \right]^{1/(1+\sigma ti)}, \qquad i \in T \quad (17)$$

$$PV_{ij} = \overline{AV}_{ij}^{-1} \left[\gamma_{di}^{\sigma \nu i} PD_i^{1-\sigma \nu i} + \gamma_{mi}^{\sigma \nu i} PM_i^{1-\sigma \nu i} + \right.$$
$$\left. + \gamma_{wi}^{\sigma \nu i} PW_i^{1-\sigma \nu i} \right]^{1/(1-\sigma \nu i)}, \qquad i \in T, \ j \in N \quad (18)$$

$$PC_i = \overline{AC}_i \left[\omega_{mi}^{\sigma ci} PM_i^{1-\sigma ci} + \omega_{wi}^{\sigma ci} PW_i^{1-\sigma ci} + \right.$$
$$\left. + \omega_{di}^{\sigma ci} PD_i^{1-\sigma ci} \right]^{1/(1-\sigma ci)}, \qquad i \in T \quad (19)$$

For exports, negatively sloped demand functions are adopted – equations (22) and (23). Exports for Mercosul and ROW are functions of both international prices for Brazilian exports and a world aggregate price – inclusive of foreign tariffs. Since we have depicted Brazilian exporters as having a small share in world markets, the aggregate world price is meant to be fixed. However, a degree of product differentiation on the export side allows prices to differ from world-wide levels. Hence, Brazilian exporters may vary their share in world markets by changing their price.[14] This assumption is consistent with empirical evidence on the level of elasticity of

[14] *Equations (22) and (23) can be derived as a result of a two-budgeting procedure in ROW and Mercosul. In each region, an individual would choose the amount of commodities from ROW, Mercosul and Brazil, so as to minimise the cost of a composite bundle.*

demand for Brazilian exports. These figures usually do not give support for an infinite elasticity of export demand assumption, which would imply that substantial rises in exports could be feasible without reductions in prices.[15]

The way Mercosul and ROW has been inserted within the models is admittedly simplistic. For instance, this formulation does not account for changes in foreign real incomes and other international prices. Multi-country trade models are usually more suitable for capturing those effects.[16]

$$PEW_i = IPEW_i ER \qquad i \in T \tag{20}$$

$$PEM_i = IPEM_i ER \qquad i \in T \tag{21}$$

$$EW_i = E_0^w \left(\frac{\prod_i^w}{WP_i} \right)^{\sigma wi} \qquad i \in T \;\; \sigma_{wi} > 0 \tag{22}$$

$$EM_i = E_0^m \left(\frac{\prod_i^m}{MP_i} \right)^{\sigma mi} \qquad i \in T \;\; \sigma_{mi} > 0 \tag{23}$$

$$WP_i = (1 + t_{wbi}) IPEW_i \tag{24}$$

$$MP_i = (1 + t_{mbi}) IPEM_i \tag{25}$$

For imports, the assumption of infinite elasticity of supply is emphasised. This implies that the Brazilian market for imported goods is just a small fraction of world demand, so that changes in domestic demand does not affect international prices for imports. In a context of trade liberalisation, the adoption of a less than infinite supply of imports elasticity would mean that the rise in the demand for imports would be followed by a rise in prices and, *ceteris paribus*, a fall in terms of trade.

$$IPM_i = \overline{IPM}_i \qquad IPW_i = \overline{IPW}_i \qquad i \in T \tag{26}$$

$$PM_i = IPM_i (1 + t_{bmi}) ER \qquad i \in T \tag{27}$$

$$PW_i = IPW_i (1 + t_{bwi}) ER \qquad i \in T \tag{28}$$

All CES/CET functions are homogeneous of degree one and demand functions are homogeneous of degree zero. The latter highlights that quantities are not affected if all product and factor prices change. Only shifts in relative prices matter. Therefore, to establish that price fluctuations reflect relative price changes, one should specify a numeraire upon which all prices are denominated. The numeraire in our

[15] *See Zini (1988).*

[16] *See Shoven and Whalley (1992, chap.8), for a survey on global trade modelling.*

model is the index of domestic prices, fixed to unity – equation (30). The role of government is very simple; its revenue is derived from value-added taxes and tariffs on imports which are transferred in a lump-sum to a single household. In the basic model, firms behave in a competitive fashion, with prices matching the marginal cost – equation (29).

$$PX_i = \frac{CV_i}{X_i} \qquad i \in N \tag{29}$$

$$\frac{\sum_{j=1}^{n} PD_j D_j^0}{\sum_{j=1}^{n} PD_j^0 D_j^0} = 1 \tag{30}$$

The model distinguishes between intermediate and consumption demand, but no mention is made of investment demand. Another simplification regards the assumption that there is a single household. The latter clearly hinders the analysis of the impact of trade liberalisation on the distribution of income. The model follows a classical foreign sector closure.[17] The relative price of tradable to domestic goods varies to match imports and exports to an exogenously fixed trade balance.[18]

3.2 Economies of scale

The introduction of economies of scale requires some modifications in the cost functions. Following Harris (1984), Cox and Harris (1985) and Melo and Tarr (1992), total cost is now divided between variable (VC_i) and fixed cost, FC_i. Variable cost includes primary (PVC_i) and intermediate inputs requirements, $INTC_i$.

$$TC_i = VC_i(W, R, PV_{ji}, X) + FC_i(W, R) \tag{31}$$

$$VC_i = INTC_i + PVC_i \tag{32}$$

[17] *Whalley & Yeung (1984) and Melo & Robinson (1989) provide an insightful discussion on foreign sector closure within different model specifications. See also Robinson (1989), for a broad survey on model closure.*

[18] *ER is not a financial variable, it works only as a conversion factor between foreign and domestic prices. Furthermore, the index of domestic prices is not strictly speaking a non-tradables index. Though domestic goods are qualitatively different to foreign goods, not all of them are non-traded. Here, we adopt interchangeably the term real exchange rate and relative price of tradables to domestic goods (see Dervis* et al., *1982, chap.6 and Melo & Tarr, 1992, Appendix 3B).*

Total industry fixed cost (FC_i) consists of a fixed amount of labour and capital. As equation (33) indicates, when the number of firms varies from its initial level $(\overline{n}_i)$, industry fixed cost also changes.

$$FC_i = \left(\frac{n_i}{\overline{n}_i}\right) \cdot \left(\overline{KF}_i \cdot R + \overline{LF}_i \cdot W\right) \tag{33}$$

The total amount of fixed cost in each industry is derived by multiplying the cost disadvantage ratio (CDR)[19] and total cost.

$$FC_i = CDR_i \cdot TC_i \quad \text{where} \tag{34}$$

$$CDR_i = \left(\frac{AC - MC}{AC}\right) \tag{35}$$

Marginal cost equals average variable cost and is assumed to be a constant function of output. Given the presence of fixed costs, total average cost declines with production.

3.3 Imperfect competition

The assumption of economies of scale leads to the world of imperfect competition. As prices are set above marginal cost, there is a potential incentive for ever-increasing scale. Consequently, the scenario of small price-taking agents is not any longer suitable; firm's actions are likely to affect market price and quantities. Thus, they will be confronting negatively sloped demand curves. Furthermore, in this environment, questions related to firms' interaction arise. Where there are not many competitors, a firm's decisions, regarding prices, output, advertising and so on, are likely to dictate and to be dictated by the behaviour of their rivals. Also, the presence of few large competitors opens the way for co-operative arrangements, such as collusion. Our task here is to explain how imperfect competition can be introduced within our general equilibrium model. Looking ahead, the outcome of this section will be the formulation of pricing rules, reflecting a contestable and oligopolistic market structure. For the sake of simplification, we will restrict our analysis to the case of homogeneous product and non-cooperative oligopoly behaviour.

[19] *The cost disadvantage ratio accounts for local economies of scale. It can be defined as* $1-\varepsilon_c$ *– where* ε_c *is the elasticity of cost with respect to output. In the case, production functions are homothetic, i.e. factor intensity does not change with scale; the cost disadvantage ratio can also be related to elasticity of scale, as* $1-\frac{1}{\varepsilon_s}$. *See Gravelle & Rees (1992, p. 208).*

Contestable markets

The theory of contestable markets puts forward that, in a market where barriers to exit and entry are absent, the threat of outside competitors will lead firms to fix their price at competitive levels.[20] In the context of economies of scale, it means that although the number of firms operating may be few, they will not behave in a monopolistic fashion. Although economic profits are ruled out, firms set prices slightly different to those in perfect competition. With declining average cost, marginal cost pricing would lead to losses and exit in the long-run. Therefore, firms set their prices to match average cost. Using the definitions in the model, one obtains:

$$PX_i = \frac{TC_i}{X_i} = AC_i \tag{36}$$

Oligopolistic markets

Following Melo and Tarr (1992) and Melo and Roland-Host (1991a, 1991b, 1994), we derive a pricing rule that integrates the Cournot approach, along with the idea of conjecture, accruing from the work of Bowley (1924) and Frisch (1933). Conjectural variation is a common way of dealing with oligopolistic behaviour within a static model. It can be defined as the expected change in market output, given modifications on firm supply.[21] In our case, it is assumed that all firms share the same conjecture:

$$\Omega = \frac{\partial X}{\partial x_i} \tag{37}$$

Consider, first, a typical firm profit maximisation problem. Since firms maximise total revenue accruing from sales to domestic and export markets, one can write the following:[22]

$$\prod_i = (PD \cdot xd_i + PE \cdot e_i) - CT_i \tag{38}$$

$$\frac{\partial \prod_i}{\partial xd_i} = PD + \frac{\partial PD}{\partial xd_i} \cdot xd_i - \frac{\partial CT_i}{\partial xd_i} = 0 \tag{39}$$

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[20] *See Baumol* et. al. *(1982).*

[21] *The conjecture variation approach has some important analytical pitfalls. The way firms interact is not explicitly demonstrated, and one obtains only a static snapshot of equilibrium. Also, though conjectures are likely to be affected by trade policy, there is no clear-cut presumption on how this happens (see Shapiro, 1989, p. 352).*

[22] *For the sake of simplification, the exposition does not differentiate between exports to rest of the world and to Mercosul countries. This does not alter outcomes in any crucial way.*

$$\frac{\partial \prod_i}{\partial e_i} = PE + \frac{\partial PE}{\partial e_i} \cdot e_i - \frac{\partial CT_i}{\partial e_i} = 0 \tag{40}$$

where e_i and xd_i are the firm supply for export and domestic markets.

Here, it is assumed that the large number of firms within international markets would ensure a competitive outcome. Notice that the country as a whole may face a declining export demand function, but it is not perceived by individual firms. Consequently, the second term of equation (40) equals to zero. This leaves us with a marginal cost pricing condition for export markets.[23] Before arriving at the pricing formula for domestic markets, it should be emphasised that firms are treated as symmetrical, meaning that they confront the same demand and cost functions. This assumption can be summarised as follows:

$$X = nx_i \tag{41}$$

which indicates, also, that each firm has the same share in total market supply. After some manipulation, equation (39) can be presented as a the mark-up pricing rule:

$$\frac{(PD - AVC_i)}{PD} = \frac{\Omega}{\varepsilon_d n} \tag{42}$$

where

$$AVC_i = \frac{\partial TC_i}{\partial xd_i}$$

Equation (42) points out that the ability to fix price above marginal cost is a declining function of the number of firms and market demand elasticity. Conversely, it is positively related to conjecture values. Here, the elasticity of domestic demand is defined as a weighted average of the elasticity of final demand and elasticity of intermediate demand:

$$\varepsilon_i^d = \varepsilon_i^f S_i^f + \varepsilon_i^v S_i^v \tag{43}$$

where

$$S_i^f = \frac{CD_i}{D_i} \tag{44}$$

$$S_i^v = \frac{VTD_i}{D_i} \tag{45}$$

[23] *Notice that the marginal costs of supplying either domestic or export market are identical.*

4. Simulations

The analysis starts by describing two trade liberalisation scenarios.[24] The first points to the elimination of Brazilian tariffs on imports coming from Mercosul and tariffs imposed upon Brazilian exports by Mercosul partners. This regional liberalisation scenario attempts to mimic the effects on the Brazilian economy of a customs union with Mercosul countries, where common external tariffs are Brazilian domestic tariffs. The second scenario looks at unilateral trade liberalisation, where tariffs on imports are removed for all sources without discrimination. It is worth noting that both scenarios are only an approximation of the developments in Brazilian trade policy between 1990-95. In reality, the move towards regionalism was coupled with a significant non-discriminated reduction in tariffs, which would have probably happened independently of Mercosul.

The implications of trade liberalisation are examined under three distinct market structures for manufacturing activities. Given the importance of elasticities for determining the outcomes in the model and the uncertainty regarding their values, careful elasticity sensitivity analysis is required. As table 3 indicates, three overall settings are selected, indicating low, medium and high elasticity levels.[25] For simulations under imperfect competition, distinct values for cost disadvantage ratios (CDR) are also introduced.[26]

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[24] *The model was written and solved using the software Gams 2.25 and Minos 5.0 (see Brooke* et al., *1992).*

[25] *Export demand, import substitution and export transformation elasticities are frequently referred as the trade elasticities. In table 3, the settings refer not only to trade elasticities but also to distinct values for Frisch parameters and elasticity of substitution between labour and capital.*

[26] *For import substitution, export transformation and export demand elasticities, the estimates were based on the range of values presented in Dervis* et al. *(1982). These values were meant to represent the context of a typical, middle-income, less developed country. Factor substitution elasticities are extracted from Pinto (1987) and Taylor* et al. *(1980). For cost disadvantage ratios, we relied on the detailed study of economies of scale done by Pratten (1988) for the European Community.*

Table 3
Trade elasticities, tariff levels, cost disadvantage ratios

	(a)			(b)			(c)			(d)			(e)	(f)
	low	med.	high	low	med.	high	low	med.	high	low	med.	high	%	%
1. Agriculture & forestry	1,500	2,750	4,000	2,250	4,125	6,000	2,000	3,000	4,000				2,53	8,26
2. Mining	0,413	0,706	1,000	0,619	1,059	1,500	2,000	3,000	4,000				0,72	0,03
3. Non-metallic minerals	0,413	0,706	1,000	0,619	1,059	1,500	3,000	4,500	6,000	0,054	0,067	0,080	9,83	11,71
4. Metallurgy & mechanical equip.	0,381	0,690	1,000	0,571	1,035	1,500	3,000	4,500	6,000	0,093	0,116	0,139	11,96	11,69
5. Electrical equipment	0,313	0,531	0,750	0,469	0,797	1,125	3,000	4,500	6,000	0.077	0,096	0,116	11,00	12,07
6. Transport equipment	0,313	0,531	0,750	0,469	0,797	1,125	3,000	4,500	6,000	0,133	0,167	0,200	11,39	10,19
7. Wood & furniture	0,750	1,500	2,250	1,125	2,250	3,375	3,000	4,500	6,000	0,022	0,027	0,032	9,59	8,52
8. Paper	0,413	0,706	1,000	0,619	1,059	1,500	3,000	4,500	6,000	0.064	0,080	0,096	8,78	1,95
9. Plastics & rubber	0,413	0,706	1,000	0,619	1,059	1,500	3,000	4,500	6,000	0,045	0,056	0,067	13,09	15,47
10. Chemicals	0,413	0,706	1,000	0,619	1,059	1,500	3,000	4,500	6,000	0,111	0,139	0,167	8,31	6,40
11. Textiles, clothing & footwear	0,750	1,500	2,250	1,125	2,250	3,375	2,000	3,000	4,000	0,022	0,027	0,032	15,59	7,99
12. Food, beverages & tobacco	0,750	1,500	2,250	1,125	2,250	3,375	2,000	3,000	4,000	0,037	0,047	0,056	6,19	7,84
13. Other manufacturing	0,375	0,600	0,900	0,563	0,956	1,350	3,000	4,500	6,000	0,031	0,039	0,047	12,55	12,34
14. Services	0,313	0,531	0,750	0,469	0,797	1,125	2,000	3,000	4,000				0,00	0,00

(a) Elasticity of substitution between imports and domestic goods; (b) elasticity of transformation between exports and domestic supply; (c) elasticity of export demand; (d) cost disadvantage ratios; (e) Mercosul tariff; (f) Brazilian tariff.

Tariff rates are derived as customs revenue over the import bill – cif.[27] The adoption of such ratio as a measure of nominal protection should, however, be seen with caution; since the presence of non-tariff barriers is not reflected on such estimates, they are probably downward-biased. To approach Mercosul tariff on Brazilian exports, we use the ratio of customs revenue over the import bill for Argentina.[28] Similar information was not found available for Uruguay and Paraguay and the schedule below should be regarded as an approximation of regional tariffs. Table 3 shows both tariff schedules.

An often emphasised virtue of CGE models is the possibility to integrate theoretically explicit neoclassical articulations into a consistent description of how the entire economy works. Where policy changes may lead to many ramifications and feedback effects, this framework proves insightful, and it has been extended to many research areas such as the study of environmental issues.[29] Clearly, CGE models have also important shortcomings. One weakness is the lack of empirical validation of results. Often the econometric estimation of substantial numbers of parameters in the model is hindered by lack of data and other methodological problems. Therefore, most parameters are "calibrated" from the base-year data set.[30] Given that the assumptions of general equilibrium cannot be ensured to be fulfilled in a specific point in time and the exclusion of stochastic elements which characterise many economic relations, the results of the models cannot be used in accurate forecasting. What is more, the absence in most models of demographic trends, technological change, and changes in capital endowments add to the difficulty of factual prediction. Af-

[27] *The rates were extracted from the input-output matrix. Given the presence of special import regimes, under which importers are exempted from paying the full tariff, legal tariffs (officially published) are not meaningful proxies for protection. It is noteworthy that for 1990, we found a significant correlation (0.64) between legal and "true" tariffs for the 96 sectors of the NBM-SH Brazilian trade nomenclature. For the sectors in the model, the correlation between legal and "true" tariffs is also highly significant (0.94). Although the use of nominal tariffs certainly changes the magnitude of the outcomes, the sectoral resource allocation pattern emerging from trade liberalisation would be fairly similar.*

[28] *Given that some tariff preferences were already in place for trade within Mercosul in 1990, the adoption of average "true tariff" for the imports coming from Mercosul and to exports going to the region over-estimates the degree of protection. The ratio of customs revenue over the import bill for Argentina was drawn from Indec (1990).*

[29] *See Borges (1986) and Gunning & Keyzer (1995) for comprehensive list of references. Ginsburgh & Keyzer (1997) provided an updated assessment of a number of modelling structures.*

[30] *Calibration is the term used to describe the process of solving numerically the equations in the model, so as to find the value for relevant parameters. The outcomes emerging from the simulations are a function of these parameters and indirectly of the base-year data set. Apart from the parameters calibrated from the data, there are also a set of values which should be drawn from the literature – for instance elasticities.*

ter isolating the changes due to a specific policy issue, the simulations should be indicative of long-term tendencies, based on the structure of the economy at the benchmark point. Here, critics argue that the existing flexibility for model specification has meant that results can be *a priori* influenced by the structure selected, and therefore one should have some sort of grading of model specifications. However, there are serious doubts on how to choose these "best" specifications.[31] These points call for careful examination of the assumption underpinning each model and the selection of exogenous parameters. With these considerations in mind, we turn to the outcomes of both trade liberalisation scenarios.

Tables 4 and 5 outline the results of regional and unilateral liberalisation simulations under distinct market structures. We will concentrate first on the results of regional integration. The impact of regional liberalisation is very modest. In most sectors, changes in output are significantly lower than 1%. Such modifications in the composition of output will induce only marginal reallocation in sectoral employment. For instance, considering the adjustment in agriculture and forestry, the change shown in entails a transfer of less than 67,000 workers from this sector to other parts of the economy. The small part imports and exports play in composite demand and supply to a great extent explains such limited impact.

Except in the case of mining, the direction of adjustment is fairly similar under all sets of elasticity levels. Also, the pattern of resource allocation is fairly similar under competitive, contestable and oligopolistic market structure. Sectors that benefit most from regional integration are: transport equipment, metallurgy and mechanical equipment, electrical equipment, and other manufacturing. In turn, sectors that experience falling output are: agriculture, food, beverages and tobacco, and textiles, clothing and footwear. For mining, one sees a distinct outcome when elasticity levels vary. Output declines at low elasticity levels, but rises under a high elasticity set. This can be explained by changes in the real exchange rate under different elasticity levels. As mentioned above, the regional integration scenario entails a fall in domestic tariffs on imports from Mercosul and a decline in Mercosul tariffs on Brazilian exports. Depending on the level of trade elasticities, the real exchange rate can shift either upward or downward; it falls under low elasticity levels, but rises under a high elasticity set. Given that mining is significantly exposed to foreign trade, the distinct shifts in relative prices have particularly strong influence on trade flows and output.

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[31] *See Fretz* et al. *(1986), Wigle (1986) and Willenbocke (1994, chap.3), for review of the debate.*

Table 4
Regional liberalisation
(%)

	Oligopolistic			Contestable markets			Perfect competition		
	low	medium	high	low	medium	high	low	medium	high
1. Agriculture & forestry	-0.16	-0.28	-0.41	-0.16	-0.28	-0.41	-0.16	-0.28	-0.41
2. Mining	-0.02	0.11	0.23	-0.01	0.12	0.25	-0.01	0.12	0.24
3. Non-metallic minerals	0.01	0.02	0.03	0.02	0.04	0.06	0.02	0.03	0.04
4. Metallurgy & mechanical	0.05	0.14	0.25	0.07	0.19	0.33	0.06	0.17	0.27
5. Electrical equipment	0.05	0.10	0.16	0.07	0.14	0.22	0.07	0.12	0.18
6. Transport equipment	0.08	0.16	0.27	0.12	0.24	0.43	0.11	0.20	0.30
7. Wood & furniture	0.00	0.00	0.00	0.01	0.02	0.03	0.01	0.01	0.02
8. Paper	0.00	0.04	0.07	0.02	0.06	0.10	0.01	0.05	0.09
9. Plastics & rubber	0.02	0.06	0.10	0.04	0.09	0.14	0.04	0.08	0.12
10. Chemicals	-0.01	0.01	0.03	0.00	0.03	0.06	0.00	0.02	0.04
11. Textiles, clothing & footwear	-0.04	-0.07	-0.10	-0.03	-0.05	-0.07	-0.03	-0.05	-0.07
12. Food, beverages & tobacco	-0.09	-0.15	-0.21	-0.08	-0.14	-0.21	-0.08	-0.14	-0.20
13. Other manufacturing	0.02	0.08	0.14	0.04	0.11	0.19	0.03	0.10	0.16
14. Services	0.00	0.00	0.01	0.01	0.02	0.02	0.01	0.01	0.02
15. Non-tradable services	0.01	0.00	-0.01	0.01	0.01	0.01	0.01	0.01	0.00

Broadly speaking, the introduction of oligopolistic behaviour reduces the expansion or prompts a steep contraction in output. In two cases (chemicals under a low elasticity-CDR set and non-tradables services under high elasticities), a meagre output increase is turned into a small fall in production.

Table 5 introduces changes in sectoral output for the unilateral liberalisation scenario. Let us consider first the outcomes under contestable and competitive market structures. Here, mining, transport equipment, paper, food, beverage and tobacco, textiles, clothing and footwear are the sectors that experience strongest output growth. In contrast, other manufacturing, plastics and rubber, agriculture, electrical equipment experience a decline in production. For electrical equipment, output performance is modified when one goes from low to medium level elasticities. With low elasticities, output of electrical equipment rises, but the adoption of medium and high elasticity values leads to a decline in production. Electrical equipment is characterised by relatively small import-substitution elasticity. Thus, when the low set of elasticities is adopted, the scope for substitution between domestic and imported products is considerably narrowed. As a result, the growth of imports of electrical equipment is cut sharply under low elasticity.

As part of general equilibrium setting, the real exchange rate rises to secure a fixed current account deficit. Hence, resources are bidden away from sectors with low or indeed no exposure to trade. This movement accounts for the decline in production verified for non-tradables services. Although changes in gross output are greater than in the case of regional integration, they are still small. In most cases, variations of output are less than 0.5% of base year levels.

Again, the introduction of distinct market structure does not alter considerably the pattern of resource allocation. The adoption of oligopolistic behaviour prompts a steep contraction in output. In the case of services, a fall in production can be noticed in all elasticities settings; for electrical equipment, one finds a decline in output even under low elasticities values. In wood and furniture, under low elasticities values, a fall in production is also noticed in contrast to the results under competitive and contestable market structures.

Comparing both scenarios, one comes to contrasting conclusions. First, concerning the different impacts upon primary and manufacturing activities, regional integration tends to favour manufacturing activities. In most simulations, output falls only in two out of eleven manufacturing sectors under regional integration. In addition, though the performance of mining varies widely, there are a number of simulations in which production declines in both primary sectors. In contrast,

Table 5
Unilateral liberalisation
(%)

	oligopolistic			contestable markets			perfect competition		
	low	medium	high	low	medium	high	low	medium	high
1. Agriculture & forestry	-0.09	-0.19	-0.30	-0.04	-0.15	-0.27	-0.04	-0.15	-0.27
2. Mining	0.81	1.25	1.71	0.87	1.27	1.72	0.86	1.27	1.73
3. Non-metallic minerals	-0.12	-0.14	-0.17	-0.05	-0.08	-0.11	-0.06	-0.09	-0.13
4. Metallurgy & mechanical	0.09	0.06	0.09	0.22	0.19	0.24	0.20	0.17	0.19
5. Electrical equipment	-0.08	-0.23	-0.28	0.03	-0.14	-0.20	0.02	-0.15	-0.20
6. Transport equipment	0.20	0.33	0.59	0.43	0.58	0.92	0.38	0.49	0.69
7. Wood & furniture	-0.03	0.04	0.10	0.06	0.10	0.16	0.05	0.10	0.15
8. Paper	0.13	0.24	0.36	0.21	0.31	0.43	0.20	0.30	0.41
9. Plastics & rubber	-0.16	-0.26	-0.35	-0.07	-0.18	-0.27	-0.08	-0.20	-0.30
10. Chemicals	-0.09	-0.14	-0.19	-0.02	-0.08	-0.14	-0.03	-0.09	-0.15
11. Textiles, clothing & footwear	0.08	0.14	0.19	0.17	0.21	0.27	0.16	0.20	0.26
12. Food, beverages & tobacco	0.16	0.25	0.34	0.22	0.30	0.39	0.21	0.29	0.38
13. Other manufacturing	-0.17	-0.33	-0.53	-0.08	-0.25	-0.45	-0.09	-0.26	-0.46
14. Services	-0.06	-0.03	-0.01	0.00	0.02	0.03	-0.01	0.01	0.02
15. Non-tradable services	-0.15	-0.15	-0.16	-0.09	-0.10	-0.12	-0.10	-0.11	-0.13

unilateral liberalisation has a strong positive impact on mining and has a less favourable impact upon manufacturing. In most simulations, one observes a decline in production in five out of eleven manufacturing sectors under unilateral liberalisation. Inside manufacturing, sectors like plastics and rubber, other manufacturing, and electrical equipment expand under regional liberalisation but shrink, in most cases, under unilateral opening. For textiles, clothing and footwear, and food, beverages and tobacco, an opposite situation holds. Under regional integration, in most simulations, output falls. Unilateral opening, however, brings an increase in production in all cases.

In short, the two trade liberalisation scenarios may entail marked differences in resource allocation. To reach some insights concerning efficiency, the distinct scenarios are evaluated in the lights of Brazilian revealed comparative advantages.

In tables 6 and 7, changes in total trade flows, GDP and terms of trade[32] are presented for each trade liberalisation scenarios and under different market structures. As expected, regional integration increases the demand for imports from Mercosul and the supply of exports towards regional markets. The impact of regional integration on Brazilian trade with ROW is limited. Even when trade with ROW falls, the reduction is small and more than compensated by rising trade with Mercosul. Hence, total imports and exports rise as a result of regional integration.

In table 6, the increase in terms of trade in relation to Mercosul accrues from the fall of tariffs on Brazilian exports and the consequent rise in demand. However, as shown in table 7, the process of unilateral liberalisation brings a fall in terms of trade in relation to both ROW and Mercosul.[33] To maintain a fixed current account deficit, the rise in imports should be matched by expanding exports which, in turn, leads to lower export prices. Both in tables 6 and 7, the introduction of distinct market structures does not significantly modify the behaviour of the variables presented. The increase in GDP is augmented in the context of contestable markets, given the rise in factor productivity and the gains from scale rationalisation within manufacturing activities. On the other hand, the entry of firms into manufacturing activities under the oligopolistic framework curbs the expansion of manufacturing scale and the rise in GDP.

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[32] *Given that import prices are fixed, terms of trade is here defined as an average of export prices weighted by initial export levels.*

[33] *The significance of terms of trade effects within applied models has been well documented in the literature. The possibility of strong terms of trade effects stems from the Armington assumption. By allowing exports to be differentiated by country of origin, the assumption provides countries with considerable market power over foreign markets (see Brown, 1987).*

Table 6

Changes in GDP, total trade flows and terms of trade: regional integration (medium elasticity range)

	Competitive (%)	Contestable (%)	Oligopolistic (%)
Total exports	0.55	0.56	0.53
Total exports to Mercosul	7.09	7.11	7.07
Total exports to Row	0.24	0.25	0.23
Total imports	0.90	0.91	0.88
Total imports from Mercosul	9.32	9.34	9.30
Total imports from ROW	-0.12	-0.11	-0.13
GDP	0.066	0.07	0.05
Terms of trade Mercosul	6.11	6.11	6.12
Terms of trade ROW	-0.07	-0.07	-0.06

Table 7

Changes in GDP, total trade flows and terms of trade: unilateral liberalisation (medium elasticity range)

	Competitive (%)	Contestable (%)	Oligopolistic (%)
Total exports	2.77	2.79	2.70
Total exports to Mercosul	2.47	2.49	2.39
Total exports to Row	2.79	2.80	2.71
Total imports	2.35	2.37	2.29
Total imports from Mercosul	5.70	5.72	5.64
Total imports from ROW	1.94	1.96	1.88
GDP	0.314	0.32	0.25
Terms of trade Mercosul	-0.64	-0.64	-0.62
Terms of trade ROW	-0.78	-0.79	-0.77

5. RCA Indices and Output Changes

Investigating where a country's comparative advantage lies and how it changes over time is clearly important for policy purpose. A detailed knowledge of sectoral comparative advantage could help policy-makers to envisage the impact of changes in trade policy and propose measures to buttress the reallocation of resources. Focusing on the consequences of the Kennedy Round of multilateral tariff reduction, Balassa (1965) was the pioneer who proposed a measure based on trade performance that could "reveal" the scope of comparative advantage.[34] Below, we present some

[34] *See Greenaway and Milner (1993) for a detailed analysis of RCA indices.*

evidence on Brazil's revealed comparative advantage, derived from a recent study done by Nonnenberg (1995). The author provides estimates for a sample of sixty-nine manufacturing sectors, over the period 1980-88. Activities are disaggregated following the four digit classification from the national input-output matrix. The indices adopted by Nonnenberg follows Lafay (1990) and can be expressed as:

$$f_k = \frac{1.000}{GDP}\left[(X_{ik} - M_{ik}) - \frac{(X_{ik} + M_{ik})}{(X_i + M_i)} \cdot (X_i - M_i)\right] \qquad (46)$$

where M_{ik} and M_i denote import of commodity k by country i and total import of country i respectively. X_{ik} and X_i account for export of commodity k by country i and total exports of country i. The indices are based on net trade flows and use GDP levels to normalise differences in country size. The first term, from the right, portrays a "neutral" net trade for commodity k and is meant to adjust for macroeconomic imbalances. It is defined by multiplying the participation of trade in commodity k over total trade by the overall net trade. With balanced trade, this term vanishes and we would be left with the second term which accounts for effective net trade for commodity k. f_k can take negative or positive signs. If net trade in commodity k is larger than neutral net trade, f_k is positive and the commodity is said to show comparative advantage. In contrast, effective net trade lower than neutral net trade points to a negative f_k and comparative disadvantage. At values close to zero, the interpretation of the index will be ambiguous.

In table 8, we show RCA indices for sixty-nine manufacturing sectors. To reduce bias introduced by random events that may affect single year figures, a three year (1986-88) average for each estimate is worked out. The results are aggregated at four digits following the input-output classification. Since activities in the model are also derived from the input-output matrix, RCA indices can be assigned to them. Here, our aim is to find a weighted average of RCA figures for each corresponding sector. For that purpose, one should obtain sectoral weights at four digits. Since the 1990 input-output matrix presents data only at two digits,[35] it is not possible to get weights from the matrix. Hence, we rely on data from annual surveys for

[35] *As an illustration, consider the case of plastic & rubber. This sector comprises two activities at two digits in the 1990 input-output matrix: rubber and plastics products. At four digit, the latter is divided in plastics and processing of plastics products. To arrive at a weighted average for the RCAs indices, we need the participation of plastics and processing of plastics products within the two digit category. To do so, we rely on data for gross output value from the 1990 Annual Industrial Survey Tables provided in Correa & Moreira (1996).*

manufacturing activities and other input-output tables.[36] Table 8 orders the eleven manufacturing sectors following the magnitude of average revealed comparative advantage. Following table 8, one may divide the sample into four distinct groups. In the first category, we gather sectors with highest comparative advantage or those with RCA close to or above 1. There are three sectors in this group: textiles, clothing and footwear, food, beverages and tobacco, and transport equipment. The second group of activities comprises wood and furniture, metallurgy and mechanical equipment, and paper. These are sectors with moderate comparative advantage or with RCA below one but not close to zero. The third group includes activities with RCA close to zero. Non-metallic minerals, and plastics and rubber are the sectors presented in this group. Finally, the last group of activities comprises those with RCA indices well below zero. In other words, it includes sectors with least comparative advantage: chemicals, electrical equipment and other manufacturing.

Our next step is to compare the ranking yielded from RCA and the sectoral ranking emerging from our model simulations. For that purpose, table 9 reports rank correlation coefficients between RCA sectoral indices and the impact in terms of gross output accruing from regional and unilateral liberalisation. Rank correlation coefficients are calculated for all simulations under distinct market structures. For all scenarios under regional liberalisation, the rank correlation between RCA indices and changes in output are low and negative.[37] Thus, the figures suggest that regional integration would imply an overall pattern of adjustment that has a weak and negative correlation with the country's revealed comparative advantages. In contrast, for the case of unilateral liberalisation, one can observe in all scenarios a strong and positive correlation between RCA indices and the impact on sectoral output – all coefficients are significant at 95% of confidence.[38] The pattern of adjustment unfolded by unilateral trade liberalisation seems to be largely in line with Brazilian comparative advantages.

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[36] *For a large proportion, the four digit categories were weighted up with gross output values shown in the PIA-IBGE (Annual Industrial Survey) for 1990 and provided in Correa & Moreira (1996). For the activities not listed by the authors, we use data for net operational turnover shown in* Gazeta Mercantil *(1990) or data for sectoral value-added shown in the IBGE (1994a). For small number of activities, we use figures for gross output value shown in the Annual Industrial Survey for 1988 provided in IBGE (1994b). Finally, due to missing figures and/or discrepancies in classification within more recent sources for two sub-sectors of the food, beverages and tobacco activity, we base our weights on the value of gross output value shown in IBGE (1989).*

[37] *All coefficients are not significant at 95% of confidence.*

[38] *Given that results in the model depend on sectoral net total imports and RCA indices are also built upon such figures, one may suggest that the correlation between the outcomes under the unilateral scenario and the RCA indices would tend to be* a priori *positive and significant. The point emphasised in the analysis is however the discrepancies in resource allocation which may emerge from the two scenarios and how they compare relative to the rank of RCA indices.*

Table 8

Revealed comparative advantage: recent estimates

Mapping setors	Average 1986-88	Weights
Transport equipment		
1210 Automobiles and trucks	3,623	0,423
1310 Engines and parts for vehicles	0,595	0,387
1320 Ships	-0,324	0,044
1330 Railway equipment	-0,063	0,030
1340 Other vehicles	-1,509	0,115
	1,574	
Food, beverages & tobacco		
2510 Coffee processing	6,221	0,054
2610 Rice processing	-0,503	0,050
2620 Wheat milling	-0,002	0,017
2630 Vegetable and fruit juices	2,350	0,050
2640 Vegetable processing	1,252	0,048
2650 Tobacco	1,267	0,040
2710 Meat processing	0,396	0,141
2720 Poultry	0,651	0,062
2810 Dairy products	-0,618	0,096
2910 Sugar processing	1,090	0,062
3010 Vegetable oils	4,528	0,076
3020 Refined vegetable oil and fat	0,338	0,041
3110 Animal feed	0,228	0,079
3120 Other food processing	0,236	0,119
3130 Beverages	-0,339	0,066
	1,024	
Textiles, clothing & footwear		
2210 Natural fibres	1,067	0,253
2220 Artificial textile fibres	0,097	0,104
2230 Other textiles	0,631	0,177
2310 Clothing	0,335	0,296
2410 Leather and fur	-0,065	0,011
2420 Shoes	2,953	0,159
	0,959	
Wood & furniture		
1410 Wood products	0,996	0,528
1420 Furniture	0,113	0,472
	0,579	
Metallurgy & mechanical equipment		
510 Steel and iron	5,418	0,297
610 Non-ferrous metallurgy	1,094	0,131
710 Steel products	-0,026	0,087
720 Other Metalurgical products	0,425	0,165
810 Non-electrical machinery	-4,781	0,278
820 Tractors	0,560	0,041
	0,513	
Paper		
1510 Cellulose	1,070	0,106
1520 Paper	0,561	0,421
1530 Printing	-0,234	0,473
	0,238	

continuation

Mapping setors	Average 1986-88	Weights
Non-metallic minerals		
410 Cement	0,000	0,239
420 Cement products	0,013	0,152
430 Glass	0,019	0,156
440 Non-metallic products	0,158	0,454
	0,077	
Plastics & rubber		
1610 Rubber	-0,116	0,425
2110 Plastic products	-0,138	0,423
2120 Plastics	0,117	0,152
	-0,090	
Chemicals		
1710 Chemical elements	-3,461	0,063
1720 Alcool distilling	0,095	0,074
1810 Petroleum refinery	0,614	0,332
1820 Petrochemicals	-1,214	0,119
1830 Resins and other artificial fibres	-0,195	0,105
1910 Fertilizers	-1,535	0,040
1920 Other chemicals	-0,811	0,159
2010 Pharmaceuticals	-1,448	0,059
2020 Toiletries	0,004	0,050
	-0,447	
Electrical equipment		
1010 Equipment for energy dist.	-1,133	0,096
1020 Electrical material	-1,312	0,194
1030 Electrical appliances	0,827	0,187
1110 Electronic equipment	-3,930	0,297
1120 Television sets and radios	0,936	0,226
	-1,164	
Other manufacturing		
3210 Miscellaneous manuf.	-1,188	

This contrasting outcome highlights a potential pitfall of a strategy of international insertion based solely on regional integration. The emergence of regionalism in Latin America has been seen as part of a new strategy of development, where foreign trade and market signals have an enhanced role. The picture portrayed in our analysis indicates that regional integration does not assign resources accordingly to the country's revealed comparative advantage. Indeed, it may divert resource allocation away from sectors where the Brazilian economy shows high levels of average RCA. This highlights the importance of pursuing ways to mitigate such potentially damaging effects. Here, the idea of open regionalism comes to the fore, as a strategy that could foster trade among members, but would also engage the regional scheme in multilateral or even unilateral trade liberalisation efforts. Although, the scenario that entails regional integration has not altered the level of protection towards non-member countries, Mercosul negotiations have, indeed, been accompanied by an important unilateral reduction of tariffs. Therefore, in showing that a "closed" Mercosul may damage efficiency, by reallocating resources in ways not in line with revealed comparative advantage, our results support the pursuit of an open regionalism.

Clearly, these results should be considered with caution. Several caveats apply here, with different implications concerning the consistency of our results. Nominal protection has been measured using tariff measures that possibly underestimate protection by not taking into account non-tariff barriers. Although sensitivity analysis for the values of elasticities were undertaken, uncertainty about true elasticity values remains. More importantly, the results cannot be put forward without referring to the underlying assumptions of the model in hand. Since some of the assumptions adopted have clearly restricted scope, great care is needed in using model outcomes to shed light upon policy issues. Finally, indices of revealed comparative advantage have been built relying on distorted trade and, thus, give only a general idea of genuine comparative advantage.

6. Conclusions

A CGE model is employed to estimate the impact of trade liberalisation on fifteen sectors of the Brazilian economy. Two distinct trade liberalisation scenarios are proposed, resembling recent trends in Brazilian trade policy. One looks at the effects of falling Brazilian tariffs on Mercosul imports and declining Mercosul tariffs on Brazilian exports- the regional integration scenario. The second scenario focuses on the impact of removing import tariffs on a non-discriminated basis – unilateral

liberalisation. Simulations are undertaken for three different market structures, namely perfect competition, contestable and oligopolistic markets.

After undertaking extensive sensitivity analysis, we concluded that the impacts of both experiments, in term of changes in gross output, are modest. Overall, the direction of resource allocation does not differ with the introduction of contestable and oligopolistic markets. The results of the regional integration scenario showed that its benefits in terms of output growth were largely concentrated upon metallurgy and mechanical equipment, electrical equipment, other manufacturing, plastics and rubber and transport equipment. On the other hand, when declining output was observed, it often embraced the following activities: agriculture, textiles, clothing and footwear and food, beverages and tobacco. In general, unilateral opening favoured mining, transport equipment, textiles, clothing and footwear, food, beverages and tobacco and paper. In turn, it often led to declining output in electrical equipment, other manufacturing, chemicals, non-metallic minerals, plastics and rubber and agriculture.

After comparing the impact of both regional and unilateral scenarios on resource allocation, we found a contrasting pattern of adjustment. To evaluate the implication of both scenarios in terms of efficiency, changes in output accruing from the model and RCA indices are compared. Using the RCA figures provided in Nonnenberg (1995), weighted averages corresponding to manufacturing sectors in our model are worked out. Rank correlation coefficients were calculated between RCA indices and output growth rates emerging from model simulations. Whereas correlation coefficients for regional integration were all small and negative, they showed positive and large values for the scenario of unilateral liberalisation. In other words, regional liberalisation exhibits an overall pattern of resource reallocation that is weakly correlated with Brazilian revealed comparative advantages. The opposite situation holds for the case of unilateral liberalisation.

These results underscore the pursue of open regionalism, where regional schemes are also a vehicle for unilateral and multilateral trade negotiations. In the particular case of Mercosul, in reality one could observe that the move towards regionalism was also coupled with a significant non-discriminated reduction in tariffs. Our conclusions stress the negative effects of a trade liberalisation strategy that places a heavy emphasis on regionalism and gives support for the drive for open regionalism. In turn, attempts to raise trade barriers on non-member imports may entail potentially costly resource allocation implications.

The analysis is, however, not without caveats. Here, two categories of limitations can be distinguished. The first relates to the settings of our model. Non-tariff barriers are not considered. The lack of empirically based estimates for sectoral trade elasticities adds an important degree of uncertainty in the model simulations. The resulting simulations have to be interpreted in light of the underlying model assumptions which, in some cases, are simplified. The second group of caveats stems from the adoption of RCA indices. RCA indices have many limitations and they should be analysed with care when backing policy recommendations.

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