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# Removing the 'Hidden' Trade Costs: An Analysis of Mercosur's Trading Arrangements

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# REMOVING THE 'HIDDEN' TRADE COSTS: AN ANALYSIS OF MERCOSUR'S REGIONAL TRADING ARRANGEMENTS

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# ABSTRACT

After six years of stop-start negotiations, Mercosur is no closer to signing a regional trading agreement (RTA) with the EU, whilst talks between 33 countries, including Mercosur, to finalise a Free Trade of the Americas Agreement (FTAA) have also stalled. The lack of progress is due to various factors: economic crises in Mercosur, intransigence by member countries and uncertainty surrounding the outcome of the Doha Round. Estimates from the trade literature predict welfare gains to Mercosur from both regional initiatives whilst only one study assesses the benefits of removing additional non-tariff barrier (NTB) trade costs which have been largely unchallenged within the multilateral forum. In this paper, we present a more thorough specification of NTB trade costs employing a theoretically consistent gravity specification, where calculated tariff equivalent estimates are subsequently implemented into a modified computable general equilibrium (CGE) model. Relative to a realistic baseline, we reassess the benefits of both regional initiatives to Mercosur, revisiting the claim that NTB trade cost abolition doubles the 'standard' welfare estimates. Contrary to previous studies the results suggest that a FTAA yields greater gains to Mercosur than an EU RTA whilst the claim of Monteagudo and Watanuki pertaining to trade cost elimination is understated.



**Keywords**: Mercosur, EU RTA, FTAA, NTB Trade Costs, Gravity Modelling, Computable General Equilibrium.

**JEL classification**: F1, F12, F15, F17

# Removing the 'Hidden' Trade Costs: An Analysis of Mercosur's Trading Arrangements

## 1. Introduction

In the mid 1980s, Argentina and Brazil promulgated a series of 24 bilateral protocols representing a new chapter in relations between the two largest players of the Southern Cone. In 1991, these protocols were extended to form Mercosur (Mercado Común del Sur), with the inclusion of Paraguay and Uruguay at the signing of the Treaty of Asunción.[1] Originally, it was envisaged that Mercosur would be a fully functioning customs union by 1995. However, the pace of transition has been rather slower, reflected in part by the 'adjustment regime' programme which allows intra-Mercosur trade for a select range of products to continue under tariff conditions, whilst 'exceptions lists' have been drawn up to the common external tariff (CET). At the current time, a fully operational customs union is scheduled for 2006.

In terms of Mercosur-EU relations, the signing of the *EU-Mercosur Interegional Framework for Co-operation Agreement* (EMIFCA) set the political foundations for official negotiations on tariff liberalisation which began four years later in 1999. Unfortunately, the currency crises in Argentina and Brazil at the end of the last decade, which subsequently engulfed Paraguay and Uruguay, weakened the CET as Mercosur members sought short term concessions, and compromised the stability of the Mercosur pact. By 2004, the possibility of final agreement looked even more remote when at the 8th Ministerial meeting in Brussels, the two sides could not agree on market access for Latin American goods, particularly in the area of agro-food trade. Indeed, this failure

[1] Mercosur encompasses approximately half the population of Latin America and the Caribbean (World Bank indicator data, 2004). In more recent times, Bolivia (1995), Chile (1996), Venezuela and Mexico (2004) have been bestowed association status with Mercosur.

reflected ongoing divisions between developed and developing country members witnessed the previous year at the WTO trade talks in Cancun, Mexico.

Hope still remains for an agreement between the two sides when the talks resume in early 2005 with a view to completion by the end of the year. For Mercosur, EU relations are a top priority[2] with EU markets constituting approximately one-third (Dimaranan, and McDougall, 2005) of export trade, while Mercosur is keen to avoid over reliance on its single main trading country, the United States (US) (Panagariya, 1996). On the other hand, whilst Argentinean and Brazilian competitiveness could be costly for highly protected EU agro-food sectors, the EU is not blind to the international context of growing US influence in the Southern Cone of the Americas. For example, the aim of the current US administration is to foster a Free Trade of the Americas Agreement (FTAA).[3] Thus, an agreement with Mercosur not only partially negates the influence of the US through improved market shares, but also provides a stepping stone in promoting EU ideology within an evolving environment of globalisation (Faust, 2002).

## 2. Economic Relations between the EU and Mercosur.

### *2.1 Trade and protection*

Table 1 (columns 2-3) shows Mercosur import trade shares for the EU15 and the Rest of the American Continent (RoAC).[4] Given the proximity of its markets, the vast majority (except livestock) of agricultural and raw material imports are from the RoAC, although in a number of food manufacturing sectors (meat processing, vegetable oils &

[2] Mercosur is also looking to make agreements both within (Community of Andean Nations, Columbia, Ecuador) and outside (Canada, Japan, South Africa) the region.
[3] In recent times, partially encouraged by the lack of multilateral progress under the current Doha Round and within the parameters of international trade law (Article XXIV), the US stance has been much more active in ratifying bilateral preferential free trade agreements with select (groups of) partners.
[4] Later in the paper we report results for both the EU15 and 'new' EU10. However, the data for 2001 show that the vast majority of Mercosur-EU trade is sourced to (94%)/from (97%) the EU15.

fats, dairy and beverages and tobacco) imports are skewed toward the EU. Across most of the non-food manufacturing sectors, Mercosur's trade shares between the EU and RoAC are finely balanced, whilst services trade imports are more the preserve of the EU15. Columns 4 and 5 present EU and RoAC extra-bloc import shares from Mercosur. Examining EU import trade shares reveals considerable trade asymmetry, where with the exception of crops, Mercosur constitutes less than 0.1 (i.e., 10%) of import trade by sectors. A similar asymmetric pattern of trade exists between the RoAC and Mercosur, although the proximity these markets considerably lessens the degree of trade asymmetry for primary agricultural and food trade.

Table 2 shows the structure of Mercosur's tariff protection on both the EU15 and the RoAC (columns 2 and 3) and EU15/RoAC (columns 4/5) protection on extra-bloc Mercosur imports in 2001.[5] Examining the right side columns reveals, as expected, that EU import protection (column 4) is skewed toward agriculture and food due to the price distorting protectionist policies of the Common Agricultural Policy (CAP). Indeed, sizeable (Applied or Bound?) tariff peaks appear for sugar, meat and dairy processing and to a lesser extent in sensitive products such as vegetables fruits and nuts, whilst in the remaining non-food manufacturing industries, EU15 tariff protection is relatively low compared with Mercosur and the RoAC. For Mercosur (columns 1 and 2), import protection is fairly evenly spread between both the EU15 and RoAC, although in general EU imports face slightly higher tariff barriers. Finally, in column 5, we see that the RoAC highest import barriers on Mercosur produce are on food processing and

[5] With the exception of Motor vehicles (16.7%), Sugar processing (9.2%) and Light manufacturing (4.7%) sectors, intra-Mercosur trade barriers are at, or close to, zero.

textile trade. Note that services sector imports across all regions are free of 'formal' tariff barriers.[6]

*2.2 The costs of Mercosur-EU market integration*

At the simplest theoretical level, the net welfare impact from the formation of a regional trading agreement (RTA) is based on *trade diversion* and *trade creation* effects. When the formation of an RTA *diverts* a country's trade away from a more efficient supplier outside the RTA to a less efficient supplier within the RTA, national welfare *may* be reduced, although this depends on the difference in non-distorted prices (assuming MFN status for all trading partners). More specifically, from the perspective of country A, the larger the difference in non-distorted prices between the less efficient RTA partner B and the more efficient partner C outside the RTA, the smaller (larger) are country A's efficiency triangle gains (tariff revenue losses) on formation of the RTA with B. Trade creation, on the other hand, is unambiguously welfare *improving* for country A as production is shifted from higher cost to lower cost producers resulting in efficiency gains.

With the development of globally consistent trade databases and powerful computational facility, computable general equilibrium (CGE) models have become the workhorse tool of analysis in international trade policy (e.g., Francois *et al.*, 1996; Hertel *et al.*, 1998; Frandsen *et al.*, 2000).[7] Given their comprehensive coverage of regions and sectors, these models are particularly useful in summing trade diversion and creation effects across import markets, particularly where one is examining the relative

[6] Impediments to trade of a non tariff nature (i.e., licensing, health and safety standards, technical standards, 'red tape') are largely the preserve of the services sector. Due to their inherent complexity in design, they are not quantified in the GTAP database. This omission is rectified in this study.
[7] CGE has also been employed in other fields of investigation such as environmental policy (Perroni and Wigle, 1997), taxation (Wehrheim, 1998), tourism (Sinclair and Stabler, 1997) and transport economics (Oosterhaven and Knapp, 2000).

trade diversionary pull effects of simultaneous RTAs. A trawl of the literature pertaining to Mercosur trade relations, reveals a number of CGE studies examining the welfare impacts under three broad scenarios: (ii) A FTAA deal; (i) Mercosur-EU RTA; and (iii) simultaneous Mercosur-EU and FTAA deals. In the studies solicited in our review, two applications (Giordano, 2002; Diao *et al.*, 2003) apply standard constant returns to scale (CRS), perfectly competitive (PC) model assumptions. Other CGE studies of Mercosur (Bchir *et al.*, 2001; Valladao, 2003) incorporate additional modelling extensions which examine the impacts of 'new trade theory' (i.e., increasing returns to scale (IRS)/imperfect competition) and 'growth theory' (i.e., capital accumulation).

Despite variations in model datasets and assumptions pertaining to agent behaviour, policy simulations and macro closure,[8] the results of these studies appear to concur in three important respects. Firstly, that trade creation outweighs trade diversion under all RTAs yielding a welfare gain to Mercosur.[9] Secondly, welfare gains are magnified by additional 'pro-competitive' gains in imperfectly competitive sectors and capital accumulation effects resulting in further macro growth (Bchir *et al.*, 2001; Valladao, 2003). Finally, the gains to Mercosur under scenario (iii) are found to be partly additive (Bchir et al., 2001; Valladao, 2003) of the welfare gains in scenarios (i) and (ii).[10]

One important issue not covered by any of these studies is the trade impact of eliminating or harmonising market segmenting policies or non-tariff trade costs, such as health and safety regulations, competition laws (particularly in services), technical

[8] Model closure is the endogenous/exogenous split of variables in the CGE model. Thus, the choice of which policy variables (e.g., labour supply, taxes etc.) to hold exogenous reflects modelling assumptions pertaining to the workings of the economy.

[9] In CGE models, the question of whether trade creation outweighs trade diversion is a function of the benchmark tariff rates and the elasticity of substitution values in partner countries.

[10] Based on the literature sampled, the growth gains to Mercosur from an FTAA (EU FTA) agreement range between 0.25% to 3% (1% to 4.5%) of real GDP. In the case of simultaneously joining FTAA and Mercosur-EU agreements, these gains may be as high as 8% of real GDP.

standards (e.g., licensing and certification regimes, environmental standards), quantitative restrictions and 'red tape' procedures (e.g., customs clearance).[11] A number of studies have attempt to estimate non-tariff trade costs as *tariff equivalents* for merchandise and service sectors employing frequency[12] (Hoekman, 1995; Swann *et al.*, 1996), price based[13] (Deardorff and Stern, 1998) and quantity based[14] (Francois and Hoekman, 1999; Anderson and Wincoop, 2001; Park, 2002) methods of measurement. In the case of Latin American and European services trade (i.e., financial services, construction, trade services, communication etc.), there is significant evidence (Francois and Hoekman, 1999, Hoekman, 1995; Kume *et al.*, 2001; Park, 2002) of trade costs,[15] whilst other studies (Lejour *et al.*, 2001; Philippidis and Carrington, 2005) support the prevalence of trade costs in the EU across a whole range of product categories. Furthermore, a review of a number of trade restriction measures such as the IMF's 'Trade restrictiveness index' (TRI), the World Bank's 'Overall Trade Restrictiveness Index' (OTRI) and the Heritage Foundation's 'Freedom Index' (IMF, 2005), suggests that Argentina and Brazil in particular, are amongst those trading nations that more liberally employ non-tariff trade impediments to protect domestic production.

To our knowledge, only one CGE study examines the regional trade and welfare implications of these additional trade barriers in the context of a Mercosur-EU

[11] Indeed, the context of this research is even more pertinent given the focus in previous trade rounds on tariff barrier reductions, whilst such trade costs in many countries have remained unchallenged.
[12] Using surveys, coverage ratios are developed based on an examination of the proportion of each country's bilateral trade links affected by trade cost restrictions. These ratios are subsequently used to calculate tariff equivalents (see Hoekman, 1995).
[13] Price based measures (where data is available) derive estimates of trade costs based on differences between domestic and foreign prices.
[14] Based on econometric models of trade determination: Heckscher-Ohlin model (trade based on comparative advantage); Helpman-Krugman model (trade based on product differentiation); gravity modelling (trade motivated (primarily) by proximity and relative size). Trade costs are approximated either from the residuals of the regression or from dummy variable estimates.
[15] It should be noted that in the GTAP database of global trade employed in this study, there is no measure of such costs, particularly in services trade where tariff barriers are zero.

agreement.[16] Employing tariff equivalent estimates, Monteagudo and Watanuki (2003) examine the three scenarios outlined above both with and without removal of additional trade costs. The results for Mercosur are consistent with the three broad findings of other studies[17] whilst the impact of additional trade costs is to *double* the growth estimates of the standard tariff removal experiments (see Table 3).[18]

Whilst representing an important step in evaluating the true costs of RTAs, Monteagudo and Watanuki (2003) employ *borrowed* tariff equivalent estimates for broad sector aggregates (i.e., agriculture, food processing etc.) from other studies. In the absence of exact data, the authors assume that 'similar' sectors (e.g., food processing, agricultural sectors) have uniform trade costs, whilst a lack of trade cost estimates in utilities and services sectors, given evidence of significant services trade costs in the literature cited above, seems implausible. In both cases, misspecification of trade cost estimates may lead to considerable bias in trade and aggregate welfare estimates. Accordingly, in this paper, the principal aim is to perform the same CGE policy experiments as Monteagudo and Watanuki (2003), whilst we estimate our own tariff equivalents for each sector and region employing a theoretically consistent gravity specification. We revisit the claim by Monteagudo and Watanuki, (2003) that inclusion of such costs may double the welfare impacts.

## 3. CGE Model and Data aggregation

To examine the resource and welfare impacts of tariff and trade cost elimination between (principally) Mercusor and the EU, we employ the Global Trade Analysis

[16] In a policy context, another way of viewing this experiment is the potential cost from not harmonising or recognising regulatory policy regimes between trading blocs.

[17] Namely, that trade creation effects are greater than trade diversion for Mercosur; (ii) IRS magnifies the welfare gain estimates; (iii) The welfare gain estimates in scenario (iii) are additive of scenarios (i) and (ii).

[18] Results for the EU are not presented in their paper.

Project (GTAP) model and accompanying version 6 database (Dimaranan and McDougall, 2005).[19] In the standard GTAP framework, conventional neo-classical behaviour (utility maximisation, cost minimisation) is assumed, whilst regional utility is aggregated over private demands (non-homothetic), public demands and savings (investment demand). Production is characterised employing a perfectly competitive, constant-returns-to-scale technology, and bilateral trade flows are modelled using the Armington (1969) specification to allow for imperfect substitution between heterogeneous products.

Investment savings behaviour is dictated by a fictitious 'global bank' which collects investment funds (savings) from each region and disburses them across regions according to a rate of return *or* a fixed investment share mechanism. In this study, we assume a long run time horizon such that skilled and unskilled labour and capital markets are perfectly flexible such that wage/rental rates adjust and factors are perfectly mobile between sectors.[20] Land and natural resource factors are both sector specific and follow the standard GTAP treatment of being sluggish between productive sectors.

The GTAP database, currently in its sixth incarnation, represents a significant advance on version 5 in terms of (*inter alia*) broader regional coverage (87 regions), improved trade and demand elasticity estimates and significant refinements to the support and protection data. To examine the long run effects of the Mercosur-EU agreement, the regional disaggregation includes the EU15, EU10[21] and Mercosur composite regions, as well as a 'Rest of the American continent' (RoAC) composite to allow implementation of the Free Trade of the Americas (FTAA) agreement. The Rest of the World (ROW) region captures residual trade flows in the model. Finally, the

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[19] The model description here is brief. For a fully detailed discussion of the model see Hertel (1997).
[20] A caveat of perfect factor mobility is that we do not capture the frictional effects of trade liberalisation as labour is displaced in the short to medium term.
[21] The choice of EU15 and EU10 regions is explained in the scenario design section below.

choice of 22 tradable sectors captures the key production and trade activities of each of the trading regions.[22]

*3.1 CGE Model Extensions*

*3.1.1 Imperfect Competition*

In the model experiments, a perfectly competitive (PC) model (described above) and imperfectly competitive (IC) variant are employed. In the IC model, the 15 manufacturing sectors (including six food processing) are characterised as oligopolistic with increasing returns to scale. Furthermore, given long run model closure, it is assumed that firms are free to enter and exit these industries.[23] An array of concentration ratio data sources are employed to calibrate oligopolistic firm numbers to the benchmark dataset.[24] All remaining sectors are assumed perfectly competitive.[25]

*3.1.2 Trade-Productivity Links*

In both PC and IRS model versions, we follow Robinson *et al.* (2002) in identifying the total factor productivity (TFP) gains from trade liberalisation through *technology spillovers*. There is considerable evidence within the literature (de Melo and Robinson, 1992; Romer, 1994; Grossman and Helpman, 1995; Hanel, 2000) of the feedback effect of trade expansion on domestic productivity growth. Enabling greater access (i.e., cheaper prices) to technologically intensive intermediate inputs from developed countries, allows firms to improve domestic production processes thereby stimulating productivity in the recipient country. Technology transfer is particularly

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[22] The sectors are: Crops, vegetables and fruit, livestock, other agriculture, raw materials, meat products, vegetable oils and fats, dairy, sugar processing, other food processing, beverages and tobacco, textiles, wearing apparel, wood, paper and publishing, chemical products, metal products, motor vehicles, light manufacturing, other manufacturing, utilities, other services.

[23] See appendix 1.2 for a discussion of the oligopolistic sector modelling assumptions.

[24] See appendix 1.2 for fuller discussion.

[25] The decision to implement PC in the services sector is based on a lack of relevant data to calculate concentration ratios in each of the regions.

pertinent to developing countries such as the Mercosur members and the Latin American sub-continent where trade is one of the key policy variables to sustain long term economic growth. To capture this effect, we employ the Robinson *et al.* (2002) endogenous TFP growth specification which assumes productivity growth as a function of imported intermediate inputs embodied with advanced technology.[26]

*3.1.3 Capital Accumulation Effects.*

A third extension relates to the treatment of investment and savings in the model. In the standard GTAP framework, whilst welfare improving trade reform (static welfare gain) proportionally increases regional savings, no mechanism exists to link additional savings induced investment with increased capital endowment accumulation resulting in further 'dynamic' welfare gains as theorised Baldwin's (1992) classical theory growth model. Given the long run potential for additional investment under greater economic stability through freer trade, a treatment of such 'second round' effects on real income changes would appear to be a sensible addition to the standard model framework.

Thus, following Francois *et al.,* (1996), beginning of period capital grows over the medium term via an accumulation function before falling back to a 'steady state' long run equilibrium point defined as the rate of capital growth just sufficient to replace depreciated capital (i.e., zero net investment growth). With long run closure, we assume full employment in all factor markets (wages are fully flexible) and a fixed trade balance as a proportion of national income with endogenous capital stocks. As noted in Francois (1996), a fixed trade balance assumption in the GTAP reflects the empirical

[26] Following Robinson *et al.* (2000), it is assumed that (i) technology transfer is yielded by chemical products, metal products, electronic and other machinery (light manufacturing), and services intermediate inputs and (ii) only the developing regions accrue technology transfer. See appendix 1.3

observation that domestic saving directly finances domestic investment over the long run.[27]

### *3.1.4 Tax Neutrality Assumptions*

Regional arrangements involve unavoidable tariff revenue losses on partner country imports which enter tariff free, as well as further potential losses on trade diversion from third countries. The discussion above (see Table 2) revealed the pervasiveness of tariffs across all sectors (except utilities and services), suggesting significant tariff losses to the government budget. Accordingly in this study, we employ a 'tax neutrality' macro policy assumption whereby lost revenues on tariff elimination are absorbed by uniform regional increases in consumption taxes such that tax revenues remain a constant share of regional income.[28]

## 4. Gravity Specification

### *4.1 Background and Theoretical Foundation*

To quantify non-tariff trade barriers, one may employ either a direct or indirect approach. Direct measurement involves collecting information (e.g., government documents, personal interviews with industry 'experts') on existing regulations and procedures to construct an index. Statistical or subjective approaches may be used to aggregate or weight the data in order to build a composite indicator. In contrast, indirect non-tariff barriers may be 'conjectured' from border price distortions or discrepancies between actual trade and 'potential' frictionless trade (Deardoff and Stern, 2004).

[27] Due to data constraints the model does not measure the impacts of FDI from specific bilateral partners. Accordingly, a second-best approach uses the standard mechanism of the global bank which handles interregional foreign investments.
[28] Unlike Harrison *et al.*, (2002) we do not examine the welfare impacts of different tax collection schemes.

In the context of this study, the use of direct measurement to capture specific sector (e.g., yogurts, cheese, confectionary etc.) non-tariff protection regimes would appear more problematic given the broad sectoral definitions (e.g., 'dairy') employed in the CGE model. Moreover, direct measurement only captures explicit and/or recognized policies, and not all possible sources of restrictions to trade. For these reasons, we favour the use of an indirect approach.

As noted above, one possible indirect estimation is to compare observed border price distortions. This technique can be employed for homogeneous goods merchandise trade although where there are 'additional' sources of (perceived) product differentiation, such as origin, quality or marketing elements, it becomes considerably more problematic to separate prices differences based purely on anti-competitive trading practises. Indeed, in the realm of services trade where 'differentiation' is the norm, estimating border price differences as a proxy for non-tariff barriers to trade would be extremely difficult to implement.

Accordingly, in this paper we employ the gravity method of indirect estimation, which provides a benchmark for trade under frictionless conditions. Since the early works of Tinbergen (1962), the gravity model has largely been used to explain trade flows. In its simplest form, trade between a pair of countries i and j ($X^{ij}$) is a positive function of their economic 'size' and a negative function of distance. A common weakness of the model was its lack of theoretical rigour, although a number of authors (Anderson, 1979; Bergstrand, 1989, 1990; Deardorff, 1998, Anderson and van Wincoop 2003) have refined the empirical implementation based on a homothetic constant elasticity substitution (CES) Armington structure (varietal differentiation by region of origin) consistent with the assumption of monopolistic competition.[29]

[29] See chapter 5 of Feenstra (2003) for a comprehensive review of the theoretical and empirical development of the gravity equation.

Thus, under the assumption of costless or free trade, prices across countries are identical. Let us consider a multi-country framework with C countries, denoted as i,j = 1,…,C; and N varieties are available. Let $y_k^i$ denote the production of variety k in country i. The GDP in each country is then[30] $Y^i = \sum_{k=1}^{N} y_k^i$ while world GDP is $Y^W = \sum_{k=1}^{N} Y^i$. Under the assumptions above, the exporter country will sell its variety in proportion to the importer's GDP:

$$X_k^{i,j} = \frac{Y^j}{Y^W} y_k^i = s^j y_k^i \qquad [1]$$

Summing over all products we get:

$$X^{ij} = \sum_{k=1}^{N} X_k^{ij} = s^j \sum_{k=1}^{N} y_k^i = s^j Y^i = \frac{Y^j Y^i}{Y^W} = s^i Y^j = X^{ji} \qquad [2]$$

and accordingly, the total bilateral trade between countries i and j is:

$$X^{ij} + X^{ji} = 2\frac{Y^j Y^i}{Y^W} \qquad [3]$$

which is the simplest derivation of the gravity equation, showing that total trade between i and j is directly proportional to the product of their GDP's.

Anderson and van Wincoop (2003) relax the assumption of costless trade to include transport costs or tariffs. As a result, prices of each variety k are no longer equal across countries:

$$P_k^{ij} = T_k^{ij} P_k^i \qquad [4]$$

where $P_k^{ij}$ is the cost including freight (c.i.f.) price of variety k, exported from country i to country j; $P_k^i$ is the free on board (f.o.b.) price of variety k, in country i; and $T_k^{ij}$ is an

[30] Under the assumption of free trade, prices across countries are identical; normalizing prices to unity, $y_k^i$ actually measures the value of production of product k in country i.

‘iceberg cost’ (Samuelson, 1952) which states the number of units of variety k that must be shipped to country j in order for one unit to arrive.

According to the specialization assumption above, each country i produces $N^i$ unique varieties (k=1,..,$N^i$). As a consequence, the consumption of variety k in country j ($C_k^{ij}$) equals the exports to j coming from the only producing country i. The CES utility function for consumers in country j ($U^j$) is then (where σ is the elasticity of substitution across varieties):

$$U^j = \sum_{i=1}^{C} \sum_{k=1}^{N^i} (C_k^{ij})^{(\sigma-1)/\sigma} \qquad [5]$$

The sub-index k of $C_k^{ij}$ can be dropped assuming that all varieties k imported from country i are sold at the same price $P^{ij}$ in country j, as a result of a transport cost equal across categories ($T^{ij}$), and accordingly the utility function is simplified to:

$$U^j = \sum_{i=1}^{C} C^{ij(\sigma-1)/\sigma} \qquad [6]$$

A representative consumer of country j maximizes $U^j$ subject to the budget constraint:

$$Y^j = \sum_{i=1}^{C} N^i P^{ij} C^{ij} \qquad [7]$$

where $Y^j$ is aggregate expenditure and income in country j. From the restricted maximization the demand for each product $C^{ij}$ is obtained:

$$C^{ij} = \left(\frac{P^{ij}}{P^{j*}}\right)^{-\sigma} \left(\frac{Y^j}{P^{j*}}\right) \qquad [8]$$

where $P^{j*}$ is an overall index of prices in country j:

$$P^{j*} = \left(\sum_{i=1}^{C} N^i \left(P^{ij}\right)^{1-\sigma}\right)^{\frac{1}{1-\sigma}} \qquad [9]$$

Combining the relation between the value of exports from country i to j:

$$X^{ij} = N^{i} P^{ij} C^{ij} \qquad [10]$$

with the demand function in [8] a more general gravity equation is derived:

$$X^{ij} = N^{i} Y^{j} \left( \frac{P^{ij}}{P^{j*}} \right)^{1-\sigma} \qquad [11]$$

To simplify the estimation of [11] the unknown number of varieties that each country i produces is substituted by $N^{i} = \frac{Y^{i}}{P^{i}\,\bar{y}}$, where $\bar{y}$ is fixed firm output derived from zero-profit conditions. Moreover, given the relationship in [4], the price in country j ($P^{ij}$) is equal to $T^{ij}$ $P^{i}$. Substituting these expressions into expression [11] and simplifying gives:

$$X^{ij} = \frac{Y^{i}\,Y^{j}}{P^{i\sigma}\,\bar{y}} \left( \frac{T^{ij}}{P^{j*}} \right)^{1-\sigma} \qquad [12]$$

In Anderson and van Wincoop (2003) this treatment is simplified further by imposing the market clearing condition that the value of firm output in country (or variety) i (f.o.b. prices $P^{i}$) equals consumer expenditure in destination country j:

$$P^{i} y^{i} = \sum_{j=1}^{C} C^{ij} P^{ij} \qquad [13]$$

and assuming that trade costs between partners i and j are symmetric: $T^{ij} = T^{ji}$. In this way, an implicit solution for the unknown price $P^{i}$ in [13] is obtained $\tilde{P}^{i}$:

$$\tilde{P}^{i} = \frac{\left( \frac{Y^{i} / Y^{W}}{N^{i}} \right)^{\frac{1}{1-\sigma}}}{\tilde{P}^{i*}} \qquad [14]$$

which, when substituted in [9] leads to the overall price index:

$$(\tilde{P}^{j*})^{1-\sigma} = \sum_{i=1}^{C} \frac{Y^{i}}{Y^{W}} \left( \frac{T^{ij}}{\tilde{P}^{i*}} \right)^{1-\sigma} \qquad [15]$$

Substituting [14] into the gravity equation [12] a new specification for the gravity equation is obtained:

$$X^{ij} = \frac{Y^i Y^j}{Y^W}\left(\frac{T^{ij}}{\widetilde{P}^{i*}\widetilde{P}^{j*}}\right)^{1-\sigma} \qquad [16]$$

Therefore, the theoretical foundation of the gravity equation expresses exports between two countries i and j as a function of the product of their GDP's and their overall price indexes, which Anderson and van Wincoop (2003) term 'indexes of multilateral resistance' as they depend on the trade costs (see equation [15]).

To ease estimation, the expression in [16] is linearized taking logs leading to the estimating gravity equation:

$$\ln X^{ij} = \alpha + \ln Y^i + \ln Y^j + (1-\sigma)\ln T^{ij} + (\sigma-1)\ln\widetilde{P}^{i*} + (\sigma-1)\ln\widetilde{P}^{j*} \qquad [17]$$

where $\alpha$ collects the effect of $\ln Y^W$.

In the theoretical outline above, 'iceberg costs' ($T^{ij}$) are a quantitative frictional measure in delivering one unit of a product from one region to another. Empirically, this definition has incorporated not only transportation costs, which is usually proxied by distance ($Dist^{ij}$), but also other sources of unobservable costs caused by, for example, currency risk, health and safety costs, red tape procedures and paperwork etc. Such non-tariff barriers (NTB) can be approximated either employing dummy variable estimates or the residuals of the gravity regression.

The dummy variable approach consists of modelling $T^{ij}$, usually hypothesized as a log-linear relationship (Anderson and van Wincoop, 2003):

$$\ln T^{ij} = \rho \ln Dist^{ij} + \ln\tau^{ij} \qquad [18]$$

where $\rho$ is a parameter and $\tau^{ij}$ is the bilateral trade barrier, which may be an international border (McCallum, 1995; Anderson and van Wincoop, 2003); a monetary union (see Rose and Stanley (2005) for a full review); or a preferential trade agreements (see Kandogan (2003) for a full review). In Anderson and van Wincoop, (2003) this is modelled as:

$$\tau^{ij} = \tau^{1-D^{ij}} \qquad [19]$$

where $D^{ij}$ is a dummy variable that takes the value 1 when regions i and j belong to the same country, trade agreement or currency union, and 0 otherwise; and τ-1 is the non-tariff-barrier equivalent. Substituting [19] into [17], the gravity equation becomes:

$$\ln X^{ij} = \alpha + \ln Y^{i} + \ln Y^{j} + (1-\sigma)\rho \ln Dist^{ij} + (1-\sigma)\ln \tau\,(1-D^{ij}) + (\sigma-1)\ln \tilde{P}^{i*} + (\sigma-1)\ln \tilde{P}^{j*} \qquad [20]$$

Estimating equation [20] for the parameter γ (equals (1-σ)lnτ) provides an estimate of the 'average' impact of the dummy variable ($1-D^{ij}$) on trade, from which it is possible to calculate an 'average' NTB tariff-equivalent estimate of the trade barrier:[31]

$$(\tau-1) = \exp\left(\frac{\gamma}{1-\sigma}\right) - 1 \qquad [21]$$

Alternatively, in other gravity studies (Wall, 1999; Park, 2002; Harrigan and Vanjani, 2003; Deardorff and Stern, 2004) a residual based method is employed which accounts for all of the parameters of the estimated gravity equation. This method compares actual and potential trade flows with respect to a free-trade benchmark, where it is assumed that the gravity equation provides a prediction of potential trade under frictionless conditions. Then, the discrepancies between actual ($\ln X_A^{ij}$) and predicted trade ($\ln X_P^{ij}$) are taken to be indicative of trade barriers:

$$\ln X_A^{ij} - \ln X_P^{ij} = (1-\sigma)\ln \tau^{ij} \qquad [22]$$

Over this general definition, Francois (1999) and Park (2002) introduce two modifications: first, for each country j, they calculate a tariff-equivalent over all its trade

[31] Note that if $D^{ij}$ were defined as 1 when regions i,j belong to different countries, trade agreements or currency unions, the estimated coefficient γ would be (σ-1)ln τ, and the tariff-equivalent: $(\tau-1) = \exp\left(\frac{\gamma}{\sigma-1}\right) - 1$

partners. Thus, for each country j, actual ( $M_A^j$ ) and predicted ( $M_P^j$ ) imports aggregating over all countries i≠j are calculated:

$$M_A^j = \sum_{i=1}^{C} X_A^{ij} \quad \text{and} \quad M_P^j = \sum_{i=1}^{C} X_P^{ij} \qquad [23]$$

where $X_p^{ij}$ are the anti-logs of the predicted estimates of the gravity equation. Moreover, these studies normalize the difference between actual and predicted trade relative to a free-trade benchmark ($\tau^b$), where the greatest positive difference between actual and predicted trade is chosen as benchmark: $\tau^b = \text{Max}\left(\left|\frac{M_A^j}{M_P^j}\right|\right)$. Combining these modifications with equation [22] leads to:

$$\ln\left(\frac{M_A^j}{M_P^j}\right) - \ln\left(\tau^b\right) = -\sigma \ln \tau^j \qquad [24]$$

and solving for the tariff-equivalent ($\tau^j$) of the NTB imposed by country j is:

$$(\tau^j - 1) = \exp\left(\ln\left(M_A^j / M_P^j\right) - \ln\left(\tau^b\right)\right)^{-1/\sigma} - 1 = \left(\frac{M_A^j / M_P^j}{\tau^b}\right)^{-1/\sigma} - 1 \qquad [25]$$

In the final model specification, we favour the residual based approach for two reasons. Firstly, unlike the dummy-based method, the residual-based method is more general, as it provides an estimate of all potential NTB barriers on trade rather than NTBs solely related to the dummy in question. Moreover, the residual approach is flexible it that it allows the estimation of bi-directional NTB barriers between specific trade partners (i,j), rather than the ‘average’ NTB cost estimates provided in the dummy specification.

*4.2 The empirical gravity equation and data and results*

The theoretical based gravity equation has been extended in the empirical literature to improve the treatment of transportation costs. For example, Bergstrand, (1985) and Thoumi (1989) include 'shared borders' and 'landlocked' dummies in their models, whilst recent studies (Garman *et al.*, 1998; Limao and Venables, 1999, Martinez-Zarzoso and Nowak-Lehman, 2003) incorporate the importance of infrastructure in facilitating trade between partners. Other authors include cultural or historical linkages that may favour international trade, such as a common language and/or ex-colonial ties (e.g. Frankel et al., 1995; Rose and van Wincoop, 2001; Park, 2002), whilst Arnon *et al.*, (1996) and Martinez-Zarzoso and Nowak-Lehman, (2003) examine the Linder effect, that is, the hypothesis that countries with similar per capita incomes trade more prolifically.

In light of these developments in the literature, the empirical gravity specification estimated in this study is:

$$\begin{aligned} x^{ij} &= \alpha + \beta_1 \, gdp^{i} + \beta_2 \, gdp^{j} + \beta_3 \, sqinc^{ij} + \beta_4 \, Pr^{i} + \beta_5 \, Pr^{j} + \beta_6 \, Infr^{i} + \beta_7 \, Infr^{j} \\ &+ \beta_8 dist_{i,j} + \beta_9 \, Cont_{i,j} + \beta_{10} \, Lang^{ij} + \beta_{11} \, Mt^{j} + \beta_{12} Xs^{i} + \varepsilon^{ij} \end{aligned} \qquad [26]$$

where:

$x^{ij}$ : logarithm of exports from country i to country j

$gdp^{i}$ : logarithm of GDP in country i

$gdp^{j}$ : logarithm of GDP in country j

$sqinc^{ij}$ : logarithm of square difference of per capita GDPs in countries i and j

$Pr^{i}$ : level of prices indicator in country i with respect to US

$Pr^{j}$ : level of prices indicator in country j with respect to US

Infri : infrastructure indicator in country i

Infrj : infrastructure indicator in country j

$dist^{ij}$ : logarithm of distance between country i and j

$Cont^{ij}$ : dummy variable that takes value 1 when countries i and j share a common border and 0 otherwise

$Lang^{ij}$ : dummy variable that takes value 1 when countries i and j share a common language, and 0 otherwise

$Mt^{j}$ : import tariff rate (%) imposed by the importer country j (negative values imply that country j subsidizes imports)

$Xs^{i}$ : export subsidy rate (%) imposed by the exporter country i (negative values imply that country i impose a tariff on exports)

To estimate the model, US dollar value data on bilateral exports comes from version 6 of the GTAP database, benchmarked to 2001. The countries included in the analysis are: the (pre-enlargement) members of the EU, the recent 10 EU accession members, Bulgaria and Romania; the US, Canada, Alaska, Argentina, Brazil, Chile, Columbia, Mexico, Peru, Uruguay, Venezuela and Morocco. The rest of countries are aggregated as: Central America, rest of Andean Pact, Rest of Caribbean, Rest of South America, Rest of FTAA, Middle East, Rest of North Africa, and Rest of the World. Therefore, in total there are 9 composites and 38 individual countries, making a total of 2170 observations. To reduce the proportion of unexplained trade attributable to non-tariff barriers, we following Baier and Bergstrand (2001) by including GTAP bilateral import tariff data, which we have supplemented with export subsidy data from the same source.

To generate consistency with the bilateral trade data, we employ GDP values at current prices (2001) for each country in the sample from the GTAP database. Employing current price GDP data is also considered to better proxy export supply and import demand potential (Gros and Gociarz, 1996). GDP coefficients are expected to be positive and close to unity, as suggested by the theory (Anderson and Wincoop, 2003). For example, on the supply side higher regional income indicates greater economic activity and therefore greater availability of goods for exportation; while on the demand side, a higher income is positively related with the propensity to import. Given the Linder hypothesis, it is anticipated that the larger the differences in per capita income, the less likely is trade between the partner countries.

In equation [17] the price indexes are not observable. Anderson and van Wincoop (2003) first estimate a specific trade cost function ($T^{ij}$) in terms of distance and unknown trade barriers and use these estimates to derive implicit price indexes in [15] which are used in the estimation of the gravity equation [17] using non-linear least squares. Alternatively, other authors have employed standard estimation techniques (e.g., OLS) to proxy prices indexes using GDP's deflators (eg. Bergstrand 1985, 1989; Baier and Bergstrand, 2001) or wholesale price indexes (eg. Park, 2002).[32] Finally, it is possible to replace the price indexes by country specific fixed effects, particularly when panel data are employed (eg. Matyas, 1997; Jakab *et al.*, 2001; Kurihara, 2003; Egger and Pfaffermayr, 2003).[33]

To avoid some of the drawbacks recognized by the literature on using aggregate price indexes, such as the different base period of indexes across countries and movements in exchange rates which make difficult to compare price levels across countries, we have built a relative price indicator. Employing IMF (2005) data, we collect US dollar equivalent purchasing power parities (PPP) for 2001 in each country. Subsequently, exchange rates or foreign currency units per dollar are collected for the same period (http://www.oanda.com/convert/fxhistory). The ratio of the PPP to th

[32] However, Feenstra (2003) notes that a drawback of using published aggregate price indexes is the difficulty of comparing price levels across countries where index base periods differ. Moreover, Anderson and Wincoop (2003,p.16) note that employing price indices that necessarily include *non-tradable* items and nominal exchange rates do not accurately represent real tradable price differences between partner countries.

[33] When cross-section data are used, the degrees of freedom reduce drastically, and only one specific effect (dummy variable) for each country can be included, either when the country is an importer or an exporter, but not for specific pairs of trade partners as this would lead to a number of dummy variables equal to the number of observations.

exchange rate provides an index of the level of prices in each country with respect to the US.

The infrastructure indicators are calculated in a similar way to Limao and Venables (1999) and Martinez-Zarzoso and Nowak-Lehman (2003) as the per capita ratio of the total network of highways and railways for each country in the sample. Population, highway and railway data was taken from the World Bank's economic indicators and the CIA Factbook. *A priori*, it is expected that an efficient infrastructure network (lower transport costs) will impact favourably on trade (Bougheas et al., 1999).

The distance data for each of the countries in the sample are great circle distances between capital cities. For the composite regions, an arbitrary capital was selected (see appendix 1.1). As a direct proxy for transport cost, the expected parameter sign in the regression is negative. Contiguity and common languages dummies were assigned for each of the sample countries and consistent with other literature, are expected to positively affect trade. Finally, Ordinary Least Squares (OLS) is applied in the estimation, and White's consistent covariance matrix estimator is used to avoid the possible bias of OLS standard errors due to heteroskedasticity.

Results of the gravity equation estimation are shown in Table 4. The Adjusted $R^2$ range between 0.599 in other agricultural products sector and 0.933 in services, with a majority of sectors with an Adjusted $R^2$ higher than 0.74. Therefore, the gravity equation more than adequately explains bilateral trade across a wide range of individual industries. A Condition Number under 100 indicates that multicollinearity amongst explanatory variables is not a serious problem.

Incomes of exporter and importer countries are all positive, significant at 1%, and with parameter estimates close to unity, as predicted by economic theory. A Linder effect is found to be significant in 8 out of 22 sectors: the square difference per capita income is negative and significant at 5% in food sectors, raw materials and utilities. However, this variable is positive and significant in textiles and light manufacturing sectors, implying that in these industries, trade increases when there are greater differences in factor endowments, proxied by per capita incomes.

The effect of the relative price indicators is mixed across sectors and depends on whether it is the exporter's or importer's price: the exporter's price is significant in all but three of the sectors and a negative effect predominates (13 sectors); the importer's price, on the other hand, is significant in 14 sectors, while positive effects predominate (10 sectors). Infrastructure indicators are positive and significant as expected in most of the sectors (18 sectors). Distance has a highly significant and negative impact on trade in all sectors, with coefficients close to unity, while contiguity of the countries favours trade significantly, in particular, in the agro-food related sectors. Interestingly, in the services sector, the negative impact of distance is minimum while contiguity has a negative effect which is in agreement with Lejour *et al.* (2001). Apart from trade in utilities and services sectors, countries which share a common language trade more.

Finally, bilateral routes which impose non-zero import tariffs and export subsidies significantly affect trade. Surprisingly, the tariff coefficient is positive suggesting that greater tariff barriers are consistent with higher bilateral trade flows. Given the cross sectional nature of the data, we speculate that this is a spurious relationship, where many regions which trade heavily (particularly the EU) also levy significant tariffs. The subsidy results are also slightly ambiguous. Whilst the majority of the sectors have positive coefficient estimates for subsidies, a number are also negative. Once again, we speculate that this is a spurious outcome as in the case of the tariff estimates.

*4.3 Calculation and Implementation of NTBs*

The tariff equivalents of NTBs are calculated from the residuals or the differences between actual and predicted trade employing equation [25]. However, we extend the model to calculate bi-directional NTBs on imports by sector between *specific* pairs of partner countries. Thus, in the context of this paper, we calculate bi-directional sectoral NTBs between Mercosur and the EU regions (EU15 and EU10) and Mercosur and the Rest of the American Continent (RoAC). Moreover, to simulate the enlargement of the single market in the baseline, we estimate NTB costs between the EU15 and the EU10. The benchmark is calculated as above, although instead of calculating the ratio of actual and predicted total imports of a country j over all its trading partners as in equation [23], we repeat the procedure but only on trade between those countries of interest. Thus, to calculate the NTB equivalents when the EU15 imports from Mercosur:

$$M_A^{Mercosur/EU15} = \sum_{j=1}^{15}\sum_{i=1}^{3} X_A^{ij} \quad \text{and} \quad M_P^{Mercosur/EU15} = \sum_{j=1}^{15}\sum_{i=1}^{3} X_P^{ij} \qquad [27]$$

Reference to equation [25] shows that the derivation of tariff equivalents requires sectoral elasticity of substitution estimates, which are taken from the GTAP database (Dimaranan and McDougall, 2005). Extrapolated bi-directional NTB tariff equivalent values of the NTB for each sector from the underlying sectoral regressions are provided in Table 5.[34] Examining the results from the regression suggest that NTB tariff equivalents in agriculture and food sectors are relatively high compared with non-food sectors. This result concurs with other gravity based tariff equivalent studies of Columbian-NAFTA trade (Bussolo and Roland-Holst, 1998), european enlargement (Lejour *et al.*, 2001) and borrowed NTB tariff equivalent estimates in Monteagudo and

[34] Cases where the NTB value is negative imply the counterintuitive result that trade is *reduced* on abolition of NTBs. The approach here is to impose a zero value shock in the CGE model.

Watanuki (2003), whilst similar tariff equivalent peaks in beverages and tobacco are also found in Chemingui and Dessus (2004) study of NTB protection in Syria.

In the standard GTAP treatment, NTB trade costs are not incorporated explicitly within the database. To simulate their removal without altering the benchmark data, we follow the approach employed in Hertel *et al.*, (2001) who distinguish between 'observed' and 'effective' prices and quantities of trade.[35] Thus, the 'effective' import price ($PMS^E$) of good $i$ from exporting region $r$ to importing region $s$ is a function of the observed import price ($PMS^O$) divided by an exogenous technical coefficient ($AMS$), which captures changes in bilateral trade efficiency such as removal of NTBs:

$$PMS^E_{i,r,s} = PMS^O_{i,r,s} / AMS_{i,r,s} \quad [28]$$

An increase in AMS captures reductions in trade costs by reducing the effective price of good $i$ in importing region $s$ from a given exporter $r$. Since efficiency enhancement (i.e., NTB removal) reduces trade costs, in true 'iceberg cost' fashion, it also increases the effective quantity of export goods from region $r$. Thus, in the GTAP model, the effective quantity of exports is the product of observed exports and the technical coefficient:

$$QXS^E_{i,r,s} = QXS^O_{i,r,s} \times AMS_{i,r,s} \quad [29]$$

Note, that since the effective and observed *values* are identical in the benchmark data, there are no changes in producer revenues and therefore recalibration of the benchmark database is not necessary.

## 5. Scenario design

The calculation of long run trade and welfare effects is based on a baseline scenario for each model variant (see Figure 1). Thus, in the 'baseline' we account for

[35] A full description of the exact implementation of bilateral import augmenting technical change is provided in Hertel *et al.* (2001).

the subsequent enlargement of the EU from 15 to 25 members. Model simulations excluding the trade diversionary impacts of single market enlargement within the EU are likely to overestimate the benefits of a Mercosur-EU free trade agreement to Mercosur. Since version 6 GTAP data is benchmarked to 2001, to simulate the enlarged single market between the EU15 and EU10 our 'baseline' scenario incorporates removal shocks on import tariffs, export subsidies *and* trade cost removals derived from our gravity specification. Finally, we also change EU10 CET on a product basis to reflect the EU15 CET (post Uruguay Round) in 2001 to Mercosur, the Rest of the America continent (RoAC) and the Rest of the World (ROW). Whilst the focus of the research is on Mercosur-EU trade relations, we have endeavoured to represent the evolution of CAP support to reflect forthcoming (likely) WTO and internal reforms. Thus, all output subsidies (i.e., Amber Box support) in the EU regions are removed to reflect the outcome of the forthcoming Doha trade agreement, whilst the representation of the single farm payment follows Jensen and Frandsen (2004), in that we remove all input subsidy wedges and reinsert them as *uniform* hectare premiums in all land using sectors in the EU15. In the case of the EU10, we impose the same uniform headage rate payments as calculated for the EU15.[36] Finally, we include trade policy shocks to export subsidies and import tariffs to capture both the Uruguay Round (UR) and a stylised Millennium Round (MR) outcome.[37]

Following Monteagudo and Watanuki (2003), figure 1 shows the design of the *six* alternative scenarios conducted for each of the PC and IC model variants. Scenarios 1, 2 and 3 incorporate the FTAA, the Mercosur-EU agreement and a combination of

[36] Given accession of an additional 12 members to the EU15, the increase/decrease to the EU27 common external tariffs (CETs) to reproduce the original EU15 CETs are calculated before the 30% Millennium round cut.

[37] Given the benchmark year of 2001, the developed country protection has been fully implemented under the UR. For developing countries (trade weighted part of the ROW), we assume a linear time path proportion of protection has been removed, where for import tariffs dirty tariff shocks are employed using data from Harrison *et al.* (1995). In addition, further tariff reductions under the MR are assumed to be 30%. Finally, we assume that export subsidy expenditure is eliminated on all routes under the MR.

Baseline:

- Elimination of all formal tariffs and subsidies between the EU15 and EU10
- Formation of common external tariff (CET) on a product basis for the EU10
- Introduction of Single Farm Payment scheme on EU agriculture
- Uruguay Round and Millenium Round import tariff and export subsidy shocks
- Elimination of all additional trade cost estimates between EU15 and EU10

↓

Scenario 1 (S1 - The Free Trade of the Americas Agreement) *Baseline plus*:

- Elimination of all formal inter- and intra-tariff barriers between/within Mercosur and the Rest of the Amercian Continent (RoAC) regions

↓

Scenario 2 (S2 - The Mercosur-EU agreement) *Baseline plus*:

- Elimination of all formal tariff barriers between EU15/EU10 and Mercosur

↓

Scenario 3 (S3 - Mercosur-EU agreement and The Free Trade of the Americas Agreement) *Baseline plus*:

- Elimination of all formal tariff barriers between EU15/EU10 and Mercosur
- Elimination of all formal inter- and intra-tariff barriers between/within Mercosur and the Rest of the Amercian Continent (RoAC) regions

↓

Scenario 4 (S4 - The Free Trade of the Americas Agreement with trade cost elimination) *Baseline plus*:

- Elimination of all formal inter- and intra-tariff barriers between/within Mercosur and the Rest of the Amercian Continent (RoAC) regions
- Elimination of all additional trade cost estimates Mercosur and the RoAC.

↓

Scenario 5 (S5 - The Mercosur-EU agreement with trade cost elimination) *Baseline plus*:

- Elimination of all formal tariff barriers between EU15/EU10 and Mercosur
- Elimination of all additional trade cost estimates EU15/EU10 and Mercosur

↓

Scenario 6 (S6 - Mercosur-EU agreement and The Free Trade of the Americas Agreement with trade cost elimination) *Baseline plus*:

- Elimination of all formal tariff barriers between EU15/EU10 and Mercosur
- Elimination of all formal inter- and intra-tariff barriers between/within Mercosur and the Rest of the Amercian Continent (RoAC) regions
- Elimination of all additional trade cost estimates EU15/EU10 and Mercosur
- Elimination of all additional trade cost estimates Mercosur and the RoAC.

Figure 1: Design and implementation of the model experiments.

both agreements respectively. A further three scenarios are conducted to examine the removal of trade costs based on our gravity specification estimates of tariff equivalents. Thus, the removal of additional 'trade costs' between Mercosur and the RoAC in S1 gives S4, whilst elimination of tariff equivalent trade costs on Mercosur-EU bilateral trading routes in S2 gives S5. Finally, elimination of both sets of trade costs in addition to S3 provides S6.

## 6. Results

The impacts on Mercosur's sectoral trade balances are dictated by both (i) the size of the benchmark data trade flows (ii) the relative trade competitiveness (i.e., tariff power) that prevails in each region prior to free trade and (iii) the trade elasticity of substitution. Table 6 presents changes in net trade balances for Mercosur under S1, S2 and S3 relative to the baseline for both PC and IC model variants. The results in the text for each scenario are therefore presented as model variant 'range' estimates (i.e., PC - IC). Also note that in trade surplus sectors, sectoral trade balances may improve even when the foreign substitute is relatively more trade competitive (i.e., lower tariffs). For example, whilst percentage rises in Mercosur exports may be smaller than its corresponding imports, the former are percentage changes of a larger base trade flow. Finally, given the number of scenarios, we restrict ourselves to a discussion of the trade balances, factor and general price indices and regional welfare estimates in Mercosur.

### *6.1 Baseline vs. S1 (FTAA)*

In S1, Mercosur's trade competitive advantage (i.e., lower tariffs – see Table 2) with the RoAC in each of the 'dairy', 'vegetable oils and fats' and 'sugar processing' sectors, lead to improvements in sectoral trade balances relative to the baseline. The biggest improvements are in 'dairy' ($US0.958 - $US0.973bn) which accounts for 120% – 129% of Mercosur's agro-food trade balance gain. In most of Mercosur's remaining primary agricultural, food and non-food processing and services sectors, trade balances deteriorate for two main reasons. Firstly, the RoAC's corresponding tariff barrier is lower and secondly, the general price index in Mercosur rises (1.63% - 1.71%) by more than in the RoAC (0.26% - not shown) through trade induced factor price rises (see Table 7).[38] This is to be expected given the degree of trade asymmetry between the two blocs.

However, in 'textiles' and 'wearing apparel' where Mercosur's trade competitiveness disadvantage is closer to the RoAC, its trade balances improve on bilateral tariff elimination given considerably larger benchmark export flows to the RoAC. Meanwhile, in the case of the 'crops' sector, Mercosur's trade competitiveness is superior (see Table 2), although in addition to trade induced general price rises in Mercosur, intra-trade tariff eliminations in the RoAC divert net trade away from Mercosur leading to a slight deterioration in the trade balance ($US0.130 - $US0.193bn – see Table 6). Finally, the largest trade balance *improvement* in Mercosur appears in the 'motor vehicles' sector. A marginal advantage in trade competitiveness coupled with considerable export flows to the RoAC (see Table 1) leads to sectoral trade balance improvements of $US3.277 - $US3.997bn relative to the baseline (see Table 6). Moreover, given its high degree of industry concentration, ensuing price mark-up falls from tariff liberalisation result in significantly improved trade balance improvements ($US3.997bn) in the IC model variant.

*6.2 Baseline vs. S2 (Mercosur-EU FTA)*

[38] Note that in the IC model version, sharper output increases from additional scale effects result in stronger factor price rises and consequently general price rises (see Table 7).

In the Mercosur – EU FTA scenario the key agro-food sector is 'meat processing'. Relative to the EU, Mercosur has a considerable comparative advantage (see Table 2) and possesses a sizeable trade surplus in meat processing products (see Table 1). Accordingly, under S2, the meat processing trade balance improves $US6.804 – $US7.004bn (see Table 6), which accounts for 84% of the total trade surplus gain in the agro-food sectors for both PC and IC model variants. Mercosur trade balance improvements of $US1.630 - $US1.680bn and $US0.968 - $US1.008bn are also estimated for 'other food processing' and 'sugar processing' sectors respectively. In 'other food processing', EU trade competitiveness is marginally superior (see Table 2), although in the benchmark data Mercosur possesses a healthy trade surplus with the EU of $US4.495bn (see Table 1), with the result that bilateral tariff abolition still favours Mercosur. In 'sugar processing', the EU is highly protective and imports considerably more (in value terms) from Mercosur than vice versa. In 'vegetable oils and fats' and 'beverages and tobacco', gross bilateral trade flows are reasonably balanced between the two regions (see Table 1). However, the EU trade barrier is considerably lower ('beverages and tobacco') or even negligible ('vegetable oils and fats') in comparison with Mercosur (see Table 2), resulting in Mercosur trade balance deteriorations in both sectors. In 'dairy' trade, despite lower import tariffs than the EU, the change in preferences toward EU produce leads to a sectoral balance deterioration ($US0.108 - $US0.109bn) from trade diversionary export losses to the RoAC compared with the baseline.

In the agricultural sectors, expansion of Mercosur's meat processing exports results in sectoral output rises of (not shown) 30% (PC) to 31% (IC). Increased upstream purchases of livestock carcasses[39] increases the latter's output (18% (PC),

[39] In Mercosur, the meat processing sector accounts for 60% of input purchases of livestock products.

19% (IC)), thereby bidding up the price of agricultural land by as much as 38% in the IC model variant (see Table 7). As a result of land price inflation, import substitution from the EU leads to sectoral trade balance deteriorations in most agricultural sectors, where in 'crops', the trade balance is estimated to deteriorate $US0.985 - $US1.052bn. In 'vegetables, fruit and nuts' sector, a slight trade competitiveness advantage (see Table 2) and a significant net bilateral surplus (see Table 1) result in a minor trade balance improvement of $US0.183 - $US0.181bn (see Table 6).

In the remaining non-food manufacturing sectors, comparative advantage rests with the EU, where in many cases (see Table 2) trade barriers are considerably lower than in Mercosur. Accordingly, Mercosur's sectoral trade balances deteriorate in each of these sectors, particularly in 'light manufacturing' trade ($US3.302 - $US3.365bn). Finally, in 'double zero tariff' 'utilities' and 'services' sectors where benchmark trade deficits are $US0.858bn and $US3.786 (see Table 1) respectively, the Mercosur-EU FTA results in trade balance deteriorations of $US0.024 - $US0.030bn and $US0.521 – $US0.578bn respectively (see Table 6). This is due to larger general price rises in Mercosur of almost 1 percent (see Table 7) brought on by trade induced factor price (particularly land) increases. Finally, a comparison of S2 with the baseline reveals that the aggregate trade deficit of $US4.6bn in 2001 worsens marginally by $US0.095 - $US0.105bn.

*6.3Baseline vs. S3 (FTAA and Mercosur-EU FTA)*

Under conditions of scenario 3, Mercosur now has duty free access to *two* free trade areas.[40] Consequently, the model results reveal trade balance and price estimates to be broadly 'additive' of the individual estimates in scenarios 1 and 2.

[40] Note, in the model specification, all export demands go directly to final users and cannot be re-exported to other regions. Thus, region of origin rules are implicitly being enforced.

*6.4 Regional Welfare results*[41]

Table 8 shows the regional welfare results for S1, S2 and S3 in comparison with the baseline. All regional value estimates are in 2001 US dollar values, whilst the percentage improvement in real income is in per capita terms.[42] The underlying result is consistent with other CGE Mercosur studies in that trade creation effects in both S1 and S2 prevail resulting in welfare improvements. Under the FTAA (S1), Mercosur's real income gain is estimated at $US8.589 - $US11.651bn (1.22% - 1.66% per capita real income gain), whilst regional welfare under the Mercosur-EU FTA (S2) improves $US7.299 - $US8.743bn (1.04% - 1.24% per capita real income gain), albeit, less than in S1.[43] Note that the welfare results in S3 are additive of both FTAs in S1 and S2. The majority of the welfare gains to Mercosur come from trade induced net (of depreciation) capital accumulation. In S1, this gain amounts to $US5.776 - $US6.759bn whilst in S2 the corresponding estimates are $US5.180 - $US5.611bn.

Allocative efficiency is measured as the money metric change in a taxed/subsidised (higher valued/lower valued) resource or product usage from elimination of a given market distortion (e.g., import tariff).[44] In the context of this simulation, whilst tariffs are falling they still lead to simultaneous increases in imports (*ceteris paribus*) resulting in cumulative increases in allocative efficiency. Accordingly, a positive allocative efficiency estimate is a measure of pareto improvement in resource

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[41] For a full discussion of EV welfare decomposition, see McDougall (2003).

[42] The aggregate percentage real income gains are presented as per capita given the non-homotheticity of the private utility function in the GTAP model structure.

[43] These welfare estimates are below those of Monteagudo and Watanuki, (2003). Moreover, the authors report the reverse result with the Mercosur-EU FTA yielding slightly greater welfare improvements in Mercosur. We speculate that this may be related to the choice of baseline in our model which includes the EU15 becoming the EU25. Accordingly, trade creation effects are muted with the addition of a Mercosur-EU FTA in S2.

[44] Thus, a tariff on a product implies an 'under-efficient' usage of resources as the economy is producing/consuming less compared with free undistorted market forces. Conversely, a subsidy encourages over-production (i.e., more than under free market conditions) and therefore is a waste of resources.

allocation.[45] Thus, under bilateral free trade scenarios, allocative efficiency gains are estimated at $US1.680 - $US2.180bn in S1 and $US1.205 - $US1.428bn in S2.[46]

In CGE trade models, market clearance implies zero global trade balance (i.e., one country's balance improvement is another country's balance loss), under model closure total savings and imports must equal total investment and exports.[47] In our model, long run investment is directly determined by fixed savings rates respecting the long run empirical observation that domestic saving finances domestic investment (Francois *et al.,* 1996). Thus, unilateral Mercosur tariff elimination would require export increases to restore balance implying reductions in export prices and *ceteris paribus*, a terms of trade (ToT) loss. However, with reciprocal tariff reductions by the RoAC (EU) in S1 (S2), the necessary reduction in Mercosur export prices to stimulate export increases is greatly reduced. Furthermore, free trade access to RoAC and EU markets in S1 and S2 respectively bids up factor and consequently general prices (see Table 7). Consequently, Mercosur receives a ToT gain of $US0.838 - $US0.770bn in S1 and $US0.804 - $US0.804bn in S2.

The trade induced growth estimates measure the degree of productivity growth effects from 'technological transfer' as specified in Robinson *et al.* (2002). Given Mercosur's stronger import trade links with the RoAC in the technologically embodied import sectors (see Table 1),[48] trade induced growth estimates are higher in S1 compared with S2.

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[45] Note that the implementation of a private consumption tax replacement scheme to offset lost tariff revenues has a dampening effect on allocative efficiency in that compensatory increases in private consumption taxes reduce private demands.

[46] Note that the implementation of a private consumption tax replacement scheme to offset lost tariff revenues has a dampening effect on allocative efficiency in that compensatory increases in private consumption taxes reduce private demands.

[47] In a CGE model, the closure or split of exogenous/endogenous variables, determines the macroeconomic assumptions underlying the model. In this closure, this is merely a formalisation of the fact that the current and capital accounts must balance (i.e., balance of payments is zero).

[48] Chemical products, metal products, light manufacturing, services.

In the IC model specifications, estimates are also presented for the additional pro-competitive effects. Employing a partial equilibrium theoretical analysis, *ceteris paribus*, opening up imperfectly competitive sectors to trade competition through a unilateral abolition of tariff barriers leads to a rationalisation of firms in the industry whilst output of incumbent firms increases. With industry fixed costs spread over greater production at the firm level, average cost and output price under zero profit assumptions, fall in the long run.[49]

Thus, the pro-competitive estimates presented are *aggregate* efficiency gains across all industry firms from scale increases. In opening free trade with the RoAC (S1), most of the pro-competitive gains come from the non-food sectors ($US0.474bn). Given its high benchmark data mark-ups (i.e., high concentration) and significant export increases with the RoAC, the majority of these gains come from the 'motor vehicles' sector ($US0.360bn – not shown). In S2, food manufacturing accounts for most of the gain due to export expansion in the 'meat processing' sector ($US0.161bn – not shown).

*6.5 Regional Welfare Results – S4, S5 and S6.*

In S4, S5 and S6, we incorporate the elimination of additional NTB trade costs within the FTA agreements, where as elucidated in section 4.3, we characterise such trade impediments as 'iceberg costs'. In theoretical terms, the trade costs are equivalent variation monetary value estimates of an upward shift in the marginal value product of an input. In GTAP, the definition of such 'inputs' may be broadened to include primary factors, intermediate inputs, or even inputs (purchases) to final demands. Thus, in Table 9, additional trade cost efficiency estimate is attributed to greater trade possibilities

[49] This analysis is complicated in a general equilibrium specification, since it is possible that industry output may also decline as primary resources are diverted to sectors which are more trade competitive. Thus, as well as rationalisation in the number of firms, incumbent firms may also reduce the scale of their output.

from improved import ‘efficiency’. Note, that unlike tariff cuts, there is no loss in revenue to the importing country from the ‘removal’ of trade costs. Indeed, the welfare impacts are unambiguously positive as trade cost removal lowers the effective price of products on all affected bilateral routes in the importing country.

Thus, S4, S5 and S6 are counterpart experiments to S1, S2 and S3 in that they include the removal of trade cost estimates from the gravity specification. In Mercosur, the elimination of these ‘barriers’ stimulates considerable trade gains of $US23.399 - $US23.552bn under the FTAA agreement and $US12.173 - $US12.240bn under the EU FTA agreement, whilst the ‘additive’ trade cost gains in S6 are $US30.045 - $US30.352bn. The enhancement of trade through abolition/harmonisation of non-tariff measures also increases economic growth in Mercosur, such that trade induced technology transfer and capital growth increase $US2.640 - $US11.682bn and $US34.144 - $US40.522bn respectively ($US1.830 - $US7.848bn and $US19.624 - $US23.447bn respectively) in S4 (S5) compared with the baseline (see Table 9). Similarly, allocative efficiency gains relative to the baseline from increased imports rise $US11.686 - $US14.922bn and $US6.343 - $US8.250bn in S4 and S5 respectively.

With greater economic growth in Mercosur under abolition of trade costs in S4, S5 and S6, expanding output sectors place additional burdens on resource endowments leading to further factor price rises. As a result of further cost-push inflation, Mercosur’s export prices increase leading to significant terms of trade increases. In S4, where greater economic activity in Mercosur is apparent, the terms of trade rises $US6.091 - $US5.702bn, whilst corresponding figures for S5 are $US3.502 - $US3.359bn.

Examining the IC model variants, pro-competitive welfare gains in S4 and S5 (Table J) rise $US1.659bn and $US0.710bn respectively compared with the corresponding scenarios S1 and S2 in Table 8. As opposed to S2, the gains in S5 are now dominated by 'non-food' manufacturing sectors, particularly the 'motor vehicles' sector ($US0.412bn compared with the baseline – not shown). As in S1, 'non-food' manufacturing pro-competitive gains in S4 are considerably larger than 'food' manufacturing gains, over 6.5 times the magnitude. Indeed, once again most of the non-food manufacturing gain emanates from the motor vehicles sector ($US0.968bn compared with the baseline – not shown).

Finally, the long run EV regional gain estimates across both model variants in S4 and S5 for Mercusor are $US78.009 - $US98.616bn and $US43.494 - $US56.194bn respectively. This translates into long run per capita real income growth estimates of between 11.07% – 14.01% in S4 and 6.17% – 7.98% in S5. The combined opportunity cost of simultaneous FTA deals in both regions (S6) is $US107.841 - $US137.217bn (15.29% – 19.47% per capita real income growth).

## 7. Conclusions

Whilst the pace of multilateral trade reform continues to stall, the proliferation in bilateral and regional trade agreements in recent years signals a new approach in global trading relations. The US in particular has been pushing hard in this direction, seeking to create (inter alia) a Free Trade Area of the Americas (FTAA) and a Middle East Free Trade Area (MEFTA) initiative, whilst the EU, not to be outdone by American political initiatives is currently negotiating bilateral trade and/or association agreements with for example the Gulf Cooperation Council (Bahrain, Qatar, Kuwait, Oman, Saudi-Arabia), Mercosur (Argentine, Brazil, Paraguay and Uruguay), and the Mediterranean littoral countries and Syria. In addition, the EU plans to conclude regional trade liberalisation agreements, the so-called Economic Partnership Agreements, with the ACP-countries.

This shift in policy is reflected by the burgeoning number of empirical FTA studies in the literature. In the context of Mercosur, a number of CGE studies estimate significant potential long term gains from regional trading agreements with either the EU or the Rest of the Americas under the auspices of a Free Trade of the Americas Agreement. In this paper we revisit this issue, whilst attempting to deepen the trade literature by examining the impact from the removal of non-tariff barrier trade costs. More specifically, we estimate potential trade employing a residual based theoretically consistent gravity model, which allows for a comprehensive range of cultural, geographical, per capita income and infrastructure dummy variables consistent with recent gravity studies in the literature. The model results shows that the explanatory power of the model (adjusted $R^2$) is greater than 0.74 for a majority of sectors, while most of the explanatory variables are highly significant and affect trade consistently with the theory. Comparing potential trade estimates from the gravity model with actual trade flows, we derive NTB tariff equivalents across each of the sectors which are subsequently implemented within perfect and imperfectly competitive CGE model variants to calculate trade and welfare impacts.

Despite an array of different data sources, benchmark years and trade elasticity estimates, a comparison of our estimated long run[50] welfare impacts to Mercosur in scenarios 1 (EU FTA), 2 (EU FTA) and 3 (EU FTA and FTAA) shows concurrence with the literature in three respects. Firstly, trade creation is larger than trade diversion (i.e., net trade creating policies) resulting welfare gains to Mercosur in each scenario; secondly, additional pro-competitive effects magnify these welfare gains and finally the results in the simultaneous FTA scenario are additive of scenarios 1 and 2. Notwithstanding, our estimates in each scenario appear at the lower end of the range of

[50] Given the time span to implement bilateral FTAs through phased reductions in tariffs, the long term in this context could imply a period of between 10-15 years.

estimates in the literature. Moreover, in contrast to the results of Diao *et al.* (2003) and Monteagudo and Watanuki (2003), the gains to Mercosur from the EU-FTA appear to be smaller than under the FTAA scenario. This observed contradiction we explain through our choice of long run baseline which incorporates Millenium Round (multilateral) tariff reductions and European Enlargement (including trade cost eliminations) by the EU. Indeed, we speculate that the negative trade diversion impact on Mercosur from Eastern Enlargement is likely to mute potential welfare gains to Mercosur resulting in welfare estimates below those reported from a regional trading agreement.

Corresponding to scenarios 1, 2 and 3, scenarios 4, 5 and 6 include additional shocks to simulate the withdrawal/harmonisation of NTB measures between relevant regional trading areas. Monteagudo and Watanuki (2003) perform a similar extension in their study of Mercosur trading relations, employing borrowed NTB tariff equivalent cost estimates.[51] However, we refine this approach by explicitly estimating NTB tariff equivalents using a theoretically consistent gravity specification for all sectors. In particular we revisit the claim that removal of NTB estimates ‘doubles’ the welfare gains to Mercosur. Comparing scenarios 4, 5 and 6 with estimates in corresponding scenarios 1, 2 and 3 reveals considerable magnification of welfare gains to Mercosur above the level suggested in Monteagudo and Watanuki (2003). To some extent the magnitude of these gains is to be expected given the size of the NTB tariff equivalents extrapolated from the gravity model, whilst additional welfare enhancing pro-competitive, technology spillover and capital accumulation effects suggest that the estimates presented here are upper bound long run estimates. Furthermore, it should be noted that a neo-classical long run multi-region CGE representation has little to say

[51] Although, importantly, services trade is not included.

about the macroeconomic structural challenges (fiscal balance, exchange rate volatility, frictional movements in labour) that face trading partners from upheaval of resources from uncompetitive sectors, to those with comparative advantage. Moreover, the results of these simulations should be treated with caution in that they do not shed light on the degree of welfare distribution or poverty alleviation from any hypothesised trade deal. Notwithstanding, if the inferred NTB estimates from the econometric specification are to be believed, the long term potential for trade-led development policies of this nature in Mercosur is considerable.

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## 9. Appendix

### 1.1 Values of gravity variables in the composite regions

To calculate distances from a composite to an individual country, arbitrarily a capital city of the aggregated area was selected. The selections made are: for North Africa, Tunis in Tunisia; Middle East, Riyad in Saudi Arabia; Central America or CACM, Guatemala city (Guatemala); Rest of Andan Pact, Quito (Ecuador); Rest of Caribbean, Habana (Cuba); Rest of Free Trade Area of America or CARICOM, Kingston (Jamaica); Rest of North America, Juneau (Alaska); Rest of South America, Asunción (Paraguay); Rest of the World, Nairobi (Kenya).

To calculate the internal distances of the composites, an average of all the bilateral distances between capitals is calculated. In the Rest of the World composite, a country/ capital in each continent has been selected, and then, an average of the bilateral distances between these selected countries is calculated. These selected capitals (countries) were: Beijing (China) for Asia; Nairobi (Kenya) for Africa; Bern (Switzerland) for Europe; and Canberra (Australia) for Oceania.

To choose a value for the contiguity ($cont_{ij}$) variable when at least one of the countries involved is a composite, a value of 1 is assigned if there is a common border either with all the countries within the composite or with the country with the highest GDP of the composite. The common language variable ($lang_{ij}$) when at least one of the trade partners is a composite, takes value 1 when the country shares any of the languages spoken by the composite.

The quantitative variables, exports, GDP variables, population (used for per capita indicators) and infrastructure indicators, are aggregated across the countries within the composites to calculate the overall composite value. The price index for composites, are averages of the individual price indexes across the countries involved in the composite.

### 1.2 The composition of costs, mark-ups and free entry/exit of firms in imperfectly competitive industries.

Due to a lack of data on individual firm cost structures, all firms are assumed symmetric (i.e. the same cost and technology structure and face the same demand conditions) and treated as a micro-scaled version of the industry.

*(i) Mark-ups*
In imperfectly competitive industries, each firm possesses market power to mark-up output price (P) over marginal cost (MC) leading to short-run profits. A symmetric firm´s profit function is:

$$\Pi_i = PQ_i - TC_i \quad \text{(A1)}$$

where: $\Pi_i$ is profit; P is *industry* price; $Q_i$ is firm output; and $TC_i$ is total costs. Under Cournot assumptions, firms maximise profit subject to output changes, where each symmetric firm conjectures the output responses of rivals to changes in its own output. Taking the derivative $\left(\partial \pi_i / \partial Q_i\right)$, and manipulating the resulting first order conditions gives firm mark-ups as:

$$MARKUP_i = \frac{P - MC_i}{P} = \frac{\Omega_i}{N} \cdot \left| \frac{1}{\varepsilon} \right| \qquad \text{(A2)}$$

$\Omega_i$ is the conjectural variation parameter characterising changes in industry output (T) with respect to changes in firm output ($Q_i$); N is the number of firms in the industry; multiplied by the *absolute* value of the inverse elasticity of demand for the industry tradable. Under the assumption of symmetry, 1/N is equivalent to $Q_i/T$. Thus, we can derive the Cournot conjectural variation elasticity which describes the response of changes in industry output to changes in firm i's output:

$$\frac{\Omega_i}{N} = \frac{\partial T}{\partial Q_i} \frac{Q_i}{T} \qquad \text{(A3)}$$

In this paper, standard Cournot-Nash equilibrium is used, where Ω has a value of 1. Thus, firm 'i' believes that all rivals' outputs remain fixed. Thus, if N=3, a change in firm i output of 30% is translated as a change in industry output of 10%. Note that the value of N is updated by changes in the number of firms entering/leaving the imperfectly competitive industry (see below). Further, the differentiation of mark-ups from region 'r' across foreign and domestic bilateral routes ('s') is a function of endogenous changes in the absolute value of the inverse elasticity of domestic (r=s) and foreign (r≠s) demand. The composite industry mark-up in region 'r' is a weighted sales share of each of the bilateral sales mark-ups to regions 's' (r=s, r≠s).

*(ii) The structure of costs*

Examining expression (A2), with constant returns to scale in production yielding constant average variable costs (equal to marginal costs), and long run zero profits in each imperfectly competitive sector, a mark-up of 0.3 implies average variable and fixed cost components constitute 70% and 30% of the output price (or average total cost) respectively. Thus, the composite mark-up for each imperfectly competitive sector apportions *total* fixed and variable costs as fractions of total industry costs.

*(iii) Entry/exit of firms/varieties*

Long run profit is eliminated through entry/exit of firms (product variants) and is largely a function of (a) endogenous mark-up effects and (b) changes in average fixed (and therefore total) costs due to changes in output per firm (scale effects), where (a) and (b) combined are known as pro-competitive effects. Thus, a fall in the mark-up will signal, *ceteris paribus*, falling profits and therefore an exodus of firms from the industry (or *vice versa*). In linear terms (denoted by lower case letters), industry market clearing is given as:

$$qo_{i,r} = qofm_{i,r} + n_{i,r} \qquad \text{(A4)}$$

In the absence of changing industry output ($qo_{i,r}$), a reduction in firm numbers ($n_{i,r}$), will signal an increase in output per firm ($qofm_{i,r}$) which is also consistent with the reduction in the mark-up (or *vice versa*).

*(iv) Calibration of firm numbers*

Due to a lack of availability of concentration ratio data for the specific aggregation of regions and sectors in the model, the approach here is to employ a number of data sources and techniques to calibrate firm numbers in each of the industries/regions.

Following Elbehri and Hertel (2003), the Cournot mark-up condition can also be derived as:

$$\frac{P - MC_i}{P} = \frac{H}{\varepsilon} \quad \text{(A5)}$$

where H is the Herfindahl index of concentration which is the sum of the squared market shares of all n firms in the industry, and ε is the inverse elasticity of demand for the industry tradable. Comparing equations (A5) and (A2) and assuming a standard Cournot-Nash conjectural variation value (Ω) of 1, reveals that H = (1/N). Thus, for the EU15 and ROW we borrow Herfindahl estimates from Elbehri and Hertel (2003) to calibrate benchmark firm numbers. Given data constraints, for the EU10 we employ the HHI statistics for the EU15.

For Mercosur and the Rest of the American continent, three data sources are used. For Brasil we employ data from the Instituto Brasileiro De Geografia E Estatistica, Annual Industrial Survey, 1996. For Mexico, Instituto Nacional de Estadistica Geografia e Informatica, Censos Economicos, 1994, Sistema Automatizado de Información Censal 3.1. For the USA, US 1997 Census data for Manufacturing and services industries.

The data for Mexico and Brasil are cost structure data which allow us to estimate the Cost Disadvantage Ratio (CDR) measure of economies of scale for each industry given as:

$$CDR = \frac{AC - MC}{AC} = \frac{FC}{TC} \quad \text{(A6)}$$

where AC, MC, FC and TC are average, marginal, fixed and total costs respectively. As we assume long run zero-profits with free firm entry and exit, the ratio FC/TC ratio here is equivalent to the mark-up in equation (X2).

The US census data provides detailed Herfindahl data for US manufacturing industries, thereby allowing calculation of benchmark firm numbers through use of (A5) above.

Thus, the Mercosur composite is assumed to have the same mark-ups as Brasil. In the case of the Rest of the American continent, a weighted average is calculated based on the known regions (Brasil, Mexico and the USA).

## 1.3 Endogenous TFP growth from technology spillovers.

The endogenous TFP specification follows Robinson *et al.* (2002) as:

$$TFP_{j,r} = 1 + IMSHR_{j,r} \times \left[ \frac{INT_{j,r}}{INT_{j,r} + VA_{j,r}} \times \left[ \frac{\sum_t \sum_s X_{t,s,r}}{\sum_t \sum_s X^O_{t,s,r}} \right]^{\sigma_{j,r}} + \frac{VA_{j,r}}{INT_{j,r} + VA_{j,r}} - 1 \right]$$

Where:
*TFP* is total factor productivity growth which appears in the cost function of the industry
*IMSHR* is the share of the intermediate input of the technologically endowed product to industry j in total intermediate imports into sector j in r.
*INT* is intermediate input usage by sector j in r.
*VA* is primary factor usage by sector j in r.
$X$ and $X^0$ are import and base import flows respectively of the technologically endowed product (t)
$\sigma$ is the sectoral response elasticity of TFP to changes in imports of technologically intensive goods. Thus, *ceteris paribus*, a value of 0.1 would mean that a 5% increase in imports of technologically intensive goods would result in a 0.5% increase in TFP in that sector.
Moreover, as in Robinson et al. (2002), it is assumed that the technology transfer flow only moves from developed countries to developing countries.

## 10. Tables

| ($US Millions 2001) | **Value (world prices) of Mercosur imports from** | | **Value (world prices) of EU15 & RoAC imports from Mercosur** | |
|---|---|---|---|---|
| | **EU15** | **RoAC** | **EU15** | **RoAC** |
| Crops | 83.0 | 440.0 | 3788.0 | 1408.8 |
| Vegetables, fruit & nuts | 41.2 | 192.7 | 845.7 | 311.9 |
| Livestock | 40.6 | 56.5 | 99.0 | 108.5 |
| Other agriculture | 8.6 | 39.9 | 70.6 | 53.5 |
| Meat processing | 50.1 | 46.9 | 1449.5 | 547.4 |
| Vegetable oils & fats | 60.3 | 56.3 | 91.5 | 278.9 |
| Dairy | 47.1 | 17.7 | 7.1 | 240.7 |
| Sugar processing | 4.9 | 5.7 | 21.6 | 184.8 |
| Other food processing | 253.0 | 452.1 | 4747.7 | 1487.5 |
| Beverages & tobacco | 199.4 | 57.5 | 100.5 | 180.6 |
| Raw materials | 198.2 | 2247.9 | 1963.1 | 2633.4 |
| Textiles | 283.0 | 246.7 | 178.9 | 630.9 |
| Wearing apparel | 167.2 | 117.3 | 959.1 | 2168.2 |
| Wood products | 186.3 | 122.1 | 861.3 | 1543.8 |
| Paper & publishing | 686.9 | 793.9 | 783.3 | 1191.2 |
| Chemical products | 5026.8 | 5826.9 | 974.6 | 3122.3 |
| Metal products | 1835.6 | 1874.3 | 2086.2 | 4541.8 |
| Motor vehicles | 3512.6 | 2864.8 | 1761.6 | 6154.4 |
| Light manufacturing | 8599.6 | 10377.7 | 1139.5 | 5272.4 |
| Other manufacturing | 388.0 | 259.3 | 255.4 | 369.1 |
| Utilities | 882.0 | 879.3 | 23.9 | 10.1 |
| Services | 9229.6 | 5444.7 | 5443.6 | 2774.7 |
| **Total** | 31783.9 | 32420.2 | 27651.5 | 35214.9 |

Table 1: Mercosur Trade in 2001.
Source: Dimaranan, and McDougall (2005).

| | **Mercosur *ad valorem* tariff protection:** | | **A*d valorem* tariff protection on imports from Mercosur to:** | |
|---|---|---|---|---|
| | **EU15** | **RoAC** | **EU15** | **RoAC** |
| Crops | 5.4 | 1.5 | 3.7 | 9.7 |
| Vegetables, fruit & nuts | 9.8 | 10.6 | 13.4 | 2.8 |
| Livestock | 5.8 | 3.3 | 2.9 | 2.0 |
| Other agriculture | 0.8 | 11.3 | 1.3 | 1.6 |
| Meat processing | 11.3 | 8.3 | 66.9 | 7.4 |
| Vegetable oils & fats | 11.5 | 2.2 | 0.4 | 11.7 |
| Dairy | 18.0 | 16.0 | 33.0 | 35.6 |
| Sugar processing | 17.4 | 16.8 | 175.6 | 20.5 |
| Other food processing | 15.0 | 13.4 | 11.9 | 9.0 |
| Beverages & tobacco | 20.4 | 20.5 | 7.4 | 8.7 |
| Raw materials | 1.4 | 0.8 | 0.0 | 4.1 |
| Textiles | 17.6 | 16.4 | 5.7 | 10.6 |
| Wearing apparel | 19.2 | 13.5 | 3.5 | 8.2 |
| Wood products | 16.1 | 11.3 | 0.9 | 2.5 |
| Paper & publishing | 11.2 | 9.0 | 0.1 | 3.2 |
| Chemical products | 9.9 | 10.5 | 0.7 | 6.2 |
| Metal products | 13.2 | 11.2 | 2.9 | 4.7 |
| Motor vehicles | 12.1 | 6.2 | 1.3 | 6.7 |
| Light manufacturing | 13.1 | 11.8 | 0.1 | 4.3 |
| Other manufacturing | 17.7 | 19.0 | 0.0 | 5.4 |
| Utilities | 0.0 | 0.0 | 0.0 | 0.0 |
| Services | 0.0 | 0.0 | 0.0 | 0.0 |

Table 2: Mercosur and EU Trade protection (%) in 2001.
Source: Dimaranan, and McDougall (2005).

| | **Experiment A Elimination of tariffs only** | | | **Experiment B Elimination of tariffs and additional trade costs** | | |
|---|---|---|---|---|---|---|
| | **FTAA** | **EU FTA** | **Both FTA & FTAA** | **FTAA** | **EU FTA** | **Both FTA & FTAA** |
| **PC Model Variant** | 2.57 | 2.93 | 5.34 | 5.64 | 5.43 | 10.72 |
| **IC Model Variant** | 2.84 | 3.21 | 5.87 | 6.27 | 6.10 | 11.97 |

Table 3: Real GDP gains to Mercosur under FTA scenarios.
Source: Monteagudo and Watanuki, (2003)

Table 4. Estimation of the gravity equation

| Sector | | α | gdpi | gdpj | sqincij | Pri | Prj | Infri | Infrj | distij | Contij | Langij | Mtj | Xsi | $\overline{R}^2$ | Condition Number |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Crops | Coefficient | -39.419 | 1.487 | 1.012 | -0.009 | **-3.168** | 0.120 | 0.016 | **0.282** | **-0.918** | **1.311** | **0.558** | **0.077** | **0.073** | 0.724 | 80.725 |
| | std error | 1.089 | 0.026 | 0.029 | 0.015 | 0.195 | 0.197 | 0.042 | 0.045 | 0.059 | 0.235 | 0.163 | 0.009 | 0.010 | | |
| | p-value | 0.000 | 0.000 | 0.000 | 0.577 | 0.000 | 0.542 | 0.699 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | | |
| Vegetables, fruits and nuts | Coefficient | -32.744 | **1.224** | **0.856** | 0.002 | **-2.057** | **0.694** | -0.059 | **0.400** | **-0.651** | **1.510** | **0.519** | **0.058** | **-0.168** | 0.676 | 81.782 |
| | std error | 1.055 | 0.027 | 0.028 | 0.018 | 0.218 | 0.189 | 0.044 | 0.043 | 0.058 | 0.237 | 0.160 | 0.005 | 0.075 | | |
| | p-value | 0.000 | 0.000 | 0.000 | 0.932 | 0.000 | 0.000 | 0.187 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.026 | | |
| Livestock | Coefficient | -29.116 | **0.980** | **1.075** | **-0.025** | **-1.548** | 0.176 | **0.331** | **0.162** | **-0.909** | **1.473** | **0.259** | **0.046** | **0.474** | 0.762 | 80.469 |
| | std error | 0.822 | 0.023 | 0.022 | 0.013 | 0.176 | 0.156 | 0.035 | 0.036 | 0.046 | 0.185 | 0.123 | 0.008 | 0.210 | | |
| | p-value | 0.000 | 0.000 | 0.000 | 0.064 | 0.000 | 0.257 | 0.000 | 0.000 | 0.000 | 0.000 | 0.035 | 0.000 | 0.024 | | |
| Other agricultural products | Coefficient | -33.756 | **0.992** | **1.037** | **-0.038** | **-0.802** | **0.928** | -0.002 | **0.219** | **-0.776** | **1.054** | **0.585** | | | 0.599 | 77.283 |
| | std error | 1.121 | 0.037 | 0.030 | 0.017 | 0.261 | 0.193 | 0.065 | 0.044 | 0.066 | 0.282 | 0.183 | | | | |
| | p-value | 0.000 | 0.000 | 0.000 | 0.029 | 0.002 | 0.000 | 0.981 | 0.000 | 0.000 | 0.000 | 0.001 | | | | |
| Meat | Coefficient | -25.669 | **0.882** | **0.858** | -0.005 | **0.411** | **0.410** | **0.447** | **0.160** | **-0.463** | **2.091** | **0.851** | **0.050** | **-0.012** | 0.762 | 80.469 |
| | std error | 0.956 | 0.025 | 0.026 | 0.018 | 0.184 | 0.168 | 0.033 | 0.040 | 0.060 | 0.240 | 0.163 | 0.004 | 0.003 | | |
| | p-value | 0.000 | 0.000 | 0.000 | 0.772 | 0.025 | 0.015 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | | |
| Vegetable oils and fats | Coefficient | -31.952 | **1.111** | **0.926** | **-0.023** | -1.021 | -0.082 | **0.217** | **0.080** | **-0.817** | **1.526** | **0.384** | **0.077** | **-0.064** | 0.715 | 82.273 |
| | std error | 1.031 | 0.026 | 0.025 | 0.017 | 0.160 | 0.161 | 0.035 | 0.036 | 0.056 | 0.274 | 0.176 | 0.009 | 0.153 | | |
| | p-value | 0.000 | 0.000 | 0.000 | 0.168 | 0.000 | 0.611 | 0.000 | 0.027 | 0.000 | 0.000 | 0.029 | 0.000 | 0.674 | | |
| Dairy | Coefficient | -26.263 | **0.902** | **0.926** | **-0.058** | 0.209 | **0.405** | **0.486** | -0.062 | **-0.696** | **1.707** | **0.493** | **0.029** | 0.001 | 0.735 | 81.405 |
| | std error | 0.940 | 0.022 | 0.024 | 0.014 | 0.152 | 0.169 | 0.029 | 0.039 | 0.051 | 0.232 | 0.154 | 0.003 | 0.005 | | |
| | p-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.170 | 0.017 | 0.000 | 0.115 | 0.000 | 0.000 | 0.001 | 0.000 | 0.793 | | |
| Sugar | Coefficient | -32.707 | **1.111** | **0.954** | **-0.071** | **-1.784** | 0.141 | **0.153** | 0.037 | **-0.849** | **1.284** | **0.373** | **0.044** | 0.000 | 0.661 | 83.333 |
| | std error | 1.089 | 0.025 | 0.028 | 0.020 | 0.202 | 0.188 | 0.042 | 0.042 | 0.063 | 0.258 | 0.171 | 0.004 | 0.003 | | |
| | p-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.454 | 0.000 | 0.373 | 0.000 | 0.000 | 0.030 | 0.000 | 0.875 | | |

.../cont.

| Sector | | α | gdpi | gdpj | sqincij | Pri | Prj | Infri | Infrj | distij | Contij | Langij | Mtj | Xsi | $\overline{R}^2$ | Condition Number |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Other food products | Coefficient | -27.587 | **1.092** | **0.915** | **-0.026** | **-1.253** | 0.144 | -0.015 | **0.266** | **-0.853** | **1.435** | **1.342** | **0.028** | **0.130** | 0.741 | 80.885 |
| | std error | 0.823 | 0.024 | 0.024 | 0.013 | 0.196 | 0.161 | 0.044 | 0.038 | 0.048 | 0.166 | 0.131 | 0.005 | 0.032 | | |
| | p-value | 0.000 | 0.000 | 0.000 | 0.048 | 0.000 | 0.371 | 0.735 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | | |
| Beverages and tobacco | Coefficient | -22.933 | **0.874** | **0.780** | **-0.037** | **0.295** | **1.186** | **0.296** | **0.227** | **-0.520** | **1.362** | **1.659** | **0.023** | **0.556** | 0.730 | 80.489 |
| | std error | 0.882 | 0.022 | 0.023 | 0.015 | 0.175 | 0.158 | 0.037 | 0.036 | 0.050 | 0.206 | 0.140 | 0.003 | 0.132 | | |
| | p-value | 0.000 | 0.000 | 0.000 | 0.015 | 0.092 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | | |
| Raw materials | Coefficient | -34.542 | **1.333** | **1.134** | **-0.032** | **-2.132** | **-0.905** | **0.126** | **0.424** | **-1.037** | **0.954** | **0.657** | **0.080** | **-0.162** | 0.727 | 80.166 |
| | std error | 1.064 | 0.030 | 0.028 | 0.014 | 0.177 | 0.189 | 0.043 | 0.045 | 0.057 | 0.221 | 0.173 | 0.021 | 0.031 | | |
| | p-value | 0.000 | 0.000 | 0.000 | 0.026 | 0.000 | 0.000 | 0.004 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | | |
| Textiles | Coefficient | -25.497 | **1.144** | **0.977** | **0.037** | **-1.029** | **-0.615** | **0.245** | **0.104** | **-1.435** | **0.319** | **0.450** | **0.013** | **0.018** | 0.802 | 82.766 |
| | std error | 0.778 | 0.021 | 0.021 | 0.014 | 0.121 | 0.154 | 0.029 | 0.037 | 0.045 | 0.167 | 0.115 | 0.006 | 0.008 | | |
| | p-value | 0.000 | 0.000 | 0.000 | 0.009 | 0.000 | 0.000 | 0.000 | 0.005 | 0.000 | 0.055 | 0.000 | 0.037 | 0.026 | | |
| Wearing apparel | Coefficient | -24.585 | **1.080** | **0.946** | 0.011 | **-2.084** | **0.363** | **0.105** | **0.095** | **-1.261** | **0.311** | **0.302** | -0.007 | **-0.027** | 0.789 | 82.401 |
| | std error | 0.798 | 0.021 | 0.021 | 0.013 | 0.127 | 0.150 | 0.029 | 0.034 | 0.043 | 0.169 | 0.120 | 0.005 | 0.010 | | |
| | p-value | 0.000 | 0.000 | 0.000 | 0.411 | 0.000 | 0.016 | 0.000 | 0.006 | 0.000 | 0.065 | 0.012 | 0.134 | 0.010 | | |
| Word products | Coefficient | -23.622 | **0.971** | **1.010** | 0.007 | **-0.331** | **0.522** | **0.388** | **0.170** | **-1.274** | **0.699** | **0.676** | **0.024** | **0.111** | 0.728 | 81.249 |
| | std error | 0.971 | 0.025 | 0.026 | 0.016 | 0.145 | 0.183 | 0.032 | 0.043 | 0.052 | 0.200 | 0.149 | 0.009 | 0.021 | | |
| | p-value | 0.000 | 0.000 | 0.000 | 0.668 | 0.023 | 0.004 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.006 | 0.000 | | |
| Paper & publishing | Coefficient | -26.083 | **1.034** | **0.953** | -0.011 | **1.163** | **-0.348** | **0.226** | **0.075** | **-1.136** | **1.051** | **1.002** | **0.016** | **0.276** | 0.816 | 79.846 |
| | std error | 0.754 | 0.019 | 0.019 | 0.012 | 0.131 | 0.136 | 0.030 | 0.036 | 0.044 | 0.174 | 0.120 | 0.007 | 0.033 | | |
| | p-value | 0.000 | 0.000 | 0.000 | 0.355 | 0.000 | 0.010 | 0.000 | 0.035 | 0.000 | 0.000 | 0.000 | 0.035 | 0.000 | | |
| Chemical products | Coefficient | -25.558 | **1.076** | **1.013** | 0.008 | 0.193 | **-1.262** | **0.338** | 0.019 | **-1.104** | **0.677** | **0.995** | **-0.031** | **-0.051** | 0.835 | 80.473 |
| | std error | 0.665 | 0.021 | 0.020 | 0.011 | 0.132 | 0.149 | 0.038 | 0.042 | 0.039 | 0.144 | 0.107 | 0.010 | 0.015 | | |
| | p-value | 0.000 | 0.000 | 0.000 | 0.445 | 0.143 | 0.000 | 0.000 | 0.643 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | | |

.../cont.

| Sector | | $\alpha$ | gdpi | gdpj | sqincij | Pri | Prj | Infri | Infrj | distij | Contij | Langij | Mtj | Xsi | $\overline{R}^2$ | Condition Number |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Metal products | Coefficient | -29.404 | **1.203** | **1.090** | 0.014 | **-0.526** | -0.205 | **0.398** | -0.003 | **-1.370** | **0.713** | **0.723** | **0.022** | 0.049 | 0.800 | 80.981 |
| | std error | 0.820 | 0.024 | 0.022 | 0.012 | 0.148 | 0.165 | 0.039 | 0.046 | 0.048 | 0.173 | 0.124 | 0.010 | 0.056 | | |
| | p-value | 0.000 | 0.000 | 0.000 | 0.231 | 0.000 | 0.214 | 0.000 | 0.941 | 0.000 | 0.000 | 0.000 | 0.026 | 0.378 | | |
| Motor Vehicles | Coefficient | -30.606 | **1.215** | **0.974** | -0.005 | **0.753** | **0.439** | **0.270** | **0.078** | **-1.141** | **0.783** | **0.460** | **0.039** | **0.238** | 0.769 | 80.649 |
| | std error | 0.918 | 0.025 | 0.027 | 0.012 | 0.163 | 0.181 | 0.039 | 0.047 | 0.054 | 0.188 | 0.135 | 0.008 | 0.055 | | |
| | p-value | 0.000 | 0.000 | 0.000 | 0.674 | 0.000 | 0.016 | 0.000 | 0.095 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | | |
| Light manufacturing | Coefficient | -25.965 | **1.131** | **1.023** | **0.032** | **0.717** | **-0.636** | **0.443** | **0.144** | **-1.248** | **0.353** | **0.822** | **0.036** | **-0.050** | 0.820 | 79.584 |
| | std error | 0.762 | 0.021 | 0.023 | 0.013 | 0.130 | 0.158 | 0.034 | 0.046 | 0.044 | 0.163 | 0.115 | 0.012 | 0.023 | | |
| | p-value | 0.000 | 0.000 | 0.000 | 0.011 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.031 | 0.000 | 0.003 | 0.031 | | |
| Other manufactures | Coefficient | -30.730 | **1.092** | **1.005** | 0.018 | **0.339** | 0.129 | **0.230** | **0.083** | **-0.979** | **0.538** | **0.862** | 0.010 | **0.129** | 0.816 | 81.743 |
| | std error | 0.751 | 0.020 | 0.021 | 0.012 | 0.128 | 0.149 | 0.031 | 0.035 | 0.042 | 0.152 | 0.108 | 0.007 | 0.032 | | |
| | p-value | 0.000 | 0.000 | 0.000 | 0.115 | 0.008 | 0.389 | 0.000 | 0.017 | 0.000 | 0.000 | 0.000 | 0.145 | 0.000 | | |
| Utilities | Coefficient | -17.999 | **0.634** | **0.949** | **-0.040** | **-0.396** | -0.073 | **0.503** | **0.441** | **-0.474** | **1.051** | **-0.786** | | | 0.611 | 76.761 |
| | std error | 1.046 | 0.026 | 0.026 | 0.016 | 0.150 | 0.155 | 0.032 | 0.035 | 0.057 | 0.278 | 0.136 | | | | |
| | p-value | 0.000 | 0.000 | 0.000 | 0.013 | 0.008 | 0.640 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | | | | |
| Services | Coefficient | -22.784 | **0.804** | **0.877** | -0.004 | **0.559** | **0.473** | **0.213** | **0.153** | **-0.162** | **-0.339** | **-0.104** | | | 0.933 | 76.757 |
| | std error | 0.317 | 0.008 | 0.008 | 0.005 | 0.051 | 0.051 | 0.012 | 0.013 | 0.017 | 0.069 | 0.051 | | | | |
| | p-value | 0.000 | 0.000 | 0.000 | 0.434 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.042 | | | | |

| Importer | Exporter | Crops | Vegetables, fruits and nuts | Livestock | Other agricultural products | Meat | Vegetable oils and fats | Dairy | Sugar | Other food products | Beverages and tobacco | Raw materials |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mercosur | EU15 | 31.4 | 68.6 | 104.7 | 48.6 | 37.6 | 22.1 | 46.0 | 78.5 | 71.0 | 165.5 | 28.1 |
| Mercosur | EU10 | 84.8 | 160.7 | 191.7 | 109.4 | 36.6 | 50.2 | 54.5 | 102.1 | 98.0 | 192.1 | 29.6 |
| Mercosur | America | 40.6 | 87.2 | 142.7 | 42.2 | 52.1 | 48.2 | 81.1 | 124.5 | 89.3 | 335.5 | 20.1 |
| EU15 | Mercosur | 3.5 | 78.1 | 90.9 | 43.0 | 3.2 | 8.6 | 79.5 | 132.9 | 4.2 | 229.5 | 16.1 |
| EU10 | Mercosur | 45.6 | 93.6 | 109.8 | 69.0 | 11.1 | 5.1 | 37.4 | 156.3 | 12.4 | 509.2 | 21.1 |
| America | Mercosur | 47.3 | 122.0 | 145.0 | 75.3 | 3.6 | 9.9 | 20.9 | 34.3 | 60.8 | 164.1 | 30.6 |
| EU15 | EU10 | 52.1 | 117.3 | 165.4 | 91.2 | 29.8 | 88.6 | 54.8 | 132.7 | 99.0 | 262.2 | 27.6 |
| EU10 | EU15 | 98.2 | 52.7 | 143.8 | 58.4 | 34.8 | 35.6 | 64.2 | 107.3 | 90.7 | 323.5 | 33.6 |

| Importer | Exporter | Textiles | Wearing apparel | Wood products | Paper & publishing | Chemical products | Metal products | Motor vehicles | Light manufacturing | Other manufactures | Utilities | Services |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mercosur | EU15 | 30.8 | 29.6 | 35.1 | 19.7 | 12.4 | 16.6 | 27.0 | 13.6 | 29.6 | 8.3 | 36.3 |
| Mercosur | EU10 | 49.8 | 40.8 | 57.0 | 37.2 | 21.8 | 7.7 | 22.3 | 10.1 | 39.1 | 7.6 | 39.9 |
| Mercosur | America | 61.8 | 64.9 | 66.3 | 31.7 | 28.4 | 43.6 | 51.7 | 26.3 | 54.8 | 10.0 | 58.0 |
| EU15 | Mercosur | 34.4 | 29.9 | 6.7 | -12.9 | 16.7 | 3.3 | 15.9 | 12.0 | 25.3 | 122.9 | 51.4 |
| EU10 | Mercosur | 44.6 | 30.2 | 25.6 | -2.4 | 24.3 | -1.4 | 11.2 | 10.8 | 40.8 | 110.4 | 56.6 |
| America | Mercosur | 32.3 | 28.7 | 11.5 | -3.0 | 16.8 | 9.5 | 7.1 | 7.7 | 33.1 | 189.8 | 89.7 |
| EU15 | EU10 | 32.8 | 32.4 | 25.2 | 21.2 | 29.7 | 27.5 | 20.7 | 10.5 | 33.6 | 70.7 | 37.2 |
| EU10 | EU15 | 28.9 | 28.7 | 41.4 | 32.4 | 25.9 | 25.3 | 46.3 | 21.3 | 38.9 | 61.8 | 39.1 |

Table 5. NTB tariff-equivalents

| ($USm 2001) | Benchmark | PC S1 | PC S2 | PC S3 | IC S1 | IC S2 | IC S3 |
|---|---|---|---|---|---|---|---|
| Crops | 9318.4 | -130.8 | -985.0 | -1135.2 | -192.5 | -1051.9 | -1253.5 |
| Veg, Fruit Nuts | 756.2 | -77.5 | 183.4 | 96.4 | -83.8 | 180.9 | 86.9 |
| Livestock | 112.1 | -15.3 | -70.9 | -86.2 | -16.9 | -74.5 | -91.3 |
| Other Agr. | 97 | -20.0 | -23.7 | -43.3 | -21.5 | -25.2 | -46.1 |
| Meat proc. | 3406.1 | -27.9 | 6804.0 | 6486.5 | -33.2 | 7003.9 | 6669.8 |
| Veg. Oils, Fats | 2133.2 | 61.3 | -255.4 | -211.6 | 79.6 | -273.4 | -212.6 |
| Dairy | 215.1 | 957.6 | -107.6 | 736.6 | 973.0 | -109.2 | 747.0 |
| Sugar proc | 1507.1 | 80.4 | 968.2 | 1001.7 | 80.9 | 1008.3 | 1042.1 |
| Oth. food proc. | 6947.1 | -35.1 | 1630.3 | 1481.0 | -35.2 | 1679.5 | 1531.4 |
| Bevs & Tobac. | 28.5 | -5.7 | -45.8 | -50.3 | -5.8 | -45.7 | -49.9 |
| Raw materials | -493.9 | -54.5 | -105.4 | -210.0 | -67.7 | -134.2 | -256.7 |
| Textiles | -538 | 195.0 | -210.8 | -0.7 | 186.7 | -211.6 | -11.6 |
| Wearing app. | 3024 | 853.3 | -84.2 | 658.9 | 823.4 | -74.8 | 636.0 |
| Wood prod | 2044.1 | -3.1 | -151.1 | -172.4 | -19.1 | -156.9 | -200.5 |
| Paper & Publ. | 830.1 | -264.0 | -329.6 | -602.9 | -293.4 | -336.3 | -639.4 |
| Chemical Prod | -10146.2 | -974.0 | -1358.2 | -2142.5 | -1061.4 | -1402.4 | -2271.2 |
| Metal Prod. | 3464.8 | -195.7 | -652.9 | -882.5 | -289.0 | -660.8 | -991.6 |
| Motor Veh. | 1031.0 | 3277.0 | -1083.4 | 2044.5 | 3996.8 | -1076.3 | 2786.7 |
| Light Manu. | -18574.6 | -2072.3 | -3302.3 | -4438.6 | -2269.6 | -3364.9 | -4708.4 |
| Other Manu. | -415.7 | -219.7 | -369.7 | -547.7 | -236.9 | -371.8 | -568.9 |
| Utilities | -2193.5 | -80.9 | -23.8 | -114.0 | -96.0 | -29.6 | -133.9 |
| Services | -7133.1 | -1399.3 | -520.9 | -2113.0 | -1587.4 | -577.8 | -2341.9 |
| **Total** | **-4580.2** | **-145.0** | **-94.9** | **-245.0** | **-169.0** | **-104.5** | **-277.6** |
| **Agro-food** | **24520.8** | **787.0** | **8097.4** | **8275.8** | **744.6** | **8292.9** | **8423.8** |
| **Non Agro-food** | **-29101.0** | **-931.9** | **-8192.3** | **-8520.8** | **-913.6** | **-8397.3** | **-8701.4** |

Table 6: Mercosur sector Trade balance changes under S1, S2 and S3 relative to the baseline for perfectly competitive (PC) and imperfectly competitive (IC) model variants

| % changes on the baseline | PC S1 | PC S2 | PC S3 | IC S1 | IC S2 | IC S3 |
|---|---|---|---|---|---|---|
| **Factor prices:** | | | | | | |
| Land | 4.08 | 36.53 | 38.46 | 4.10 | 38.09 | 39.99 |
| Unskilled Labour | 2.70 | 1.48 | 4.35 | 3.19 | 1.65 | 5.00 |
| Skilled Labour | 2.60 | 1.39 | 4.20 | 3.12 | 1.58 | 4.89 |
| Capital | 0.35 | -0.54 | 0.25 | 0.44 | -0.53 | 0.33 |
| Natural Resources | 2.75 | -0.05 | 1.63 | 2.89 | 0.04 | 1.88 |
| **General price index** | 1.63 | 0.97 | 2.75 | 1.71 | 0.98 | 2.82 |

Table 7: Changes in factor prices and the general price index in Mercosur under S1, S2 and S3

| **Perfectly Competitive variant:** | **S1** | **S2** | **S3** |
|---|---|---|---|
| Equivalent Variation (EV) | 8589.4 | 7298.8 | 16061.7 |
| EV (per capita real income gain %) | 1.22 | 1.04 | 2.28 |
| *Of which:* | | | |
| Allocative Efficiency | 1679.8 | 1205.4 | 3460.2 |
| Terms of Trade | 826.5 | 780.8 | 1902.3 |
| Trade Induced Growth | 306.7 | 132.6 | 455.0 |
| Trade Costs | 0.0 | 0.0 | 0.0 |
| Net Capital Accumulation | 5776.4 | 5180.0 | 10244.2 |
| **Imperfectly Competitive variant:** | **S1** | **S2** | **S3** |
| Equivalent Variation (EV) | 11651.1 | 8743.4 | 20488.1 |
| EV (per capita real income gain %) | 1.66 | 1.24 | 2.91 |
| *Of which:* | | | |
| Allocative Efficiency | 2179.8 | 1428.4 | 4173.5 |
| Terms of Trade | 760.3 | 781.6 | 1826.9 |
| Pro-Competitive | 522.0 | 317.1 | 783.9 |
| *Of which:* | | | |
| *Food Sectors* | *47.8* | *227.1* | *258.7* |
| *Non-food sectors* | *474.2* | *90.0* | *525.2* |
| Trade Induced Growth | 1430.0 | 605.8 | 2075.9 |
| Trade Costs | 0.0 | 0.0 | 0.0 |
| Net Capital Accumulation | 6759.0 | 5610.5 | 11627.9 |

Table 8: Welfare Impacts relative to the Baseline under S1, S2 and S3

| **Perfectly Competitive variant:** | **S4** | **S5** | **S6** |
|---|---|---|---|
| Equivalent Variation (EV) | 78009.4 | 43494.3 | 107841.3 |
| EV (per capita real income gain %) | 11.07 | 6.17 | 15.29 |
| *Of which:* | | | |
| Allocative Efficiency | 11686.1 | 6342.8 | 17448.7 |
| Terms of Trade | 6091.2 | 3502.0 | 10729.6 |
| Trade Induced Growth | 2639.5 | 1830.1 | 3861.3 |
| Trade Costs | 23398.9 | 12172.9 | 30044.8 |
| Net Capital Accumulation | 34144.2 | 19624.3 | 45602.6 |
| Capital Goods production | 49.5 | 22.2 | 154.3 |
| **Imperfectly Competitive variant:** | **S4** | **S5** | **S6** |
| Equivalent Variation (EV) | 98616.3 | 56193.5 | 137216.6 |
| EV (per capita real income gain %) | 14.01 | 7.98 | 19.47 |
| *Of which:* | | | |
| Allocative Efficiency | 14921.8 | 8250.1 | 22014.6 |
| Terms of Trade | 5701.7 | 3358.5 | 10203.9 |
| Pro-Competitive | 2181.0 | 1027.3 | 2660.8 |
| *Of which:* | | | |
| *Food Sectors* | *285.1* | *364.2* | *561.5* |
| *Non-food sectors* | *1895.9* | *663.1* | *2099.3* |
| Trade Induced Growth | 11681.6 | 7847.8 | 17099.4 |
| Trade Costs | 23552.3 | 12239.9 | 30352.0 |
| Net Capital Accumulation | 40522.3 | 23447.3 | 54725.9 |
| Capital Goods production | 55.6 | 22.6 | 160.0 |

Table 9: Welfare Impacts relative to the Baseline under S4, S5 and S6