REGIONAL INTEGRATION AGREEMENTS AND THE GEOGRAPHY OF WORLD TRADE: STATISTICAL INDICATORS AND EMPIRICAL EVIDENCE

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ABSTRACT

The growth in intra-regional trade and investment has been one of the dominant features of the world economy in the last years. The statistical indicators which are commonly used in order to measure this phenomenon are inadequate to evaluate its dynamics, as well as to compare different regions.

This paper reviews the analytical limitations of the available statistical tools, and proposes some new indicators, experimenting their application to data concerning the four main regional integration areas (ASEAN, EU, MERCOSUR and NAFTA) in the period 1990-2000. In particular, a "trade introversion index" is proposed, which seems able to surmount all the main shortcomings of the traditional indicators. Comparative assessments of intra-regional trade are strongly affected by the choice of the statistical indicator. All the four regions considered in this paper experienced a moderate upward trend in trade introversion in the nineties. The level of the index for MERCOSUR was much higher than for the other regions.

The trade introversion index can be read as an *ex-post* measure of the *trade-diverting* effects of regional integration. Combining data on trade and GDP, an index of relative trade openness can be obtained, which is related to the internal and external *trade-creating* effects of regional integration. ASEAN appears the region with the highest degree of relative trade openness, whilst both MERCOSUR and NAFTA are well below the world average.

1.   Introduction

A process of international economic integration, propelled by strong technological and economic forces, as well as by trade liberalization policies, characterized the second half of the twentieth century, and translated into a growth of world trade much more rapid than that of production. This phenomenon has been gradually assuming a global scope, but manifested itself with particular intensity within groups of countries tied by geographic proximity, or by historical and political factors, such as the conclusion of preferential trade agreements.

Theoretical debates and empirical research about regionalism and its implications for the multilateral trading system are still very lively[1]. At the same time policy circles tend to adopt a pragmatic approach to the issue, aimed at recognizing the strong political and institutional motivations for regional integration policies, as well as at reducing their possible economic costs (World Bank, 2000).

One of the first steps to be taken in order to assess the trade effects of regional integration agreements is to measure the actual intensity of trade among their member countries. The problem is less trivial than it could appear at first sight, and this paper aims at offering a contribution to its solution, by proposing and experimenting new measurement methods.

Section 2 contains a critical survey of the available statistical indicators for the measurement of intra-regional trade intensity, as well as some proposals in order to overcome their limitations. In section 3 the indicators are applied to the analysis of intra-regional trade intensity within the four main regional integration agreements (ASEAN, European Union, MERCOSUR and NAFTA) in the nineties. Section 4 discusses some indicators that can be obtained by combining trade and GDP data, aimed at measuring the trade-creating effects of regional integration. Some brief remarks conclude the paper.

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[1]   See, for example, Baldwin and Venables (1995), El-Agraa (1996), Frankel (1997), Guerrieri and Scharrer (2000), Hine (1994), Panagariya (2000) and Pomfret (1997).

2.   Measuring the intensity of intra-regional trade

In the literature on international trade, countries are often grouped in areas – or regions – that are defined according to different physical, political or economic geography criteria, among which the membership of preferential trade agreements is particularly important. Trade flows are defined as intra-regional if both partners belong to the same region, and extra-regional if they belong to different regions.

The importance of intra-regional trade (exports plus imports) is often measured by the *intra-regional trade share* (S_i):

$$S_i = t_{ii} / t_i \qquad\qquad\qquad [\,1\,]$$

where: t_{ii} =   region i's intra-regional trade;

$t_{i.}$ =   region i's total trade.

At first sight this indicator seems the most obvious choice to detect the trade effects of regional integration and is indeed widely used in empirical studies[2]. However, its usefulness for both cross-region and time-series analysis is limited by some problems, which have been outlined by Anderson and Norheim (1993: 80-81).

When comparing different regions, for example, the intra-regional trade share may give misleading information, because its value is biased by the number of countries in each region and by their dimensions.

Given the size of a region, as measured by its total trade, the higher the number of countries in that region, the larger its intra-regional trade share will be. In other words, splitting a region into an increasing number of countries (as happened in Central and Eastern Europe in the nineties) raises its intra-regional trade share by transforming domestic exchange into international (intra-regional) trade. Moreover, other things being equal, a region with a high number of member countries would show a larger intra-regional trade share than a region of the same total trade size, but with a smaller number of members.

The second problem is more important and subtle. In order to understand it, the concept of *geographic neutrality*, must be introduced, defined as the absence of preferential directions in trade flows: the geographic distribution of a region's trade is said to be neutral if the weight of

every partner in the region's trade is equal to its weight in world trade. If a partner is more important than what would be implied by the neutrality criterion, this reveals the presence of factors, such as common borders or regional integration agreements, that generate a preferential orientation in trade flows. Using the neutrality criterion in a simple numerical example, it is easy to verify that, other things being equal, and in particular for any given number of member countries, the intra-regional trade share is positively influenced by the size of the region, as measured by its total trade. In other words, even assuming that every member country's trade is geographically neutral, larger regions would show a higher intra-regional trade share only because of their higher size, that is independently of the actual intensity of intra-regional trade.

Similar arguments may be used in the case of a single region to explain why an increase in its intra-regional trade share does not necessarily imply a higher inward orientation of trade flows, but may simply reflect a growth in the region's relative size in world trade. Stated differently, other things being equal, the intra-regional trade share is biased by a pro-cyclical distortion.

In order to get rid of these problems, one may use the trade intensity index, pioneered by Brown (1949) and elaborated by Kojima (1964). In its simplest form, the *intra-regional trade intensity index* of the region i (I_i) is equal to the ratio between the intra-regional trade share (S_i) and the region's share in world trade (W_i)[3]:

$$I_i = S_i / W_i = (t_{ii} / t_{i.}) / (t_{i.} / T)$$

[2]

where: T =   world trade.

This index is equal to one if the region's weight in its own trade is equal to its weight in world trade (geographic neutrality). On the contrary, if intra-regional trade is relatively more important than trade flows with the rest of the world, as it is usually the case, the intra-regional trade intensity index is higher than one. It can be considered as a variant of the well-known index of revealed comparative advantages, which was proposed by Balassa (1965) in order to study trade

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[2]   See, for example, WTO (1995: 38-41).

[3]   Since no country can trade with itself, the denominator of the index should be corrected by subtracting from the region's total trade, as well as from world trade, one *n*-th of the region's total trade (where *n* is the number of countries in the region), as shown by Anderson and Norheim (1993, p. 82, footnote 6). This correction ensures that the index is approximately equal to unity, if the geographic orientation of the region's trade is not inward biased. The more similar are the trade values of the region's countries, the lower is the approximation error.

specialization patterns. If a region's intra-regional trade intensity is higher than one, it can be said that the region's trade is 'specialized', i.e. relatively more oriented, towards its member countries than towards the rest of the world. An increase of the index, revealing that the region's importance for its own trade rises more (or falls less) than its weight in world trade, can be considered as an *ex-post* indication of an increase in trade integration, that is a reduction of trade *resistances* among the region's countries (Drysdale and Garnaut, 1982). It could also be claimed that the intensity index is a loose *ex-post* measure of the trade-diverting effects of regional integration, since its increases are usually associated with reductions in the intensity of extra-regional trade, but this is not necessarily the case, as will be shown below.

The meaning of the intra-regional trade intensity index can be further clarified using the interpretation proposed by Kunimoto (1977) for a wide class of similar indicators[4]. The intra-regional trade intensity index can be seen as the ratio of the actual value of intra-regional trade flows to their expected value, $E(t_{ii})$, under the assumption of neutrality in the regional direction of trade:

$$I_i = t_{ii}/E(t_{ii}) \hspace{6cm} [\,3\,]$$

where $\hspace{2cm} E(t_{ii}) = t_{i.}^2/T$

In other words, assuming that the matrix representing the geographic distribution of world trade shows no statistical connexion between the origin and the destination regions of trade flows, this would reveal the absence of preferential directions (neutrality) and would translate into values of intra- and extra-regional trade flows that would be exactly proportional to the importance of each region in world trade. These hypothetical values represent the benchmark against which the intensity of actual trade flows can be evaluated. In a region, if there are factors of any kind rousing trade relations among member countries, the value of intra-regional trade will be higher than its

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This correction is important for comparing the trade intensity levels of different regions, but may be neglected if the interest is focused on the time path of intra-regional trade intensity in a single region.

[4] Bowen (1993) criticized trade intensity indices, arguing that in Kunimoto's interpretation they imply a hypothetical world where every good is exported and imported by every country, which would be inconsistent with standard trade theories. Bowen's critique applies particularly to revealed comparative advantage indices, such as that proposed by Balassa (1965), and is questionable for several reasons, including those mentioned by Vollrath (1991). Anyway, it could not be applied to the intra-regional trade intensity index, because this index does not refer to the commodity distribution of trade flows. A world without geographic preferences, in which every country, although not necessarily exporting every good, trades with each partner in proportion to its importance in world trade, appears to be a reasonable yardstick for actual trade flows.

expected value under the neutrality assumption, which translates into an intra-regional trade intensity index higher than one.

Although being immune from the specific problems afflicting the intra-regional trade share, due to its sensitivity to the number and size of member countries, the traditional Balassa intensity index is also characterized by at least three uncomfortable features, which limit its interpretability and usefulness:

a) variability of its range, whose maximum value is inversely related to the region's total trade size;

b) asymmetry of its range with respect to the threshold value of one;

c) possible sign concordance between the changes of complementary indicators.

The next sub-sections will be devoted to the analysis of these problems, proposing a possible solution for each of them.

a)   Range variability

Looking at [2], it is easy to see that the actual range of values assumed by the intra-regional trade intensity index is influenced by the region's size. In fact, whilst in the extreme case of no intra-regional flows the intensity index is equal to zero for any region, its maximum value, which is reached in the opposite case when all trade is intra-regional, is inversely proportional to the region's relative size in terms of total trade:

$$Max \ (I_i) = T/t_i \qquad\qquad\qquad [\,4\,]$$

In other words, the intra-regional trade intensity index ranges from zero (no intra-regional trade) to a maximum value (no extra-regional trade), which is the higher, the smaller the region's total trade. This range variability implies that indices computed for different regions and/or periods are not perfectly comparable among each other.

At first sight, the solution for this problem could appear to divide the intra-regional trade intensity index by its maximum value. However, the result of this normalization would simply be equal to the intra-regional trade share, arousing again the problems mentioned before. An alternative solution consists in changing the denominator of the intra-regional trade intensity index, by substituting the region's weight in the trade of the *rest* of the world (V_i), which is equal to zero in

the limiting case of no extra-regional trade, for the region's weight in world trade. The result could be called *homogeneous index of intra-regional trade intensity* (HI_i):

$$HI_i = S_i / V_i = (t_{ii}/t_i)/(t_{ri}/t_r) \qquad\qquad [\,5\,]$$

where: t_{ri} =   region's i extra-regional trade;

                t_r =   total trade of the rest of the world.

The threshold value of this index, in the case of geographic neutrality, is equal to one, not differently from its traditional Balassa formulation, but its range goes now from zero (no intra-regional trade) to infinity (no extra-regional trade), independently of the region's trade size.

b)   *Range asymmetry*

The second problem of the intra-regional trade intensity index, in both its Balassa and homogeneous formulations, is that its range is not symmetrical around its neutrality threshold. More precisely, if the intensity of intra-regional trade is lower than its expected value under the assumption of geographic neutrality, the intensity index ranges only from zero to one, whilst it goes from one to infinity in the homogeneous formulation, and from one to a number which is always much higher than two in the traditional Balassa formulation, if the region's trade reveals a preferential inward orientation.

This problem may give rise to biased assessments of the index changes, depending on whether they occur above or below the neutrality threshold. In addition, it may create problems in econometric estimates involving the index.

One possible solution for the asymmetry problem consists in applying to the homogeneous index the transformation proposed by Dalum, Laursen and Villumsen (1998) for the Balassa revealed comparative advantage index, which yields the following *symmetrical index of intra-regional trade intensity* (SI_i):

$$SI_i = (HI_i - 1) / (HI_i + 1) \qquad\qquad [\,6\,]$$

This index ranges from minus one (no intra-regional trade) to one (no extra-regional trade), and is equal to zero in the case of neutrality[5]. It is therefore a standardized transformation of the intensity index, which allows proper cross-region comparisons.

c)   *Dynamic ambiguity (possible sign concordance between the changes of complementary indicators)*

Each of the above mentioned indicators for intra-regional trade can be compared with a complementary indicator, measuring the intensity of extra-regional trade.

In the case of the intra-regional trade share, this complement is given by the share of extra-regional flows in the region's total trade. It is obvious that an increase in the former implies a decrease in the latter, and vice versa.

The complementary indicators of the three intensity indices discussed in the previous sub-sections are given by the following *extra-regional trade intensity indices*:

$$E_i = (1 - S_i) / (1 - W_i) \qquad\qquad [\,7\,]$$

$$HE_i = (1 - S_i) / (1 - V_i) \qquad\qquad [\,8\,]$$

$$SE_i = (HE_i - 1) / (HE_i + 1) \qquad\qquad [\,9\,]$$

Each of these indicators' value will be the higher, the larger is the share of extra-regional trade in a region's trade, relative to the other regions' weight in world trade, in [7], or to the intra-regional trade share of the rest of the world, taken as a single region, in [8] and [9]. In the case of geographic neutrality, the first two indicators are equal to one, whilst the third one is equal to zero.

Unfortunately, unlike the intra- and extra-regional trade shares, all the above mentioned couples of intensity indices are afflicted by a common problem: the change of the intra-regional index, although having usually opposite sign than that of its complementary extra-regional index, does sometimes assume the same sign, which makes it difficult to interpret their dynamics.

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[5]   Similar properties are shown by the hyperbolic tangent of the natural logarithm of the intensity index, proposed by Jungmittag, Grupp and Hullmann (1998) as a substitute for the Balassa formulation.

More precisely, it can be shown that, if $I_i \neq E_i$, i.e. if the regional direction of trade is not neutral, and if the ratio between the changes of S_i and W_i lies in the interval between I_i and E_i, the two complementary indices change in the same direction (*condition of sign concordance*). Since almost all regions are intra-regionally oriented, I_i is usually higher than E_i. In this case, if:

$$E_i < \Delta S_i / \Delta W_i < I_i, \qquad\qquad [\,10\,]$$
$$\text{then: } \Delta E_i \cdot \Delta I_i > 0$$

and, more precisely, if the sign concordance condition holds, and $\Delta W_i > 0$, then $\Delta I_i < 0$ and $\Delta E_i < 0$; on the contrary, if under the same condition, $\Delta W_i < 0$, then $\Delta I_i > 0$ and $\Delta E_i > 0$.

In other words, if a region's trade is relatively dynamic, in the sense that its weight in world trade increases, it *may* happen that both the intra- and the extra-regional trade intensity indices decrease. On the contrary, if the region is relatively slow, and the sign concordance condition holds, both of the complementary indices increase. In practice, with reference to the latter case, the increase of the intra-regional trade intensity index is due to the fact that the intra-regional trade share falls at a lower rate than the region's weight in world trade, whilst the increase of the extra-regional trade intensity index results from a rise of the corresponding trade share which is relatively larger than the increase of the other regions' weight in world trade.

These results should be reversed in the few cases where $I_i < E_i$, and hold also for the homogeneous and the symmetrical versions of the index. It should be noted that the range of values of $\Delta S_i / \Delta W_i$ for which the complementary indices change in the same direction is equal to the difference between their levels, which means that, other things being equal, the probability of obtaining results that are dynamically ambiguous is higher when intra-regional trade intensity is either very high or very low.

It is in any case difficult to interpret the data, when the indices show a simultaneous increase (or fall) of both intra- and extra-regional trade intensity. Any reference to the effects of regional integration policies would be problematic, because the first index seems to contradict the second, and vice versa.

In order to solve this problem, one could refer to the ratio between the complementary indicators, which shows synthetically if the intensity of intra-regional trade is growing more or less rapidly than that of extra-regional trade. The resulting indicators of relative intra-regional trade intensity, which could be called *trade introversion indices*, are the following:

$$J_i = I_i / E_i \qquad\qquad [11]$$

$$HJ_i = HI_i / HE_i \qquad\qquad [12]$$

$$SJ_i = (HJ_i - 1) / (HJ_i + 1) \qquad\qquad [13]$$

It is easy to see that, also in this 'relative' version, the homogeneous index HJ_i ranges from zero (no intra-regional trade) to infinity (no extra-regional trade), independently of the size of the region, and is equal to one in the threshold case of geographic neutrality. Correspondingly, its symmetrical formulation SJ_i ranges from minus one to one, passing through the neutrality threshold of zero, and should be preferred to the others for the reasons already explained in the previous sub-sections[6].

Moreover, a symmetrical trade extroversion index (SF_i) can be defined as:

$$SF_i = (HE_i / HI_i - 1) / (HE_i / HI_i + 1) \qquad\qquad [14]$$

and it is clear that $SJ_i = - SF_i$. The trade introversion index could therefore be interpreted as an *ex-post* measure of trade diversion, since its increase necessarily occurs at the expense of extra-regional trade intensity.

An interesting property of the homogeneous trade introversion index is that it simultaneously measures the intensity of intra-regional trade in the target region i and in the rest of the world, taken as a single "complementary region". In other words, if the world is divided into two regions, since, by definition, $S_2 = (1 - V_1)$; $V_2 = (1 - S_1)$, and vice versa, it is easy to show that:

$$HJ_2 = [(1 - V_1)/(1 - S_1)]/(V_1/S_1) = HJ_1 \qquad\qquad [15]$$

which obviously implies that $SJ_2 = SJ_1$, independently of the regions' size.

Intuitively, it is reasonable that, if the world is divided into only two regions, any level of trade introversion in one of them implies the same result in the other, with the limiting case where both regions are completely isolated from each other.

3. Intra-regional trade intensity in the nineties: a comparison among four preferential integration areas (ASEAN, EU, MERCOSUR, NAFTA)

The indicators discussed in the previous section will now be applied to the analysis of intra-regional trade intensity in the nineties, with reference to the four regional integration agreements that have the highest share of world trade: the European Union (EU), the North American Free Trade Agreement (NAFTA), the Association of South East Asia Nations (ASEAN) and the Southern Common Market (MERCOSUR) [7].

Time series of trade data have been drawn from the WTO website[8], and are measured in US dollars at current prices. Throughout the 1990-2000 period, the country composition of each region has been kept constant as it was in 2000, independently of the actual accession date of each member, in order to avoid distortions due to changes in the number of member countries[9].

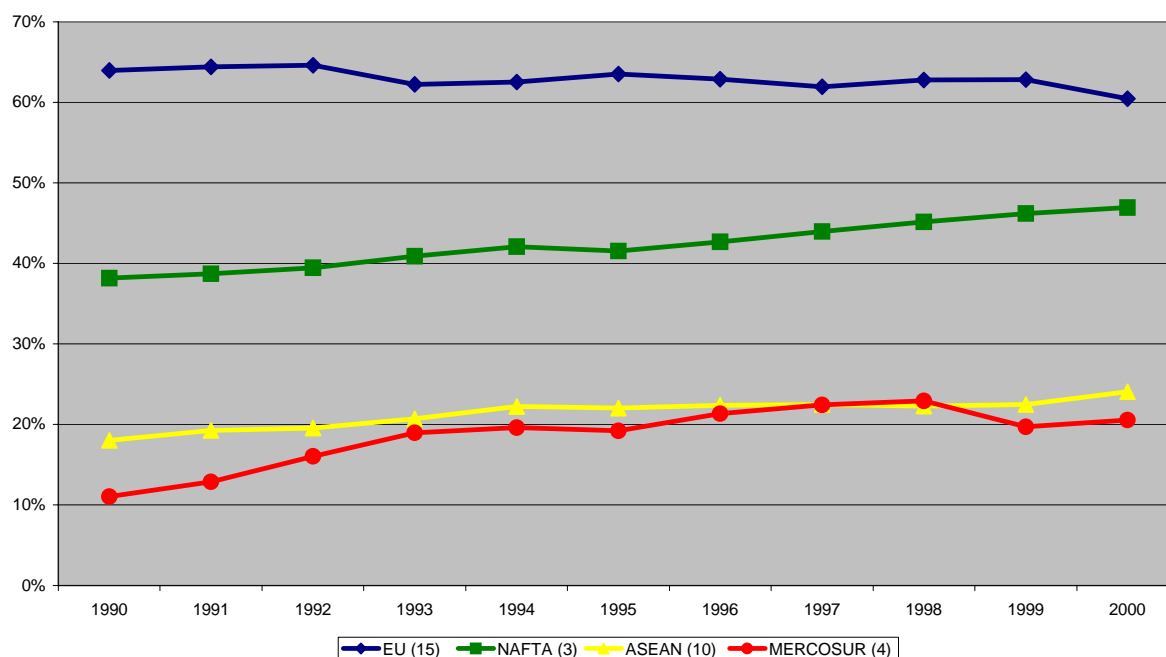Figure 1 shows the simple intra-regional trade shares of the four regions in the nineties, computed according to [1].

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[6] It is also easy to verify that J_i happens to be equal to HI_i .

[7] Many other preferential trade agreements exist, but the sum of their intra-regional trade flows does not exceed 1% of world trade (WTO, 1999, p. 20).

[8] http://www.wto.org/english/res_e/statis_e/its2001_e/its01_appendix_e.htm

[9] The EU is therefore taken with 15 members (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and the United Kingdom). NAFTA includes Canada, Mexico and the United States. ASEAN includes Brunei Darussalam, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam. Members of the MERCOSUR are Argentina, Brazil, Paraguay and Uruguay.
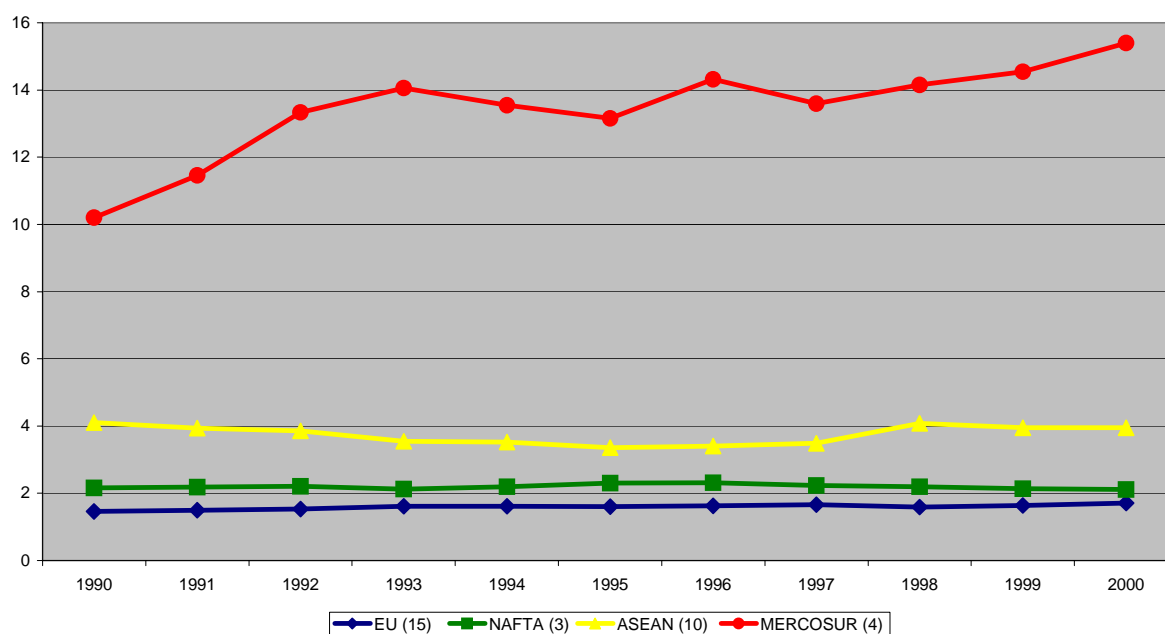
FIG. 1 - INTRA-REGIONAL TRADE SHARES

In the case of the EU, the trend is slightly decreasing, from a maximum of 64,6% in 1992 to 60,4% in 2000. The relatively sharp fall in 1993, which seems paradoxical in the completion year of the Single Market programme, is mainly a statistical artefact, due to the introduction of a new collection system for intra-Community trade data (Intrastat), which led to a considerable under-evaluation of intra-regional flows (Iapadre, 1996). The other three areas show a more or less pronounced upward trend, which in the case of MERCOSUR was temporarily interrupted by the Brazilian crisis in 1999.
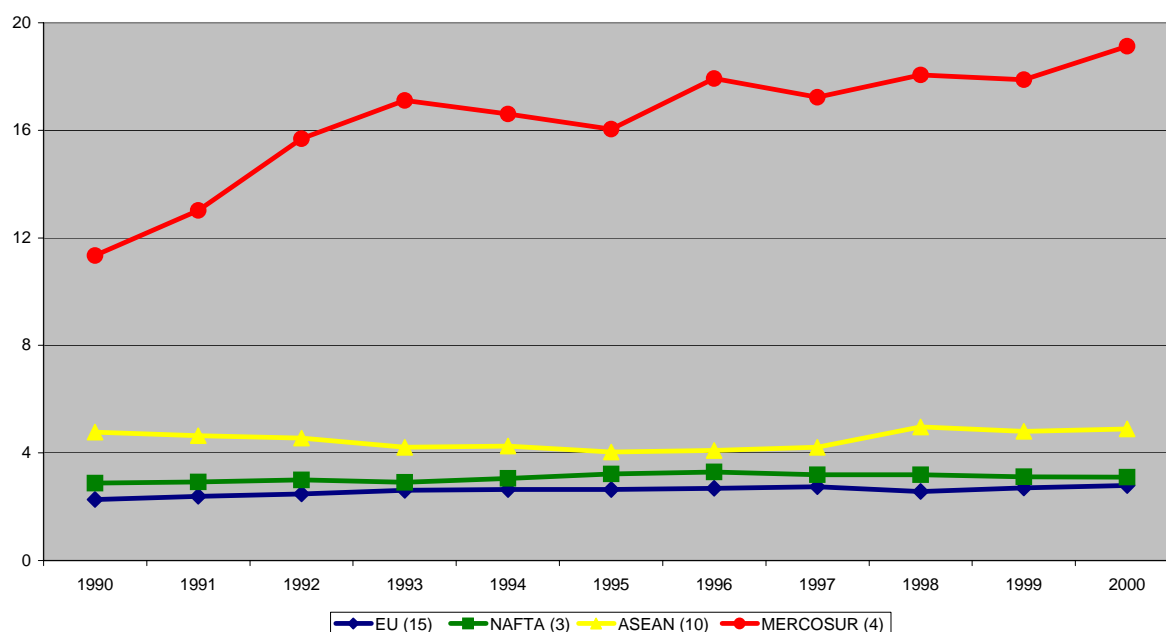
The regions' ranking is clearly influenced by their different trade size, as well as by the number of member countries.

FIG. 2 - INTRA-REGIONAL TRADE INTENSITY
(traditional Balassa indicator)

A completely different ranking emerges from figure 2, which shows the intra-regional trade intensity index, computed according to the traditional formulation [2], resembling the Balassa index of revealed comparative advantages. The figure is dominated by MERCOSUR, whose intra-regional trade share was, on average, 13 times larger than the region's weight in world trade, with an upward trend of the intensity index, particularly strong until 1993. The other regions show much lower and more stable intensity indices.
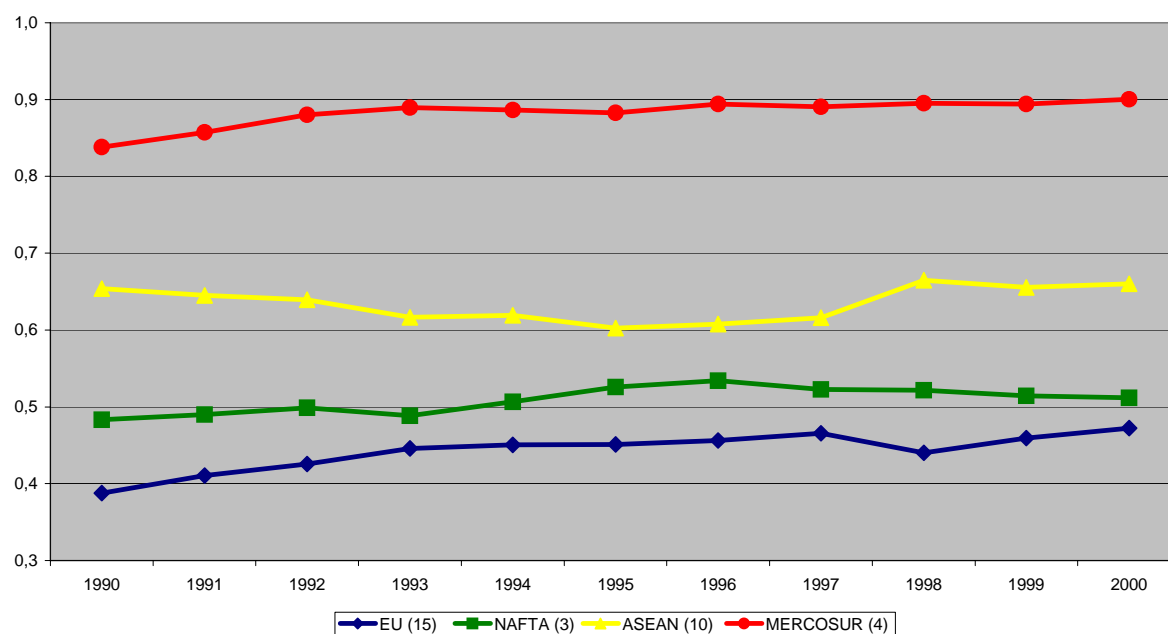
FIG. 3 - INTRA-REGIONAL TRADE INTENSITY
(homogeneous indicator)

A similar picture is shown by figure 3, where the intensity indices have been computed according to the homogeneous formulation [5]. The level of all the indices is obviously higher than in figure 2, but the relative distances between the regions are lower, because the correction operated by [5] with respect to [2] is more pronounced for the larger regions, which lie in the bottom of the figure.
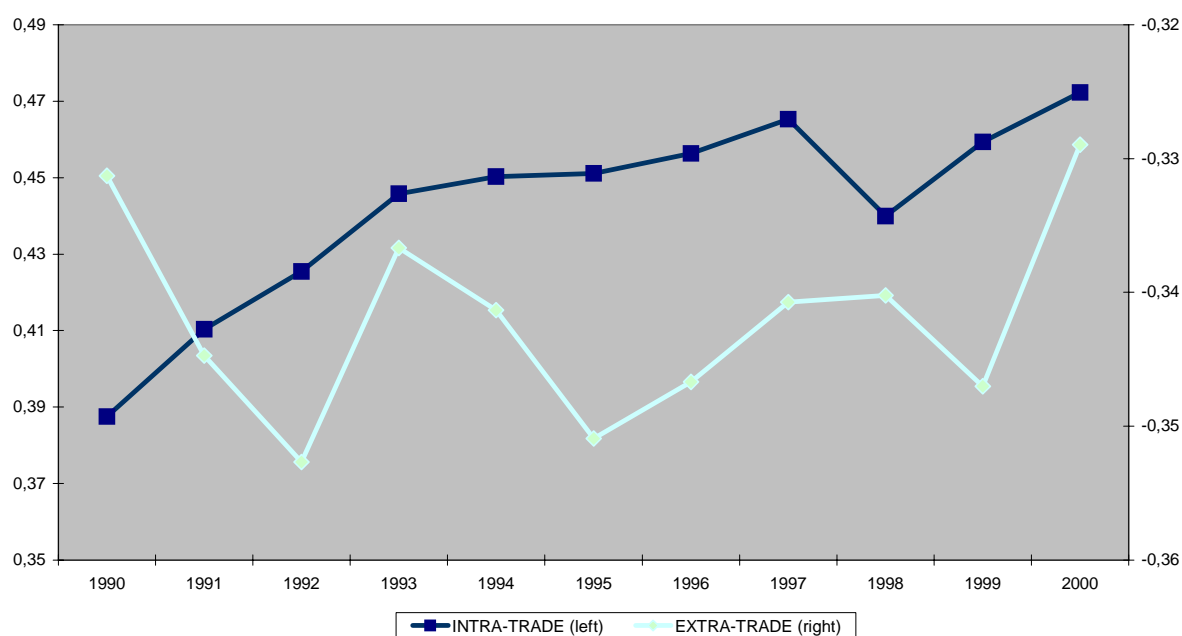
Both the latter two figures do not allow to see clearly the time pattern of the indices for the three larger regions, because they are squashed by the high level of the MERCOSUR index. This problem is solved by the symmetrical formulation of the intensity indices [6], which has been used in figure 4. The normalization of the index range, from minus one to one, generates a much more readable figure, where all regions show significant changes across time.

FIG. 4 - INTRA-REGIONAL TRADE INTENSITY
(symmetric indicator)

As explained in section 2, however, all the intensity indices, whatever their formulation, are exposed to a problem of dynamic ambiguity. Figure 5 shows this problem in the case of the European Union.
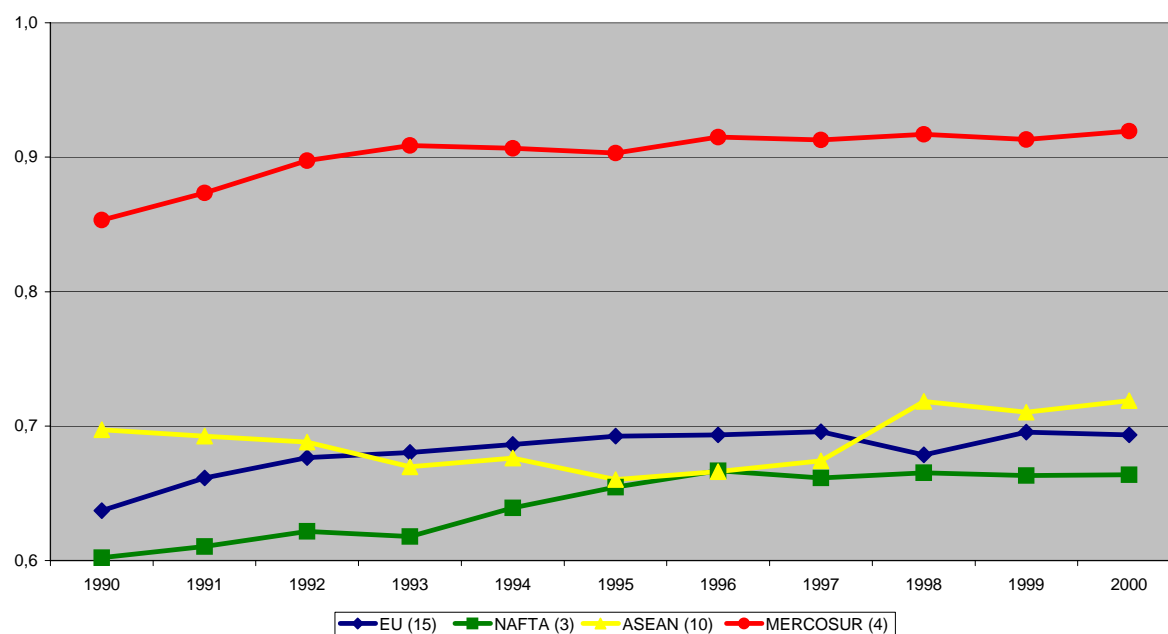
FIG. 5 - EU (15): INTRA- AND EXTRA-REGIONAL TRADE INTENSITY
(symmetric indicators)

In general, one expects that an increase in intra-regional trade intensity will be associated with a fall in the corresponding index of extra-regional trade, and this is what actually happened in most of the years shown in figure 5. However, there are four exceptions (1993, 1996, 1997 and 2000), when both the complementary indices rose, because the condition of sign concordance [10] held, and the EU's total trade grew at a lower rate than the world average.

Figure 6 shows the indicator which has been proposed in this paper in order to solve the above problem, i.e. the *trade introversion index*, computed in its symmetrical specification [13]. The regions' ranking is now partly different from what shown in the previous figures. MERCOSUR confirms as the area with the highest level of intra-regional trade intensity, with an upward trend which was particularly strong in the first three years. In the ASEAN region a fall of trade introversion until 1995 was followed by an increase in the second half of the decade, which was particularly pronounced in the aftermath of the Asian crisis. On average, the index for ASEAN was approximately equal to that for the European Union, which increased continuously until 1995. A similar pattern is shown by the trade introversion index for NAFTA, which now appears the region with the lowest intra-regional trade intensity.

FIG. 6 - TRADE INTROVERSION
(symmetric indicator)

4.   The trade-creating effects of regional integration: indicators of relative openness

The indicators discussed in section 2 are all aimed at measuring the relative intensity of intra-regional trade with respect to trade with the rest of the world. With some caution, as we have seen, they could be interpreted as an *ex-post* measure of the trade-diverting effects of regional integration. It is therefore necessary to resort to different indicators, if one is interested also in assessing the extent of internal and external trade creation, that is of the substitution of domestic trade with intra- and extra-regional foreign trade, induced by the preferential trade agreement.

The starting point could be a useful decomposition of the intra-regional trade intensity index, proposed by Anderson and Norheim (1993: 81), who reformulated definition [2], showing that a region's *intra-regional trade intensity index* (I_i) is inversely related to its *share of world output* (G_i) and to its *relative degree of openness* (O_i) *with respect to the world average degree of openness* (both measured by the trade-to-GDP ratio)[10]:

$$I_i = S_i / (G_i \cdot O_i) = (t_{ii}/t_i) / [(y_i/Y) \cdot (t_i/y_i)/(T/Y)] \qquad\qquad [16]$$

where: y_i =   region i's gross domestic product (GDP)

              Y =   world GDP.

The two components of the denominator of the intra-regional trade intensity index are influenced by a complex set of cyclical and structural forces. Specifically G_i depends on the various supply and demand factors letting the region's gross domestic product grow faster or slower than world output[11]. As to the relative degree of openness (O_i), its shifts may be seen as reflecting mainly changes in resistance factors which dampen the region's international trade as a whole (including its intra-regional component), such as those changes induced by the growing integration of national markets and by multilateral trade negotiations. The speed of these processes may be different across the regions of the world, resulting in variations in the *relative* degree of openness of each region[12]. However O_i may also be influenced by the internal and external *trade creation* ef-

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[10]   Corrections similar to those described in footnote 3 should be applied to the GDP data in expression [16] to get an unbiased measure of trade intensity.

[11]   It must be stressed that all the variables are inevitably measured at current prices, given the non availability of regional trade data at constant prices. As a consequence of this, all the indicators are also influenced by inflation differentials and exchange rate fluctuations.

[12]   It must also be reminded that G_i and O_i are not completely independent of each other. For example, other things being equal, if the region's GDP is growing faster than world output, capacity constraints could in

fects of regional integration and this means that, other things being equal, I_i will be negatively related to those effects.

Anderson and Norheim (1993, p. 84) proposed a further indicator which, at first sight, could capture the combined effects of trade creation and diversion. They named it *aggregate index of the propensity to trade intra-regionally* (PI_i), defined as follows:

$$P_i = I_i \ (t_{ii}/y_i) \qquad\qquad [\,17\,]$$

However, it is evident that P_i, not differently from I_i, is negatively related to O_i :

$$P_i = (t_{ii} \ /y_i \ )/(G_i \cdot O_i) \qquad\qquad [\,18\,]$$

so that, other things being equal, any global trade creation effect of regional integration lowers the value of the index.

A slight modification of Anderson and Norheim's index allows to solve this problem. An index of *propensity to intra-regional trade* (PI_i) can be defined as the intra-regional trade share divided by the region's weight in world GDP:

$$PI_i = (t_{ii}/t_i)/(y_i/Y) = I_i \cdot O_i \qquad\qquad [\,19\,]$$

In other words, the new index is the product between the intra-regional trade intensity index and the region's relative degree of openness. In PI_i the *expected* value of the intra-regional trade share is simply the region's share of world output. If the *actual* intra-regional trade share is higher than expected, this may be the effect of a higher relative degree of openness (global trade creation) and/or of a higher intra-regional trade intensity (trade diversion).

There is a clear analogy between the logic of this descriptive indicator and that of gravity models of international trade, where the intensity of bilateral flows depends positively on the GDP of partner countries, and negatively on their "distance" (Frankel, 1997). A PI_i higher than one can be interpreted as a sign of a situation where, after controlling for the region's GDP, the intensity of intra-regional trade is higher than expected due to the operation of "proximity" factors, such as common borders and preferential trade agreements.

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principle make so that the pressure of domestic demand in the region makes easier to purchase goods from external sources, thus raising the region's relative degree of openness.

It must be stressed, however, that both I_i and O_i can give only an *ex-post* evaluation of the relative intensity of the observed phenomena, which is not enough to draw any conclusion about the strength of the underlying causal links. In other words, they simply measure *revealed* trade creation and diversion, in analogy to what can be said about the Balassa specialization index, which measures *revealed* comparative advantages, without pretending to give any *ex-ante* assessment of their intensity.

Furthermore, PI_i is an indicator affected by all the problems already discussed with reference to I_i : its maximum value is inversely related to the trade size of the region; its range is not symmetrical around its geographic neutrality threshold of one; and its changes may have the same sign as those of the complementary indicator of propensity to extra-regional trade (PE_i), given by the ratio between the extra-regional trade share and the rest of the world's weight in world GDP:

$$PE_i = (1 - S_i) \, / \, (1 - G_i) \tag{20}$$

These problems can be solved in a way similar, but not identical, to that followed for the intra-regional trade intensity index. The difference is due to the denominator of PI_i, which cannot be adjusted in the same way as that of I_i, because GDP flows, unlike trade flows, are not associated to a couple of partner regions, but refer only to the region where the product is produced. In order to bypass this hurdle, it is necessary to reverse the sequence followed in the construction of SI_i. First, the asymmetry problem can be reduced, although not suppressed, by building a *symmetrical index of intra-regional trade propensity (SPI$_i$)*, through a formula similar to [6]:

$$SPI_i = (PI_i - 1)/(PI_i + 1) \tag{21}$$

This index is equal to zero under the assumption of geographic neutrality in the regional direction of trade and ranges from minus one (no intra-regional trade) to a maximum value (no extra-regional trade) which is the closer to one, the smaller the region's weight in world GDP, biasing comparisons among different regions or periods.

The second step could be to divide SPI_i by its maximum value, getting a *normalised index of intra-regional trade propensity (NPI$_i$)*:

$$NPI_i = SPI_i \, / \, [(Y/y_i - 1)/(Y/y_i + 1)] \tag{22}$$

This index is also equal to zero under the assumption of geographic neutrality of trade, but its maximum value (no extra-regional trade) is equal to one independently of the region's size. On the other hand, the comparability problem is now shifted to the minimum level of the index (no intra-regional trade), which is a negative number the closer to minus one, the larger the region's weight in world GDP. In this case the problem is less worrisome, because the intra-regional trade share is almost always higher than the region's weight in world GDP, so that the section of the NPI_i's range where the comparability problem matters is that of positive numbers.

The last remaining problem, that is the possible sign concordance of changes in complementary indicators, has the same features as for the intensity indices. Its solution, although giving rise to a relatively complex indicator, has the advantage of solving completely the asymmetry and non-homogeneity problems which still affect both SPI_i and NPI_i. The first step is to compute an index of *relative propensity to intra-regional trade (PJ_i)*, given by the ratio between the two complementary indicators of intra- and extra-regional trade propensity:

$$PJ_i = PI_i \,/\, PE_i = (S_i \,/\, G_i) \,/\, [(1 - S_i)/(1 - G_i)] \qquad\qquad [\,23\,]$$

Similarly to what seen for the introversion indices, PJ_i is less ambiguous than its underlying complementary indicators because, even if their changes happen to have the same sign, it increases if a region's propensity to intra-regional trade rises more rapidly than that to extra-regional trade, and vice versa. It is easy to see, furthermore, that the range of PJ_i is homogeneous: independently of the region's size, it goes from zero (no intra-regional trade) to infinity (no extra-regional trade), crossing at one the geographic neutrality threshold.

Finally, a *symmetrical index of relative intra-regional trade propensity (SPJ_i)* can be obtained in the usual way:

$$SPJ_i = (PJ_i - 1)/(PJ_i + 1) \qquad\qquad [\,24\,]$$

SPJ_i is equal to zero if the regional distribution of trade is neutral and ranges between minus one and one, independently of the region's size.

All the propensity indices discussed in this section aim at capturing the combined trade creation and diversion effects of regional integration. However, for analytical purposes, it is in most cases more convenient to rely on separate measures of the two kinds of effects. For example, while the trade diversion effects could be gauged through the introversion indices presented
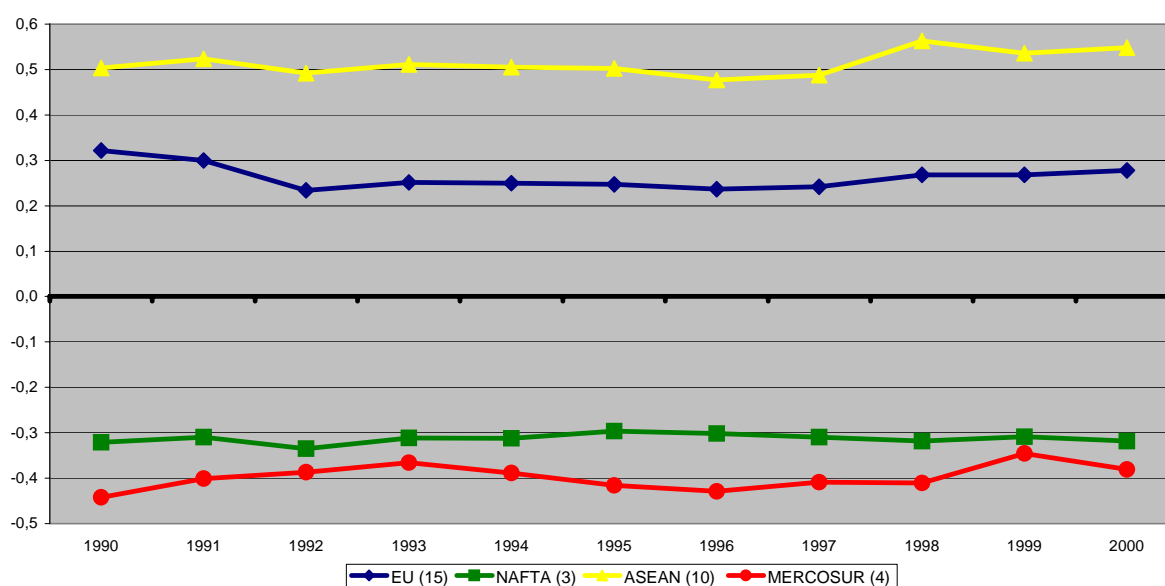
in section 2, the internal and external trade creation effects could be measured by a *symmetrical indicator of relative openness (SO$_i$)*:

$$SO_i = \{(t_i./y_i)/[(T-t_i.)/(Y-y_i)] - 1\} / \{(t_i./y_i)/[(T-t_i.)/(Y-y_i)] + 1\} \qquad [\,25\,]$$

based on the comparison between the region's trade-to-GDP ratio and that of the rest of the world. This index is higher than zero if the region's degree of trade openness is higher than the world average, revealing that forces leading to market integration are stronger than in other regions, possibly also as an effect of preferential trade agreements.
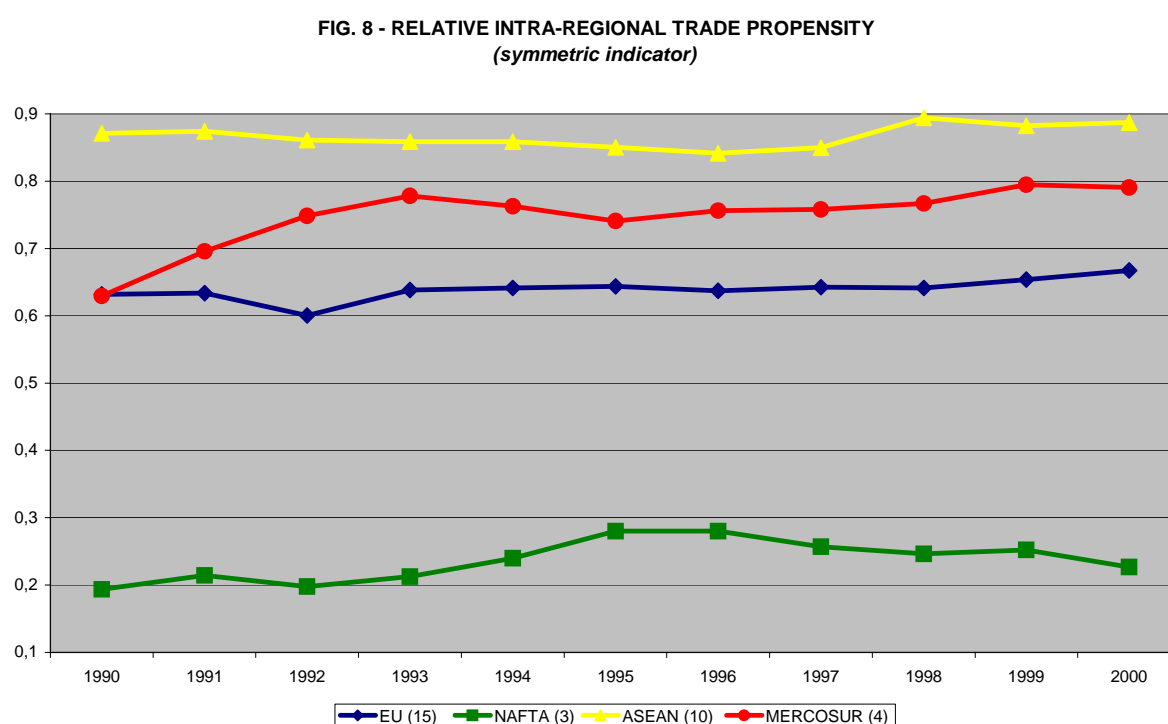
Figure 7 applies *SO$_i$* to the same regions considered in section 3 and shows huge differences among their relative degree of trade openness, with the two American regions much lower than the rest of the world. It is a well-known property of the trade-to-GDP ratio to be inversely related to the size of the country, because the importance of the foreign markets relative to the domestic one decreases with the country's GDP. Therefore, it is not particularly surprising that the relative trade openness of NAFTA is so low, given the GDP size of the US. More striking is the position of MERCOSUR, which is probably due also to the relatively inward-looking orientation of its member countries' trade policies, as well as to the market access barriers faced by their exports, particularly in the agricultural sector.

FIG. 7 - RELATIVE TRADE OPENNESS
(symmetric indicator)

It is also interesting to note that no curve in figure 7 shows a clear upward trend, which seems to reveal that the trade-creating effects of regional integration were not particularly strong in the nineties, or at least not stronger than the other technological and economic factors leading to a global increase of the trade-to-GDP ratio[13].

Combining the indicators of trade openness with the trade introversion indices shown in figure 6, one gets the index of relative intra-regional trade propensity [24], which appears in figure 8:

FIG. 8 - RELATIVE INTRA-REGIONAL TRADE PROPENSITY
(symmetric indicator)

This figure ranks the four regions according to the ratio between their intra-regional trade share and their weight in world production. ASEAN and MERCOSUR show the highest levels of SPJ_i, but it has just been shown that the underlying factors are completely different. In the ASEAN countries the high importance of intra-regional trade is mainly the result of their higher degree of openness, whilst in the MERCOSUR case it stems from a particularly high degree of trade introversion.

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[13] The upsurges of the index for ASEAN in 1998 and for MERCOSUR in 1999 are due mainly to the sharp depreciations of the local currencies hit by the financial crises, which translated into an increase of trade prices much higher than that of production prices.

6.   Conclusions

The figures presented in this paper show clearly that the empirical assessment of intra-regional trade is strongly influenced by the choice of the statistical indicator used to measure its importance. The simplest indicators, such as the intra-regional trade share and the trade intensity index, suffer from several limitations, making them inadequate both to evaluate the dynamics of the process in a single region, and to compare different regions.

In this paper, some alternative indicators have been proposed and experimented. One of them in particular, the symmetrical trade introversion index, seems able to solve the main problems of traditional indicators, and offers a completely different picture of the regional geography of trade patterns.

The highest degree of trade introversion is shown by a region, such as MERCOSUR, whose process of preferential integration began relatively late with respect to other regions, and was not particularly deep. This feature is common to other developing regions, not covered by this paper, and points to one of the possible interpretations of the index: a high trade introversion could be the combined outcome of the reciprocal protectionism between the region and the rest of the world. It is well-known that trade policies in developing countries are more inward-looking than in developed countries, and that, at the same time, their trade opportunities are severely limited by protectionist policies in the rest of the world. This could help understand why MERCOSUR's trade introversion index appears so high with respect to other regions.

However, all the four regions considered in this paper are characterised by a moderate upward trend in their trade introversion indices, albeit with different timing. In the EU, MERCOSUR and NAFTA the increase was relatively stronger in the first half of the nineties, and the index has been stabilizing in the last years. On the contrary, in the ASEAN region the upward trend began in 1996, after a phase of decline in the previous years. It would be difficult to ascribe this common trend to an increase in protectionism, given the prevailing open orientation of trade policies in the nineties. A possible explanation could be found in the trade diversion effects of the preferences among members of regional integration agreements.

A useful complement to the trade introversion index can be found in an index of relative trade openness, which is based on the comparison between a region's trade-to-GDP ratio and the world average. This index shows if integration forces are stronger at the regional level than on a

global scale, and can therefore be interpreted as a measure of revealed internal and external trade creation. ASEAN resulted as the most open region in the nineties, while MERCOSUR and NAFTA were largely below the world average. However no region exhibited a clear increasing trend in its relative openness, which could indicate that regional trade-creating forces were not stronger than the global drift towards an increase in the trade-to-GDP ratio.

Further research is needed in order to assess the reliability of these interpretations concerning the trade effects of regional integration. In addition, similar indicators could be applied to the study of the geographic direction of FDI, in order to explore its links with trade integration. However, a deeper understanding of the relation between trade and investment in the context of regional integration requires the availability of comparable and detailed data on firms' international activities, based on a new approach to the production of statistics on globalisation, centred on the enterprises more than on their transactions, which is emerging in several countries. Although these new developments are potentially very interesting, the current situation of the available sources is not yet adequate to the needs.

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