Three models of insertion into globalization and their impact on the economic development of Brazil, Korea and Mexico

Tania Molina del Villar [a] **and Ricardo Zárate Gutiérrez** [a]

[a] Universidad Nacional Autónoma de México, Mexico.

Email addresses: t.molinadv@yahoo.com and ricardozrate157@gmail.com, respectively.

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Abstract

The text explores the case of three economies with a significant degree of internationalization (Brazil, South Korea and Mexico) between 2005 and 2015 to define their mode of integration and its impact on economic development. The study, rooted in input-output analysis, specifically on productive leakages and linkages methodology, discusses three integration schemes that influence economic growth in unique ways, depending on the type of trade specialization and dependence. This leads to the conclusion that not all export promotion strategies benefit different countries; hence, export orientation is not always synonymous with economic development.

Keywords: input-output analysis; trade specialization; trade integration; economic growth; global value chains.

1. INTRODUCTION

The analysis of the economic development process requires the consideration of two elements that facilitate the understanding of both the economic dynamics and how primary changes are interpreted: on the one hand, the changes in the international economic context and their ramifications for the development of each country (both externally and internally within the productive structures themselves) and, on the other hand, the development of different diverse theoretical interpretations that seek to explain the logic behind these transformations.

As far as the international economic context is concerned, the spectacular integration of the world economy is leading to a profound transformation in the relations and forms of organization of production and trade, highlighting those in which production takes place in different geographical areas, the allocation of which does not necessarily depend on differences in factor resources but rather on the productive and technological capabilities of the businesses involved in the various production links, which transcend the level of economic development of individual countries. The trade resulting from this type of production organization has immediate effects on the characteristics of the internal economic structures of the countries in question, breaking down sectoral interrelationships in favor of an increasing import behavior of parts and components.

From a theoretical standpoint, various approaches offer an interpretation of the logic of trade flows and the current reorganization of production within the global system, with explicit reference to the processes of fragmentation of production and its dispersion in different geographical spaces (Gereffi, 2001 and 2006; Gereffi *et al.*, 2001; Kaplinsky, 1998; Kaplinsky and Kaplan, 1999; Hummels *et al.*, 1999). One of the most notable contributions of these studies is the acknowledgment that, alongside the expansion of global trade flows, there have been substantial shifts in the nature of trade. This has led to an increased interconnection of production processes within a vertical trade chain, which is orchestrated by companies located in different countries, each focusing on specific phases of the production process of goods (Hummels *et al.*, 1999).

Thus, the global value chain (GVC) approach is relevant in current economic analysis, particularly in the context of formulating development policies. From a GVC perspective, three elements are essential: the first is a methodological advance that addresses the local-global nexus, the behavior of units within a more general process—economic globalization; the second is intra-chain domain relationships, which identifies governance as the way power is exercised in global industries and; the third element is the concept of scaling, which refers to how companies can improve their position (scale) within the chain to generate and appropriate more value. Therefore, in order for countries (particularly developing countries) to succeed in the international economy, they need to strategically position themselves within global networks and develop strategies to access and achieve a more advantageous international position.

In short, the concepts of "governance" and "scaling up" constitute the foundation of their developmental vision. According to Gereffi *et al.* (2005), understanding the functioning of governance and scaling up within each chain is indispensable for the formulation of effective policies and strategies pertaining to industrial modernization, economic development, job creation and poverty alleviation, contingent upon the realization of favorable insertion and scaling up.

Meanwhile, McMichael (1996) indicates that during the 1980s and ‘90s, the vision of the "development project" evolved into the "globalization project", making the changes in the orientation of economic policies in developing countries obvious, whereby State-led industrialization strategies were abandoned in favor of an export-oriented development strategy (Zárate and Molina, 2017). Bair (2005) asserts that this novel approach to development is adopted by international organizations, including the International Labor Organization (ILO), the Economic Commission for Latin America and the Caribbean (ECLAC), the International Monetary Fund (IMF), the World Bank, the Inter-American Development Bank (IDB), the International Bank for Reconstruction and Development (IBRD), which is primarily active through the United Nations Conference on Trade and Development (UNCTAD), the Organization for Economic Cooperation and Development (OECD) and the World Trade Organization (WTO) (Santarcángelo *et al.,* 2017).

Despite the importance gained by the GVC approach, a critical vision forces us to examine its possible limitations, not only when analyzing the consequences of the globalization process on individual economies but also when formulating development policies. In this regard, from the same

perspective of GVC, some studies, such as that of Dolan and Humphrey (2000), indicate that companies often encounter difficulties in "scaling up" due to the increasing barriers to entry as they move along the chain, while at the same time exclusion processes are generated.

This article recognizes that the more traditional view of GVCs, including that promoted by some international organizations, while making significant contributions to the explanation of world trade flows and attempting to define the position of businesses and national economies in these flows, focuses its economic policy recommendations mainly on the benefits of accelerated international integration from a trade perspective alone, without really addressing the implications that this process could generate within each economy, many of which exacerbate the phenomena of polarization, productive dualization and import dependency, thus limiting economic development, understood as the process by which the production structure and its interrelationships allow the reproduction of the economic and social system, which implies not only growth, but also the complexification (Leontief, 1973), specialization and articulation of the production structure (Zárate and Molina, 2017), in order to respond to the need to make efficient use of productive resources and without generating a high dependence on imports in a scenario of high international integration.

Thus, based on a critical view of GVCs and the impact of international trade, the case of three highly internationalized economies (Brazil, South Korea and Mexico) with entirely different integration patterns is analyzed in order to define, first, the type of integration model or scheme and, second, to evaluate the impact of these models on the development of these economies, considering that some commercially dynamic industries involve companies that are part of a GVC that operates as fragmented production at the international level.

For these purposes, the document is structured in four sections, beginning with this introduction. The second section presents the methodological elements based on the analysis of leakage and production linkages from the perspective of input-output (IP) analysis; the third section is devoted to presenting empirical results and, finally, the conclusions of the research are presented.

2. LINKAGES OR LEAKAGES

Identifying the sectors that have the capacity to exert the most significant impact on the economic system has been one of the most important and recurring issues in the analysis of IO. Since the studies of Rasmussen (1956), Chenery and Watanabe (1958) and Hirschman (1958), the way in which exogenous sources - for example, final demand - can affect the production system based on a given structure has been analyzed (Aroche *et al.*, 2021; Molina, 2018).

According to Reis and Rua (2009), although this type of technique is of great interest, studies that focus on the empirical application of IO do not pay much attention to the distinction between imported and domestically produced inputs, especially when analyzing the structural characteristics of a single economy. These authors point out that when linkages are measured to make comparisons between the economic structures of different countries, it is sufficient to consider the total intermediate transactions (which include both domestically produced and imported inputs) because the objective is to observe the differences in the forms of production between countries and not where the inputs come from. However, if the interest is focused on studying a single country, domestically supplied inputs must be considered, and the analysis must focus on the impact on the domestic economy.

Meanwhile, Dietzenbacher *et al.* (2005) argue that ignoring the distinction between imported and domestically produced inputs has critical empirical implications by biasing the results and, thus, overestimating the multiplier effect of a given sector. One way to solve this type of problem is to compare total and domestic transaction matrices and determine the weight of imports within domestic production (Aroche *et al.*, 2021 and 2022). Nevertheless, one way to determine domestic linkages and investigate the impact of international trade on such connections and how this influences the interdependence of an economy is through the analysis of linkages and leakages. In other words, high dependence on imports may result in lower linkages between domestic production sectors (Reis and Rua, 2009).

Measurement of linkages and leakages

Three concepts are fundamental for analyzing the economic system dynamics within the classical IO analysis. On the one hand, Hirschman (1958) proposes the idea of "key" sectors as those that have the capacity to induce economic growth, both through the demand for inputs used in their production and through the supply of goods and services they produce. In other words, there will be industries that are characterized by providing incentives and driving forces for the development or expansion of the system through the demand for inputs or through the production of goods that will be destined for other activities. On the other hand, in order to define the degree of interrelationship - and thus their capacity to stimulate growth - of the different productive sectors, two other concepts are defined as indexes, linkages or connections.

In this respect, Rasmussen (1956) finds that changes in one monetary unit in the final demand of a sector affect the system and, at the same time, changes in the final demand of the system have repercussions on the level of production of the *i-th* branch. He defines the two indexes as the "index of dispersion power" and the "index of dispersion sensitivity". The former refers to the total increase in the system's output to cover the increase by one unit in the final demand for sector *j*'s product. This index is identified as a measure of backward linkages (BL). The second index measures the increase in industry *i*'s production caused by a one-unit increase in the final demand of all industries in the system. This index is also known as forward linkages (FL).

Although the analysis of the strengths of the BL and FL linkages makes it possible to identify the most critical sectors of the economy, it should not be forgotten that, in an open economy, an increase in production can also generate the use of imported inputs to carry out production. This type of import is known as economic leakage since it represents a leakage of the multiplier effect (Guo and Planting, 2000).

BL linkages and leakages

According to Reis and Rua (2009), if we consider that there are *n* sectors in the economy and that for the production of each good *i*, there is an equilibrium between total supply and demand.

$$x_i + m_i = z_{i1} + z_{i2} + \cdots + z_{in} + y_i \quad (1)$$

where x_i is the production of sector *i*, m_i denotes the imports of product *i*, z_{ij} is the product of sector *i* used by sector *j* (either of domestic or imported origin) and $(z_{ij} = z_{ij}^d + z_{ij}^m)$- e y_i is the total final demand for the product of sector *i*, which includes domestic and imported final demand $(y_i = y_i^d + y_i^m)$. Since $m_i = \sum_{j=1}^{n} z_{ij}^m + y_i^m$, equation (1) is written as:

$$x_i = z^{d_{i1}} + z^{d_{i2}} + \ldots + z^{d_{in}} + y^{d_i} \quad (2)$$

For the *n* sectors there is a set of *n* equations. a_{ij}^d is defined as the internal coefficient of direct inputs: $a_{ij}^d = {z_{ij}^d}/{x_j}$. In matrix terms, the set of *n* equations is written as:

$$X = A^d X + Y^d \quad (3)$$

Solving equation (3) for *X*, we obtain:

$$X = \left(I - A^d\right)^{-1} Y^d \quad (4)$$

Matrix *I* is the *n* x *n* identity matrix, A^d is the domestic direct input coefficient matrix. The expression $\left(I - A^d\right)^{-1}$ is the Leontief inverse matrix, which can be written as $B = \left(I - A^d\right)^{-1}$. Equation (4) can be expressed as a system of equations:

$$\begin{aligned} x_1 &= b_{11}y_1^d + b_{12}y_2^d + \cdots + b_{1n}y_n^d \\ x_2 &= b_{21}y_1^d + b_{22}y_2^d + \cdots + b_{2n}y_n^d \\ &\vdots \\ x_n &= b_{n1}y_1^d + b_{n2}y_2^d + \cdots + b_{nn}y_n^d \end{aligned} \quad (5)$$

Coefficient b_{ij} indicates how much the production of the *i-th* sector, x_i, increases if the final demand for the production of sector *j*, $j\ y_j^d$, increases by one unit. Thus, the sum of the elements of the *j-th* column of the Leontief inverse matrix measures the total production of all sectors generated based on one unit of final demand for sector *j*'s production. In other words, $b \cdot j = \sum_{i=1}^{n} b_{ij}$ is a production multiplier reflecting the backward linkage of sector *j* (Rasmussen, 1956). A unit increase in the production of sector *j* requires $b \cdot j$ units of increased production for the economy as a whole (both in the production of sector *j* and the direct and indirect inputs employed). In other words, the multiplier measures the effects of a change of one monetary unit in the final demand of each sector on the total production of all sectors, including the sector itself.

Similarly, a_{ij}^m is the direct input coefficient of imports, $a_{ij}^m = {z_{ij}^m}/{x_j}$ i.e., the imports of product *i* that are used for the production of sector *j* per unit of production of sector *j*.

Dietzenbacher *et al.* (2005) show that the (*i, j*) element of the matrix $A^m\left(I - A^d\right)^{-1}$ calculates the additional imports of product *i* if the final demand for sector *j*'s production increases by one unit. Hence, the total leakage resulting from a unit increase in the final demand for sector *j*'s production is calculated by the sum of the elements of the *j-th* column of the matrix $A^m\left(I - A^d\right)^{-1}$.

FL linkages and leakages

Like the calculation of BL linkages and leakages, it is possible to determine the relationship between production and primary inputs. Similar to the demand side relationship, the supply side is considered.

$$x_j = z_{ij}^d + z_{2j}^d + \cdots + z_{nj}^d + w_j \quad (6)$$

where w_j includes the imports used by sector *j* and the value added components. For the *n*, a_{ij}^{*d} is defined as the coefficient of direct domestic production, $a_{ij}^{*d} = {z_{ij}^d}/{x_i}$. In matrix terms, the system of *n* equations is as follows:

$$X' = X'A^{*d} + W' \quad (7)$$

where A^{*d} is the matrix of coefficients of direct domestic production. If expression (7) for X' is solved, we obtain:

$$X' = W'\left(I - A^{*d}\right)^{-1} \quad (8)$$

The inverse matrix of the product is defined by $\left(I - A^{*d}\right)^{-1}$. If $B^* = \left(I - A^{*d}\right)^{-1}$, equation (8) is $X = B^*W$, in the form of a system of equations:

$$\begin{aligned} x_1 &= b_{11}^* w_1 + b_{21}^* w_2 + \cdots + b_{n1}^* w_n \\ x_2 &= b_{12}^* w_1 + b_{22}^* w_2 + \cdots + b_{n2}^* w_n \\ &\vdots \\ x_n &= b_{1n}^* w_1 + b_{21}^* w_2 + \cdots + b_{nn}^* w_n \end{aligned} \quad (9)$$

Coefficient b_{ij}^{*} measures the effect on sector *j*'s output of a unit change in the availability of primary inputs for sector *i*. Thus, the sum of the elements in the *i-th* row of the inverse production matrix affects the total production of all sectors of a unit change in primary inputs in sector *i*. Therefore, a decrease in primary inputs in sector *i* causes a reduction in the production of sector *i* and in the production of all sectors that depend on the output of that sector. Therefore, $b_{i\cdot}^{*} = \sum_{i=1}^{n} b_{ij}^{*}$ is the direct link of sector *i*, also known as the input multiplier, which measures the effects of a change in monetary unit on the primary inputs of each sector on the total production for all sectors, including the sector itself.

The import input coefficient is defined as $a_{ij}^{*m} = {z_{ij}^{m}}/{x_{t}}$. According to Dietzenbacher *et al.* (2005), the FL leakage matrix is defined by $\left(I - A^{*d}\right)^{-1} A^{*m}$. The total leakage resulting from a unit change in primary inputs for sector *i* is calculated by the sum of the elements in the *i-th* row of matrix $\left(I - A^{*d}\right)^{-1} A^{*m}$.

Identification of key sectors

The key industry will be an activity with a high dispersion power and broad interrelationships (both backward and forward) with the rest of the branches (Robles and Sanjuán, 2008; Drejer, 1999). In other words, its importance lies in its significant capacity to transfer effects onto the activity as a whole and its sensitivity to changes in demand of the rest of the industries in the system.

Table 1. Classification of industries by BL and FL linkages

	BL < average BL	*BL > average BL*
FL < average FL	Island Sectors (A) do not affect the branches they buy from or the ones they sell to.	Driver sectors (I) have a high demand for inputs from other sectors.
FL > average FL	Base or strategic sectors (E) respond to the requirements of other sectors and demand little from the rest of the industries.	Key sectors (C), high supply and demand of intermediate inputs.

Note: forward linkages (FL), backward linkages (BL).

Source: summary of Table 1 (Classification of industries using Ramuser-Hirschman indexes) in Molina (2016, p. 53).

To carry out the study of the three selected economies (Brazil, South Korea and Mexico), the empirical analysis was based on three types of indicators: first, the structural position of the most exporting activities was determined based on the analysis of BL and FL linkages and leakages. Second, the patterns of trade specialization were explored, identifying the technological profile (based on the OECD's classification of technological intensity) and the type of trade advantage using the calculation of the Revealed Comparative Advantage (RCA). It is worth remembering that, for the RCA, values higher than one unit mean that the country has an advantage over others in trade and values lower than one unit represent a disadvantage in trade. Finally, the value-added content of exports and the share of re-exported intermediate imports are presented. Both measurements are presented graphically and make it possible to establish both the level of participation of domestic production factors (an indicator of the insertion of domestic economies) and the level of dependence of industries with the highest levels of exports on imports of intermediate inputs that will be re-exported as part of a fragmented type of production (substitution of domestic production by imports). For the joint analysis of both aspects, it is first assumed that the share of imports is equivalent to the percentage of domestic production that is no longer produced domestically to complete a production process, which is given a negative sign. Then, regarding the value added in exports, since it is the contribution of the factors of national production to the productive and commercial practices of the exporting sector, it is given a positive sign.

In summary, the purpose of the empirical study was to define whether an export-oriented strategy could be the basis for economic development in terms of the degree of dependence on imports. Therefore, the aim is to determine the vulnerability of national economies to a model driven by the export sector. The analysis focused on the study of extractive and manufacturing activities since the tertiary sectors support the commercial trading of goods, so they are exporters to the extent that the real extractive and industrial sectors participate in trade. Finally, for this analysis we used the IO matrices of the three countries for 2005 and 2015, as well as data relating to value added content contained in exports and the percentage of re-exported intermediate imports. All data is published by the Structural Analysis Database-Organization for Economic Cooperation and Development (STAN-OECD) at a 36-sector aggregation level, standardized for the different countries at the same ISIC Rev. 4 classification level, which facilitates the comparative analysis.

3. ANALYSIS OF RESULTS: STRENGTHS OF THE EXPORT SECTORS

Since the end of the last century, international trade has become a key element in the economic development of many national economies. Protectionist practices have been left aside, and a phase has begun that is defined by the growing expansion of trade within a more general and universal process: economic internationalization. In many cases, this is achieved by establishing regional trade agreements; in others, it goes beyond the border limits of geographical regions, being transoceanic in nature, and, in others, it is a combination of both.

In this respect, international trade has become a key element in the development strategies of different economies. The globalization process, together with the dispersion of the various stages of production in different geographical areas, converts each country into a possible participant in the production and, of course, commercial practices of the most dynamic companies, which are at the forefront of technological development worldwide. At the same time, these new forms of production mean that each economy is more interconnected to the world stage than the national one, further evidencing the importance of international trade. Hence, it is important to define, on the one hand, the position of each country studied in international trade through its contribution to world trade and, on the other hand, to establish the relevance of the most export-oriented activities in these countries.

Table 2 shows the contribution of different countries' gross exports and global production between 2005 and 2015.[1] As can be seen, the share of exports of the four leading economies (United States, Germany, China and Japan) fluctuates between 30 and 34%, while that of the three economies analyzed (Brazil, South Korea and Mexico) is around 10%. Although the contribution of the three follower countries in exports represents barely a fifth of what the leading exporters contribute, this share is not so insignificant when compared with production data, in which the follower countries only contribute one-eighth of the leading ones. In other words, the follower countries behave in a highly dynamic manner in the commercial sphere, which does not necessarily translate into a more significant contribution to global output, which could call into question the export strategy of each country.

Table 2. Selected countries. Share in global trade and output (2005 and 2015)

	Trade		*Output*	
	2005	*2015*	*2005*	*2015*
Leading export countries				
United States	10.8	11.3	27.7	24.6
Germany	7.8	7.1	6.0	4.5
China	6.3	12.3	4.9	14.9
Japan	5.8	4.1	10.1	5.9
Follower countries				
South Korea	2.9	3.4	2.0	2.0
Brazil	1.2	1.3	1.9	2.4
Mexico	2.0	2.1	1.9	1.6
Rest	63.2	58.5	45.6	44.0

Source: prepared by the authors with trade statistics from Trade in Value Added: Principal Indicators (OECD) (https://www.oecd.org/) and production statistics from the World Bank's World Development Indicators (https://data.worldbank.org/).

South Korea shows the same participation in world production during the two selected years of study, although with an increase in the contribution of exports from 2.9% to 3.4%. Meanwhile, Brazil's share of world output is greater than the slight increase in exports. On the contrary, while Mexico's contribution to world exports increases, its share of world output falls, suggesting that the economy has been oriented towards export promotion without necessarily spilling over to the rest of the economy.

In this respect, world trade continues to be dominated by leading countries. However, the participation of follower economies is increasingly visible, reflecting the fact that production and commercial activity tend to be dispersed to less developed countries. In this regard, what defines the pattern of trade specialization of the countries studied? What are the advantages with which they are competing, and consequently, can we be sure that the national economies are really benefiting from a strongly outward-oriented economic model?

As part of the internationalization process, national economies undertook important transformations beyond the political sphere, focusing on production, technological and structural changes, among others (Zárate and Molina, 2017). For this reason, the degree of technological and structural complexity achieved by each country is related to the definition of a pattern of trade specialization that allows it to actively or passively face the process of international integration, which will have significant repercussions on the countries' economic development.

South Korea: a model driven by the manufacturing export sector

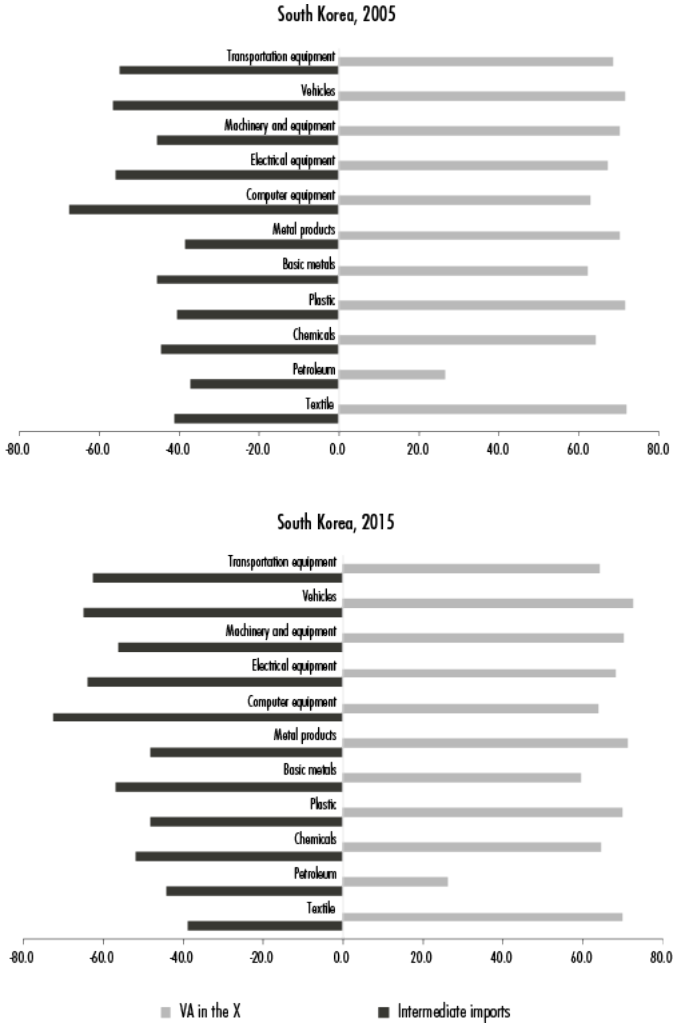
South Korea's pattern of trade specialization is basically manufacturing, with moderate to high technological intensity. Despite a certain dependence on intermediate imports, it is relatively connected with the rest of the production sectors (see Table 3 and Figure 1). In general, it is possible to point out that export activities show a high degree of productive articulation and, therefore, of specialization and structural complexity. According to the linkage data, ten of the eleven industries are classified as key, driver or strategic, and only one industry is isolated from the internal structure. The South Korean production structure shows a certain stability, with only four industries changing their level of intersectoral connection. The Textile and Basic Metals sectors increase their linkages, with the former changing from Driver and the latter from Strategic to Key. Meanwhile, Computer Equipment decreases its linkages going from Driver to Isolated and Electrical Equipment from Key to Driver.

Table 3. South Korea. Main export activities. Revealed comparative advantage, linkages and leakages, 2005 and 2015

				2005					2015			
				Linkages		Leakages			Linkages		Leakages	
OECD Tech. Classif.	Activities	Revealed Comparative Advantage		Backward	Forward	Backward	Forward		Backward	Forward	Backward	Forward
BT	Textile	0.6	I	2.0182	1.8990	0.2842	0.2466	C	2.1035	2.2460	0.3021	0.3661
MBT	Petroleum	1.8	E	1.2586	2.1962	0.7374	0.3047	E	1.3616	2.1080	0.7376	0.2926
AT	Chemicals	1.1	C	1.9861	2.2661	0.3623	0.3614	C	2.0250	2.1563	0.3541	0.3521
MBT	Plastics	1.1	C	1.9964	2.4760	0.2892	0.3017	C	2.1016	2.4888	0.3029	0.3062
MBT	Basic metals	1.5	E	1.8690	2.4348	0.3811	0.5033	C	1.9663	2.3209	0.4045	0.4253
MBT	Metal Products	1.2	C	1.9900	2.4337	0.3002	0.2402	C	2.0308	2.3764	0.2887	0.2721
AT	Computer	3.0	I	1.8862	1.7359	0.3806	0.2862	A	1.8371	1.7500	0.3680	0.3065
MAT	Electrical Equipment	1.6	C	2.0029	2.0473	0.3312	0.2981	I	2.0262	1.9026	0.3197	0.2566
MAT	Machinery and equipment	1.2	I	2.0135	1.5549	0.3017	0.2078	I	2.0357	1.6459	0.3007	0.2480
MAT	Vehicles	1.8	I	2.2974	1.6113	0.2869	0.0711	I	2.2239	1.6987	0.2750	0.1103
MAT	Transportation equipment	2.7	I	1.9304	1.3490	0.3179	0.1058	I	2.0261	1.2787	0.3608	0.1135
ABT	Trade	0.6	E	1.6271	2.1247	0.1270	0.3036	E	1.7435	2.1895	0.1472	0.3019
I	Business services	0.4	E	1.6043	2.0725	0.1115	0.2395	E	1.6099	2.1181	0.1181	0.2867
	Exporters	**1.4**		**1.8831**	**2.0155**	**0.3239**	**0.2669**		**1.9301**	**2.0215**	**0.3292**	**0.2798**

Source: Prepared by the authors with statistical information from the STAN-OECD database (https://www.oecd.org/).

Figure 1. South Korea. Main export activities, 2005 and 2015.
Re-exported intermediate imports and value added content of exports



Source: Prepared by the authors with statistical information from the STAN-OECD database (https://www.oecd.org/).

BL and FL high linkage activities, which are key sectors, are industries that participate in trade activity with RCA and whose share of value added in exports exceeds 60%. Among the five key industries, one is of high technological intensity (AT) —Chemicals and Pharmaceuticals (C&P)— whose leakage data and high share of re-exported intermediate inputs reflect that it is not able to supply the intermediate inputs necessary for its production domestically, nor does it manage to supply the needs of other sectors. Three of the key industries are of medium-low technological intensity —with a high leakage indicator— Rubber and plastic (PLAST), Basic metals (METB) and Metal products (PMET) —the first two show a high need for intermediate imports (high leakages and more than 50% in re-exported intermediate imports). In contrast, PMET shows a higher level of articulation with the domestic production structure. The only South Korean export activity of low technological intensity (BT) —Textiles and clothing (TEX)— which is key, shows an increase in the value of leakage and its need for re-exported intermediate inputs is relatively low (less than 40%).

The four sectors with high FL linkages, in other words, drivers, are activities characterized by their high participation in world trade and involvement in the VCRs. In the case of South Korea, these sectors compete with a high VCR, are of medium-high technological intensity (MAT) and have an extremely high contribution of value added in their exports, exceeding 60%. Two of these industries —Machinery and Equipment (M&E) and Motor Vehicles (VEH)— although they have a considerable share in intermediate re-exported imports (60%), their high degree of productive articulation translates into a relatively low rate of leakages. However, the other two industries —Electrical machinery and equipment (ELECT) and Transportation equipment (ETRNS)— have high requirements for imported intermediate inputs and do not manage to supply the rest of the production sectors.

Only one of the exporting sectors is a high linkage sector (Strategic), Coke and refined petroleum products (PET), which is classified as MBT and has a high RCA. It is a sector that demands imported inputs that cannot be supplied internally and, at the same time, does not have the capacity to supply the rest of the production sectors with the requirements for this type of input. The contribution of value added in exports is only 20%.

One of the largest export and internationalized industries in South Korea, characteristic of GVCs and AT, is Computer and Information Technology Equipment (COMP). Despite the dynamism of this activity, its level of productive linkage is so low that it is an Isolated sector, with a high leakage rate and more than 70% participation in re-exported intermediate imports, even though its value-added content is close to 60%.

In short, the technological component is fundamental in South Korea's export sectors; i.e., medium-high-tech activities predominate. Ten of the eleven manufacturing activities have a trade advantage. Notwithstanding the case of COMP, Korea is an example of a country with a high degree of trade specialization based on a productive and technological advantage in most export sectors and with a certain level of productive articulation.

Brazil: traditional goods export model

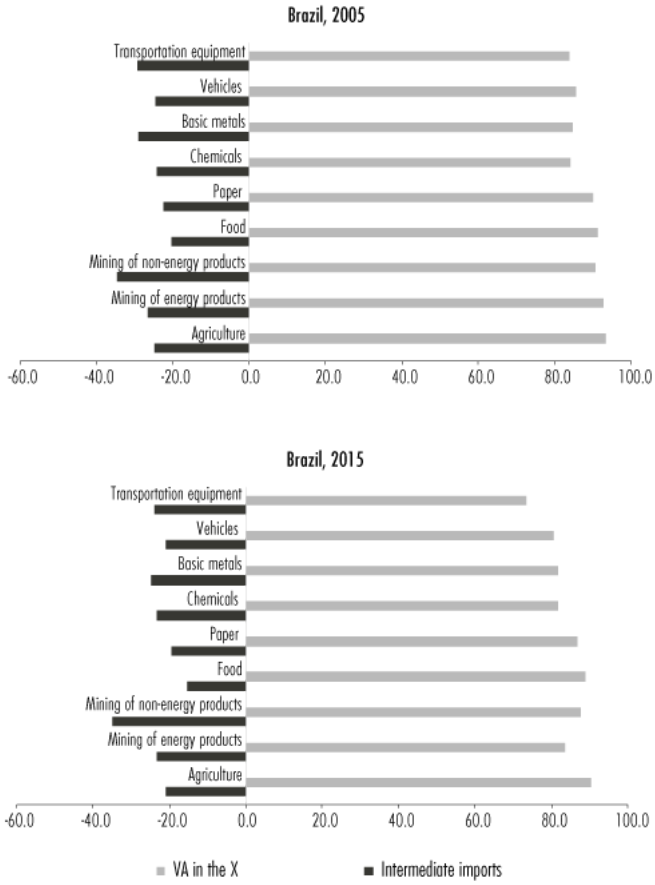
Brazil's pattern of trade specialization is primarily composed of 12 activities, of which 9 are both in the extractive and manufacturing industries. As a result, its technological characterization is highly varied (see Table 4 and Figure 2). Unlike South Korea, not all activities have a high RCA. Although in terms of production linkages, it demonstrates a certain degree of articulation in at least seven activities, in general, all of them depend to a certain extent on imports because they do not supply the rest of the sectors and require inputs for their production. At the same time, it should be noted that while only one activity increases its level of articulation, three industries reduce it. Transportation Equipment changes from Isolated to Driver, while Agricultural Activities and Mining of non-energy products change from Strategic to Isolated and Transportation from Key to Driver. Hence, its production structure is less complex and specialized than that of South Korea.

Table 4. Brazil. Main export activities. Revealed comparative advantage, linkages and leakages, 2005 and 2015

				2005					2015			
				Linkages		Leakages			Linkages		Leakages	
OECD Tech. Classif.	Activities	Revealed Comparative Advantage		Backward	Forward	Backward	Forward		Backward	Forward	Backward	Forward
ABT	Agriculture	6.8	E	1.8168	2.1111	0.0672	0.0429	A	1.7475	1.7687	0.0967	0.0335
ABT	Mining energy products	0.8	E	1.6818	3.3119	0.0741	0.4866	E	1.7360	2.7612	0.1658	0.3775
ABT	Mining non-energy products	5.7	E	1.9946	2.1428	0.0954	0.2450	A	1.8726	1.7815	0.1246	0.1484
BT	Food	3.1	I	2.5303	1.5755	0.0892	0.0221	I	2.3947	1.4663	0.1114	0.0296
BT	Paper	2.8	C	2.2504	2.5978	0.0990	0.0925	C	2.1156	2.2340	0.1338	0.1011
AT	Chemicals	0.5	C	2.2740	2.6716	0.1611	0.2691	C	2.2324	2.2667	0.1838	0.2769
MBT	Basic Metals	1.9	C	2.2334	2.1176	0.1553	0.1465	C	2.2400	2.0902	0.1833	0.2032
MAT	Machinery and equipment	0.5	I	2.1695	1.5760	0.1432	0.1433	I	1.9986	1.6589	0.1801	0.2136
MAT	Vehicles	0.7	I	2.4008	1.6094	0.1467	0.0542	I	2.2738	1.4629	0.1978	0.0877
MAT	Transportation equipment	0.9	A	1.9635	1.3468	0.1637	0.1369	I	2.0113	1.4180	0.2659	0.3081
ABT	Commercial	1.0	E	1.7661	2.2990	0.0440	0.0976	E	1.5573	2.0341	0.0483	0.1093
I	Transportation	1.0	C	2.1738	2.0375	0.0935	0.0773	I	1.8922	1.9026	0.1112	0.0986
I	Business services	0.9	E	1.7027	2.4506	0.0320	0.0802	E	1.5327	2.5730	0.0475	0.2151
	Exporters	**2.1**		**2.0737**	**2.1421**	**0.1049**	**0.1457**		**1.9696**	**1.9552**	**0.1423**	**0.1694**

Source: Prepared by the authors with statistical information from the STAN-OECD database (https://www.oecd.org/).

Figure 2. Brazil. Main export activities, 2005 and 2015.
Re-exported intermediate imports and value-added content in exports



Source: Prepared by the authors with statistical information from the STAN-OECD database (https://www.oecd.org/).

Three activities have high forward and backward linkages (Key), one of which is AT —C&P— without comparative advantage despite the high value added content in exports (more than 80%) and a low share of re-exported intermediate imports, with a high leakage indicator. This can be explained by the fact that much of the Chemicals industry's production is not exported but consumed domestically. Therefore, the sector's imports of intermediate goods cannot necessarily be considered re-exports.

Meanwhile, the manufacture of basic metals (METB) in Brazil, which is classified as MBT, has a high comparative advantage, with a value-added content in its exports of 80% and, like C&P, the share of re-exported intermediate imports is 20%, but the leakage indicator is above average. Key activities include Paper products and publishing (PAP), classified as BT. This industry has one of the highest RCAs, with value added content in exports above 90% and the share of re-exported intermediate imports low at 20%. It does not present above-average leakages.

As for the Driver sectors' group, three MAT industries show characteristics of fragmented production. The three activities —Machinery and Equipment (M&E), Motor Vehicles (VEH) and Transport Equipment (ETRNS— do not have a high comparative advantage, although their value added content exceeds 80% and the share of re-exported intermediate imports is approximately 20%. In all three cases, there is a high level of leakage, i.e., there is no capacity to supply inputs to the industries of these sectors and, at the same time, the rest of the sectors require output from these types of industries (M&E, VEH and ETRNS), with much of the production not necessarily directed to the export market but to the domestic market.

Only one non-manufacturing activity of low technological intensity (ABT) is a Strategic exporter —Mining of energy products (MIPER)— which, although it has a low RCA, has an export value-added content of over 90%, while intermediate re-exported imports are almost 40%. It is an industry with a high dependence on imports, with an above-average leakage indicator.

Two non-manufacturing activities of low technological intensity belong to the category of low FL and BL linkages, Isolated, Agricultural, forestry and fishing activities (AGRIC) and Mining of non-energy products (MINER). Both compete with the highest RCA of all export activities in Brazil. Despite their low productive articulation, neither has a high leakage indicator in the last year. Their value-added content is above 80% and the share of re-exported intermediate imports is approximately 20%. This can be explained by the type of production process of both activities, which are labor-intensive and directly linked to extraction, so they are not industries that process imported goods.

In general, Brazil's export profile can be considered traditional and low-tech. Although export sectors with high levels of technification exist, the country's commercial strength in extraction activities is indisputable. In other words, it retains a commercial advantage in sectors with low or medium-low technological intensity, and as the technological intensity of the industries increases, it loses competitive strength. Another characteristic feature is that export industries show a low and decreasing dependence on imports, while their value added content is higher than 70%.

In short, the most dynamic activities in Brazilian exports are of lower technological intensity; in other words, as the technological intensity of the activities increases, trade dynamism tends to decrease and, with it, the value-added content decreases and the participation in intermediate imports increases. The loss of export dynamism of AT and MT activities may be because Brazilian companies —which managed to develop an important

industrial base in the country— when confronted with international companies or conglomerates —which fragmented their productive processes by taking advantage of the capabilities developed in other countries at lower costs— are not able to compete on equal terms, thus resulting in a decrease in international competitiveness.

Mexico: specialization in manufacturing industries with a diverse technological profile

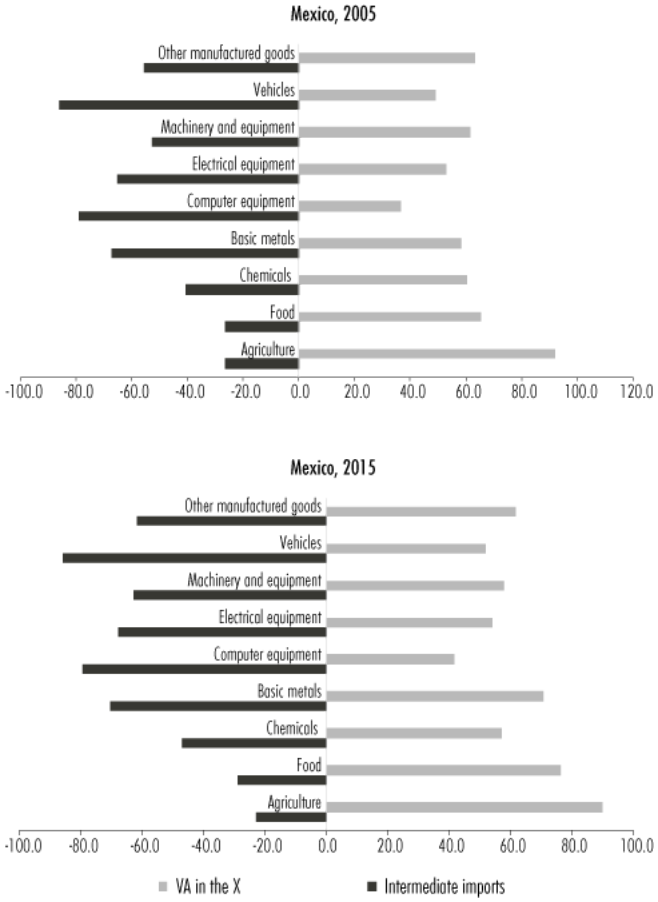
Mexico's export specialization pattern is very diverse in terms of technology (see Table 5 and Figure 3). Eight of the 11 highest export activities are manufacturing, and one is extractive. The country tends to be highly commercialized in industries subject to solid international competition where production fragmentation practices and value chains prevail and in which it is highly competitive but with a low level of production linkage. As a result, it has a high level of dependence on imports of intermediate inputs, low levels of complexity and specialization in industries with greater inter-industrial connections. In general, there have been no substantial changes in the production structure; only one activity decreased its production links, Electrical equipment, which changed from being a Driver in the first year to becoming Isolated by 2015.

Table 5. Mexico. Main export activities. Revealed comparative advantage, linkages and leakages, 2005 and 2015

			2005					2015				
			Linkages		Leakages			Linkages		Leakages		
OECD Tech. Classif.	Activities	Revealed Comparative Advantage		Backward	Forward	Backward	Forward		Backward	Forward	Backward	Forward
ABT	Agriculture	1.1	E	1.4844	1.6136	0.0837	0.0793	E	1.4482	1.7868	0.7429	0.1303
BT	Food	0.7	I	1.8177	1.1815	0.1254	0.0222	I	1.7722	1.2244	1.1580	0.0369
AT	Chemicals	0.4	C	1.9970	2.0075	0.2341	0.4025	C	1.7610	1.8310	1.6242	0.5649
MBT	Basic Metals	0.7	C	1.8613	2.2102	0.2026	0.5137	C	1.7952	1.9469	1.4986	0.6300
AT	Computer	2.2	A	1.6988	1.3993	0.4741	0.4259	A	1.3820	1.1225	1.9850	0.5119
MAT	Electrical Equipment	1.6	I	1.7989	1.3266	0.3742	0.4634	A	1.5237	1.2052	1.8663	0.8619
MAT	Machinery and equipment	0.8	A	1.6782	1.2056	0.2852	0.4114	A	1.5081	1.1560	1.5589	0.5861
MAT	Vehicles	4.2	I	1.7857	1.1553	0.3756	0.1348	I	1.5970	1.1649	1.8793	0.1567
MBT	Other manufacturing	1.3	I	1.8096	1.1783	0.2416	0.0459	I	1.6897	1.1433	1.5743	0.0621
ABT	Trade	1.0	E	1.2492	1.7372	0.0346	0.1977	E	1.2169	1.7552	0.3143	0.2251
I	Transportation	0.8	A	1.5445	1.4544	0.0861	0.1324	A	1.4432	1.4215	0.8251	0.1643
	Exporters	**1.3**		**1.7023**	**1.4972**	**0.2288**	**0.2572**		**1.5579**	**1.4325**	**1.3661**	**0.3573**

Source: Prepared by the authors with statistical information from the STAN-OECD database (https://www.oecd.org/).

Figure 3. Mexico. Main export activities, 2005 and 2015.
Re-exported intermediate imports and value-added content of exports



Source: Prepared by the authors with statistical information from the STAN-OECD database (https://www.oecd.org/).

The group of Key activities comprises two industries of dissimilar technological intensity and without a broad RCA, with an RCA index of less than one unit for both activities. AT C&P is the export branch with the lowest RCA, the value added content in exports is relatively high, above 60%, and the share of re-exported intermediate imports is approximately 50%. Import dependence is also reflected in the forward and backward leakage indicators. Meanwhile, the manufacturing of basic metals (METB) with MBT technological intensity also has a considerable value added content in exports (60%) and an extremely high dependence on foreign purchases, with a 70% share of re-exported intermediate imports. Likewise, the leakage indicator is high.

The technological characterization of the Driver sectors is remarkably diverse, as is the case for the Key sectors. One MAT activity —Motor vehicles (VEH) — has the highest RCA not only in Mexico but also in comparison with Brazil and Korea. Although its value-added content in exports is considerable (50%), the need for imports is exceptionally high, with the share of re-exported intermediate imports exceeding 80%. At the same time, the leakage indicator is also extremely high, showing the sector's strong dependence on imports.

Other manufacturing (OMANUF), whose technological intensity is MBT, can be found in the Driver industries for which the RCA indicator is above average. At the same time, the value-added content is considerable (60%), while intermediate re-exported imports are above 60%, with high backward and forward linkages. Low tech food products, beverages and tobacco (ALIM) also have high backward linkages, with an above average RCA, a value added content of more than 60%, and very low dependence on imports. This is confirmed by the share of re-exported imports (20%) and the absence of leakages.

Only one of the exporting industries has high BL, Strategic —Agriculture, forestry and fishing activities (AGRIC)— with low-tech intensity (ABT), for which there is RCA, the value added content is one of the highest (over 80%) and the import requirements are extremely low, observed in the share of re-exported imports (20%) and the leakage indicator, which is below average.

The unlinked nature of Mexico's export activity, in addition to being observed in most of the activities above, is palpable because it has the highest number of Isolated activities in the AT and MAT sectors. Among the high-tech industries is Computer and information technology equipment (COMP), which, although it has a high RCA, its value added content is among the lowest of the Mexican export industries (40%) has a high import requirement, both for those that are re-exported (80%) and for the high indicator of leakage. Meanwhile, two MAT sectors form part of the Isolated exporters group — Electrical equipment and machinery (ELECT) and Other machinery and equipment (M&E)— both with a significant value-added content (50%) and a high contribution of re-exported imports of 60% and with an above-average leakage indicator. The only difference in the evolution of both activities is that the former has a high RCA while the latter has a below-average comparative advantage.

Finally, it is clear that Mexico's commercial advantage lies in high-tech industries, which are however highly dependent on imports. It is also well known that Mexico is one of the countries that has focused its economic model on the export of manufactured goods, characteristic of fragmented production at an international level, with a high degree of participation of re-exported intermediate imports and a relatively low value-added content in exports. It is worth mentioning that these activities are highly technological and account for a substantial proportion of world trade in parts and components but are

not linked with the domestic production structure. As a result, it is possible to question the adequacy of the development strategy with the prevalence of maquila and assembly as an essential characteristic of the current development model.

4. CONCLUSIONS

The definition of the activities that dominate the foreign trade of the three countries, the determination of the advantages that define the competitive position of each country in world trade based on the RCA, the technological characterization of the industries, the analysis of the value added content in exports and re-exported imports, enable a deeper analysis of the importance of the most export-oriented activities as the nuclei of dynamization of the economic development of each of the countries analyzed.

Thus, the empirical analysis developed throughout this paper allowed us to find three types of specialization that define different models, which, depending on their characteristics, can enhance or restrict countries' economic growth.

Export-oriented model for traditional products or products with low levels of technification

Brazil's economy represents this type of model. In general, it specializes commercially in traditional activities with low levels of technification, most of which have a high RCA. The value-added content of its exports is significantly higher than the contribution of re-exported intermediate imports. The country's trade specialization pattern is dominated by traditional or mature industries, characterized by their low level of technification. The country may present a high RCA, which enables participation in re-exported intermediate imports to be comparatively lower than the contribution in the value-added content of exports.

The growth potential of this type of traditional trade orientation may be limited by the low level of technification of the activities developed by each economy and not necessarily by the dependence of these industries on imports to complete their production process. A high level of productive disconnection probably does not exist between the exporting sectors and the rest of the activity.

Export-oriented model for high-tech dependent products

Mexico is the most representative example of this type of model. It specializes commercially in AT and MAT activities, mostly representative of the GVCs. Although the country has a high RCA, the contribution of re-exported intermediate imports is considerably higher than the value-added content, making it highly dependent on imports. The activities in which the country specializes are mainly high or medium AT. Unlike the previous case, the component of re-exported intermediate imports is proportionally higher than the value added content. These activities may be high and medium-high tech, which, despite having a high RCA, are highly dependent on imports, indicating that the country participates in the less technologically advanced links of international production chains, in maquila or assembly practices in which it is unable to develop sufficient technological capabilities to join the more technologically advanced links.

Unlike the previous model, the growth potential of this type of commercial orientation is limited, not because of the low level of technification of the activities carried out but because of their high dependence on imports. This strong dependence reflects a high intersectoral unlinking between exporting sectors and the rest of the productive activity.

Export-oriented model for high-tech goods with insertion not dependent on the economy

South Korea is an example of this type of model. It specializes in AT and MAT activities, although it has a high share of intermediate imports. Contribution in value-added content is much higher, and the RCA is also high, which indicates that it is inserted in links with higher levels of technification of the GVCs. The industries in which it specializes are dominated by high-tech. There may be a high share of imports, but the value-added content is significantly higher than imports. The country may have a high RCA in these industries, which, in general, may be AT and MAT. Given that, on the one hand, the RCA is high and the country's contribution to the value added content of exports is higher than intermediate imports, it follows that the country manages to participate very actively in the higher links of the production chains, thereby achieving a better level of international integration.

As a result, the country has high growth potential since it specializes in high-tech and medium-high-tech industries that are not dependent on imports. This could indicate that export activities are more closely linked to the rest of the production system, which positively impacts economic development.

Based on the identification of the characteristics of each of these export-oriented models, it can be concluded that not all export promotion strategies may be favorable for different countries. Although high-technification models exist, thus achieving more favorable international insertion, there are also models that generate a high level of dependence on imports, showing a high degree of vulnerability. Hence, export orientation is not synonymous with economic development.

In this respect, basing a development strategy solely on the performance of the companies that participate in the GVCs and seeking to "scale up" as the only way to implement economic policy is not only a planning error but is also highly likely to generate (or deepen) phenomena of polarization or production dualization, with negative repercussions on the economic development process.

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[1] For gross exports, reference is made to OECD and non-OECD member and non-member countries. Calculations were carried out using data from Trade in Value Added: Principal Indicators (OECD) and the World Bank's World Development Indicators.