Determinants of Manufacturing Concentration Patterns in Mercosur

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Abstract

Over the last fifteen years, Argentina, Brazil, Paraguay, and Uruguay have implemented major economic reforms including unilateral trade liberalization programs and the constitution of a regional trade bloc, Mercosur. This trade policy change has led to a reallocation of resources across sectors and space. The impact of the trade liberalization on industrial production structures in Mercosur countries has been little investigated so far. How concentrated/dispersed are manufacturing activities? Have patterns of manufacturing concentration changed? What are the determinants of manufacturing concentration patterns? The present paper identifies absolute and relative concentration patterns of manufacturing activities in three Mercosur member countries, namely, Argentina, Brazil, and Uruguay, over the period 1970-1998. Further, by using econometric techniques, it analyses inter-industry and across-time differences in manufacturing concentration patterns and explain their main determinants over the period 1985-1998. Descriptive evidence suggests that some industries, such as Beverages, Tobacco, Pottery, and Leather are highly concentrated in relative terms, while industries such as Glass, Textiles, Food products, and Fabricated metal products are dispersed. On average, relative manufacturing concentration has increased over the above mentioned period. While industries, such as, Non-electrical machinery, Electrical machinery and Professional and scientific instruments have experienced significant monotonic increases, other industries, such as Printing and publishing, Rubber products, and Non-ferrous metals have registered a reversal of their relative concentration levels. The econometric evidence indicates that localization of demand and comparative advantage factors are the main driving forces of the observed relative manufacturing concentration patterns. Moreover, Mercosur seems to have an impact on spatial developments.

Keywords: Economic Integration, Concentration of Industries, Comparative advantage, Economic Geography.
JEL Classification: L60, F14, F15, C23.

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1. INTRODUCTION

During the last fifteen years, South American countries have implemented broad unilateral trade liberalization programs. They have also actively engaged in regional trade initiatives. In particular, Argentina, Brazil, Paraguay, and Uruguay signed up a trade agreement in 1991, which gave rise to *Mercosur* (Mercado Común del Sur). The launching of the arrangement implied the instrumentation of a gradual process of tariff barriers dismantling among member countries. Specifically, the average Most Favoured Nation tariff imposed by Mercosur countries with respect to the rest of the world diminished from 37.2 percent to 12.2 percent between 1985 and 1997, while the average intra-bloc tariff declined from 35.2 percent to 4.2 percent over the same period (Estevadeordal, Goto, and Saez, 2000). As a consequence, over the last decade, the volume of bilateral trade as well as with the rest of the world increased substantially.

The reduction of trade costs and the consequent larger gravitation of foreign markets tend to induce non-negligible changes in the prevailing spatial equilibrium and concretely in the pattern of geographical distribution of specific economic activities. Such locational shifts are essentially determined by comparative advantage considerations and agglomeration forces (World Bank, 2000).

The analysis of locational patterns and their changes over time is important for at least three reasons.

First, the spatial distribution of economic activities has relevant welfare implications. From an efficiency point of view, the way activities are organized across locations affects the overall welfare an area can generate. From an equity point of view, the spatial distribution of activities also affects the geographical distribution of overall welfare (Ottaviano, 2002). Hence, by altering the locational pattern of economic activities, trade liberalization may promote changes in both the overall level of welfare and its distribution over space.

Second, as a logical consequence of the previous point, the spatial distribution of economic activities has important political economy implications. Economic integration may trigger relocation of economic resources at the aggregate and sectoral levels. In the first case, the whole activity might become concentrated in few regions. Under such a scenario, immobile agents in the region experiencing delocation suffer both as consumers and as workers. As consumers because the nearby available diversity of goods and services decreases and, given the existence of trade costs, they must pay higher effective prices for those goods whose production is relocated to other regions. As workers due to the fact that the matching process between workers and firms tends to worsen, so that unemployment length rises (Martin, 2000). It is then clear that such a level of interregional disparities may become politically unacceptable and hence it may hurt the viability of the ongoing economic integration process (Martin and Rogers, 1994; Begg, Judgin, and Morris, 1996). In the second case, activity levels in some industries increase in certain countries due to their locational advantages and decrease in others. Even though both groups of countries may still have net gains in terms of combined producer and consumer surpluses, the industry-specific welfare gains are larger for the country specializing into a particular sector (Brülhart, 1998). Hence, if spatial and intersectoral mobility of affected workers is low, then depending on their respective relative weight in the government's objective function, this might pose an obstacle for the integration process.

Third, the spatial distribution of economic activities has significant macroeconomic implications. Increased geographical concentration and hence inter-industry specialization imply diverging production structures across involved countries and consequently higher probability of experiencing asymmetric shocks and lower synchronization of business cycles (Kenen, 1969). Under such conditions, a higher bilateral exchange rate variability might be expected. This, in its turn, might act as a channel of agglomeration of economic activities in the larger country within the bloc (Ricci, 1998) and might promote reversions in the integration process in the form of reinsertion of protectionist measures (Eichengreen, 1993; Fernández-Arias, Panizza, and Stein, 2002).

Surprisingly very little empirical work on patterns of manufacturing location in Mercosur has been undertaken. In particular, there exists no empirical evidence of how the economic landscape within the area constituted by Mercosur countries looks like and how it has evolved over time and in particular since the creation of the trade bloc.

This paper aims at filling this gap. We examine the concentration patterns of manufacturing activities in three Mercosur countries (Argentina, Brazil, and Uruguay) and their time profile by means of a comprehensive descriptive analysis based on conventional summary statistics for the period 1970-1998 and an econometric analysis trying to shed light on their underlying factors for the period 1985-1998[3]. More specifically, we address the following questions: How concentrated/dispersed are manufacturing activities ? Have patterns of manufacturing concentration changed? What are the determinants of manufacturing concentration patterns? Did Mercosur have a spatial impact and concretely has the relative importance of determinant factors varied after its launching?

The remainder of this paper is organized as follows. Sections 2 reviews the relevant theoretical literature with the purpose to formulate the set of hypotheses to be tested empirically. According to international trade theory, there exist different factors that may lead to the concentration of economic activity. The *neoclassical theory* stresses technological and relative factors endowments considerations. The *new trade theory* emphasizes the role of scale economies and trade costs in a context of countries with asymmetric market sizes. Finally, the *new economic geography* highlights agglomeration forces like the ones linked to input-output linkages within industries.

Section 3 presents the data set and the concentration measures we use in this paper. Section 4 discusses the cross-sectional and time dimensions of concentration levels . Main findings suggest that certain industries, such as Beverages, Tobacco, Pottery, and Leather are highly concentrated in relative terms, while industries such as Glass, Textiles, Food products, and Fabricated metal products are dispersed. Furthermore, most relatively concentrated industries figure among the less absolutely concentrated industries, which suggests a locational bias towards the smaller countries. The group of sectors with high absolute concentration includes Electrical machinery, Non-electrical machinery, and Professional and scientific instruments. On average, relative manufacturing concentration has increased over the period. While industries, such as, Non-electrical machinery, Electrical machinery and Professional and scientific instruments have experienced significant monotonic increases, other industries, such as Printing and publishing, Rubber products, and Non-ferrous metals have registered a reversal of their relative concentration levels. In its turn, absolute concentration first increases and then decreases. Most industries adjust to this time pattern.

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[3] Unfortunately, Paraguay could not be included in the analysis due to missing data.

Section 5 discusses estimation results from our econometric analysis that aimed at identifying the determinants of relative concentration patterns. The explanatory variables correspond to the main forces suggested by international trade theory. The econometric evidence indicates that localization of demand and comparative advantage factors are the main driving forces of observed relative manufacturing concentration patterns. Moreover, the formation of Mercosur seems to matter for the location of manufacturing in Argentina, Brazil and Uruguay.

Section 6 concludes.

2. THEORETICAL BACKGROUND

Economic activities exhibit different spatial patterns at particular time points. They also differ in the way such patterns evolve over time. Several factors can help to explain the cross-section diversity and its dynamics. Those factors can be classified into two broad groups: *first nature elements,* that is, the physical geography and endowment of natural resources; and *second nature elements,* that is, the geography of distance between economic agents (Krugman, 1993; Overman, Redding, and Venables, 2001). Relevant theoretical approaches can be then differentiated through the weight they assign to the aforementioned factors. The *neoclassical theory* emphasizes the role of the first group of factors; the *new trade theory* builds up on a combination of both sorts of forces; finally, the *new economic geography* concentrates on the second group of factors.

Locational patterns are frequently characterized in terms of the degree of concentration activities do display. In this sense, one can distinguish between *absolute concentration* and *relative concentration*. One industry is *absolutely concentrated* if a few particular countries, independently of their sizes, account for very large shares of its overall activity (Midelfart-Knarvik, Overman, Redding, and Venables, 2000). In turn, one industry is *relatively concentrated* if the spatial pattern of its activity differs from the average spread of the total manufacturing activity across countries. Theoretical approaches can also be distinguished in terms of the predictions they allow for. The *neoclassical theory* permits essentially to derive clear-cut predictions about relative concentration but not for absolute concentration. The opposite is true for the *new economic geography*. Finally, the *new trade theory* makes possible to draw inferences about *relative* as well as *absolute* concentration (Haaland, Kind, Midelfart-Knarvik, and Torstensson, 1999).

The present section reviews those theoretical approaches, by examining their assumptions and main results, with the objective of providing a basis for the empirical analysis that is carried out in the following sections through the identification of testable hypotheses.

2.1 The Neoclassical Theory

The *neoclassical theory*, assumes perfect competition, product homogeneity and non-increasing returns to scale, and shows that location is exogenously determined by *first nature factors*, namely, the spatial distribution of technologies, natural resources and productive factors.

Let us consider first the canonical *Ricardian model*. Within this framework, locational patterns are basically driven by relative differences in technology, which can be described in terms of the relative labour productivity. In particular, *relative technology differences across countries may give rise to comparative advantages and the larger they are, the higher the degree of relative concentration of industries.*

Consider now the *Heckscher-Ohlin model*. In this case, the locational pattern is essentially determined by the interaction between country and industry characteristics (Venables, 2001). Concretely activities settle in locations with a matching relative attribute advantage.

Then, under absence of underlying differences between countries in the world, economic activities distribute uniformly in the space, since firms producing in places in which they coexist with many partners face a more intense competition both in product and in factor markets and therefore their profitability is lower than the one achieved by firms coexisting with less firms and hence facing a less intense competition. However, *if countries display pronounced differences in their inherent characteristics, so that there prevails a lumpy distribution of factor endowments, then emerges a more uneven spatial distribution of production with activities relatively concentrating in those countries which are relatively abundant in the factors they intensively use* (Ottaviano and Puga, 1997; Brülhart, 1998).

In this context, the spatial distribution of demand is essentially relevant for trade patterns, but not for locational patterns, unless that trade costs are positive. In particular, if such costs are prohibitive, then the geographical configuration of industries mirrors the one of the demand (Brülhart, 2000).

One relevant question from the point of view of the present work is how can trade liberalization influence the configuration of economic landscape. According to the approach under consideration, the answer is that a general opening induces activities to relatively concentrate in countries with the matching true comparative advantage (Jones, 1965; Brülhart, 1998). In the case of a regional integration process, the influence of comparative advantage considerations on the spatial dynamics has singular aspects. In particular, *the launching of a trade agreement among developing countries with different comparative disadvantages relative to the rest of the world that consists of a preferential reduction in tariffs holding invariant protection rate with respect to non- members would induce a relocation of manufacturing to 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 in both countries would be increasingly supplied with manufactures stemming from such a country*.

Although relevant, comparative advantage is insufficient to explain the notorious concentration of economic activity observed in reality (Ottaviano and Puga, 1997). Particularly, there are many regions without obvious natural advantages which develop into economic centres (Krugman, 1993; Schmutzler, 1999). Which other factors can then help to understand factual patterns? The *new trade theory* makes and important contribution in this sense.

2.2 The New Trade Theory

The *new trade theory* combines *second nature elements* and one *first nature element,* the market dimension, which is determined by the size of the working force living in a particular country jointly with the assumption of international labour immobility. In general, models within this theoretical approach assume that the world consists of two regions: a big central country and a small peripheral country. The first one has an absolute factorial endowment larger than the second one, but both have the same relative endowment[4]. Moreover, it is particularly assumed that there exist two productive sectors. On one hand, there is a perfectly competitive sector, which operates under constant returns to scale and whose output is costless traded, and on the other hand, there is a monopolistically competitive sector with firms producing differentiated products under conditions of increasing returns to scale which are traded at a positive cost[5].

The typical result of such models is that sectors concentrate in locations possessing the better access to the markets of their respective products. This result derives from the interaction between scale economies and trade costs. Effectively, under economies of scale, average costs fall as the level of production rises. Then, producers have an incentive to spatially concentrate their activities, because in such a way they can operate at a more efficient level. Nevertheless, the geographical concentration of production simultaneously increases the costs of selling output to disperse customers. Thus, the presence of trade costs induce firms to concentrate in the country which has the larger market in their goods, since in this form they are able to avoid such costs in a larger fraction of their sales.

In short, *industries tend to be more absolutely (relatively) concentrated, the more absolutely (relatively) concentrated the demand for the goods they produce*. On the other hand, it is clear that *a higher degree of scale economies is associated with higher absolute levels of spatial concentration*. However, *there exists no non-ambiguous theoretical prediction concerning the influence of increasing returns on relative concentration*. The following numerical example illustrates the previous point. Let us consider three countries, (A), (B), and (U) and two industries (1) and (2). First, let us assume that industry (1) has significant scale economies and that consequently is highly absolutely concentrated, so that the share of each country are: 0.15; 0.80; and 0.05, respectively. Second, suppose that industry (2) has low increasing returns and hence is absolutely dispersed with country shares equal to 0.45; 0.30; 0.25, respectively. Finally, assume that the overall geographical distribution of manufacturing activity is as follows: 0.70; 0.20; 0.10, respectively. By comparing figures, it is clear that the industry with weak increasing returns exhibit a more relatively concentrated pattern, as it has the more pronounced share differences with respect to the whole industry. Thus, in this case, scale economies would be negatively correlated with high relative concentration. Nevertheless, analogously, one could construct a hypothetical example showing a positive correlation[6].

The locational consequences of economic integration in the form of reduced trade costs hinge upon the interplay between market size and factor market considerations.

Krugman (1980) and Krugman and Helpman (1985) find that, other things equal, *as trade costs fall towards zero, all increasing returns activities tend to concentrate in the larger country measured*

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[4] Thus, there are no comparative advantages.

[5] Most traditional works in location theory rely implicitly or explicitly on the assumption that there exist significant economies of scale driving the concentration of economic activities, like in von Thünen (1826), Weber (1909), Christaller (1933), Lösch (1940) (Krugman, 1998). The essentiality of increasing returns for explaining the geographical distribution of economic activities constitutes the "Folk Theorem of Spatial Economics" (Scotchmer and Thisse, 1992).

[6] For example, consider again industry (1) and postulate and industry (3) whose distribution across countries is the following: 0.65; 0.25; and 0.10, respectively.

in terms of demand size. Therefore, demand differences amplify differences in production structures. This basic analysis can be extended by allowing for a third country with the purpose of examining the repercussion of a regional integration process, like Torstensson (1995) and Brülhart and Torstensson (1996). Specifically, they assume two size-asymmetric countries forming a custom union and a remaining one as the rest of the world. They show that there exists an U-shaped relationship between the share of industrial production located in the large country of the custom union and the deepness of the integration.

However, when factor market considerations are conveniently introduced, as in Krugman and Venables (1990), *the tendency to locate in the larger market is stronger for values of trade costs that are neither too high nor too low, so that there exists an inverted-U shaped relationship between the degree of relative and absolute spatial concentration of industry in the central country and trade costs*. In other words, at intermediate levels of trade costs the number of manufacturing firms located in the large country owing of its better market access is disproportionately large with respect to its share in world endowments (Amity, 1998). The reason is that when trade costs are sufficiently high, location is mainly determined by product market competition, while when trade costs are sufficiently low the spatial result is fundamentally dictated by factor market competition (Ottaviano and Puga, 1997).

The theory underlying the home market effect can not be viewed as a complete theory of economic geography. Indeed, it assumes rather than explains international differences in manufacturing shares and income (Neary, 2001). Concretely, two main questions are left unanswered by the new trade theory: Why a priori similar countries can develop very different production structures? Why do appear clear patterns of regional specialization, so that certain sectors have a tendency to locate at the same place? The *new economic geography* provides elements which help to rationalize such phenomena.

2.3 The New Economic Geography

The *new economic geography* extends the line of research initiated by the *new trade theory* by showing that interregional demand differences are themselves endogenous (Amity, 1998). Thus, even the market size is explained within the model by starting from a featureless locus with uniformly distributed labour and output in a single industry (Brülhart, 2000).

In the presence of increasing returns and trade costs, firms and workers tend to locate close to large markets. But, large markets are in turn those where more firms and workers locate (Baldwin, 1994; Ottaviano and Puga, 1997). Thus, there exists a sort of cumulative causation mechanism, which can originate an endogenous differentiation process of initially similar regions, so that, in this case, *second nature factors* determine the locational pattern (Brülhart, 1998; Venables, 1998).

The *new economic geography* uses two main agglomeration mechanisms for formally modelling the cumulative causation process: interregional labour mobility (Krugman, 1991) and mobility of firms demanding intermediate inputs (Venables, 1996)[7].

[7] There are also inter-temporal mechanisms related to factor accumulation (Baldwin, 1997) and to input-output linkages with an innovative sector (Martin and Ottaviano, 1996).

The basic idea postulated by Krugman (1991) is that if factors, namely, industrial workers, are mobile across regions, the countervailing pressure against agglomeration exercised by the behaviour of factor markets would be eased, so that firms could exploit the demand linkages to each other workers and a persistent concentration would take place[8].

Venables (1996) shows that the agglomeration could be induced by the presence of input-output linkages among firms[9]. When imperfect competitive industries are linked through an input-output structure and trade costs are positive, the downstream industry forms the market for upstream firms and the latter are drawn to locations where there are relatively many firms of the former industry (backward 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 (forward linkages). Hence, the joint action of such linkages might result in an agglomeration of vertically linked industries (Amity, 1998) and could give such an equilibrium location a certain inherent stability (Venables, 1996). In this sense, the reasoning provides a rationale for the notion of industrial base.

Therefore, the degree of absolute concentration is positively affected by the intensity in the use of own production as intermediate input[10]. Nevertheless, note that the theory does not allow to unambiguously predict the impact of intra-industry linkages on relative concentration. The following hypothetical situation inspired in Haaland, Kind, Midelfart-Knarvik, and Torstensson (1999), can be useful for illustrating the indeterminacy. Assume that there are two size-asymmetric countries and consider two industries with different factor intensities. Under those conditions, the industry in which the small country has a comparative advantage will display the higher relative concentration degree. Now suppose additionally that the industry in question has the weaker input-output linkages. In this case, it might be expected that the prevailing pattern in absence of such linkages does not significantly change and thus that industry with less intense intra-relationships exhibits the higher relative concentration level. Nevertheless, if firms in such an industry intensively use their own goods as intermediates and sell a considerable proportion of its products to firms belonging to the same industry, then agglomeration forces linked to those linkages will tend to bias the location of the industry towards the larger economy. Depending on the relative strength of the interactions comparative advantage-factor intensities and size-input-output linkages, the industry may end up with a still higher or a lower degree of relative concentration than the other one[11].

New economic geography models show that, under scale economies, labour migration and input-output linkages between firms lead to industry concentration in one region when trade costs between two initially identical regions are reduced. However, this might be only the

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[8] The crucial point is that for industry agglomeration to occur it must be possible for firms to draw resources from elsewhere, particularly from other regions or from other sectors, so that the factors supply becomes sufficiently elastic and consequently large increases in factor prices are avoided (Puga, 1998).

[9] The potential importance of intermediate inputs in models of monopolistic competition of international trade was highlighted by Either (1982).

[10] It should be remarked that the effect of intra-industry linkages on concentration is stronger the higher the degree of scale economies characterising the production in an industry (Krugman and Venables, 1996). Under similarity of intra-industry linkages intensities, it should be expected that the industry with higher increasing returns will be the most absolutely concentrated.

[11] Amity (2001) presents a model combining relative factor endowments considerations and input-output linkages.

beginning of the process. When relevant centrifugal forces related to the induced dynamics in factor markets are taken into account, the already mentioned U-curve pattern emerges again (Venables, 1996; Ludema and Wooton, 1997; Puga 1998). Thus, *at early stages of integration, concentration forces dominate and industry tends to cluster, but further integration, beyond certain threshold, promotes a re-dispersion towards the periphery, which offers lower factor costs.*

2.4 Summary of testable hypotheses

Previous sub-sections can be summarized in terms of the following hypotheses concerning relative concentration:

Hypothesis 1: Relative concentration is an increasing function of relative technology differences across countries.

Hypothesis 2: Under lumpy distribution of factor endowments, relative concentration is an increasing function of relative factor use intensities.

Hypothesis 3: Relative concentration is an increasing function of relative expenditure concentration.

Hypothesis 4: Relative concentration is a decreasing function of trade costs according to the *neoclassical theory* and the restricted version of the *new trade theory* and maintain an inverted-U shaped relationship with respect to them in the extended *new trade theory*.

On the other hand, no unambiguous theoretical predictions can be established regarding the impact of increasing returns and intra-industry linkages.

3. DATA AND MEASUREMENT

3.1 The Data

In this paper we investigate patterns and determinants of manufacturing concentration in Argentina, Brazil and Uruguay using a data set covering the period 1970-1998. The main characteristics of our data set are described in Table 1.

We identify manufacturing concentration patterns in the aforementioned countries using production data for 28 manufacturing branches (*ISIC Rev. 2 Classification* at 3 digits as described in Table A1.1 of the Appendix) over the period 1970-1998. These data is part of the *PADI* database (Software for Industrial Dynamics Analysis) generated by the Industry and Technological Development Unit at Economic Commission for Latin America and Caribbean (ECLAC). It includes homogeneous statistical information for those variables for the period 1970-1998 on an annual basis[12].

Determinants of manufacturing concentration are analysed using the following variables: imports and exports, value added, employment, the number of establishments, qualifications

[12] It should be stressed that, in the case of Uruguay, available data correspond to the period 1970-1996. Data for 1997 and 1998 were obtained by applying sectoral variation rates calculated from a productive data base for Uruguay kindly provided by Marcel Vaillant (Economics Department, Universidad de la República).

of workers, intermediate intensity and tariffs. Import and export data, which are used for calculating the expenditure variable defining market size, employment, and value added data for each country and for each manufacturing industry at the *ISIC Rev.2* 3 digit level are taken from the *PADI* database. Information about the number of establishments and hence about the average establishment size, which is employed as a proxy for scale economies, and about the qualification level of the workers in each sector for the period 1985-1998 come from the *RAIS* database (Annual Social Information Report) and were kindly provided by the Brazilian Ministry of Works. Data on intermediate intensity, from the own sector and from the whole manufacturing sector, are derived from the Brazilian input-output tables published by *IBGE* (Brazilian Statistics Bureau). Finally, tariff data for each manufacturing sector in the period 1987-1998 are taken from Kume, Piani, and Braz de Sousa (2000).

The data for the last four variables (the number of establishments, qualifications of workers, intermediate intensity and tariffs) were available only for Brazil. Similar statistical information for Argentina and Uruguay was not found. In the case of Argentina, there exist data for a few particular years[13]. A simple inspection of such available data suggests that using the Brazilian data should not be, however, significantly misleading. For instance, by comparing the establishment size between Argentina and Brazil, it turns out that the Spearman-rank correlation coefficient 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).

Table 1. Data set description

Data availability				
Variable	**Aggregation**	**Country coverage**	**Period**	**Source**
Production value	ISIC. Rev. 2, 3digits	Argentina, Brazil, Uruguay	1970-1998	PADI/ECLAC
Employment	ISIC. Rev. 2, 3digits	Argentina, Brazil, Uruguay	1970-1998	PADI/ECLAC
Value added	ISIC. Rev. 2, 3digits	Argentina, Brazil, Uruguay	1970-1998	PADI/ECLAC
Exports	ISIC. Rev. 2, 3digits	Argentina, Brazil, Uruguay	1970-1998	PADI/ECLAC
Imports	ISIC. Rev. 2, 3digits	Argentina, Brazil, Uruguay	1970-1998	PADI/ECLAC
Number of establishments	IBGE Subsector Classification	Brazil	1985-1998	RAIS/Ministry of Works
Workers qualification	IBGE Subsector Classification	Brazil	1985-1998	RAIS/Ministry of Works
Intermediate inputs	IBGE Subsector Classification	Brazil	1985, 1990-1998	IBGE
Tariffs	IBGE Subsector Classification	Brazil	1987-1998	Kume, Piani, Souza (2000)

The data on establishments, qualification levels, intermediate intensity, and tariffs are reported according to the *IBGE* subsector classification. In order to get comparable figures, they were mapped into the *ISIC Rev. 2* Classification using a concordance table supplied by *IBGE*.

Finally, it should be mentioned that our econometric analysis focus 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[14].

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[13] 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 only for 1997 and can be extracted from the input-output matrix elaborated that year; the former one corresponds to the 1970 decade.

[14] Kume, Piani, and Souza (2000) indicate that the Brazilian import policy at the starting year of their study, 1987 was essentially based on a tariff structure set in 1957.

3.2 Measures of Geographic Concentration of Manufacturing

Geographic concentration could be defined as the narrowness of the range of geographical units in which a certain activity is carried out. That is to say, *concentration* is the extent to which a given activity takes place in a small number of countries or regions (WIFO, 1999). As it has been already mentioned, it is possible to distinguish between *absolute and relative geographic concentration*. In absolute terms, an activity is geographically concentrated if a few countries/regions account for a large share of that activity. Absolute measures of geographic concentration are influenced by large units. In order to account for the different sizes of geographical units, relative measures of geographic concentration are used. In this latter case, the spatial distribution of a particular activity is compared to the spatial distribution of the whole manufacturing sector.

The distinction between *absolute* and *relative* is then intermediated by the heterogeneity in the sizes of relevant units. If countries considered are symmetric, that is, they have the same size, then the two measures coincide. However, this is not the case under the presence of asymmetry. One example can be useful for illustrating the former assertion. Consider two countries, *A* and *B*, such one (*A*) has a size which doubles the size of the other one (*B*) and two industries, *1* and *2* , such one (*1*) is symmetrically split across countries (1/2,1/2), while for the other one (*2*), 1/3 of the total activity locates in the small country and the remaining 2/3 situates in the large country. Under the defined assumptions, the industry *1* is more concentrated than the industry *2* in relative terms, while the latter is more concentrated than the former from an absolute point of view (Haaland, Kind, Midelfart-Knarvik, and Torstensson, 1999). And this has implications for the empirical analysis, because the different measures represent empirical counterparts for specific economic phenomena.

Geographic concentration of manufacturing has been analysed using a variety of production data such as value added (WIFO, 1999), gross production values (Midelfart-Knarvik, Overman, Redding, and Venables, 2000), or manufacturing employment (Brülhart and Torstensson, 1996; Brülhart, 2000)[15].

In this paper we use gross production values for measuring the geographic concentration of manufacturing. The reference geographic unit is the country level. Formally, the production value of industry *k* in country *i* at time *t* is denoted by $x_{ik}(t)$. This value may be expressed as a share of the total production value in the industry, in which case one has that:

$$(1a) \quad s_{ik}(t) \equiv \frac{x_{ik}(t)}{\sum_i x_{ik}(t)}$$

and for the whole manufacturing industry,

$$(1b) \quad s_i(t) \equiv \frac{\sum_k x_{ik}(t)}{\sum_i \sum_k x_{ik}(t)}$$

[15] There is a debate in the empirical literature about the convenience of using value added or gross production value as an indicator for activity level. Midelfart-Knarvik, Overman, Redding, and Venables (2000) argue that the use of value added makes the analysis more vulnerable to structural shifts in outsourcing to other sectors.

Geographic concentration measures relate to the distribution of the first ratio (absolute or normalized, for instance, by the second one, the share of the country in regional manufacturing production value) across countries for a given industry.

Absolute concentration

For our empirical study we will use a slight variant of the *Hirschman-Herfindahl Index* consisting of a simple normalization introduced by Haaland, Kind, Midelfart-Knarvik, and Torstensson (1999). Formally,

$$(2) \quad MHHI_k \equiv \sqrt{\sum_{i=1}^{N} s_{ik}^2 \Big/ N} \quad \textit{(Haaland, Kind, Midelfart – Knarvik, and Torstensson)}$$

The index takes a value of *(1/N)* when all countries have the same share in the focal industry and a value of $(1/N)^{1/2}$ when there prevails complete concentration in one of them.

Relative concentration

The basis of our descriptive and econometric analysis of relative concentration will be the variant proposed by Amity (1996) and Haaland, Kind, Midelfart-Knarvik, and Torstensson (1999) of an index that was firstly designed by Florence (1948) and lately used by Ellison and Glaeser (1994, 1997). Such an index is constructed on the basis of differences of shares then working out their quotients, which allows to avoid some of the drawbacks of the *Gini Coefficient*[16]. Formally,

$$(3) \quad HKMT_k \equiv \sqrt{\sum_{i=1}^{N} \left(s_{ik} - s_i\right)^2 \Big/ N} \quad \textit{(Haaland, Kind, Midelfart – Knarvik, and Torstensson/Amity)}$$

The index takes a value of *0* when the spatial distribution of the industry under consideration coincides with that of the whole manufacturing industry.

4. DESCRIPTIVE EMPIRICS

4.1 Manufacturing Production Structures

With the aim to analyse manufacturing production structures in the period 1971-1998, we calculated averages of gross production value shares based on four years from 1971-1974 to 1995-1998[17].

[16] For a discussion of main statistical properties of the Gini Coefficient see Volpe Martincus (2002).
[17] Detailed results of these calculations are available on request from the authors.

Argentina experienced on aggregate terms a significant loss of its share in the regional manufacturing production during the seventies and the eighties. The share of the country fell from 40.69 percent at the beginning of the period to 26.19 percent in the second part of the 1980s. Such a decline is partially reverted during the nineties. The time path in the case of Brazil is exactly the opposite one. In its turn, Uruguay suffered a secular reduction in its share, from almost 2 percent to 1.33 percent between 1992 and 1998.

A number of changes in sectoral patterns are worth noting. Table 2 shows the five largest sectors in terms of their share in total regional manufacturing production value for each country in the first and the last sub-period.

Table 2. Sectors with the five largest shares at regional level by country, 1971-1974 and 1995-1998

Mercosur – Sectors with the five largest shares at regional level by country					
Argentina		**Brazil**		**Uruguay**	
1971-1974	**1995-1998**	**1971-1974**	**1995-1998**	**1971-1974**	**1995-1998**
Petroleum refineries	Leather products	Furniture	Other industries	Tobacco	Tobacco
Wearing Apparel	Pottery, china, and earthenware	Non-ferrous metals	Professional instruments	Beverages	Leather products
Footwear	Tobacco	Iron and steel	Non-electrical machinery	Leather products	Beverages
Leather Products	Beverages	Non-electrical machinery	Non-ferrous metals	Footwear	Printing and publishing
Pottery, china, and earthenware	Petroleum refineries	Other industries	Electrical machinery	Rubber products	Pottery, china, and earthenware

The composition of the sectors with the largest shares seem to be similar in Argentina and Uruguay, while it differs in Brazil. In the case of Argentina and Uruguay, the sectors with the highest shares in gross production value included the resource-intensive sectors Petroleum refineries and Rubber products, and labour-intensive sectors such as Wearing apparel and Footwear as well as sectors with middle and low labour intensity such as Pottery, china and earthenware, Leather products, Tobacco, and Beverages. Note that the labour intensive sectors abandoned the group in the last sub-period. In Brazil, during the 1970s the sectors with the biggest production shares included resource-intensive Non-ferrous metals, Iron and steel, Furniture as well as capital-intensive sectors such as Non-electrical machinery. During the 1990s, Professional instruments, a high technological sector, and Electrical machinery, a capital intensive sector, replaced the Furniture and Iron and steel in the group of the largest five sectors.

Table 3 classifies industries in each country according to the time profile of their regional shares in the following categories: Increasing, U, Inverted-U, and Decreasing[18].

[18] Industries are considered to follow an "U-shaped path" if the change in their shares between the seventh and the fourth sub-periods is positive and the change between the fourth and the first sub-periods is negative and if their difference in absolute value does not exceed 20% of the initial share. Industries are assigned to the class "Inverted-U" if the change between aforementioned sub-periods display opposite signs and their absolute difference does not exceed 20% of the initial share. Industries are assumed to belong to the category "Increasing" if both changes are positive or when the difference is positive and higher than 20% of initial shares.

Table 3. Classification of industries according to the time profile of their regional shares

Country/Category	Increasing	U	Inverted-U	Decreasing
Argentina	Other non-metallic minerals; Beverage; Tobacco.	Leather products; Transport equipment; Printing and publishing; Paper; Iron and steel; Furniture; Pottery, china, and earthenware.	Fabricated metal products.	Wearing apparel; Miscellaneous products of petroleum and coal; Plastics; Footwear; Wood products; Petroleum refineries; Electrical machinery; Industrial chemicals; Glass; Rubber; Non-electrical machinery; Non-ferrous metals; Other industries; Food products; Other chemical products Professional instruments; Textiles.
Brazil	Professional instruments; Other industries; Non-electrical machinery; Non-ferrous metals; Petroleum refineries; Industrial chemicals; Footwear; Miscellaneous products of petroleum and coal; Wearing apparel; Rubber; Plastics; Electrical machinery; Food products; Textiles; Wood products.	Fabricated metal products.	Printing and publishing; Food products; Textiles; Glass; Fabricated metal products; Wood products; Iron and steel; Other chemical products; Paper; Furniture Pottery, china, and earthenware; Tobacco; Leather products; Transport equipment; Other non-metallic minerals.	Beverages; Tobacco.
Uruguay	Printing and publishing; Professional instruments; Plastics; Non-ferrous metals; Pottery, china, and earthenware.	Tobacco; Fabricated metal products; Wearing apparel.	Other chemical products; Wood products; Leather products; Paper.	Furniture; Other industries; Non-electrical machinery; Food products; Non metallic minerals; Electrical machinery; Beverages; Iron and steel; Miscellaneous products of petroleum and coal; Industrial chemicals; Footwear, Petroleum refineries; Glass; Textiles; Rubber; Transport equipment

Finally, they are viewed as "Decreasing" if both changes are negative or if their difference is negative and, in absolute terms, higher than 20% of the initial share.

The five largest sectors in Mercosur at the initial sub-period were Food products (12.62%), Textiles (8.97%), Transport equipment (8.46%), Petroleum refineries (7.81%), and Non-electrical machinery (6.79%). Three out of those sectors remain within the group in the last sub-period and they even show increased percentage shares: Food products (13.99%), Transportation equipment (9.25%), and Petroleum refineries (8.85%). From the previous figure it can be inferred that there occurred non-minor changes in the production structure of Mercosur. Specifically, some sectors experienced significant share gains, like Industrial chemicals (+2.59), Electrical machinery (+2.32), Other chemical products (+1.81), Iron and steel (+1.60), Food products (+1.37), Petroleum refineries (+1.04), and towards the end of the sample period, Transportation equipment (+3.74), whereas other sectors exhibited declined shares, like Textiles (-4.27), Wearing apparel (-1.65), Wood products (-1.30), Printing and publishing (-1.26), and Fabricated metal products (-1.24)[19].

4.2 Manufacturing Concentration Patterns

Figure 1 shows the evolution of absolute concentration of manufacturing in Mercosur in the period 1971-1998 measured with the *MHH Index* on the basis of two years moving averages. One can notice that it rose until 1989 and then diminished. This trend confirms the change in patterns of gross production shares discussed above.

According to the *MHH Index,* (Tables A2.1 in the Appendix) Professional and scientific instruments, Other manufacturing industries, and Footwear are the industries with the highest rises in absolute concentration, while Petroleum refineries, Other non-metallic minerals, and Furniture.

As shown in Figure 2, relative concentration displays an upward trend since the beginning of the eighties as measured with the *HKMT Index*.

A comparative analysis of relative manufacturing concentration in the first and the last sub-periods measured with the aforementioned index (see Table A2.2 in the Appendix), suggests that the highest increases were registered in the cases of Tobacco, Professional and scientific instruments, and Leather products, while Furniture, Wearing apparel, and Petroleum refineries exhibit the highest reductions in the index.

Overall, there are changes in activities ranking for each index, which can be seen in declining correlations between periods. Particularly, the significance of variations in concentration indices for each industry can be simply assessed by regressing the natural logarithm of the index on a time trend. Tables A2.3a and A2.3b present estimation results for the *MHH Index* and for *HKMT Index* for the whole sample period and two roughly equally-sized sub-periods.

With respect to absolute concentration, most industries have contradictory patterns across sub-periods, increasing in the first one and decreasing in the second one. Such opposite changes result for some industries in non-significant variations over the whole period (Furniture, Paper, Printing and publishing, Other non-metallic minerals, Iron and steel, and Transport equipment), while for other sectors reversions do not impede the emergence of a defined trend towards higher absolute concentration (Footwear, Wood products, Industrial

[19] Sectors enumerated are those with share changes larger than 1 percentage point.

chemicals, Other chemical products, Miscellaneous products of petroleum and coal, and Plastics). With respect to relative concentration, some industries, such as Non-electrical machinery, Electrical machinery, and Professional and scientific instruments show monotonic increases; other industries, such as, Printing and publishing, Rubber products, and Non-ferrous metals exhibit a reversion in their concentration levels; finally, one industry, Furniture, displays a monotonic declining trend.

Finally, we find low correlations between indices measuring relative concentration and indices measuring absolute concentration (Table A2.4 in the Appendix). In particular, there exist industries that rank higher in relative concentration than in absolute concentration, such as Beverages, Tobacco, Leather, Pottery, and Petroleum refineries; Argentina and Uruguay, the smaller countries within the bloc, have an important presence in those activities. On the other hand, there exist industries that rank higher in absolute concentration than in relative concentration, such as Footwear (from the second sub-period on), Furniture, Wood products, Other-non metallic minerals (in the first sub-periods), Electrical machinery, and Rubber products; the location of those activities is biased towards Brazil, the larger country in the considered area.

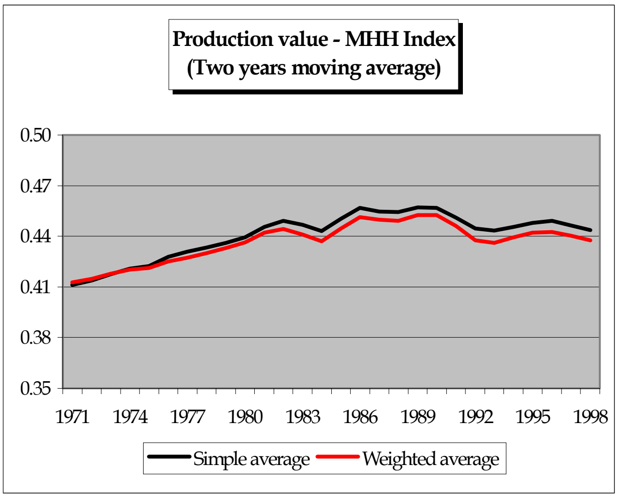

Fig 1. Absolute manufacturing concentration, *MHH Index*, 1971-98

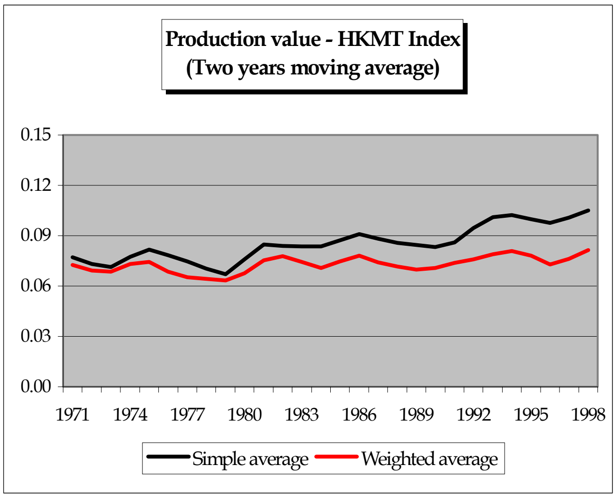

Fig. 2. Relative manufacturing concentration, *HKMT index*, 1971-98

5. DETERMINANTS OF MANUFACTURING CONCENTRATION PATTERNS

In order to econometrically test the hypotheses that were identified in the section reviewing the central theoretical approaches, one must first select the relevant concentration measure and then define the explanatory variables that each of them postulates as the main driving force in a way that assures the correspondence between the theoretical concept and the respective empirical counterpart measuring it. Their relative importance for the phenomenon under consideration, namely, observed concentration patterns, can be then assessed through econometric techniques. In this section we first describe the variables used in the econometric analysis and then discuss our estimation results.

5.1 Dependent Variable

The econometric analysis aims at examining the determinants of relative concentration patterns in Mercosur. Since the sample includes only three countries and one of them, Brazil, is significantly larger than the other two, a corresponding study for absolute concentration does not seem to be very interesting. In fact, conducted regressions suggest that the only significant determinant of absolute concentration pattern is the absolute concentration of expenditures, that is to say, the market size.

Hence, the dependent variable will be a relative concentration measure, specifically, the *HKMT Index*, which corrects for country sizes and is robust to some of the statistical problems raised by the *Gini Coefficient*.

5.2 Explanatory Variables

Factor intensities

The *Heckscher-Ohlin theory* points out that industries tend to locate in countries with a matching comparative advantage. Concretely, industries tend to settle in those countries that are relative abundant in the factor they intensively use. Hence, the interplay between differing relative factor endowments across countries and differing relative factor intensities across industries may give rise to distinct relative concentration patterns. In particular, given a lumpy distribution of factor endowments, it should be expected a positive relationship between the relative factor intensity of industries and their corresponding degree of relative concentration. The former idea can be captured by means of indices measuring the deviation of factor intensities from the mean (Amity, 1997; Haaland, Kind, Midelfart-Knarvik, and Torstensson, 1999). Formally,

(4) Labour intensity:

$$labint_k = \left| \frac{\sum_{i=1}^{N} L_{ik}}{\sum_{i=1}^{N} VA_{ik}} - \frac{\sum_{i=1}^{N}\sum_{k=1}^{M} L_{ik}}{\sum_{i=1}^{N}\sum_{k=1}^{M} VA_{ik}} \right|$$

(5) Human capital intensity:

$$relskillint_k = \left| \frac{H_k}{L_k} - \frac{\sum_{k=1}^{M} H_k}{\sum_{k=1}^{M} L_k} \right|$$

where *L* represents employment, *VA* depicts value added, and *H* stands for workers with at least secondary school; *i=1,…,N* indices countries, while *k=1,…,M* indices industries[20].

The definitions allow to see, on the one hand, that labour intensity is measured as the number of employees relative to value added, whereas the human capital intensity is measured as the number of skilled workers relative to the total number of workers[21]. On the

[20] Recall that data on skills refer only to Brazil. Consequently, the sub-index *i* was suppressed.

[21] Haaland, Kind, Midelfart-Knarvik, and Torstensson (1999), by following Balassa (1979, 1986), measure human capital intensity through the average labour compensation (ratio of wage to the number of employees). Such an alternative measure could not be implemented due to missing data on wages for several years.

other hand, they permit to observe that the measures take high values for industries differing substantially in their use of the factor in question from the average (i.e., they employ such a factor either too much or too little relative to the mean). According to the theory, those industries would tend to be relatively concentrated[22].

Technology

The *Ricardian theory* highlights the role of technology differences across countries as the main comparative advantage element explaining relative concentration patterns. Such differences in technology are captured by differences in labour productivity, which is defined as value added per employee (Torstensson, 1996; Haaland, Kind, Midelfart-Knarvik, and Torstensson, 1999). Formally,

(6) Technology:

$$technology_k = \sqrt{\frac{1}{N}\sum_{i=1}^{N}\left[\frac{VA_{ik}/L_{ik}}{\left(1/N\right)\sum_{i=1}^{N} VA_{ik}/L_{ik}} - \frac{\sum_{k=1}^{M} VA_{ik}/L_{ik}}{\left(1/N\right)\sum_{i=1}^{N}\sum_{k=1}^{M} VA_{ik}/L_{kik}}\right]^2}$$

where *VA* and *L* have been already defined.

The first term within the brackets measures the labour productivity in industry *k* in country *i* relative to the average labour productivity in this industry across countries, whereas the second term measures the average labour productivity in country *i* relative to the other countries. The index takes higher values, the higher the cross-country disparities in relative productivity; in particular, the measure displays large values for those industries that exhibit important discrepancies among countries in productivity relative to the whole manufacturing sector. According to the theory, significant relative productivity differences promote high degrees of cross country specialization and relative spatial concentration.

Market size

The neoclassical theory postulates, in its basic setting, that production patterns are uniquely determined by relative price and supply factors. Hence, demand biases may affect trade patterns, but not locational patterns. Nevertheless, results do change when trade costs are present. In this case, the spatial distribution of demand has an impact on the spatial configuration of the manufacturing sector. The effect hinges upon the interplay between trade costs and factor endowment considerations; specifically, if demand is more evenly spread over space than endowments, then industry concentration correlates negatively with trade costs (Brülhart, 2000). At the extreme, if trade costs are prohibitive, then the degree of industrial geographical concentration exactly coincides with that of expenditure.

The new trade theory also shows that cross-country differences in expenditure help to explain production structures and industry location. In particular, the theory predicts, that, due to the interaction between trade costs and economies of scale, firms tend to concentrate

[22] Like Haaland, Kind, Midelfart-Knarvik, and Torstensson (1999), a separate measure for physical capital is not included in the empirical model. Theoretically, with value added made up of labour, human capital, and physical capital, the intensity in this last factor would be implicitly taken into account in the already defined measures. Factually, the relevant data is not available; the same also applies for other variables regarding natural resources such as energy, land, and forest.

in the country having a demand bias towards the good they produce and thus depicting a larger market for their products. Therefore, demand concentration induces production concentration; concretely, the higher the relative spatial concentration of the demand for a particular good, the higher the relative spatial concentration of the respective manufacturing activity[23]. Formally, relative expenditure concentration is measured as follows (Haaland, Kind, Midelfart-Knarvik, and Torstensson, 1999):

(7) Market size:

$$relexpconc_k = \sqrt{\frac{1}{N}\sum_{i=1}^{N}\left(\frac{E_{ik}}{\sum_{I=1}^{N} E_{ik}} - \frac{\sum_{k=1}^{M} E_{ik}}{\sum_{I=1}^{N}\sum_{k=1}^{M} E_{ik}}\right)^2}$$

where E denotes expenditure, which is defined as production plus imports minus exports (thus, including both final and intermediate consumption) (Eaton and Kortum, 2001). The former expression indicates that the degree of relative expenditure concentration is higher, the larger the deviation of the expenditure share of each country on a given industry goods with respect to their respective total expenditure shares[24]. In order to see this point, consider three countries which have the following total spending shares: 1/2, 1/4, and 1/4; it is clear that relative spending concentration of an industry with shares 1/3, 1/3, and 1/3, respectively, will be higher than the one of an industry whose demand present the following spatial distribution: 1/2, 1/4, and 1/4, respectively.

Economies of scale

New trade theories suggests that there prevails a positive relationship between the significance of economies of scale and the degree of absolute concentration. However, the theory does not provide any clear-cut guidance regarding the association between the intensity of increasing returns to scale and the level of concentration relative to other industries.

Now, even though the variable has an priori not defined impact in terms of the expected sign, the variable might have an influence on locational patterns. Scale economies is an important component for the effect of other variables like market size. Therefore, in order to investigate whether it affects or not and how the relative concentration of industries and to account for the role it plays in shaping the incidence of other relevant variables, it will be included in the regression equation.

Economies of scale has been measured in different ways in the empirical literature. Brülhart and Torstensson (1996) use engineering estimates of minimum efficient scale. Haaland, Kind, Midelfart-Knarvik, and Torstensson (1999) employ the percentage reduction in average cost for each percent increase in output. Here, by following Kim (1995) and Amity (1997), the average establishment size will be used as a proxy for that variable. Formally,

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[23] The new economic geography demonstrates that the expenditure concentration pattern may be endogenous, that is to say, may depend on the industrial concentration pattern. This issue will be opportunely addressed.

[24] The measure used for capturing market size effects is similar to the one used by Lundbäck and Torstensson (1997) and Davis and Weinstein (1996, 1997). Brülhart and Torstensson (1996) resort to a centrality index, but it is not industry-specific.

(8) Scale economies: $scale_k = \frac{L_k}{EST_k}$

where *L* corresponds to employment and *EST* symbolizes the number of establishments[25].

Input-output linkages

The *new economic geography* stresses that input-output linkages may affect locational patterns. Effectively, under increasing returns to scale and trade costs, input-output linkages tend to foster industrial agglomeration, since in that case firms face lower costs for obtaining their inputs and have a larger market to place their product in. In particular, the intensity industries exhibit in the use of their own goods as intermediate is positively correlated to their degree of absolute concentration. The theory does not allow, however, to draw clear conclusions with respect to the influence of intra-industry linkages on relative concentration.

Now, as it was already pointed out, the fact that the direction of the impact is not theoretically *a priori* determined does not necessarily imply that the variable has no impact on relative locational patterns. In order to evaluate if it influences relative concentration and, if that is the case, how, intermediate consumption from the own sector will be included in the empirical analysis. Formally,

(9) Inputs from own industry: $osint_k = \frac{INT_k}{PV_k}$

where *INT* stands for intermediate consumption from the own sector and *PV* for production value[26].

It could be argued that the information reflected by *osint* is already accounted for by the expenditure variable. In this respect, it should be stressed that, according to the *new economic geography*, input-output linkages not only have backward effects, that is, they do not only affect the market size for the industry, but they also have forward effects, since such linkages do also influence the production costs faced by firms. In short, the expenditure variable may capture in a gross way the spatial impact originated in backward linkages; nevertheless, this does not imply that one must disregard the variable *osint*, as it is needed to assess the incidence of forward linkages.

An alternative specification will be based on an intermediate intensity variable for the whole manufacturing sector. The main idea is to test for the significance of linkages among industries within the sector given the high concentration displayed by aggregate manufacturing activity. Formally,

(10) Inputs from the whole manufacturing sector: $wmsint_k = \frac{\sum_{k=1}^{M} INT_k}{PV_k}$

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[25] Remind that data on establishment size correspond solely to Brazil.

[26] Recall that data on intermediate intensity refers exclusively to Brazil.

where *INT* and *PV* have been already explained.

Trade costs

The literature review makes clear that trade costs are an important factor shaping the economic landscape.

It was seen that in the *neoclassical* framework, demand patterns affect locational patterns when trade costs are positive. In particular, the *neoclassical theory* predicts that, under a lumpy distribution of factor endowments, a reduction in trade costs will induce an increase in the degree of relative concentration. It also postulates that, in the case of a regional trade agreement, industrial location may be biased towards the country with lower comparative disadvantage *vis a vis* the rest of the world.

On the other side, in the *new trade theory* the relationship between relative and absolute concentration and trade costs is monotonically decreasing when factor market considerations are not taken into account and non-monotonic when they are incorporated into the analysis. Similarly, in the *new economic geography* setting, market size and input-output linkages foster agglomeration due to the interaction between increasing returns and trade costs. Specifically, it shows the existence of an inverted U-relationship between trade costs and absolute concentration. However, the *new economic geography* does no provide any clear guidance regarding the sign of the correlation between trade costs and relative concentration.

Argentina, Brazil, and Uruguay implemented broad trade liberalization programs and they also signed up a regional trade agreement jointly with Paraguay, *Mercosur*. In order to account for the effects associated to the unilateral opening of the economy, external tariff barriers for each manufacturing sector in the period 1985-1998 will be used. Formally,

(11) Trade costs: np_k

The impact of the regional trade liberalization will be captured through time dummies.

5.3 Econometric Results

The current section discusses the results of our econometric analysis based on several estimations. First, the main specification is presented and a number of estimation issues are addressed. Second, basic results are commented. Third, we provide an answer to the question whether *Mercosur* has affected the behavioural relationships.

Specification and econometric issues

The dependent variable is the relative concentration measure defined by the *Haaland, Kind, Mideldart-Knarvik, and Torstensson/Amity Index*, $hkmt_k$ based on production value data. Such an index takes values within the interval [0,1], so that the variable to be explained is truncated. As a consequence, estimation with OLS will lead to biased estimates. Hence, it will be redefined by applying a logistic transformation similar to Balassa and Noland (1987) and Torstensson (1997). The variable then becomes *ln[hkmt/(1-hkmt)]*, which ranges in $(-\infty,+\infty)$. It should be noted that, in the present case, the transformation does not require dropping out observations, since none of them takes the value zero.

The degree of relative concentration will be explained in terms of the variables previously described, namely, factor endowments, relative technology differences, relative market size, the significance of increasing returns, the intensity of input-output linkages and the level of trade costs. Formally, the basic specification is as follows:

$$(12)\ ln\left(\frac{hkmtp_{kt}}{1-hkmtp_{kt}}\right)=\alpha+\beta\ labint_{kt}+\gamma\ relskillint_{kt}+\delta\ technology_{kt}+\sigma\ scale_{kt}+\eta\ relexpconc_{kt}+\varphi\ osint_{kt}+\lambda\ np_{kt}+\mu_k+\varepsilon_t+\nu_{kt}$$

where k=311,…,390 (28 sectors), t=1985,…,1998, and μ_k , ε_t depict industry and time fixed effects.

Table A3.1 in Appendix reports summary statistics for each variable, while Table A3.2 presents the correlations among them.

The basic equation and some variants are estimated in the first place by OLS pooling over years, which produces LSDV or fixed effect estimations. The sample includes 28 industries and 14 years, so the estimation is based on 392 observations. Further, it was conditioned on the standard deviation of the underlying variables in order to make comparisons across them more appropriate; thus, the shown coefficients are standardized ones. Lastly, according to the White's general test (Greene, 1997), there exists heteroscedasticity; hence, White's heteroscedasticity consistent standard errors are reported and used for hypothesis testing.

There exist *a priori* reasons to presume that some of the core conditions required for the validity of OLS may be not met. In particular, the following concerns should be addressed: potential endogeneity problems and potential cross-section and auto-correlation.

The *new economic geography* highlights that an agglomeration process may be impulsed by a circular causation mechanism, so that industrial location may be driven by expenditure location and at the same time the spatial distribution of manufacturing activity may influence the geographical pattern of spending. Hence, potential endogeneity problems might be anticipated. Specifically, there could exist a contemporaneous correlation between the error term and the market size variable. From a statistical point of view, this means that the regression equation does not correspond to a conditional expectation, so that the usual assumptions on the error term cannot be imposed (Verbeek, 2000). As a consequence, OLS estimations might be biased and inconsistent. In order to account for this possibility several exercises were carried out. First, the original regressions were re-ran by using only the initial value for the expenditure variable. Second, those regressions were also replicated by utilizing the one-lag period value for that regressand. Third, 2SLS regressions were performed by instrumenting the variable in question by the respective one-period lag and the Hausman test statistic was calculated.

On the other side, the first estimation assumes a relatively simple error term. Effectively, the standard error component model assumes that the regression disturbances are homoscedastic with the same variance across time and across individuals. Undoubtedly this is a very restrictive assumption. As it was already mentioned, there exist evidence of heteroscedasticity. Given the panel nature of the data, one can presume that there may be a specific pattern of disturbances associated to the presence of groups of observations. Concretely, cross-sectional units may be size-asymmetric and as a result may exhibit different variation (Baltagi, 1995).

Further, the basic model assumes that the error terms are not correlated across individuals. However, industries are not only tied to specific factors, they are also tied to common macroeconomic factors affecting the economy as a whole (Greene, 1997) and likely with differential repercussion across groups of sectors. Thus, it seems likely that there prevails correlation of disturbances across industries.

Lastly, the classical LSDV model assumes that the only correlation over time is due to the presence of the same individual across the panel. In particular, the equicorrelation coefficient is the same no matter how far are periods in time. Clearly, this is also a restrictive assumption for the economic relationships under consideration, as an unobserved shock in the current period might affect the concentration patterns for at least some coming periods (Baltagi, 1995).

Ignoring groupwise heteroscedasticity, cross sectional correlation and/or serial correlation when they are present result in consistent but inefficient estimates of the regression coefficients and biased standard errors (Baltagi, 1995; Greene, 1997). Therefore, relevant test statistics for identifying such data features were carried out and an appropriate econometric strategy was implemented.

Results

Table A3.3 shows estimation results from the OLS regression including sequentially increasing subsets of explanatory variables with and without time dummies.

The first column corresponds to a pure *neoclassical model*, since only relative factor intensities (*Heckscher-Ohlin Theory*) and relative technology differences (*Ricardian Theory*) are considered. Note that all estimated coefficients have the expected sign and are significant at conventional levels. Thus, relative concentration increases with labour intensity and human capital intensity differences and with technology differences from the average. The incorporation of the trade costs variable (column 2) does not substantially alter the results: the estimated coefficient on that variable is not significant.

In columns 3 - 4 (and 7 - 8) variables highlighted by the *new trade theory* are included, namely, scale economies and relative expenditure concentration.

The estimated coefficient for scale economies is negative and significant in 3 out of 4 specifications, so that high increasing returns seem to be associated with low relative concentration levels. Such a result can be explained in terms of the arguments previously raised when discussing the expected influence of scale economies. Effectively, from a theoretical point of view, their intensity may be linked *a priori* either to higher or lower relative concentration. Further, as it was appreciated in the numerical example, the link may be naturally negative under certain specific locational patterns. On the other hand, it could be argued that the proxy for economies of scale, the average establishment size, is not appropriate. In order to assess this possibility an alternative definition for that variable was used. Concretely, the position of each industry in the ranking of activities according to their degree of increasing returns elaborated by Pratten (1988)[27]. Estimations results are essentially the same.

The estimated coefficient on relative expenditure concentration is positive and significant, which means that relative concentration of spending tend to favour relative concentration of manufacturing activity. This finding would be consistent with both the *new trade theory* and the *Heckscher-Ohlin theory* in presence of positive trade costs. It should be stressed that, by comparing coefficients, it turns out to be the more important determinant of industrial location.

Note that the coefficient on trade costs becomes significantly positive. Hence, higher external tariff barriers with respect to the rest of the world tend to promote increased relative concentration of industries within the trade bloc. This results coincides with the theoretical conclusion derived by Venables (2000) regarding the locational impact of custom unions. The combination of relatively high external barriers and internal trade liberalization may induce the spatial concentration of economic activity within the bloc[28].

Columns 9-16 report estimation results when input-output linkages are taken into account. High intermediate intensity, from the own sector as well as from the whole manufacturing sector, is positively correlated with relative concentration, but in a non significant way in most specifications.

Tables (A3.4-a)-(A3.4-c) report estimations from alternative econometric strategies dealing with potential endogeneity. Note that the results patterns remain essentially the same[29]. According to the Hausman statistic the null hypothesis of no contemporaneous correlation between the expenditure variable and the error term cannot be rejected. Therefore, endogeneity does not seem to constitute a severe problem.

Further, relevant test statistics for detecting non-spherical disturbances were calculated. The modified Wald statistic for groupwise heteroscedasticity in residuals (Greene, 1997) suggests that the null hypothesis of homoscedasticity across panels should be rejected. In its turn, the Breusch-Pagan LM test (Greene, 1997) indicates that the null hypothesis of independence of error across panels should be also rejected. Finally, the Baltagi-Li LM test (Baltagi, 1995) for first order serial correlation in a fixed effects model points out the null hypothesis of no autocorrelation should be rejected, too. Henceforth, an alternative estimation method is needed. In particular, one can remove the autocorrelation from the data by means of the Prais-Winsten transformation (Greene, 1997) and, since the number of cross sectional units is substantially larger that the number of time periods (28 vs. 14), one can then use OLS but replacing OLS standard errors with panel-corrected standard errors accounting for heteroscedasticity and contemporaneous correlation across panels (Beck and Katz, 1996).

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[27] Such a variant was used by Brülhart and Torstensson (1996) in different correlation analyses of concentration patterns for the European Union. In the present context, its use might be criticized on the ground that it is based on estimations from information coming exclusively from developed countries. Further, those estimates were carried out in the 1980 decade and thereafter significant changes in technology and production techniques have taken place (Haaland, Kind, Midelfart-Knarvik, and Torstensson, 1999).

[28] To same extent, it also resembles the link between trade protection and internal agglomeration theoretically established by Krugman and Livas Elizondo (1996). Observe that those authors assume three locations, two regions within a country and the rest of the world. For the sake of the present interpretation the two regions should be assumed to be two countries in the custom union.

[29] One exception in this sense is that *labint* becomes insignificant in some specifications.

Results obtained by using such a procedure are reported in Table A3.5. They confirm basically previous findings.

Does Mercosur make a difference?

Former estimations pooled across the 14 sample years, which implies the assumption that the parameters in the regression equation are stable over time. One interesting question in this respect is whether the underlying system exhibited a different behavioural pattern after the creation of Mercosur. In order to provide a first answer to that question a dummy variable for the Mercosur period is included: it takes a value of 1 for the years over the period 1991-1998 and 0 otherwise. This dummy variable is then interacted with the already known explanatory variables[30]. The joint significance of such interactions is assessed through the Wald test. As it can be seen in Table A3.6, the test statistic leads to the rejection of the null hypothesis that parameters are stable over the whole sample period for almost all specifications. Therefore, the relative importance of relative concentration determinants seem to have changed after the launching of Mercosur.

One natural additional question that arises is how do those changes look like. The answer can be found in tables A3.7a - A3.7d that present estimation results for the periods 1985-1990 and 1991-1998 with and without fixed time effects. Several remarks are in order.

First, the estimated coefficient on labour intensity and on relative skill intensity evolve from being non-significant in the first sub-period to significantly positive in the second sub-period. Therefore, relative factor intensities and hence relative factor endowments do seem to play a more important role in explaining observed relative concentration patterns within the trade bloc. This is precisely what one would expect according to the *Heckscher-Ohlin theory*.

Second, the estimated coefficient on relative technology differences decreases from the first to the second sub-period; in fact, in the specification including time dummies it turns to be directly non-significant. Such a result could be explained in terms of a technological convergence across countries as a consequence of the opening of the economies[31].

Third, the coefficient on scale economies is positive and significant in the first sub-period and negative and insignificant in the second one. Thus, high increasing returns favoured high relative geographical concentration of manufacturing activity before the constitution of Mercosur, when internal trade barriers were still relatively high segmenting the market, but they lost explanatory power after the start of the unilateral and regional trade liberalization programs between considered countries.

Fourth, the estimated coefficient on relative expenditure is positive and significant at 1% level across sub-periods, albeit it experiences a decline. In fact, relative labour intensity seems to be taking over the position as the most influential determinant of locational patterns.

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[30] Reported results aims solely at evaluating the hypothesis of a differential slope coefficient. The hypothesis of a common intersection was examined and could not be rejected.

[31] The variable capturing technology differences across countries can be considered a valid counterpart of the relevant theoretical concept if wages do not significantly differ across countries (Torstensson, 1996). Thus, it might alternatively be argued that the variable losses its significance due to an increased divergence in this respect. By looking at the evolution of wages in dollars in Argentina after the implementation of the Convertibility Plan in 1991, this possibility should not be disregarded.

Fifth, remaining variables are, in general, non-significant. However, it should be mentioned that the estimated coefficient on intermediate intensity (from the own sector as well as from the whole manufacturing sector) show up an increase.

Sixth, the goodness of fit as measured by the adjusted R^2 fell, which seems to indicate that some non-included variables are gaining relative weight in the determination of relative concentration patterns.

Summing up, relative factor intensities become more relevant in the explanation of relative concentration levels, while other variables like techonology, economies of scale, and relative expenditure lost relative influence. Overall, results seem to confirm the main insights from the Heckscher-Ohlin approach: trade liberalization increases the locational gravitation of factor endowments, since it induces industries to settle in the country with a matching comparative advantage in those terms.

6. CONCLUDING REMARKS

South American countries increased substantially their trade links among themselves and with the rest of the world thanks to both general-unilateral and regional trade liberalization initiatives like Mercosur.

According to international trade theory, one should expect such trade policy changes to be associated with important modifications in the economic landscape of the integrating area. Further, those locational shifts, due to their welfare, political economy, and macroeconomic implications, are very relevant from an economic policy point of view. Nevertheless, there exist only a few empirical studies investigating the spatial implications of trade liberalization in Mercosur countries.

The present paper aimed at filling this gap. By means of a comprehensive descriptive analysis of relative and absolute concentration patterns for the period 1970-1998 and several econometric exercises focused on relative concentration for the period 1985-1998, it attempted to provide an answer to the following questions: How concentrated/dispersed are industries? Have concentration levels changed significantly over time? How can observed relative concentration degrees be explained? Did the launching of Mercosur cause any variation in the relative importance of explanatory factors?

Our main findings indicate that there is a group of industries with high relative concentration levels and low absolute concentration levels which includes industries such as Beverages, Tobacco, and Leather. Those are precisely industries in which the smaller countries, Argentina and Uruguay, have relatively important shares. Other industries, such as Electrical machinery and Wood products exhibit an opposite pattern, which is linked to a locational bias towards the larger country, Brazil. With respect to the time evolution, it could be seen that, on average, relative concentration has increased over the sample period. Specifically, Non-electrical machinery, Electrical machinery, and Professional and scientific instruments registered monotonic increases, whilst other industries, such as Printing and publishing, Rubber products, and Non-ferrous metals experienced reversions in their relative concentration levels. In its turn, absolute concentration show, on average, an inverted-U path which prevails in most sectors.

Our econometric analysis concentrated on relative concentration patterns, which seems to be more interesting, since only three countries with evident size asymmetries are considered. We drawed on the relevant theoretical approaches in order to define the regression equations. Relative concentration measures we then regressed on technological and relative factor intensities elements (*neoclassical theory*), scale economies and exogenous market size (*new trade theory*), input-output linkages (*new economic geography*), and, to account for trade reforms, on external nominal tariffs and time dummies. Our results suggest that localization of demand and comparative advantage factors are the main driving forces behind observed relative concentration patterns and that Mercosur seems to have an influence on their behavioural explanation.

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APPENDIX

A1. Industry Classification

International Standard Industrial Classification, Revision 2, 3 digits	
Code	**Description**
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

A2. Descriptive Empirics

Table A2.1a

Modified Hirschman-Herfindahl Index - Production value (1971-1998)

Sector/Year	1971-1974	1975-1978	1979-1982	1983-1986	1987-1990	1991-1994	1995-1998	VII/I
Food products	0.40	0.41	0.41	0.42	0.42	0.42	0.42	0.019
Beverages	0.38	0.39	0.38	0.39	0.38	0.38	0.39	0.007
Tobacco	0.38	0.38	0.38	0.38	0.38	0.39	0.39	0.009
Textiles	0.41	0.41	0.42	0.42	0.43	0.42	0.42	0.018
Wearing apparel, except footwear	0.41	0.40	0.43	0.46	0.48	0.46	0.45	0.046
Manufacture of leather and leather products	0.39	0.37	0.38	0.38	0.38	0.39	0.40	0.010
Footwear	0.40	0.41	0.46	0.48	0.51	0.49	0.49	0.083
Wood products	0.43	0.45	0.47	0.46	0.48	0.47	0.47	0.035
Furniture	0.46	0.48	0.47	0.49	0.48	0.45	0.45	-0.009
Manufacture of paper and paper products	0.42	0.42	0.45	0.45	0.45	0.44	0.42	0.001
Printing and publishing	0.41	0.43	0.44	0.42	0.43	0.40	0.41	-0.008
Industrial chemicals	0.41	0.43	0.45	0.46	0.46	0.45	0.45	0.039
Other chemicals products	0.41	0.42	0.43	0.44	0.45	0.43	0.43	0.022
Petroleum refineries	0.44	0.40	0.40	0.40	0.40	0.40	0.40	-0.036
Miscellaneos products of petroleum and coal	0.41	0.45	0.51	0.50	0.50	0.48	0.48	0.068
Rubber products	0.43	0.43	0.44	0.45	0.47	0.46	0.47	0.041
Plastic products	0.42	0.45	0.46	0.45	0.48	0.46	0.46	0.042
Pottery, china, and earthenware	0.40	0.41	0.40	0.39	0.39	0.40	0.41	0.003
Manufacture of glass and glass products	0.41	0.42	0.43	0.44	0.43	0.44	0.43	0.025
Other non-metallic minerals	0.43	0.46	0.47	0.47	0.46	0.42	0.42	-0.015
Iron and steel	0.44	0.46	0.46	0.46	0.46	0.46	0.45	0.006
Non-ferrous metals	0.45	0.47	0.47	0.48	0.50	0.49	0.50	0.051
Fabricated metal products	0.42	0.42	0.43	0.42	0.42	0.42	0.42	0.002
Non-electrical machinery	0.44	0.46	0.48	0.50	0.52	0.51	0.52	0.077
Electrical machinery	0.43	0.45	0.48	0.49	0.49	0.47	0.49	0.068
Transport equipment	0.41	0.42	0.43	0.44	0.44	0.42	0.42	0.009
Professional and scientific instruments	0.42	0.45	0.49	0.51	0.52	0.51	0.52	0.105
Other manufacturing industries	0.44	0.50	0.53	0.53	0.54	0.53	0.53	0.097
Simple average	**0.42**	**0.43**	**0.44**	**0.45**	**0.46**	**0.45**	**0.45**	**0.029**
Weighted average	**0.42**	**0.43**	**0.44**	**0.45**	**0.45**	**0.44**	**0.44**	**0.024**
Standard Deviation	**0.02**	**0.03**	**0.04**	**0.04**	**0.01**	**0.02**	**0.02**	**0.003**
Skewness	**0.07**	**0.16**	**0.06**	**0.00**	**0.09**	**-0.01**	**-0.07**	**-0.147**
Kurtosis	**-0.22**	**-0.27**	**-0.30**	**-0.76**	**-0.05**	**-0.08**	**-0.54**	**-0.321**

Table A2.1b

MHH Index/Rankings - Production value (1971-1998)

Spearman Correlations

	1971-1974	1975-1978	1979-1982	1983-1986	1987-1990	1991-1994	1995-1998
1971-1974	1.000	0.804	0.686	0.608	0.580	0.554	0.524
1975-1978		1.000	0.883	0.779	0.711	0.685	0.664
1979-1982			1.000	0.951	0.911	0.881	0.834
1983-1986				1.000	0.968	0.923	0.882
1987-1990					1.000	0.972	0.940
1991-1994						1.000	0.974
1995-1998							1.000

Table A2.2a

Haaland, Kind, Midelfart-Knarvik, and Torstensson Index - Production value (1971-1998)								
Sector/Year	1971-1974	1975-1978	1979-1982	1983-1986	1987-1990	1991-1994	1995-1998	VII/I
Food products	0.01	0.02	0.05	0.04	0.04	0.02	0.02	0.008
Beverages	0.06	0.06	0.12	0.19	0.20	0.21	0.19	0.127
Tobacco	0.08	0.13	0.14	0.19	0.19	0.19	0.22	0.145
Textiles	0.03	0.04	0.02	0.04	0.03	0.02	0.02	-0.013
Wearing apparel, except footwear	0.15	0.11	0.04	0.06	0.09	0.08	0.07	-0.084
Manufacture of leather and leather products	0.13	0.19	0.18	0.11	0.12	0.16	0.26	0.135
Footwear	0.13	0.04	0.06	0.10	0.12	0.13	0.12	-0.009
Wood products	0.08	0.07	0.08	0.06	0.08	0.09	0.08	0.005
Furniture	0.15	0.14	0.09	0.11	0.07	0.05	0.04	-0.109
Manufacture of paper and paper products	0.04	0.01	0.03	0.03	0.01	0.03	0.05	0.005
Printing and publishing	0.03	0.02	0.02	0.03	0.02	0.07	0.07	0.040
Industrial chemicals	0.01	0.02	0.04	0.04	0.02	0.05	0.03	0.023
Other chemicals products	0.03	0.01	0.01	0.02	0.01	0.02	0.00	-0.021
Petroleum refineries	0.25	0.21	0.22	0.18	0.18	0.18	0.17	-0.083
Miscellaneos products of petroleum and coal	0.02	0.08	0.14	0.13	0.10	0.11	0.10	0.080
Rubber products	0.10	0.04	0.03	0.04	0.06	0.08	0.09	-0.011
Plastic products	0.04	0.08	0.05	0.03	0.07	0.07	0.08	0.035
Pottery, china, and earthenware	0.10	0.04	0.15	0.18	0.17	0.22	0.23	0.128
Manufacture of glass and glass products	0.01	0.02	0.01	0.02	0.02	0.04	0.00	-0.007
Other non-metallic minerals	0.09	0.10	0.08	0.07	0.03	0.04	0.05	-0.030
Iron and steel	0.11	0.09	0.06	0.05	0.04	0.06	0.04	-0.069
Non-ferrous metals	0.11	0.11	0.08	0.09	0.10	0.12	0.13	0.022
Fabricated metal products	0.04	0.01	0.02	0.06	0.06	0.05	0.03	-0.007
Non-electrical machinery	0.09	0.09	0.10	0.12	0.14	0.16	0.17	0.071
Electrical machinery	0.06	0.08	0.10	0.10	0.10	0.09	0.13	0.069
Transport equipment	0.02	0.03	0.03	0.02	0.01	0.05	0.06	0.036
Professional and scientific instruments	0.04	0.07	0.10	0.14	0.13	0.16	0.18	0.143
Other manufacturing industries	0.10	0.17	0.17	0.17	0.16	0.19	0.20	0.099
Simple average	**0.08**	**0.07**	**0.08**	**0.09**	**0.08**	**0.10**	**0.10**	**0.026**
Weighted average	**0.07**	**0.07**	**0.07**	**0.07**	**0.07**	**0.08**	**0.08**	**0.006**
Standard Deviation	**0.05**	**0.06**	**0.06**	**0.06**	**0.00**	**0.00**	**0.00**	**-0.052**
Skewness	**1.21**	**0.98**	**0.80**	**0.56**	**-0.23**	**-0.41**	**-0.65**	**-1.859**
Kurtosis	**2.26**	**0.47**	**-0.15**	**-0.98**	**-1.79**	**-2.41**	**-3.23**	**-5.490**

Table A2.2b

HKMT Index/Rankings - Production value (1971-1998)							
	Spearman Correlations						
	1971-1974	1975-1978	1979-1982	1983-1986	1987-1990	1991-1994	1995-1998
1971-1974	1.000	0.705	0.495	0.496	0.528	0.472	0.508
1975-1978		1.000	0.756	0.635	0.631	0.555	0.596
1979-1982			1.000	0.900	0.865	0.820	0.847
1983-1986				1.000	0.931	0.826	0.795
1987-1990					1.000	0.910	0.856
1991-1994						1.000	0.950
1995-1998							1.000

Table A2.3a

Regressions on a time trend - Absolute concentration (MHH Index)			
Sector/Period	**1970-1998**	**1970-1984**	**1985-1998**
Food products	**0.001980*** (0.000304)**	**0.003256*** (0.00717)**	-0.000630 (0.000653)
Beverages	0.000278 (0.000411)	0.000967 (0.001493)	0.000900 (0.000563)
Tobacco	**0.000969*** (0.000184)**	0.000579 (0.000615)	**0.000756* (0.000384)**
Textiles	**0.002116*** (0.000404)**	**0.003306*** (0.001064)**	-0.001082 (0.000853)
Wearing apparel, except footwear	**0.006187*** (0.001110)**	**0.007265** (0.002649)**	-0.005878*** (0.001302)
Manufacture of leather and leather products	0.000885 (0.000642)	-0.002675 (0.001652)	**0.005707*** (0.001178)**
Footwear	**0.008838*** (0.001084)**	**0.012081*** (0.002388)**	-0.003364** (0.001283)
Wood products	**0.003648*** (0.000759)**	**0.008490*** (0.0016456)**	-0.003085** (0.001327)
Furniture	-0.000528 (0.001073)	**0.007454*** (0.001958)**	-0.009961*** (0.002016)
Manufacture of paper and paper products	0.001215 (0.000765)	**0.007433*** (0.000897)**	-0.006564*** 0.001291
Printing and publishing	-0.001128 (0.000686)	**0.004717*** (0.001178)**	-0.006216*** (0.001374)
Industrial chemicals	**0.003618*** (0.000705)**	**0.010214*** (0.001116)**	-0.002855*** (0.000574)
Other chemicals products	**0.002045*** (0.000487)**	**0.005652*** (0.000684)**	-0.002637** (0.000991)
Petroleum refineries	-0.002759*** (0.0006633)	-0.008617 (0.001564)	0.000552 (0.000407)
Miscellaneos products of petroleum and coal	**0.005923*** (0.001523)**	**0.022462*** (0.002532)**	-0.003654*** (0.000927)
Rubber products	**0.004652*** (0.000540)**	0.002367 (0.001470)	0.000762 (0.000783)
Plastic products	**0.003741*** (0.000787)**	**0.006955*** (0.002170)**	-0.002691* (0.001250)
Pottery, china, and earthenware	-0.000276 (0.000486)	-0.001448 (0.001268)	**0.003758*** (0.001006)**
Manufacture of glass and glass products	**0.002848*** (0.000724)**	**0.006859*** (0.001046)**	-0.003327 (0.002055)
Other non-metallic minerals	-0.001868 (0.001099)	**0.007991*** (0.001177)**	-0.012174*** (0.0013336)
Iron and steel	0.000839 (0.000503)	**0.003211** (0.001071)**	-0.004271*** (0.000858)
Non-ferrous metals	**0.004275*** (0.000551)**	**0.005370*** (0.001558)**	-0.000453 (0.000854)
Fabricated metal products	0.000097 (0.000325)	0.001004 (0.001029)	-0.001384* (0.000668)
Non-electrical machinery	**0.007417*** (0.000707)**	**0.011504*** (0.001291)**	-0.000349 (0.000989)
Electrical machinery	**0.005433*** (0.000839)**	**0.011610*** (0.001307)**	-0.001414 (0.002010)
Transport equipment	0.000874 (0.000698)	**0.005774*** (0.001221)**	-0.005655*** (0.001330)
Professional and scientific instruments	**0.009069*** (0.000871)**	**0.015732*** (0.001227)**	-0.000114 (0.001282)
Other manufacturing industries	**0.007477*** (0.001160)**	**0.019353*** (0.002158)**	-0.000611 (0.000611)

Note: The firts row reports the estimated coefficient and the second row indicates the standard error.

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

Table A2.3b

Regressions on a time trend - Relative concentration (HKMT Index)

Sector/Period	1970-1998	1970-1984	1985-1998
Food products	0.008001 (0.014930)	**0.100949**** **(0.034906)**	-0.108550 (0.028848)
Beverages	**0.058018***** **(0.008690)**	**0.080693**** **(0.028847)**	-0.001031 (0.007165)
Tobacco	**0.042939***** **(0.005293)**	**0.072556***** **(0.013608)**	0.003338 (0.009738)
Textiles	-0.030305** (0.011314)	0.007336 (0.025082)	-0.060433 (0.038818)
Wearing apparel, except footwear	-0.022024* (0.011483)	-0.131129*** (0.028770)	-0.015395 (0.010782)
Manufacture of leather and leather products	**0.013720*** **(0.007464)**	-0.007573 (0.021497)	**0.064973***** **(0.015134)**
Footwear	**0.021232*** **(0.012025)**	-0.060844 (0.038549)	0.007238 (0.007052)
Wood products	**0.009995*** **(0.005773)**	0.017701 (0.019150)	0.013218 (0.013080)
Furniture	-0.070860*** (0.013158)	-0.025634* (0.013866)	-0.160677*** (0.048200)
Manufacture of paper and paper products	0.001733 (0.023433)	0.014524 (0.062461)	0.1076900 (0.068452)
Printing and publishing	**0.046927***** **(0.015867)**	-0.072263* (0.040302)	**0.084678**** **(0.034141)**
Industrial chemicals	**0.040005**** **(0.015501)**	**0.114973**** **(0.049986)**	0.029848 (0.028696)
Other chemicals products	-0.062466*** (0.016541)	-0.058047 (0.040210)	-0.094339 (0.056940)
Petroleum refineries	-0.014428*** (0.002123)	-0.020592*** (0.006307)	-0.008994 (0.005571)
Miscellaneos products of petroleum and coal	**0.061824***** **(0.016661)**	**0.216468***** **(0.043459)**	0.003499 (0.010095)
Rubber products	0.011926 (0.014169)	-0.138353*** (0.030786)	**0.045588***** **(0.008449)**
Plastic products	0.024875 (0.016737)	-0.059087 (0.058997)	**0.026222**** **(0.011437)**
Pottery, china, and earthenware	**0.056745**** **(0.015458)**	0.058961 (0.059472)	**0.038380***** **(0.007072)**
Manufacture of glass and glass products	-0.009388 (0.022230)	0.012528 (0.047566)	-0.169083** (0.067163)
Other non-metallic minerals	-0.039308*** (0.010282)	-0.016661** (0.007295)	0.022425 (0.039768)
Iron and steel	-0.038640*** (0.007737)	-0.083639*** (0.014228)	-0.012784 (0.025643)
Non-ferrous metals	0.005882 (0.005020)	-0.042136*** (0.011032)	**0.031050***** **(0.006330)**
Fabricated metal products	**0.027203*** **(0.014730)**	0.017888 (0.048623)	-0.056068*** (0.015465)
Non-electrical machinery	**0.031749***** **(0.003683)**	**0.028950*** **(0.013599)**	**0.024314***** **(0.004350)**
Electrical machinery	**0.022172***** **(0.003900)**	**0.035817***** **(0.010055)**	**0.023664*** **(0.012127)**
Transport equipment	**0.027043*** **(0.015610)**	0.002171 (0.036625)	**0.149203***** **(0.041134)**
Professional and scientific instruments	**0.056534***** **(0.007078)**	**0.086283***** **(0.024455)**	**0.026476***** **(0.006463)**
Other manufacturing industries	**0.023834***** **(0.004470)**	**0.063441***** **(0.012232)**	**0.020486***** **(0.003757)**

Note: The firts row reports the estimated coefficient and the second row indicates the standard error.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table A2.4

Spearman rank correlation between absolute and relative measures (1971-1998)

	1971-1974	1975-1978	1979-1982	1983-1986	1987-1990	1991-1994	1995-1998
Correlation	0.356	0.192	0.116	0.075	0.077	0.072	0.052

A3. Econometric evidence

Table A3.1

Summary statistics					
Variable	**Obs.**	**Mean.**	**Std. Dev.**	**Min.**	**Max.**
hkmtp	392	0.09415	0.06610	0.00090	0.28810
labint	392	28.06147	26.00098	0.05876	116.17780
relskillint	392	0.07599	0.06297	0.00007	0.24583
technology	392	0.71464	0.15611	0.31499	1.32000
scale	392	38.31868	26.34696	11.23629	147.86860
relexpconc	392	0.08745	0.07017	0.00114	0.47399
osint	392	0.21631	0.12651	0.01384	0.45723
wmsint	392	0.44320	0.12422	0.12886	0.65173
np	392	0.29639	0.20900	0.04600	0.88400

Table A3.2

Correlation matrix								
Variables	**labint**	**relskillint**	**technology**	**scale**	**relexpconc**	**osint**	**wmsint**	**np**
labint	1.00000							
relskillint	0.24160	1.00000						
technology	0.07000	0.19250	1.00000					
scale	-0.36450	0.03450	-0.01120	1.00000				
relexpconc	-0.02600	0.08620	0.16120	0.10200	1.00000			
osint	-0.28840	-0.13230	0.03520	0.11820	-0.31030	1.00000		
wmsint	-0.07210	-0.28360	-0.05670	-0.00320	-0.36460	0.48030	1.00000	
np	0.12480	-0.20310	-0.33560	0.29620	-0.10390	-0.13160	0.13350	1.00000

Table A3.3

Basic regresions

	(1) lnhkmtp	(2) lnhkmtp	(3) lnhkmtp	(4) lnhkmtp	(5) lnhkmtp	(6) lnhkmtp	(7) lnhkmtp	(8) lnhkmtp	(9) lnhkmtp	(10) lnhkmtp	(11) lnhkmtp	(12) lnhkmtp	(13) lnhkmtp	(14) lnhkmtp	(15) lnhkmtp	(16) lnhkmtp
labint	0.300	0.272	0.373	0.291	0.371	0.376	0.204	0.213	0.360	0.279	0.333	0.250	0.206	0.217	0.183	0.192
	(0.130)**	(0.142)*	(0.118)***	(0.129)**	(0.150)**	(0.150)**	(0.131)	(0.132)	(0.113)***	(0.125)**	(0.117)***	(0.130)*	(0.131)	(0.132)	(0.132)	(0.133)
relskillint	0.283	0.317	0.166	0.247	0.258	0.251	0.327	0.316	0.161	0.241	0.146	0.227	0.314	0.299	0.297	0.285
	(0.102)***	(0.115)***	(0.077)**	(0.081)***	(0.112)**	(0.111)**	(0.091)***	(0.090)***	(0.076)**	(0.079)***	(0.079)*	(0.082)***	(0.088)***	(0.087)***	(0.093)***	(0.092)***
technology	0.123	0.134	0.100	0.136	0.280	0.293	0.096	0.113	0.102	0.138	0.101	0.137	0.099	0.119	0.118	0.138
	(0.029)***	(0.033)***	(0.025)***	(0.030)***	(0.062)***	(0.066)***	(0.050)*	(0.054)**	(0.025)***	(0.030)***	(0.025)***	(0.030)***	(0.050)**	(0.055)**	(0.057)**	(0.062)**
scale			-0.079	-0.168			-0.242	-0.234	-0.072	-0.161	-0.081	-0.171	-0.228	-0.215	-0.232	-0.223
			(0.052)	(0.055)***			(0.064)***	(0.066)***	(0.052)	(0.055)***	(0.053)	(0.057)***	(0.067)***	(0.070)***	(0.064)***	(0.066)***
relexpconc			0.370	0.374			0.389	0.393	0.367	0.372	0.366	0.370	0.385	0.389	0.379	0.383
			(0.061)***	(0.062)***			(0.069)***	(0.069)***	(0.060)***	(0.061)***	(0.061)***	(0.062)***	(0.069)***	(0.067)***	(0.070)***	(0.069)***
osint									0.308	0.291			0.210	0.258		
									(0.196)	(0.191)			(0.213)	(0.219)		
wmsint											0.151	0.153			0.136	0.144
											(0.086)*	(0.085)*			(0.094)	(0.095)
np		0.032		0.112		0.085		0.114		0.110		0.112		0.129		0.121
		(0.038)		(0.038)***		(0.072)		(0.068)*		(0.038)***		(0.038)***		(0.072)*		(0.069)*
Obs.	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392
Adj. R2	0.78	0.78	0.82	0.82	0.78	0.78	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Ind. Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	No	No	No	No	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes	Yes

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

Table A3.4a

Addressing endogeneity 1 (Regressions with relexpconc in initial year)								
	(1) **lnhkmtp**	**(2)** **lnhkmtp**	**(3)** **lnhkmtp**	**(4)** **lnhkmtp**	**(5)** **lnhkmtp**	**(6)** **lnhkmtp**	**(7)** **lnhkmtp**	**(8)** **lnhkmtp**
labint	0.206	0.217	0.183	0.192	0.280	0.288	0.237	0.243
	(0.131)	(0.132)	(0.132)	(0.133)	(0.148)*	(0.149)*	(0.149)	(0.150)
relskillint	0.314	0.299	0.297	0.285	0.276	0.266	0.243	0.235
	(0.088)***	(0.087)***	(0.093)***	(0.092)***	(0.102)***	(0.101)***	(0.104)**	(0.104)**
technology	0.099	0.119	0.118	0.138	0.249	0.264	0.281	0.295
	(0.050)**	(0.055)**	(0.057)**	(0.062)**	(0.056)***	(0.062)***	(0.063)***	(0.069)***
scale	-0.228	-0.215	-0.232	-0.223	-0.215	-0.206	-0.220	-0.214
	(0.067)***	(0.070)***	(0.064)***	(0.066)***	(0.069)***	(0.072)***	(0.066)***	(0.069)***
relexpconc	0.385	0.389	0.379	0.383				
	(0.069)***	(0.067)***	(0.070)***	(0.069)***				
relexpconciy					0.948	0.950	0.896	0.886
					(0.135)***	(0.134)***	(0.125)***	(0.126)***
osint	0.210	0.258			0.353	0.387		
	(0.213)	(0.219)			(0.234)	(0.241)		
nwmsint			0.136	0.144			0.255	0.261
			(0.094)	(0.095)			(0.099)**	(0.100)***
nnp		0.129		0.121		0.089		0.080
		(0.072)*		(0.069)*		(0.077)		(0.076)
Obs.	392	392	392	392	392	392	392	392
Adj. R2	0.82	0.82	0.82	0.82	0.78	0.78	0.78	0.78
Ind. Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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

Robust standard errors in parentheses.

The industry dummy i2 was supressed from the regression with relexpconc in the initial year due to collinearity problems.

Table A3.4b

Addressing endogeneity 2 (Regressions with relexpconc lagged one period instead of contemporary value)

	(1) lnhkmtp	(2) lnhkmtp	(3) lnhkmtp	(4) lnhkmtp	(5) lnhkmtp	(6) lnhkmtp	(7) lnhkmtp	(8) lnhkmtp
labint	0.206	0.221	0.217	0.231	0.183	0.185	0.192	0.192
	(0.131)	(0.137)	(0.132)	(0.138)*	(0.132)	(0.138)	(0.133)	(0.139)
relskillint	0.314	0.300	0.299	0.287	0.297	0.271	0.285	0.259
	(0.088)***	(0.095)***	(0.087)***	(0.094)***	(0.093)***	(0.099)***	(0.092)***	(0.098)***
technology	0.099	0.163	0.119	0.182	0.118	0.192	0.138	0.210
	(0.050)**	(0.053)***	(0.055)**	(0.058)***	(0.057)**	(0.059)***	(0.062)**	(0.064)***
scale	-0.228	-0.223	-0.215	-0.211	-0.232	-0.226	-0.223	-0.217
	(0.067)***	(0.070)***	(0.070)***	(0.073)***	(0.064)***	(0.068)***	(0.066)***	(0.071)***
relexpconc	0.385	0.247	0.389	0.251	0.379	0.243	0.383	0.247
	(0.069)***	(0.052)***	(0.067)***	(0.052)***	(0.070)***	(0.054)***	(0.069)***	(0.053)***
osint	0.210	0.282	0.258	0.327				
	(0.213)	(0.226)	(0.219)	(0.231)				
wmsint					0.136	0.218	0.144	0.226
					(0.094)	(0.096)**	(0.095)	(0.097)**
np		0.129		0.116		0.121		0.109
		(0.072)*		(0.074)		(0.069)*		(0.072)
Obs.	392	392	392	392	392	392	392	392
Adj. R2	0.82	0.80	0.82	0.80	0.82	0.80	0.82	0.80
Ind. Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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

Robust standard errors in parentheses.

(1),(3),(5),(7): Relexpconc in contemporaneos value; (2),(4),(6),(8): Relexpconc in one period lagged value.

Table A3.4c

Addressing endogeneity 3 (Regressions with relexpconc instrumented with its own one lag value)								
	(1) **lnhkmtp**	**(2)** **lnhkmtp**	**(3)** **lnhkmtp**	**(4)** **lnhkmtp**	**(5)** **lnhkmtp**	**(6)** **lnhkmtp**	**(7)** **lnhkmtp**	**(8)** **lnhkmtp**
labint	0.214	0.206	0.225	0.217	0.189	0.183	0.197	0.192
	(0.101)**	(0.101)**	(0.101)**	(0.101)**	(0.102)*	(0.102)*	(0.102)*	(0.102)*
relskillint	0.310	0.314	0.296	0.299	0.291	0.297	0.280	0.285
	(0.097)***	(0.097)***	(0.097)***	(0.097)***	(0.098)***	(0.098)***	(0.099)***	(0.098)***
technology	0.116	0.099	0.135	0.119	0.136	0.118	0.154	0.138
	(0.069)*	(0.067)	(0.070)*	(0.068)*	(0.071)*	(0.069)*	(0.072)**	(0.070)**
scale	-0.226	-0.228	-0.214	-0.215	-0.231	-0.232	-0.222	-0.223
	(0.080)***	(0.080)***	(0.080)***	(0.080)***	(0.079)***	(0.079)***	(0.079)***	(0.079)***
relexpconc	0.341	0.385	0.347	0.389	0.338	0.379	0.344	0.383
	(0.065)***	(0.046)***	(0.065)***	(0.046)***	(0.065)***	(0.046)***	(0.065)***	(0.046)***
osint	0.226	0.210	0.272	0.258				
	(0.209)	(0.208)	(0.211)	(0.210)				
wmsint					0.149	0.136	0.156	0.144
					(0.099)	(0.097)	(0.099)	(0.097)
np			0.124	0.129			0.117	0.121
			(0.081)	(0.081)			(0.080)	(0.080)
Obs.	392	392	392	392	392	392	392	392
Adj. R2	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Hausman		0.94		0.85		0.81		0.72
Ind. Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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

Standard errors in parentheses.

Relexpconc was instrumented with ist own one lag value.

(1),(3),(5),(7): OLS; (2),(4),(6),(8): IV

Table A3.5

Addressing panel correlations (PW-regressions with panel corrected standard errors)								
	(1) **lnhkmtp**	**(2)** **lnhkmtp**	**(3)** **lnhkmtp**	**(4)** **lnhkmtp**	**(5)** **lnhkmtp**	**(6)** **lnhkmtp**	**(7)** **lnhkmtp**	**(8)** **lnhkmtp**
labint	0.229	0.232	0.219	0.222	0.298	0.298	0.287	0.291
	(0.139)*	(0.139)*	(0.140)	(0.141)	(0.141)**	(0.140)**	(0.141)**	(0.141)**
relskillint	0.244	0.238	0.235	0.229	0.228	0.227	0.203	0.207
	(0.100)**	(0.099)**	(0.101)**	(0.100)**	(0.083)***	(0.083)***	(0.081)**	(0.083)**
technology	0.074	0.082	0.086	0.093	0.125	0.131	0.140	0.146
	(0.056)	(0.057)	(0.058)	(0.059)	(0.052)**	(0.052)**	(0.055)**	(0.055)***
scale	-0.114	-0.114	-0.122	-0.120	-0.157	-0.150	-0.155	-0.151
	(0.058)**	(0.058)*	(0.060)**	(0.060)**	(0.063)**	(0.063)**	(0.065)**	(0.066)**
relexpconc	0.457	0.460	0.452	0.455	0.542	0.547	0.538	0.544
	(0.064)***	(0.064)***	(0.064)***	(0.064)***	(0.071)***	(0.071)***	(0.072)***	(0.072)***
osint	0.374	0.391			0.253	0.286		
	(0.252)	(0.251)			(0.241)	(0.240)		
wmsint			0.158	0.161			0.163	0.156
			(0.089)*	(0.089)*			(0.068)**	(0.068)**
np		0.098		0.091		0.112		0.093
		(0.074)		(0.074)		(0.081)		(0.078)
Obs.	392	392	392	392	392	392	392	392
Ind. Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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

Panel corrected standard errors in parentheses (correction for cross sectional correlation and autocorrelation).

(1)-(4): Common autocorrelation coefficient; (5)-(8): Panel specific autcorrelation coefficient.

Table A3.6a

Identifying the Mercosur effect (OLS regressions with an interactive dummy for Mercosur period)								
	(1) lnhkmtp	**(2) lnhkmtp**	**(3) lnhkmtp**	**(4) lnhkmtp**	**(5) lnhkmtp**	**(6) lnhkmtp**	**(7) lnhkmtp**	**(8) lnhkmtp**
labint	0.239	0.203	0.201	0.164	0.127	0.132	0.098	0.100
	(0.132)*	(0.139)	(0.146)	(0.150)	(0.132)	(0.134)	(0.146)	(0.144)
relskillint	0.241	0.323	0.223	0.284	0.331	0.343	0.321	0.325
	(0.114)**	(0.128)**	(0.116)*	(0.123)**	(0.130)**	(0.132)***	(0.131)**	(0.131)**
technology	0.243	0.195	0.245	0.235	0.292	0.301	0.238	0.302
	(0.057)***	(0.059)***	(0.056)***	(0.054)***	(0.105)***	(0.107)***	(0.097)**	(0.106)***
scale	-0.171	-0.240	-0.170	-0.217	-0.279	-0.292	-0.266	-0.284
	(0.061)***	(0.071)***	(0.071)**	(0.073)***	(0.070)***	(0.080)***	(0.070)***	(0.075)***
relexpconc	0.422	0.428	0.419	0.387	0.386	0.415	0.368	0.366
	(0.076)***	(0.074)***	(0.080)***	(0.078)***	(0.079)***	(0.078)***	(0.085)***	(0.084)***
osint	0.205	0.313			0.203	0.307		
	(0.233)	(0.240)			(0.241)	(0.258)		
wmsint			0.152	0.185			0.151	0.170
			(0.100)	(0.102)*			(0.108)	(0.109)
np		0.131		0.154		0.159		0.187
		(0.049)***		(0.049)***		(0.077)**		(0.070)***
mlabint	0.222	0.249	0.187	0.224	0.233	0.250	0.190	0.228
	(0.055)***	(0.060)***	(0.051)***	(0.056)***	(0.057)***	(0.058)***	(0.052)***	(0.055)***
mrelskillint	-0.018	-0.075	-0.013	-0.053	-0.015	-0.043	-0.018	-0.034
	(0.064)	(0.076)	(0.068)	(0.072)	(0.072)	(0.078)	(0.075)	(0.076)
mtechnology	-0.152	-0.088	-0.159	-0.142	-0.286	-0.270	-0.202	-0.257
	(0.048)***	(0.056)	(0.055)***	(0.054)***	(0.121)**	(0.122)**	(0.108)*	(0.119)**
mscale	0.134	0.165	0.145	0.191	0.123	0.146	0.144	0.187
	(0.062)**	(0.063)***	(0.066)**	(0.069)***	(0.060)**	(0.061)**	(0.067)**	(0.069)***
mrelexpconc	-0.007	-0.015	-0.021	0.013	0.056	0.028	0.045	0.058
	(0.060)	(0.060)	(0.062)	(0.062)	(0.063)	(0.065)	(0.067)	(0.067)
mosint	0.071	0.034			0.101	0.058		
	(0.043)	(0.044)			(0.047)**	(0.057)		
mwmsint			0.053	0.111			0.101	0.142
			(0.045)	(0.052)**			(0.055)*	(0.056)**
mnp		-0.081		-0.228		-0.071		-0.303
		(0.126)		(0.139)		(0.206)		(0.194)
Obs.	392	392	392	392	392	392	392	392
Adj. R2	0.82	0.83	0.82	0.83	0.82	0.83	0.82	0.83
Joint Sig.(X2)	24.90***	22.19***	27.42***	24.57***	21.96***	23.59***	23.46***	26.95***
Ind. Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	No	No	No	No	Yes	Yes	Yes	Yes

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

Robust standard errors in parentheses.

Table A3.7a

Subperiods regressions (1985-1990 and 1991-1998)

	1985-1990				1991-1998			
	(1) lnhkmtp	(2) lnhkmtp	(3) lnhkmtp	(4) lnhkmtp	(1) lnhkmtp	(2) lnhkmtp	(3) lnhkmtp	(4) lnhkmtp
labint	-0.098	-0.104	-0.093	-0.100	0.480	0.480	0.451	0.454
	(0.198)	(0.206)	(0.198)	(0.205)	(0.186)**	(0.188)**	(0.183)**	(0.183)**
relskillint	-0.222	-0.169	-0.212	-0.163	0.160	0.159	0.162	0.156
	(0.271)	(0.288)	(0.261)	(0.289)	(0.089)*	(0.090)*	(0.091)*	(0.091)*
technology	0.116	0.115	0.117	0.116	0.107	0.107	0.095	0.093
	(0.040)***	(0.038)***	(0.041)***	(0.039)***	(0.045)**	(0.045)**	(0.046)**	(0.046)**
scale	0.289	0.269	0.279	0.261	-0.084	-0.084	-0.114	-0.106
	(0.174)*	(0.147)*	(0.177)	(0.151)*	(0.092)	(0.086)	(0.093)	(0.087)
relexpconc	0.567	0.559	0.568	0.561	0.391	0.391	0.380	0.378
	(0.085)***	(0.088)***	(0.084)***	(0.086)***	(0.075)***	(0.075)***	(0.074)***	(0.075)***
osint	0.016	0.029			0.364	0.365		
	(0.392)	(0.406)			(0.347)	(0.351)		
wmsint			-0.034	-0.028			0.526	0.542
			(0.133)	(0.143)			(0.308)*	(0.316)*
np		0.016		0.014		-0.001		-0.017
		(0.048)		(0.048)		(0.048)		(0.049)
Obs.	168	168	168	168	224	224	224	224
Adj. R2	0.91	0.91	0.91	0.91	0.82	0.82	0.82	0.82
Ind. Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	No	No	No	No	No	No	No	No

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

Robust standard errors in parentheses.

Table A3. 7b

Subperiods regressions (1985-1990 and 1991-1998)

	1985-1990				1991-1998			
	(1) lnhkmtp	(2) lnhkmtp	(3) lnhkmtp	(4) lnhkmtp	(1) lnhkmtp	(2) lnhkmtp	(3) lnhkmtp	(4) lnhkmtp
labint	0.057	0.077	0.058	0.080	0.446	0.448	0.443	0.448
	(0.231)	(0.229)	(0.231)	(0.229)	(0.197)**	(0.199)**	(0.197)**	(0.199)**
relskillint	-0.304	-0.279	-0.301	-0.264	0.217	0.217	0.195	0.195
	(0.317)	(0.324)	(0.307)	(0.315)	(0.098)**	(0.099)**	(0.097)**	(0.097)**
technology	0.217	0.222	0.218	0.224	0.020	0.020	0.019	0.021
	(0.061)***	(0.062)***	(0.064)***	(0.064)***	(0.086)	(0.086)	(0.086)	(0.086)
scale	0.324	0.385	0.323	0.375	-0.137	-0.138	-0.141	-0.142
	(0.191)*	(0.215)*	(0.186)*	(0.205)*	(0.093)	(0.092)	(0.095)	(0.095)
relexpconc	0.603	0.620	0.603	0.621	0.412	0.412	0.396	0.397
	(0.109)***	(0.103)***	(0.109)***	(0.104)***	(0.083)***	(0.083)***	(0.082)***	(0.082)***
osint	0.016	0.100			0.322	0.318		
	(0.382)	(0.414)			(0.364)	(0.364)		
wmsint			0.000	-0.000			0.507	0.514
			(0.141)	(0.138)			(0.333)	(0.336)
np		0.106		0.103		0.009		0.029
		(0.074)		(0.067)		(0.082)		(0.084)
Obs.	168	168	168	168	224	224	224	224
Adj. R2	0.91	0.91	0.91	0.91	0.81	0.81	0.82	0.82
Ind. Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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

Robust standard errors in parentheses.

Table A3.7c

Subperiods regressions (1985-1990 and 1991-1998)

	1985-1990				1991-1998			
	(1) lnhkmtp	(2) lnhkmtp	(3) lnhkmtp	(4) lnhkmtp	(1) lnhkmtp	(2) lnhkmtp	(3) lnhkmtp	(4) lnhkmtp
labint	-0.098	-0.104	-0.093	-0.100	0.480	0.480	0.451	0.454
	(0.198)	(0.206)	(0.198)	(0.205)	(0.186)**	(0.188)**	(0.183)**	(0.183)**
relskillint	-0.222	-0.169	-0.212	-0.163	0.160	0.159	0.162	0.156
	(0.271)	(0.288)	(0.261)	(0.289)	(0.089)*	(0.090)*	(0.091)*	(0.091)*
technology	0.116	0.115	0.117	0.116	0.107	0.107	0.095	0.093
	(0.040)***	(0.038)***	(0.041)***	(0.039)***	(0.045)**	(0.045)**	(0.046)**	(0.046)**
scale	0.289	0.269	0.279	0.261	-0.084	-0.084	-0.114	-0.106
	(0.174)*	(0.147)*	(0.177)	(0.151)*	(0.092)	(0.086)	(0.093)	(0.087)
relexpconc	0.567	0.559	0.568	0.561	0.391	0.391	0.380	0.378
	(0.085)***	(0.088)***	(0.084)***	(0.086)***	(0.075)***	(0.075)***	(0.074)***	(0.075)***
osint	0.016	0.029			0.364	0.365		
	(0.392)	(0.406)			(0.347)	(0.351)		
wmsint			-0.034	-0.028			0.526	0.542
			(0.133)	(0.143)			(0.308)*	(0.316)*
np		0.016		0.014		-0.001		-0.017
		(0.048)		(0.048)		(0.048)		(0.049)
Obs.	168	168	168	168	224	224	224	224
Ind. Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	No	No	No	No	No	No	No	No

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

(1)-(4): OLS regressions with panel corrected standard errors;(5)-(8): P-W regressions with panel corrected standard errors.

Table A2.7d

Subperiods regressions (1985-1990 and 1991-1998)

	1985-1990				1991-1998			
	(1) lnhkmtp	(2) lnhkmtp	(3) lnhkmtp	(4) lnhkmtp	(1) lnhkmtp	(2) lnhkmtp	(3) lnhkmtp	(4) lnhkmtp
labint	0.051	0.070	0.052	0.072	0.420	0.422	0.423	0.426
	(0.138)	(0.140)	(0.136)	(0.138)	(0.213)**	(0.217)*	(0.211)**	(0.215)**
relskillint	-0.331	-0.304	-0.328	-0.288	0.227	0.227	0.212	0.211
	(0.427)	(0.429)	(0.469)	(0.463)	(0.102)**	(0.101)**	(0.101)**	(0.100)**
technology	0.407	0.416	0.408	0.419	0.011	0.011	0.010	0.011
	(0.067)***	(0.068)***	(0.073)***	(0.071)***	(0.073)	(0.073)	(0.072)	(0.073)
scale	0.296	0.351	0.295	0.343	-0.118	-0.119	-0.126	-0.127
	(0.186)	(0.190)*	(0.197)	(0.203)*	(0.077)	(0.079)	(0.082)	(0.084)
relexpconc	0.731	0.752	0.732	0.753	0.431	0.432	0.416	0.418
	(0.110)***	(0.108)***	(0.108)***	(0.108)***	(0.078)***	(0.079)***	(0.075)***	(0.076)***
osint	0.017	0.102			0.276	0.271		
	(0.535)	(0.492)			(0.385)	(0.378)		
wmsint			0.000	-0.000			0.461	0.463
			(0.085)	(0.086)			(0.309)	(0.313)
np		0.122		0.118		0.043		0.078
		(0.086)		(0.087)		(0.222)		(0.218)
Obs.	168	168	168	168	224	224	224	224
Ind. Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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

(1)-(4): OLS regressions with panel corrected standard errors;(5)-(8): P-W regressions with panel corrected standard errors.