

**The Impact of South-South  
Preferential Trade Agreements  
on Industrial Development:  
An Empirical Test**

# The Impact of South-South Preferential Trade Agreements on Industrial Development: An Empirical Test<sup>1</sup>

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## Abstract

Preferential trade agreements could lead to a reallocation of resources across sectors and countries. Production patterns resulting from North-North regional integration initiatives have been documented in several studies. However, empirical evidence on South-South arrangements is limited. The purpose of this paper is to fill this gap in the empirical literature by looking at the effects of the establishment of MERCOSUR on manufacturing production patterns in Argentina, Brazil, and Uruguay over the period 1985-1998. We find that deepened preferential trade liberalization has fostered a reshaping of manufacturing production according to regional comparative advantage in labor and skilled labor. Furthermore, declining internal tariffs have weakened agglomeration forces determined by the distribution of market sizes. By using GMM estimation techniques, we ensure that these results are robust to endogeneity and serial correlation problems.

### Keywords:

Preferential Trade Liberalization  
Production Patterns, MERCOSUR

### JEL-Classification

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## 1. Introduction

The number of South-South preferential trade agreements has rapidly increased in recent years. In Latin America 17 trade treaties were signed between 1991 and 2002 (see IADB, 2002). Not surprisingly, there is an ongoing policy debate about the implications of these agreements for the involved nations (see World Bank, 2000, and Panagariya, 2000). Some authors argue that developing countries have small economies with a relatively similar and concentrated production structures so that there is a priori not much hope for strong gains in terms of new opportunities for production and trade generated by regional integration (see, e.g., Leamer, 1998, Schiff, 1996).

Formal analyses of the consequences of South-South trade arrangements confirm some of these fears. Thus, Venables (2003) uses the traditional concepts of comparative advantage and trade creation–trade diversion and predicts that these agreements can foster a process of production and income divergence among members, giving rise to a clear pattern of losers and winners. In particular, the economies with regional comparative disadvantage in manufacturing can loose via trade-diversion effects. Puga and Venables (1998) use a framework where cumulative processes triggered by economies of scales and cost and demand linkages can potentially induce concentration of industrial activities in certain countries. Specifically, these authors show that South-South trade arrangements can be associated with a very unequal spread of industry among participating countries, at least during the transition towards internal free trade. Both Venables (2003) and Puga and Venables (1998) therefore conclude that preferential trade agreements between developing countries can potentially generate diverging patterns of industrial development across members. Moreover, both papers argue that developing countries seem to be better served by trade arrangements with developed nations.

To what extent have the above predictions been confirmed in practice? We do not know. The existing empirical evidence on the impact of South-South agreements on industrial production patterns is scarce. This is in contrast to the numerous studies that analyze the cases of North-North and North-South preferential trade arrangements.<sup>2</sup>

The purpose of this paper is to fill the aforementioned gap in the empirical literature by looking at the effects of the establishment of MERCOSUR on manufacturing production patterns in Argentina, Brazil, and Uruguay over the period 1985-1998.<sup>3</sup>

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<sup>2</sup> See, e.g., Brülhart and Torstensson (1996), Amiti (1998), Brülhart (1998a, 1998b, 2001), Haaland et al. (1999), Ulltveit-Moe et al. (2000a), and Ulltveit-Moe et al. (2000b) for the North-North case, and Hanson (1997, 1998) for North-South integration.

<sup>3</sup> Unfortunately, Paraguay could not be included in the analysis due to missing data.

MERCOSUR provides an interesting case study. Established in 1991 by Argentina, Brazil, Paraguay, and Uruguay, this regional integration agreement is undoubtedly one of the most important trade initiatives among developing countries. Intra-regional trade was gradually liberalized between 1991 and 1994 for most sectors and a Common External Tariff (CET) was implemented in 1995, which includes tariff rates that vary between 0% and 20%. For some items temporarily excluded from the CET, external barriers were set at larger values. Potential problems stemming from trade diversion might therefore be substantial. Furthermore, MERCOSUR is a customs union formed by countries with important size differences. Brazil, the largest economy in the bloc, has a GDP that is 10 or 15 times that of the smaller countries (Uruguay or Paraguay). This allows us to study whether this size asymmetry is a relevant factor affecting the dynamic of industrial development within the area.

More precisely, we address the following questions: Has MERCOSUR had an impact on the spatial distribution of industrial activity in member countries? To what extent did traditional factor endowments and intensities matter relative to market size and input-output linkages for the location of industry within MERCOSUR? Did the relative importance of these forces change as a result of preferential trade liberalization and the enlargement of the regional market?

We find that higher preference margins tend to be associated with a higher sensitivity of production patterns to comparative advantage considerations along two dimensions: labor and human capital (skilled labor).<sup>4</sup> Hence, in the presence of larger preference margins, labor and human capital intensive industries show a stronger tendency to locate in countries with larger endowments of labor and human capital, respectively. Interestingly, we do not find any significant impact of these preferences on the responsiveness of production patterns of industries using intensively agriculture inputs to countries' endowments of arable land. Argentina, Brazil, and Uruguay have a revealed comparative advantage in these sectors. Thus, as expected from the theory, we find that regional preferences have no significant impact in those sectors in which countries have a global comparative advantage.

On the other hand, lower internal tariffs weaken the tendency of sectors with increasing returns to scale to locate in countries with larger market potentials. This result is consistent with theory suggesting that deepened internal trade liberalization generates a weakening of agglomeration forces determined by the distribution of market sizes. By

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<sup>4</sup> We use interchangeably skilled labor and human capital throughout the paper.

using GMM estimation techniques, we ensure that all the above results are robust to accounting for serial correlation and endogeneity problems.

The remainder of this paper is structured as follows: Section 2 reviews theoretical analyses of the effect of preferential trade liberalization among developing countries on production patterns. Section 3 presents a brief summary of trade policy reforms in MERCOSUR member countries. Section 4 introduces the dataset and describes basic stylized facts about industrial development in these countries. Section 5 explains the empirical methodology. Section 6 reports and discusses the estimation results showing the impact of MERCOSUR on manufacturing production patterns. Section 7 concludes.

## 2. Theoretical Framework

How does preferential trade liberalization between developing countries affect industry development patterns? This section reviews the predictions from two alternative theoretical approaches. Each of the analyses assumes a different view as to why countries trade with each other. Venables (2003) emphasizes the traditional comparative advantage mechanism and trade diversion-trade creation effects. On the other hand, Venables and Puga (1998) introduce cumulative processes triggered by economies of scale and cost and demand linkages. We believe that by covering these two approaches we are exhausting most plausible explanations (from a trade theory perspective) of the spatial spread of industry.

### 2.1 *Preferential Trade Liberalization and Comparative Advantage*

Venables (2003) proposes a model along the lines of traditional trade theory. He shows that the impact of preferential arrangements hinges upon the comparative advantage of member countries, relative to each other and relative to the rest of the world. In particular, countries with a comparative advantage between that of their partners and the rest of the world benefit at the expense of countries having an “extreme” comparative advantage. The explanation is as follows: Assume that two developing countries, A and B, decide to establish a customs union. There are two sectors: agriculture, which is intensive in unskilled labor, and manufacturing, which is intensive in skilled labor. Suppose further that both countries are abundant in unskilled labor relative to the rest of the world. Country B is also abundant in this factor relative to the partner. Evidently, this second country has an “extreme” comparative advantage, while the other one has an “intermediate” comparative advantage. As a consequence, the formation of a customs union between these two countries will result in country A exporting manufacturing to B who will export agriculture goods in return. Generally, the launching of a preferential trade agreement among developing countries with different comparative disadvantage

relative to the rest of the world tends to induce a restructuring of manufacturing production in favor of the country that, even with a comparative disadvantage relative to the world, has a comparative advantage within the newly created regional economic space so that consumers would be increasingly supplied with manufactures stemming from that country.

From the discussion above, we can conclude that South-South preferential trade liberalization magnifies the relative importance of regional comparative advantage in shaping manufacturing production patterns across member countries for those sectors where they have a comparative disadvantage *vis-à-vis* the rest of the world. Thus, higher preferential margins will be associated with a greater tendency of sectors to locate in the country that, within the region, is relatively abundant in those factors used intensively in their production processes. Hence, if we were to apply this theory to MERCOSUR, we expect that these preferences will fundamentally affect the pattern of industrial development across member countries in labor intensive and human capital intensive sectors, where these countries do not have a global comparative advantage, but not in agriculture intensive industries, where the region is an internationally efficient supplier (see, e.g., Volpe Martincus, 2003, and Sanguinetti and Bianchi, 2004).

## **2.2 *Regional Trade Liberalization and Market Enlargement: Scale Economies and Input-Output Linkages***

Puga and Venables (1998) explore the implications of different trading arrangements on industrial development and intra-regional disparities using a new trade model that features cumulative causation through input-output linkages among firms that have increasing returns to scale and operate in imperfectly competitive environments.

These authors highlight that preferential trade arrangements between developing countries can lead to industrialization of the region as a whole as a consequence of the effective market enlargement induced by reducing intra-South barriers.<sup>5</sup> Moreover, as usual in this kind of settings, agglomeration forces are strongest for intermediate trade costs. Hence, for intermediate tariffs the outcome within the bloc is asymmetric where the manufacturing industry tends to concentrate in one the member countries. Which country hosts the industry? In the framework considered by Puga and Venables (1998), countries are assumed to be initially identical so that there is no basis to discriminate between them.

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<sup>5</sup> Puga and Venables (1998) assume that initially there is no industry in the South countries. This analysis can be easily extended to the case where industry is initially present by assuming that transport costs between North and South are large enough.

In addition, in this case, the aforementioned diverging pattern between countries may be only transitional, since industries may start to disperse as tariffs are reduced enough.<sup>6</sup>

However, the indeterminacy may disappear if size asymmetry prevails. In particular, a large domestic market increases the attraction of a country as a base for industrial sectors with increasing returns to scale. The uneven spread is then driven by cost and demand linkages to other firms in the same country, i.e., as more firms settle in the same location, more intermediate inputs will be locally available at a lower price, and also the intermediate demand increases (see also Venables, 1999). Under these circumstances, there is no guarantee that total elimination of internal tariffs will go far enough to promote the spread of industry to all participating countries, especially when important non-tariff internal barriers persist. Thus, whether South-South regional integration arrangements strengthen or weaken agglomeration forces is largely an empirical question dependent on the involved countries and the level of remaining internal trade costs.

We can therefore conclude that if there are substantial underlying size differences between economies, South-South preferential trade liberalization may be, on average, associated with decreased manufacturing production in the smallest country of the agreement. This is especially the case if, at the starting point tariffs were high enough so that industry spread over countries in proportion to their initial size, and when significant internal barriers (both natural and artificial) still segment markets after the establishment of the agreement.

If we now apply this theory to MERCOSUR, we thus expect that the presence of higher internal tariffs (lower preferential margins) would accentuate the impact of variables such as countries' market potential and industrial base as determinants of industry development in those sectors with economies of scale or strong cost and demand linkages. On the other hand, for those sectors where a substantial reduction of internal trade obstacles has been reached, these agglomeration forces will be weakened.

### **3. MERCOSUR: Tariff Policy Reforms**

Argentina, Brazil, and Uruguay implemented broad trade reforms over the last two decades.<sup>7</sup> A distinguishing feature of the reduction and elimination of trade barriers in these economies is that the process of preferential trade liberalization overlapped with the

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<sup>6</sup> This is because congestion costs (high wages) could be avoided by establishing plants in neighboring member countries where industry has not been yet developed, while, at the same time, enjoying cost savings by importing inputs from (and exporting output to) the more industrially developed partner.

<sup>7</sup> As mentioned before, Paraguay is also a member of MERCOSUR, but trade policy developments in this country will not be discussed, because it could not be included in the empirical analysis.

latter stages of unilateral programs that had been previously initiated in each country. Given the relevance of these reforms for understanding the changes in manufacturing production patterns, this sub-section will describe the trade liberalization strategy pursued by MERCOSUR member countries.

### ***3.1 Unilateral Trade Liberalization***

Argentina, Brazil, and to a lesser extent Uruguay have traditionally had relatively high tariffs. As shown in Table 1, these countries started to unilaterally reduce MFN tariffs by the mid-1980s, i.e., before the establishment of MERCOSUR. This process of trade liberalization generalized in the early 1990s. In particular, tariff cuts were pronounced in the larger economies between 1988 and 1991. It is noteworthy that, while unilateral trade reform seems to have been completed in Argentina by 1991, in the remaining countries, the impulse towards further liberalization continued up to 1994.

### ***3.2 Preferential Trade Liberalization***

Argentina, Brazil, and Uruguay signed a number of bilateral agreements within the LAIA (Latin American Integration Association) framework. These agreements were based on positive lists of products, i.e., products that obtained tariff preferences (with varying degree of preference margins) and also were exempted from non-tariff barriers (Estervadeordal et al., 2000). Nevertheless, as highlighted in Table 1, the level of tariff preference was rather limited by the mid-1980s.

MERCOSUR was established by Argentina, Brazil, Paraguay, and Uruguay in 1991 with the Treaty of Asuncion. The first article of this treaty states that the agreement aims at achieving “the free circulation of goods, services, and production factors among the member countries, through the elimination of the tariff and non tariff restrictions to the circulation of merchandises and of any other equivalent measure”. It also established the adoption of a Common External Tariff (CET) and a common trade policy with third countries or groupings of countries. We can split up the evolution of MERCOSUR into two sub-periods: the transition period towards the free trade area and the customs union period.

The transition phase was between 1991 and 1994 and consisted of progressive, linear, and automatic tariff reductions at six months intervals. This sequence aimed to achieve free trade within the bloc by the end of 1994. The drop in preferential tariffs since 1991 reflects this policy (see Table 1). Exemptions to internal free trade were nevertheless allowed for a limited number of products on a temporary basis. Brazil included in its national exemption list only 29 items, including wool products, canned peaches, rubber



factories, and wines. In contrast, Argentina had 223 tariff line items on this list, of which 57% were steel products, 19% textiles, 11% paper, and 6% footwear, while Uruguay had an extensive list with 953 items, including textiles (22%), and steel and electric machinery (8%) (see INTAL, 1996). In addition to the general exceptions already indicated, the sugar and automotive sectors were not included in the general intra-MERCOSUR trade liberalization scheme due to significant divergence across member countries in their national policies toward these sectors, especially in the cases of Argentina and Brazil. In the interim, the exchange of these products took place under a specific set of rules and restrictions. For autos, a managed trade arrangement was put in place, which favored local contents, importation of parts under special conditions, and export balancing requirements.

The customs union period began with the establishment of a Common External Tariff (CET) entering into force at the beginning of 1995. The average level of the CET was approximately 11%, but tariff levels were allowed to vary between 0 and 20% across industries. In general, the lowest tariffs were set on input and materials, intermediate tariffs were charged on semi-finished industrial goods, and the highest tariffs were assigned to final manufactures.

During this period, two types of exceptions were established. First, remaining products on national lists that were exempted from internal free trade were included in the so-called "Adaptation Regime". Within this regime tariffs were progressively and automatically reduced so that import taxes would be completely eliminated by January 1, 1999 in the case of Argentina and Brazil, and by January 1, 2000 for Uruguay. Second, just as with intra-MERCOSUR tariffs, exceptions were granted for extra-zone trade so that certain imports faced tariff rates different from the CET. Countries agreed that the import taxes on these products would progressively converge toward the CET by the year 2001. Out of approximately 9000 8-digit tariff lines, Argentina, Brazil and Uruguay initially selected 300 each. In addition, exceptions to the CET were established for capital goods imports (e.g., machines and equipment), computers, and telecommunication equipment.<sup>8</sup>

An overall assessment of the result of the preferential trade reforms in the framework of MERCOSUR up to 1996 can be performed with the help of Table 2, taken from Olarreaga and Soloaga (1998). This table contains data on average 8-digit Harmonized System (HS) tariffs, extra-bloc and intra-bloc, for Argentina, Brazil, and Uruguay. We can conclude that countries were on average very close to internal free

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<sup>8</sup> Though a CET was also established for textiles, countries agreed not to put it into practice immediately. Thus, for example, Argentina maintained specific tariff on several textiles products as well as on footwear. A similar policy was followed in Uruguay for almost 100 textile items.

trade. However, for some specific sectors, non-negligible internal tariffs remained in place. Average external tariffs, even though substantially lower than in the past, were still high relative to those of developed countries. Moreover, for those products excluded from the CET, the average tariffs were relatively high in the case of Brazil and, to a less extent, in Argentina.

In summary, the evolution and cross-sectional patterns of external and internal trade barriers in MERCOSUR described above makes this group of countries a particularly interesting case study to assess the implications of preferential trade liberalization on industrial development. But before going to the formal empirical test, in the next section we will present some stylized facts about manufacturing production patterns in the region.

#### **4. MERCOSUR: Production Patterns**

The trade policy reforms described before could potentially be associated with significant changes in production patterns across MERCOSUR member countries. After introducing our dataset, this section precisely reports descriptive evidence on the actually observed changes in these patterns.

##### **4.1. Data**

We describe production patterns in MERCOSUR using production value data for each manufacturing industry at *ISIC, Rev. 2, 3 digit-level*. These data is part of the *PADI* database produced by the Industry and Technological Development Unit at the United Nations' Economic Commission for Latin America and Caribbean (ECLAC). It includes homogeneous statistical information for the period from 1985 to 1998 on an annual basis.

We also have data that allow for a suitable characterization of countries in terms factor endowments as well as sectors in terms of factor intensities. In this respect, we have used Brazilian input-output matrices to construct time variant factor utilization indicators at a disaggregated level. Appendix A1 presents a detailed description of our dataset. Some specific aspects of this dataset are discussed in Appendix A2.<sup>9</sup>

##### **4.2. Manufacturing Production Patterns**

Manufacturing production patterns in MERCOSUR can be described by the distribution of country shares in total production value for each industry in this bloc. Formally, the production value of industry  $k$  in country  $i$  at time  $t$  is denoted by  $z_{ikt}$ . This

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<sup>9</sup> As shown in Appendix A2, using Brazilian technological data does not imply imposing a restrictive assumption.

value is expressed as a share of the total production value in the industry within MERCOSUR:

$$s_{ikt} \equiv \frac{z_{ikt}}{\sum_i z_{ikt}} \quad (1)$$

and for the whole manufacturing sector we obtain:

$$s_{it} \equiv \frac{\sum_k z_{ikt}}{\sum_i \sum_k z_{ikt}} \quad (2)$$

Figure 1 plots the evolution of this aggregate indicator over the period 1985-1998 as a two-year moving average. Brazil is the largest country within the bloc. It accounted for roughly 70% of overall manufacturing activity in the MERCOSUR area over the period from 1985 to 1998. The share of this country has declined slightly after 1991. Uruguay seems to have witnessed a more pronounced decrease in its share over the same years, while the opposite is true for Argentina.

Of course, there are noticeable cross-sectional differences around this aggregate indicator. In which specific sectors have the particular countries gained or lost shares over time? In response, Figure 2 shows for each country and industry, the shares in MERCOSUR's total manufacturing production value and their changes over the sub-periods 1985-1990 and 1995-1998. This figure allows us to assess the main changes in production structures before and after MERCOSUR.

We observe substantial changes over time. Argentina registered increased shares in almost all sectors, but with significant variation over industries. For example, Argentina's share increased in leather products, while Brazil and Uruguay experienced a decrease. The higher share of Argentina in pottery, china, and earthenware comes essentially at the expense of the smaller country, Uruguay, while the higher share in other non-metallic minerals at the expense of Brazil. On the contrary, Brazil and Uruguay slightly expanded their shares in professional and scientific instruments.

Simple correlations between the share of each country in each industry and the score in selected industry characteristics show that the two countries with higher specialization in agriculture activities, Argentina and especially Uruguay, have higher shares in industries which intensively use agriculture inputs. Trends are, however, different: increasing in the case of Uruguay and decreasing in the case of Argentina. Similarly, Brazil, the country with the largest industrial base in the region, has a higher relative importance in sectors which intensively use manufactured inputs and sell a large fraction of their output to manufacturing firms (see Sanguinetti et al., 2004). The above

correlations are suggestive but they cannot be considered a rigorous examination of the determinants of industry location. Therefore, in the next section we turn to a formal econometric analysis.

## 5. Empirical Methodology

We have documented that the establishment of MERCOSUR implied important changes in trade barriers among member countries as well as between them and the rest of the world. We have also showed that there have been significant modifications production patterns. We will now investigate whether there is a relationship between both phenomena. The theoretical analysis presented in Section 2 provides the required background to derive precise hypotheses to link regional trade liberalization with the configuration of manufacturing production across member countries. This section introduces the empirical methodology. We first describe the general empirical strategy and the main hypotheses to be estimated and we then define the selected model specification and review relevant estimation issues. Estimation results are presented in Section 6.

### 5.1 *General Approach and Hypotheses: Capturing the Impact of Preferential Trade Liberalization*

The distribution of manufacturing activities across countries will be described by the country shares in total MERCOSUR production value for each industry, as defined in Equation (1). Several empirical studies of production patterns estimate summary statistics (e.g., concentration and specialization indices) on these shares and then regress such measures on industry or country characteristics.<sup>10</sup> This strategy has, however, two main disadvantages (e.g., Combes and Overman, 2003). First, theory does not always provide a clear guidance with respect to the expected relationship between these summary measures and economic unit characteristics. Second, using summary statistics implies wasting information on the distribution of manufacturing industries across countries, since individual industry/country shares are available. Therefore, we take these raw shares as our dependent variable.

In order to explain these shares, we adopt as a starting point the approach that has been proposed by Ulltveit-Moe et al. (2000a) and Ulltveit-Moe et al. (2000b). As we will see below, this approach allows us to come closer to the theory than those based on summary statistics. More importantly this framework permits an easy and intuitively clear adaptation to empirically assess the consequences of preferential tariff liberalization.

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<sup>10</sup> See, among others, Amiti (1999) and Haaland et al. (1999) as well as previous research by the authors, e.g., Siedschlag and Volpe Martincus (2006).

In general, industries intensively using a given “factor” tend to locate in countries relatively abundant in this “factor”. Thus, if countries differ in their endowments of human capital, then industries that intensively use this factor will be drawn to countries with relatively high shares of highly educated workers. This suggests explaining production patterns through a set of interactions resulting from a specific pairing of industry characteristics and country characteristics. The particular correspondence of country and industry characteristics mirrors a set of hypotheses identified from traditional and new international trade theories. These theories are the frameworks in which Venables (2003) and Puga and Venables (1998), respectively, derive their predictions of the impact of preferential trade liberalization on manufacturing production patterns across member countries. The interactions we will consider are listed in Table 3. The respective hypotheses will be described next.<sup>11</sup>

According to the traditional comparative advantage trade theory, production patterns are determined by the exogenous spatial distribution of natural resources and production factors. Activities settle in locations abundant in the factors which those activities use most intensively. This general proposition can be translated into the following three specific hypotheses:

*Hypothesis 1: Industries that intensively use agriculture inputs tend to locate in countries with a large endowment of arable land.*

*Hypothesis 2: Labor intensive industries tend to be drawn to countries which are relatively labor abundant.*

*Hypothesis 3: Industries that intensively use human capital tend to be drawn to countries which are relatively well endowed with human capital.*

New trade theories predict that sectors with increasing returns tend to settle in locations with good access to the markets of their respective products (see, e.g., Krugman, 1980, and Krugman and Helpman, 1985). This result derives from the interaction between scale economies and trade costs. In the presence of economies of scale, producers operate more efficiently by spatially concentrating their activities. The existence of trade costs in turn induces firms to concentrate in the country which has the larger effective market for their goods, since they are thus able to avoid such costs in a larger fraction of their sales. The following hypothesis can therefore be established:

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<sup>11</sup> Appendix A3 contains details about the construction of the underlying variables.

*Hypothesis 4: Industries with increasing returns to scale tend to locate in countries with large market potentials.*

In particular, when imperfectly competitive industries are linked through an input-output structure and trade costs are positive, the firms in the upstream industry are drawn to locations where there are relatively many firms of the downstream industry because in this way they can reach their customers more easily (demand linkage). Moreover, having a larger number of upstream firms in a location benefits downstream firms, which obtain their intermediate goods at lower costs, by saving transport costs and having easier access to a larger variety of differentiated inputs (cost linkage). Hence, the joint action of such linkages might result in an agglomeration of vertically linked industries and could give such an equilibrium location a certain inherent stability (Venables, 1996). In this sense, the above reasoning provides a rationale for the notion of an industrial base. It follows that *industries which intensively use manufactured intermediate inputs and industries for which demand comes to a large extent from the manufacturing sector itself tend to locate in regions with large industrial bases.* This is stated in the following hypotheses:

*Hypothesis 5: Industries that rely to a large extent on industrial intermediate inputs tend to locate in countries with a large industrial base and thus ensuring a better access to their relevant suppliers.*

*Hypothesis 6: Industries for which the manufacturing sector itself is an important user of their products find it advantageous to locate in countries with a large industrial base and hence providing a better access to a significant demand source.*

So far we have derived hypotheses that allow us to assess the relevance of traditional advantage comparative forces and of agglomeration factors in the allocation of industrial activities across MERCOSUR countries. But how can we empirically identify the effect of preferential trade liberalization within the region? One strategy is to report estimation results for different sub-periods and argue that observed changes in the relative importance of the different determinants, i.e., estimated coefficients on the interaction terms, are driven by economic integration.

We believe that this methodological approach is not entirely adequate for our purposes. First, member countries of MERCOSUR implemented nearly simultaneously several structural reforms including privatizations and de-regulations, which went well beyond the trade dimension. We need therefore to explicitly disentangle the effect of trade

policy. Second, as mentioned in Section 4, Argentina, Brazil, and Uruguay reduced their trade barriers unilaterally to the rest of the world and concertedly to their partners within the agreement. In particular, these economies are relatively small and trade with the rest of the world is significant. In addition, while intra-bloc trade was to a large extent tariff-free by 1996, MFN tariffs on manufacturing goods are relatively high when compared with those of developed countries. Hence, the preferential nature of trade liberalization should be explicitly taken into account. In fact, establishment of this trade agreement seems to have had a significant impact on aggregate and sectoral trade flows. Various empirical analyses confirm this conclusion. In particular, Yeats (1998) shows a pronounced increase in the regional orientation of exports for those goods benefiting from higher tariff preferences. Sanguinetti et al (2004) find that preferences due to MERCOSUR have affected Argentina's manufacturing exports pattern to the region *vis-à-vis* the rest of the world.

We will therefore extend the basic setting suggested by Ulltveit-Moe et al. (2000a) and Ulltveit-Moe et al. (2000b) by including measures of sectoral preferential margin and internal tariffs (Appendix A3 has details on the construction of these indicators). As discussed in Section 2, both variables are relevant for capturing the effect of regional integration on the spread of industrial activity across member countries. Preferences are important from the point of view of the impact of comparative advantage. On the other hand internal tariffs may play a key role in strengthening or weakening agglomeration forces. Thus we can state the following two propositions:

*Hypothesis 7: Higher preferential margins strengthen the responsiveness of manufacturing production patterns to regional comparative advantage patterns, i.e., to the matching of country and industry characteristics within the region, for those sectors where member countries have a comparative disadvantage with respect to the rest of the world.*

*Hypothesis 8: Higher internal barriers (i.e., lower preferential margins) increase the responsiveness of production patterns to the distribution of market potentials over member countries of the arrangement for those sectors featuring economies of scale and significant cost and demand linkages.*

## **5.2. Model Specification and Estimation Issues**

As previously indicated, the dependent variable is the share of a country in total manufacturing production value in each industry,  $s_{ik}$ . Note that this ratio can only take values within [0,1] so that the dependent variable is truncated. As a consequence, classical estimation will lead to biased estimates. Therefore, we perform a logistic transformation,

similar to Balassa and Noland (1989). The variable becomes  $\ln[s_{ikt}/(1-s_{ikt})]$  and ranges between  $(-\infty, +\infty)$ .

The dependent variable is expressed as a function of the interactions between industry and country characteristics, and country-, industry-, and time-fixed effects, which control for the non-conditional effects of these characteristics. Formally, the baseline model is:

$$\ln\left(\frac{s_{ikt}}{1-s_{ikt}}\right) = \sum_j \beta(j) \varpi_{it}(j) \theta_{kt}(j) + \zeta_i + \nu_k + \tau_t + \varepsilon_{ikt} \quad (3)$$

where  $\varpi_i(j)$  is the level of the  $j^{\text{th}}$  characteristic in country  $i$  and  $\theta_k(j)$  is the industry  $k$  value of the industry characteristic paired with the respective country characteristic,  $\zeta_i$ ,  $\nu_k$ , and  $\tau_t$  are country-, industry, and time-fixed effects, respectively.<sup>12</sup>

As mentioned in the previous sub-section, we extend this model incorporating a variable that captures preferential trade liberalization in the following way:

$$\ln\left(\frac{s_{ikt}}{1-s_{ikt}}\right) = \sum_j \beta(j) \varpi_{it}(j) \theta_{kt}(j) + \sum_j \gamma(j) pt_{kt} \varpi_{it}(j) \theta_{kt}(j) + \zeta_i + \nu_k + \tau_t + \varepsilon_{ikt} \quad (4)$$

where  $pt$  denotes sectoral preferential margins or internal tariffs.

We interact the sectoral preferential margins (internal tariffs) with each matching pair of country and industry characteristics. The coefficients on the original interactions will thus measure the responsiveness of production patterns to these characteristics matching when there is no tariff preference (internal tariffs equal the external tariff) and the new interactions will capture to what extent preferences (internal tariffs below the external duty) accentuate or ameliorate such responsiveness.

Our sample includes 27 industries, 3 countries, and 14 years, 1985-1998, i.e., it contains 1,134 observations.<sup>13</sup> Moreover, we condition on the standard deviation of the underlying variables in order to make comparison across variables more appropriate so that the coefficients that will be presented are standardized ones. In addition, there are three potential sources of heteroscedasticity: across countries, across industries, and across

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<sup>12</sup> This paper aims at analyzing the influence of preferential trade liberalization on production patterns across MERCOSUR member countries. Unfortunately, available data do not allow us to discriminate between pure internal relocation and the new settlements. In order to perform such an examination we would need data on sectoral foreign direct investment. This is, however, beyond of the scope of this study.

<sup>13</sup> The industry "Other manufacturing industries", which is a residual component, was dropped out.



time.<sup>14</sup> Hence, Huber/White heteroscedastic consistent standard errors are reported and used for hypothesis testing.

Two main issues, which may result in biased and inconsistent estimations, are usually not properly addressed in the literature. First, most empirical studies use a static framework, i.e., they perform static panel data analysis (see, e.g., Kim, 1995, Amiti, 1999). However, production patterns are likely to display inertia (see, e.g., Baldwin et al., 2003 and Robert-Nicoud, 2004). In fact, the Baltagi-Lee test for autocorrelation in our fixed-effects model suggests that there is serial correlation of first order in the disturbances.<sup>15</sup> It is well known that LSDV (Least Square Dummy Variables) estimates are biased and inconsistent when lagged dependent variables are included in the regression equation (e.g., Nickell, 1981, and Kiviet, 1995). A dynamic panel estimation is then required.

On the other hand, endogeneity is potentially a severe problem for the kind of estimations we are proposing. Human capital industries tend to locate in skill abundant countries, but causation can run also in the opposite direction: by settling in a country, industries employing highly qualified workers may end up changing its relative human capital abundance through induced migration. A similar reasoning also applies to firms with input-output linkages, as suggested by the new trade theories. We therefore treat all right-hand size variables as endogenous. The panel structure of our data allows us to generate appropriate instruments and thus to improve on previous works.

Specifically, to address both econometric problems, we perform GMM estimations using the method developed by Arellano and Bond (1991), which incorporates one lag of the dependent variable on the right hand side. This method first-differentiates the regression equation and permits obtaining additional instruments using the orthogonality conditions existent between lagged values of the dependent variable and the disturbances.<sup>16</sup>

## 6. Estimation Results

Table 4 shows the estimation results corresponding to Equation (4) for the whole period, 1985-1998, according to alternative econometric techniques. These methods allow for different ways of correcting for heteroscedasticity and autocorrelation of the error term. In the last column we present the Arellano–Bond regression. The Sargan test for overidentifying restrictions indicates that the instruments are valid. Moreover, we cannot

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<sup>14</sup> We applied the White's general test for heteroscedasticity (Greene, 1997). This test suggests that heteroscedasticity is present. The corresponding chi-square statistic is highly significant.

<sup>15</sup> These test statistics are not reported, but are available from the authors upon request.

<sup>16</sup> For additional details see Arellano and Bond (1991) and Baltagi (1995).

reject the null hypothesis of absence of serial correlation of second order. Accordingly, these estimations are consistent. Qualitatively, the results do not change significantly, though we clearly observe that when the econometric method allows correction of biases generated by persistence and endogeneity, the value of the estimated coefficients are significantly reduced. Since both problems seem to be important, we take the procedure proposed by Arellano and Bond (1991) as our preferred estimation strategy.

Overall the results show a pattern of matching between specific country and industry characteristics, which confirms some of the hypotheses previously stated. Thus, arable land and skilled labor seem to be factors that have played an important role in shaping the distribution of manufacturing activities in MERCOSUR economies. With respect to agriculture this is clearly not surprising, given the world leadership of these countries in this activity. On the other hand, we do not find a clear link between labor abundance and labor intensity. If anything, we obtain a negative partial correlation. This again can be interpreted as showing that MERCOSUR nations have not developed global comparative advantage in this type of industries. What remains to be shown is whether preferential liberalization implied that regional comparative advantage played a role in shaping the allocation of industry activities across countries.

Concerning the variables derived from the new trade theories, we observe that market potential interacted with economies of scale has had an impact on industry allocation within the region. Moreover, we find that industrial market potential has been a significant factor in attracting sectors that use intermediate inputs intensively. Hence, we can conclude that agglomeration forces have also been an important determinant of industrial development in MERCOSUR countries. The key issue is whether these forces have been affected by preferential trade policies.

Before addressing this important question we would like to review our robustness checks. First, we tested the stability of parameters by sequentially introducing the explanatory variables. This exercise is presented in Table 5. Second, we used the absolute production value instead of the shares as dependent variable.<sup>17</sup> Third, we have also utilized alternative measures of labor abundance, labor intensity, and market potential (see Appendix A3 for more details). Fourth, the differentiation performed when applying the method of Arellano and Bond (1991) implies removing country-fixed effects. We have therefore included either population or GDP in the GMM estimations to control for size. Fifth, if series being used were highly persistent, a weaker instrument problem arises

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<sup>17</sup> We have also performed estimations using the share of national sectoral manufacturing production value to total GDP as dependent variable. In this case, the same comparative advantage factors remain positive and significant.

when using the Arellano and Bond (1991) procedure because lagged levels of the variables become inappropriate instruments for their first differences (Bond, 2002). Hence, we have re-estimated Equation (5) using the “GMM system” method as proposed by Blundell and Bond (1998). In all cases, results were qualitatively the same.<sup>18</sup>

As discussed above, one indirect and commonly used method to empirically identify the effects of preferential trade policies enacted when MERCOSUR was established consists of running separate regressions for different sub-periods and to compare the estimated coefficients measuring the responsiveness of these patterns to the matching of specific country and industry characteristics. Detected changes are then implicitly or explicitly attributed to the process of integration. Our “moving regressions” presented in Table 6 replicate this procedure.

We find that interactions involving factor endowments and factor intensities, specifically abundance and intensity of agriculture and human capital, show an upward trend. Production patterns across MERCOSUR member countries seem to be more sensitive to comparative advantage considerations. This is exactly what we would expect in an environment where trade is being liberalized. On the other hand, interactions between market potential and economies of scale and industrial market potential and intensity in intermediate manufactured inputs do not display a clear trend. If anything, they seem to have declined in recent years suggesting that agglomeration forces have somewhat diminished with the full implementation of MERCOSUR.<sup>19</sup>

The above regressions have a main drawback. They do not represent a direct test of the impact of the trade policies associated with MERCOSUR. Indeed, observed changes in the relative importance of explanatory factors could be the net result of the multiple reforms implemented in the region since the second half of the 1980s. They could be driven not only by preferential trade liberalization, but also by the general unilateral opening of the economies. This is, perhaps, the right interpretation for the observed positive trend of the estimated impact of arable land abundance. The relevant question is then: Is there any

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<sup>18</sup> These results are not reported, but are available from the authors upon request.

<sup>19</sup> Ulltveit-Moe et al. (2000a) and Mideldart et al. (2000b) perform a similar analysis for Europe and are thus a natural benchmark to compare our results with those from studies focusing on developed countries. They run cross-section regressions for specific years over the period 1980-1997 and compare the coefficients on the interactions over time. These authors find that the location of industries intensive in R&D and skilled labor have become increasingly responsive to countries’ endowments of researchers and well educated labor force in general, respectively. Similarly, industries using intensively agriculture inputs have become overrepresented in countries with abundant agriculture production. Our results are in line with these findings. Moreover, according to Ulltveit-Moe et al. (2000a), the tendency of industries with economies of scale to locate in central countries has decreased over time, while the opposite is true for industries with strong cost and demand linkages. Ulltveit-Moe et al. (2000b) use specific and hence different measures of market access (i.e., supplier and demand access). In this case, their econometric results suggest that supplier access is not significant for the location of manufacturing industries and that demand linkages are significant but their effect is declining over time.

specific role for MERCOSUR? To answer this question we turn to the estimation of Equations (4).

Results are reported in Table 7 and 8. In Table 7 we have interacted the country-industry characteristics with the sectoral level of tariff preferences, while in Table 8 we use internal tariffs as interacting factor. In both tables we show the contemporaneous effect (Column 1) and we also allow for a lagged impact of trade policies on the locational influence of matching characteristics (Column 2).<sup>20</sup> The results presented in Table 7 suggest that higher preferences margins tend to be associated with a higher sensitivity of production patterns to comparative advantage considerations along two dimensions: labor and human capital. Hence, in the presence of larger preference margins, labor and human capital intensive industries show a stronger tendency to locate in countries with larger endowments of these factors. Interestingly, we do not find any significant impact of these preferences on the responsiveness of production patterns of industries using intensively agriculture inputs to countries' endowments of arable land. Argentina, Brazil, and Uruguay have a revealed comparative advantage in these sectors, as measured by the Balassa-Index, especially in food products (see, e.g., Volpe Martincus, 2003). Thus, as expected from the theory, we find that regional preferences have no significant impact in those sectors in which countries have a global comparative advantage.

Clearly this does not seem to be the case for labor and skilled labor. First, the terms in which these variables are not interacted with tariff preferences are not significant or they have a negative sign suggesting that, in the absence of these preferences, regional comparative advantage is not a relevant determinant of industrial development. Once we condition on tariff preferences, we find positive effects both for labor (for the contemporaneous regression) and for skilled labor (in the case of the lagged estimation). This can be interpreted as being consistent with the idea that MERCOSUR countries do not have global comparative advantage in industries that intensively use labor and skilled labor and that regional comparative advantage in these factors affects the regional pattern of manufacturing distribution across countries only when tariff preferences are large enough.<sup>21</sup>

On the other hand, higher preferential margins weaken the tendency of sectors with increasing returns to scale to locate in countries with larger market potentials. If high

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<sup>20</sup> We do this because we do not have exact priors about the timing of the impacts. In particular, we could expect these effects to follow trade liberalization with a lag.

<sup>21</sup> As shown in Venables (2003), this would be associated with trade diversion and welfare reduction for some countries. In our empirical analysis, we consider other factors than comparative advantage such as economies of scale and input-output linkages. Drawing robust conclusions on the welfare implications of production developments would require an explicit theoretical model combining both sets of factors. This is beyond the scope of this paper.

preferences reflected low internal tariffs, this result would be consistent with theory suggesting that deepened internal trade liberalization generates a weakening of agglomeration forces. In order to test the plausibility of this interpretation, we re-estimate Equation (4), this time with internal tariffs as a trade policy instrument instead of preferential margins. The results are presented in Table 8. They confirm our priors. Lower intra-bloc tariffs weaken the tendency of sectors with increasing returns and strong cost linkages to locate in countries with larger market potentials.<sup>22</sup>

Therefore, support for Hypothesis 7 is provided. Preferential tariffs seems to be favoring a restructuring of production patterns across MERCOSUR member countries along the lines dictated by regional (as opposed to global) comparative advantage as suggested by Venables (2003). Furthermore, consistent with Hypothesis 8, regional trade liberalization seems to have weakened agglomeration forces. This is in line with the theoretical prediction by Puga and Venables (1998) when intra-bloc trade obstacles are low enough.

## 7. Concluding Remarks

Argentina, Brazil, Paraguay, and Uruguay have actively engaged in trade liberalization initiatives during the last 20 years. These initiatives have resulted in significant changes in the spatial distribution of economic activities. This paper has uncovered the determinants of these changing manufacturing production patterns over the period 1985-1998 in Argentina, Brazil, and Uruguay. We contribute to the literature by providing empirical evidence on developing countries and by explicitly assessing the impact of preferential trade liberalization on industrial development.

In order to distinguish the role played by increased economic integration in shaping manufacturing production patterns, we explicitly use measures of sectoral preferential margin and internal tariffs interacted with each matching pair of country and industry characteristics. Our econometric results are in line with theoretical predictions suggesting that preferential trade liberalization in the Southern Cone has driven a spatial reorganization of production along internal comparative advantage in labor and human capital. Moreover, declining internal tariffs have weakened agglomeration forces determined by the interplay of distribution of market sizes and scale economies and input-output linkages.

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<sup>22</sup> We use the level of internal tariff as interacting term, so the positive sign on the interactions suggests that higher internal tariffs are associated with higher sensitivity to market potentials.

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Table 1

<b>MERCOSUR: Preferential Tariffs by Countries (1985-1994)</b>			
<b>MFN and Preferential Tariffs</b>			
<b>Country/year</b>	<b>1985</b>	<b>1991</b>	<b>1994</b>
<b>Argentina MFN</b>	39.20	14.22	15.40
Brazil	36.60	7.20	5.10
Uruguay	36.00	8.10	10.70
<b>Brazil MFN</b>	55.09	20.37	9.70
Argentina	51.90	10.00	3.20
Uruguay	51.10	10.70	4.90
<b>Uruguay MFN</b>	35.87	21.35	13.63
Argentina	34.60	15.50	12.00
Brazil	34.60	15.80	10.00

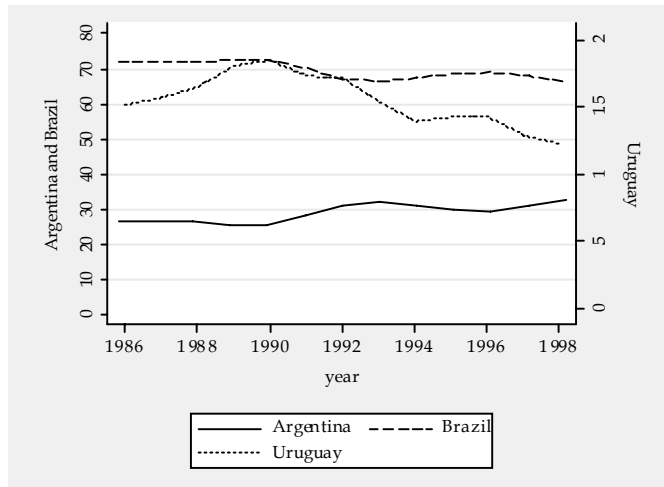
Source: Estevadeordal et al. (2000).

Table 2

<b>Mercosur: External and Internal Tariffs in 1996</b>						
<b>Country</b>	<b>External Tariff (Simple Average)</b>	<b>Internal Tariff (Simple Average)</b>	<b>Import Weighted External Tariff</b>	<b>Import Weighted Internal Tariff</b>	<b>Tariff Level CET Exemptions</b>	<b>Tariff Level Internal Exemptions</b>
<b>Argentina</b>	11.78	0.36	13.37	0.86	14.33	11.69
<b>Brazil</b>	13.14	0.02	15.44	0.02	21.39	10.20
<b>Uruguay</b>	10.78	0.88	11.01	1.77	5.92	19.73
<b>Mercosur CET</b>	<b>11.75</b>	<b>0.00</b>	<b>11.09</b>	<b>0.00</b>		

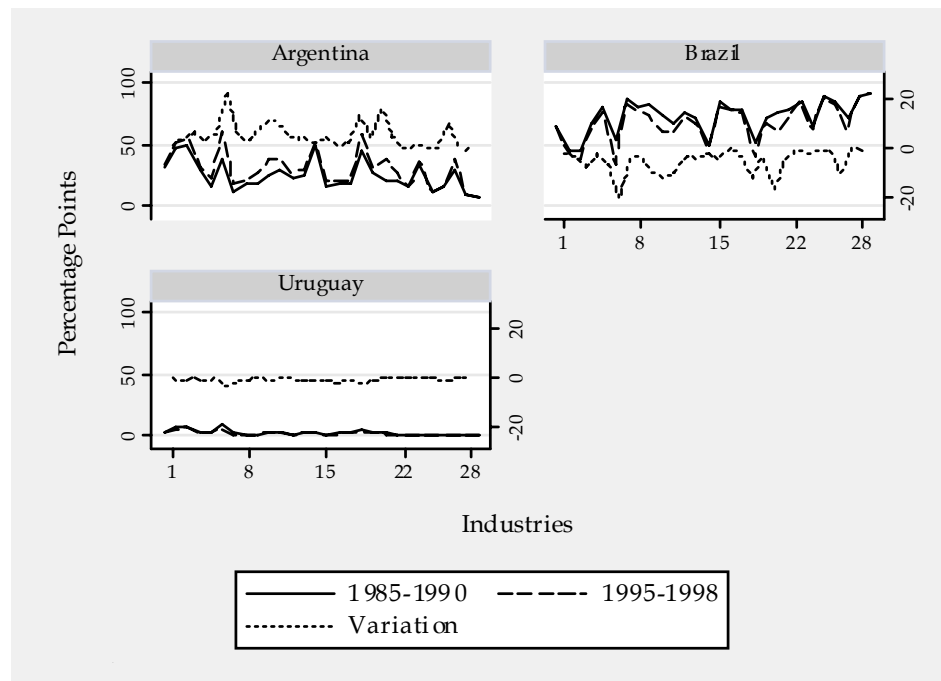
Source: Olarreaga and Soloaga (1998).

**Figure 1: National Manufacturing Production Value as a Percentage of MERCOSUR Total Manufacturing Production Value Two-years moving average (1986-1998)**



The Figure plots aggregate production shares by country as defined in Equation (4) in text multiplied by 100.

**Figure 2: Countries' Shares in MERCOSUR Manufacturing Production Value and Changes (1995-1998 vs. 1985-1990)**



The Figure plots sectoral production shares by country as defined in Equation (3) in text multiplied by 100. These shares are averaged over the sub-periods 1985-1990 and 1995-1998. "Variation" corresponds to the absolute change between these sub-periods. Industries are numbered following the order in which they are listed in Appendix A1.

Table 3

<b>Regressions</b>			
<b>Category</b>	<b>Variables</b>		
Basic Interaction Terms	Agriculture abundance	*	Agriculture intensity
	Labor abundance	*	Labor intensity
	Human capital abundance	*	Human capital intensity
	Market potential	*	Economies of scale
	Industrial market potential	*	Industrial intermediate consumption
	Industrial market potential	*	Sales to industry
Preferential Trade Liberalization	<b>Agriculture abundance</b>	*	<b>Agriculture intensity</b> * Preferential margin/Internal tariff
	<b>Labor abundance</b>	*	<b>Labor intensity</b> * Preferential margin/Internal tariff
	<b>Human capital abundance</b>	*	<b>Human capital intensity</b> * Preferential margin/Internal tariff
	<b>Market potential</b>	*	<b>Economies of scale</b> * Preferential margin/Internal tariff
	<b>Industrial market potential</b>	*	<b>Industrial intermediate consumption</b> * Preferential margin/Internal tariff
	<b>Industrial market potential</b>	*	<b>Sales to industry</b> * Preferential margin/Internal tariff

Table 4

Alternative Estimation Strategies					
Explanatory variables - Interactions		LSDV	PCSE	PW	AB
		Ints	Ints	Ints	Ints
Agriculture abundance	* Agriculture intensity	0.563 (0.086)***	0.563 (0.035)***	0.347 (0.093)***	0.252 (0.049)***
Labor abundance	* Labor intensity	0.029 (0.067)	0.029 (0.040)	-0.070 (0.023)***	-0.070 (0.030)**
Human capital abundance	* Human capital intensity	0.120 (0.048)**	0.120 (0.018)***	0.056 (0.024)**	0.045 (0.026)*
Market potential	* Economies of scale	0.047 (0.089)	0.047 (0.054)	-0.007 (0.020)	0.086 (0.033)**
Industrial market potential	* Intermediate inputs intensity	0.297 (0.128)**	0.297 (0.046)***	0.270 (0.053)***	0.192 (0.056)***
Industrial market potential	* Intensity of sales to industry	0.205 (0.186)	0.205 (0.144)	-0.004 (0.075)	-0.006 (0.069)
Year fixed-effects		Yes	Yes	Yes	Yes
Number of observations		1134	1134	1134	972
Sargan test for overidentification, $X^2(539)$					62.96
Test for second order autocorrelation, $z$					-0.38

The table reports estimations of Equation (3) with alternative econometric methods:

LSDV: Least Square Dummy Variable estimation (with country and industry fixed-effects) with Huber/White corrected standard errors;

PCSE: Least Square Dummy Variable estimation (with country and industry fixed-effects) with standard errors corrected for groupwise heteroscedasticity and cross-sectional correlation;

PW: Prais-Winsten estimation (with country and industry fixed-effects) with standard errors corrected for groupwise heteroscedasticity and cross-sectional correlation;

AB: GMM one-step estimation based on the procedure developed by Arellano and Bond (1991); in this model, one lag of the dependent variable is included (not reported) and all right-hand side variables are treated as endogenous; robust standard errors are in parentheses; the Sargan test statistics is based on the two-step estimations.

Dependent variable (*Ints*) is the (logistically transformed) location share as defined in Equation (1) in the text.

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

Table 5

<b>Arellano-Bond Estimations - Specification</b>					
Explanatory variables - Interactions		(1)	(2)	(3)	(4)
		<b>Ints</b>	<b>Ints</b>	<b>Ints</b>	<b>Ints</b>
<b>Agriculture abundance</b>	* <b>Agriculture intensity</b>	0.151 (0.070)**	0.154 (0.063)**	0.245 (0.053)***	0.252 (0.049)***
<b>Labor abundance</b>	* <b>Labor intensity</b>	-0.001 (0.032)	-0.016 (0.027)	-0.066 (0.028)**	-0.070 (0.030)**
<b>Human capital abundance</b>	* <b>Human capital intensity</b>	0.064 (0.030)**	0.061 (0.027)**	0.054 (0.028)*	0.045 (0.026)*
<b>Market potential</b>	* <b>Economies of scale</b>		0.069 (0.036)*	0.087 (0.034)**	0.086 (0.033)**
<b>Industrial market potential</b>	* <b>Intermediate inputs intensity</b>			0.184 (0.045)***	0.192 (0.056)***
<b>Industrial market potential</b>	* <b>Intensity of sales to industry</b>				-0.006 (0.069)
<b>Year fixed-effects</b>		Yes	Yes	Yes	Yes
<b>Number of observations</b>		972	972	972	972
<b>Sargan test for overidentification, X<sup>2</sup>(539)</b>		70.69	67.22	67.34	62.96

The table reports one-step GMM estimations of Equation (3) based on the procedure developed by Arellano and Bond (1991). Dependent variable (*Ints*) is the (logistically transformed) location share as defined in Equation (1) in the text. One lag of the dependent variable included (not reported). All right-hand side variables in Equation (3) are treated as endogenous. The Sargan test statistics is based on the two-step estimations. Robust standard errors are reported in parentheses. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

Table 6

Explanatory variables - Interactions		1985-1993	1986-1994	1987-1995	1988-1996	1989-1997	1990-1998
		<i>lnts</i>	<i>lnts</i>	<i>lnts</i>	<i>lnts</i>	<i>lnts</i>	<i>lnts</i>
Agriculture abundance	* Agriculture intensity	-0.100 (0.189)	0.272 (0.107)**	0.311 (0.103)***	0.233 (0.088)***	0.292 (0.080)***	0.307 (0.084)***
Labor abundance	* Labor intensity	-0.091 (0.041)**	-0.103 (0.041)**	-0.091 (0.041)**	-0.054 (0.044)	-0.043 (0.045)	-0.049 (0.041)
Human capital abundance	* Human capital intensity	0.004 (0.049)	0.039 (0.048)	0.027 (0.045)	0.044 (0.041)	0.070 (0.033)**	0.083 (0.035)**
Market potential	* Economies of scale	0.039 (0.036)	0.067 (0.031)**	0.061 (0.029)**	0.074 (0.042)*	0.059 (0.042)	0.056 (0.038)
Industrial market potential	* Intermediate inputs intensity	0.277 (0.079)***	0.284 (0.080)***	0.264 (0.077)***	0.192 (0.086)**	0.157 (0.091)*	0.194 (0.080)**
Industrial market potential	* Intensity of sales to industry	-0.056 (0.113)	-0.076 (0.096)	-0.014 (0.109)	0.027 (0.118)	0.078 (0.112)	0.091 (0.111)
Year fixed-effects		Yes	Yes	Yes	Yes	Yes	Yes
Number of observations		567	567	567	567	567	567
Sargan test for overidentification, $X^2(189)$		69.10	69.32	70.53	67.88	72.22	67.83
Test for second order autocorrelation, $z$		0.36	-0.53	0.31	-0.34	-2.00**	-1.44

The table reports one-step GMM estimations of Equation (3) based on the procedure developed by Arellano and Bond (1991). Dependent variable (*lnts*) is the (logistically transformed) location share as defined in Equation (1) in the text. One lag of the dependent variable included (not reported). All right-hand side variables in Equation (3) are treated as endogenous. The Sargan test statistics is based on the two-step estimations. Robust standard errors are reported in parentheses. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

Table 7

<b>The Impact of Preferential Margins (1985-1998)</b>			<b>(1)</b>	<b>(2)</b>
<b>Explanatory variables - Interactions</b>			<b>Ints</b>	<b>Ints</b>
<b>Agriculture abundance</b>	*	<b>Agriculture intensity</b>	0.221 (0.079)***	0.256 (0.070)***
<b>Labor abundance</b>	*	<b>Labor intensity</b>	-0.105 (0.032)***	-0.081 (0.034)**
<b>Skilled labor abundance</b>	*	<b>Skilled labor intensity</b>	0.004 (0.042)	-0.001 (0.038)
<b>Market potential</b>	*	<b>Economies of scale</b>	0.064 (0.032)**	0.071 (0.033)**
<b>Industrial market potential</b>	*	<b>Intermediate inputs intensity</b>	0.261 (0.054)***	0.237 (0.057)***
<b>Industrial market potential</b>	*	<b>Intensity of sales to industry</b>	-0.044 (0.076)	-0.028 (0.078)
<b>Preferential margin</b>				
	*			
<b>Agriculture abundance</b>	*	<b>Agriculture intensity</b>	0.018 (0.020)	0.006 (0.012)
<b>Labor abundance</b>	*	<b>Labor intensity</b>	0.069 (0.040)*	0.013 (0.010)
<b>Skilled labor abundance</b>	*	<b>Skilled labor intensity</b>	0.041 (0.029)	0.025 (0.012)**
<b>Market potential</b>	*	<b>Economies of scale</b>	-0.048 (0.024)**	-0.022 (0.014)
<b>Industrial market potential</b>	*	<b>Intermediate inputs intensity</b>	-0.055 (0.056)	-0.013 (0.012)
<b>Industrial market potential</b>	*	<b>Intensity of sales to industry</b>	0.025 (0.023)	0.015 (0.012)
<b>Year fixed-effects</b>			Yes	Yes
<b>Number of observations</b>			972	972
<b>Sargan test for overidentification, <math>\chi^2</math></b>			64.11	55.09
<b>Test for second order autocorrelation, z</b>			-0.43	-0.30

The table reports one-step GMM estimations of Equation (4) based on the procedure developed by Arellano and Bond (1991). Dependent variable (*Ints*) is the (logistically transformed) location share as defined in Equation (1) in the text. One lag of the dependent variable included (not reported). All right-hand side variables in Equation (4) are treated as endogenous. The Sargan test statistics is based on the two-step estimations. Robust standard errors are reported in parentheses. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

Table 8

<b>The Impact of Internal Tariffs (1985-1998)</b>			<b>(1)</b>	<b>(2)</b>
<b>Explanatory variables - Interactions</b>			<b>Ints</b>	<b>Ints</b>
<b>Agriculture abundance</b>	*	<b>Agriculture intensity</b>	0.246 (0.053)***	0.238 (0.057)***
<b>Labor abundance</b>	*	<b>Labor intensity</b>	-0.062 (0.028)**	-0.068 (0.027)**
<b>Skilled labor abundance</b>	*	<b>Skilled labor intensity</b>	0.045 (0.026)*	0.049 (0.027)*
<b>Market potential</b>	*	<b>Economies of scale</b>	0.001 (0.019)	-0.003 (0.021)
<b>Industrial market potential</b>	*	<b>Intermediate inputs intensity</b>	0.264 (0.052)***	0.237 (0.054)***
<b>Industrial market potential</b>	*	<b>Intensity of sales to industry</b>	-0.023 (0.065)	0.009 (0.065)
<b>Internal tariff</b>				
	*			
<b>Agriculture abundance</b>	*	<b>Agriculture intensity</b>	-0.013 (0.022)	-0.004 (0.013)
<b>Labor abundance</b>	*	<b>Labor intensity</b>	-0.170 (0.064)***	-0.038 (0.016)**
<b>Skilled labor abundance</b>	*	<b>Skilled labor intensity</b>	-0.013 (0.026)	-0.011 (0.020)
<b>Market potential</b>	*	<b>Economies of scale</b>	0.078 (0.039)**	0.029 (0.015)*
<b>Industrial market potential</b>	*	<b>Intermediate inputs intensity</b>	0.100 (0.073)	0.030 (0.016)*
<b>Industrial market potential</b>	*	<b>Intensity of sales to industry</b>	-0.022 (0.028)	-0.012 (0.015)
<b>Year fixed-effects</b>			Yes	Yes
<b>Number of observations</b>			972	972
<b>Sargan test for overidentification, <math>\chi^2</math></b>			55.15	55.77
<b>Test for second order autocorrelation, z</b>			-0.44	-0.39

The table reports one-step GMM estimations of Equation (4) based on the procedure developed by Arellano and Bond (1991). Dependent variable (*Ints*) is the (logistically transformed) location share as defined in Equation (1) in the text. One lag of the dependent variable included (not reported). All right-hand side variables in Equation (4) are treated as endogenous. The Sargan test statistics is based on the two-step estimations. Robust standard errors are reported in parentheses. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.



## Appendix

### A1 Dataset

Table A1

Data				
Variable	Aggregation	Country coverage	Period	Source
Production value	ISIC. Rev. 2, 3digits	Argentina, Brazil, Uruguay	1985-1998	PADI/ECLAC
Exports and Imports	IBGE Subsector Classification	Brazil	1985, 1990-1998	IBGE
Employment	ISIC. Rev. 2, 3digits	Argentina, Brazil, Uruguay	1985-1998	BADECEL/ECLAC
Value added	IBGE Subsector Classification	Brazil	1985-1998	RAIS/Ministry of Labor
Number of establishments	IBGE Subsector Classification	Brazil	1985-1998	RAIS/Ministry of Labor
Labor compensation	IBGE Subsector Classification	Brazil	1985-1998	IBGE
Workers qualification	IBGE Subsector Classification	Brazil	1985-1998	RAIS/Ministry of Labor
Intermediate inputs	IBGE Subsector Classification	Brazil	1985, 1990-1998	IBGE
Sales to industry	IBGE Subsector Classification	Brazil	1985, 1990-1998	IBGE
Agricultural inputs	IBGE Subsector Classification	Brazil	1985, 1990-1998	IBGE
Intermediate demand	IBGE Subsector Classification	Brazil	1985, 1990-1998	IBGE
Total demand	IBGE Subsector Classification	Brazil	1985, 1990-1998	IBGE
Tariffs	IBGE Subsector Classification	Brazil	1987-1998	Kume, Piani, Souza (2000)
Total GDP	Country	Argentina, Brazil, Uruguay	1985-1998	PADI/ECLAC
Industrial GDP	Country	Argentina, Brazil, Uruguay	1985-1998	PADI/ECLAC
Skill level of population	Country	Argentina, Brazil, Uruguay	1985, 1990, 1995, 1999	Barro and Lee (2000)
Arable land	Country	Argentina, Brazil, Uruguay	1985-1998	FAO

**Manufacturing sectors according to the ISIC, Revision 2, at the 3 digit level:** 311- Food products; 313- Beverages; 314- Tobacco; 321- Textiles; 322- Wearing apparel, except footwear; 323- Leather and leather products, except footwear and wearing apparel; 324- Footwear, except vulcanized or moulded rubber or plastic footwear; 331-Wood and wood and cork products, except furniture; 332- Furniture and fixtures, except primarily of metal; 341-Paper and paper products; 342- Printing, publishing and allied industries; 351- Industrial chemicals; 352- Other chemicals product; 353- Petroleum refineries; 354- Miscellaneous products of petroleum and coal; 355- Rubber products; 356- Plastic products not elsewhere classified; 361- Pottery, china, and earthenware; 362- Glass and glass products; 369- Other non-metallic mineral products; 371- Iron and steel; 372- Non-ferrous metals; 381- Fabricated metal products; 382- Machinery, except electrical; 383- Electrical machinery apparatus; 384- Transport equipment; 385- Professional, scientific, measuring, controlling, photographic and optic equipment; 390- Other manufacturing industries.

**Manufacturing sectors according to the IBGE Sub-sectors Classification:** Non metallic minerals; Metallurgy; Mechanics; Electrical and communication equipment; Transport equipment; Woods; Furniture; Paper; Printing and publishing; Rubber; Leather and hides; Chemicals; Pharmaceuticals; Perfumes, soaps, and candles; Plastics; Textiles; Clothing, footwear, and cloth goods; Food products; Beverages; Tobacco; Other manufacturing industries.

## A2 Specific Aspects of the Dataset

First, the data for several variables, such as the number of establishments, qualifications of workers, intensity of use of intermediate inputs, were available only for Brazil. Similar statistical information for Argentina and Uruguay was not found. In the case of Argentina, there are data only for a few particular years.<sup>23</sup> A simple inspection of such available data suggests that using the Brazilian data should not be, however, significantly misleading.<sup>24</sup>

Data on intensity in consumption of manufactured intermediate inputs, sales to industry as a share of total demand, labor compensation, and agricultural inputs are derived from the Brazilian input-output tables published by the *IBGE*. These data are available for 1985 and 1990-1998. Data for the period 1986-1989 are linearly interpolated or simply assumed to be the same as in 1985 with no major impact on results. The reason is that industry characteristics did not have changed significantly over the second half of the 1980s. This is plausible, because most important changes in economic environment took place since the beginning of the 1990s when trade liberalization deepened.

Tariff data for each manufacturing sector are taken from Kume et al. (2000). Our econometric analysis focuses on the period 1985-1998. However, our tariff data are available beginning with 1987. We assume that sectoral tariffs rates in 1985 and 1986 did not significantly differ from those in 1987.<sup>25</sup>

These sectoral data are reported according to the *IBGE* Sub-sectors classification. In order to get comparable figures, we have mapped them into the *ISIC Rev. 2* Classification using a concordance table supplied by the *IBGE*.

Data on the skill level of population reported by Barro and Lee (2000) is available on a 5 years basis. Following Harrigan (1997), we have interpolated the values for intermediate years.

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<sup>23</sup> Information on the number of establishments is only available for the years 1985 and 1994 from the National Economic Census. Data on intermediate intensity exist also for 1997 (Input-output table published by the INDEC).

<sup>24</sup> For example, the Spearman-rank correlation coefficient for establishment size between Argentina and Brazil was 0.57 in 1985 and 0.66 in 1994, in both cases significant at the 1% level. On the other hand, the simple correlation between Argentinean and Brazilian external tariffs for the *ISIC* Classification at 4 digits was 0.68 in 1992 and 0.77 in 1994 (see Sanguinetti and Sallustro, 2000).

<sup>25</sup> Kume et al. (2000) state that the Brazilian import policy at the starting year of their study, 1987 was essentially based on a tariff structure set in 1957.

### A3 Variables

**Agriculture abundance:** Share of arable land to total land area.

**Labor abundance:** Share of population older than 25 years with incomplete primary education. We have also used as an alternative proxy the raw share of each country's population in MERCOSUR's total population.

**Skilled labor abundance:** Share of population older than 25 years which have attained at least high school.

**Market potential and Industrial market potential:** The market potential of a country is captured through the index proposed by Keeble et al. (1986). Formally:

$$MP_i \equiv \sum_{j \neq i} \frac{Y_j}{d_{ij}} + \frac{Y_i}{d_{ii}}$$

where  $i$  is the country under examination,  $j$  corresponds to remaining countries in the bloc,  $Y_i$  is the GDP (industrial GDP) of country  $i$ ,  $d_{ij}$  measures the distance between the most important cities from an economic point of view in countries  $i$  and  $j$  and  $d_{ii}$  is the intra-state distance, given by 1/6 of the radius of a circle with the same area as the country  $i$ .<sup>26</sup> The value of the measure is higher, the higher the own GDP (industrial GDP), viewed as a proxy for own market size, the lower the own area, and the lower the distance to the main markets of other countries.

Distances between cities have been estimated using the formula of geodesic distances by CEPIL. Formally, the distance between two points  $i$  and  $j$  is given by:

$$d_{ij} = 6370 * \arccos \left[ \begin{array}{l} \cos(lat_j / 57.2958) * \cos(lat_i / 57.2958) * \cos(\min(360 - \text{abs}(long_j - long_i), \text{abs}(long_j - long_i) / 57.2958)) \\ + \sin(lat_j / 57.2958) * \sin(lat_i / 57.2958) \end{array} \right]$$

where  $lat$  is latitude and  $long$  means longitude.

We have also considered a tariff-adjusted measure of market potential defined as follows:

$$MP_i \equiv \sum_{j \neq i} \frac{Y_j}{(1 + \bar{\rho}_j) d_{ij}} + \frac{Y_i}{d_{ii}}$$

where  $\bar{\rho}$  is the average preferential tariff applied by the country on intra-MERCOSUR trade flows.

<sup>26</sup> We use 1/6 instead of 2/3 as in Head and Mayer (2003) and Redding and Venables (2004) for two related reasons. First, population and economic activity shows a high spatial concentration in the two larger countries, i.e., Argentina and Brazil, so that using this conventional measure would result in a factual understatement of domestic market potentials. Second, we wanted to ensure that internal distance is smaller the international distance (see also Redding and Venables, 2004).

**Agriculture intensity:** Share of agriculture inputs to total sectoral production value.

**Labor intensity:** Share of labor compensation to sectoral value added. We have also used as an alternative proxy a measure of unskilled labor intensity (i.e., share of employees with incomplete primary education to total sectoral employment).

**Skilled labor intensity:** Share of employees with at least incomplete high school education to total sectoral employment.

**Economies of scale:** Following Kim (1995) and Amiti (1998), economies of scale are captured by average establishment size, i.e., the average number of employees per establishment in the industry in question. Measuring scale economies is problematic, since they might be product-specific, plant-specific or due to multi-plant operations (see Amiti, 1998). There are other possible measures, such the one developed by Pratten (1988) and extensively used by other authors. Pratten ranked industries “in order of the importance of the economies of scales for spreading development costs and for production costs”. The classification bases on two criteria: engineering estimates of the minimum efficient plant scale relative to the industry’s output, and estimates of the cost gradient below the minimum efficient scale. Thus, the ranking is based on observed plant size but also on (unexploited) potential for scale economies (Brühlhart, 1998). However, estimations are exclusively based on information on developed countries. Given the evident technological differences between countries at different levels of development, using this rank for developing countries appears inappropriate.

**Industrial intermediate consumption:** Share of manufactured inputs to total sectoral production value.

**Sales to industry:** Share of intermediate demand (i.e., sales to the manufacturing sector) to total demand.

**Preferential margin/Internal tariffs:** The preferential margin is derived as follows. Starting from Brazilian sectoral tariff data, we have constructed a proxy for the preference tariff variable, which measures the degree of intra-bloc trade impediments in each sector. These internal tariffs were calculated applying the internal trade liberalization schedule set in the Asunción Treaty on the (Brazilian) MFN sectoral tariffs. Then we combined these sectoral preferential tariffs with the respective MFN tariffs into the following indicator of preferential margin (see, e.g., Estevadeordal et al., 2000):

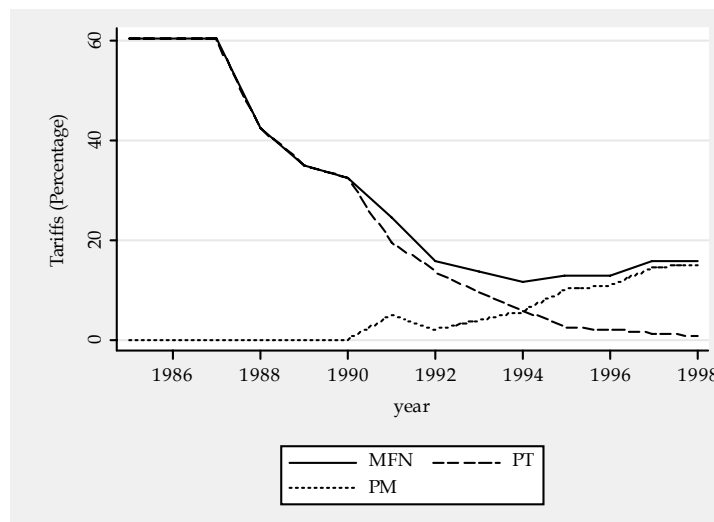
$$PM = \frac{(1 + \delta_k)}{(1 + \rho_k)} - 1$$

where  $\delta_k$  is the MFN tariff in sector  $k$  for trade flows with the rest of the world and  $\rho_k$  is the preferential tariff in sector  $k$  for trade flows within MERCOSUR.

For sectors included in national exception lists, e.g., textiles-wearing apparel, footwear, paper, and iron and steel (for more details see INTAL, 1996), tariff on intra-zone trade flows are kept equal to MFN tariffs over the transition period towards the customs union, i.e., 1991-1994 so that preferential margins are equal to zero for these sectors during this sub-period. These tariffs are thereafter automatically and linearly reduced according to the prescriptions of the Regime for the Final Adaptation to the Customs Union (Régimen de Adecuación Final a la Unión Aduanera).

We have thus a variable which measures the level of trade barriers within the bloc relative to those with the rest of the world. This variable is an appropriate empirical counterpart to the theoretical one to assess the effect of preferential trade agreements among developing countries which still have relatively high extra-zone trade barriers.

#### Average MFN and Preferential Tariffs and Average Preferential Margin (1985-1998)



The figure plots simple (unweighted) averages of Most Favored Nation (MFN) and Preferential Tariffs (PT) and of preferential margins. MFN tariffs correspond to Brazil and have been taken from Kume et al. (2000). Preferential tariffs have been calculated applying the schedule of tariff reductions set in the Treaty of Asuncion and taken into account major sectoral exceptions. Preferential margins have been estimated from MFN and Preferential Tariffs as indicated above.