

Sanguinetti, Pablo; Traistaru, Iulia; Martincus, Christian Volpe

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Economic Integration and Location of Manufacturing Activities: Evidence from Mercosur

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South-South Preferential Trade Agreements and Manufacturing Production Patterns: Evidence from MERCOSUR*

Preliminary Version

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Pablo Sanguinetti

Iulia Traistaru

Christian Volpe Martincus[♦]

Universidad Torcuato Di Tella

ZEI, University of Bonn

ZEI, University of Bonn

Abstract

Preferential trade agreements lead to a reallocation of resources across sectors and space. Production patterns resulting from North-North regional integration initiatives have been documented in several studies. However, empirical evidence on South-South arrangements is rather limited. In this respect, MERCOSUR provides an interesting case study. This paper aims at answering one main question: To what extent has the establishment of MERCOSUR affected the production patterns across member countries? Using data for the period 1985-1998, we identify the determinants of manufacturing production patterns and assess their changes in the context of deepened preferential trade liberalization. We find that increased regional economic integration has a significant impact on these patterns.

Keywords: Preferential Trade Liberalization, Production Patterns, MERCOSUR

JEL-Classification: F14, F15, L60

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[♦] Corresponding author: Center for European Integration Studies (ZEI-b), Walter-Flex-Strasse, D-53113 Bonn, Germany. E-mail: cvolpem@uni-bonn.de. Tel: +49 228 73 4031. Fax: +49 228 73 1809.

1 Introduction

Do preferential trade liberalization induce changes in production patterns across countries? International trade theory suggests a positive answer: reduced trade costs are likely to result in a spatial reorganization of production. In this paper we investigate the effects of the establishment of MERCOSUR on production patterns in Argentina, Brazil, and Uruguay over the period 1985-1998.¹

The number of South-South preferential trade agreements has rapidly increased in recent years. Just 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 involved nations (see World Bank, 2000, and Panagariya, 2000). Some authors argue that developing countries have small economies with a relatively similar and concentrated structure of production so that there is a priori not much hope that regional integration will generate strong gains in terms of new opportunities for production and trade (see, e.g., Leamer, 1998).

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 to predict 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 least industrialized participating economy can loose via trade-diversion effects.

On the other hand, 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.

Both Venables (2003) and Puga and Venables (1998) therefore conclude that preferential trade agreements between developing countries can potentially generate diverging patterns of industrial

¹ Unfortunately, Paraguay could be included in the analysis due to missing data.

development across members. Moreover, developing countries seem to be better served by trade arrangements with developed countries than with pairs.

To what extent have the above disquieting predictions been confirmed in practice? The answer is: we do not know. The empirical evidence on the impact of South-South agreements on industrial production patterns is almost absent. This should be contrasted with the numerous studies that analyze the cases of North-North and North-South preferential trade arrangements.²

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. MERCOSUR provides an interesting case study. This regional integration agreement is undoubtedly one the most important trade initiative among developing countries. It has been established in 1991 by Argentina, Brazil, Paraguay, and Uruguay. Intra-regional trade was gradually liberalized between 1991 and 1994 for most sectors and a Common External Tariff was implemented by 1995 featuring tariff rates which vary between 0% and 20%. For some items external barriers have been set at very high levels. Potential problems stemming from trade diversion can be thus substantial. Furthermore, MERCOSUR is a customs union signed among 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 or not relevant factor affecting the dynamic of industrial development within the area. More precisely, we address the following questions: What were the consequences of MERCOSUR on the industrial development of member countries? To what extent did traditional endowment and intensity factors matter relative to market size and input-output linkages for the location of industry in MERCOSUR? Did the relative importance of these forces change as a result of preferential trade liberalization?

In addressing these questions we further contribute to the empirical literature by explicitly assessing the consequences of tariff preferences with the help of a preference margin variable and by using improved econometric techniques (i.e., GMM methods) which permit us to circumvent endogeneity and serial correlation problems.

² See, e.g., Brülhart and Torstensson (1996), Amiti (1998), Brülhart (1998a, 1998b, 2001), Haaland et al. (1999), Midelfart et al. (2000), and Overman et al. (2000) for the first case, and Hanson (1997, 1998) for the second case.

The remainder of this paper is structured as follows. Sections 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 trade patterns and industry 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 backward and forward linkages. We believe that by covering these two approaches we are exhausting most possible explanations (at least those coming from trade theory).

2.1 Preferential Trade Liberalization and Comparative Advantage

Venables (2003) proposes a model along the lines of the 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 such a factor relative to the partner. Evidently, this second country has an

“extreme” comparative advantage, while the other one 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 and this last country will export agriculture goods in return. Generally, the launching of a preferential trade agreement among developing countries with different comparative disadvantages 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 an intensified tendency of sectors to locate in that country that, within the region, is relatively abundant in those factors they use intensively in their production processes.

2.2 *Preferential Trade Liberalization, Economies of Scale, 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 incorporates additional explanatory factors. This model 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.³ 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 with manufacturing industry tending to concentrate in one the member countries. Which country does host the industry? Countries are assumed to be initially

³ 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 already present there by assuming that transport costs between North and South are large enough.

identical so that there is no basis to discriminate among them. In addition, in this case the aforementioned diverging pattern between countries may be only transitional, since industry may start to disperse as tariffs are reduced low enough. However, the indeterminacy may disappear if size asymmetry prevailed. 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 the cost and demand linkages they create to other firms in the same country, i.e., as more firms are settled in the same location more intermediate inputs will be locally available and thus at a lower price and the intermediate demand will be higher (see also Venables, 1999). Under these circumstances, there is no guarantee that the final trade liberalization will go far enough to promote the spread of industry to all participating countries, especially when important barriers persist. Thus, whether preferential trade arrangements strengthen or weaken agglomeration forces is an empirical question, as this depends on the involved countries and the level of remaining trade costs.

We can therefore conclude that if there are substantial underlying size differences between economies, South-South preferential trade liberalization will 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 enough high that industry spread over countries in proportion to their initial size and when significant barriers (both natural and artificial) still segment markets. In particular, under these conditions, higher preferential margins can accentuate the tendency of manufacturing sectors with economies of scale to locate in countries with larger market potentials and that of sectors with strong cost and demand linkages to locate in countries with larger industrial bases. On the other hand, if preferential trade agreements are associated with a substantial reduction of internal trade obstacles, these agglomeration forces will not become stronger and may be even weakened.

3 MERCOSUR: Tariff Policy Reforms

Argentina, Brazil, and Uruguay implemented broad trade reforms over the last two decades. 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 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 member countries of MERCOSUR.

3.1 *Unilateral Trade Liberalization*

Argentina, Brazil, and to less 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 by the beginning of the 1990s. In particular, tariff cuts were particularly pronounced in the larger economies between 1988 and 1991. Note, on the other hand, that while in Argentina trade reform seems to have been completed by 1991, in the remaining countries the impulse towards further liberalization continued up to 1994.

3.2 *Preferential Trade Liberalization*

Argentina, Brazil, and Uruguay had 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 variable degree of preference margins) and also got exempted from non-tariff barriers (see 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 extended 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. In particular, Brazil included in its national exemption list only 29 items, including wool products, peaches in can, rubber factories, and wines. Argentina had 223 tariff line items on this list, of which 57% were steel products, 19% textiles, 11% paper, and 6% footwear. Finally, 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 in place, which favors 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), which entered 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 type of exceptions must be handled with. First, remaining products in 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.⁴

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 HS tariffs, extra-bloc and intra-bloc, for Argentina, Brazil, and Uruguay. We can conclude that, in spite of the above mentioned exceptions, countries were on average very close to internal free trade. Average external tariffs, even though substantially lower than in the past, are still high relative to those of developed countries.

4 MERCOSUR: Trade and Production Patterns

The trade policy reforms described above can potentially be associated with significant changes in trade and production patterns. After introducing our dataset, this section presents descriptive evidence on these changes in MERCOSUR member countries.

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.

⁴ 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 a great quantities of textiles products as well as on footwear. A similar policy was followed in Uruguay for almost 100 textile items.

We have also data that allow for a suitable characterization of countries and sectors. Table A1 in Appendix A presents a detailed description of the dataset indicating aggregation, time coverage, and sources. Some specific aspects of the dataset are also discussed in Appendix A2.

4.2 Manufacturing Trade Patterns

According to Venables (2003), preferential trade liberalization may have a significant impact on patterns of regional trade. This is exactly what seems to have happened in our case. In particular, the trade policy changes seem to have caused a geographical reorientation of trade flows, both at aggregate and sectoral levels. One simple aggregate indicator is the share of exports to MERCOSUR in total exports, i.e., the regional orientation of total manufacturing exports (*ROTX*). Formally:

$$ROTX_{it} \equiv \frac{\sum_k x_{ikt}^{RB}}{\sum_k x_{ikt}} \quad (1)$$

where x_{ikt}^{RB} denotes exports of country i in manufacturing industry k to MERCOSUR at time t and x_{ikt} is total exports from country i in manufacturing sector k .

Figure 1 plots this indicator for Argentina, Brazil, and Uruguay as a two-years moving average over our sample period. This index is highest for Uruguay and lowest for Brazil. Moreover, there is a clear upward trend in the relative importance of MERCOSUR as a destination of national exports for the three countries since 1991. We should remark that, even though increasing, the relative level of intra-bloc exports of the larger partners is substantially lower than that observed among European countries (see, e.g., Bevilaqua et al., 1999).

Sectoral export patterns can be described using the index of regional orientation of trade proposed by Yeats (1998). This index takes the ratio of each sector share in a country's total exports to the bloc to the share of the same sector in exports to the rest of the world. Formally:

$$ROSX_{ikt} \equiv \frac{x_{ikt}^{RB}}{\sum_k x_{ikt}^{RB}} \bigg/ \frac{x_{ikt}^{ROW}}{\sum_k x_{ikt}^{ROW}} \quad (2)$$

where x^{ROW} represents exports to the rest of the world. This index ranges between 0 and infinity. A value of 1 indicates the same tendency to exports the good under consideration to members

of the trade agreement and non-members, whereas increasing values suggest a stronger tendency to export to regional markets. We normalize this index by the cross-sectional mean in order to highlight the relative cross-sectoral geographical specialization, i.e., once the average degree has been controlled for.

Table 3 identifies for each country the five sectors with the largest increase in the ROSX index between 1985-1990 and 1995-1998, i.e., between the period before the establishment of MERCOSUR and the customs union period. It also includes their ranks in these two sub-periods. Uruguay has the largest sectoral index. Second, we overall observe significant growth rates of the index and also important changes in the sectoral rank across sub-periods. Hence, there is evidence of increased regional specialization of exports and also of marked intra-distribution mobility. Third, transport equipment and textiles are among the sectors with larger rises in the regional orientation of exports for the larger countries. As previously mentioned, the former sector has been subject to a special trade regime. Tobacco outstands in Argentina and Uruguay.⁵

4.3 *Manufacturing Production Patterns*

Manufacturing production patterns in MERCOSUR are 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 value is expressed as a share of the total production value in the industry:

$$s_{ikt} \equiv \frac{z_{ikt}}{\sum_i z_{ikt}} \quad (3)$$

and for the whole manufacturing sector we obtain:

$$s_{it} \equiv \frac{\sum_k z_{ikt}}{\sum_i \sum_k z_{ikt}} \quad (4)$$

Figure 2 plots the evolution of this aggregate indicator over the period 1985-1998 as a two-years moving average. Brazil is the largest country within the bloc. It has accounted for roughly 70%

⁵ In Brazil tobacco occupies the seventh position among the sectors with larger increases in their regional orientation indices.

of overall manufacturing activity in the MERCOSUR area over the period from 1985 to 1998. The share of this country has slightly declined after 1991. Uruguay seems to have witnessed a more pronounced decrease in its share over the same years. The opposite is true for Argentina.

Of course, there are noticeable cross-sectional differences. Which are the specific sectors in which the particular countries have gained or lost shares over time? Figure 3 shows for each country the share 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 production structures before and after the entry into force of MERCOSUR.

We observe substantial changes over time. Argentina registered increased shares in almost all sectors, but there is a significant variation over industries. This country's share raised in leather products, while Brazil and Uruguay experienced decreases. 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 expanded slightly 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 use intensively agriculture inputs. Trends are, however, different. The tendency is 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 use intensively manufactured inputs and sell a large fraction of their output to manufacturing firms (see Sanguinetti et al., 2004). The above correlations are suggestive but, because of their bivariate nature, they cannot be considered a rigorous examination of the determinants of industry location. Therefore, we turn to a formal econometric analysis in the next section.

5 Empirical Methodology

The question we investigate is the following: Did the establishment of MERCOSUR have an impact on the configuration of the manufacturing sector across member countries? In order to answer this

question, we perform a formal econometric analysis. This section introduces the empirical methodology. First, we describe the general econometric strategy and the hypotheses. Third, we define the selected model specification and review relevant estimation issues.

5.1 *General Approach and Hypotheses: Capturing Preferential Trade Liberalization*

Manufacturing production patterns are described by the distribution of country shares in the total MERCOSUR production value for each industry, as defined in Equation (3).

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.⁶ This strategy has, however, two main disadvantages (see, 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 space, since individual industry shares are available. Therefore, we take these shares as our raw dependent variable.

In order to explain these shares we adopt as a starting point the approach that has been proposed by Midelfart et al. (2000) and Overman et al. (2000), which allows us to come closer to the theory than those based on summary statistics. The general idea is that industries that use intensively a given “factor” tend to locate in countries that are relatively abundant in this “factor”. Thus, if countries differ in their endowments of educated population, then industries which use intensively well educated workers will be drawn to countries with relatively high shares of these 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

⁶ See among others Amiti (1999) and Haaland et al. (1999).

manufacturing production patterns across member countries, while these country and industry characteristics are the mechanism through which this impact takes place.

Interactions are listed in Table 4. The respective hypotheses will be considered next. Appendix A3 contains details about the construction of the underlying variables.

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

Hypothesis 1: Industries that use intensively 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 use intensively skilled workforce tend to be drawn to countries which are relatively well endowed with skilled labor.

New trade theories predict 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 in this way they are able to avoid such costs in a larger fraction of their sales. The following hypothesis can be thus established:

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

In particular, when imperfect 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, the fact of 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 also benefiting from 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 (see Venables, 1996). In this sense, the above reasoning provides a rationale for the notion of industrial base. Therefore, *industries which use intensively 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 which rely highly on industrial intermediate inputs tend to locate in countries with a large industrial base and thus ensuring a better access to their relevant providers.

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

We have thus identify the main determinants of production patterns according to the theory. Using a new trade model embedded in a traditional trade one, Amiti (2001) shows that the balance between comparative advantage and cost and demand linkages depends on the level of trade costs with the latter being relatively more important for intermediate trade barriers. Hence, one could evaluate the effect of trade liberalization by looking at the relative strength of these forces. Previous empirical studies generally assume a perfect correlation between time and deepness of integration. Thus, in order to assess the impact of reducing trade costs on production patterns, these studies rely on an “implicit strategy”, i.e., they report estimation results for different sub-periods and implicitly or explicitly argue that observed changes in the relative importance of the different determinants, e.g., estimated coefficients on the interaction terms, are driven by economic integration.

Is this a reasonable methodological approach for our case study? We believe that this approach is inadequate for our purposes. First, member countries of MERCOSUR implemented rather 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, as shown before, 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 subject to higher tariff preferences.

Therefore, in the case of MERCOSUR countries, the original approach must be extended. Specifically, we improve upon the basic setting suggested by Midelfart et al. (2000) and Overman et al. (2000) by including a measure of sectoral preferential margin. This is our first methodological contribution.

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. Then we have combined this sectoral preferential tariff with the respective MFN tariff into an indicator of preferential margin (see Appendix A3 for more details). 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 who still have relatively high extra-zone trade barriers. Indeed, the no inclusion of this indicator may lead to biased estimates due to the omission of potentially relevant information.

The preference margin variable allow us to explicitly test the following hypotheses that can be derived from the theoretical studies reviewed in Section 2:

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 preferential margins increase (decrease) 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 for intermediate (low) internal trade barriers

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 $\ln[s_{ik}/(1-s_{ik})]$ and ranges in $(-\infty, +\infty)$.

The dependent variable is expressed as a function of the interactions between industry characteristics 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:

$$\ln\left(\frac{s_{ikt}}{1-s_{ikt}}\right) = \sum_j \beta(j) \varpi_{it}(j) \theta_{kt}(j) + \zeta_i + \nu_k + \tau_t + \varepsilon_{ikt} \quad (5)$$

$\varpi_i(j)$ is the level of the j th characteristic in country i and $\theta_k(j)$ is the industry k value of the industry characteristic paired with the country characteristic, ζ_i , ν_k , and τ_t are country-, industry, and time-fixed effects, respectively.⁷

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

$$\ln\left(\frac{s_{ikt}}{1-s_{ikt}}\right) = \sum_j \beta(j) \varpi_{it}(j) \theta_{kt}(j) + \phi \zeta_i pm_{kt} + \nu_k + \tau_t + \varepsilon_{ikt} \quad (6)$$

$$\ln\left(\frac{s_{ikt}}{1-s_{ikt}}\right) = \sum_j \beta(j) \varpi_{it}(j) \theta_{kt}(j) + \lambda pm_{kt} + \sum_j \gamma(j) pm_{kt} \varpi_{it}(j) \theta_{kt}(j) + \zeta_i + \nu_k + \tau_t + \varepsilon_{ikt} \quad (7)$$

where pm denotes sectoral preferential margin.

With Equation (3) we aim at assessing the overall impact of tariff preferences, i.e., across sectors, while with Equation (4) we explore the mechanism behind the observed aggregate patterns. In particular, we interact the sectoral preferential margin with each matching pair of country and

⁷ This paper aims at analyzing the influence of preferential trade liberalization on production patterns across MERCOSUR member countries. Our econometric strategy does 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.

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 and the new interactions will capture to what extent preferences accentuate or ameliorate such responsiveness.

Our sample includes 27 industries, 3 countries, and 14 years, 1985-1998, i.e., it contains 1,134 observations.⁸ 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. Furthermore, there are three potential sources of heteroscedasticity: across countries, across industries, and across time.⁹ Hence, White (1980)'s heteroscedastic consistent standard errors are reported and used for hypothesis testing.

Two main problems, which may result in biased and inconsistent estimations, are usually under-addressed in the literature. First, most empirical studies use a static framework, i.e., they carry out cross-sectional regressions (see, e.g., Midelfart et al., 2000 and Overman et al., 2000) or a static panel data analysis (see, e.g., Kim, 1995, Amity, 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-effect model suggest that there is serial correlation of first order in the disturbances.¹⁰ A dynamic panel estimation is then required. 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 (see, e.g., Nickell, 1981, and Kiviet, 1995).

On the other hand, endogeneity is potentially a severe problem for the kind of estimations we are proposing. Thus, skill intensive 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 skill abundance through induced migration. A similar reasoning also applies to firms with input-output linkages, as suggested by the new trade theories. We

⁸ The industry "Other manufacturing industries", which is a residual component, was dropped out.

⁹ The White's general test perform to test for heteroskedasticity (see Greene, 1997). This test suggests that indeed there is heteroscedasticity. The corresponding chi-square statistic is highly significant.

¹⁰ These test statistics are not reported, but are available from the authors upon request.

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 estimate previous equations by GMM estimations using the method developed by Arellano and Bond (1991) after incorporating one lag of the dependent variable on the right hand side. This method first-differentiate previous equations and permits to obtain additional instruments using the orthogonality conditions existent between lagged values of the dependent variable and the disturbances (for additional details see Arellano and Bond, 1991, and Baltagi, 1995). This is our second methodological contribution.

6 Estimation Results

We proceed in two steps, which are related to the contributions we aim at. First, since we are looking at developing countries, we want to compare our results with those based on developed countries. We therefore generate estimation results following the general approach proposed by Midelfart et al. (2000) and Overman et al. (2000), but using the improved econometric techniques we described before. More precisely, we first report GMM estimates of Equation (5) for the whole period, 1985-1998, and for “moving” equally-sized sub-samples of this period beginning with 1985-1993 and finishing with 1990-1998.¹¹ Second, we turn to the explicit assessment of preferential trade liberalization, i.e., to the estimation of Equations (6) and (7).

Table 5 reports results from GMM estimates for the whole sample period and “moving” sub-periods, where the standard errors have been corrected to account for unknown heteroscedasticity. This table includes also two specification tests: the Sargan test for over-identifying restrictions and the test for second order autocorrelation.¹² The Sargan test statistics indicate that the instruments are

¹¹ We have chosen sub-periods of 9 years to ensure a reasonable minimum number of time periods to carry out GMM estimations.

¹² The test statistics for first order autocorrelation (not reported) is significant in all specification. The null hypothesis of absence of serial correlation of this order can be thus rejected.

valid. Moreover, we cannot reject the null hypothesis of absence of serial correlation of second order.¹³ Accordingly, our estimations are consistent.

The first column shows a pattern of matching between specific country characteristics and specific industry characteristics, which confirms the priors derived from theory, especially those from the traditional trade theory. Thus, industries that use intensively agricultural inputs tend to be located in countries that are relatively abundant in arable land. Similarly, industries that use intensively skilled labor tend to be located in countries that are relatively abundant in this factor. Furthermore, industries with increasing returns to scale tend to locate in countries with larger market potentials. In addition, sectors which use intensively industrial intermediate inputs tend to locate in countries with larger industrial market potentials. We do not find, however, a clear link between labor abundance and labor intensity and industrial market potential and relative importance of intermediate demand in total demand.¹⁴ To summarize, the data provide support for Hypotheses 1, 3, 4, and 5.

We have checked the robustness of these estimation results in several ways. First, we used the absolute production value instead of the shares as dependent variable.¹⁵ Second, we tested the stability of parameters by sequentially introducing the explanatory variables. Third, the differentiation performed when applying the method of Arellano and Bond (1991) implies removing country-fixed effects. We have therefore included population or GDP in GMM estimations to control for size. Fourth, we have also utilized alternative measures of labor abundance, labor intensity, and market potential (see Appendix A3 for more details). In all cases, results were qualitatively the same.¹⁶

¹³ There is evidence of second order autocorrelation for the regression that corresponds to the sub-period 1989-1997. Nevertheless, the time trend over the set of regressions for the coefficients of interest seems to be clear. In addition, we incorporated a second lag value for the dependent variable in the regression with the consequence of removing such serial correlation. Also in this case the main picture remains robust. These results are available from the authors upon request.

¹⁴ Amiti (2001) shows that industries may end up located in countries without a matching comparative advantage when there are other competitive reasons for location: the convenience to be settled closer to providers of other intermediate inputs or to customers.

¹⁵ 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.

¹⁶ These results are not reported, but are available from the authors upon request.

As discussed before, the effect of trade integration on manufacturing production patterns is usually assessed running separate regressions for different sub-periods and comparing 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” replicate this procedure.

We find that interactions involving factor endowments and factor intensities, specifically abundance and intensity of agriculture and skilled labor, show an upward trend. Production patterns across MERCOSUR member countries seems thus becoming 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 involving market potential and economies of scale and industrial market potential and intensity in intermediate manufactured inputs do not display a monotonic trend. Estimations suggest that the responsiveness to these factors has followed an inverted-U shaped path: it has first increased and then decreased.¹⁷ These results can reflect the fact that, as suggested by the theory, agglomeration forces are stronger at intermediate levels of trade costs. Finally, demand linkages, as measured by the interaction between industrial market potential and intensity of sales to industry, even though still insignificant, show a growing relative importance.

Are these results comparable to those from previous studies focusing on developed countries? Midelfart et al. (2000) and Overman et al. (2000) perform a similar analysis for Europe and are thus a natural benchmark. 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 Midelfart et al. (2000), the tendency of industries with economies of scale to locate in central countries has decreased over time, while the opposite is true for industries

¹⁷ In the case of the interaction between industrial market potential and industrial inputs intensity a slight increase in the last sub-period can be observed. However, the average value over the last sub-periods is significantly lower than that over the first sub-periods.

with strong cost and demand linkages. Overman et al. (2000) 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. Comparing these results with our findings we get a mixed picture. We have also found a declining significance of market potential for industries with economies of scale towards the end of the period. Furthermore, similar to Midelfart et al. (2000), we detect an increasing importance of demand linkages (although they are not significant). Finally, contrary to these authors, we overall observe a weakening of cost linkages.

The previous econometric analysis has followed the existent literature in assessing the impact of trade liberalization through an implicit approach. Indeed, observed changes in the relative importance of explanatory factors could be the net results of the multiple reforms that were implemented in the region since the second half of the 1980s. In particular, they could be driven by preferential trade liberalization, but also by the general unilateral opening of the economies. The relevant question is then: Is there any specific role for MERCOSUR? To answer this question we turn to the estimation of Equations (6) and (7).

Table 6 reports GMM estimates of Equation (6). They suggest that the smallest country in the bloc, Uruguay, has systematically lower shares in those sectors with higher preferential margins.¹⁸ We have also replicated the analysis for the sub-period 1990-1998. Results are presented in Table 7. The coefficient on the interaction between Uruguay's dummy and preferential margin is larger (in absolute value) than for the whole sample period, 1985-1998. This suggests an intensification of the effect over the first years after the launching of the trade arrangement. Moreover, estimated coefficients on other variables decline as the preferential margin is included, which indicates that they could be capturing the influence of preferential trade liberalization. Therefore, as predicted by the theory, regional trade agreements among asymmetric developing countries bias manufacturing production patterns against the country which have an extreme comparative advantage in other sectors and are small. In particular, Uruguay has comparative advantage in agriculture products and has a narrower preexistent industrial base in comparison to Argentina and Brazil (see INTRACEN, 2004). Under such

¹⁸ Uruguay is the smallest country in the sample as measured by population and GDP and, in spite of its central position, the one with the smallest market potentials (when internal distances are set to be lower than international distances).

circumstances, the expected result from a preferential trade arrangement between these countries is a decline in the manufacturing share of the former country.

Previous econometric results show that preferential trade liberalization has had an impact on aggregate production patterns across Southern Cone countries. This is compatible with two explanations. The question then arises: What are the main mechanisms? Comparative advantage or market size?

Estimates of Equation (7) provide us an answer to this question. Results are reported in Table 8. These results 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 skilled labor.¹⁹ Hence, (skilled) labor intensive industries show a stronger tendency to locate in countries with larger endowments of (skilled) labor in the presence of larger preference margins. 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 Volpe Martincus, 2003). The increased coefficient on this interaction observed in our "moving regressions" could be thus traced back to general trade liberalization. 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. Finally, we do not observe a clear effect on sensitivity to market access. These last results would correspond to a scenario where the trading agreement is associated with low internal barriers. In order to test the plausibility of this interpretation, we re-estimate Equation (7), this time with internal (preferential) tariffs as trade policy instrument instead of preferential margins. Results are presented in Table 9. 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.²⁰

¹⁹ We have performed regressions with both contemporaneous interactions as well as interactions with lagged preferential margins 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.

²⁰ 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 potential.

Therefore, the evidence provides support for Hypothesis 7. Preferential trade liberalization seems to be favoring a restructuring of production patterns across MERCOSUR member countries along the lines of internal comparative advantage, as we should expect according to Venables (2003). Furthermore, it seems to weaken agglomeration forces, which 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, by assessing explicitly the impact of preferential trade liberalization, and by using appropriate techniques to address econometric problems such as serial correlation and endogeneity.

In order to distinguish the role of increased economic integration on changing manufacturing production patterns, we first followed the existent literature in re-estimating the regression equation that specifies the determinants of these patterns for “moving sub-periods” from 1985-1993 to 1990-1998 which accompany the evolution of MERCOSUR. According to this evidence, increased integration appears associated with a higher sensitivity of production patterns to comparative advantage, namely, to countries’ endowments of arable land and skilled labor. Furthermore, the responsiveness of industries with increased returns to scale and strong cost linkages to market potentials seems to have followed an inverted U-shaped path as trade costs declined.

We complemented this indirect evidence by explicitly assessing the role of preferential trade liberalization including a measure of sectoral preferential margin interacted with country dummies as an additional explanatory variables in the original model. We found, in concordance with the theory, that Uruguay, the smallest country in the sample and with an extreme comparative advantage in agriculture (relative to Argentina and Brazil), has systematically lower shares in sectors with higher preferential margins.

Moreover, we attempted to uncover the mechanisms behind this aggregate result. In particular, we interacted the preferential margin 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 is driving a spatial reorganization of production along the lines of internal comparative advantage and weakening agglomeration forces.

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Table 1

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

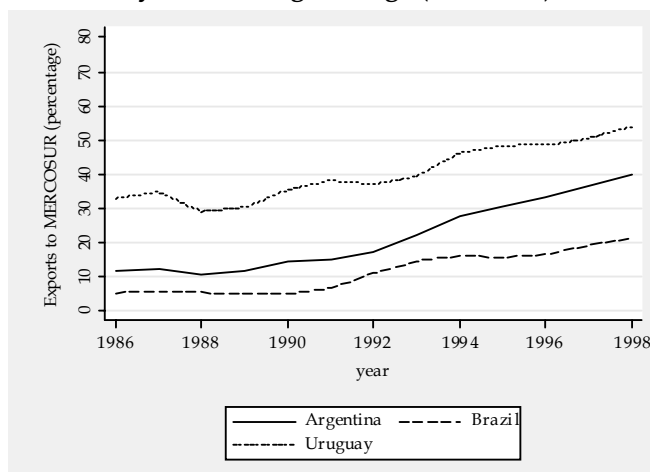
Source: Estevadeordal et al (2000)

Table 2

MERCOSUR: External and Internal Tariffs (1996)				
Country	External Tariff (simple average)	Internal Tariff (simple average)	External Tariff (import-weighted)	Internal Tariff (import-weighted)
Argentina	11.78	0.36	13.37	0.86
Brazil	13.14	0.02	15.44	0.02
Uruguay	10.78	0.88	11.01	1.77
Mercosur CET	11.75	0.00	11.09	0.00

Source: Olarreaga and Soloaga (1998).

**Figure 1: Manufacturing Exports to MERCOSUR as a Percentage of Total Manufacturing Exports
Two-years Moving Average (1986-1998)**



The Figure plots the Index ROTX as defined in Equation (1) in text multiplied by 100

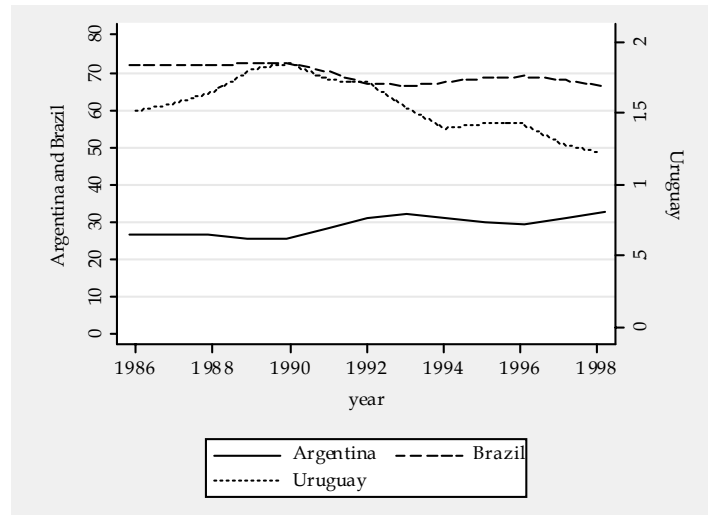
Table 3

Argentina, Brazil, and Uruguay: Five Sectors with the Largest Increases in their Regional Orientation of Trade						
Country	Sector	Normalized ROSX Index				Change
		1985-1990		1995-1998		
		Index	Rank	Index	Rank	
Argentina	Miscellaneous products of petroleum and coal	0.29	23	5.94	1	5.65
	Transport equipment	1.93	4	4.22	2	2.30
	Tobacco	0.19	24	2.46	3	2.27
	Footwear	1.04	14	2.39	4	1.35
	Textiles	0.35	22	0.69	12	0.34
Brazil	Beverages	3.49	2	5.73	1	2.24
	Transport equipment	0.46	21	1.40	6	0.93
	Wearing apparel	1.56	23	2.34	12	0.78
	Plastics products	0.41	6	1.09	2	0.69
	Textiles	0.66	18	1.17	13	0.51
Uruguay	Iron and steel	2.61	2	10.08	1	7.48
	Glass products	1.17	4	4.53	2	3.36
	Tobacco	0.02	22	1.93	4	1.91
	Furniture and fixtures	0.71	15	1.99	6	1.29
	Petroleum refineries	0.08	14	1.31	9	1.23

The Table reports the (normalized) index of regional orientation of exports at the sectoral level calculated as indicated in Equation (2).

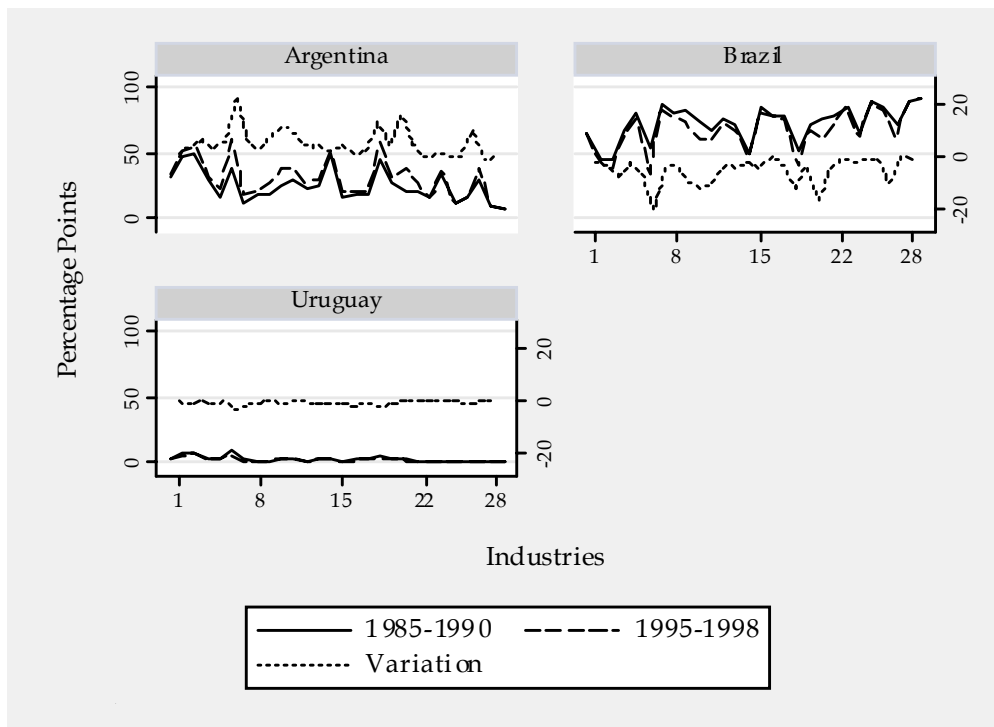
This index has been averaged over the sub-periods 1985-1990 and 1995-1998. "Change" corresponds to the absolute variation between sub-periods. Sectors are ordered according to this change.

**Figure 2: 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 3: 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 4

Regressions			
Category	Variables		
Basic interaction terms (1)	Agriculture abundance	* Agriculture intensity	
	Labor abundance	* Labor intensity	
	Skilled labor abundance	* Skilled labor intensity	
	Market potential	* Economies of scale	
	Industrial market potential	* Industrial intermediate consumption	
	Industrial market potential	* Sales to industry	
Preferential trade liberalization - Aggregate Impact (2)	Country dummies		* Preferential margin
Preferential trade liberalization - Mechanisms (3)	Agriculture abundance	* Agriculture intensity	* Preferential margin
	Labor abundance	* Labor intensity	* Preferential margin
	Skilled labor abundance	* Skilled labor intensity	* Preferential margin
	Market potential	* Economies of scale	* Preferential margin
	Industrial market potential	* Industrial intermediate consumption	* Preferential margin
	Industrial market potential	* Sales to industry	* Preferential margin

Note:

(1): Variables included in the estimation of Equation (5)

(1) + (2): Variables included in the estimation of Equation (6)

(1) + (3): Variables included in the estimation of Equation (7)

Table 5

The Impact of Trade Liberalization - Moving Regressions								
Explanatory variables - Interactions		1985-1998	1985-1993	1986-1994	1987-1995	1988-1996	1989-1997	1990-1998
		Ints	Ints	Ints	Ints	Ints	Ints	Ints
Agriculture abundance	* Agriculture intensity	0.252 (0.049)***	-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	-0.070 (0.030)**	-0.091 (0.041)**	-0.103 (0.041)**	-0.091 (0.041)**	-0.054 (0.044)	-0.043 (0.045)	-0.049 (0.041)
Skilled labor abundance	* Skilled labor intensity	0.045 (0.026)*	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	0.086 (0.033)**	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	0.192 (0.056)***	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	-0.006 (0.069)	-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	Yes
Number of observations		972	567	567	567	567	567	567
Sargan test for overidentification, χ^2 (189)		62.96	69.10	69.32	70.53	67.88	72.22	67.83
Test for second order autocorrelation, z		-0.38	0.36	-0.53	0.31	-0.34	-2.00**	-1.44

The table reports GMM estimations based on the procedure developed by Arellano and Bond (1991)

Results correspond to one-step estimations

Dependent variable is the (logistically transformed) location share as defined in Equation (3) in text

One lag of the dependent variable included (not reported)

All right-hand side variables in Equation (5) are treated as endogenous

The Sargan test statistics is based on the two-step estimations

Robust standard errors in parentheses

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

Table 6

The Impact of Preferential Trade Liberalization on Aggregate Production Patterns (1985-1998)		
Explanatory variables - Interactions	(1) Ints	(2) Ints
Agriculture abundance * Agriculture intensity	0.202 (0.058)***	0.151 (0.060)**
Labor abundance * Labor intensity	-0.070 (0.030)**	-0.060 (0.031)*
Skilled labor abundance * Skilled labor intensity	0.028 (0.024)	0.012 (0.025)
Market potential * Economies of scale	0.093 (0.031)***	0.082 (0.031)***
Industrial market potential * Intermediate inputs intensity	0.201 (0.053)***	0.163 (0.057)***
Industrial market potential * Intensity of sales to industry	-0.009 (0.069)	-0.012 (0.078)
Argentina and Brazil * Preferential margin	0.001 (0.022)	
Uruguay * Preferential margin	-0.065 (0.028)**	-0.073 (0.028)***
Argentina * Preferential margin		0.031 (0.025)
Brazil * Preferential margin		-0.029 (0.024)
Year fixed-effects	Yes	Yes
Number of observations	972	972
Sargan test for overidentification, χ^2	59.15	65.76
Test for second order autocorrelation, z	-0.46	-0.36

The table reports GMM estimations based on the procedure developed by Arellano and Bond (1991)

Results correspond to one-step estimations

Dependent variable is the (logistically transformed) location share as defined in Equation (3) in text

One lag of the dependent variable included (not reported)

All interactions between country and industry characteristics in Equation (6) are treated as endogenous

The Sargan test statistics is based on the two-step estimations

Robust standard errors in parentheses

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

Table 7

The Impact of Preferential Trade Liberalization on Aggregate Production Patterns (1990-1998)				
Explanatory variables - Interactions		(1)	(2)	(3)
		Ints	Ints	Ints
Agriculture abundance	* Agriculture intensity	0.308 (0.086)***	0.253 (0.092)***	0.211 (0.093)**
Labor abundance	* Labor intensity	-0.062 (0.042)	-0.070 (0.038)*	-0.063 (0.039)
Skilled labor abundance	* Skilled labor intensity	0.073 (0.036)**	0.037 (0.035)	0.014 (0.038)
Market potential	* Economies of scale	0.065 (0.038)*	0.054 (0.031)*	0.049 (0.032)
Industrial market potential	* Intermediate inputs intensity	0.216 (0.085)**	0.201 (0.092)**	0.196 (0.090)**
Industrial market potential	* Intensity of sales to industry	0.082 (0.124)	0.036 (0.122)	0.035 (0.126)
Argentina and Brazil	* Preferential margin		-0.042 (0.040)	
Uruguay	* Preferential margin		-0.080 (0.040)**	-0.132 (0.049)***
Argentina	* Preferential margin			-0.020 (0.045)
Brazil	* Preferential margin			-0.063 (0.041)
Year fixed-effects		Yes	Yes	Yes
Number of observations		486	486	486
Sargan test for overidentification, X^2		74.17	68.25	76.59
Test for second order autocorrelation, z		-0.15	-0.01	0.24

The table reports GMM estimations based on the procedure developed by Arellano and Bond (1991)

Results correspond to one-step estimations

Dependent variable is the (logistically transformed) location share as defined in Equation (3) in text

One lag of the dependent variable included (not reported)

All interactions between country and industry characteristics in Equation (6) are treated as endogenous

The Sargan test statistics is based on the two-step estimations

Robust standard errors in parentheses

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

Table 8

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

The table reports GMM estimations based on the procedure developed by Arellano and Bond (1991)

Results correspond to one-step estimations

Dependent variable is the (logistically transformed) location share as defined in Equation (3) in text

One lag of the dependent variable included (not reported)

All right-hand side variables in Equation (7) are treated as endogenous (except preferential margin)

(1): Contemporaneous interactions between matching characteristics and preferential margins

(2): Interactions between lagged preferential margins and matching characteristics

The Sargan test statistics is based on the two-step estimations

Robust standard errors in parentheses

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

Table 9

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

The table reports GMM estimations based on the procedure developed by Arellano and Bond (1991)

Results correspond to one-step estimations of Equation (7) with pm reemplaced by internal tariffs

Dependent variable is the (logistically transformed) location share as defined in Equation (3) in text

One lag of the dependent variable included (not reported)

All right-hand side variables are treated as endogenous (except internal tariff)

(1): Contemporaneous interactions between matching characteristics and preferential margins

(2): Interactions between lagged internal (preferential) tariffs and matching characteristics

The Sargan test statistics is based on the two-step estimations

Robust standard errors in parentheses

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

Table A1

Data				
Variable	Aggregation	Country coverage	Period	Source
Production value	ISIC. Rev. 2, 3digits	Argentina, Brazil, Uruguay	1985-1998	PADI/ECLAC
	IBGE Subsector Classification	Brazil	1985, 1990-1998	IBGE
Exports and Imports	ISIC. Rev. 2, 3digits	Argentina, Brazil, Uruguay	1985-1998	BADECEL/ECLAC
Employment	IBGE Subsector Classification	Brazil	1985-1998	RAIS/Ministry of Works
Value added	IBGE Subsector Classification	Brazil	1985, 1990-1998	IBGE
Number of establishments	IBGE Subsector Classification	Brazil	1985-1998	RAIS/Ministry of Works
Labor compensation	IBGE Subsector Classification	Brazil	1985-1998	IBGE
Workers qualification	IBGE Subsector Classification	Brazil	1985-1998	RAIS/Ministry of Works
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.²² A simple inspection of such available data suggests that using the Brazilian data should not be, however, significantly misleading.²³

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 1987.²⁴

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.

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 .²⁵ 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.

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

²² 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).

²³ 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 (Sanguinetti and Sallustro, 2000).

²⁴ 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.

²⁵ 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).

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

where lat is latitude and $long$ means longitude.

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

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

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

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 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 (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 about developed countries. For that reason its use for developing countries could be inconvenient.

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.

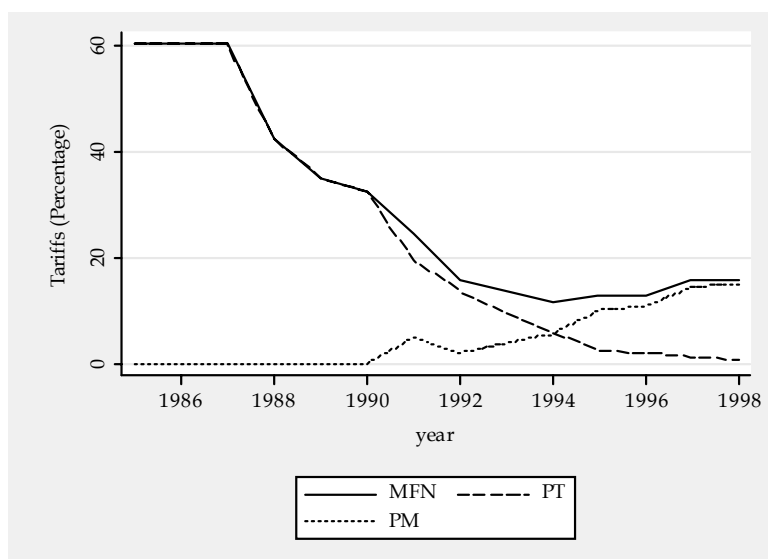
Preferential margin: We define *preferential margins* as follows (see, e.g., Estevadeordal et al., 2000):

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

where δ_k is the MFN tariff in sector k for trade flows with the rest of the world and ρ_k is the preferential tariff in sector k for trade flows within MERCOSUR. Preferential tariffs are in turn calculated applying the internal trade liberalization schedule set in the Asunción Treaty on the (Brazilian) MFN sectoral tariffs.

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).

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



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