MANUAL ON FOREIGN TRADE AND TRADE POLICY

BASICS, CLASSIFICATIONS AND INDICATORS OF TRADE PATTERNS AND TRADE DYNAMICS

José E. Durán Lima
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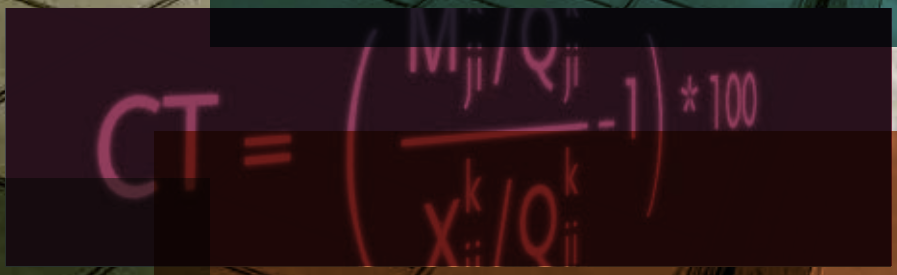

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Manual on foreign trade and trade policy

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Economic Commission for Latin America and the Caribbean (ECLAC)

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Summary

This manual systematizes the basics of a set of methodologies, analytical variables and indicators for a better understanding of international trade dynamics. For the systematic development of that document, the first part includes basic knowledge like definitions of proportions, percentages, annual growth rates, and structural analysis. Based upon that, the second part introduces more comprehensive concepts for a profound analysis of trade. Furthermore, concepts of tariff and non-tariff protection, the link between production and trade as well as the main classifications of international trade and their different analytical uses are discussed in detail.

The manual focuses on providing the largest number of possible indicators for a better understanding of a country's trade pattern and its trade dynamics, taking into account the different types of firms and sectors involved in international trade. Among the developed and analyzed indicators are: simple diversification/concentration indices and the Herfindahl-Hirschman index, similarity indices, revealed comparative advantage, the Balassa index, and the index of intra-industry trade (Grubel-Lloyd index). To illustrate the concepts, an important part is dedicated to practical examples from the regional environment.

The main purpose of this work is to provide technical support for government officials, negotiators and/or decision-makers in both political and business sectors. However, it is expected that the work will also be used in academia and for the dissemination of the analysis of international trade patterns in Latin America and the Caribbean.

Introduction

During the last decade, the International Trade and Integration Division of the Economic Commission for Latin America and the Caribbean (ECLAC) has been developing technical assistance activities in the field of strengthening technical and analytical capacities for the development of foreign trade indicators and trade policy. Different groups of government officials from various countries in the region have been contributing their experiences in many ways and have thereby allowed the comprehensive development of the present manual.

Countless discussions, a variety of approaches as well as the potential uses of primary sources of statistical information on foreign trade allowed us to gain practical experience that we now provide to technicians of the region.

The main purpose of this manual is providing officials in the area of foreign trade with an easy-to-use toolkit for the development of their daily work including the assessment of international trade dynamics, the analysis of the nature of national and regional export patterns, and assisting negotiators and/or decision-makers in both political and business environments. At the same time, it is expected that the present work will stimulate a homogenous and elaborated compilation of trade statistics for academic use, dissemination, and economic diagnosis.

We hope that the regional reports developed by the countries can build upon that effort of a methodological compilation while at the same time this is a starting point for a critical look on the available information and materials analyzed for their own audience.

This document consolidates, updates, and expands two technical reports of the International Trade and Integration Division of ECLAC from the period 2008-2010, as part of the program of technical cooperation in the countries of the region. It is a revised and updated translation of the Spanish original version “Manual de comercio exterior y política comercial” from 2011.

Among the topics covered in this outlet are basic methodological notions in key topics such as rates of change, annual growth, index numbers, deflation, change of base and weighting along with a review of the applied practices for calculating the index numbers relevant to the subsequent tracking of prices and the volume of foreign trade and the real exchange rate. Moreover, the basics of the link between trade and production are presented together with a detailed review of tariff and non-tariff trade barriers. Comprehensive related references for the main classifications of trade and its different analytical uses are also included.

Additionally, a number of selected indicators for a better understanding of a country's trade pattern are analyzed, as well as its trade dynamics, taking into account the different types of firms and sectors involved in international trade. Among the developed and analyzed indicators are: indicators per capita, relative indices of foreign trade, proportions of domestic trade relative to world trade, simple diversification/concentration indices and the Herfindahl-Hirschman index, similarity indices, revealed comparative advantage, the Balassa index, and the index of intra-industry trade (Grubel-Lloyd index).

Finally, the review and calculation of a set of designed indicators is included to understand the dynamics and relative weight of intraregional trade in the subregions of Latin America and the Caribbean: the Andean Community, the Caribbean Community, the Central American Common Market, and the Southern Common Market.

We hope that this manual, together with the "Indicators of Foreign Trade and Trade Policy: Analysis and derivations of balance of payments" (Span.: Indicadores de comercio exterior y política comercial: análisis y derivaciones de la balanza de pagos) and the "Manual on Micro, Small, and Medium Enterprises. A contribution to the improvement of information systems and the development of public policies" (Span.: Manual de la Micro, Pequeña y Mediana Empresa. Una contribución a la mejora de los sistemas de información y el desarrollo de las políticas públicas) becomes a primary source of reference.

I. Overview about the basic statistical analysis of foreign trade

This first section is dedicated to the basic, but fundamental notions of the foreign economic sector. Some definitions apply across a wide range of economic studies while others belong more specifically within the scope of foreign trade. Most of them provide useful tools on their own, but they will also be necessary elements within the remaining sections of that manual.

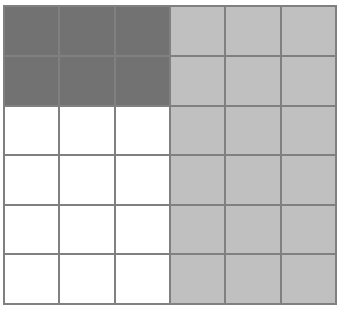
A. Proportions

Before conducting any analysis it is important to point out a basic indicator for quantitative analyses that is easily calculated but essential to the conjecture of wide parts of those indicators that we will look at later. A proportion is simply the ratio between two measurable figures (e.g. prices, quantities); it is one part of a population or a sample disaggregated in parts.

A simple way to understand the concept is starting from a fraction with the maximum (total) in the denominator (this number we will call *N*) and the relevant part in the numerator (this number we will call *n*). Mathematically, the proportion is an integer value or a decimal between zero and one, which can then be expressed in percentages when multiplied by one hundred.

If the possible values obtained for different homogeneous individuals (*n*) of a sub-sample are summed up, it is possible to calculate the total value for the sample (*N*), which in relative terms is always 100. Because of that, one commonly speaks of a "certain of hundred" instead of a proportion, or alternatively of "percentages".

Scheme 1
Derivation of a ratio



Source: Own compilation.

Scheme 1 presents a simple geometric example. Note that the square is divided in 36 sub-squares with 24 shaded —six in dark grey and 18 in light grey. These two sub-groups of squares represent a proportion of 0.167 or 0.5, respectively, which is equivalent to 16.7% or 50%, respectively, of the total. For obtaining these proportions and their respective percentages, the following formula is used:

$$\text{Proportion dark grey boxes} = \frac{n_i}{N} = \frac{6}{36} = 0.167 * 100 = 16.7\%$$

$$\text{Proportion light grey boxes} = \frac{n_i}{N} = \frac{18}{36} = 0.5 * 100 = 50\%$$

B. Rates of change

The rate of change is the differential between two magnitudes. The evolution of a given series can be expressed in various ways. The most common is the use of total numbers but if one wants to know to what extent the series changed, it is necessary to use rates of change, which give the change, normally expressed in percentages, between two subsequent periods.

$$RC_t = \left(\frac{X_t}{X_{t-1}} - 1\right) * 100\,, \qquad (1)$$

where *t* indicates the period and *X* the value of the series.

If we want to use this indicator for a longer series, that is to compare two non-subsequent periods, it is necessary to correct the formula by "annualizing" the growth. This modification of the rate of change enables us to do calculations between two periods, typically longer and comprising several years. The result will be the average rate at which the series must have changed since the first period to reach the outcome in the second period.

$$ARC = \left(\sqrt[m]{\frac{X_N}{X_n}} - 1\right) * 100\,, \qquad (2)$$

where *n* is the initial year, *N* the final year, and *m* indicates the number of years between the first and the last period, that is: $m = N\text{-}n$.

The number of decimal places used within the further data analysis and presentation depends on the degree of accuracy desired by the analyst. The use of one or two decimal places for the purpose of analysis is recommended. In other cases, like the calculation of growth decompositions, it is highly recommended to use the whole series of decimal places obtained, i.e. the exact value, if possible.

C. Index numbers

This is an indicator that has the power to capture the central tendency of a dataset. In general, index numbers are expressed in percentages, where the center of the series is referred to as the "base year", for which the indicator value is 100.

In foreign trade, it is essential to have series that show the evolution of exports and imports, as well as its decomposition. Here, the number indices are of great importance because they allow comparing the trend in the levels of two distinct series, which originally had been difficult to determine, for example, due to different scales.

Due to their intrinsic characteristics, index numbers must fulfill a set of ideal properties, but as simple indices —those that condense information of solely one variable— they meet most of these. The more complex ones —those that combine the value of different variables through a system of weights that determine their interrelation— do not fulfill some of the properties.

Identity: indicates that if the actual period is equal to the base period, the result must be 100. In case of complex indices, this has to be realized following the sum of the weightings.

Proportionality: if all quantities of the index are increased by the same proportion, the index itself must exactly increase in the same way.

Inversion: implies that if the base (t_0) and the actual period (t_1) are inverted in the fraction, and one divides 1 by that term, the result must be equal to the initial index. Formally: $\mathrm{t_1/t_0} = 1/(\mathrm{t_0} / \mathrm{t_1})$.

Circularity: implies that the multiplication of two index numbers from subsequent periods t_1 with base t_0 and t_2 with base t_1, is equal to an index derived from taking t_2 as the actual and t_0 as the base value. Formally: $\frac{\mathrm{t_1}}{\mathrm{t_0}} * \frac{\mathrm{t_2}}{\mathrm{t_1}} = \frac{\mathrm{t_2}}{t_0}$.

Example: Given the indices $t_0 = 100$, $t_1 = 110$, and $t_2 = 111$. For circularity, it must hold that $\frac{\mathrm{t_1}}{\mathrm{t_0}} * \frac{\mathrm{t_2}}{\mathrm{t_1}} = \frac{110}{100} * \frac{111}{110} = 1.11 = \frac{111}{100} = \frac{\mathrm{t_2}}{t_0}$ (which is true in that case).

Existence: the values of the index must always be real and finite.

D. Deflators

The procedure of deflation appears to be very useful. It is done by taking a dataset at a base year and discounting the price effect between that year and the succeeding years. As a result, we obtain the effect of prices on the quantity effect (also called quantum), which indicates the evolution of the volume of a certain measured variable or indicator, such as the Gross Domestic Product (GDP), exports, or another statistical series.

The main tool used for this process is a series of deflators centered on a base year. Often an index number is used that well represents the characteristics of a given year. If different conventions are available for the base years, one often uses those ending on a zero or a five, e.g. 1990 or 2015.

The deflation procedure is formally defined as the division of the variable in nominal terms by the value of the deflator. This means, for example, for calculating the value of exports/imports in constant prices we apply the following formulas:

$$\mathrm{X_{constant}} = \frac{\mathrm{X}}{\mathrm{UVIX}} * 100\,, \qquad (3)$$

$$\mathrm{M_{constant}} = \frac{\mathrm{M}}{\mathrm{UVIM}} * 100\,, \qquad (4)$$

where *X* and *M* are the imports and exports of goods in current prices, and *UVIX* and *UVIM* are the corresponding indices of the unit value of exports and imports, respectively. Table 1 presents an example with practical results.

Table 1
Argentina: foreign trade in current and constant prices of 2010, 2005 - 2014
($ million and indices)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Current exports	40 106	46 546	55 780	70 019	55 672	68 187	84 051	80 927	76 634	68 335
UVIX	67.0	72.7	82.5	104.3	92.9	100.0	119.2	121.9	119.7	117.2
Constant exports	59 885	64 026	67 583	67 140	59 943	68 187	70 532	66 400	64 003	58 300
Current imports	28 689	34 154	44 707	57 462	38 786	56 792	74 319	68 507	73 655	65 323
UVIM	87.7	89.7	96.0	108.2	95.5	100.0	107.1	105.3	111.0	111.2
Constant imports	32 721	38 055	46 581	53 106	40 612	56 792	69 394	65 069	66 332	58 745

Source: Own compilation based on figures from CEPALSTAT and Comtrade of the United Nations Statistics Division (UNSD).

E. Changing bases and splicing series

With each year that we move away from the base year, the structure of the weighting coefficients gets less representative for reality —especially with complex indices. Therefore it can become necessary to determine a new base year or period by establishing a weighting structure to better reflect the new price structure.

To avoid having different, unconnected series, there exists a process that can be defined as "rebasing". In the jargon of researchers this process is also known as the "splicing" of different series or statistical indices. Usually this is necessary for long-term series and the analysis of historical performance. In this case, the researcher might be interested in taking an old series with a new base or, vice versa and trough a process of retrograde extrapolation, consider the trend of an old series with its growth rates or annual variation in consecutive periods with available data.

Given the value of the initial year of a new series and the growth rates of the old series from its beginning to the common year, it is possible to calculate the new values by retrograde extrapolation using the following methodology:

$$G_{t-1} = \frac{G_t}{1+\frac{a_t}{100}}; \ldots G_{t-2} = \frac{G_{t-1}}{1+\frac{a_{t-1}}{100}}; \ldots G_{t-n} = \frac{G_{t-n+1}}{1+\frac{a_{t-n+1}}{100}}, \qquad (5)$$

where G_t is the value in the initial year of the given series, a_t is the annual variation expressed in percentage of the index for the year t (the last year of the old series and the start of the series that is to be spliced).

Example: Given in the year 2015, the total value of exports of a country yields $103 million and the growth rate from 2015 is known to be 3%. Then the total value of export in 2014 is $100 million, because $X_{2014} = \frac{X_{2015}}{1+\frac{a_{2015}}{100}} = \frac{103}{1+\frac{3}{100}} = 100$.

F. Weightings

When calculating the averages for various economic indicators one must be careful with not being prone to an error that often occurs. For example, if the values of export per capita for each Central American country are given and we want to calculate the average value of exports per capita for the entire subregion, it is recommended not to use the arithmetic mean of the data for its derivation; otherwise the researcher must clarify that this is the simple average that not considers the relative size or the scale of the different economies involved. This problem can be serious if the group of countries shows considerable differences and asymmetries, as it is the case with the Member States of MERCOSUR (Southern Common Market), where Argentina and Brazil are large-scale producers while the other three members are of much smaller scale.

Table 2, column 2, shows the exports per capita of the five member countries of the Central American Common Market (CACM). The simple arithmetic average of the exports per capita for the countries in the named subregion can be calculated as $946. However, this value is different to that obtained by taking the weighted average according to column 5. In this case, the weighted average of $821 yields the more accurate value representing the joint population of the CACM. Note that the focus of this analysis is directly related to the weightings applied in column 4.

The weighted average in the mentioned example considers the internal differences of the sample. The result is equivalent to taking all joint exports and the joint population and then performing the calculation of the average value.

Table 2
Central American Common Market: calculation of the weighted average for exports per capita, 2014

Countries	Exports per capita *($)*	Population *(million people)*	Weights *(rounded)*	Weighted exports per capita *($)*
Costa Rica	2,307	4.9	0.12	272
El Salvador	824	6.4	0.15	127
Guatemala	686	15.8	0.38	261
Honduras	496	8.2	0.20	98
Nicaragua	419	6.2	0.15	63
Sum		41.5	1.00	821
Simple average	946			
Weighted average	821			

Source: Own compilation based on figures from Comtrade and the World Bank.

Formally, the weights are defined as the proportion of a specific variable of the population. In this case the countries' population was chosen, however, the chosen variable may also be a different one, such as GDP. The choice of the variable solely depends on the researcher. Generally speaking, the weight α_i of each observation i is equal to:

$$\alpha_i = \frac{f_i}{\sum_i f_i}, \quad (6)$$

where f_i is the respective value of observation i.

Using all α_i, the weighted average can be derived in the following way:

$$X^{weighted} = \sum_i X_i = \sum_i \alpha_i * f_i, \quad (7)$$

where X_i are the weighted values of each observation i.

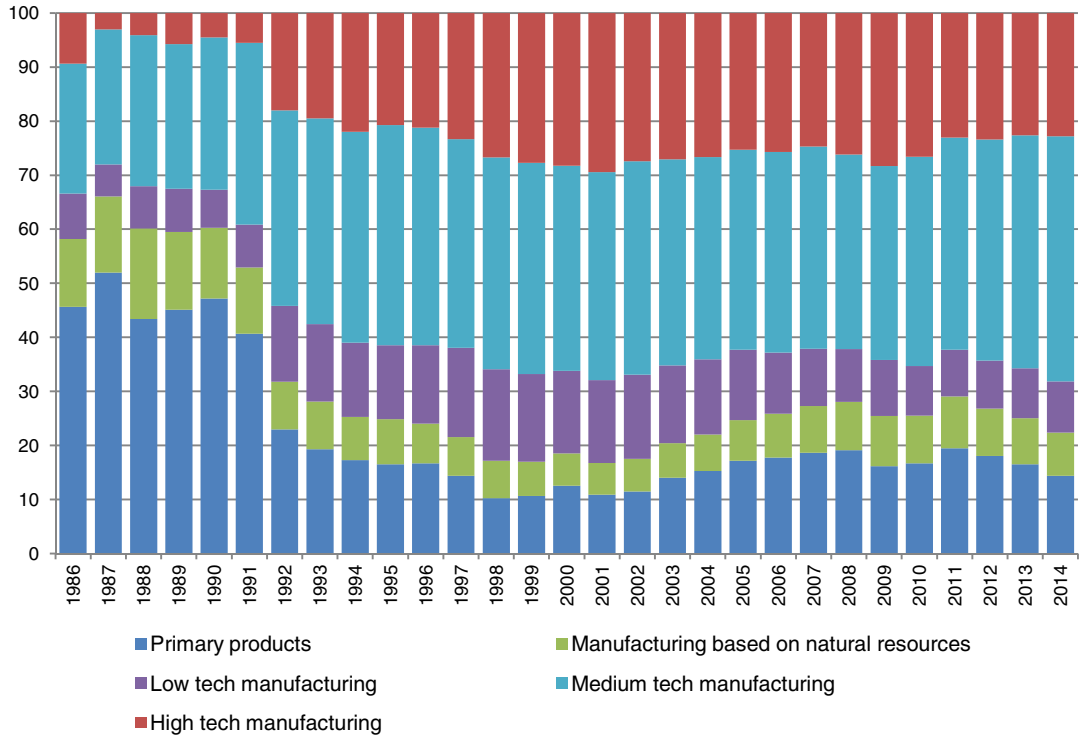
G. Structural changes

In general, production, trade, and consumption undergo structural changes of various kinds and origins over time. These changes can be explained using different factors: changes in relative prices, technical progress, the expansion of services in production and consumption, the emergence of international production sharing systems (typically known as outsourcing), among others.

A simple way to capture these changes is analyzing the different sectors over time or in different points of time. In this case, it is very useful to remember what we have learned about percentages and proportions.

As an example, let us take the change in the structure of Mexico's exports to the world. In the early 90's, one of the principal products exported was oil, which can be seen in the fact that primary products accounted for more than 40% of total exports. Over time, and with the development of maquilas (manufacturing plants in free-trade zones mostly in the north of Mexico, see also Chapter IV.B), the weight of primary materials dropped as can be seen in figure 1. The development of production and exports towards more elaborated products is typical for developing countries (Akamatsu, 1962).

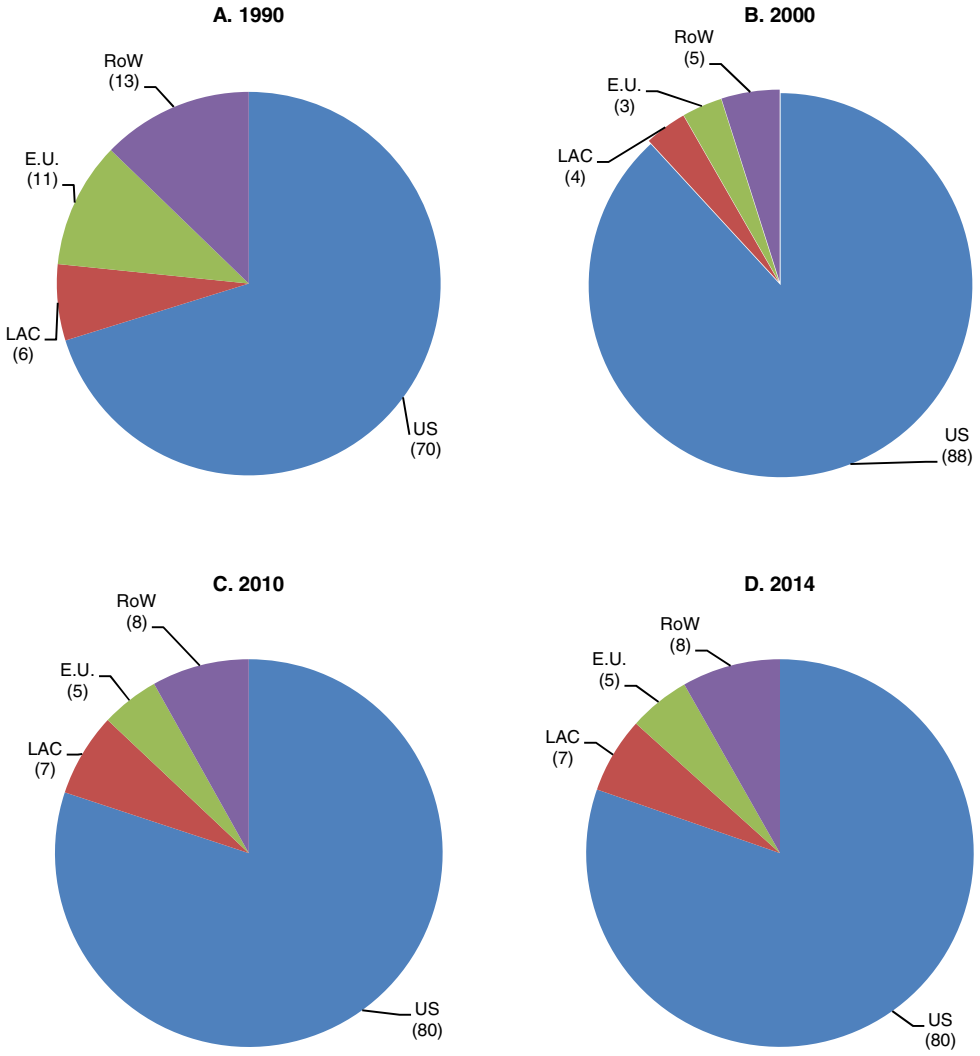
Figure 1
Mexico: structural change in the export basket by technological intensity, 1986 - 2014
(% of total exports)



Source: Own compilation based on figures from Comtrade.

A similar trend is found taking a narrow look on the development of Mexico's main export destinations. Figure 2 depicts the share of exports to the United States in Mexico's total exports for the years 1990, 2000, 2010 and 2014. We can see that the share initially increased from 70% to 88% in 2000, but then dropped to 80% as the economic crisis in 2010 affected that target market. In 2014, the share remains at that level.

Figure 2
Mexico: main export destinations, 1990, 2000, 2010, and 2014



Source: Own compilation based on figures from Comtrade.
Note: For the European Union, different member states were considered for different periods.

II. Price and quantity indicators, price ratios, and terms of trade

A. Price indices

The development of exports or imports in absolute values does not tell us too much about a long-term series, as its increase or decrease may be due to variations in prices, the exchange rate or the country's inflation (next to other causes).[1] It is therefore necessary to analyze the development of the trade basket, for which a price index is calculated. This index is the same as the unit cost of the products, but in a more general expression.

These indicators can be calculated for both exports as well as imports and are usually obtained following the methodology of price indices of either Laspeyres (1871) or Paasche (1874). The choice between the two indices depends on the needs and/or restrictions the researcher faces. In the case of the Laspeyres price index (LPI), the calculation is done according to the following formula:

$$\mathrm{LPI} = \frac{\sum \frac{p_n^k}{p_0^k} * p_0^k q_0^k}{\sum p_0^k q_0^k} * 100 \equiv \frac{\sum p_n^k q_0^k}{\sum p_0^k q_0^k} * 100\,, \qquad (8)$$

where p_n is the price in a given period, p_0 is the price in the period considered as the base, q_0 is the quantity in the base period, and subindex k represents the type of the considered good.

The index should be interpreted as the level that the prices achieve in a given year, when their value in the base year is set to 100 and the same quantities of the base year are considered in both periods. Thus, the change in prices is calculated for an identical basket of export/import goods, i.e. that of the base year. The result then corresponds to the change in prices over time.

It is important to note that in the Laspeyres index the value of the quantities should not vary over time, so that it is not distorted. When that occurs, it s recommended to use the alternative Paasche price index (PPI). It is calculated as:

[1] We will mainly discuss countries as representatives of an economy. Note, however, that all presented concepts apply not only to countries but also to any other kind of economies (if correponding data are available).

$$\text{PPI} = \frac{\sum \frac{p_n^k}{p_0^k} * p_0^k q_n^k}{\sum p_0^k q_n^k} * 100 \equiv \frac{\sum p_n^k q_n^k}{\sum p_0^k q_n^k} * 100 \,, \qquad (9)$$

where the notation is the same as for the LPI and q_n is the quantity in a given period.

The methodological change within the PPI is that quantities are not kept constant, since the PPI considers the quantities of the basket in a given year as measurement unit. Related to that, it is said that the PPI underestimates the ideal cost of living, as it assumes the same basket of goods in the base year as is observed in the given year. Thereby it ignores the possibility that consumers have adjusted their consumption pattern over time.

Strictly speaking, the price index shows the development of prices over time, being a price index of foreign trade as well. The technical description of the unit value reflects that fact that in practice there exist different varieties of the same good and the index of a product is typically an average of the prices of its different varieties.

In this manual, we refer to unit value indices of exports (UVIX) and unit value indices of imports (UVIM) as indicators to measure the development of export and import prices, respectively, over time.

B. Volume indices

A volume index (quantum) is an indicator that is used to measure the development of quantities. This is very helpful in identifying the price effect in exports or imports and to observe its real trend. To say that a country is exporting more than before can have two (not exclusive) meanings: one in absolute terms, where only the value is analyzed, and the other one in relative terms, where also the change in quantities is analyzed.

The calculation of volume indices follows the same logic and criteria as that of price indices. Thus, a Laspeyres volume index (LVI) will be:

$$\text{LVI} = \frac{\sum \frac{q_n^k}{q_0^k} * p_0^k q_0^k}{\sum p_0^k q_0^k} * 100 \equiv \frac{\sum q_n^k p_0^k}{\sum q_0^k p_0^k} * 100 \,. \qquad (10)$$

Similarly, a Paasche volume index (PVI) is:

$$\text{PVI} = \frac{\sum \frac{q_n^k}{q_0^k} * q_0^k p_n^k}{\sum q_0^k p_n^k} * 100 \equiv \frac{\sum q_n^k p_n^k}{\sum q_0^k p_n^k} * 100 \,. \qquad (11)$$

When calculating such indices for foreign trade, ECLAC follows the methodology of factor reversal according to Fisher (1922, p. 75), which is based on an analogy criterion: "[…] no reason can be given for employing a given formula for one of the two factors which does not apply to the other, and, […] such reversibility already applies to each pair of individual price and quantity ratios, and should, in all logic, apply to the index numbers which aim to represent them in the mass." Thus, if for a certain product it holds that

$$\text{Value} = p * q \,, \qquad (12)$$

i.e. the multiplication of price indices with quantities yields a value index of total trade, it is possible to estimate the respective volume indices (VI) from the actual export or import value indices, with the following formulas:

$$\text{VIX} = \frac{\text{IX}_i}{\text{UVIX}_i} * 100 \,, \qquad (13)$$

$$\text{VIM} = \frac{\text{IM}_i}{\text{UVIM}_i} * 100 \,. \qquad (14)$$

What has been done by dividing the value index of trade (exports or imports) by its respective price index is a deflation that isolates the price effect on the trade. If the price and the value index are expressed on a base 100, the result will be a volume index also with a base 100. If the price index was not previously based on 100, the deflation process will approximate the series from units expressed in current prices to units expressed in constant prices on the basis of the used index.

C. Terms of trade

This expression measures the exchange ratio between the basket of goods that a country exports with that the same country imports, considering the price effect adjusted on a base year. Statistically, it is defined as the ratio between the price index of exports and the price index of imports. Both indices must be related to the same base. Following the previously used notation, the terms of trade (TOT) in year *t* are calculated as:

$$\mathrm{TOT_t} = \frac{\mathrm{UVIX_t}}{\mathrm{UVIM_t}} * 100\ . \qquad (15)$$

The result of this indicator is a measure for the development of the exchange rate between the exports of a given country and its imports. In other terms, it represents the change in the purchasing power of a given export volume, i.e. the extent to which such an export volume allows the country to access a similar volume of imported products, taking the base year as a reference. Thus take as an example a hypothetical country that exports a natural resource like wood and needs to export 5 tons of wood to import one tractor in the base year. Five years later, it needed to export 20 tons of wood to import the same tractor. Then, the TOT index has decreased by 75%, reflecting the development of prices in that period.

In economic jargon, we usually speak about an improvement or a deterioration of the terms of trade, depending on the development of this indicator. If the base is 100 and the index reaches 115, we would speak of improved TOT while we would call a subsequent decline to 100 a deterioration of the TOT.

This analysis is very important to study a country's dependence on its trade partners and its relation towards them as regards its ability to buy or sell. For further details see Furtado (1961).

D. Real exchange rate

This expression measures the ratio of a country's export basket (domestic) with respect to the exports of another country (foreign). In other words, it indicates the relative price of the foreign country's goods expressed in terms of local goods. Technically, it is defined as a bilateral exchange rate and calculated as follows:

$$\mathrm{RER_{ij}} = \frac{\mathrm{E_i}}{\mathrm{E_j}} * \frac{\mathrm{D_j}}{\mathrm{D_i}}\ , \qquad (16)$$

where *E* is the type of the nominal exchange rate, *D* is the GDP deflator, subindices *i* indicates the local country, and *j* the foreign country.

This indicator measures the position of the prices of domestic tradables relative to the change in the prices of foreign goods, considering the nominal exchange rate, which itself can experience changes that result in changes in the relative prices of a country's export basket. Likewise, we can calculate real exchange rates for imports.

The correct way of interpreting this indicator is taking a base year as a reference. From there, a reduction of the RER is equivalent to a real appreciation of local goods, which makes them more expensive compared to the prices of the foreign goods. Vice versa, an increase in the RER indicates a

real depreciation, with which the local goods become less expensive relative to the neighboring country's goods. Following that approach, we can derive the formulas for calculating the real exchange rates for exports (RERX) and imports (RERM) for a given country as:

$$\mathrm{RERX} = \frac{\mathrm{E}*\mathrm{PIX}}{\mathrm{PIC}} \equiv \mathrm{E} * \frac{\mathrm{UVIX}}{\mathrm{PIC}} \quad , \tag{17}$$

$$\mathrm{RERM} = \frac{\mathrm{E}*\mathrm{PIM}}{\mathrm{PIC}} \equiv \mathrm{E} * \frac{\mathrm{UVIM}}{\mathrm{PIC}} , \tag{18}$$

where *E* is the nominal exchange rate, *PIX* is the price index of exports, *PIM* is the price index of imports, and *PIC* is the price index of consumption.

The difficulty of the bilateral RER is that it cannot be compared between countries, because of the different baskets of goods traded between. While it is possible to conduct an analysis as regards the same indicator over time, it is not adequate to compare the bilateral exchange rates between countries. To circumvent this difficulty in the analytical field, the calculation of a relative RER, or multilateral RER, is applied where the RER is weighted according to the trade with each country.

E. Real effective exchange rate

The effective exchange rate is an indicator that gives information about a country's international competitiveness shown in the terms of trade with the countries it trades with.

The nominal effective exchange rate (NEER) is obtained using a weighted average of the local currency with respect to the exchange rates of the trade partners, where the weighting represents the relative importance in the country's foreign trade. It can be calculated for exports, imports or total trade by varying the weights appropriately.

$$\mathrm{NEER} = \prod_{\mathrm{j}=1}^{\mathrm{n}} \mathrm{E}_{\mathrm{ij}} * \mathrm{P}_{\mathrm{j}} , \tag{19}$$

where E_{ij} is the nominal exchange rate of the local country (i) with its trade partner (j), P_j is the relative weight that this trade partner has in the total exports (or imports) of the domestic country (i), and n is the total number of trading partners of country i.

When the nominal effective exchange rate is adjusted so that it incorporates the differences in the inflation rates, we obtain the real effective exchange rate (REER). That way, the nominal exchange rate is deflated by the price index of the country and those of the corresponding trade partners. As in the case of the NEER, it can be calculated for the exports as well as for the imports or the total trade by applying the corresponding price index.

$$\mathrm{REER} = \frac{\mathrm{NEER}}{\mathrm{D}} * \mathrm{PI} , \tag{20}$$

where *PI* is the corresponding price index (e.g. of exports or imports) and *D* is a deflator of the economy, which could be the consumer price index or the GDP deflator.

F. Trade-weighted exchange rate

In the previous section, we have described the REER, which cannot be compared across countries because the export/import basket varies among prospective destinations. To solve that problem, it is possible to take all the goods baskets and weight them according to the share they represent within the total exports/imports of the country of interest. The result is the trade-weighted exchange rate (TWER). This indicator is thus calculated on the basis of bilateral exchange rates that are weighted according to the importance of each trading partner within the exports and/or imports of the local country.

$$\mathrm{TWER}_{\mathrm{i}} = \sum_{\mathrm{j}=1}^{\mathrm{n}} \mathrm{BER}_{\mathrm{ij}} * \mathrm{P}_{\mathrm{j}} , \tag{21}$$

where *BER* is the bilateral exchange rate between the domestic country (*i*) and the foreign country (*j*), *n* is the number of trade partners, and P_j is the share of country *j* in the total exports of the domestic country.

This indicator has the property that we can compare it between different countries, thereby yielding an approximately homogenous measure of the development of the macroeconomic competitiveness derived from the relative prices and the exchange rate. The calculations are usually conducted with respect to an internationally accepted, rather hard currency, traditionally in $ or in recent years also in Euro (€).

G. Real trade exchange rate

If we perform a double deflation of the exchange rate, the first to cover the change in export prices and the second to cover national inflation, we obtain the real trade exchange rate (RTER). This indicator measures the change of a country's basket of goods that it exports to another country or to the world, taking into account the change in export value to that destination. Likewise, one can calculate an indicator for the import side.

$$\text{RTER} = \frac{\text{ER} \bullet \text{UVIX}}{\text{D}}, \qquad (22)$$

where *ER* is the nominal exchange rate in dollars, *UVIX* is the unit value index of exports (or *UVIM* for imports), and *D* is a price deflator of the national economy (which might be the consumer price index or the GDP deflator).

The practical to read this indicator is creating a series composed of index numbers build on a base year with value 100. A reduction is then equivalent to a real appreciation of local goods and vice versa.

H. Tradable and non-tradable prices

The tradable sectors of an economy are all those that are producing in the national economy and are subject to trading with other countries, while non-tradables are those solely consumed in the economy where they are produced.

By its very nature, tradable and non-tradable goods in an economy often experience different changes in their price levels, which finally determine variations in the inflation within an economy. The relative prices of tradables and non-tradables provide information about the goods and services whose values are primarily determined by international prices as well as about those goods and services whose prices are mainly determined by such factors as domestic supply and demand (and indirectly by the tradable sectors).

The distinction between tradable and non-tradable prices is quite difficult and the academic discourse is not yet completed. The most common way to differentiate between both is distinguishing between tradable and non-tradable sectors in an economy, to separate them in import and export sectors later on.

Following the methodology developed by Dwyer (1992) for the case of Australia, the following steps are defined:

(i) Measure the production (output) of each industry in the economy;

(ii) identify to which extent the domestic production of each sector is exported and define a threshold value from which it can be classified as export-oriented;

(iii) identify the extent to which the domestic production is replaceable with imports and define a threshold value from which this production can be classified as competing with imports;

(iv) sum up the production (output) of all sectors defined as export-oriented and competing with imports to obtain a measure for the tradable sectors;

(v) sum up the production (output) of all remaining industries to obtain a measure for non-tradable goods sectors.

As you can see from the steps outlined above, important, subjective considerations persist in defining the threshold values for classifying an industry as export-oriented or competing with imports. However, this problem can be partially resolved by analyzing the changes in size and the composition of each of the sectors for different thresholds. This can help us to determine thresholds that are considerably robust.

Knight and Johnson (1997) present two criteria for defining thresholds in the most adequate manner. On the one hand, the threshold should reflect to which extent the participation in imports or exports affects the behavior of the sector to be more exposed to the influences of international trade. On the other hand, the classification resulting from the thresholds should maintain certain stability over time, so that the representativity of the tradable sectors is given also through the economic cycle.

It is important to understand that this methodology defines a measure of production (output) at a single moment and does not incorporate the possibility that a product will be traded internationally in the future. For that reason, the same authors define two general ways for classifying the tradable products. The first definition considers the products and services that are actually traded internationally as tradables and those that are absorbed domestically as non-tradables. This approach obviously depends on the availability of international trade statistics.

The second approach is more sophisticated and more difficult to implement in practice because it considers the change in relative prices when defining products as tradables or non-tradables. A more strict approach should consider both definitions.

Indices of tradable and non-tradable prices that are adjusted reflections of inflation behavior can yield essential information for the analysis of foreign trade and exchange rates. They thus provide a tool for decision-making on type and intensity of trade policies.

In the same way, it has been found that the tradable goods in economies that are international price takers can create an effect on the local inflation that escapes from the macroeconomic control which the central banks may have on that phenomenon. That point is not trivial within the development of practices related to the degree of monetary policy and other instruments to control inflation.

III. The link between trade and production

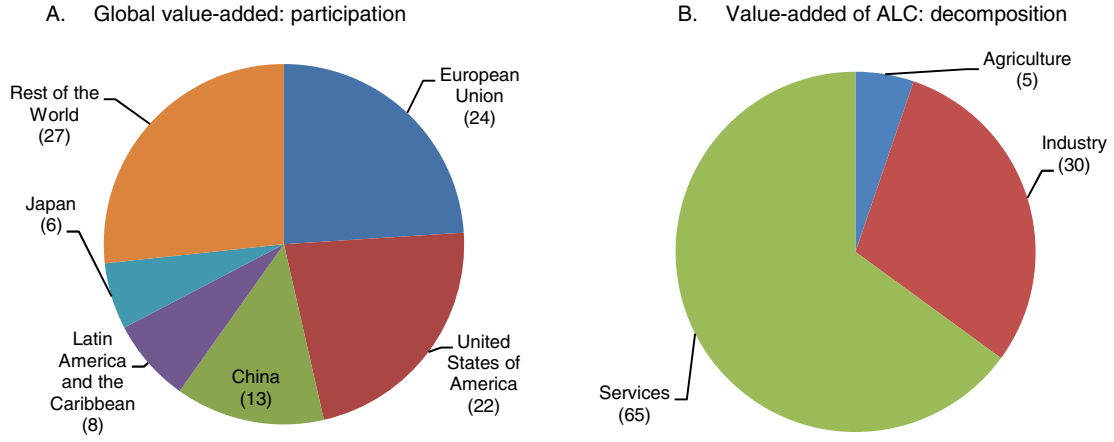
A. Added-value of production

The value-added corresponds to that part of a country's total production that is related to the processing industry. It is defined as the differential between the costs (inputs and fixed capital) and the income obtained from the sale of the final product. The sum of the value-added for the whole country is its GDP.

The value-added can be consumed domestically or exported to residents of other economies. The share exported from the value-added is also known as "export propensity" and provides a measure that is often used as an indicator for an "economy's internationalization". A higher value of this measure thus hints on the fact that the economy at hand is more internationalized.

At the same time, the total value-added can be decomposed into several sectors and subsectors. Traditionally, it includes information about the agriculture, the industry, and the services. As an example, Figure 3 shows the share of total value-added of Latin America and the Caribbean in the world total.

Figure 3
Latin America and the Caribbean: participation in the global value-added, 2014



Source: Own compilation based on figures from the International Monetary Fund (IMF) World Economic Outlook and the World Bank.

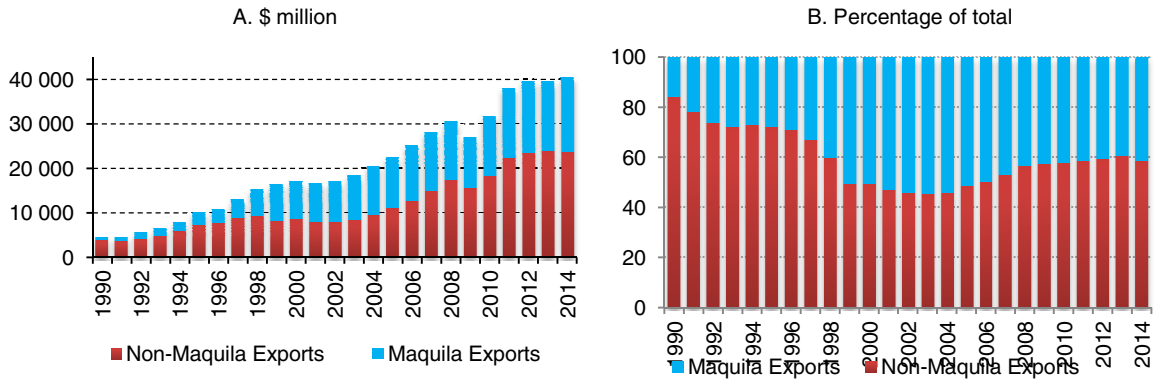
B. The maquiladora activities

There are indications that the use of the word "maquila" dates back to the year 1020 where it was used to describe the portion of the ground that belonged to the miller. The root of the word comes from the Arabic word "makila" whose root k-y-l means "to measure". From this we can understand the actual use of the word to describe that part of the production process that is subcontracted to third-parties. These are then in charge of assembling elaborated pieces, with the particularity that the inputs to assemble are brought from abroad with the commitment that the final product made this way will be resold abroad or internalized into the local economy. It is this principal connotation that describes the actual maquilas in the region. Moreover, their activity has been enhanced to a large degree by transnational corporations (Durán Lima and Ventura-Dias, 2003).

Given the greater integration of the firm, the production and the trade of technology, as well as the components and their subsequent assembly, globalized industries have become more important in the 90s, replacing the old pattern that linked parent companies with their subsidiaries mainly for strategic access to raw materials needed for production.

In this context, the maquiladora activities have considerably developed in Latin America, especially in Mexico and Central America. In the Central American Common Market, they increased from a value less than $ 1,000 million in 1990 to overcome the barrier of $13,000 million in 2008. Due to the financial crisis, their value decreased slightly in 2009 and reached more than $16,000 million in 2014 (see Figure 4).

Figure 4
Central American Common Market: maquila and non-maquila exports, 1990 - 2014



Source: Own compilation based on figures from the countries' central banks.

In the process of value creation and the transformation of manufactured goods, the use of intermediate goods has increased over time, yielding a vertiginous wave of shared production at industry level. However, this process occurs with greater intensity in some types of industries such as those that assemble computers, electronic equipment, aircrafts, vehicles, and textile manufacturing (OECD, 1996).

According to the Organisation for Economic Co-operation and Development (OECD), the main intra-firm operations in the mid-nineties focused on functional areas of intermediate operation, on areas related to technology, research and development, as well as on the cooperation during different stages of the production. To some extent, this process has also occurred in Latin America, especially in Mexico, Central America and the Dominican Republic. Maquila activities also have contributed to local technological development (Buitelaar, Padilla and Urrutia, 1999).

Several countries already have institutions that follow very closely the process of value creation through maquiladora activities. Among these institutions are customs offices, central banks and specialized agencies.

Table 3
Sources of information and institutions that follow maquiladora activities

Brazil	Central Bank of Brazil, Ministério do Desemvolvovimento , Industria e Comércio Exterior, Secretaria de Comercio Exterior, BRAZILIAN EXPORTERS, Agéncia de Promoção e Investimentos (APEXBRAZIL), Departamento de Desenvolvimento e Planejamento de Comercio Exterior (DEPLA).
Colombia	Departamento Administrativo Nacional de Estadística (DANE), la Dirección de Impuestos y Aduanas Nacionales (DIAN), el Banco de la República, PROEXPORT COLOMBIA.
Costa Rica	Central Bank of Costa Rica, Dirección General de Aduanas, Promotora del Comercio Exterior de Costa Rica.
Ecuador	Central Bank of Ecuador, Junta de Defensa Nacional.
El Salvador	Central Reserve Bank of El Salvador.
Guatemala	Bank of Guatemala.
Honduras	Central Bank of Honduras.
Mexico	Bank of Mexico (BANXICO), Servicio de Administración Tributaria (SAT), Instituto Nacional de Estadística, Geografía e Informática (INEGI), la Secretaría de Economía.
Nicaragua	Central Bank of Nicaragua, Dirección General de Servicios Aduaneros (DGA), CETREX, Corporación de Zonas Francas, Dirección General de Hidrocarburos, Comisión Nicaragüense del Café (CONICAFE), Administración nacional de Pesca y Acuicultura (AD-PESCA), Comité Nacional de Productores de Azúcar (CNPA), Asociación de Productores Bananeros de Nicaragua (PROBANICSA), Instituto Nicaragüense de Energía (INE).
Panama	Contraloría General de la República, Dirección de Estadística y Censo.
Dominican Rep.	Central Bank of the Dominican Republic.

Source: Own compilation.

C. Decomposition of maquila

From an analytical point of view, the maquiladora activities can be decomposed into the main elements that shape the total gross value of production of that activity (GVPMaq). Formally:

$$X^{Maq} = FI^{Maq} + VA^{Maq} \equiv GVP^{Maq}, \quad (23)$$

where *X* are the exports, *FI* are the foreign inputs, *VA* is the value-added, and the superscript *Maq* refers to the maquiladora activities.

It is also interesting to note that maquila value-added can be decomposed into production factors according to the following formula:

$$VA^{Maq} = R^{Maq} + DI^{Maq} + G^{Maq} + P^{Maq}, \quad (24)$$

where *R* are the remunerations of labor, *DI* are the domestic inputs used in the value creation process, *G* are the general expenses incurred by the maquila (water, electricity, rent, telephone etc.), and *P* is the profit margin of the entrepreneurs or companies.

If we only have the value of the total exports of maquila activities and the complete information for finding the gross value of maquila production directly is not available, we can infer the valued-added from the total value of foreign and domestic inputs to contribute to the maquiladora activity (see equation 25). Note that Equation 25 is used to approximate the value-added.

$$VA^{Maq} \approx X^{Maq} - FI^{Maq} - DI^{Maq} \quad (25)$$

If the sectoral information for different product groups and/or single products is available in detail, we can derive the information about the whole maquiladora activities from the analysis of the value-added and its components. It is not the same to know the share of the value-added in the total maquiladora activities, compared to having an idea of the difference of the same indicator for the cases of the gross production in the different industries, e.g. textile industry, electronics, and cars.

An analysis of the components that can be valuable for the inference and analysis of the export pattern of maquiladora activities and its linkage to the production structure can be derived from calculating some simple coefficients. Some of these indicators are presented in table 4 and they are based upon the use of other known trade and production indicators and their easy compilation.

Table 4
Some indicators for analysising maquiladora activities

Coefficients	Formulas	#
Share of maquila exports in total exports	$(X^{Maq}/X) * 100$	(26)
Share of maquila value-added in total maquila exports	$(VA^{Maq}/X^{Maq}) * 100$	(27)
Share of foreign inputs in gross value of maquila production	$(FI^{Maq}/GVP^{Maq}) * 100$	(28)
Share of maquila value-added in total GDP	$(VA^{Maq}/GDP) * 100$	(29)
Share of maquila value-added in manufacturing GDP	$\left(VA^{Maq}/GDP^{Manuf}\right) * 100$	(30)
Share of domestic inputs in maquila value-added	$(DI/VA^{Maq}) * 100$	(31)

Source: Own compilation.

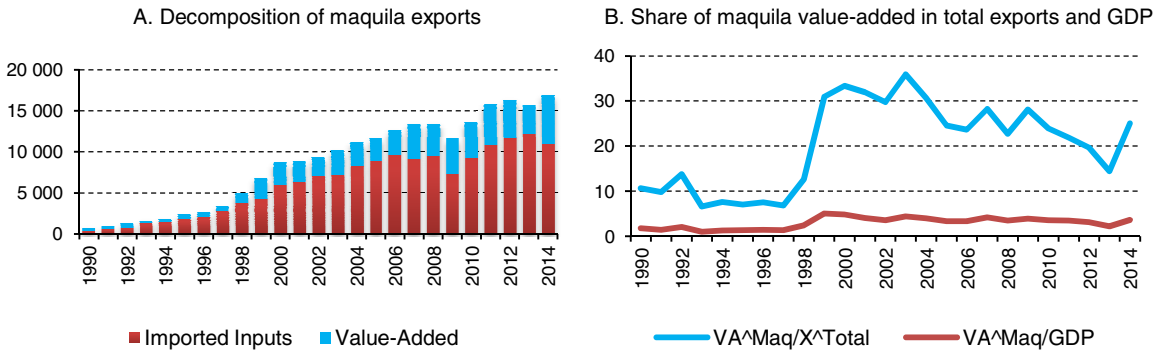
Table 5
Central American Common Market: examples of analytical indicators of the maquiladora activity, 1990, 2000, 2010 and 2014
(Percentage)

	Maquila exports as a proportion of total exports				Contribution of value-added to maquila exports			
	1990	2000	2010	2014	1990	2000	2010	2014
Costa Rica	22.6	57.4	54.4	53.1	26.6	36.5	31.2	38.2
El Salvador	12.6	54.7	22.9	19.4	18.5	28.4	40.4	33.8
Guatemala	22.8	35.5	31.4	32.3	12.7	22.3	32.3	32.1
Honduras	-	61.0	54.8	49.3	-	35.8	33.0	35.6
Nicaragua	0.0	26.4	41.2	47.3	0.0	35.8	28.0	31.4
CACM	15.9	50.8	42.6	42.0	56.3	32.4	32.3	35.1

Source: Own compilation based on figures from the central banks and governmental institutions.
Note: For Honduras no data are available before 2000.

Finding coefficients for the components of the value-added through a greater disaggregation can be a very complex and difficult task due to a lack of data. However, if this is possible —as in the case of Mexico and Honduras— one can observe that the local inputs are quite low and that the payment of salaries explains more than 60% of the maquila value-added (Kuwayama and Durán Lima, 2003).

Figure 5
Central American Common Market: some indicators of maquiladora activities, 1990 - 2014
(Percentage million and %)



Source: Own compilation based on figures from CEPALSTAT, and the countries' central banks and governmental institutions.
Note: Honduras is not included until 2000.

D. Different denominations of the maquiladora activity

For some countries in the region, the proportion of exports realized through the use of mechanisms of temporary admission or special custom regimes is relatively high. The more familiar name in the literature for the definition of this activity is "maquila" or "free zone" (Span.: *zona franca*). Although the countries vary its name, it is strictly speaking a definition comparable to the unique concept of the maquiladora activities.

Needless to say that the existence of a free zone does not necessarily imply that maquiladora activity develops itself in this area. A free zone with temporal admission of goods becomes a generator of maquila if it allows the installation of industries and processing of production using foreign inputs under the free zone regime, i.e. without paying taxes, provided that these products are exported.

Among the different possible names are: "free-trade zones", "active finishing" (Span.: *perfeccionamiento activo*), "Goods for processing" (Span.: *bienes para la transformación*), and other more specified terms with tax implication as in the case of "Vallejos Plan" (named after its inventor Joaquín Vallejo Arbelaéz) or "Special Free Zones" (Span.: *Zonas Francas Especiales*) in Colombia (see table 6). Other countries outside that region also apply names, e.g. special export zones as used in China. In Jordan, Madagascar and the Syrian Arab Republic these are known as free industrial zones, in Togo as tax-free factories, and in Thailand as free points.

Table 6
Latin America and the Caribbean: different denomination of maquila activity

Denominations (original in spanish)	Countries
Z. Franca, Z. Libre Comercio, Polo Industrial	Brazil, Costa Rica, Dominican Republic, Ecuador, Guatemala, Panama,
Maquila	Ecuador, El Salvador, Honduras, Mexico
Bienes para transformación	Nicaragua
Perfeccionamiento activo	Costa Rica
Valor bruto de producción	Honduras
Decreto 29-89	Guatemala
Plan Vallejos, 2006 (ZZ. FF. Especial, 2007)	Colombia

Source: Own compilation.

E. Decomposition of trade data by grade of processing

Trade information can be analyzed by adding trade flows according to the stage of processing of the goods, starting from raw materials, towards stages of higher processing. This type of analysis is complementary to that obtained from the information flow of the maquilas.

This procedure was applied at the regional level in Kuwayama and Durán (2003) in the examination of 20 traditional exports products with high importance for the region and its export performance towards to the world between the mid-eighties and the early years of this decade. They disaggregated three levels of processing (raw materials, intermediate goods, and processed products). The study showed that, in general, the degree of the processing of the basket of raw material in the sample increased 47% in 1985 to 55% in 2001. Table 7 shows as an example the details of the aggregation used for an analysis of such type.

Table 7
Stages of processing: examples
(According to SITC Rev.4)

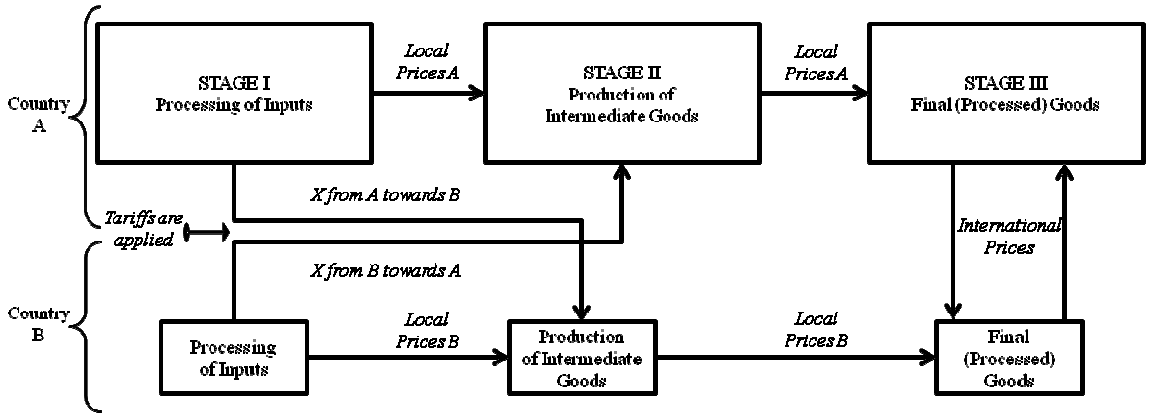
Raw materials Stage I	
Cocoa beans	0721
Sugar raw	0611
Intermediate goods Stage II	
Cocoa powder	0722
Cocoa paste	0723
Cocoa butter	0724
Other beet or cane sugar (formerly refined sugar)	0612
Processed products Stage III	
Chocolate	073
Molasses	0615
Sugar confectionery	062

Source: Reproduced from Kuwayama and Durán (2003) and updated from Standard International Trade Classification (SITC) Revision 2.

IV. Tariffs and non-tariff barriers

The production structure of an economy has a certain complexity that is manifested in the transformation of goods and the generation of services. First, production inputs are generated, the same that will in turn be used in the subsequent processes such as the production of intermediate goods. From cotton one gets yarn and cotton threads. From here, the process proceeds to the manufacture of processed products (see scheme 2).

Scheme 2
Stages of the production process with international trade



Source: Own compilation.

In international trade, the aforementioned production structure determines how the exchanges are conducted at international prices, i.e. prices considering additionally transport costs, the structure of tariff barriers established through customs tariffs within countries as well as non-tariff barriers applied to trade relations (e.g. quotas and contingents, specific tariffs, import prohibitions, and licenses, among others). This section revises the main concepts of barriers and tariffs, pointing out a number of methods and technical details to provide a better understanding and use of available customs information.

A. Most favored nation tariff

The Member States of the World Trade Organization (WTO) can in principle not discriminate between their trade partners. The term "Most Favored Nation" (MFN) means that any preferential treatment that is granted or has been granted to a party is automatically extended to all other parties to the agreement.

If a country gives another one a special advantage, as for example reducing a tariff on a product, the MFN clause means that it shall grant the same to all other WTO members. This principle is the first article of the General Agreement on Tariffs and Trade (GATT) of 1947:

"With respect to customs duties and charges of any kind imposed on or in connection with importation or exportation, […] any advantage, favour, privilege or immunity granted by any contracting party to any product originating in or destined for any other country shall be accorded immediately and unconditionally to the like product originating in or destined for the territories of all other contracting parties." (WTO, 1986)

There exist some exceptions to this provision of the GATT. For example, article XXIV allows the creation of customs unions, i.e. those countries that are members of a certain free-trade agreement may discriminate products produced by other countries which are non-members to that agreement. Moreover, under strict conditions, it is possible to facilitate the access to goods from developing countries or well establish obstacles to products subject to unfair trade.

B. The effective tariff

The effective tariff is the one including all the eventual preferences that products of a certain country face as regards entering a specific market. If information from the customs office is available timely and disaggregated by tariff level, it is possible to calculate the effective tariff rate (ET) with the following formula:

$$\mathrm{ET}_{\mathrm{it}}^{\mathrm{k}} = \frac{\mathrm{VR}_{\mathrm{it}}^{\mathrm{k}}}{\mathrm{M}_{\mathrm{it}}^{\mathrm{k}}} * 100 \,, \qquad (32)$$

where *VR* is the total amount collected by the customs in country *i* with respect to product *k*, *M* is the value of total imports of product *k*, and *t* is the year of the collection.

The effective tariff for the set of products on the import bill from a country then is given by:

$$\mathrm{ET}_{\mathrm{it}} = \sum_{\mathrm{k}=1}^{\mathrm{n}} \mathrm{ET}_{\mathrm{it}}^{\mathrm{k}} \,, \qquad (33)$$

where *n* is the number of products representing the set of imported products from country *i* in the year *t*.

When no information disaggregated by the customs office is available, it is possible to calculate an approximate value based on the so-called Most Favored Nation (MFN) tariff that the World Trade Organization (WTO) publishes in a country's tariff profile or based on available data that show the development of the MFN tariff rate. The World Bank also presents a series of average tariff rates for several countries on its website, in the trade section.

For the calculation of the effective tariff for Colombia as presented in table 8, we subtract from total trade the proportion that corresponds to all signed preferential agreements. Then, we multiply the resulting figure with the MFN tariff. This calculation includes the implicit assumption that the trade with countries where preferential agreements exist is 100% open, which is not true in all cases. We followed that assumption, nevertheless, as the proportion corresponding to each agreement is not available in all cases. Formally:

$$\mathrm{p}^{\mathrm{ET}} = (1 - \mathrm{TPT}) * \mathrm{MFN} \,, \qquad (34)$$

where p^{ET} is the proxy for the effective tariff and *TPT* is the proportion of the Total Preferential Treatments in total trade, whose estimation is based on the value of imports from those countries that are granted preferential treatments.

Table 8
Colombia: MFN tariffs and proxy of effective tariffs, 1990 - 2014

	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
MFN tariff	23.0	13.3	11.7	11.9	12.5	12.5	12.5	12.5	12.5	8.4	8.8	8.8	5.8
TPT	8.5	17.5	18.7	28.8	29.8	28.9	24.8	26.0	27.8	29.7	66.6	69.3	68.1
p^{ET}	21.0	11.0	9.5	8.5	8.8	8.9	9.4	9.3	9.0	5.9	2.9	2.7	1.8

Source: Own compilation based on figures from the World Bank and the WTO World Tariff Profiles.

We can see that Colombia in 2014 granted prefential treatments also to its main trading partners (e.g. United States and the European Union) and not only to its neighboring states as in 1990.

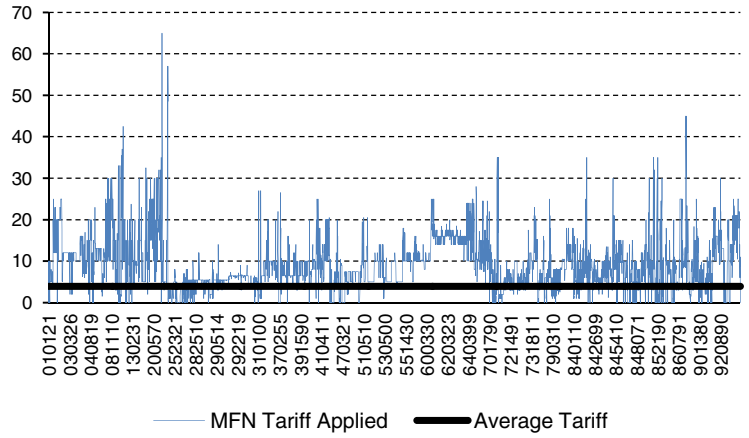
The limitation of this type of exercise is that it only serves as an approximation of the effective tariff, but cannot be seen as being equal to the level of effective protection of products and/or sectors of an economy. In the following, we apply further methods.

C. Tariff peaks

It is not sufficient to look only at the averages of the tariffs, because for each type of aggregated good tariffs may vary at a large scale at the disaggregated level. Therefore it is appropriate to analyze in detail what the literature defines as tariff "peaks", i.e. the maximum and minimum of tariffs for each type of good.

An analysis of China's import tariffs to the world in 2014 for a total of more than 5,200 products disaggregated at the level of 6-digit codes of the Harmonized System from 2012 (HS12) indicates that the mean tariff was 3.91%. However, it varied between 0 and 65%, showing the highest concentration of peaks at primary goods (see figure 6).

Figure 6
China: MFN tariffs applied to the world, 2014



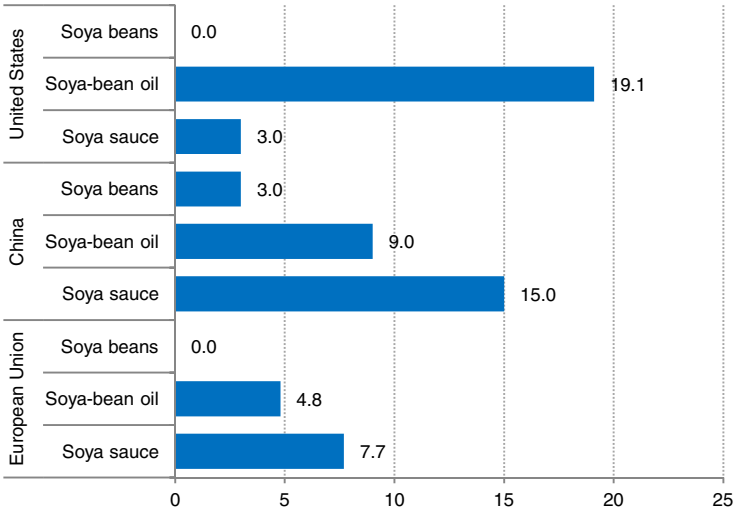
Source: Own compilation based on figures from Comtrade and WTO.

These peak tariffs often correspond to protection measures particularly implemented by countries and regions to protect products of their local industries, which would not survive open international competition, or what would sacrifice social, tax or profit variables, among others.

D. Tariff escalation

While the existence of tariff peaks is a problem in general, it manifests even more when the tariffs are analyzed according to the processing stage of a given product. In 1966, Max Corden explained with great concern that the tariff rates in developing countries tended to be graded, showing a clear differentiation between different degrees of processing (Corden, 1966). This remains still very valid, as this grading —also known as "tariff escalation"— continues in the levels of protection and is observed not only in developing countries (see figure 7).

Figure 7
Selected countries: Tariff escalation of soy, 2014
(MFN tariffs)



Source: Own compilation based on figures from WTO.

Tariff escalation means that a country protects its processing industry by imposing low tariffs on raw materials and high tariffs on products with a higher processing stage, e. g. intermediate and capital goods. According to the WTO, tariff escalation is used less than before and several developing countries have removed it entirely for many products (WTO, n.d).

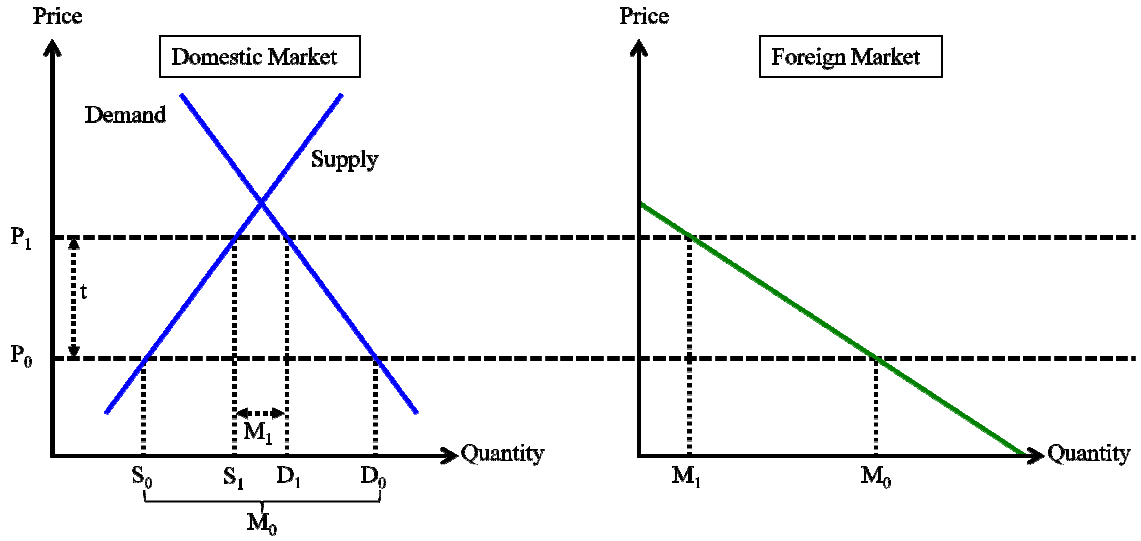
E. Tariff quotas and contingents

With that term, we describe a system of protection that consists of implementing a lower tax on a specific quantity of a product and a higher tax on all imports that exceed this quantity.

Scheme 3 presents a normal situation where imports are high in the absence of a tariff. At price P_0, companies offer S_0 and consumers have to import a quantity equal to M_0. If the price is

increased to P_1 through the introduction of a tariff ($P1 = P_0 + t$), local firms expand their (potentially exportable) supply, imports decrease, and the producer surplus increases.

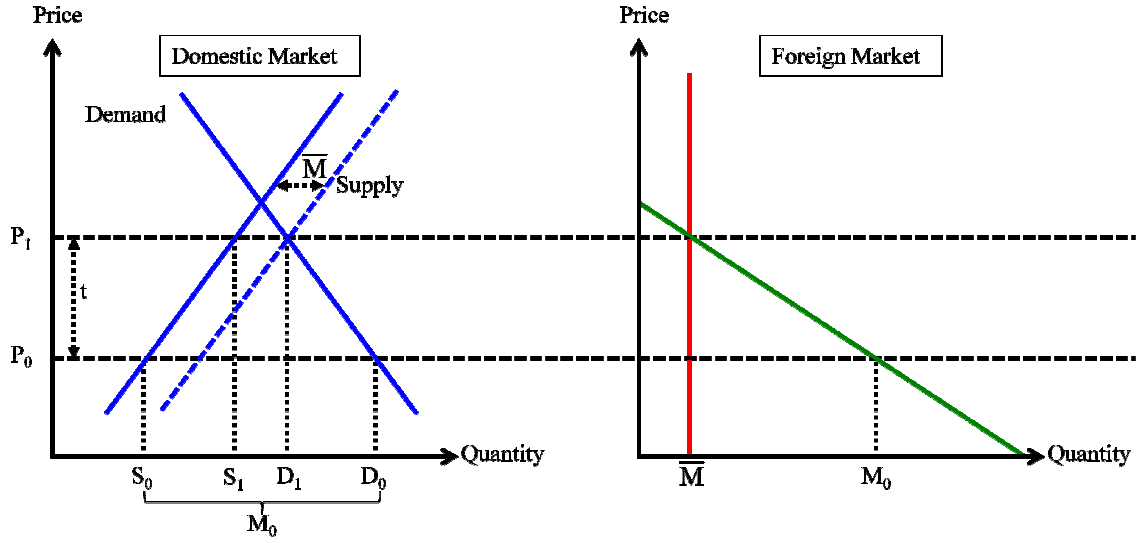
Scheme 3
Introduction of a tariff and import demand



Source: Own compilation.

When an import quota is introduced, something quite different happens: the imports are reduced to fit the amount determined by the quote (see $\overline{M}$ in the example in scheme 4).

Scheme 4
Introduction of a quota and import demand



Source: Own compilation.

From the consumers' point of view, the introduction of a quota implies paying higher prices. For the producers that face this limitation in the external market, it means that they can only import at a low price for the amount set by the quota. The domestic producers obtain a higher surplus as they can sell at higher prices. Likewise, importers achieve non-economic benefits through the handling of the quotas.

F. Ad valorem tariff and equivalents

An ad valorem tariff is calculated in percentages of the value of imports. For example, a 10% tariff means that the tariff on the imports equals 10% of the value of the questioned good. From the ad valorem tariff, customs officials directly calculate the value to be collected, which in terms of the product equals the effective protection for that particular product. Formally:

$$VC_i^k = T_i^k * M_i^k \ , \qquad (35)$$

where VC_i^k is the value to be collected for product k in country i, T_i^k is equal to the ad valorem tariff, and M_i^k is the amount imported.

Next to the ad valorem tariffs that put a particular percentage at the value of the import bill, there are countries that apply non-ad valorem tariffs. Among those used most often are: specified tariffs, compound tariffs, mixed tariffs, and those by content of the product, for example sugar, which are more complex and whose calculation requires sophisticated techniques.

The specified tariffs are those that are not applied on the imported value but rather on the weight, volume, or space occupied by the products. Its application includes a specified number of monetary units per quantity. The compound tariffs consider the combination of an ad valorem tariff and a specified tariff that can be added or deducted as defined in the relevant customs regulations. The mixed tariffs are those that involve the choice of an ad valorem tariff and a specified tariff, depending on a specific, preestablished condition. In some cases, also technical tariffs are applied, depending on containing some intermediate inputs such as sugar or alcohol. Table 9 summarizes the 4 described non-ad valorem tariffs and provides one example each.

Table 9
Non-ad valorem tariffs

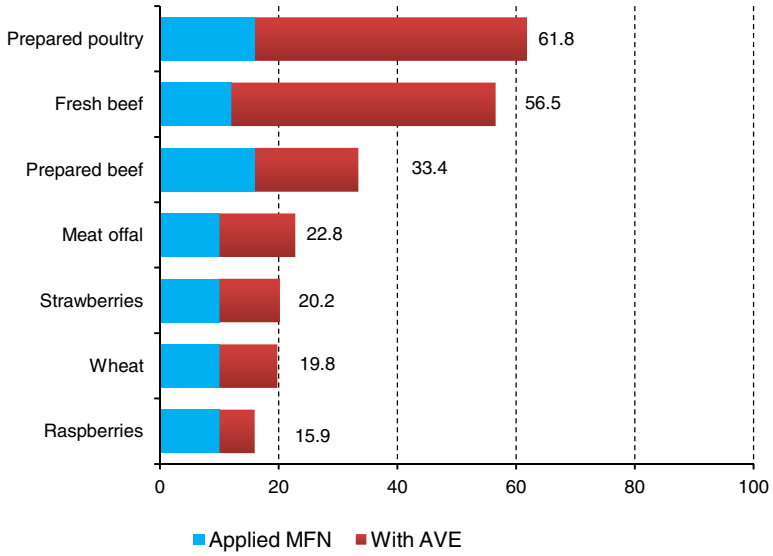
Type	Description	Example
Specified tariff	Specification of onetary units per quantity	$2 per kilogram or $120 per cubic meter
Compound tariff	Combination of ad valorem and specified tariff	15% plus $3 per kilo
Mixed tariff	Application of an ad valorem or a specified tariff, depending on a preestablished condition	10% or $6 per kilogram, whichever is higher
Technical tariff	Specification of monetary units per content	$2 for each 5 milligram of sugar

Source: Own compilation.

Since the average tariffs hide certain differences in the production levels, due to tariff escalation and the presence of non-ad valorem tariffs, it is important to stress the necessity of estimating ad valorem equivalent tariffs (AVE). A country for example may even be able to reduce the MFN tariffs, obtaining import rebates, but the specified tariffs may nevertheless undermine the competitiveness of the country's exporters, making it obviously more difficult to access those countries that neither provide trade agreements nor benefit from special preferential tariffs as the Generalized System of Preferences.

Figure 8 displays the applied MFN and AVE tariffs for eight products Argentina faces within the trade with Germany. We can see that the exports of meat offal, wheat, and different fruits, for example, face the same MFN tariffs. When we add the AVE, however, the trade barrier differs notably between these products (including their respective AVE). Fresh beef that faces a lower MFN than prepared beef products even face a higher total AVE. The most severe case is that of prepared poultry, as in it faces a moderate MFN tariff, but their AVE raise the barrier up to nearly 62 percentage points of its value.

Figure 8
Germany: breakdown of applied tariffs to Argentina on some selected products, 2013
(Tariff levels and ad valorem equivalents in %)



Source: Own compilation based on figures from Market Access Map of the International Trade Centre (for AVE) and the Trade Analysis Information System of the United Nations Conference on Trade and Development (UNCTAD) (for applied MFN).
Note: corresponds to estimations based on figures, aggregated at six-digit level.

To calculate ad valorem tariffs, the WTO recommends some complementary methodologies according to the nature of the type of non-ad valorem tariff that applies. Therefore, for the calculation of AVE of a specific right, it is recommended to use the following methodology:

$$\text{AVE} = \frac{\text{ST}}{\text{UVM}*\text{E}*\text{UCF}} * 100\,, \qquad (36)$$

where *ST* is the specific tariff of the product, *UVM* is the unit value of the product expressed in $ per imported quantity, *E* is the nominal exchange rate (in $ per national currency), and *UCF* is the unit conversion factor. Note that AVE is expressed in percentages.

Using a unit conversion factor is crucial for the calculation of the AVE, because both the specific value and the unit value must be expressed in the same unit of measure. For example, if we have a specific tariff expressed in hectoliters, while the unit value is expressed in liters, we have to apply a conversion factor of 100. Table 10 shows the conversion factors for unit quantities. All the derivative unit values (tons, hectoliters, kilometers) must be converted into their respective basic units (kilograms, liters, meters, etc.). Ensuring that the units are the same is highly important to avoid mistakes.

Table 10
Conversion factors of unit quantities

Abbrev.	Denomination	Abbrev.	For converting in	Unit conversion factors
KGG	Kilogram Gross Weight	KGM	Kilogram	1
KGN	Kilogram Net Weight	KGM	Kilogram	1
TNE	Ton	KGM	Kilogram	1 000
CKN	100 Kilograms Net Weight	KGM	Kilogram	100
CKB	100 Kilograms Gross Weight	KGM	Kilogram	100
TNN	Tonne Net Weight	KGM	Kilogram	1 000
TNG	Tonne Gross Weight	KGM	Kilogram	1 000
KMT	Kilometer	MTR	Meter	1 000
HMT	Hectometer	MTR	Meter	100
MSM	Thousand Square Meters	MTK	Square Meter	1 000
MQM	Thousand Cubic Meters	MTQ	Cubic Meter	1 000
HLT	Hectoliter	LTR	Liter	100
PFL	Proof Liter	LTR	Liter	2.5
LPA	Liter of Pure Alcohol	LTR	Liter	2.5
NAR	Number of Articles/Items	NEH	Number/Each/Head	1
HUP	Hundred of Pieces	NEH	Number/Each/Head	100
PCE	Piece	NEH	Number/Each/Head	1
MIL	Thousand	NEH	Number/Each/Head	1 000

Source: Reproduced from Stawowy (2001).

G. Tariff binding

This regulates the maximum tariff that a WTO member can apply and the gradual reduction of such tariffs. However, they can be increased or eliminated if the countries affected by the tariff are compensated.

The lists of market access are also not mere tariff announcements and represent commitments not to increase rights above those listed, i.e. that these are “bound”. In developed countries, these are generally the applied effective rates, while in the majority of developing countries the bound rates are somewhat higher than the actually applied ones. This means the bound rate work as a ceiling.

The countries can leave a commitment (e.g. increase a tariff the bound rate), but not without difficulties. To do so, they have to negotiate with the most affected countries, which can lead to a compensation for the loss of trade by trading partners (WTO, 2008a).

H. Non-tariff measures

The non-tariff measures have a protectionist impact, i.e. they seek to safeguard the competitiveness of the national manufacturing under artificially favorable conditions.

Non-tariff measures (or barriers) can be very different in nature. Among them, we find for example import quotas, tariff contingents, applying indiscriminate sanitary and phytosanitary standards, and all measures of controlling import prices and volume. A more or less elaborated list of the bandwidth of non-tariff measures applied to trade can be found in table 11.

Table 11
Classification of some non-tariff measures

Category	Group	Measure
Fiscal measures	Tariffs	Tariffs with quota
		Seasonal tariff
		Charges applied on the basis of declared value
		Charges applied on the basis of decreed value
		Transaction-specific charges
	Product-specific taxes	Ad valorem taxes
		Specific taxes
		Combined taxes
Volume-restraining measures	Total prohibitions	Of a general nature
		Health and safety prohibitions
		Wildlife prohibitions
		Seasonal
	Conditional prohibitions	General
		On basis of origin
	Simple prohibitions	
	Quotas	
Import-authorizations	Non-automatic	
	Automatic	
Control of the price level	Minimum price systems	
	Price investigation	
	Price surveillance	
Other measures	Technical requirements	
	Other import measures	

Source: Adapted from Laird and Yeats (1990).

The common purpose of all those measures is to restrict trade flows and to introduce distortions in the international markets. A number of international agreements exist to prevent several of these: about Import Licensing, regulations for the valuation of a good, pre-shipment inspection, and investment measures (WTO, 2008b).

It is somewhat difficult to have a measure for all of the factors that are affecting exports, without being easily quantifiable tariffs. Despite this difficulty to get an AVE, the possibility exists to obtain the impact of such measures on the total trade realized. Bora, Kuwahara and Laird (2002) developed a measure that considers the number of items or products subject to any restrictions for the calculation of such a measure for total imports. Formally:

$$\mathrm{CNTM_{it}} = \frac{\sum \mathrm{D}*\mathrm{M_t^k}}{\sum \mathrm{M_t^k}} * 100\,, \qquad (37)$$

where $CNTM_{it}$ is the coverage ratio (or frequency index) of non-tariff measures regarding total imports of country i in the year t, D is the value of a "mute" variable that equals one if any non-tariff measure exists and zero if no restriction exists, and M^k_t is the import value of product k.

Note that this coefficient can be calculated for a given product group. In this case, the products of each group are disaggregated in the numerator and the chosen groups are aggregated in the denominator. Formally:

$$\mathrm{CNTM_{it}^g} = \frac{\sum \mathrm{D}*\mathrm{M_{it}^{k\epsilon g}}}{\sum \mathrm{M_{it}^{k\epsilon g}}} * 100\,, \qquad (38)$$

where the barriers are calculated only for the products (k) of a group (g).

The outcome of this calculation results in a coefficient for the coverage for each identified group. Table 12 shows the results at group levels obtained for selected Latin American countries.

Table 12
Selected countries: coverage ratio of non-tariff measures (technical barriers to trade) for product groups, 2008 - 2010
(Percentage)

Sector (HS07)	Chile	Colombia	Costa Rica	El Salvador	Guatemala	Honduras	Mexico	Nicaragua	Peru
Animal (01-05)	96.1	11.3	58.8	97.5	95.5	57.5	24.1	46.8	…
Vegetable (06-15)	91.4	35.7	45.0	32.1	78.8	24.2	66.3	91.1	12.2
Foodstuffs (16-24)	60.7	22.4	35.5	85.8	81.8	21.5	69.1	34.6	18.6
Minerals (25-26)	2.1	5.1	51.1	52.7	12.5	…	1.1	82.2	…
Oil Minerals (27)	0.1	0.1	44.3	97.7	95.2	…	75.8	4.6	0.5
Chemicals (28-38)	56.1	40.5	81.4	98.5	74.0	4.5	38.5	63.7	34.4
Plastic / Rubber (39-40)	27.7	1.2	1.6	44.1	…	1.4	21.4	…	13.6
Hides, Skins (41-43)	…	5.7	…	28.5	…	…	99.5	…	…
Wood (44-49)	16.1	4.4	3.8	0.0	…	…	21.5	…	15.9
Textiles, Clothing (50-63)	96.8	25.7	0.1	…	…	…	96.5	…	0.9
Footwear (64-67)	93.7	86.9	…	2.4	…	…	93.0	…	89.6
Stone / Glass (68-71)	…	0.0	0.3	…	…	…	19.7	2.1	1.0
Metals (72-83)	0.8	1.2	0.0	0.3	0.3	…	17.4	0.0	2.0
Machineries/Electricals (84-85)	2.3	0.3	9.2	0.0	2.9	…	44.8	…	1.5

Source: Own compilation and reproduction from Kelleher and Reyes (2014).

I. Method of calculating the effective protection

A synthetic indicator of great analytical power is the effective rate of protection that expresses the value of protection from the point of view of the processing sector and includes the producers' preferences. Unlike the nominal rate of protection, that only covers the product and the consumers' decisions, the effective rate of protection includes the producers and the implicit resource allocation decisions in the processing sector.

The effective protection adds the overall structure of protection rates, assuming non-zero normal substitution elasticities. To some extent it reveals the so-called "producer effect": when a certain level of protection is obtained, one will observe a shift of production activities in the tradable goods sectors. That means that activities with a low degree of protection will move towards activities with greater levels of protection. Moreover, there will be a "consumption effect" meaning that consumption will shift from highly protected goods towards those with lower protection or local products, depending on the elasticity of substitution or of consumption.

In general terms, the rate of effective protection will be higher, equal to, or lower than the tariff rate of a product, depending on whether this tariff exceeds, equals or is less than the average tariff rate of the input materials. Thus, the rates of effective protection will be negative if the input

materials increase at a greater rate than the price of the product. Table 13 shows a mnemonic aid for interpreting the theory and its implications in terms of resource allocation decisions.

Table 13
Rate of effective protection and ressource allocation decisions

Effective rate of protection Z vis a vis effective tariffs t*	Product tariff rate vis a vis average rate of input materials	Resource allocation decision
Z > tk*	If tk* > average rate of input materials	The effective protection rate is positive and the producers maintain the activity.
Z = tk*	If tk* = average rate of input materials	The effective protection rate is equal to the effective tariff. The producers are indifferent.
Z < tk*	If tk* < average rate of input materials	The effective protection rate is negative and the producers remove from the production activity.

Source: Own compilation based on Balassa (1965) and Balassa and Schydlowsky (1968).

The formula to calculate the effective protection rate is the following:

$$Z = \frac{t^k - \sum_g (a^{gk} * t^g)}{1 - \sum a^{gk}}, \qquad (39)$$

where t^k is the tariff of the final good k, also called nominal tariff, t^g are the tariffs of the inputs g, and a^{gk} are the input-output coefficients.

An alternative way of interpreting the effective protection is that it represents the proportion of the added value of the good measured in domestic prices that exceeds the added value at world prices.

We use this formula to find the degree of distance between the effective protection and the nominal protection. In practical terms, and following equation (39), the effective and the nominal protection will differ from each other if tariffs on intermediate goods and final products are different. For countries with paired levels of effective protection, the effective protection will be quite approximate at the rate of the nominal protection.

A refined version of equation (39) was supposed by Corden (1966), who argues for the differentiation between tradable and non-tradable goods, including the first in the numerator of the formula and the non-tradables in the denominator. Formally:

$$Z = \frac{t^k - \sum_g^T (a^{gk} * t^g)}{(1 - \sum a^{gk}) + \sum_g^{NT} a^{gk}} \qquad (40)$$

where: t^k is the tariff of the final good k, also called nominal tariff, t^g are the tariffs of the inputs g, and a^{gk} are the input-output coefficients, T are the tradables, and NT are the non-tradables.

For a more-detailed revision of the effective protections and its practical application, we refer to the works of Berlinski (2000) for the case of the countries of MERCOSUR and of Fairlie, Torres and Cuadra (2003) for the case of the Peruvian economy.

J. Cost of transportation

With the gradual reduction of tariffs worldwide and the seeking to eliminate non-tariff barriers and technical barriers to trade, a third dimension each time gains more importance within the analysis of export costs. It is about transport and insurance.

The proposed indicator for observing the effect of these costs on the value of the exported good is an approximation of the cost of transportation (or shipping cost) that is translated into an ad valorem tariff (Durán-Lima and Avarez).

It uses the methodology of Cost of Insurance and Freight (CIF) versus Free on Board (FOB), but from an approximation of unit values, which allows to solve several drawbacks of reporting. This is due to the traditional methodology that consists of deducting from the CIF reported by the country of destination the FOB cost reported by the country of origin. Several limitations appear hereby, starting from the loss of goods on the way, rejected products, registry errors, and finally shipping that begins in one year and arrives the following year. The result is a calculation of the product's unit value in the port of origin and destination. On this basis, a calculation of the inference is performed. Formally, the cost of transportation CT is given by:

$$\mathrm{CT} = \left(\frac{M_{ji}^{k}/Q_{ji}^{k}}{X_{ij}^{k}/Q_{ij}^{k}} - 1\right) * 100\,, \qquad (41)$$

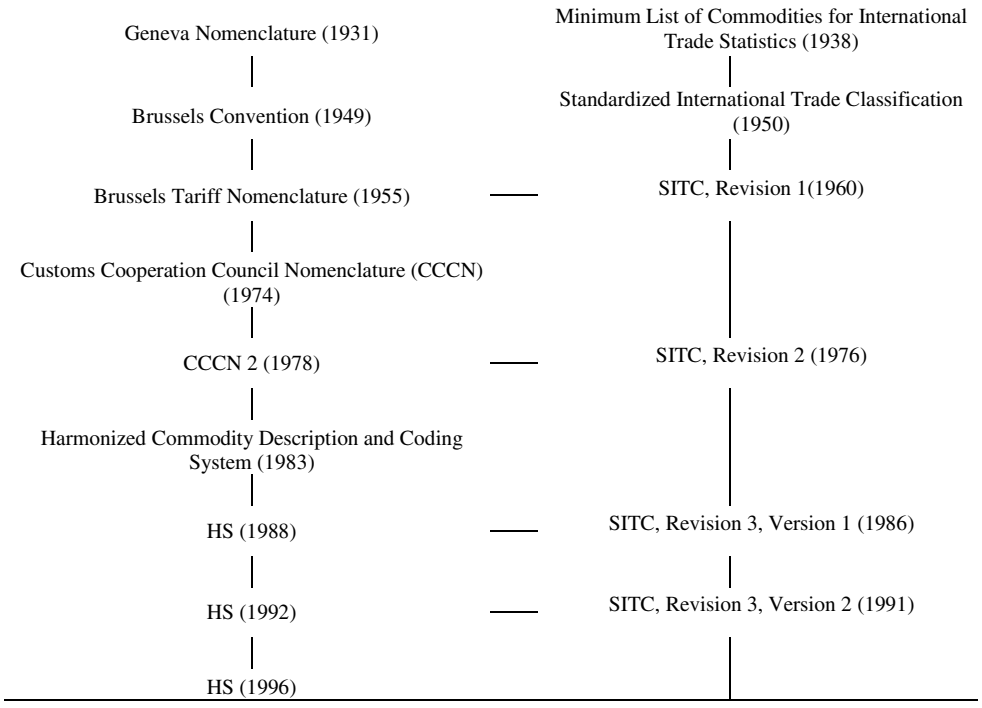
where *M* and *X* are the imports and exports, respectively, *Q* are the quantities, *i* is the country of origin, *j* is the destination and k is the product.

It is important that the calculation is conducted at the highest disaggregated level possible to obtain the best data available regarding the unit value.

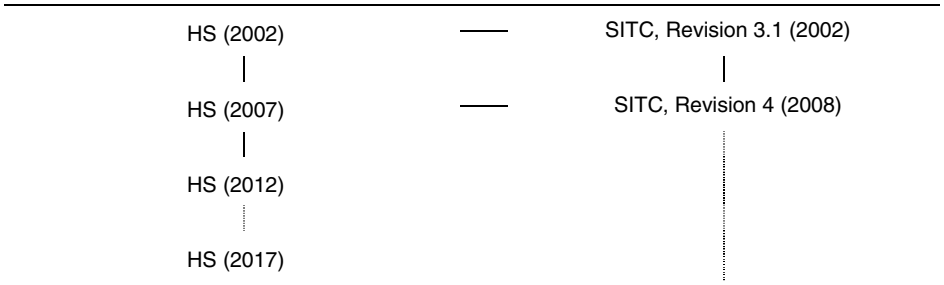
V. Main trade classifications and their different analytical usage

The international trade in goods is classified in different forms, with typologies that have varied over time and that incorporate specific usages, utilities and their own limitations. Before beginning any investigation, it is important to determine which classification will be used, because if this starting point is chosen badly, it will complicate the whole analysis. Scheme 5 summarizes the evolution and interaction between the two main streams of classification. The sections in this chapter analyze these and other specific classifications that have been derived from them.

Scheme 5
Evolution of the main international trade classifications



Scheme 5 (concluded)



Source: Own compilation.

A. Customs and tariff classifications of trade flows

1. Brussels Tariff Nomenclature (BTN)

In 1948, a group of exports from the European Customs Union initiated the revision of the Geneva Nomenclature which was used by an important number of European countries as reference to their national tariff nomenclatures. Various modifications were made, cutting and simplifying it to standardize customs tariffs that were used at that time. In 1949, the draft of the nomenclature was annexed to the Brussels Convention, which established the Customs Cooperation Council. This body should, among other objectives, oversee and ensure the correct application of the Convention of the Nomenclature. This convention entered into force on September 11, 1949, and suffered its first revision through a Protocol Amendment on the first of July, 1955, when it adopted the name Brussels Tariff Nomenclature (BTN) (see WCO, 2006).

The classification criteria that were taken into account to order the goods in the BTN were mainly starting from raw materials, the processing stage and the industrial origin. To determine its structure, the criteria were used for their simplicity and accuracy that allowed an objective application. The criterion of industrial origin of the goods for its part was included at the request of the statisticians who participated in its preparation. The intent of this criterion was to ensure to a large degree that each subheading of the classification should include only those goods normally produced by the same industry.

These classification criteria considered by BTN have served as the basis for the development of other international classifications like the United Nations Central Product Classification (CPC).

In 1960, the revision of the BTN and of the original Standardized International Trade Classification (SITC) provided the basis for the development of the SITC Revision 1.

The structure of the nomenclature was given by 21 sections, 99 chapters, headings, and subheadings. Their numerical order was alphanumerical, being the 4-digits which determine the headings and one additional letter specifying the subheading.

To avoid subjectivity when assigning a good's tariff position, this nomenclature contained "General Interpretative Rules" and additionally "Legal Notes" designed to ensure a correct and uniform interpretation of the former.

2. Customs Cooperation Council Nomenclature (CCCN)

In 1974, the BTN was renamed Customs Cooperation Council Nomenclature (CCCN) to relate it more clearly to the institution that it produced, namely the Customs Cooperation Council based in

Brussels (WCO, 2006). Later, in 1978, to achieve a full correspondence with the SITC Rev.2, 1083 statistical subheadings were incorporated into the CCCN, derived from 262 of its 1011 headings.

3. Harmonized commodity description and coding system (HS)

In 1983, the name of the CCCN was changed into Harmonized Commodity Description and Coding System (HS), see CCC (1985). On the first of January 1988, the HS88 entered into force, delivering a new classification with multiple purposes (WCO, 2006). The most important ones were: providing a base for the development of tariffs, the collection of statistics on international trade, the rules of origin, the collection of excise tax, the trade of goods, the transport tariffs and statistics, and the monitoring and control of goods. Moreover, as a vital element of customs controls and procedures, they included the assessment of risk, information technologies, and compliance.

In contrast to its predecessor CCCN, the HS88, broadened the categories from four to six digits to maintain a nearly full correspondence to the new SITC Rev.3. The only exception between that version of the HS and the SITC is given for heading HS88 2710 which is not divided in subheadings as occurring in SITC Rev.3 (8 subheadings).[2]

The HS88 shows a structure of 21 sections, 96 chapters (plus one Chapter 77 for potential future use), and 1241 headings of four digits. Of this total, 930 of the headings are divided into subheadings giving origin to a total of 5019 groups of goods identified by a six-digit code. Later on, the HS88 was revised in the years 1992, 1996, 2002, 2007, and 2012. A further revision is already announced to take part in 2017 (WCO, 2015).

The most recent version HS12 maintains the structure of the 21 sections (of 1 digit) from 1988, but not the number of the following categories: chapters 96 (two digits, plus chapter 77 for future use and chapter 98 and 99 for national use), 1225 headings (four digits), and subheadings (six digits). In total, the HS12 counts 5299 subheadings of which 4996 directly correspond to HS88. The situation of the heading 2710 in the HS88 was resolved through incorporating five subheadings HS12 (2710.12, 2710.19, 2710.20, 2710.91, and 2710.99) that correspond now with the new structure of the heading 334 of the SITC Rev.4. To sum up, the HS88 has undergone several modifications since its implementation that have also affected the SITC.

As it would be too extensive to describe the various aggregation levels of that classification, we list the 21 sections that build the base for its structure below in table 14.

Like the BTN and the CCCN, the HS also has General Interpretative Notes on the system and Explanatory Notes for the sections, chapters, and subheadings as well as an Alphabetical Index of headings and subheadings if appropriate.

According to accessible data, the development of the number of levels of these customs classifications in each version is as presented in table 15.

[2] HS88 2710: "Petroleum oils and oils obtained from bituminous minerals, other than crude; preparations not elsewhere specified or included, containing by weight 70% or more of petroleum oils or of oils obtained from bituminous minerals, these oils being the basic constituents of the preparations; waste oils" (WCO, 2002).

Table 14
Structure of the harmonized commodity description and coding system

Section	Description
I	Live animals; animal products.
II	Vegetable products.
III	Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal or vegetable waxes.
IV	Prepared foodstuffs; beverages, spirits and vinegar; tobacco and manufactured tobacco substitutes.
V	Mineral products.
VI	Products of the chemical or allied industries.
VII	Plastics and articles thereof; rubber and articles thereof.
VIII	Raw hides and skins, leather, furskins and articles thereof; saddlery and harness; travel goods, handbags and similar containers; articles of animal gut (other than silk-worm gut).
IX	Wood and articles of wood; wood charcoal; cork and articles of cork; manufactures of straw, of esparto or of other plaiting materials; basketware and wickerwork.
X	Pulp of wood or of other fibrous cellulosic material; recovered (waste and scrap) paper or paperboard; paper and paperboard and articles thereof.
XI	Textiles and textile articles.
XII	Footwear, headgear, umbrellas, sun umbrellas, walking-sticks, seat-sticks, whips, riding-crops and parts thereof; prepared feathers and articles made therewith; artificial flowers; articles of human hair.
XIII	Articles of stone, plaster, cement, asbestos, mica or similar materials; ceramic products; glass and glassware.
XIV	Natural or cultured pearls, precious or semi-precious stones, precious metals, metals clad with precious metal and articles thereof; imitation jewelry; coin.
XV	Base metals and articles of base metal.
XVI	Machinery and mechanical appliances; electrical equipment; parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles.
XVII	Vehicles, aircraft, vessels and associated transport equipment.
XVIII	Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical instruments and apparatus; clocks and watches; musical instruments; parts and accessories thereof.
XIX	Arms and ammunition; parts and accessories thereof.
XX	Miscellaneous manufactured articles.
XXI	Works of art, collector's pieces and antiques.

Source: Own compilation based on WCO (2015).

Table 15
Evolution of the number of levels by classification

	Sections	Chapters	Headings	Subheadings
GN (1931 and 1937)	XXI	86	991	-
BTN (1955)	XXI	99	-	-
CCCN (1978)	XXI	99	1 011	-
HS88 (1988)	XXI	96	1 241	5 019
HS12 (2012)	XXI	96	1 225	5 299

Sources: Own compilation based on CCC (1985), ECLAC (1993, 1998, 2004), and WTO (2006).

B. Statistical classifications of trade flows

1. Standardized International Trade Classification (SITC)

The fourth revision of the SITC entered into force at the first of January 2007, at the same day as the HS07 of the WTO did.

The SITC was for several decades (since 1938) the "Minimum List of Commodities for International Trade Statistics" (League of Nations, 1938), being the worldwide most-used statistical classification for countries within their analysis of Foreign Trade. Since then, it has maintained its classification criteria although the trade itself has experienced changes in its size, its number and quality of the products traded, and the diversity of the geographical patterns that have occurred since this period. Its revisions have been directly related to the different versions of the WTO's nomenclatures.

The classification criteria of the SITC have been conserved over time to ensure the conceptual coherence of its own revisions (4) that followed:

(i) Tthe nature of the good and the materials used in its production,

(ii) the processing stage,

(iii) the market practices and uses of the products,

(iv) the importance of the commodities in terms of world trade, and

(v) the technological changes.

The SITC aims to present a classification for all products traded in the foreign trade of goods, or all those goods that increase or reduce a country's material resources resulting from entrance or exits in the customs area of that state. Moreover, it encompasses the official trade (including goods of foreign aid, war reparations, and trade of goods for military purposes), trade of foreign licensees, trade by products of postal services, and exports of fish unloaded abroad by domestic fishing vessels. In so far listed by a country's foreign trade statistics and for the purpose of an analysis conform to the SITC Rev.4, it must also include trade in container or bonded warehouses, the reexportations and reimportations, and trade in fuels as well as foreign ship and aircraft supplies. By this mean, it excludes all those goods that pass through the country only in transit as well as monetary gold, gold coins and coins in circulation, since its movement affects the monetary resources but not the material resources of a country (the HS includes them under codes 710820 or 711890, respectively).

The SITC Rev.4 maintains the same structure as its previous version and consists of an equal number of Sections, Divisions (Chapters), and Groups. The changes between both are at the level of subgroups and basic items (headings) where 238 items were eliminated and 87 new basic items were integrated in Rev.4. Resulting from these additions and deletions, SITC Rev.4 now contains 2,970 basic items. To observe the evolution of this classification quantitatively, we present a comparative summary of each version in table 16.

Table 16
Summary of the SITC

	No. of Digits	Rev.1	Rev.2	Rev.3	Rev.4
Sections	1	10	10	10	10
Divisions	2	56	63	67	67
Groups	3	177	233	261	262
Subgroups	4	625	786	1 033	1 023
Basic items	5	944	1 466	2 824	2 970

Source: Own compilation based on UNSD (1950, 1961, 1975, 1986, 2006a).

The correspondence relationship between SITC Rev.4 and HS12 is given at the level of subgroups and basic items and the headings and subheadings, respectively. To realize an exact correlation between the headings and subheadings of the HS12 and the subgroups and basic items of the SITC, it was thus necessary to subdivide a substantial number of subgroups in new basic items, thereby increasing their total in the classification. For example, for the complete correspondence between HS02

and SITC Rev.3 736 of 1033 subgroups had been subdivided in 2,824 basic items leaving the SITC Rev.3 with a total of 3,121 basic items (1,033+2,824-736) for the purpose of correspondence.

Below, we present the titles of the wider categories of the SITC Rev.4 in table 17.

Table 17
Structure of the SITC

Section	Description
0	Food and live animals.
1	Beverages and tobacco.
2	Crude materials, inedible, except fuels.
3	Mineral fuels, lubricants and related materials.
4	Animal and vegetable oils, fats and waxes.
5	Chemicals and related products, n.e.s.
6	Manufactured goods classified chiefly by material.
7	Machinery and transport equipment.
8	Miscellaneous manufactured articles.

Source: Own compilation based on UNSD (2006a).

2. International Standard Industrial Classification of all economic activities (ISIC)

The original version of this classification dates back to 1948 and is used in national and international levels to classify data by type of economic activity in statistics on population, production, employment, national income and others. A great number of countries have adopted it as the base for the elaboration of their national classification of economic activities. Various specialized agencies of the UN have also used it in their studies and publications, among others the United Nations Industrial Development Organization, the International Labour Organization, the Food and Agricultural Organization of the UN, and the United Nations Educational, Scientific and Cultural Organization (UNESCO), as well as other international organizations.

It is the purpose of ISIC to establish a standardized classification of all productive economic activities, offering a set of categories of activities that can be used for the collection and presentation of statistics according to these activities. Consequently, this set of categories is presented in a way that the entities can be classified by the economic activities that they perform.

ISIC is a classification by type of economic activity and not of goods and services. It is not possible to establish a biunivocal correspondence between activities and products. Therefore, ISIC does not allow the measurement of production with any degree of detail.

UNSC has been responsible for maintaining and revising this classification since its origin. In 1958 was the first revision, in 1968 the second, in 1990 its third, in 2002 the revision 3.1, and in 2008 followed the most up-to-date revision 4, compare UNSD (1948, 1958, 1968, 1990, 2002, 2008).

The need for a harmonization with other classifications, for activities as well as goods and services, has led the ISIC Rev.3.1 to differ from its previous versions. Its development was more complex and the restrictions have been greater. With this respect, it incorporates new judgment elements, product of its application and where possible, it took into account the distinction that is made in the systems of national accounting between its material and immaterial sphere.

The ISIC Rev.3.1 incorporates of codes and titles assigned to its divisions that differ from those of the Rev.2. However, the general structure was not object of large changes. The inclusion of more detailed information made it more flexible to harmonize its statistics between countries as well

as to use it at the national and regional level. In this context, the highest degree of disaggregation is mainly focused on service activities.

The ISIC Rev.3.1 maintained its coding system of four digits and the principle that the two-digit level is appropriate to classify companies and similar units while the four digits are used to identify units and institutions according to the class of corresponding activity. Although in some cases the categories and levels do not differ to that in the Rev.2 with respect to changes in their titles (only maintaining that of "Division" in the two-digit category), this revision makes it more harmonious to categories of other classifications of the UN like the SITC and the Central Product Classification (CPC). The Rev.4 of the ISIC has therefore been necessary in order to maintain the correspondence to SITC Rev.4 and CPC Version 2.

The new tabulation structure since its Rev.3 is formed by "Sections" represented by one letter, "Divisions" indicated by the first two digits, "Groups" indicated by the first three digits and the "Class" represented by the fourth and last digit. In total, the ISIC Rev.4 consists of 21 sections, 88 divisions, 238 groups and 419 classes.

Because it would be too lengthy to describe all the titles of the levels of the ISIC Rev.4, we compromise the 21 "Tabulation Categories" (Sections) below in table 18.

Table 18
Structure of the ISIC

Section	Description
A	Agriculture, forestry and fishing.
B	Mining and quarrying.
C	Manufacturing.
D	Electricity, gas, steam and air conditioning supply.
E	Water supply; sewerage, waste management, and remediation activities.
F	Construction.
G	Wholesale and retail trade; repair of motor vehicles and motorcycles.
H	Transportation and storage.
I	Accommodation and food service activities.
J	Information and communication.
K	Financial and insurance activities.
L	Real estate activities.
M	Professional, scientific and technical activities.
N	Administrative and support activities.
O	Public administration and defense; compulsory social security.
P	Education.
Q	Human health and social work activities.
R	Arts, entertainment and recreation.
S	Other service activities
T	Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use.
U	Activities of extraterritorial organizations and bodies.

Source: Own compilation based on UNSD (2008).

3. Classification by economic use or destination

The Classification by Economic Use or Destination (Span. Clasificación según Uso o Destino Económico, CUODE) of ECLAC came to meet the need of using an aggregation in the foreign trade statistics whose structure facilitates the economical analysis of international trade flows before and after the 1960s. In fact, it allows investigating the possibilities of imports substitution in Latin America. For this purpose, a classification of 10 groups primarily based on the use and economic destination is used. The ten groups that shape this scheme initially were as presented in table 19.

Table 19
Initial structure of the CUODE

Number	Main Group	Subgroup
1	Consumer goods	Durables
2	Consumer goods	Non-durables
3	Raw materials and intermediate goods	Metals
4	Raw materials and intermediate goods	Non-metals
5	Fuels and lubricants	-
6	Capital goods	For construction
7	Capital goods	For agriculture
8	Capital goods	For industry
9	Transport material	-
10	Others (not classified)	-

Source: Own compilation based on ECLAC (1965).

This classification was applied with limitations by ECLAC, mainly due to comparison issues between national foreign trade. In the 1960s, not all countries of the region used the SITC for their economic analyses, which complicated the collection of the data in these categories. This requested a classification independent of the national data to obtain groups of classification by economic use or destination.

Thanks to the efforts of the Latin American Free Trade Association, its member countries compiled their foreign trade data based on the updated BTN. That way, it was possible to obtain the aggregation of these data in the Revised SITC through mechanized procedures.

This new possibility of obtaining information about the foreign trade by the guidelines of SITC Rev.1 led the Statistics Division (formerly Statistics and Quantitative Analysis Division) of ECLAC to undertake a review of the CUODE. The advantages of the practical and methodological orders that the adoption of the SITC Rev.1 contributed as a basis for defining each group of that classification were decisive. It could also make the data comparable across countries because each group of the CUODE could be broken down into the level of chapters, groups, subgroups, or headings of the SITC Rev.1.

Another important contribution that came with the adoption of the SITC Rev.1 as a basis for the classification was that it allowed the restructuring of the 10 group classification. Next to maintaining the criterion of economic use or destination of commodities, the processing stage of those could be integrated.

The new structure of the CUODE is organized in three-digit keys. The first digit determines the classification group by economic use or destination, the second digit the subgroup, and the third digit the stage of processing.

Each product is examined by its use or economic function based on the nature and final position in the production process. Those products that have more than one use are classified taking into account its most frequent or most likely use. By these criteria, the new CUODE takes a structure as shown in table 20.

Table 20
New structure of the CUODE

Number	Main Group	Subgroup
1	Consumer goods	Non-durable
		Durable
2	Raw materials and intermediate goods	For agriculture
2	Raw materials and intermediate goods	For industry
2	By stage of processing:	Primary products
2	By stage of processing:	Semi-finished products
2	By stage of processing:	Intermediate products
2	By stage of processing:	Waste
3	Capital Goods	Construction materials
3	Capital Goods	Capital goods for agriculture
3	Capital Goods	Capital goods for industry
3	Capital Goods	Transport equipment
4	Various	

Source: Own compilation (ECLAC intern).

CUODE reports in its annex all cases of the SITC Rev.1 headings that have multiple uses, i.e. those that have been subdivided to be classified by CUODE and the headings that include multiple products.

ECLAC did not continue to update and use this classification for its very regional character and its limited purpose. When the Commission started to give more importance to studies on exports, especially to analyze the exports of manufactured goods, it became evident that its application was not the most adequate one. At present, ECLAC uses the classifications of comprehensive coverage elaborated under the guidance of the United Nations Statistical Commission (UNSC), mainly SITC, the Classification by Broad Economic Activities (BEC) (similar to the CUODE for classifying products taking into account their final use and stage of processing), ISIC, and CPC. All of these have in common that they are the most used by the countries and national as well as international institutions within the organization of data and subsequent analyses. Additionally, the HS of the WCO is used.

4. Classification by Broad Economic Categories (BEC)

UNSC and UNSD were given the task to develop a classification that would satisfy the need of international trade statistics analyzed by ample economic categories. This classification should distinguish between food, industrial supplies, capital goods, and durable and non-durable consumer goods to complement the data already summarized by the SITC sections.

In 1971 the original Classification by Broad Economic Categories (BEC) was published, based on the SITC Rev.1 structure. Later on, in 1976 its first revision was published based on the SITC Rev.2 and its second revision in 1986 based on SITC Rev.3. In 1998, its third revision was published that incorporates more details on the categories 41* and 62* of the BEC formerly excluded due to the omission of a page in the second revision. Finally, BEC Revision 4 was published in 2003 corresponding to SITC Rev.3.

The BEC Rev.4 as its previous versions maintains the same structure and purposes. It counts 7 basic categories, each of those defined with direct reference to the chapters, groups, subgroups and basic items of SITC Rev.3, i.e. each category constitutes a rearrangement and an aggregation of the basic items of SITC taking into account the main final uses of the products that cover each basic item. This is underlined by the fact that each SITC basic item is exactly mapped in one of the BEC.

In addition to distinguishing the five categories already described above, this classification creates separate categories for “Fuels and lubricants” and “Transport equipment” establishing at the same time special subcategories for “Gasoline” and “Passenger motor cars”. As regards “Capital

goods", it distinguishes between equipment as such, the pieces, and accessories. As regards "Food and beverages", "Industrial supplies not elsewhere specified", and "Fuels and Lubricants", it distinguishes between "primary" items and "processed" items. Within the categories "Primary food and drinks", "Processed food and drinks", and "Transport equipment", it incorporates a distinction between industrial products and articles for household consumption.

An equally important purpose of this classification is serving as a measure for collecting the foreign trade data by SITC in categories of final use that were utilized in the scope of the System of National Accounting (SNA), specifically the three basic classes of the SNA: capital goods, intermediate goods, and consumer goods. To do this, the subcategories of the BEC can be aggregated to obtain a close approximation of the three basic classes of the SNA. Theses summaries allow studying the foreign trade statistics, for example, together with national and industrial accounts to realize economic analyses at the national, regional, or global level.

The 10 basic categories of the BEC are those that have no subdivisions, for example the 111* and 31*. The codes of this classification are indicated with a star (*) to avoid possible confusions with those of the SITC. The basic categories according to BEC Rev.4 are those presented in table 21.

Table 21
Structure of the BEC

Number	Main Group	Subgroup	Specification
111*	Food and beverages	Primary	Mainly for industry
112*	Food and beverages	Primary	Mainly for household consumption
121*	Food and beverages	Processed	Mainly for industry
122*	Food and beverages	Processed	Mainly for household consumption
21*	Industrial supplies not elsewhere specified	Primary	-
22*	Industrial supplies not elsewhere specified	Processed	-
31*	Fuels and lubricants	Primary	-
321*	Fuels and lubricants	Processed	Motor spirit
322*	Fuels and lubricants	Processed	Other
41*	Capital goods (except transport equipment), and parts and accessories thereof	Capital goods (except transport equipment)	-
42*	Capital goods (except transport equipment), and parts and accessories thereof	Parts and accessories	-
51*	Transport equipment and parts and accessories thereof	Passenger motor cars	-
521*	Transport equipment and parts and accessories thereof	Other	Industrial
522*	Transport equipment and parts and accessories thereof	Other	Non-industrial
53*	Transport equipment and parts and accessories thereof	Parts and accessories	-
61*	Consumer goods not elsewhere specified	Durable	-
62*	Consumer goods not elsewhere specified	Semi-durable	-
63*	Consumer goods not elsewhere specified	Non-durable	-
7*	* Goods not elsewhere specified	-	-

Source: Own compilation based on UNSD (2003).

5. Central Product Classification (CPC)

The CPC was provisionally approved by the UNSC in 1989. With its provisional character, it was sought to gain experience and gather comments through its application, all which should provide the base for any subsequent revision.

In 1991 the provisional CPC was published where the experience of the national and international users provided an appropriate basis for its revision. The experience acquired within the development of the Statistical Classification of Products by Activity of the European Union was also taken into account (EEC, 1993).

In 1998, the provisional CPC was revised, updated, and completed and submitted for approval through the UNSD under the name CPC Version 1.0. In this version, particular attention was paid to the part corresponding to the services. The result guaranteed that the structure of the CPC corresponded adequately to the new technologies and the rise of the service sector in the economy. The transportable goods in the provisional CPC and in the SITC Rev.3 were revised in accordance with the 1996 version of the HS.

In 2002, the CPC Ver.1.0 was actualized giving origin to the Ver.1.1 that was published to be used in 2006 (UNSD, 2006b). This new revision took into account the work of a technical group created by the Expert Group on International Economic and Social Classifications of the UNSC and the collaboration of a large number of international countries and organizations. In this sense, it incorporated all changes that appeared since its official application in 1998 until the modifications done in SITC Rev.3 in accordance with the 2002 edition of the HS. These changes and the necessary changes to correspond with the SITC Rev.3.1 have been integrated in the Ver.1.1 in its sections 0 to 4. In 2008, the Version 2 of the CPC was published and presents a correspondence to the new HS 2007 and the SITC Rev.4. Finally, CPC Ver.2.1 has been released in 2015.

The purpose of CPC is very broad although it is treated as a central standardized product classification. It satisfies needs of detailed information referring to statistics about production, consumption, prices, foreign trade, flows of goods, inventories or balances, accumulation of capital, and others. Moreover, it contains information needed to prepare input-output tables and the balance of payments (BOP). It was also designed to achieve an improved harmonization between the subsectors of economic statistics and those related and, additionally, to increase the usefulness of the national accounts and balances as instruments of coordinating economic statistics.

The CPC includes categories corresponding to all the articles that can be traded on a national or international level or can be stored. It covers not only the goods and services derived from an economic activity, but also buying and selling of land or analogous transactions as well as those that stem from juristic contracts (patents, licenses, copyrights, among others). Consequently, it encompasses transportable and non-transportable goods, services as well as tangible and intangible assets. Although these assets are neither considered as goods nor as services in the SNA, they are included as they are object to numerous trade activities, at national and international level and are of great interest to many users.

In short, the CPC provides a framework for the comparison of statistics on goods, services, and assets across countries. It also works as a reference for the countries that develop a product classification for the first time or decide to review their current information system to become compatible with international norms.

The CPC that contains all the goods and services is a comprehensive system of categories and also mutually exclusive. In most of the case, the CPC classifies products in categories based on their physical properties, their inherent nature and their industrial source.

The relationship between the CPC and the HS is very narrow, because it completely utilizes the HS to form its first five sections (0 to 4). In other words, each subclass of the sections 0 to 4 of the CPC —which correspond to the transportable goods— has as unit elements the headings and subheadings of the HS, i.e. each subclass is an aggregate of one or more headings of the HS.

As regards the link between the CPC and the ISIC, this is not a biunivocal relation in all cases. The CPC gives more importance to the nature of the product and if possible incorporates the industrial origin already determined by the HS in the majority of the cases. Thus, it may happen that a group in a subclass of primary goods and services produced by a particular industry includes products of different industrial origin and therefore the correspondence is not fully given.

There are cases where the HS cannot consider the criterion of industrial origin because the goods and services are produced in a way that it is impossible to determine their origin from the products and therefore no distinction is made.

The structure of the CPC follows a decimal system. It consists of Sections (one digit), Divisions (dos digits), Groups (three digits), Classes (four digits), and Subclasses (five digits).

The CPC Ver.2.1 is constituted by 10 sections, 68 divisions, 358 groups, 1,385 classes, and 2,957 subclasses. With respect to the Ver. 1.1, the most significant changes occurred in the Sections 0, 2, and 7, where the details of the headings where significantly increased. Furthermore, construction was reintroduced in Section 5, the transport services were regrouped in Section 6, computing products were added to Section 4, and the degree of details was increased in Section 8 and 9. Its broadest categories (Sections) are listed below in table 22 to show the structure of the CPC.

Table 22
Structure of the CPC

Section	Description
0	Agriculture, forestry and fishery products.
1	Ores and minerals; electricity, gas and water.
2	Food products, beverages, tobacco; textiles, apparel and leather products.
3	Other transportable goods, except metal products, machinery and equipment.
4	Metal products, machinery and equipment.
5	Constructions and construction services.
6	Distributive trade services; accommodation, food and beverage serving services; transport services; and electricity, gas and water distribution services.
7	Financial and related services; real estate services; and rental and leasing services.
8	Business and production services.
9	Community, social and personal services.

Source: Own compilation based on UNSD (2015).

The CPC Ver.2.1 like its previous versions contains Rules of interpretation and explanatory notes to resolve situations where it is unclear which of the two or more classification categories corresponds to a given product or service, e.g. to determine whether a product of a considered transaction involves transportable goods or products different from transportable goods.

The non-transportable goods (mainly services) in the categories of the sections 5 to 9 of the CPC Ver.2.1 will be classified in accordance with the terms of the categories as described in the divisions, groups, classes, or subclasses. When the services are classifiable in two or more categories in the first place, the classification shall be realized considering that the categories are only comparable within the same level (sections, division, groups, classes, or subclasses).

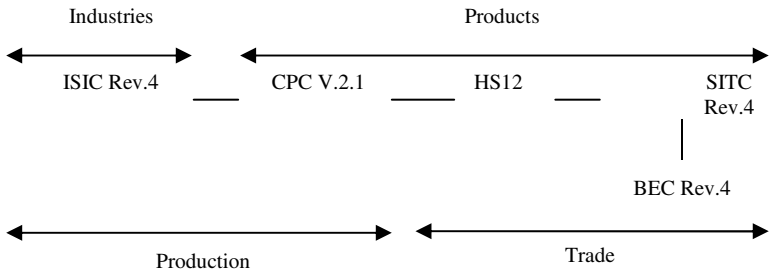
C. Concordance between the described classifications

The international classifications described in the previous parts are all linked to foreign trade transactions, even if each of them has a different purpose.

In brief, the HS aims to classify goods according to the raw materials and the stage of processing. It is mainly used by the countries as a base for developing the tariff or customs classification of goods. Although the SITC contains the purposes of the HS classification as part of its own classification criteria, it differs in its application as it is a statistical classification for the economic analysis of all transportable goods that are traded internationally. The BEC allows compiling foreign trade statistics by ample product categories for different purposes. The CPC was created to classify alls goods, services, and assets in an economy. The ISIC aims to classify the goods and services by the economic activities where they stem from.

The concordance between these classifications is given as follows: the SITC and the CPC are two different forms of regrouping all the categories of the HS. At the same time, they respond to different aggregation levels of the ISIC since in a single category of goods and services they bring together the commonly produced goods of a single industry. In contrast, the BCE regroups the items of the SITC by determining its broad categories. From a schematic point of view, these relations can be presented with distinct pivot classifiers. Mostly, the HS and SITC are used for this purpose.

Scheme 6
Correlations of trade classifications



Source: Own compilation.

Whenever we want to establish this type of correspondence, we must use the revisions or versions, respectively, which are linked to each other. For example the HS12 is linked with the SITC Rev.4, which will lead to a new revision of the BEC (Rev.4). The HS12 in turn entails a new version of the CPC. Likewise, the new CPC Ver.2.1 and the SITC Rev.4 entail the new revision of ISIC (Rev.4).

D. Some specific classifications

1. The classification by Pavitt (1984)

Pavitt (1984) proposed a classification with the aim to create large groups of industries taking into account the different channels through which the companies of each group of sectors acquire and develop their technologies. Using this approach he managed to overcome the limitations of the classification of the OECD, which does not include important existing differences between several industrial sectors with respect to the different ways new means of technology are produced and disclosed.

In this classification, the technological capabilities of companies and countries are not only determined by their expenditures on Research and Development (R&D) or the acquisition of patents, but also by inter-industrial linkage and the corresponding interdependent technology. Grouping the industries in four broad groups is described as below:

The first group consists of those industries dominated by suppliers, including those whose innovation processes come from other sectors through the purchase of materials and capital goods. In this group fall the sectors of industrial textile, garment, leather, footwear, and ceramics.

To the second group belong the scale-intensive industries. These are highly capital-intensive oligopolistic industries with large economies of scale and high technical and business complexity. In this group, we can find automobiles, electronic consumer goods, durable consumer goods, rubber products, and the steel industries.

The third group includes the industries of specialized suppliers that are characterized by their high diversification and the remarkable innovation capacity. This group is mainly formed by the capital goods industries, for example service machineries.

The fourth and last group of this classification is based on science. It distinguishes itself by its high investment in R&D and the development of technologies that benefits all activities. Among these industries are fine chemicals, electronics, telecommunication, and the aerospace sector.

To obtain a complete picture of all the economic sectors, ECLAC followed Ferraz, Kupfer and Hagenauer (1996b) and further split the first group that includes all raw materials, e.g. agriculture as well as mining and energy. Moreover, four main product groups were identified, all based on the SITC, Rev.1. Table 23 presents in detail the concordances of this classification that is regularly used by the International Trade and Integration Division of ECLAC.

Table 23
Classification of trade by consumption destination

Category	Examples of Products	Consumption Destination	SITC, Rev.1
A. Primary goods 1. Agricultural 2. Mining 3. Energetical	Fish, vegetable, fruit, wood, wool, minerals, petroleum	Final or intermediate	Agricultural: 001, 025, 031, 041, 0421, 043, 044, 045, 051, 054, 0711, 0721, 074, 075, 121, 211, 212, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2311, 241, 242, 244, 261, 2621, 2622, 2623, 2625, 2631, 264, 265, 2711, 291, 292. Mining: 2712, 2713, 2714, 273, 274, 275, 276, 281, 283, 285, 286. Energy: 321, 331, 341.
B. Industrial goods 1. Traditionals a) Food, beverages, and tobacco b) Other traditionals	Dairy, oils, sugar, textiles, tools, furniture, footwear, prints, leather	Final	Food, beverages, and tobacco: 011, 012, 013, 022, 023, 024, 032, 0422, 046, 047, 048, 052, 053, 055, 061, 062, 0713, 0722, 0723, 073, 081, 091, 099, 111, 112, 122, 2219, 411, 422, 431. Other traditional: 2313, 2314, 243, 2511, 2626, 2627, 2628, 2629, 2632, 2633, 2634, 267, 551, 611, 612, 613, 621, 631, 632, 633, 642, 6511, 6512, 6513, 6514, 6515, 6518, 6519, 652, 653, 654, 655, 656, 657, 662, 663, 665, 666, 667, 691, 692, 693, 694, 695, 696, 697, 698, 733, 812, 821, 831, 841, 842, 851, 892, 893, 894, 895, 897, 899.
2. Goods with high economics of scale and high intensity of natural resources	Petrochemical, paper, pulp, cement, basic metals (industrial commodities)	Intermediate	Goods with high economies of scale and high intensity of natural resources: 2312, 2512, 2515, 2516, 2517, 2518, 2519, 266, 282, 284, 332, 421, 512, 513, 514, 515, 521, 531, 532, 533, 554, 561, 571, 5811, 5812, 5813, 5819, 599, 629, 641, 6516, 6517, 661, 664, 671, 672, 673, 674, 675, 676, 677, 678, 679, 681, 682, 683, 684, 685, 686, 687, 688, 689.
3. Durable goods	Household appliances, consumer electronics, vehicles	Final or intermediate	Durable goods: 7241, 7242, 725, 731, 732, 735, 891.
4. Goods as sources of technical progress	Machines, instruments, fine chemicals	Capital good or intermediate	Goods as sources of technical progress: 541, 553, 7111, 7112, 7113, 7114, 7115, 7116, 7117, 7118, 712, 7141, 7142, 7143, 7149, 715, 717, 718, 719, 722, 723, 7249, 726, 729, 734, 861, 862, 864, 9510.

Source: Own compilation based on ECLAC (1992), Ferraz, Kupfer and Hagenauer (1996a, 1996b), and Guerrieri and Milana (1990).

2. Classification by technological intensity

This classification was developed by ECLAC following the work of Lall (2000) with the purpose of determining the technological intensity in the manufacturing exports of the developing countries, which is an indicator of quality as well as of quantity, and distribution. The classification is a combination of that of Pavitt (1984) and of the OECD (1994). In contrast to Lall (2000), ECLAC includes the groups 681 to 687 in the category manufacturing based on natural resources and not on primary products. In turn, the groups 281, 286, 287, and 289 were changed to belong to the primary products.

The classification is structured using the levels of the groups of the SITC at a three-digit level. It is defined through the categories as summarized in table 24 (using SITC Rev.2).

Table 24
Structure of the classification by technological intensity

Group	Examples
Primary products	Fresh fruits, meat, rice, cocoa, tea, coffee, timber, coal, crude oil, gas, concentrated minerals, and scrap
Manufacturing based on natural resources	Products based on agriculture/forest
	Prepared fruits and meat, beverages, wood products, vegetable oils
	Other products based on natural resources
	Basic metals (except steel), petroleum derivatives, cement, precious stones, glass
Manufacturing with low technology	Textiles/fashion cluster (clothing, fashion, and design)
	Textiles, clothing, footwear, leather products, luggage
	Others with low technology
	Ceramics, simple metal structures, furniture, jewelry, toys, plastic products
Manufacturing with medium technology	Automotive products
	Passenger vehicles and parts thereof, commercial vehicles, motorcycles and parts thereof
	Industrial processes with medium technology
	Synthetic fibers, chemicals and paints, fertilizers, plastics, iron and steel, pipes and tubes
	Industrial engineering with medium technology
	Machinery and engines, industrial machines, pumps, boats, electrical equipment for the splicing, cutting, protection, or connection of electrical circuits, watches
Manufacturing with high technology	Electrical and electronic products
	Office/data processing/telecommunication equipment, television sets, transistors, turbines, power equipment
	Other with high technology
	Pharmaceutics, aerospace, optical/precision instruments, cameras

Source: Own compilation.

This classification excludes electric current, films, prints, special transactions, gold, art works, coins, and animals (pets). Table 25 presents in detail the main groups by SITC Rev. 2 that correspond to the various subgroups as identified above. The mapping is complete and like the previous classification, it is used in the Interactive Graphic System of International Economic Trends (SIGCI Plus) provided by the International Trade and Integration Division of ECLAC.[3]

Continuously, ECLAC is making adjustments to update this classification in order to achieve compatibility with the latest SITC Revision.

3 The database is avalable at: *www.cepal.org/comercio/ecdata2/.*

Table 25
Classification of trade by incorporated technological intensity

Category	Examples of products	SITC, Rev.2
A. Primary goods	Fresh fruits, meat, rice, cocoa, tea, coffee, timber, coal, crude oil, gas, concentrated minerals, and scrap.	001, 011, 022, 025, 034, 036, 041, 042, 043, 044, 045, 054, 057, 071, 072, 074, 075, 081, 091, 121, 211, 212, 222, 223, 232, 244, 245, 246, 261, 263, 268, 271, 273, 274, 277, 278, 281, 286, 287, 289, 291, 292, 322, 333, 341.
B. Industrial goods		
- Manufacturing based on natural resources	Prepared fruit and meat, beverages, wood products, vegetable oils.	a) Agriculture/forestry 012, 014, 023, 024, 035, 037, 046, 047, 048, 056, 058, 061, 062, 073, 098, 111, 112, 122, 233, 247, 248, 251, 264, 265, 269, 423, 424, 431, 621, 625, 628, 633, 634, 635, 641.
	Basic metals (except steel), petroleum derivatives, cement, precious stones, glass	b) Other products based on natural resources 282, 288, 323, 334, 335, 411, 511, 514, 515, 516, 522, 523, 531, 532, 551, 592, 661, 662, 663, 664, 667, 681, 682, 683, 684, 685, 686, 687, 688, 689.
- Manufacturing with low technology	Textiles, clothing, footwear, leather products, luggage	a) Grouping of textile and fashion 611, 612, 613, 651, 652, 654, 655, 656, 657, 658, 659, 831, 842, 843, 844, 845, 846, 847, 848, 851.
	Ceramics, simple metal structures, furniture, jewelry, toys, plastic products	b) Other products of low technology 642, 665, 666, 673, 674, 675, 676, 677, 679, 691, 692, 693, 694, 695, 696, 697, 699, 821, 893, 894, 895, 897, 898, 899.
- Manufacturing with medium technology	Passenger vehicles and parts thereof, commercial vehicles, motorcycles and parts thereof	a) Automotive products 781, 782, 783, 784, 785.
	Synthetic fibers, chemicals and paints, fertilizers, plastics, iron and steel, pipes and tubes	b) Processing industries with medium technology 266, 267, 512, 513, 533, 553, 554, 562, 572, 582, 583, 584, 585, 591, 598, 653, 671, 672, 678, 786, 791, 882.
	Machinery and engines, industrial machines, pumps, boats, watches	c) Engineering industries with medium technology 711, 713, 714, 721, 722, 723, 724, 725, 726, 727, 728, 736, 737, 741, 742, 743, 744, 745, 749, 762, 763, 772, 773, 775, 793, 812, 872, 873, 884, 885, 951.
- Manufacturing with high technology	Office/data processing/ telecommunication equipment, television sets, transistors, turbines, power equipment	a) Electrical and electronical products 716, 718, 751, 752, 759, 761, 764, 771, 774, 776, 778.
	Pharmaceutics, aerospace, optical/precision instruments, cameras	b) Other products with high technology 524, 541, 712, 792, 871, 874, 881.
C. Other transactions		
	Electricity, films, prints, special transactions, gold, coins, animals (pets, art works.	351, 883, 892, 896, 911, 931, 941, 961, 971.

Source: Developed by ECLAC.

3. Classification of information and communication technologies

In the field of manufacturing exports, a subsector that has experienced great dynamism in global trade is the one of information and communication technologies (ICT). It has reached such a level that the U.S. Department of Commerce and the OECD have defined categories for its classification. Based on this classification, the Japan External Trade Organization has created its own Classification of Information and Communication Technologies (JETRO, 2001; Kuwayama and Durán Lima, 2003).

This is a specific classification that defines its eight ICT product groups taking the headings and subheadings of the HS96 as a base (see Table 26).

Table 26
Classification of information and communication technologies

ICT groups[a]	Headings (4) and Subheadings (6) of the HS96
1 Computers and peripherals	8471, 8473
2 Office equipment	8469, 8470, 9009
3 Communication equipment	8517, 852510, 852520, 8526
4 Semiconductors and other electrical parts	8540, 8541, 8542
5 Electrical components (miscellaneous)	8504, 8518, 8522, 8523, 8529, 8532, 8533, 8534, 8535, 8536
6 Video equipment	8521, 852530, 852540, 8528, 9006
7 Audio equipment	8519, 8520
8 Measuring equipment	8543, 9014, 9015, 9024, 9025, 9026, 9027, 9030, 9031, 9032

Source: Own compilation.
[a] The ICT subsector excludes those machinery that could contain many ICT components as inputs, e.g. machinery of general uses, transport, and precision equipment.

4. Classification for environmentally sensitive industries

Several decades ago, the international community was concerned about the occurring changes in the environment due to the worldwide production and marketing of goods. Thus, various studies were undertaken by specialists such as Schaper (2000) and Murillo (2007) to analyze the impact of certain industrial sectors on pollution in countries where the measures for protecting the environment had not yet been developed sufficiently.

The classification of environmentally sensitive industries (ESI) developed by Low and Yeats (1992) is based on the criterion of increased spending on the reduction and control of the contamination per unit of production. To determine more precisely which industries fall within this criterion, they used the following condition: only those industries that incurred expenses of this type greater than 1% of the total sales were considered (as a reference they used US data from 1988). The identification of the ESI was done using the SITC on its three-digit group level. It could thereby determined that 40 industries met the condition and could be aggregated into five sectors of ESI or dirty sectors: those of "Iron and steel", those of "Non-ferrous base metals", those of "Industrial chemicals", those of "Pulp and paper", and those of "Non-metallic minerals". These industries are in capital-intensive sectors with high intensity of energy and land use. Below in Table 27, we present the scheme of this classification and further elements associated with its production, such as the intensity of use of natural resources, skilled labor, product development, use of production factors, and technical level.

Table 27
Environmentally sensivitve industries

SITC Rev.1	Description	RES	SK	PD	FI	Technical level
251	Pulp and waste paper	R				
332	Petroleum products	R				M
512	Organic chemicals	R				
513	Inorganic chemicals	R				
514	Other inorganic chemicals	R				
515	Radioactive materials	R				
521	Mineral tar	R				
561	Manufactured fertilizers	R				
599	Insecticides, fungicides, etc.		H	L	C	M
631	Veneers and plywood	R				L
632	Wood manufactures, n.e.s.	R				L
641	Paper and paperboard	R				L
642	Articles of pulp, paper and paperboard	R				L
661	Lime, cement, and other building materials		L	L	C	L
671	Pig-iron		L	H	C	L
672	Ingots of iron or steel		L	L	C	L
673	Iron or steel bars		L	H	C	L
674	Iron or steel plates		L	H	C	L
675	Iron or steel strips		L	H	C	L
676	Iron or steel rails		L	H	C	L
677	Wire of iron or steel		L	L	C	L
678	Pipes of iron or steel		L	H	C	L
679	Parts of molding or forging iron or steel, without work		L	L	C	L
681	Silver and platinum	R				L
682	Copper	R				L
683	Nickel	R				L
684	Aluminum	R				L
685	Lead	R				L
686	Zinc	R				L
687	Tin	R				L
688	Uranium					
689	Non-ferrous base metals	R				L
691	Finished structural parts		H	H		L
692	Metal container for transport		H	L		L
693	Wire products and related		H	L	L	L
694	Nails, bolts, nuts, etc.		H	L	C	L
695	Tools		L	L	C	L
696	Cutlery		L	L	L	L
697	Household equipment		H	L	L	L
698	Manufactures of base metal, n.e.s.		H			L

Source: Adapted from Low and Yeats (1992).
Notes: RES: Industries based on natural resources (indicated by an R); SK: Number of employed persons with high qualifications (skill): L (low) or H (high); PD: Product development: L (low) or H (high): FI: Intensity of use of production factors: C (capital-intensive) or L (labor-intensive). Moreover the activities are differentiated according to their technical level, which is determined by the effort invested in R&D: L (low level of R&D expenses), M (medium level of R&D expenses) or H (high level of R&D expenses).

5. Classification of Environmental Goods (EG)

The Environmental Goods (EG) correspond to a concept under negotiation in the WTO and are defined as those goods or chemicals used in the provision of environmental services (Class A) or the

industrial or consumption goods whose protection, final use, or disposal have a positive relative impact on a substitute good (Class B).

There are many proposals on what should be classified as an "environmental good" and consequently receive a special treatment as regards trade barriers. In the past, the negotiations were about the lists proposed by the Asia-Pacific Economic Cooperation (APEC) and the OECD, which are called "Friends of Environmental Goods" ("friends-153 list"), the proposal of the World Bank ("WB43") as well as other proposals by individual countries. As can be seen in table 28, the different classifications yield different results with respect to their impact on trade. For more details about the classifications, we refer to the work of LaFleur (2011) and the summary presented in table 28.

Table 28
Proposals for environmental goods and impact on trade, 2009

Region/list	Trade *($ million)*	Precentage of total trade	Percentage of manufacturing trade[a]
Exports to the world			
Friends 153	728.3	6.04	8.87
APEC	435.0	3.61	5.30
OECD	491.6	4.08	5.99
WB43	181.8	1.51	2.21
WTO-Allb	2 719.8	22.56	33.12
Exports of the LAC (33)			
Friends 153	23.6	3.49	8.24
APEC	13.2	1.95	4.60
OECD	19.0	2.81	6.64
WB43	6.4	0.95	2.23
WTO-All[b]	135.0	19.94	47.06

Source: Reproduced from LaFleur (2011).
[a] SITC Rev.3, codes 5+6+7+8-667-68.
[b] "WTO-All" is the sum of all proposed lists that were under discussion at the WTO.

In 2012, APEC Member States have agreed on their list of 54 goods (HS, 6 digits) to be classified as EG and therefore have decided to reduce tariffs to 5% or less for these goods by the end of 2015. Next to that, negotiations of 17 WTO members like the European Union, the United States, or China started in mid-2014 and will build upon that list to conclude a plurilateral Economic Goods Agreement that is aimed to eventually result in a WTO agreement. After the eleventh round of negotiations in December 2015, participating parties announced that they would continue efforts by reconvening in early 2016.

VI. Basic indicators of trade pattern

The main data of foreign trade correspond to the components of the current account, namely the exports and imports of goods and services. The basic indicators are widely known and define a profound measure of a country's (or more generally speaking an economy's) level of internationalization. In this section, we will analyze the definitions and use of these key trade indicators.

A. Export value of goods and services

The exports correspond to the set of goods and services that are sold from residents of one economy to residents of another economy. In other words, they correspond to the proportion of domestic production that is not consumed within the economy or stored, but sold abroad. The analysis of export is important at least in three dimensions (i) the structure, (ii) the evolution (or dynamics), and (iii) its record and measurement.

Regarding the composition of exports, it is necessary to note that the type of products included in the majority of the export structure of goods will determine the trade pattern of that country. Thus, the prevalence of natural resources in the total exports of goods hints on large advantages in that category. The same holds for the trade in services, which are more or less complementary indicators to the trade in goods and allow a broad view on the real effect of globalization on production patterns in a more and more intertwined world.

Moreover, the evolution of exports in goods and services identified by the annual variation or the average rate of growth in a given period is indicative for the contribution of exports to GDP growth. Recently, we observe that more studies try to analyze the determinants of the evolution of global trade in services.

As regards the record and measurement export activities, it can be noted that for the case of goods, the customs prepare a list of products and their individual characteristics. In the case of services, one can follow the guidelines defined in the Balance of Payments Manual (most recent version BPM6 of 2013) and/or Quarterly National Accounts Manual, both drafted by the IMF, as well as in the Manual on Statistics of International Trade in Services (most recent version MSITS 2010, revised in 2013) which is a joint publication of UNSD, the Statistical Office of the European Union, IMF, OECD, UNCTAD, World Tourism Organization, and WTO; see also Durán Lima and Alvarez (2013).

Additionally, a combination of all of these three dimensions in the long term can help to understand to a certain degree the evolution of the development strategy of the country at hand. Obviously, this comes along with the utilization of other indicators that require the disaggregation of basic export data at the product and destination level. This in turn will be discussed in the second section of this chapter.

Although it has already been pointed out, the reader is reminded that exports may be goods and/or services with the goods being tangible items that occupy physical space in an international mean of transport (truck, train, ship, or plane) passing through the customs. The services are by their nature "intangible" and so their tradability is not discussed. Thus, the MSITS adds to the definition of international trade in services the value of those services provided through subsidiaries abroad. Moreover, it includes the services provided by persons staying abroad, either as service providers or as employees of suppliers.

Section C presents some considerations about the statistics in services which are a bit more complicated to systematize and to measure according to its special treatment, compared to the trade in goods that is easier to record as the objects pass the customs.

B. Import value of goods and services

The concept of imports is exactly opposite to that of exports, i.e. it is the set of all goods and services bought by the residents of an economy from residents of another. If exports measure the share of domestic production that is consumed outside of a country, the imports evaluate the proportion of domestic consumption of goods that is not produced inside the country. Again, we stress here the importance of all dimensions of such an indicator like structure and dynamics.

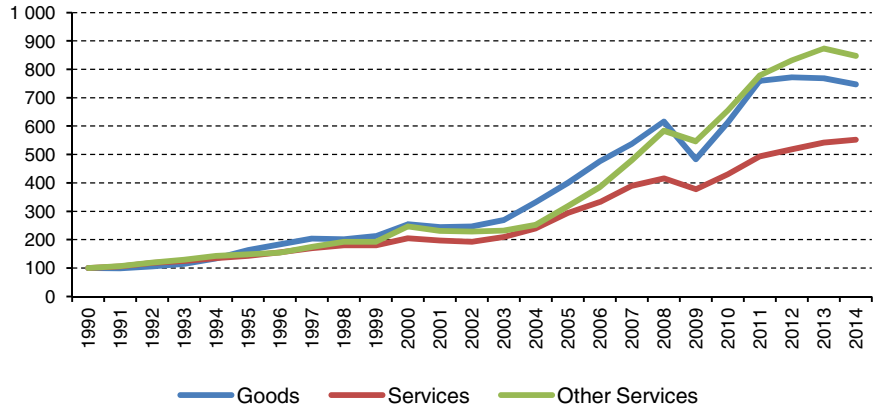
Considering the components, the imports can also be goods and services. Due to its high complementarity, we observe a steadily increasing number of international service activities that are involved in the structural transformation of transnational companies. In 2014, services generated more than 80% of the valued-added in Luxembourg and Greece and 60% or more in the rest of the OECD countries (World Bank, n.d.). Lately, companies have become more internationalized than in the past and the production is distributed in numerous geographical regions within or outside national borders (Durán Lima and Ventura-Dias, 2003).

In case of the goods, the recording and measurement is normally undertaken using classification criteria based on comprehensive product lists that in turn are related to the level of customs protection.

C. Statistics of trade in services

The trade in services in Latin America has experienced continuing growth in more than the last twenty-five years with remarkable acceleration in the 2000s, especially in the category "Other services". It also showed a higher rate than that of exports in goods and services in general (see figure 9). This leads to an increased need of improving the statistics with which the calculations are made, in order to be able to derive better trade promotion policies or to raise more beneficial clauses in trade agreements based on a profound understanding of the sector.

Figure 9
Latin America: Exports of recorded services in the balance of payments, 1990 - 2014
(Index number 1990=100, based on current currency)



Source: Own compilation based on figures from CEPALSTAT.

There are two concepts that are used to define the service statistics. The first refers to cross-border trade and is normally considered as trade in services. This corresponds to the conventional concept of the nature of the subject (resident or nonresident) that performs the operation. It defines the purchase of a resident (national of country j) in a country i as exports of the latter, and its sale as imports. Vice versa, the purchases or sales of a resident (of country i) abroad (in a country j) are denominated as imports or exports, respectively. This type of statistics is collected for the countries' BOP.

A second concept is related to the sales and purchases of foreign affiliates (of country j) in country i or the sales and purchases of domestic affiliates (of country i) abroad (in country j). This is reflected in the Foreign Affiliates Trade in Services (FATS) statistics which are normally not included in the BOP as exports or imports of services. It is a type of service statistics from a broader perspective, which has been reflected in recent international agreements, most prominently in the General Agreement on Trade in Services (GATS) from 1995.

GATS offers four modes of service supply. This classification is very useful but reveals difficulties when more than one mode is incorporated in the same product. Therefore it is very difficult to relieve them separately:

(i) Mode 1 → Cross border trade. Here, we find any movements of persons and the traditional examples are customer assistance (call centers), telecommunications, and telemedicine (remote diagnostics), among others.

(ii) Mode 2 → Consumption abroad. Includes all data from the travelers who consume abroad, whereby the main expenses stem from tourism, education, and medical services, among other.

(iii) Mode 3 → Commercial presence. The service is provided by a subsidiary established in a foreign country. These are the FATS statistics.

(iv) Mode 4 → Presence of natural persons. It is hard to measure when a professional travels to a foreign country to provide a service, especially if it is a temporal work of short duration. However with long term stays, the question arises from which point on a person should be considered as a resident of the foreign country. Usually the convention is one year but the GATS provide that this time horizon can be extended upon agreement.

Internationally, there are rules for service statistics that establish the guiding principles in this field and which are normally compatible and surrogate over time.

(v) The Sixth Edition of Balance of Payments (and International Investment) Manual (BPM6) of the IMF → it was published in 2009 and establishes guiding for the conventional statistics (resident/nonresident) without considering Modes 3 and 4. However, the implementation of the new characteristics and classifications has been postponed by the countries that mostly apply its predecessor, the Fifth Edition of the manual from 1993.

(vi) The Benchmark Definition of Foreign Direct Investment of the OECD → this definition that becomes increasingly complex establishes the operational guidelines for the statistics on Foreign Direct Investment. It is compatible with BPM and the SNA. At the end of 2008 its 4th edition was published.

(vii) Manual on Statistics of International Trade in Services (MSITS) → it presents a framework for the collection of service statistics with the purpose that its recommendations progressively widen and structure the information on the trade in services in order to provide internationally comparable statistics. An update followed the BPM, and provides more information on Mode 4 and on the way to use the statistics. The first draft of the update was prepared in 2008 and has been published in 2010 after it was made available to the countries for its review (UNSD, 2012).

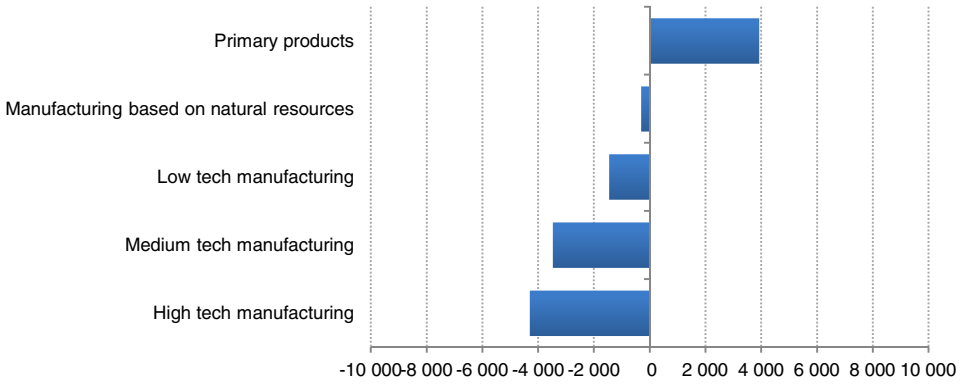
D. Trade balance

The trade balance indicates the net flow of foreign trade of a country in a given period. It shows a surplus if the exports exceed the imports and a deficit in the case where the exports do not reach such a level as to cover total consumption of imported goods, in which case the residents of an economy would be borrowing some production from other economies. In practical terms, a negative net balance implies that the imports bring back national income that was captured by citizens living in other countries.

It is important to note that a trade deficit is not inherently bad. However, an imbalanced debt that finally is to be paid can result in uncomfortable macroeconomic performances.

The indicator "trade balance" is important for the analysis as it can be calculated at the trade partner and regional level in total terms or by product. This allows us to determine in which product and/or towards which trading partner a country has a competitive advantage (see figure 10). We will come back to this issue when we look at the family of indices of revealed comparative advantages.

Figure 10
Argentina: Trade balance with China by technological intensity, average 2012 - 2014
($ million)



Source: Own compilation based on figures from Comtrade.

E. Relative indicators of foreign trade

If we divide total exports, imports, or total trading (exports plus imports) by the population of the country or alternatively by its GDP, we obtain trading indicators per capita or an index of openness, respectively.

In the first case, the measure yields the amount of trade that corresponds to each individual, which has two interesting practical applications. On the one hand, it allows the comparison of a country's relative position vis a vis other countries, i.e. a country's relative position within a certain group of countries. On the other hand, if the index is calculated annually, it sheds light on the evolution of the growth in volumes of exports, imports, or total trading in relative terms.

According to the level of openness, the indices report upon the level or grade of the internationalization of the economy at hand. In the practical literature on trade analysis, this index can be calculated in different ways and according to the researcher's particular interest, which can be focused on exports, imports, or total trading. Table 29 presents these different possibilities for the indicators per capita as well as for the indices of openness.

Table 29
Some relative indicators of foreign trade

Index type	Calculation	Description
Indicators per capita	X_i / N_i	Exports per inhabitant
	M_i / N_i	Imports per inhabitant
	$(X_i+M_i) / N_i$	Trading per inhabitant
Indicators of Openness	X_i / GDP_i	Openness measured by exports
	M_i / GDP_i	Openness measured by imports
	$(X_i+M_i) / GDP_i$	Openness measured by trading
	$((X_i+M_i) / 2) / GDP_i$	Openness measured by average trading

Source: Own compilation.
Note: X_i are the exports, M_i are the imports, N_i is the population, and GDP_i is the gross domestic product of country i.

Usually, the results of these indices are expressed in percentages that can be later compared between countries. Lower figures are indicators of a poor openness of the analyzed country. For illustration purposes, table 30 and figure 11 show the development of the trade openness of the LAC countries between 2000 and 2014.

Table 30
Latin America and the Caribbean: level of trade openness, 2000 and 2014
(Percentage based on current currency)

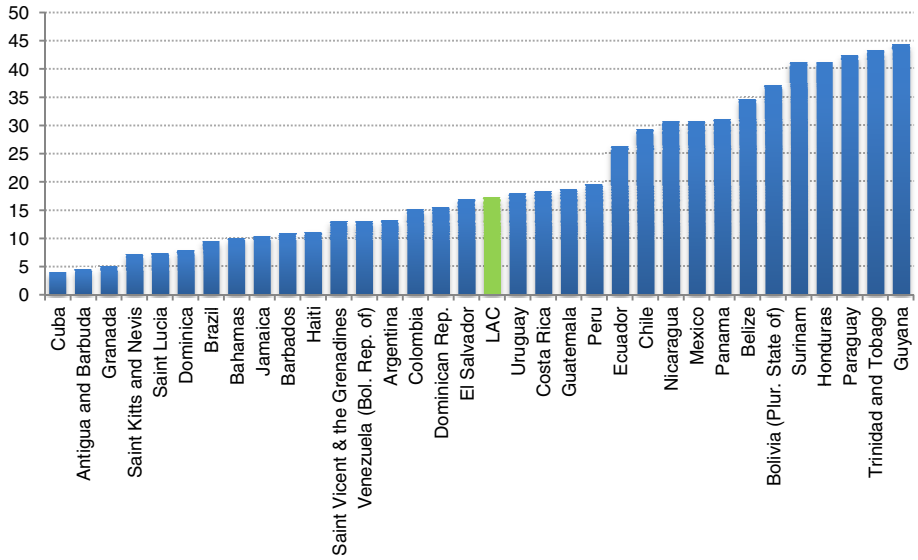
Countries	Indices of Opennes							
	(X / GDP)		(M / GDP)		(((X+M) / 2) / GDP)		((X+M) / GDP)	
	2000	2014	2000	2014	2000	2014	2000	2014
Antigua and Barbuda	9.8	4.5	43.7	40.9	26.7	22.7	53.5	45.5
Argentina	7.7	13.1	7.0	11.4	7.4	12.3	14.8	24.5
Bahamas	7.3	10.0	31.3	38.4	19.3	24.2	38.7	48.4
Barbados	8.8	10.9	33.0	48.2	20.9	29.5	41.8	59.1
Belize	33.9	34.7	57.5	54.5	45.7	44.6	91.4	89.2
Bolivia (Plurinational State of)	14.8	37.2	19.2	31.9	17.0	34.5	34.0	69.0
Brazil	8.4	9.6	8.5	9.8	8.5	9.7	16.9	19.4
Chile	24.2	29.3	21.5	26.3	22.9	27.8	45.7	55.6
Colombia	13.8	15.1	11.1	16.3	12.4	15.7	24.9	31.4

Table 30 (concluded)

Countries	Indices of Openness							
	(X / GDP)		(M / GDP)		(((X+M) / 2) / GDP)		((X+M) / GDP)	
	2000	2014	2000	2014	2000	2014	2000	2014
Costa Rica	36.5	18.4	37.8	29.9	37.1	24.2	74.2	48.3
Cuba	5.5	4.1	15.7	13.1	10.6	8.6	21.2	17.2
Dominica	16.4	7.9	39.1	34.5	27.8	21.2	55.5	42.4
Dominican Republic	22.7	15.5	37.6	27.0	30.1	21.3	60.3	42.5
Ecuador	27.6	26.4	20.0	26.4	23.8	26.4	47.6	52.8
El Salvador	10.2	16.9	26.8	37.6	18.5	27.3	36.9	54.5
Granada	16.0	5.0	42.5	32.8	29.2	18.9	58.4	37.8
Guatemala	23.0	18.7	32.3	29.0	27.7	23.8	55.4	47.7
Guyana	44.2	44.3	48.4	52.6	46.3	48.5	92.7	97.0
Haiti	9.1	11.2	29.7	42.6	19.4	26.9	38.7	53.7
Honduras	46.5	41.3	55.5	56.6	51.0	48.9	102.0	97.8
Jamaica	17.4	10.4	33.4	37.2	25.4	23.8	50.7	47.7
Mexico	25.7	30.7	26.9	30.9	26.3	30.8	52.6	61.7
Nicaragua	17.2	30.7	35.3	51.0	26.2	40.9	52.5	81.7
Panama	47.5	31.2	56.7	47.7	52.1	39.5	104.2	78.9
Paraguay	44.4	42.5	33.4	39.1	38.9	40.8	77.8	81.6
Peru	13.4	19.5	14.2	20.2	13.8	19.8	27.7	39.7
St. Kitts and Nevis	12.3	7.2	41.1	32.6	26.7	19.9	53.4	39.8
Saint Vincent & the Grenadines	6.7	13.0	39.8	37.2	23.3	25.1	46.6	50.2
Saint Lucia	13.1	7.3	36.4	43.8	24.7	25.6	49.5	51.1
Surinam	31.6	41.2	19.5	37.7	25.5	39.5	51.1	79.0
Trinidad and Tobago	52.6	43.3	40.7	30.8	46.7	37.0	93.3	74.1
Uruguay	11.4	18.0	15.8	19.7	13.6	18.8	27.1	37.7
Venezuela (Bolivarian Republic of)	28.6	13.0	14.4	7.4	21.5	10.2	43.0	20.4
Latin America and the Caribbean	16.8	17.3	16.9	17.5	16.8	17.4	33.6	34.8

Source: Own compilation based on figures from CEPALSTAT and the Direction of Trade Statistics (DOTS) of the IMF.
Note that the countries more open to trade are usually the smaller ones. In the case of Brazil, the indices show a low level of openness. This simple indicator sheds light on the trade policy strategies of a country or a group of countries. Consider also that GDP broken down by its components yields: consumption, investment, public expenses, exports, and imports. In the large countries, the proportion of the first three components tends to be substantial (more than 60%, close to 70%) meaning that the domestic market is of high importance and therefore the calculated openness tends to be lower. Moreover, a large country may be hesitating to open competition in certain markets, for example public procurement, especially if the local firms are not ready for international competition. In a closed environment, governments can shift rents to their taxpayers incentivizing the progress of domestic consumption and hence the production. Obviously, this will have clear effects on the trade policy of the countries, especially as regards the openness of the public procurement sector.

Figure 11
Latin America and the Caribbean: coefficient of openness measured by exports of goods, 2014
(Percentage in current currency)



Source: Own compilation based on figures from Comtrade and DOTS.

F. Shares in world trade

A simple and very useful index for measuring the dynamism and adaptation of a developed economy to international trade is the one that relates the country's exports/imports to the total global exports/imports in goods and/or services.

Although the index can be set between 0 and 1, it is usually presented as a percentage. The highest value then represents the largest country worldwide in terms of its activity in global trade. Table 31 shows the alternatives of the indicator.

Table 31
Some relative indicators on the participation of national trade in world trade

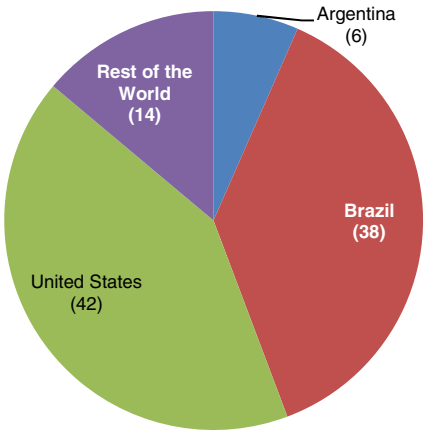
Calculation	Description
Xi / Xworld	Openness measured by exports
Mi / Mworld	Openness measured by imports
(Xi+Mi) / (Xworld + Mworld)	Openness by the weight of local trading in world trade

Source: Own compilation.

In the same way as pointed out above, the structural indicators can be applied to disaggregated analyses. In particular the presented index of share in world trade can be studied in such dimensions, being itself disaggregated. In this case, the result will indicate the specific weight of a country in the export/import of a particular product in world trade. Thus, a technician may be interested in knowing exactly what share her country holds in the global trade of a specific product.

An example is presented in figure 12 that shows the distribution of exports in soy comparing the three main exporters Argentina, Brazil and the US to the rest of the world.

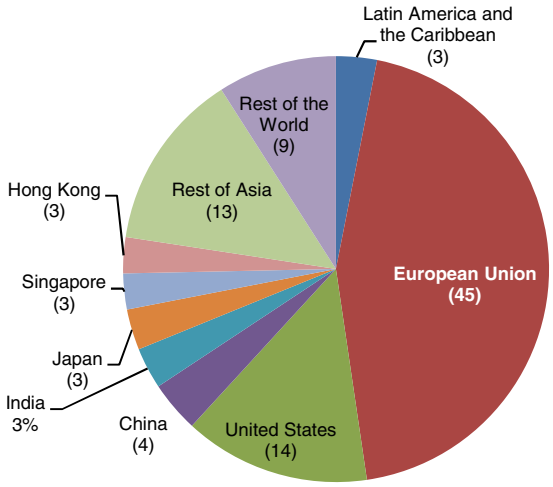
Figure 12
Argentina, Brazil and the United States: relative participation in global export of soy, average 2012 - 2014
(Percentage)



Source: Own compilation based on Comtrade.
Note: Code 1201 HS, Rev.4

Figure 13 presents the results of this indicator for the case of world trade in services in 2013. It reveals that the highest shares are held by the European Union and the US.

Figure 13
Global distribution of trade in services, 2013
(Percentage of world total)



Source:Own compilation based on the BOP of the IMF and national sources.
Note: European Union does not include figures from Croatia.

G. Basic indicators of trade concentration at the product level

A rough measure for a country's degree of export concentration can be approximated by counting the number of products in a goods basket that accounts for up to 80% of the total bill of exports.[4] The lower the number of products, the more concentrated is the export/import basket of a given country. Another way to approach the topic is listing the five main products and determining their relative weight in the export basket of the country.

Alternatively, it is possible to build the analysis upon imports. In this case, the result reports on the dependence of the country from the products in the basket.

As an example, we list the five main products leading exports for a group of selected countries of the region in Table 32. We also present the cumulated share of these products in total exports for each country.

Table 32
Latin America: concentration at the product level with highest impact on the exports, 2014
(Percentage from total exports)

Countries	Five main products	Joint representation
	2014	
Venezuela (Bolivarian Republic of)[a]	Oil (85.1), petroleum products (12.5), alcohol (0.7), iron ore and concentrates (0.3), ferroalloys (0.3)	98.9
Ecuador	Oil (50.6), fruits and nuts (10.5), crustaceans (10.0), prepared fish (4.9), non-monetary gold (3.3)	79.3
Bolivia (Plurinational State of)	Natural gas (46.6), non-monetary gold (10.6), base metals and concentrates (9.3), precious metals and concentrates (5.6), animal feed (5.4)	77.5
Paraguay	Soybeans (24.9), electric current (22.2), beef (13.3), animal feed (11.8), vegetable oils and fats (5.2)	77.5
Colombia	Oil (47.0), not agglomerated coal (11.7), petroleum products (5.2), coffee and coffee substitutes (5.0), non-monetary gold (2.9)	71.8
Chile	Copper (28.3), copper ores an concentrates (22.0), fruits and nuts (7.0), fish (6.0), pulp and waste paper (3.8)	67.1
Peru	Copper ores an concentrates (18.1), non-monetary gold (14.6), petroleum products (8.6), base metals and concentrates (6.6), processed copper (6.1),	54.0
Costa Rica[a]	Cathodes (20.9), fruits and nuts (14.8), medical instruments (9.8), edible products (4.1), coffee and coffee substitutes (2.7)	52.3
Honduras	Coffee and coffee substitutes (17.3), equipment for distributing electricity (12.8), crustaceans (7.7), fruits and nuts (6.9), vegetable oils and fats (5.6)	50.3
Panama	Fish (10.2), fruits and nuts (18.4), crustaceans (10.0), animal feed (5.6), ferrous scrap (5.6)	49.9
Uruguay	Soybeans (17.7), beef (15.7), rice (5.6), dairy products (4.9), wood (4.8)	48.7
Nicaragua	Equipment for distributing electricity (11.3), beef (9.0), clothing (8.9), coffee and coffee substitutes (8.4), non-monetary gold (7.8)	45.4
El Salvador	Clothing (22.3), men's clothing (5.4), clothing accessories (5.1), plastic (4.9), sugars (4.3)	42.0
Argentina	Animal feed (18.8), soybeans (6.0) vegetable oils and fats (5.9), cars for transport (5.6), maize (5.2)	41.5
Dominican Republic	Non-monetary gold (16.0), medical instruments (8.8), petroleum products (5.6), manufactured tobacco (5.3), electrical apparatus for electrical connections (5.0)	40.7

[4] The exact value can be chosen by the researcher. At ECLAC, a threshold of 80% is used, but nothing impedes using a value of 90% or another, alternative criterion.

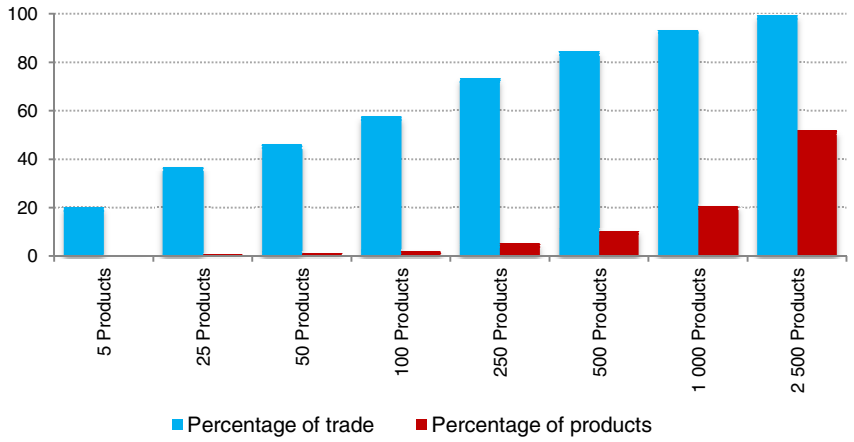
Table 32 (concluded)

Countries	Five main products	Joint representation
	2014	
Brazil	Iron and concentrates (11.5), soybeans (10.4), oil (7.3), sugars (4.3), edible meat offal (4.0)	37.4
Mexico	Oil (9.0), cars for people (8.2), parts of motor vehicles (5.8), cars for transport (5.4), data-processing machines (5.2),	33.6
Guatemala	Fruits and nuts (9.1), sugars (9.1), coffee and coffee substitutes (6.2), women's clothing (4.6), base metals and concentrates (3.5)	32.4

Source: Own compilation based on figures from Comtrade.
Note: Products classified according to SITC, Rev.4 at the 3-digit level.
[a]Data for Costa Rica and the Bolivarian Republic of Venezuela are from 2013. Products for Venezuela are classified according to SITC, Rev.3 at the 3-digit level.

Another interesting option that the researcher can adopt is illustrating the cumulated relative frequencies of the various product groups by its contribution to global trade as well as by its proportion of the total number of products (according to the tariff line, i.e. the product classification code). In Figure 14, such an illustration is done for the case of the concentration of intraregional trade.

Figure 14
Intraregional trade in Latin America: degree of concentration at the product level, 2014
(Percentage of total exports and tariff lines at the HS2 6-digit level)



Source: Own compilation based on figures from Comtrade.
Note: Data do not include Costa Rica and Venezuela.

H. Number of main destinations/origins

The concentration of destination/origin of exports/imports measures the number of trade partners that account for a selected threshold value. Here, the 80% or 90% rule can be applied; however, also the total exports/imports can be taken. A higher number of countries mean a higher degree of diversification. Inversely, if only a small number of countries account for the amount chosen as a threshold, this reflects a higher degree of concentration or trade dependence with respect to a particular market.

An alternative measure is counting the exports exceeding a certain reference point, for example $1 million. For a dynamic view, one has to redo the calculations at different points in time.

VII. Indicators related to trade dynamism

A. Revealed comparative advantages

These indicators are used to analyze a country's comparative advantages or disadvantages in trading with its partners or certain groups of countries. Its most simple form is the Relative Trade Balance (RTB), formally:

$$RTB_{it}^{k} = \frac{X_{ijt}^{k} - M_{ijt}^{k}}{X_{iwt}^{k} + M_{iwt}^{k}}, \quad (42)$$

where *X* are the exports, *M* are the imports, subindex *k* corresponds to the products, *i* to the country of origin, *j* to the country of destination, w to the world, and t to the year.

The index can take positive and negative values. A negative (positive) index will indicate a deficit (surplus) in total trade, thereby expressing a disadvantage/advantage in trading. In other words, an RTB index greater than zero indicates that the sector is competitive with potential, while a negative index hints on a net import sector that lacks competitiveness with other markets.

The calculation of the same index for both various subregions and/or countries allows identifying where the main advantages for each country or region lie. Moreover, it helps to observe in which sectors structural coincidences can be found. The calculation of the index can be performed using time series.

The Balassa index (BI) and its variants also belong to this family of indicators (Balassa, 1963b). It measures the degree of importance of a product within the exports of one market to another relative to the importance of the same country's exports in the exports of that product to the world. Formally:

$$BI_{ij}^{k} = \frac{X_{ij}^{k}/TX_{ij}}{X_{iw}^{k}/TX_{iw}}, \quad (43)$$

where *X* are the exports, *TX* are total exports, subindex *k* corresponds to the products, *i* to the country of origin, *j* to the country of destination, and *w* to the world.

This index can be calculated in particular cases with information in reference to the analyzed target market. Equation 44 presents the calculation of the Balassa index for a specific market, i.e. from the perspective of the country receiving the exports. In the literature, this index is also known as the index of revealed comparative advantage (IRCA) of the exports and is derived by the following formula:

$$\text{IRCA} = \frac{M_{ji}^{k}/TM_{ji}}{M_{jw}^{k}/TM_{jw}} \quad , \qquad (44)$$

where *M* are the imports, *TM* are the total imports; subindex *k* corresponds to the products, *i* to the countries to be compared, *j* to the specific market, and *w* to the world.

Another variant of this index can be constructed by using the coefficient of world imports at the product level as denominator of the export coefficient at the product level. This way, i.e. when the participation at the product level is analyzed in relation to the world imports, one obtains a measure that is denominated as the Specialization Index.

To improve treatability and the analysis of the IRCA, the index can be normalized to take maximum or minimum values, respectively, between 1 and -1 using the following approach:

$$IRCA^{norm} = \frac{IRCA-1}{IRCA+1} \qquad (45)$$

For the interpretation of the indicator, we recommend using the following scale:

IRCAnorm between +0.33 and +1 → An advantage for the country exists.

IRCAnorm between -0.33 and -1 → A disadvantage for the country exists.

IRCAnorm between - 0.33 and +0.33 → Neither an advantage nor a disadvantage exists.

In the normalized case the indices will take values between1 and -1, which allows the application of the above mentioned typology. Like in the previous section, where the virtue of the calculation of indices for different markets and/or partners was highlighted, doing exercises with competing countries in particular markets also for the BI or the IRCA is useful.

This index can moreover be used to deliver more detailed information to negotiators or the civil society and give clear signals where are the main strengths and weaknesses of the national export pattern in a given market. As an example, table 33 presents part of an analysis developed for the case of Panama and its trade with the US vis a vis the main trade partners and potential competitors of Panama, namely those of the Dominican Republic-Central America Free Trade Agreement (DR-CAFTA). Following this method, a total of 261 products were reviewed during the whole analysis.

Table 33
Panama and DR-CAFTA countries: normalized IRCA for the US market products with IRCA > 0.33), 2014
(Balassa index, Equation 44)

SITC Rev.4	Product	Panama	Costa Rica	Dominican Republic	El Salvador	Guatemala	Honduras	Nicaragua
034	Fish	0.95	0.47	-0.93	-0.46	-0.17	0.71	0.47
288	Non-ferrous base metal waste and scrap	0.94	0.32	0.23	0.70	0.79	0.31	0.42
036	Crustaceans	0.93	-0.86	-0.54	-0.88	-0.21	0.73	0.71
061	Sugars	0.93	0.49	0.85	0.94	0.94	0.70	0.83
793	Ships and boats	0.90	-0.69	-0.98	-1.00	-1.00	-1.00	-1.00
122	Tobacco, manufactured	0.85	-0.87	0.99	-1.00	-1.00	0.94	0.97
685	Lead	0.83	-1.00	-0.42	-1.00	-1.00	-0.99	-1.00
071	Coffee and coffee substitutes	0.72	0.76	-0.44	0.77	0.94	0.88	0.93
098	Edible products	0.72	-0.24	0.69	0.50	0.44	-0.59	-0.90

Table 33 (concluded)

SITC Rev.4	Product	Panama	Costa Rica	Dominican Republic	El Salvador	Guatemala	Honduras	Nicaragua
579	Waste, parings and scrap, of plastics	0.71	0.03	0.92	0.42	0.55	0.50	-0.42
111	Non-alcoholic beverages	0.67	-0.89	0.38	0.46	0.16	0.02	-0.90
057	Fruit and nuts	0.57	0.91	0.20	-0.81	0.96	0.85	0.23
247	Wood	0.57	-1.00	-1.00	-1.00	-0.29	0.07	-1.00
551	Essential oils, perfume and flavour materials	0.53	-0.37	-0.64	-0.85	-0.37	-0.99	-1.00
657	Special textile fabrics	0.52	-0.50	-0.57	-0.16	-0.44	-0.68	-0.97

Source: Own compilation based on figures from Comtrade.
Note: Category 9 was excluded.

In the areas where Panama has a comparative advantage in the US market, competition from Central American countries and from the Dominican Republic is present, with exceptions in lead, Ships and boats, wood, essential oils, perfume and flavor materials as well as special textile fabrics.

B. Concentration/diversification index

It is possible to measure the degree of diversification/concentration of a country's export basket or of its trading partners starting from the Hirschman-Herfindahl Index (HHI).[5] This measure has the property to consider the weight of each product and country in the total of its trade in a way that if the value of exports is small, it only has a limited influence on the final indicator and vice versa. This is achieved by taking the square of the shares of each country. Formally, the HHI is calculated the following way:

$$\mathrm{HHI} = \sum_{j=1}^{n} \left(\frac{X_{ij}}{X_{iw}}\right)^2, \qquad (46)$$

where X are the exports, subindex j represents the countries of destination, i the countries of origin and, w the world.

In this manual, we propose to correct the index by the number of observations, which allows a comparison of the results between different product sets, countries of export destination, or both. To present the results in a statistically normalized way, use equation 47.

$$\mathrm{HHI}^{\mathrm{norm}} = \frac{\mathrm{HHI} - 1/n}{1 - 1/n} \qquad (47)$$

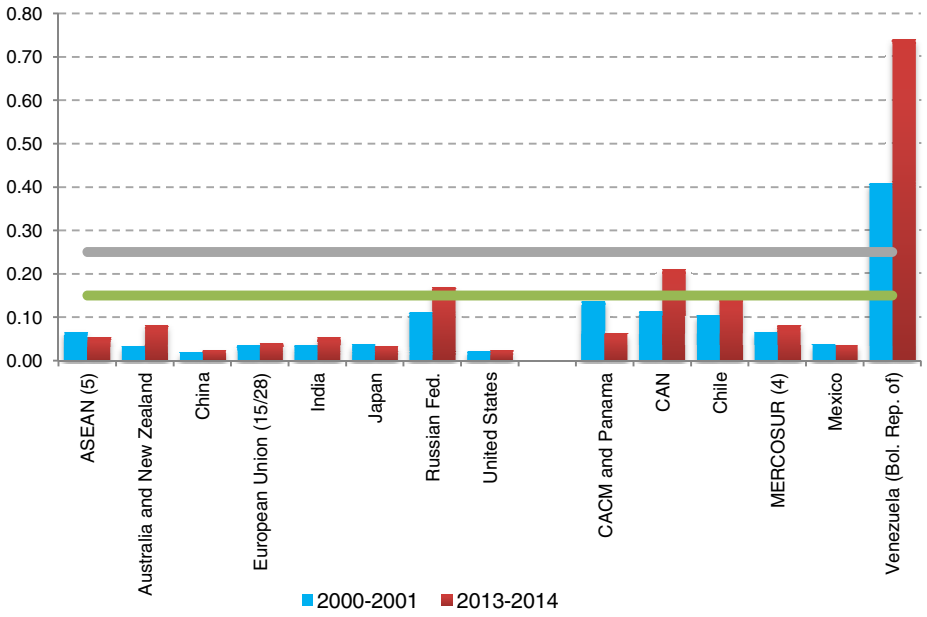
The HHI (in its original, uncorrected version) has been used in the industrial economics literature as an indicator of market concentration. An index greater than a threshold value of 0.25 is considered as a "highly concentrated" market, one between 0.15 and 0.25 as "moderately

[5] It is important to note here that in the literature this index can also be found under names like Gini Coefficient or Herfindhal-Index due to the confusion about its origin. However, Hirschman (1964) itself sought to clarify this in a note published in The American Economic Review where he declared that the indicator was created by him in 1945 and reinvented by Herfindahl in 1950, from which it became popular. We therefore denominate the indicator as HHI in order to bridge the short gap of five years that separate the the publication of Hirschman (1945) and Herfindahl (1950).

concentrated", while a value between 0 and 0.15 is considered as being "unconcentrated" (diversified).[6]

Figure 15 shows results for the HHI for the product concentration/diversification in exports using product classification at the SITC, Rev.3 3-digit level. Note that one can easily draw quite solid conclusions about the trade pattern of the included countries and/or groups.

Figure 15
Latin America and benchmark countries: concentration of exports, 2000/2001 and 2013-2014
(HHI calculated for each biennium)



Source: Own compilation based on figures from Comtrade.
Note: For country groups, simple averages are used. ASEAN (5) includes Indonesia, Malaysia, Philippines, Singapore, and Thailand. MERCOSUR (4) includes Argentina, Brazil, Paraguay, and Uruguay. European Union (15/28) includes the members at the end of the respective biennium.

C. Trade overlap index

The indicator was proposed by Finger and de Rosa (1978) to measure the degree of specialization in international trade in goods within one sector, relative to different sectors in the economy.[7] In short, it shows the degree of the analyzed economy's liberalization and its integration in the international market.

The result lies always between 0 and 1, whereby for a higher degree of intra-industrial specialization, the index is closer to 1. In contrast, lower values indicate that a country specializes itself rather between sectors than within them. Formally written:

$$TO = 2 * \frac{\sum_{k=1}^{n} \min(X^k, M^k)}{\sum_{k=1}^{n} (X^k + M^k)}, \qquad (48)$$

[6] These threshold values were taken from the methodological approach of the US Department of Justice for the case of evaluating collusion (www.justice.gov/atr/public/guidelines/hhi.html).
[7] For a general discussion on trade overlap, see also Finger (1975).

where X_k and M_k are exports and imports, respectively, of products k, and n is the total number of traded products.

D. Theil index

This indicator is used in calculating a diversification measure as an alternative to the HHI. It has the virtue that can be decomposed into two parts: one corresponds to the degree of diversification between population groups and the other one contains the degree of diversification within each group. The sum of both is equal to the total Theil index (TI). The general formula for its calculation is given in Equation 49 and its decomposition is presented in the following equations 50 and 51:

$$TI = \frac{1}{n}\sum_{k=1}^{n}\left[\frac{X^k}{P} * \left(Ln\frac{X^k}{P}\right)\right], \quad (49)$$

where X^k is the value of exports of heading k (SITC at 5 digits), P is the average value of all headings, and n is the number of headings.

The first term in brackets is the share of each heading in the total exports while the second term is the export value of heading k compared to the average value.

Decomposition:

$$TI = T_w + T_b, \quad (50)$$

where T_w is the "internal" component and T_b is the "between groups" component:

$$TI = \sum_{g=1}^{g} s^g T_g + \sum_{g=1}^{g} s^g \left(Ln\frac{P^g}{P}\right), \quad (51)$$

where s^g is the share of category g (SITC at 3 digits) in the total exports of the country, T^g is the Theil index of each category (SITC at 3 digits), P^g is the average value of exports in group g, and P is the average value of the headings (SITC at 5 digits).

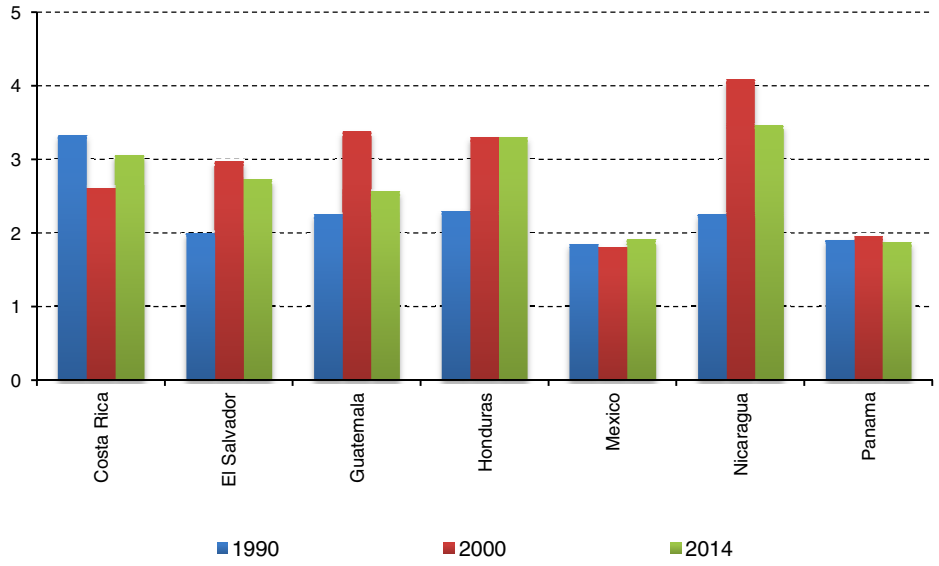
This indicator, like the HHI, allows getting an idea of the degree of concentration and/or diversification of a country's export structure. High numbers greater than 4 indicate high levels of concentration while a low index between 2 and 2.5 is an indicator of higher diversification.

Because its calculation is somewhat complex, it requires the use of appropriate software to manipulate the data, e.g. Stata or others that allow handling matrices like MATLAB.

With the purpose to illustrate that lesson, we present an analysis for several countries using the TI and its properties. Figure 16 shows the results for Mexico and Central America in the years 1990, 2000, and 2009.

It stresses that the results of the TI provide a complementary look on the process of export diversification. According to this indicator, there is a divergence in trends in the last two decades. With Mexico and Costa Rica being exceptions, the other Central American countries concentrated its exports between 1990 and 2000. However, this development was reversed until 2014. While the outlook seemed to be encouraging in the last decade, the long-term view indicates that the subregion enters the second decade of the 21st century with more than half of its countries having higher concentration indices than in 1990.

Figure 16
Mexico and Central America: diversification, 1990, 2000, and 2014
(Theil index by SITC Rev.2)



Source: Own compilation based on data from Comtrade.
Note: Figures for Costa Rica are from 2013 instead of 2014.

E. Grubel-Lloyd index

Grubel and Lloyd (1975) used this indicator to support their hypothesis that the large part of increase in international trade in the 1960s between industrialized countries had its origin in the similarity of the factor endowments. For their analysis, they used bilateral trade between countries to establish the so-called Grubel-Lloyd index (GLI).

At the industry level:

$$GLI^k = 1 - \frac{|X_{ij}^k - M_{ij}^k|}{X_{ij}^k + M_{ij}^k} \qquad (52)$$

and at the country level:

$$GLI = 1 - \frac{\sum|X_{ij}^k - M_{ij}^k|}{\sum\left(X_{ij}^k + M_{ij}^k\right)}, \qquad (53)$$

where X^k_{ij} and M^k_{ij} are the exports and imports of industry k in country i with respect to country j in a given year or period.

Alternatively, one can get the GLI for total trade through a simple weighting that takes into account the export and/or trade shares at the level of each considered group k. Formally:

$$GLI = \sum_{k=1}^{n} GLI^k * P^k, \qquad (54)$$

where P^k is the weight of each industry in the country's total exports.

Bowen, Hollander and Viaene (1998) demonstrated that the use of this system is more effective and dependable than the mere calculation of the unweighted index at the product level.

The index yields results that lie between 0 and 1. A high GLI close to 1 is indicating trade in similar sectors or, which is the same, so-called intra-industry trade. Some economists prefer to use a

value between 0 and 100. In this case, the equations 52, 53, and 54 only need to be multiplied by 100. Following this presentation form of results, the interpretation remains the same for low values (predominantly inter-industry trade) and high values close to 100 (predominantly intra-industry trade).

The first results of Grubel and Lloyd were contrary to the traditional theory of international trade based on the family of Heckscher-Ohlin (H-O) and H-O-Samuelson models postulating that inter-industry trade was based on comparative advantages that were determined by the factor endowments.[8] The index and the approach became popular because they gave new live to the intuition of works of renowned economists such as Hirschman (1945), Verdoorn (1960) and Balassa (1963a), which had outlined the importance of trade "manufacturing for manufacturing", especially in the period following World War II. In the nineties, evidence appeared in the sense that it was shown that the intra-industry trade between countries of the rising European Economic Community (today's European Union) measured by the GLI increased from 0.50 in 1958 to 0.58 in 1963 and later on to 0.65 in 1970 (Sapir, 1992). Similar pattern regarding intra-industry trade have been revealed for developing countries in general (Tharakan, 1989) and also empirical underlined for Chinese trade (Hu and Ma, 1999).

The key behind the importance of intra-industry trade, as opposed to inter-industry trade, has been found in that it explains well the increase in trade based on economies of scale and product differentiation (Davis, 1995). Both elements which are already formalized in the "new theory of international trade" that also incorporates the imperfect competition (Krugman, 1980), provide good arguments for justifying economic as well as trade integration. This is precisely the base of the works Balassa (1966), Willmore (1974), and Grubel and Lloyd (1975).[9]

The main focus of an analysis with this type of indicator lies on the observation of intra-industry trade relations at the disaggregation level of SITC 3-digit or ISIC 2-digit. However, it must be taken into account that with a smaller number of groups the accuracy of the analysis becomes worse.

For analytical convenience, it is recommended that the results of the GLI are analyzed following its development over time and the degree or level of intensity. Usually, three levels are defined:

Level 1:	$IGL > 0.33$	→	Indication of intra-industry trade,
Level 2:	$0.33 \geq IGL \geq 0.10$	→	Potential intra-industry trade,
Level 3:	$IGL < 0.10$	→	Inter-industrial relations.

The index takes a value of 1 when the trade is realized between the same sectors (intra-industrial) and 0 when it is realized only between sectors of different activities (inter-industry trade). This index is sensitive to the level of aggregation applied for its calculation. To capture the intra-industry dynamics in bilateral relations, it is recommended to use a disaggregation at SITC 3 digits. This allows capturing in a clearer way the type of trade relation at the industry level with the respective partner for whom the analysis is performed. If the same exercise is performed at the 2- or 1-digit level, the results will be higher (because in less diversified classification, more industries are considered to be similar).

Table 34 illustrates the trade pattern of Bolivia in the case of the Andean countries. It stresses that despite particular cases like high-tech manufacturing with Peru, there exist no intra-industry relations at the level aggregated by technological intensity and the general relations are markedly inter-industrial.

[8] The model was formulated by Ohlin (1933) modifying an original theorem of Heckscher. Later, Samuelson (1949) confirmed the theorem of factor price equivalence.

[9] Recent works have also looked to formulate measurements to capture so-called vertical intra-industry trade, i.e. international fragmentation of production (Wakasugi, 2007).

Table 34
Plurinational State of Bolivia: degree of technological intensity in the intra-industry trade in the Andean countries, 2014
(Based on data from SITC Rev.4 at 3-digit level)

	Colombia	Ecuador	Peru
Primary products	0.01	0.00	0.05
Manufacturing based on natural resources	0.00	0.01	0.11
Low tech manufacturing	0.03	0.06	0.03
Medium tech manufacturing	0.00	0.00	0.02
High tech manufacturing	0.00	0.00	0.36
IGL global	0.01	0.02	0.06

Source: Own compilation based on figures from Comtrade.

F. Lafay index

Lafay (1979) created this indicator to measure the degree to which a country has a comparative advantage in a certain area that makes it a natural exporter of this product. It belongs thus to those indicators just as the HHI that receive the name "specialization index".

It simply shows the ratio between the production of the good and its apparent consumption (production plus imports minus exports). Alternatively, the indicator can be interpreted as the relation between the national economy and the rest of the world, or in other words, the weight of the product (or product group) in the domestic market (Crespo Faustino, 1991). If this value is greater than 1, the country is a net exporter of the studied good. With a higher value, domestic production is increasingly directed at exporting the same good (Trejos, 2008).

$$\mathrm{LI}^{\mathrm{k}} = \frac{\mathrm{Pd}_{\mathrm{i}}^{\mathrm{k}}}{\mathrm{Pd}_{\mathrm{i}}^{\mathrm{k}} + \mathrm{M}_{\mathrm{i}}^{\mathrm{k}} - \mathrm{X}_{\mathrm{i}}^{\mathrm{k}}}, \qquad (55)$$

Where Pd^k_i is the production of good k in country i, and M^k_i and X^k_i aare its respective imports and exports. Note that all variables are valid for only one product, in one country in a certain period of time.

G. Economic environment index

This indicator captures the movements of in the economic activity of a country's main trade partners (as measured by the GDP) weighting them by the relative importance of exports sent from the said country towards each of them in the total exports for this group of countries. The peculiarity is that through the GDP projections of the destinations, we can infer the impact that these have on the total exports of the country of origin. The general formula for the calculation of the Economic Environment Index (EEI) is the following:

$$\mathrm{EEI} = \sum_{\mathrm{j}=1}^{\mathrm{n}} \alpha_{\mathrm{jt}} * \mathrm{GDP}_{\mathrm{j}}, \qquad (56)$$

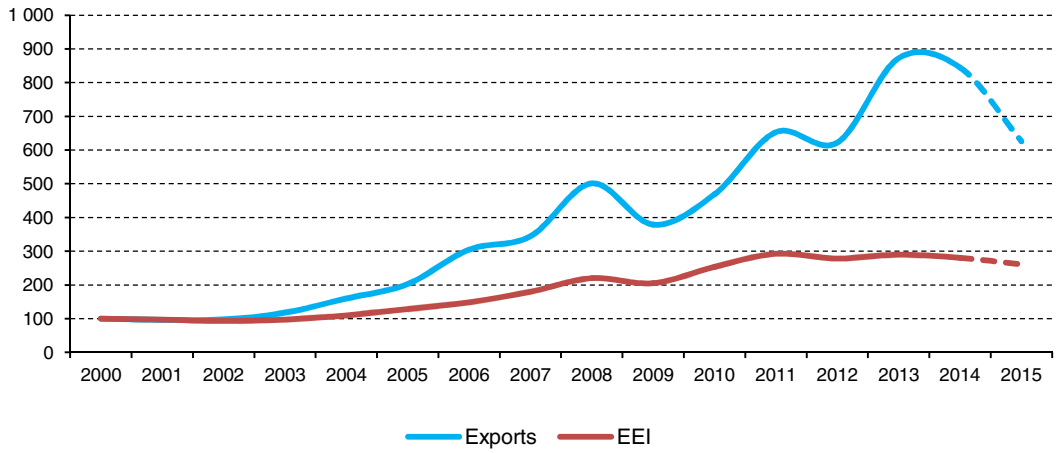
where α_{jt} is the weight of country j in the total exports to the main destinations of country i in the period t, n is the number of main destinations, t is the period (it is recommended to use quarters), and GDP_j is the development of the GDP index number of country j.

The EEI approximates the variation in exports through the dynamics in the growth in trade partners. Normally, the EEI is validated with the development of the country's exports and serves as a trade projection tool utilizing the demand of the main partners.

For its calculation, first, the main trade partners of the reference country must be determined and second, the historical trend of the GDP development in the identified countries must be concluded from official projections and/or the most reliable forecasts that are available for its final calculation.

The intuition behind that type of indicator is anticipating to a certain extent the development of the demand of the major buying markets. Figure 17 gives an example for Bolivia. Although the dynamics in exports are larger at an absolute scale, the main trend is found to be similar.

Figure 17
Plurinational State of Bolivia: economic environment index, 2000 - 2015
(Number indices and projections for 2015)



Source: Own compilation based on figures from Comtrade and IMF.

H. Similarity Index

This indicator is calculated as the aggregation of the minimum participation of each product group in the total exports of each country or region to a market of homogeneous destination, which can be a subregion or the world.

$$SI = \sum_{k=1}^{n} \text{Min}\left[\frac{x_i^k}{x_i}, \frac{x_j^k}{x_j}\right], \qquad (57)$$

where X^k_i are country i's exports of product k, X^k_j are country j's exports, X_i and X_j are the total exports of the two countries, and n is the number of products. Note that the calculation can also be performed from the view of the imports of the destination market.

The result of the index ranges from 0 to 1. If the two countries have totally different trade structures, the similarity index (SI) will take a value of 0, which is an indicator for the absence of any competition.

For example, if one analyzes this index for a particular country in the E.U. market and compares it to one of the new members of the E.U., it is possible to determine to what extent the trade pattern of the analyzed country looks like those of the new partners of the E.U., considering the demand of the said market as the unit of analysis.

One conclusion that can be derived from the calculation of the index is that the trade pattern of two countries (or regions) is similar, which yields the subsequent conclusion that there exists

competition in the reference market. Equal to the case of the previously defined indicators, this index can be analyzed according to its development over time, in which case the additional information may be the higher or smaller degree of closeness or distance of both production structures in different points in time.

Table 35
Andean Community: calculation of Similarity index, 2014

	Bolivia (Plurinational State of)	Colombia	Ecuador	Peru
Bolivia (Plurinational State of)		0.13	0.14	0.35
Colombia	0.13		0.62	0.23
Ecuador	0.14	0.62		0.21
Peru	0.35	0.23	0.21	

Source: Own compilation based on data from Comtrade (SITC Rev.4, 3-digitos).

From Table 27, we can see that the export structures of the Andean Community countries considerably differ among them. While Colombia and Ecuador present similar structures, Bolivia is rather similar to Peru, and not at all to Colombia and Ecuador. Peru for its part finds its structure to a certain extent similar to that of Argentina and Brazil.

I. Krugman index

This indicator follows the logic of the similarity index and measures the difference in export structures by summing the differences between the share of each industry in the total industrial value added of a country and the share of the same industry in the industrial value added of another country taken as a reference. It varies between 0 (the structures are exactly the same) and 2 (there is absolutely no overlap in the trade patterns of the two countries. Its formal calculation is done with the following formula:

$$KI = \sum_{k=1}^{n} \left| \frac{x_i^k}{x_i} - \frac{x_j^k}{x_j} \right|, \qquad (58)$$

where X^k_i are country i' exports of product k, X^k_j are country j's exports, X_i and X_j are the total exports of the two countries, and n is the number of products. Equal to the case of the SI, the calculation can also be performed from the view of the imports of the destination country.

Table 36
Andean Community: calculation of Krugman index, 2014

	Bolivia (Plurinational State of)	Colombia	Ecuador	Peru
Bolivia (Plurinational State of)		1.74	1.73	1.30
Colombia	1.74		0.76	1.54
Ecuador	1.73	0.76		1.58
Peru	1.30	1.54	1.58	

Source: Own compilation based on data from Comtrade (SITC Rev.4, 3-digitos).

The index as presented in table 36 confirms our previous observations regarding similarity (compare table 35): Colombia and Ecuador have similar export patterns. At the same time, the structure of both is highly different to that of Bolivia. Finally in the case of Peru, its export pattern is more similar to that of Bolivia than to that of Colombia or Ecuador.

VIII. Indicators of relative dynamics in intra-regional trade

In the international trade literature, a field of increasing importance is referred to as the analysis of the trade dynamics in regional integration schemes or countries participating in customs unions projects. In Latin America and the Caribbean, for example, exist four: the Andean Community, the Southern Common Market (MERCOSUR), the Central American Common Market, and the Caribbean Community. This section summarizes some key indicators that have the power to measure and explain the intensity of intra-regional trade.

A. Intra-regional trade index

This is the best-known and simplest indicator to measure the importance of intra-regional trade flows. It is calculated by relating the total mutual trade between the members of a customs union or a trade agreement (may be exports, imports, or both) to the total exports that the group of countries trades to the world. Formally:

$$\text{IRTI} = \frac{\sum_{i=1}^{n} X_{ij}}{\sum_{i=1}^{n} XT_i}, \qquad (59)$$

where X_{ij} are country i's exports to partner j, and XT_i are the total exports of country i. Note that the indicator can be calculated for the case of imports or total trade as well.

The index shows directly the share representing the trade between members of a regional grouping and is a quick measure of the relationship of the countries in a trade group. Nevertheless, there are economists that question its usefulness given the bias that a measure like this can cause for groups of countries that maintain high participation levels in world trade, e.g. the countries of the E.U. In contrast, the small countries forming integration groups do not reach high levels at such an indicator because the effect of their small scale reduces the size of the index. This is the case of the index for the integration schemes of Latin America and the Caribbean, which is still small compared to that in the E.U. (compare table 37).

Table 37
Selected regions: development of the intra-regional trade coefficient measured by exports, 1990, 2000, 2010, and 2014
(Percentage of total exports per subregion/region)

	1990	2000	2010	2014
Andean Community	4.0	8.1	8.8	8.0
Central American Common Market	16.0	20.6	24.3	22.5
Southern Common Market (MERCOSUR)	8.9	21.1	16.2	14.0
Association of Southeast Asian Nations (4)	15.2	18.9	20.2	20.1
North American Free Trade Agreement	41.5	55.8	49.1	50.7
European Union	65.7	59.8	63.5	62.4

Source: Own compilation based on figures from Comtrade.
Note: Figures for the Andean Community and MERCOSUR do not include Venezuela. Figures for the Central American Common Market in 2014 are without Costa Rica. ASEAN (4) include figures from Indonesia, Malaysia, Philippines, and Singapore. Figures for the European Union account for the different Member States in the respective year.

One way to resolve that type of problem was suggested by Brown (1948) and later further developed by Kojima (1994). It consists of correcting the original index with help of the weight of the group in world trade using either exports, imports, or trading. We will look upon this topic in Subsection B.

It is also convenient to calculate the extra-regional trade index, i.e. the complement of the previously described indicator. It expresses the degree of dependence of a country or a group from the rest of the world that is not subject to any preferential treatment granted within a customs union or an integration group. Its calculation is derived from the results of the previously considered index. Formally:

$$\mathrm{ERTI} = 1 - \frac{\sum_{i=1}^{n} X_{ij}}{\sum_{i=1}^{n} XT_i} \qquad (60)$$

$$(\mathrm{ERTI} = 1 - \mathrm{IRTI}),$$

where X_{ij} are country i's exports to partner *j*, and XT_i are the total exports of country *i*. Note that the indicator can be calculated for the case of imports or total trade as well.

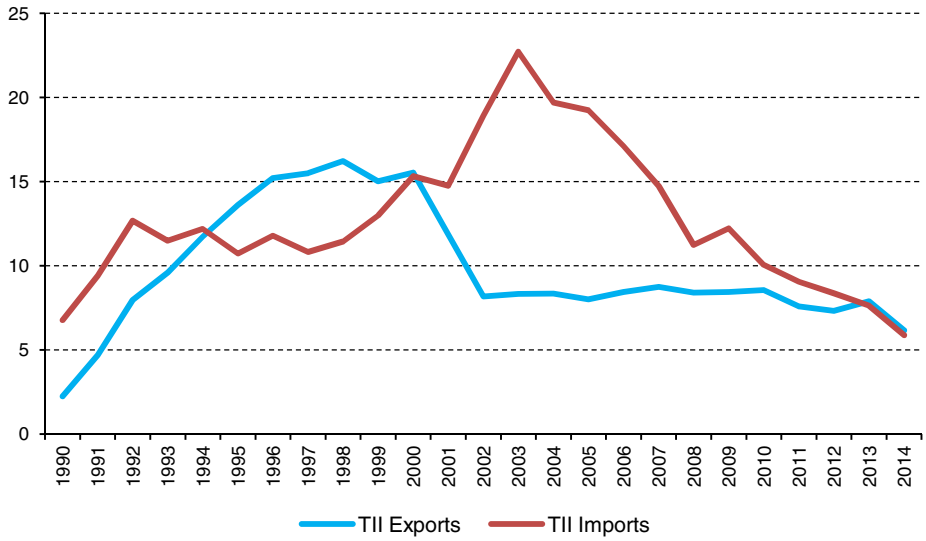
B. Trade Intensity Index

The trade intensity index (TII) corrects the bias of the IRTI with respect to world trade. Formally, it is calculated by dividing the IRTI by the weight of the corresponding subregion or group of countries in world trade. Equation 61 shows the notation and mechanics to follow for such a correction:

$$\mathrm{TII} = \frac{\sum_{i=1}^{n} X_{ij} / \sum_{i=1}^{n} XT_i}{\sum_{i=1}^{n} XT_i / XW}, \qquad (61)$$

Where X_{ij} are the exports of country *i* to its partner *j*; XT_i are the total exports of country *i*, and *XW* are the global exports. Like the previous indicators, the calculation can be also performed using imports or total trade.

Figure 18
MERCOSUR: development of the trade intensity index, 1990 - 2014
(Percentage)



Source: Own compilation based on figures from Comtrade.
Note: Figures from Venezuela are not included.

Figure 18 reveals the results from an analysis of intra-regional trade of the MERCOSUR. While exports increased more than proportionally compared to the rest of the world during the 1990s, they suffered from a sharp decline in the early 2000s and rested afterward at the level of 1992. For the case of imports, they rose within the integration scheme more than proportionally to the rest of the world from 1996 until 2003, when they experienced a breakdown that stopped in 2008 at a level lower than in the last two decades. Since 2009, the breakdown continued.

C. Potential intra-regional trade

Here, we present a methodology for calculating the maximum trade flow that a set of member countries in a regional integration scheme might reach. From the view of public policies, this indicator is a measure of higher or lower degree of intra-regional preferences that the countries grant each other within the corresponding regional group.

The developed methodology takes into account the historical trade records of the group's countries. This index is obtained by aggregating equation 61 as regards a temporal dimension in the form displayed by equation 62.

$$TII_t = \frac{\sum_{i=1}^{n} X_{ijt} / \sum_{i=1}^{n} XT_{it}}{\sum_{i=1}^{n} XT_{it} / XW_t}, \qquad (62)$$

Where X_{ij} are country *i*' exports to its partner *j*, XT_i are the total exports of country *i*, *XW* are the global exports, and *t* is the period.

The inclusion of the time dimension allows to derive a method of the here proposed ad hoc estimation. It consists of obtaining the maximum value of the defined variable in the analyzed period (between *t=1* and *t=n*) and using that value as a benchmark to obtain the value of potential intra-regional trade, formally:

$$\overline{TII} = Max_{t=1}^{t=n}(TII_t), \qquad (63)$$

where $\overline{TII}$ is the fixed value taken as a maximum threshold of the intra-regional trade coefficient. From that value we calculate an expansion vector defined as the gap size in percentage terms of actual intraregional trade compared to the maximum intraregional trade possible. Then we multiply the observed value with the intra-regional trade in the selected period to obtain the potential intra-regional trade (PIRT) from which it is possible to calculate the gap between the actual and potential trade.

$$\mathrm{PIRT_{it}} = \frac{\overline{\mathrm{TII_{ig}}}}{\mathrm{TII_{igt}}} * \mathrm{X_{igt}}\ , \qquad (64)$$

where *X* are the exports, *i* is the country, *g* is the region, and *t* is the period.

This methodology is an ad hoc calculation and allows a first approximation of the potential trade considering historical trade data. It is based on the assumption that the potential intra-regional trade is such that it could maintain the share of intra-regional trade in the total trade with the partners at the maximum level observed in the period adjusted for the shares of the region in global trade.

The indicator does not consider the determinants of intra-regional trade. Thus, its results are better adjusted to capture a more realistic picture to the extent that during the period of analysis do not exist important changes in factors such as the resource endowment, trade policies, bilateral real exchange rates, and changes in the infrastructure of the countries considered that provoke changes in its trade specialization.

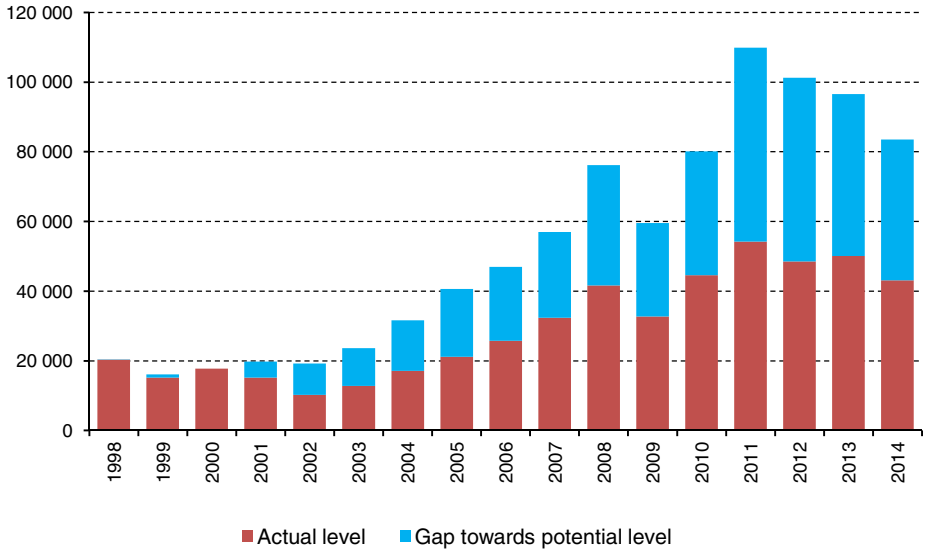
Table 38
Selected regions: estimation of potential intra-regional trade and its impact on total exports, 2014
($ million)

Regions	Indicators					
	Intra-regional exports	PIRT (Eq. 64)	Gap	Exports to the World	IRTI (Eq. 59) *(percentages)*	Impact of the gap *(percentages)*
	A	B	C=B-A	D	E=A / D	F=C / C+D)
Andean Community	9 799	25 444	15 644	122 410	8.0	11.3
MERCOSUR	43 060	90 234	47 173	307 975	14.0	13.3
Africa (49)	73 641	107 363	33 722	384 572	19.1	8.1
E.U. 27	3 697 852	3 782 459	84 607	5 950 265	62.1	1.4
NAFTA	1 242 267	1 338 381	96 113	2 447 894	50.7	3.8

Source: Own compilation based on Comtrade.
Note: Figures for the Andean Community and MERCOSUR do not include Venezuela. Figures for the European Union refer to the same member states throughout the whole series considered (since 1990).

Table 38 presents the estimations of potential intraregional trade in selected regions. The results show that in 2014 the intra-regional exports in all of the regions were below its potential level. Being at the level of $308 billion, the trade between the countries in the MERCOSUR region is found to be $108 billion lower than its estimated trade potential. In terms of its weight in the total exports of this region, the intra-regional trade estimation is thus 14%, while the level observed in 1998 was 25%. In relative terms, the gap in the Latin American subregions is comparable to that in Africa. In the case of the European Union (E.U.) or the North Atlantic Free Trade Agreement (NAFTA), the intra-regional trade observed in 2014 almost reached the potential level estimated by this procedure.

Figure 19
MERCOSUR: historical and potential intra-regional trade, 1998 - 2014
($ million)



Source: Own compilation based on figures from Comtrade.
Note: Figures from Venezuela are not included.

Figure 19 presents the historical and potential intra-regional trade. We observe that the gap between both became smaller from the beginning of the 1990s but widened in the last years, when the trade in goods in particular with the Asian Pacific region accelerated. Estimating the export flows at its potential level between 1980 and 2009, it can be observed that in the last five years the MERCOSUR stopped benefitting between 7 and 8% of the total exports, This is the value of the gap between the observed flows and those estimated.

Another way to calculate the indicator is through using econometrics on a gravity model, for which we recommend to review Durán and Lo Turco (2010).

D. Effects of a customs union

The theory of economic integration has followed Balassa (1961) in his typology of the stages of integration, according to which it can take various forms that represent different levels of economic, political, and social integration. These are: free trade area, customs union, common market, economic union, and total economic integration.

Inside a free trade area, the tariffs and remaining non-tariff barriers between members are completely eliminated. However, each state maintains its own barriers towards non-members of the integration scheme. This also holds for a free trade agreement between countries. The creation of a customs union is always connected to a consolidated, common external tariff so that any non-members of the scheme face the same resistance in all markets of the union's members. A common market implies free factor mobility inside the geographical area presently covered by all Member States to that agreement. In the case of an economic union, we speak of a certain degree of harmonization among the national economic policies. Furthermore in a total economic integration scheme, we find full harmonization which assumes the unification of monetary, fiscal, and social policies as well as the establishment of certain supranational institutions.

From the second stage of the economic theory, the risk of trade diversion raises, i.e. the new imports that a country A receives from the partner B which is member of the scheme, or the new exports that it sends to the latter do not create (new) trade. This is because trade with another partner C (outside the preference scheme) is now shifted towards a partner B because of the newly assigned preferences.

While trade creation implies a change from one supplier with high cost to one with lower costs, trade diversion acts in the opposite direction by producing a change in purchases from a producer with low costs to one with higher costs but higher preferences. That is why the benefits of a customs union predominate if the trade creation exceeds trade diversion.

However, these benefits will depend on the differences of the unit costs between the products subject to created and diverted trade. Therefore, if the differences in the unit costs are considerably higher for the goods that have been creating trade than for those goods that have been diverting trade, it is possible that the customs union yields benefits in global efficiency, even when trade diversion is greater than trade creation.

Following the intuition of Viner (1950), this is why we propose the use of an artificial indicator —whose information is difficult to collect— that would allow identifying the Customs Union Effect (CUE). Formally:

$$\mathrm{CUE} = \frac{\sum_{k=1}^{n}\left[\mathrm{CT}_{t=1}^{k}\left(\frac{V_{t=1}^{k}}{Q_{t=1}^{k}}\Big/\frac{V_{t=0}^{k}}{Q_{t=0}^{k}}\right)\right]}{\sum_{k=1}^{n}\left[\mathrm{DT}_{t=1}^{k}\left(\frac{V_{t=1}^{k}}{Q_{t=1}^{k}}\Big/\frac{V_{t=0}^{k}}{Q_{t=0}^{k}}\right)\right]}, \qquad (65)$$

where *CT* is the created trade, *DT* is the diverted trade, *V* is the value, *Q* is the quantity, *t* is the period, and *k* is the product.

This type of analysis can lead to the conclusion that the trade creation and diversion only cover an aspect of productive effects and that if one looks for a greater accuracy it is necessary to distinguish between negative and positive effects of the products' unit costs.

To that it should be added that "[…] the consumption effects of a union may be positive or negative, depending primarily on the extent of trade relations between the member countries, the complementarity and competitiveness of the participating economies, and the height of tariff levels" (Balassa, 1961, p. 62). Everything that claims to provide a general theory about the integration effects should be taken only with great caution.

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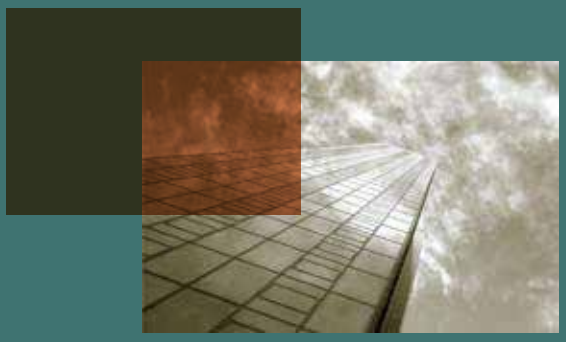

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