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Upgrading process in global value chains: Evidence from Latin American countries

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Abstract. This paper analyzes the participation of Argentina, Brazil, Chile, Colombia, Costa Rica, Mexico, and Peru (Latin American countries) in Global Value Chains (GVCs) from a multi-regional and multi-sectoral perspective in the period 1995-2015. Our objective is to answer a key question: the participation of Latin American countries in GVCs, in which sectors and industries have they evolved towards upgrading processes? We use a multi-regional in-input-output model (MRIO) to estimate domestic and foreign value-added rates as a percentage of total national exports, classifying the participation of the countries in GVCs into four production stages: strategic, intermediate-final stages, initial and secondary. We find that GVCs have been drivers of the development of the manufacturing industry in Mexico, Brazil, Argentina, and Costa Rica. Upgrading processes stand out in value-added intensive industries, such as the manufacture of vehicles, trailers and semi-trailers, electronic, electrical, and optical products, among others.

Keywords. Global Value Chains, Latin American countries, MRIO, upgrading processes, value-added.

1. Introduction

The economic facts analyzed in this paper¹ on the participation of Argentina, Brazil, Chile, Colombia, Costa Rica, Mexico, and Peru (Latin American countries) in Global Value Chains (GVCs), have been extensively examined from different theoretical and methodologies perspectives, to show the development of upgrading processes in this GVCs.

Often in these studies, the GVC concept is assumed as an analytical framework, under the reasoning that the structural change of the world economy (1980s) has been articulated around the functional integration of production across national borders [1]. In other words, the configuration of GVCs allows the production of intermediate or final goods to be fragmented among one or more companies that may have different geographical locations [2] [3] [4].

Likewise, GVCs as an analytical concept allow capturing the main elements to consider in the organization of global industries [5]. This concept has also given a new meaning to the concept of competitive advantage because it makes it possible to focus the analysis on the management, coordination, and synchronous operation of the productive chains [6]. Both

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elements have influenced the positioning of GVCs as an analytical framework in studies on the participation of countries in production and trade processes derived from international production fragmentation.

Its frequent use in research on international trade, vertical integration of production, global supply networks, among others, has been the main recommendation for used in empirical studies on the participation of undeveloped countries in GVCs [7] [8] [9]. According to Gereffi [10], the objective is for underdeveloped countries to promote productive development strategies to scale positions in the successive stages of GVC production.

Both the expansion processes of GVCs and economic liberalization in Latin American countries (LAC, hereinafter) are part of the structural change of the world economy, which caused rearrangements in the participation of countries in world production and trade. GVCs have represented opportunities for the restructuring of manufacturing through complementary strategies from an institutional perspective. On the one hand, the consolidation of specialized manufacturing in the assembly-maquila of intermediate goods (components, parts, and pieces) and/or final goods (televisions, computers, telephones, etc.). On the other hand, the development of traditional manufacturing with strong backward linkages in domestic markets, to produce final goods intensive in added value; for example, the development of a specialized food processing industry to take advantage of pre-existing industrial capabilities and promote diversification of commodity exports.

To this end, the development of medium-high technological level manufacturing (industrial modernization) was considered a priority, with the capacity to generate efficient and dynamic productive environments that would serve for the dissemination of technical knowledge and encourage industrial in domestic markets. Likewise, the greater generation of value-added in production processes would be a key element to retain, within national territories, higher percentages of wealth generated by various concepts, such as wages, federal and local tax payments, dividends, profits, and benefits to investors, among others. Thus, LAC promoted their comparative advantages, which have not been limited to the abundance of cheap productive factors, since there are advantages created and developed to satisfy the requirements of global companies [11].

In this context, we analyze the participation of LAC in GVCs during the period 1995-2015, to answer a key question: in which sectors and industries have they evolved towards upgrading processes? We use a multi-regional input-output model (MRIO), so-called GVC income ([12], [13] and [14]) supported on data from the Inter-Country Input Output Tables (ICIO) published by the OECD [15], for 1995, 1999, 2003, 2007, 2011 and 2015.

The paper is organized in five sections. The second describes the methodology, including the criteria used to determine the magnitude of the participation of LAC in the production stages of GVCs. The results and discussion design the third. In the fourth section the results are compared with the empirical evidence from other studies. We finish with conclusions.

2. Methodology

MRIO models allows describing an economic system of intra-industry and inter-regional transactions, where the production of each country depends both on the production of the different domestic industries and on those located in other countries. In MRIO models, the final demands are made up of the goods and services that are consumed in the different countries and that may or may not have been produced in them. Direct and indirect industrial interdependencies are formed through the flows of inputs between countries; it is a sequential intraindustrial and multiregional production [16] [17] [18].

An advantage of these models is that they provide a total assessment of geographically dispersed and fragmented production in various stages of production, considering the role of countries as sellers and buyers. This makes it possible to identify complex networks of industrial interdependencies and at the same time differentiate between processes of vertical and horizontal integration of production. Therefore, Recent research has positioned MRIO models as a key tool for analyzing the added value embodied in international trade and, based on this, evaluating national participation in GVCs [19] [20] [21] [22] [23].

As MRIO model, the GVC Income [12] [13] [14] provides flexibility to make estimates with different territorial and industrial scales. It allows analyzing the different components of international value-added trade, such as the value-added produced and marketed within national territories (domestic component); the value-added exported that is produced in each country and marketed in other countries (international component); and imported added value, whose production originates in a certain country and is consumed in other countries (international component).

For this, we use the ICIO tables for the period 1995-2015, but two different versions are offered, which are not compatible in industrial and geographical coverage. The 2016 version offers information for the years 1995, 1999 and 2003, with a breakdown of 34 industries and 63 countries plus the rest of the world (RoW). Meanwhile, the 2018 version is broken down for 64 countries plus RoW and 36 industries in 2007, 2011 and 2015.

Therefore, we adjust geographic and industry coverage. First, the differences in geographic coverage were cancelled, including Kazakhstan as part of the RoW, and the same geographic coverage was maintained: 63 countries plus the RoW (see Appendix, Table 1). Second, to standardize industrial coverage, a classification of five economic sectors was elaborated: primary, energy, manufacturing, construction, and services (see Appendix, Table 2).

In general, the input-output models are expressed as follows:

$$x = Ax + y \quad (1)$$

The equation (1) represents the equilibrium in the MRIO model with m countries and n industries, where the vector x mxn is the total product. $A = (a_{ij}^{rs})$ is the matrix of technical coefficients, whose element a_{ij}^{rs} indicates the quantity of intermediate inputs i from country r that is needed to produce a unit of product j in country s . We denote $y = (y^{rs}) = (y_i^{rs})$ by the matrix $(mxn) \times m$ of total final demand (not of demand for intermediate goods or inputs), whose elements y_i^{rs} show the demand for product i of country r to satisfy the final demand of country s , being y^{rs} the vector $nx1$ of goods of r included in the final demand of s . Additionally, it is denoted by $y = (y_i^r) = (\sum_s y_i^{rs})$ the vector $(mxn) \times 1$ of global final demand embodied in (1). $L = (I - A)^{-1} = (\alpha_{ij}^{rs})$, whose representative elements α_{ij}^{rs} show, in this multiregional model, the total production generated in industry i of the country r embodied in (directly and indirectly necessary for satisfy) a unit of final demand for good j produced in country s . It should be noted that this unit can satisfy the final consumption of the country or another country.

$$x = (I - A)^{-1}y = Ly \quad (2)$$

The inverse Leontief matrix allows us to connect production with demand, so that it is possible to evaluate, given a final demand, what is the total production of the economy generated directly and indirectly to satisfy the final demand for a good in any country. Likewise, the multiregional vision also makes it possible to identify where this production is being generated and how it is moving geographically, by tracking the destination of exports and the origin of imports.

Furthermore, if we pre-multiply said production by a diagonal matrix of income per unit

of production \mathbf{v} (vector of coefficients of added value), and if we diagonalize final demand \mathbf{y} , we obtain the matrix $\mathbf{\Omega}$ ($(m \times n) \times (m \times n)$), as follows:

$$\mathbf{\Omega} = \hat{\mathbf{v}}\mathbf{L}\hat{\mathbf{y}} = \begin{pmatrix} \Omega_{11} & \Omega_{12} & \cdot & \cdot & \Omega_{1m} \\ \Omega_{21} & \Omega_{22} & \cdot & \cdot & \Omega_{2m} \\ \cdot & \cdot & \cdot & \cdot & \cdot \\ \Omega_{r1} & \cdot & \Omega_{rs} & \cdot & \Omega_{rm} \\ \cdot & \cdot & \cdot & \cdot & \cdot \\ \Omega_{m1} & \Omega_{m2} & \cdot & \cdot & \Omega_{mm} \end{pmatrix} = \begin{pmatrix} \hat{v}_1 & 0 & \cdot & \cdot & 0 \\ 0 & \hat{v}_2 & \cdot & \cdot & 0 \\ \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \hat{v}_r & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot \\ 0 & 0 & \cdot & \cdot & \hat{v}_m \end{pmatrix} \begin{pmatrix} L_{11} & L_{12} & \cdot & \cdot & L_{1m} \\ L_{21} & L_{22} & \cdot & \cdot & L_{2m} \\ \cdot & \cdot & \cdot & \cdot & \cdot \\ L_{r1} & \cdot & L_{rs} & \cdot & L_{rm} \\ \cdot & \cdot & \cdot & \cdot & \cdot \\ L_{m1} & L_{m2} & \cdot & \cdot & L_{mm} \end{pmatrix} \begin{pmatrix} \hat{y}_1 & 0 & \cdot & \cdot & 0 \\ 0 & \hat{y}_2 & \cdot & \cdot & 0 \\ \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \hat{y}_s & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot \\ 0 & 0 & \cdot & \cdot & \hat{y}_m \end{pmatrix} \quad (3)$$

Where ω_{ij}^{rs} (is an element of sub-matrix $\mathbf{\Omega}_{11}$, por example) is the value-added associated with the production of goods i in country r that are necessary directly or indirectly to produce a unit of good j that is produced in s to satisfy the global final demand of that good. This unit can be consumed in the country or in another country. In addition, the different sub-matrices $\mathbf{\Omega}_{rs}$ collect the value-added generated in any industry i in country r that is embodied into the global final demand for any good j produced in s , when $r \neq s$, $\mathbf{\Omega}_{rs}$ represents the flows of value-added traded from country s to country r , and when $r = s$, $\mathbf{\Omega}_{rs}$ calculates the direct and indirect flows from country r that finally end up in the final global demand produced in r .

The sum by rows in the matrix $\mathbf{\Omega}$ shows the value-added generated in each country and industry, and the elements in the rows their distribution in the different sectors and countries according to the destination of the goods. Meanwhile, the sum by columns shows for each country and sector all the value-added generated in the world and finally embodied in goods produced in that country and sector to satisfy the final global demand. The elements of the column allow to see the different origins of the value-added embodied in the final demand.

In summary, the matrix $\mathbf{\Omega}$ provides information on the origin and destination of total value-added linked to the production of goods and services in m countries and n industries. Let us now see how this happens when we look specifically at the value-added generated by a s and which is captured by the vector \mathbf{v}_s . The direct application of (3) allows us to obtain:

$$\begin{aligned} \mathbf{\Omega}^s &= \hat{\mathbf{v}}_s \mathbf{L}_{s1} \hat{\mathbf{y}}_1 + \hat{\mathbf{v}}_s \mathbf{L}_{s2} \hat{\mathbf{y}}_2 + \dots + \hat{\mathbf{v}}_s \mathbf{L}_{ss} \hat{\mathbf{y}}_s + \dots + \hat{\mathbf{v}}_s \mathbf{L}_{sm} \hat{\mathbf{y}}_m \\ &= \hat{\mathbf{v}}_s \mathbf{L}_{ss} \hat{\mathbf{y}}_s + \sum_{r \neq s} \hat{\mathbf{v}}_s \mathbf{L}_{sr} \hat{\mathbf{y}}_r = \mathbf{\Omega}_{ss} + \sum_{r \neq s} \mathbf{\Omega}_{sr} \end{aligned} \quad (4)$$

where $\mathbf{\Omega}_{ss}$ represents the value-added of the country s that ends up in the final demand of the country itself, while $\sum_{r \neq s} \mathbf{\Omega}_{sr}$ is the international component, which is to say that it is the value-added of the country s embodied in the final goods exported to other countries and that they will be used as inputs in the final demand generation processes in other countries. This decomposition allows calculating the value-added generated in each national economy and used to satisfy the final domestic demand, or to satisfy the final international demand.

Thus, the second component measures for each country the “value-added exports”, defined as the total amount of value-added produced in a country that finally crystallizes in the

final global demand for products produced abroad. Note that the matrices Ω_{sr} are $n \times n$.

From these elements, we can measure for each country and sector the domestic value-added embodied in exports, as well as the foreign value-added embodied in imports, and relate them to total exports, as follows:

A) The Domestic Value-Added (DVA) contained in the total exports of sector i in country r ,

measured as a percentage of total exports, is defined as: $DVA_i^r = \frac{\sum_{s \neq r} \omega_{ij}^{rs}}{E^r} * 100$, where E^r represents the total exports of country r . At the same time, we will call the DVA of country r , measured as a percentage of exports, to: $DVA^r = \sum_i DVA_i^r$

A high DVA rate indicates that countries transfer relatively greater value-added to other countries through international trade. Thus, countries with a high DVA rate will often be integrated in the early stages of GVC production as sellers of basic products, scarcely processed goods and other goods that are used as inputs in production processes in third countries.

B) In the same way, for each country s and industry j the Foreign Value-Added contained in

imports, FVA_j^s , measured as a percentage of total exports, will be given by $FVA_j^s = \frac{\sum_{r \neq s} \omega_{ij}^{rs}}{E^s} * 100$, while the FVA to country s – measured as a percentage of its exports– will be: $FVA^s = \sum_j FVA_j^s$.

A high proportion of the FVA rate tells us that country s in its sector j is receiving relatively higher value-added from other countries through international trade. Note that the reference is the value of each country's exports. In general, countries can benefit from high FVA rates because their value-added intensive imports are inputs in their manufacturing processes for final or intermediate goods; in the case of final consumer goods, it can refer to the manufacture and/or assembly of televisions, automobiles, mobile phones and others. Meanwhile, the production of intermediate goods often tends to specialize in the manufacture/assembly of parts, components, and pieces such as electric motors of cars, electrical and optical cables for electronic devices (computers, consoles, etc.), positioning the countries where they are producing closer to final consumers. So, countries with high FVA rates tend to have a relatively important participation in the intermediate-final stages of GVCs.

To visualize the global panorama of the participation of the countries in GVCs, we proceed to compare the DVA and FVA rates of the countries with the respective world averages (See Table 1).

Table 1. Classification of country participation in the production stages of GVCs

	$DVA^s \geq$ World average DVA rate	$DVA^s <$ World average DVA rate
$FVA^s \geq$ World average FVA rate	Strategic	Intermediate-final stages
$FVA^s <$ World average FVA rate	Initial stages	Secondary

Note: The above classification requires country rates and world averages to be for a specific year.
Source: Own elaboration.

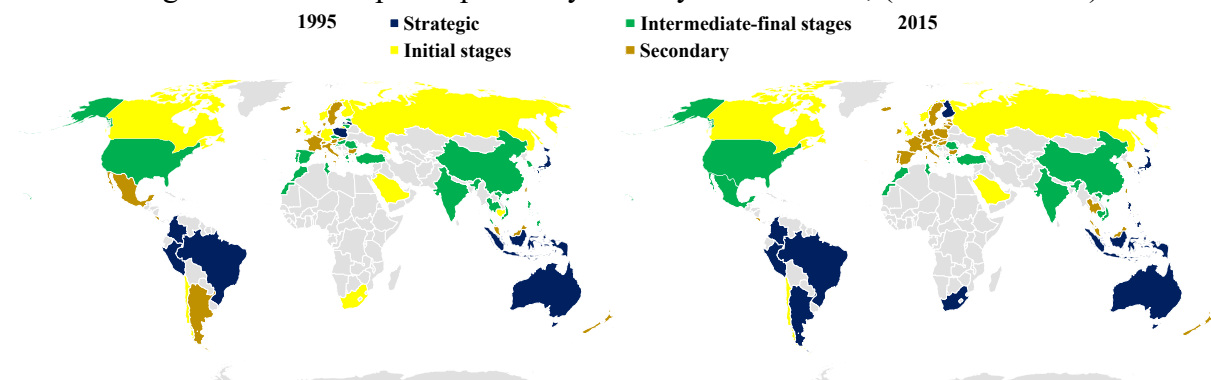
3. Results

We analyze the general participation of countries in GVCs to determine in which production stages LAC are relatively positioned (See Appendix, Table 3). We find that strategic participation in GVCs is characteristic of Japan, Australia, and New Zealand, as well as Brazil and Colombia, as DVA and FVA rates as a percentage of total exports are higher than world averages. The strong forward and backward linkages of these countries underpin their strategic

position in global value chains. In addition, the United States, China, India, South Korea, Romania, Poland, Hungary, Italy, Portugal, Spain, and others often participate in the intermediates and final stages of GVCs. This evidence the predominance of vertical integration in the manufacturing industry, as well as in the service activity that provides general, technical, and organizational support to companies.

Meanwhile, in the initial stages of GVCs, there are the largest number of nations, we can find three LAC, Argentina, Chile, and Peru. Finally, secondary participation in GVCs defines the rest of the countries, including Costa Rica and Mexico; its DVA and FVA rates have a lower relative weight in total exports, which indicates the key role of the domestic market as the engine of national production, compared to what is observed at a general level in other countries. The results for Mexico and Argentina show an upgrading in participation in GVCs between 1995 and 2015 (See Figure 1).

Figure 1. General participation by country in the GVCs, (1995 and 2015)



When analyzing the results by economic sectors –primary, energy, manufacturing, construction, and services–, using sectoral DVA and FVA rates for each country, we find common patterns in the participation of LAC in GVCs. Thus, in the primary sector, strategic participation is predominant, except in Mexico, which registered participation in the initial stages of GVCs. Consequently, the weight of international trade in primary goods is relatively more important in Argentina, Brazil, Chile, Colombia, Costa Rica, and Peru, than in Mexico, the United States, Russia, Germany, South Africa, among others.

In turn, participation in energy GVCs –exploitation of mines and quarries; production of coke and refined petroleum products; and generation and supply of electricity, gas, and water –has registered greater diversity among LAC. Participation of Argentina is strategic, Brazil in the intermediate-final stages, and the other countries of LAC in the initial stages in these GVCs.

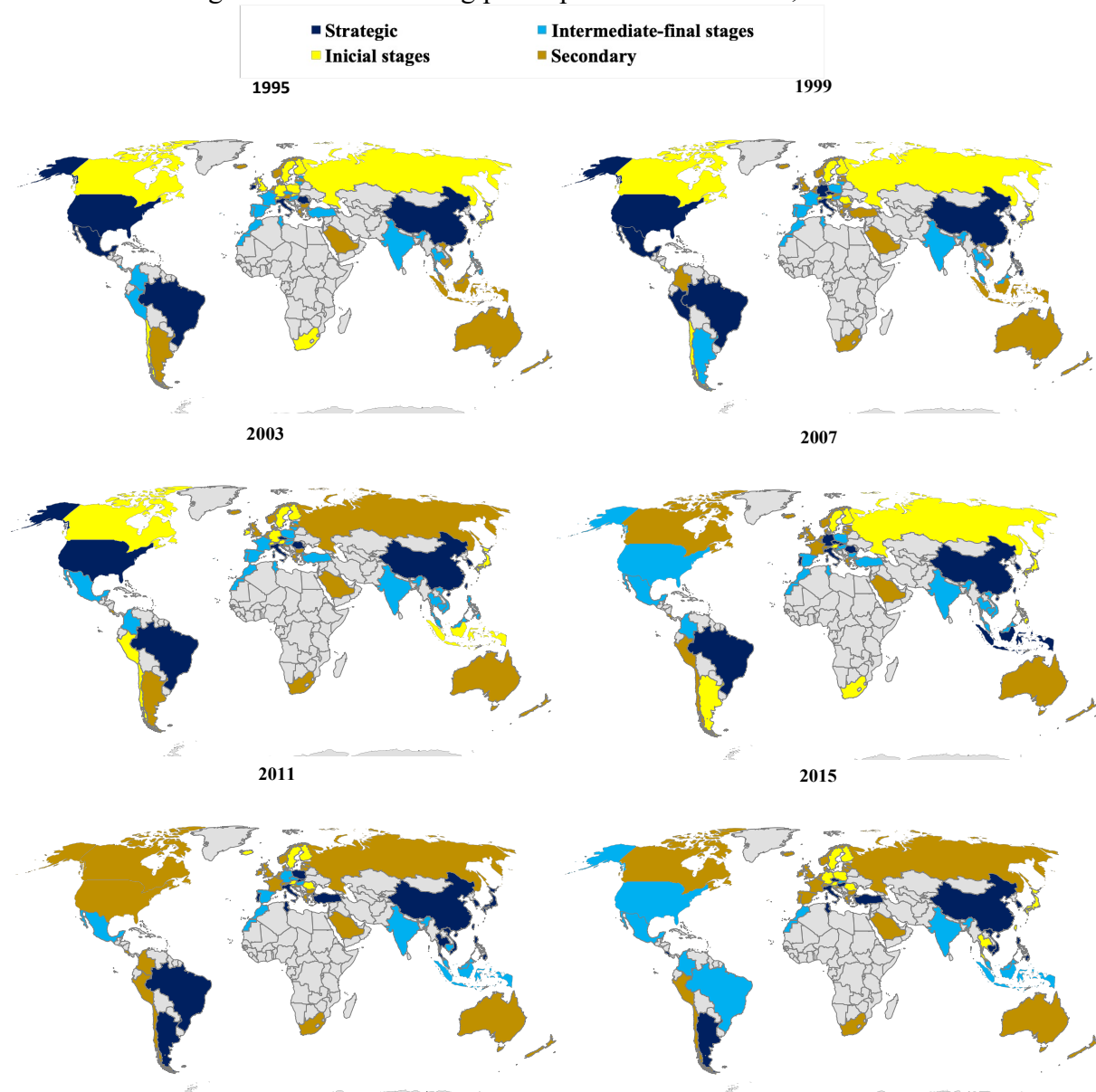
Regarding the manufacturing industry, there are pronounced differences between LAC in the patterns of production specialization in GVCs: Brazil and Mexico are outlined with strategic participations, Colombia in the intermediate-final stages, Chile in the initial stages and secondary participation in GVCs define the rest of the LAC. That is, only the economies of the largest economic size, Brazil, and Mexico, positioned themselves with strategic participation in manufacturing GVCs. The foregoing may be related to a greater endowment of comparative advantages, particularly those associated with the industrial development pre-existing to the expansion of the GVCs, providing them with initial advantages in their integration processes of said chains. (See Figure 2).

About the construction sector, we know that it produces non-tradable goods in international trade, but it is an importer of inputs, knowledge, and technology on a regular

basis. This explains why Brazil, Colombia and Peru have registered participations in the initial stages and intermediate-final stages of the GVCs specialized in construction. In the other Latin American countries, integration into global chains is secondary.

Finally, services include essential activities for the organization of production in GVCs. For this reason, the countries with strategic stakes in GVCs worldwide are the most developed, such as the United States, Australia, and the United Kingdom, with some emerging economies added — South Korea, India, and so on. In these nations the generation of knowledge, technology, organizational and productive techniques are concentrated, which are exported to the rest of the world through the provision of technical services, specialized technology transfer to countries characterized by having companies strongly integrated in one or more stages of GVC production. This explains the weak participation of LAC in these activities.

Figure 1. Manufacturing participation in the GVCs, 1995-2015



Our findings allow us to identify patterns of participation in manufacturing GVCs with outstanding differences between these countries. The common pattern is participation in manufacturing GVCs with low added value, such as food, beverages, and to-bacco; textiles, clothing, leather, and related products (except Chile); wood and wood and cork products (except Colombia and Mexico). Their integration into manufacturing GVCs specialized in the processing of raw materials and food registered wide gaps in their DVA and FVA shares (See Figures 3 and 4).

Figure 3. Latin American countries in the food, beverages, and tobacco GVCs

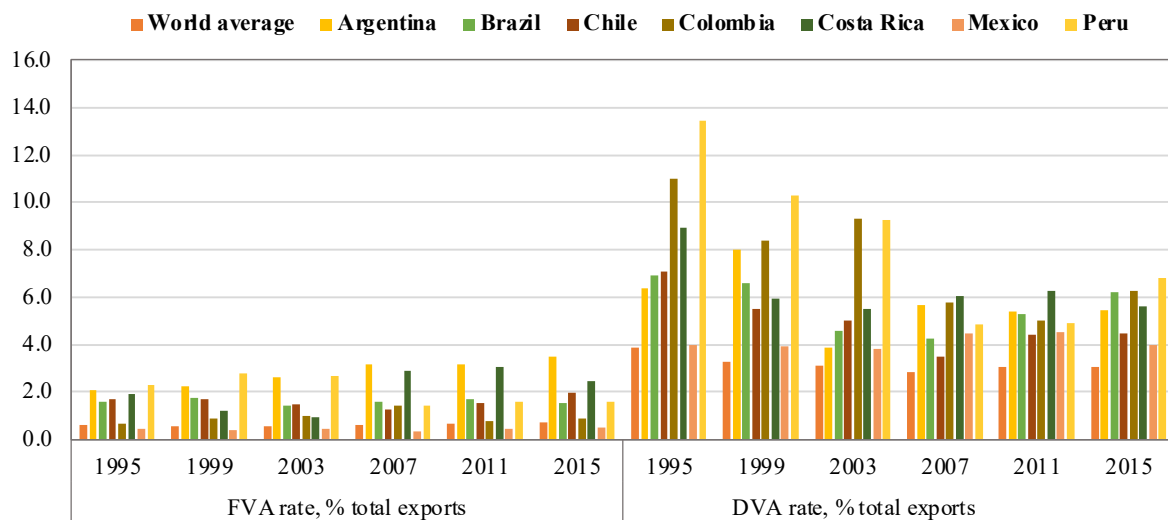
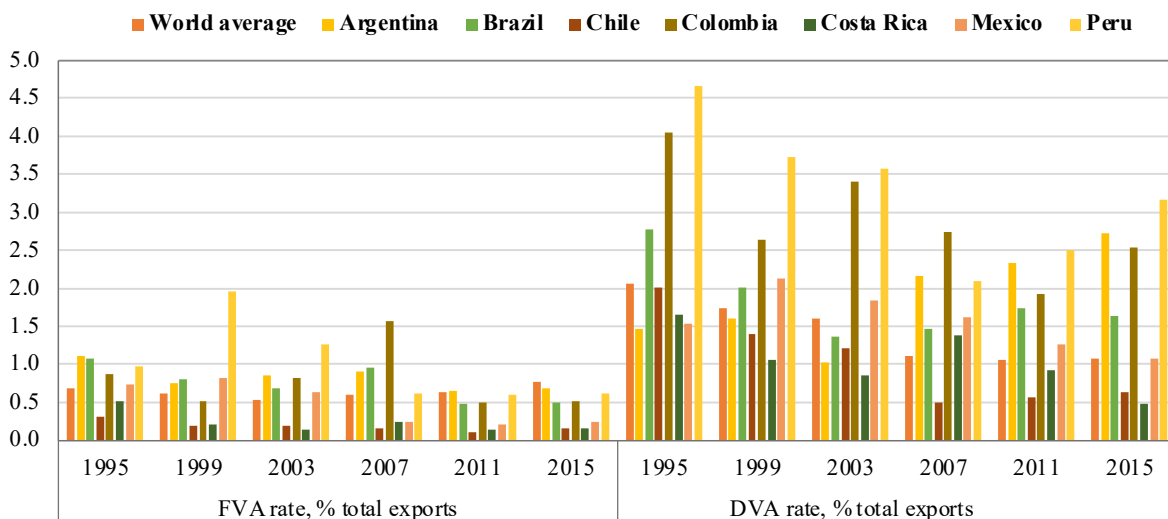


Figure 4. Latin American countries in the textiles, wearing apparel, leather, and related products GVCs



The second common pattern includes the production of chemical and pharmaceutical products; the production of rubber and plastic products; other non-metallic mineral products; base metals; and other manufactures. Finally, in the third the industries specialized in the manufacture of computer, electronic and optical products are concentrated; electric

equipment; motor vehicles, trailers and semi-trailers and other transportation equipment. These industries are the ones with the highest added value, highlighting the participation of Mexico, Brazil, Costa Rica, and Argentina in these GVCs (See Figures 5 and 6).

Figure 5. Latin American countries in the computer, electronic and optical products; electrical equipment GVCs

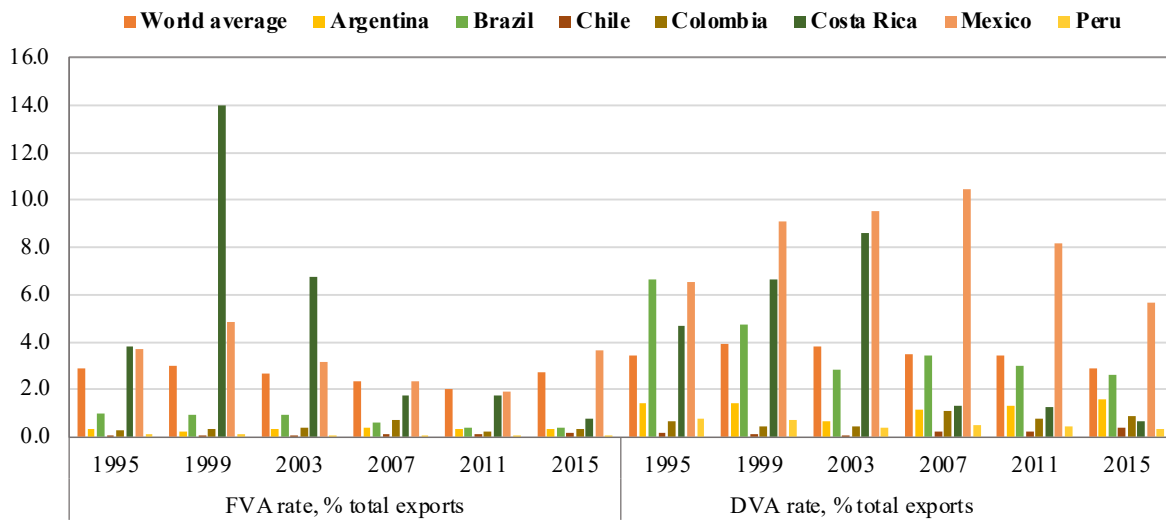
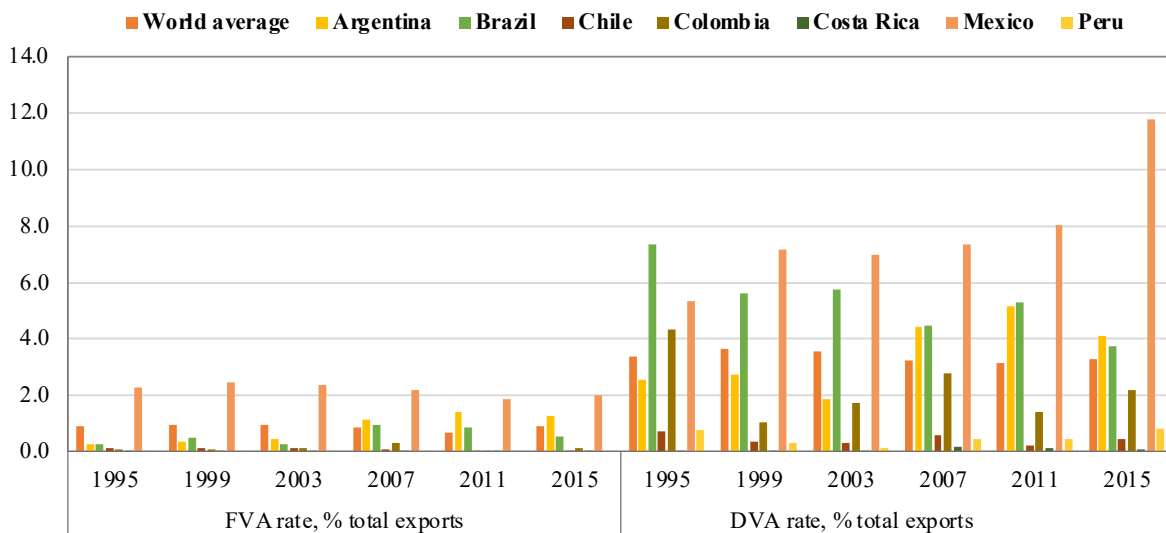


Figure 6. Latin American countries in the motor vehicles, trailers, and semi-trailers GVCs



Regarding the evolution of participation in manufacturing GVCs, we identified upgrading processes for Argentina driven by integration in industries such as motor vehicles, trailers, and semi-trailers; textiles, wearing apparel, leather, and related products; rubber and plastic products; among other. Stability in manufacturing GVCs characterized Colombia, despite the decline in participation in industries such as other non-metallic mineral products; basic metals; motor vehicles, trailers, and semi-trailers; other transport equipment; and other manufacturing.

Meanwhile, Brazil and Mexico positioned themselves as key participants in the

intermediate-final stages of these GVCs. In Brazil, the upgrading took place in industries such as rubber and plastic products; basic metals; other transport equipment; among other. On the other hand, in Mexico, the upgrading in GVCs was registered in the manufacture of textiles, wearing apparel, leather and related products; chemicals and pharmaceutical products; rubber and plastic products; other manufacturing.

Chile, Costa Rica, and Peru registered a decline in integration in manufacturing GVCs, due to industries such as rubber and plastic products; other non-metallic mineral products; basic metals; among other. It is important to highlight the decline in Costa Rica in the manufacture of computer, electronic and optical products, and electrical equipment.

The evolution of the integration processes of LAC in manufacturing GVCs has been heterogeneous. On the one hand, the results show the general importance of low value-added manufacturing in these economic integration processes in GVCs. On the other hand, the evidence also reveals that some countries have managed to integrate more and more into manufacturing with higher added value. Mexico is the most visible example of the expansion in these GVCs and, we must add that these dynamic processes have been determined by the economic forces framed in NAFTA.

4. Discussion

We find that the integration dynamics of LAC into GVCs has been slower than that of less developed Asian and European countries [24][25], except for Brazil and Mexico that experienced greater dynamism compared to the other countries. Furthermore, most studies generally agree on the predominance of forward over backward participation in the case of LAC, since sectoral patterns have been articulated in the intensive production in natural resources such as primary, energy and manufacturing activities specialized in the processing of food and raw materials. In this sense, LAC have stood out worldwide considering the forward participation in GVCs, both in the period 1995-2011 [26] [24], and in the period 1995-2015 [27].

Our results suggest that the participation of LAC in GVCs has been heterogeneous, as is posed in Cadestin et al. [28], when analyzing the predominant modality of productive integration concluding that in Costa Rica and Mexico the backward participation has predominant over the forward because their industries require the importation of intermediate goods to produce to a greater extent than Argentina, Brazil, Chile and Colombia that have specialized in the export of intermediate products based on natural resources that are processed or consumed abroad, particularly in China, India and Asian countries in general.

Likewise, the heterogeneity is the main characteristic of the participation of LAC in GVCs and identify that integration with greater ties with the United States of America is materialized in the participation of Costa Rica and Mexico in industries specialized in electronics, automotive, aerospace, among others and whose common denominator is the high dependence on imports of intermediate goods [29].

Meanwhile, the participation of the other LAC in the GVCs tends to be characterized by the predominance of forward participation, as well as the development of greater productive and commercial links between Argentina, Brazil, Chile, Colombia, and Peru. These same authors compare the integration of Brazil and Mexico in the GVCs, finding that the participation of Brazil is based on the forward participation with greater incorporation of domestic added value, unlike Mexico where the backward participation has been relatively greater, showing the predominance of the vertical integration of production in the GVCs by being sustained by assembly activities of final goods that incorporate little value-added in the manufacturing process.

Other researcher found that the integration of Argentina and Brazil in the global GVCs has been characterized by the persistence of patterns of primary specialization or manufacturing with low added value [30]. Another research on the integration of Argentina in the GVCs, although based on raw data on international trade according to the evidence in [31] in the analysis of the integration of Argentina in the GVCs, which reveals the strengthening of the sectors intensive in natural resources as exporters while maintaining a high dependence on imports of capital goods, technology, inputs, and parts.

Along the same lines, we also believe that international trade is an accelerator of economic growth. However, to maximize its impact, it is necessary to implement public policies that favour the development of innovation and technology in underdeveloped countries [32].

A conclusive fact of our research, like Shepherd [33], is that the sectoral patterns of the integration of LAC in GVCs have been mainly structured around the traditional comparative advantages embodied in the production of goods intensive in natural resources. such as raw materials, food, minerals, fossil fuels, and low-value-added, sparsely processed goods.

This is manifested with greater precision with the evidence analyzed based on the taxonomy of the participation of the countries mentioned in the GVCs, allowing to differentiate between the degree of forward and backward participation during the 1995-2015 period. Their results in general have revealed that LAC are far from experiencing the so-called industrial upgrading in their production integration processes in GVCs and, even applies in economies that experienced higher levels of backward integration in the initial stages of expansion of the companies, GVCs like Mexico, Brazil, and Costa Rica.

5. Conclusions

In this paper we have used an MRIO model called GVC income to measure the participation of Argentina, Brazil, Chile, Colombia, Costa Rica, Mexico, and Peru in GVCs in the period 1995-2015. Our main contribution consists of the identification of common patterns of productive specialization of the participation of LAC in GVCs based on intensive production in natural resources. These patterns are even maintained in the best-positioned economies in manufacturing GVCs, such as Brazil and Mexico. Likewise, participation in the intermediate-final stages of the GVCs is positively related to the expansion of productive capacities to generate greater value-added based on the importation of intermediate goods in an increasing way, again we refer to Brazil, Mexico, and Costa Rica.

However, empirical evidence suggests that the international fragmentation of production has materialized in higher levels of integration of less developed economies in GVCs. Notwithstanding, the participation of LAC in GVCs has been lower than that experienced in less developed nations from Europe and Asia. This weakness in the participation of LAC in global chains is because the patterns of productive specialization are based on the intensive use of comparative advantages, which are fundamentally their natural resources.

A relevant finding is that the international fragmentation of production has contributed to maintaining the role of LAC as primary exporting economies in GVCs, including Brazil, Costa Rica, and Mexico, which are the countries with a prominent participation in intensive manufacturing in technology. In general, these processes have been determined by the growing global demand for basic products [34] [35] [24], which created opportunities for horizontal integration in GVCs for these countries, which have supplied raw materials and food to the rest of the world.

Consequently, during the commodities boom [36], the patterns of productive specialization intensive in natural resources strengthened particularly in Argentina, Chile, Colombia, and Peru. Of this group, Chile is the Latin American economy with strategic participation and in the initial stages of the GVCs of primary industries, energy, as well as in traditional manufacturing. A notable characteristic of the Chilean economy is that it is ahead of the rest of the LAC by relying relatively less on imports of goods and services.

The participation of LAC in the intermediate-final stages of GVCs is concentrated in technology-based manufacturing, with greater relevance in Brazil, Costa Rica, and Mexico. These nations produce to supply GVCs from intermediate goods (integrated circuits, electrical components and parts, electric motors, among other parts) to activities specialized in the manufacture and/or assembly of final consumer goods (computers, automobiles, delivery trucks, etc.) to supply world markets. Brazil, Mexico, and Costa Rica (the latter to a lesser extent) show the development of the so-called upgrading in the integration processes in GVCs. Therefore, in these countries more heterogeneous patterns of production specialization have developed according to their industrial composition.

However, the empirical evidence does not reveal the sustained development of structural transformation processes emanating from the participation of LAC in GVCs. Rather, the results suggest that the patterns of productive specialization identified as characteristic of the 1995-2015 period had already developed in previous stages. Consequently, what our indicators show are traditional production specialization patterns in LAC during the period under review. Certainly, the results reveal that LAC are far from experiencing accelerated growth in their integration processes in technology based GVCs, since cyclical fluctuations in world demand for basic products have become limiting for the development of industrial upgrading processes in GVCs for these nations.

In LAC, strategic actions are required in terms of industrial policy to accelerate the development of vertical chains of production to increase the generation of added value; particularly in industries with higher levels of participation in GVCs. In Latin America, as global value chains have strengthened, so has disenchantment with the meager benefits of globalization. Neither trade openness nor participation in GVCs have been enough to accelerate growth and drive the structural change promised by national governments when they implemented the economic model based on market forces.

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Appendix

Table 1. Geographic coverage of the ICIO tables

#	ICIOs 2016 and 2018	Code	#	ICIOs 2016 and 2018	Code	#	ICIOs 2016 and 2018	Code
1	Australia	AUS	23	Netherlands	NLD	45	Croatia	HRV
2	Austria	AUT	24	New Zealand	NZL	46	Indonesia	IDN
3	Belgium	BEL	25	Norway	NOR	47	India	IND
4	Canada	CAN	26	Poland	POL	48	Cambodia	KHM
5	Chile	CHL	27	Portugal	PRT	49	Lithuania	LTU
6	Czech Republic	CZE	28	Slovak Republic	SVK	50	Malta	MLT
7	Denmark	DNK	29	Slovenia	SVN	51	Malaysia	MYS
8	Estonia	EST	30	Spain	ESP	52	Morocco	MAR
9	Finland	FIN	31	Sweden	SWE	53	Peru	PER
10	France	FRA	32	Switzerland	CHE	54	Philippines	PHL
11	Germany	DEU	33	Turkey	TUR	55	Romania	ROU
12	Greece	GRC	34	United Kingdom	GBR	56	Russian Federation	RUS
13	Hungary	HUN	35	United States	USA	57	Saudi Arabia	SAU
14	Iceland	ISL	36	Argentina	ARG	58	Singapore	SGP
15	Ireland	IRL	37	Bulgaria	BGR	59	Thailand	THA
16	Israel	ISR	38	Brazil	BRA	60	Tunisia	TUN
17	Italy	ITA	39	Brunei Darussalam	BRN	61	Chinese Taipei	TWN
18	Japan	JPN	40	China	CHN	62	Viet Nam	VNM
19	Korea	KOR	41	Colombia	COL	63	South Africa	ZAF
20	Latvia	LVA	42	Costa Rica	CRI	64	Kazakhstan *	RoW
21	Luxembourg	LUX	43	Cyprus	CYP	64	Rest of the world	RoW
22	Mexico	MEX	44	Hong Kong SAR	HKG			

Note: The OECD publishes ICIO tables with split data for China and Mexico. In this work, we have made our estimates for 63 countries plus the Rest of the World. Data for Kazakhstan* not available for 2016.
Source: Own elaboration.

Table 2. Industrial coverage of the ICIO tables

Industry	ICIOs 2016	ICIOs 2018	Economic sector
1	Agriculture, hunting, forestry and fishing	Agriculture, forestry and fishing	Primary
2	Mining and quarrying	Mining and extraction of energy producing products Mining and quarrying of non-energy producing products Mining support service activities	Energy
3	Coke, refined petroleum products and nuclear fuel	Coke and refined petroleum products	
4	Electricity, gas and water supply	Electricity, gas, water supply, sewerage, waste and remediation services	
5	<i>1. Food products, beverages and tobacco</i>	<i>1. Food products, beverages and tobacco</i>	
6	<i>2. Textiles, textile products, leather and footwear</i>	<i>2. Textiles, wearing apparel, leather and related products</i>	
7	<i>3. Wood and products of wood and cork</i>	<i>3. Wood and products of wood and cork</i>	
8	<i>4. Chemicals and chemical products</i>	<i>4. Chemicals and pharmaceutical products</i>	
9	<i>5. Rubber and plastics products</i>	<i>5. Rubber and plastic products</i>	
10	<i>6. Other non-metallic mineral products</i>	<i>6. Other non-metallic mineral products</i>	
11	<i>7. Basic metals</i>	<i>7. Basic metals</i>	
12	<i>8. Fabricated metal products</i>	<i>8. Fabricated metal products</i>	Manufacturing
13	<i>8. Machinery and equipment, nec</i>	<i>8. Machinery and equipment, nec</i>	
14	<i>9. Computer, electronic and optical equipment</i>	<i>9. Computer, electronic and optical products</i>	
15	<i>9. Electrical machinery and apparatus, nec</i>	<i>9. Electrical equipment</i>	
16	<i>10. Motor vehicles, trailers and semi-trailers</i>	<i>10. Motor vehicles, trailers and semi-trailers</i>	
17	<i>11. Other transport equipment</i>	<i>11. Other transport equipment</i>	
18	<i>12. Manufacturing nec; recycling</i>	<i>12. Other manufacturing; repair and installation of machinery and equipment</i>	
19	<i>12. Pulp, paper, paper products, printing and publishing</i>	<i>12. Paper products and printing</i>	
17	Construction	Construction	Construction
18	Wholesale and retail trade; repairs	Wholesale and retail trade; repair of motor vehicles	
19	Transport and storage	Transportation and storage	
20	Hotels and restaurants	Accommodation and food services	
21	Post and telecommunications	Telecommunications	
22	Computer and related activities	IT and other information services	
23	Financial intermediation	Financial and insurance activities	
24	Real estate activities	Real estate activities	
25	Renting of machinery and equipment	Other business sector services	Services
26	Not data	Publishing, audiovisual and broadcasting activities	
27	Public admin. and defence; compulsory social security	Public admin. and defence; compulsory social security	
28	Education	Education	
29	Health and social work	Human health and social work	
30	Other community, social and personal services	Arts, entertainment, recreation and other service activities	
31	Private households with employed persons	Private households with employed persons	

Source: Own elaboration.

Table 3. General participation by country in the GVCs (1995-2015)

	1995			1999			2003			2007			2011			2015		
	DVA Rate	FVA Rate	GVCs production stages	DVA Rate	FVA Rate	GVCs production stages	DVA Rate	FVA Rate	GVCs production stages	DVA Rate	FVA Rate	GVCs production stages	DVA Rate	FVA Rate	GVCs production stages	DVA Rate	FVA Rate	GVCs production stages
World	45.99	45.99		44.84	44.84		45.90	45.90		46.59	46.59		47.15	47.15		45.91	45.91	
ARG	45.33	42.29	Secondary	47.57	44.07	Initial stages	48.94	25.95	Initial stages	49.68	38.13	Initial stages	49.26	42.90	Initial stages	48.88	47.95	Strategic
BRA	54.14	62.87	Strategic	49.93	61.96	Strategic	49.05	46.36	Strategic	57.29	44.40	Initial stages	61.48	52.88	Strategic	56.34	56.77	Strategic
CHL	61.94	34.48	Initial stages	54.68	35.57	Initial stages	55.83	33.96	Initial stages	70.02	27.05	Initial stages	70.37	33.73	Initial stages	67.11	37.63	Initial stages
COL	60.09	77.92	Strategic	63.30	49.93	Strategic	59.24	56.89	Strategic	62.46	52.75	Strategic	75.41	43.66	Initial stages	66.55	61.05	Strategic
CRI	38.09	41.91	Secondary	37.96	30.93	Secondary	34.89	36.34	Secondary	34.63	46.37	Secondary	37.58	46.33	Secondary	38.50	40.32	Secondary
MEX	45.31	35.35	Secondary	39.56	41.71	Secondary	40.25	42.91	Secondary	42.77	47.92	Intermediate-final stages	42.71	45.37	Secondary	33.70	46.05	Intermediate-final stages
PER	66.30	68.05	Strategic	63.97	53.51	Strategic	63.25	46.80	Strategic	67.47	31.33	Initial stages	69.43	34.10	Initial stages	65.36	46.05	Strategic
CAN	47.87	36.13	Initial stages	42.51	36.91	Secondary	46.28	37.72	Initial stages	55.35	36.03	Initial stages	55.27	38.47	Initial stages	53.41	44.82	Initial stages
USA	43.87	57.16	Intermediate-final stages	42.92	61.04	Intermediate-final stages	45.49	72.43	Intermediate-final stages	43.57	71.78	Intermediate-final stages	44.85	64.02	Intermediate-final stages	45.76	55.46	Intermediate-final stages
AUT	41.19	40.78	Secondary	40.94	37.41	Secondary	41.07	37.29	Secondary	41.00	37.29	Secondary	39.45	37.46	Secondary	40.95	36.57	Secondary
BEL	40.63	39.03	Secondary	40.08	39.33	Secondary	42.87	39.21	Secondary	40.76	37.86	Secondary	40.18	41.12	Secondary	40.35	42.16	Secondary
BGR	41.74	37.84	Secondary	35.00	44.70	Secondary	32.13	49.97	Intermediate-final stages	29.94	65.74	Intermediate-final stages	32.60	42.38	Secondary	34.87	44.44	Secondary
CYP	33.10	38.75	Secondary	33.42	37.08	Secondary	33.74	45.99	Intermediate-final stages	39.76	49.15	Intermediate-final stages	44.10	44.56	Secondary	40.33	39.46	Secondary
CZE	39.75	51.39	Intermediate-final stages	36.72	47.88	Intermediate-final stages	33.94	48.45	Intermediate-final stages	33.47	46.63	Intermediate-final stages	32.61	46.42	Secondary	32.75	40.02	Secondary
DEU	46.43	38.22	Initial stages	44.70	37.53	Secondary	45.31	33.98	Secondary	42.51	35.81	Secondary	40.23	38.54	Secondary	42.20	34.11	Secondary
DNK	40.90	36.59	Secondary	41.01	35.80	Secondary	41.96	36.45	Secondary	41.49	40.52	Secondary	41.90	36.99	Secondary	41.43	35.10	Secondary
ESP	37.08	54.90	Intermediate-final stages	35.17	54.97	Intermediate-final stages	36.32	57.24	Intermediate-final stages	35.84	64.25	Intermediate-final stages	37.09	49.48	Intermediate-final stages	37.73	44.54	Secondary
EST	32.61	50.35	Intermediate-final stages	32.48	46.22	Intermediate-final stages	34.18	45.21	Secondary	41.47	44.13	Secondary	36.61	38.79	Secondary	36.15	38.19	Secondary
FIN	48.87	36.26	Initial stages	48.12	37.16	Initial stages	46.40	38.15	Initial stages	43.44	42.47	Secondary	42.15	47.62	Intermediate-final stages	46.54	47.39	Strategic
FRA	43.46	43.04	Secondary	41.02	41.16	Secondary	41.94	43.54	Secondary	39.80	45.34	Secondary	40.84	48.92	Intermediate-final stages	42.95	45.19	Secondary
GBR	46.80	44.60	Initial stages	47.94	45.86	Strategic	50.88	45.77	Initial stages	50.60	43.53	Initial stages	48.04	44.75	Initial stages	48.67	41.45	Initial stages
IRG	33.78	69.64	Intermediate-final stages	31.56	67.99	Intermediate-final stages	33.82	70.27	Intermediate-final stages	40.08	70.62	Intermediate-final stages	39.81	55.95	Intermediate-final stages	34.29	46.72	Intermediate-final stages
HUN	35.67	65.83	Intermediate-final stages	30.43	53.62	Intermediate-final stages	25.23	59.73	Intermediate-final stages	26.69	64.54	Intermediate-final stages	28.28	52.65	Intermediate-final stages	27.92	46.32	Intermediate-final stages
HRV	33.31	48.96	Intermediate-final stages	25.57	50.27	Intermediate-final stages	27.35	50.70	Intermediate-final stages	27.34	46.10	Secondary	27.30	44.36	Secondary	30.41	41.18	Secondary
IRL	34.06	38.54	Secondary	34.06	36.99	Secondary	36.11	36.34	Secondary	35.21	41.63	Secondary	33.59	34.78	Secondary	31.19	31.34	Secondary
ITA	39.87	42.39	Secondary	39.89	44.83	Secondary	40.35	48.72	Intermediate-final stages	37.96	53.22	Intermediate-final stages	36.85	55.69	Intermediate-final stages	38.86	45.77	Secondary
LTU	40.57	66.03	Intermediate-final stages	37.93	56.50	Intermediate-final stages	42.28	51.11	Intermediate-final stages	38.19	49.68	Intermediate-final stages	34.18	44.87	Secondary	36.06	39.60	Secondary
LUX	35.43	24.34	Secondary	30.82	26.27	Secondary	29.22	27.84	Secondary	25.60	25.14	Secondary	25.94	28.39	Secondary	21.10	28.38	Secondary
LVA	46.58	53.63	Strategic	48.36	51.41	Strategic	49.56	58.39	Strategic	45.56	58.35	Intermediate-final stages	44.54	45.43	Secondary	43.83	40.90	Secondary
MLT	19.97	44.97	Secondary	22.81	39.73	Secondary	25.16	40.33	Secondary	24.19	42.27	Secondary	14.40	36.38	Secondary	17.43	38.92	Secondary
NLD	43.05	38.61	Secondary	43.70	41.03	Secondary	47.08	40.30	Initial stages	46.36	40.42	Secondary	46.73	40.67	Secondary	44.14	42.29	Secondary
POL	46.64	48.39	Strategic	41.59	63.37	Intermediate-final stages	39.00	51.38	Intermediate-final stages	39.01	53.68	Intermediate-final stages	39.28	49.95	Intermediate-final stages	40.23	42.06	Secondary
PRT	33.73	58.60	Intermediate-final stages	32.56	64.07	Intermediate-final stages	33.19	59.84	Intermediate-final stages	33.29	59.70	Intermediate-final stages	36.14	53.54	Intermediate-final stages	35.70	42.19	Secondary
ROU	44.23	61.69	Intermediate-final stages	46.48	61.72	Strategic	45.59	63.48	Intermediate-final stages	39.11	73.07	Intermediate-final stages	40.76	60.00	Intermediate-final stages	42.38	47.98	Intermediate-final stages
SVK	39.37	40.41	Secondary	39.59	42.91	Secondary	30.35	43.10	Secondary	30.10	43.55	Secondary	28.80	41.86	Secondary	31.03	41.19	Secondary
SVN	34.74	43.64	Secondary	35.19	45.21	Intermediate-final stages	35.45	43.00	Secondary	33.75	43.58	Secondary	34.91	39.84	Secondary	37.88	35.03	Secondary
SWE	44.44	37.00	Secondary	43.90	37.16	Secondary	43.90	36.24	Secondary	42.20	36.45	Secondary	43.17	38.58	Secondary	45.18	35.90	Secondary
CHE	45.79	33.60	Secondary	45.41	31.47	Initial stages	42.29	32.03	Secondary	36.65	38.15	Secondary	35.84	38.09	Secondary	36.82	36.05	Secondary
ISL	39.63	33.95	Secondary	39.22	43.81	Secondary	39.32	42.15	Secondary	42.06	49.28	Intermediate-final stages	41.45	33.84	Secondary	36.42	34.63	Secondary
NOR	59.22	36.12	Initial stages	58.09	33.77	Initial stages	63.05	26.22	Initial stages	69.16	26.06	Initial stages	71.06	24.81	Initial stages	63.62	31.72	Initial stages
RUS	61.93	31.86	Initial stages	63.14	21.84	Initial stages	66.36	26.88	Initial stages	73.79	28.78	Initial stages	72.55	29.20	Initial stages	68.83	31.96	Initial stages
TUR	38.86	47.09	Intermediate-final stages	35.48	46.04	Intermediate-final stages	28.62	61.01	Intermediate-final stages	34.61	56.75	Intermediate-final stages	36.57	59.75	Intermediate-final stages	37.60	48.67	Intermediate-final stages
AUS	55.94	47.64	Strategic	52.78	49.72	Strategic	54.60	50.87	Strategic	62.47	50.98	Strategic	69.07	41.47	Initial stages	64.04	48.02	Strategic
BRN	82.49	32.96	Initial stages	86.56	27.88	Initial stages	87.11	16.01	Initial stages	85.28	10.79	Initial stages	85.42	10.40	Initial stages	87.75	16.00	Initial stages
CHN	41.83	50.08	Intermediate-final stages	39.42	51.41	Intermediate-final stages	36.58	53.07	Intermediate-final stages	38.62	45.05	Secondary	38.63	55.52	Intermediate-final stages	43.40	49.27	Intermediate-final stages
HKG	39.26	37.69	Secondary	45.45	26.19	Initial stages	46.59	23.52	Initial stages	39.28	46.24	Secondary	35.28	55.32	Intermediate-final stages	37.99	56.10	Intermediate-final stages
IDN	56.65	46.39	Strategic	54.34	35.43	Initial stages	56.50	41.04	Initial stages	57.91	45.83	Initial stages	61.40	45.90	Initial stages	55.27	52.99	Strategic
IND	42.41	68.70	Intermediate-final stages	43.30	75.73	Intermediate-final stages	45.55	65.82	Intermediate-final stages	42.24	75.08	Intermediate-final stages	37.76	78.73	Intermediate-final stages	39.70	72.04	Intermediate-final stages
JPN	53.33	46.05	Strategic	53.29	43.37	Initial stages	52.91	46.30	Strategic	49.56	50.34	Strategic	48.16	61.01	Strategic	49.73	53.11	Strategic
KHM	49.51	38.57	Initial stages	24.90	52.20	Intermediate-final stages	20.31	60.50	Intermediate-final stages	35.59	51.13	Intermediate-final stages	38.93	52.82	Intermediate-final stages	39.18	49.58	Intermediate-final stages
KOR	43.11	55.45	Intermediate-final stages	41.12	45.88	Intermediate-final stages	40.39	51.18	Intermediate-final stages	39.72	54.33	Intermediate-final stages	32.84	52.73	Intermediate-final stages	40.63	43.70	Secondary
MYS	41.93	40.50	Secondary	33.37	33.10	Secondary	33.08	36.52	Secondary	33.91	35.96	Secondary	37.64	36.77	Secondary	40.64	38.57	Secondary
NZL	40.51	44.49	Secondary	40.82	44.85	Intermediate-final stages	38.98	44.02	Secondary	41.68	42.36	Secondary	42.78	42.70	Secondary	40.15	40.90	Secondary
PHL	37.42	56.01	Intermediate-final stages	35.70	49.89	Intermediate-final stages	31.95	51.95	Intermediate-final stages	41.70	43.30	Secondary	45.00	49.39	Intermediate-final stages	46.73	47.07	Strategic
SGP	31.60	41.28	Secondary	34.12	39.44	Secondary	40.44	28.47	Secondary	37.79	27.92	Secondary	37.04	29.42	Secondary	40.05	28.90	Secondary
THA	34.43	53.83	Intermediate-final stages	34.84	37.74	Secondary	34.87	44.84	Secondary	34.75	42.86	Secondary	33.00	46.30	Secondary	34.00	37.16	Secondary
TWN	38.93	43.96	Secondary	41.21	38.95	Secondary	42.36	35.93	Secondary	39.96	34.70	Secondary	36.71	39.26	Secondary	45.68	30.27	Secondary
VNM	40.42	70.24	Intermediate-final stages	39.73	53.73	Intermediate-final stages	37.09	61.64	Intermediate-final stages	32.70	63.20	Intermediate-final stages	31.46	57.70	Intermediate-final stages	30.07	55.37	Intermediate-final stages
ISR	38.59	60.87	Intermediate-final stages	38.16	49.24	Intermediate-final stages	38.95	49.16	Intermediate-final stages	41.00	50.30	Intermediate-final stages	40.58	51.68	Intermediate-final stages	44.10	45.75	Secondary
MAR	25.14	61.48	Intermediate-final stages	27.16	48.85	Intermediate-final stages	27.59	46.43	Intermediate-final stages	43.99	53.46	Intermediate-final stages	44.00	57.19	Intermediate-final stages	42.71	55.65	Intermediate-final stages

Table 4. Manufacturing: participation of the Latin American countries according to the stages of production of the GVCs (1995-2015)

	1995	1999	2003	2007	2011	2015
Food products, beverages, and tobacco						
Argentina	Strategic	Strategic	Strategic	Strategic	Strategic	Strategic
Brazil	Strategic	Strategic	Strategic	Strategic	Strategic	Strategic
Chile	Strategic	Strategic	Strategic	Strategic	Strategic	Strategic
Colombia	Strategic	Strategic	Strategic	Strategic	Strategic	Strategic
Costa Rica	Strategic	Strategic	Strategic	Strategic	Strategic	Strategic
Mexico	Intermediate-final stages	Intermediate-final stages	Intermediate-final stages	Intermediate-final stages	Intermediate-final stages	Intermediate-final stages
Peru	Strategic	Strategic	Strategic	Strategic	Strategic	Strategic
Textiles, wearing apparel, leather, and related products						
Argentina						
Brazil	Strategic	Strategic	Initial stages	Strategic	Intermediate-final stages	Intermediate-final stages
Chile	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
Colombia	Strategic	Intermediate-final stages	Strategic	Strategic	Intermediate-final stages	Intermediate-final stages
Costa Rica	Secondary	Secondary	Secondary	Intermediate-final stages	Secondary	Secondary
Mexico	Initial stages	Strategic	Strategic	Intermediate-final stages	Intermediate-final stages	Intermediate-final stages
Peru	Strategic	Strategic	Strategic	Strategic	Intermediate-final stages	Intermediate-final stages
Wood and products of wood and cork						
Argentina						
Brazil	Strategic	Strategic	Strategic	Initial stages	Initial stages	Initial stages
Chile	Strategic	Strategic	Strategic	Initial stages	Strategic	Initial stages
Colombia	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
Costa Rica	Intermediate-final stages	Intermediate-final stages	Intermediate-final stages	Secondary	Intermediate-final stages	Intermediate-final stages
Mexico	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
Peru	Secondary	Initial stages	Initial stages	Initial stages	Initial stages	Initial stages
Chemicals and pharmaceutical products						
Argentina	Intermediate-final stages	Intermediate-final stages	Initial stages	Secondary	Initial stages	Intermediate-final stages
Brazil	Intermediate-final stages	Intermediate-final stages	Intermediate-final stages	Strategic	Intermediate-final stages	Intermediate-final stages
Chile	Secondary	Initial stages	Secondary	Secondary	Secondary	Secondary
Colombia	Strategic	Strategic	Strategic	Strategic	Secondary	Intermediate-final stages
Costa Rica	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
Mexico	Secondary	Secondary	Secondary	Intermediate-final stages	Intermediate-final stages	Intermediate-final stages
Peru	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
Rubber and plastic products						
Argentina	Intermediate-final stages	Intermediate-final stages	Strategic	Strategic	Strategic	Strategic
Brazil	Secondary	Secondary	Secondary	Secondary	Intermediate-final stages	Intermediate-final stages
Chile	Intermediate-final stages	Intermediate-final stages	Intermediate-final stages	Secondary	Secondary	Secondary
Colombia	Intermediate-final stages	Secondary	Initial stages	Strategic	Secondary	Intermediate-final stages
Costa Rica	Strategic	Intermediate-final stages	Strategic	Initial stages	Initial stages	Initial stages
Mexico	Secondary	Secondary	Secondary	Intermediate-final stages	Intermediate-final stages	Intermediate-final stages
Peru	Intermediate-final stages	Intermediate-final stages	Secondary	Secondary	Secondary	Secondary
Other non-metallic mineral products						
Argentina	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
Brazil	Strategic	Initial stages	Initial stages	Initial stages	Initial stages	Initial stages
Chile	Intermediate-final stages	Intermediate-final stages	Intermediate-final stages	Secondary	Secondary	Secondary
Colombia	Intermediate-final stages	Initial stages	Initial stages	Initial stages	Initial stages	Initial stages
Costa Rica	Intermediate-final stages	Secondary	Intermediate-final stages	Intermediate-final stages	Intermediate-final stages	Intermediate-final stages
Mexico	Strategic	Strategic	Strategic	Intermediate-final stages	Intermediate-final stages	Secondary
Peru	Intermediate-final stages	Secondary	Secondary	Initial stages	Initial stages	Initial stages
Basic metals						
Argentina	Strategic	Strategic	Strategic	Strategic	Strategic	Strategic
Brazil	Initial stages	Strategic	Initial stages	Initial stages	Strategic	Strategic
Chile	Strategic	Strategic	Strategic	Secondary	Secondary	Secondary
Colombia	Intermediate-final stages	Intermediate-final stages	Initial stages	Initial stages	Secondary	Secondary
Costa Rica	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
Mexico	Strategic	Strategic	Strategic	Strategic	Strategic	Intermediate-final stages
Peru	Initial stages	Initial stages	Initial stages	Strategic	Initial stages	Initial stages
Fabricated metal products; machinery and						
Argentina	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
Brazil	Secondary	Intermediate-final stages	Intermediate-final stages	Secondary	Secondary	Secondary
Chile	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
Colombia	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
Costa Rica	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
Mexico	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
Peru	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
Computer, electronic and optical products:						
Argentina	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
Brazil	Intermediate-final stages	Intermediate-final stages	Secondary	Secondary	Secondary	Secondary
Chile	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
Colombia	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
Costa Rica	Strategic	Strategic	Strategic	Secondary	Secondary	Secondary
Mexico	Strategic	Strategic	Strategic	Intermediate-final stages	Intermediate-final stages	Strategic
Peru	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
Motor vehicles, trailers, and semi-trailers						
Argentina	Secondary	Secondary	Secondary	Strategic	Strategic	Strategic
Brazil	Intermediate-final stages	Intermediate-final stages	Intermediate-final stages	Strategic	Strategic	Intermediate-final stages
Chile	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
Colombia	Intermediate-final stages	Secondary	Secondary	Secondary	Secondary	Secondary
Costa Rica	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
Mexico	Strategic	Strategic	Strategic	Strategic	Strategic	Strategic
Peru	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
Other transport equipment						
Argentina	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
Brazil	Initial stages	Secondary	Initial stages	Secondary	Secondary	Intermediate-final stages
Chile	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
Colombia	Intermediate-final stages	Secondary	Secondary	Secondary	Secondary	Secondary
Costa Rica	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
Mexico	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
Peru	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
Other manufacturing; repair and installation of						
Argentina	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
Brazil	Initial stages	Initial stages	Initial stages	Initial stages	Initial stages	Strategic
Chile	Initial stages	Initial stages	Initial stages	Initial stages	Initial stages	Initial stages
Colombia	Intermediate-final stages	Intermediate-final stages	Intermediate-final stages	Initial stages	Secondary	Secondary
Costa Rica	Intermediate-final stages	Secondary	Secondary	Strategic	Strategic	Strategic
Mexico	Secondary	Intermediate-final stages	Intermediate-final stages	Intermediate-final stages	Intermediate-final stages	Intermediate-final stages
Peru	Initial stages	Initial stages	Initial stages	Secondary	Initial stages	Initial stages

Notes: 1/ The cells shaded in gray identify upgrading processes in the country's GVCs and the shaded industry (row). 2/ The cells with information in red indicate processes of decline in the Source: Own elaboration.