

# Sectoral composition, export trade partners and value added: an input-output analysis for Brazil and Mexico<sup>1</sup>

Patieene Alves-Passoni

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## Abstract

This study examines the impact of changes in the sectoral composition of exports and in trade partners on the value added of Brazil and Mexico between 2000 and 2019, within the framework of Latin American structuralism. Employing quantitative input-output structural decomposition analysis, we identify shifts in value added coefficients, production techniques, domestic demand and exports (level, product mix and trade partners). The research brings out a significant correlation between changes in trade partners and the structure of the export basket. Both Brazil and Mexico display export concentration, geographically and sectorally. While alterations in the export basket and trade partners had a negative impact on Mexico's value added growth, Brazil experienced a positive effect. This finding for Brazil is attributed in part to its specialized agricultural and mineral exports to China. Conversely, Mexico's specialization in transport equipment exports to the United States and Canada contributed to its unfavourable outcome.

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## Keywords

International trade, exports, export policy, value, production specialization, economic growth, economic analysis, input-output analysis, Brazil, Mexico

## JEL classification

N16, C67, F14

## Author

Patieene Alves-Passoni is an associate professor at the Institute of Economics of the Federal University of Rio de Janeiro (UFRJ), Brazil. Email: patieene.passoni@gmail.com.

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## I. Introduction

The Brazilian and Mexican governments have been adopting strategies to stimulate export-led growth since 2015. However, as Alves-Passoni and Blancas (2022) show, this demand component has been unable to accelerate gross domestic product (GDP) growth even when it is its leading driver, mainly because of the low share of exports in final demand. However, this analysis can be complemented by an important consideration: the composition of exports.

On the Latin American structuralist view, differentiation of products and trade partners is a vital determinant of the production structure and growth pattern. According to this theoretical approach, expressed by the centre-periphery hypothesis (Prebisch, 1951; Singer, 1950), the production, export and import structures depend on the technology gap between two regions consisting of a country on the one hand and the “rest of the world” on the other.

The objective of this study is to observe how changes in the sectoral composition of exports and in trade partners affected Brazilian and Mexican value added between 2000 and 2019, using a quantitative input-output structural decomposition analysis. We decompose value added growth into the contributions of the value added coefficient, the production technique (technical coefficients), domestic demand and exports. To observe the effect of export composition, we express the sectoral export vector by considering the level of exports, their sectoral composition (product mix) and export trade partners.

The most recent study comparing the Brazilian and Mexican economies is that of Alves-Passoni (2022a), which decomposes gross output in 2000 and 2014 to identify the role of the medium-high- and high-technology manufacturing and service industries. Although this was not the author’s objective, she identifies the external sector as being more important in explaining changes in gross output in Mexico and the domestic sector as being more important in Brazil. The decomposition also shows a reduction in the importance of high-technology goods exports, especially from 2010 onward. However, gross output is only part of the analysis, as it does not reveal an economy’s capacity to appropriate value added, which is related to factors of production.

As regards trade partners, the most recent study is that of Castilho and Puchet Anyul (2012), which compares the two countries between 1985 and 2008. The authors’ main finding is that trade integration in Mexico and Brazil has different characteristics. The primary market for Mexican exports is the United States, and this relationship became more dominant from 1990 because of the North American Free Trade Agreement (NAFTA). This finding is corroborated by other studies, such as Gómez and Camacho (2020), Costa, Castilho and Puchet Anyul (2021), Fujii and Cervantes (2013) and Moreno-Brid and others (2016), showing that most Mexican exports are in the automotive sector.

In the Brazilian case, Castilho and Puchet Anyul (2012) argue that the specialization of the export structure depends on the trade partner. Higher-technology goods are exported to Latin American countries, while commodities such as agricultural and mineral products are exported to China. These results can also be seen in Castilho, Costa and Torracca (2019) and Nassif and Castilho (2020).

The contribution of this study is therefore twofold: (i) it extends the time period for the analysis of Brazilian and Mexican exports, including trade partners; (ii) it shows how changes in sectoral composition and in trade partners impact value added growth. We hypothesize that there is an intrinsic relationship between changes in sectoral and geographical contributions to value added in Brazil and Mexico.

We believe that this research is relevant because Brazil and Mexico share essential similarities. Both countries have become increasingly reliant on imported intermediate inputs, particularly parts and components, since the trade opening of the 1990s. This has directly impacted the generation of value added, which is calculated as gross value minus the consumption of domestic and imported

intermediate inputs from a production perspective. Studies by Fujii and Cervantes (2013), Moreno-Brid and others (2016), Nassif and Castilho (2020), Morceiro and Guilhoto (2020) and Alves-Passoni (2023) have all explored this issue.

Mexico and Brazil's lack of an industrial policy to promote growth has resulted in a focus on comparative advantage strategies for export growth, such as currency devaluation (Moreno-Brid and others, 2016; Ferraz, Paula and Kupfer, 2013). This has led to an increase in Mexico's maquila exports, which have a large imported content and poorly connected supply chains. Similarly, Brazil has seen a rise in exports of unprocessed agricultural products, which Alves-Passoni (2022b) attributes to regressive specialization.

Brazil and Mexico are two economically significant countries in Latin America that act as leaders in the region because of the size of their markets and the volume of their production. However, they belong to different regional integration strategies, with Brazil being part of the Southern Common Market (MERCOSUR) and Mexico of the North American Free Trade Agreement (NAFTA). This has resulted in distinct development strategies for their external and internal sectors. Comparing these two countries makes it possible to identify similarities and differences that are essential to an understanding of Latin American development.

This introduction is followed by four additional sections. Section II provides an empirical and theoretical overview of the influence of trade partners and sectoral exports on export composition, drawing on both previous studies and new data. Section III outlines the methodology (including structural decomposition analysis) and database used. Section IV discusses the results of the structural decomposition analysis. Section V offers concluding remarks.

## **II. The influence of export partners and the sectoral composition of exports: theoretical and empirical aspects**

Latin American structuralist theory focuses on how a country's choice of trade partners and product differentiation affect its economic growth and development. This approach provides the foundation for the present study's effort to understand economic changes. According to this theory, the global South, which includes Latin American countries such as Brazil and Mexico, tends to have a productive specialization in a few products, primarily low-technology agricultural and mineral commodities with little processing. These goods are particularly subject to price competition in the international market (Singer, 1998), making countries more likely to adopt policies to stimulate exports through pricing, such as currency devaluation and subsidies to export sectors. In this context, Singer (1950 and 1998) argues that not only trade products but also trade partners should be analysed.

Thirlwall (1979) also discusses the impact of external constraints on growth, considering the elasticities of exports and imports. In a 1983 paper, the author mentions the similarities between his theory and that developed by Singer (1950), while Dávila-Fernández and Amado (2015) and Nassif and Castilho (2020) argue that Thirlwall's law can be interpreted as the mathematical formalization of the Prebisch-Singer hypothesis.

According to the Thirlwall model, elasticities play a fundamental role in determining growth constraints, since expenditure (reflected in imports) cannot grow by more than the income generated from exports; if this occurs, there will be a current account deficit problem. This idea is very similar to the Prebisch-Singer hypothesis, whereby there can only be sustained growth with balance-of-payments sustainability if the elasticity of demand of exported goods is higher than that of imported ones.

Thirlwall's original model was developed for a single economy, but McCombie (1993) and Nell (2003) extended it to include the impact of trade partners on growth. Their objective was to capture the effects of growth in one region on others, this being fundamental to an understanding of the spillover effect of economic policies. Since there is “mutual interdependence of the world economy where one country's (or a block of countries') growth rate depends on others” (Nell, 2003, p. 264), “there is not much scope for a country to increase its rate of growth relative to that of its trading partners faster than in the past” (McCombie, 1993, p. 501). Even though the analysis in this paper is not designed to observe growth determinants in different countries or capture differences in current account balances, the value added decomposition contributes to an understanding of how changing the composition of trade partners affects sectoral growth.

Torracca (2017) proposes two possible trajectories when considering the effects of sectoral composition and trading partners on the economy. One is “outward”, whereby the structure of exports determines the structure of domestic production, and the other is “inward”, whereby domestic demand is the determining factor in the type of trade specialization. The first is based on Ricardian theory and its neoclassical developments, whereby the specialization of production focuses on the export activities in which a country has comparative advantages (relative prices). The “inward” profile is guided by what Linder (1961) discusses about the need to construct dynamic competitive advantages as against so-called comparative advantages.

The theories mentioned here argue that a long-run growth strategy must be focused on non-price competitiveness. In a recent Latin American structuralist model, Cimoli, Porcile and Rovira (2010) show that the developing countries which have reduced the gap with the developed countries are those where efforts to bring about structural change have focused on sectors in which the elasticity of export income is high compared to that of imports. These sectors have high Schumpeterian and Keynesian efficiency. Keynesian efficiency is associated with a greater demand for dollars, whereas Schumpeterian efficiency is associated with a superior technological structure. In the case of Latin America, the authors show from econometric studies that the region is dominated by low-technology sectors affected by a low rate of growth in international demand.

The structure of Brazil's and Mexico's export partners is directly related to their regional integration. While Brazil plays a central role in MERCOSUR, Mexico responds to developments in other major economies, especially the United States, because of NAFTA (Beaton and others, 2017). Owing to these structural characteristics, the sectoral composition of Mexico's exports is more concentrated than that of Brazil's. However, this concentration is even greater when it comes to trade partners. Table 1 shows the composition of Mexico's exports to its six main export partners: the United States, Canada, China, Germany, Spain and Japan. Our findings are similar to those of previous studies (see, for example, Gómez and Camacho (2020), Costa, Castilho and Puchet Anyul (2021), Fujii and Cervantes (2013) and Fraga-Castillo and Moreno-Brid (2015)), showing the United States to account for more than two thirds of all Mexican exports. The figure decreased by approximately 5 percentage points between 2000 and 2019, from 80% to 74.5%. This (small) decline was associated with an increase in exports to Canada (up from 4% to 6.3%) and China (up from 0.3% to 2.9%).

**Table 1**  
Geographical distribution of Mexican and Brazilian exports, 2000–2009  
(Percentages)

Brasil	China	United States	Japan	Germany	Mexico	India	World	Total
2019	31.26	17.52	4.03	3.83	2.15	1.69	39.52	100.00
2015	14.94	11.80	3.40	2.60	1.71	2.40	63.14	100.00
2011	14.37	9.47	3.63	3.13	1.84	2.66	64.91	100.00
2008	8.25	12.76	3.35	4.05	2.48	2.42	66.68	100.00
2000	2.39	21.99	4.55	3.53	4.34	2.39	60.82	100.00

Mexico	United States	Canada	China	Spain	Germany	Japan	World	Total
2000	79.54	3.99	0.29	0.80	0.38	0.19	14.81	100.00
2008	73.70	5.02	1.15	1.34	0.34	0.28	18.16	100.00
2011	72.14	5.73	2.13	1.58	0.37	0.43	17.63	100.00
2015	74.40	5.01	1.80	1.68	0.51	0.35	16.24	100.00
2019	74.43	6.29	2.92	1.17	0.69	0.31	14.20	100.00

**Source:** Prepared by the author, on the basis of R. M. Consing III and others, "The wellness economy: a comprehensive system of national accounts approach", *ADB Economics Working Paper Series*, No. 631, December 2020; and Asian Development Bank (ADB), *Capturing the digital economy: a proposed measurement framework and its applications. A special supplement to key indicators for Asia and the Pacific 2021*, Manila, 2021.

The analysis of Mexico's sectoral export structure in table 2 shows that, as of 2000, 56% of exports were made by manufacturing industry, which is traditionally classified as having medium-high and high technology intensity. Most of this share was accounted for by two sectors, electrical and optical equipment (31%) and transport equipment (20%). A focus on the North American market has led the country to integrate into global value chains by importing parts and components for the assembly of automobiles that are then exported to the United States (Castilho and Puchet Anyul, 2012). Since the United States accounts for the bulk of exports, developments in that country have a critical impact on Mexico's export structure. In 2015, bilateral flows from Mexico to the United States represented the largest magnitude, followed by those to Canada and China (Beaton and others, 2017). Between 2008 and 2011, the transport sector accounted for only 15% of Mexican exports because of the global subprime crisis. With the resumption of growth in the United States, this sector grew its share substantially to 20% in 2012 and then 32% in 2019.

**Table 2**

Brazil and Mexico: composition of exports by sectors and trade partners, 2000, 2011 and 2019  
(Percentages)

Country Sector	Brazil								Mexico							
	CHN	USA	JPN	GER	MEX	IND	World	Total	USA	CAN	CHN	SPA	DEU	JPN	World	Total
2000																
AGR	1.81	0.84	0.03	5.33	2.47	3.40	1.62	1.76	1.81	0.84	0.03	2.47	5.33	3.40	1.62	1.76
MNQ	6.24	4.67	1.49	0.45	66.14	7.21	29.48	10.07	6.24	4.67	1.49	66.14	0.45	7.21	29.48	10.07
TRM	21.88	19.37	9.24	20.02	6.46	20.54	18.98	21.18	21.88	19.37	9.24	6.46	20.02	20.54	18.98	21.18
CIM	60.30	65.64	63.88	56.72	14.78	42.32	35.39	56.42	60.30	65.64	63.88	14.78	56.72	42.32	35.39	56.42
CHM	1.71	0.82	5.46	8.19	5.21	13.55	6.12	2.41	1.71	0.82	5.46	5.21	8.19	13.55	6.12	2.41
MAC	2.37	1.68	1.78	6.60	0.16	3.82	1.93	2.28	2.37	1.68	1.78	0.16	6.60	3.82	1.93	2.28
EOP	33.22	37.11	55.95	38.02	7.58	20.67	18.68	31.08	33.22	37.11	55.95	7.58	38.02	20.67	18.68	31.08
TRA	23.00	26.03	0.69	3.91	1.84	4.29	8.66	20.65	23.00	26.03	0.69	1.84	3.91	4.29	8.66	20.65
OTH	9.77	9.48	25.35	17.48	10.14	26.52	14.53	10.58	9.77	9.48	25.35	10.14	17.48	26.52	14.53	10.58
2011																
AGR	24.19	3.07	2.54	6.87	1.87	0.77	3.04	2.56	3.07	2.54	1.87	0.77	3.04	6.87	2.56	2.91
MNQ	45.56	17.84	7.24	16.95	48.65	81.29	2.62	11.43	17.84	7.24	48.65	81.29	2.62	16.95	11.43	17.70
TRM	16.30	23.12	19.67	22.07	13.05	6.91	33.47	28.63	23.12	19.67	13.05	6.91	33.47	22.07	28.63	23.45
CIM	3.76	51.11	65.79	44.74	32.94	9.13	54.44	48.48	51.11	65.79	32.94	9.13	54.44	44.74	48.48	50.43
CHM	1.45	2.57	1.44	13.99	4.95	3.85	6.53	10.07	2.57	1.44	4.95	3.85	6.53	13.99	10.07	3.96
MAC	0.77	7.29	5.40	5.08	3.86	1.33	9.82	5.00	7.29	5.40	3.86	1.33	9.82	5.08	5.00	6.61
EOP	0.33	24.98	35.59	7.12	16.49	3.16	31.10	21.45	24.98	35.59	16.49	3.16	31.10	7.12	21.45	24.39
TRA	1.22	16.28	23.36	18.55	7.64	0.79	6.98	11.96	16.28	23.36	7.64	0.79	6.98	18.55	11.96	15.47
OTH	10.19	4.86	4.76	9.38	3.48	1.90	6.43	8.90	4.86	4.76	3.48	1.90	6.43	9.38	8.90	5.51

Country Sector	Brazil								Mexico							
	CHN	USA	JPN	GER	MEX	IND	World	Total	USA	CAN	CHN	SPA	DEU	JPN	World	Total
2019																
AGR	44.31	5.60	2.67	2.54	2.65	2.71	0.40	2.50	5.60	2.67	2.65	2.71	0.40	2.54	2.50	4.81
MNQ	35.89	4.35	0.93	9.15	15.44	62.79	1.25	11.69	4.35	0.93	15.44	62.79	1.25	9.15	11.69	6.18
TRM	14.28	17.71	17.05	18.32	11.86	6.42	9.74	11.94	17.71	17.05	11.86	6.42	9.74	18.32	11.94	16.49
CIM	1.42	69.08	74.35	42.54	59.82	16.17	64.58	46.21	69.08	74.35	59.82	16.17	64.58	42.54	46.21	65.16
CHM	0.87	1.75	1.77	9.61	3.57	2.89	4.58	3.59	1.75	1.77	3.57	2.89	4.58	9.61	3.59	2.12
MAC	0.36	6.71	6.50	5.08	3.47	1.82	5.60	3.26	6.71	6.50	3.47	1.82	5.60	5.08	3.26	6.04
EOP	0.09	25.29	27.28	16.85	40.72	5.46	36.92	19.97	25.29	27.28	40.72	5.46	36.92	16.85	19.97	24.94
TRA	0.10	35.33	38.79	10.99	12.06	5.99	17.48	19.39	35.33	38.79	12.06	5.99	17.48	10.99	19.39	32.06
OTH	44.31	5.60	2.67	2.54	2.65	2.71	0.40	2.50	5.60	2.67	2.65	2.71	0.40	2.54	2.50	4.81

**Source:** Prepared by the author, on the basis of R. M. Consing III and others, "The wellness economy: a comprehensive system of national accounts approach", *ADB Economics Working Paper Series*, No. 631, December 2020; and Asian Development Bank (ADB), *Capturing the digital economy: a proposed measurement framework and its applications. A special supplement to key indicators for Asia and the Pacific 2021*, Manila, 2021.

**Note:** USA: United States of America; JPN: Japan; CAN: Canada; CHN: China; SPA: Spain; GER: Germany; IND: India; MEX: Mexico. AGR: Agriculture, hunting, forestry and fisheries; MNQ: Mining and quarrying; TRM: Traditional (low- and medium-low-technology) manufacturing; CIM: Computer-integrated (medium-high- and high-technology) manufacturing; CHM: Chemicals and chemical products; MAC: Machinery, not elsewhere classified; EOP: Electrical and optical equipment; TRA: Transport equipment; OTH: Other industries.

The decline in the share of the mining and quarrying sector may be due to a composition effect. The oil sector increased its exports as part of the commodities boom in 2003–2013, contributing to a loss of share for other sectors in the Mexican export basket (Schneider, 2013). Likewise, the share of mining and quarrying sector exports to the United States rose from 6% of the total in 2000 to 15% in 2008 and 18% in 2011. However, the oil price decline since 2013 means that the mining and quarrying sector now accounts for only 4.3% of Mexican exports to the United States.<sup>2</sup>

The share of transport equipment has also increased because of the Mexican strategy of stimulating growth through exports, using exchange-rate devaluation and tax incentives as economic policies (Alves-Passoni and Blancas, 2022). Again, United States automotive multinationals that operate in both countries changed their strategy and transferred various operations and segments to Mexico, such as premium categories (Carrillo and Hernández, 2020), thus increasing Mexico's exports to the United States. The Mexican machinery sector was another that substantially increased its exports to the United States, from a share of 2% in 2000 to 6% in 2011, maintaining this level until 2019.

Brazil's most important export destinations, accounting for around 60% of the total, are in the "rest of the world" group, mainly because the MERCOSUR and Latin American Integration Association (LAIA) countries are not included in the Asian Development Bank database. Of the countries in the database, the ones taking the largest shares are the United States, Japan, India, China, Mexico and Germany. In this case, specialization differs depending on the trade partner (Castilho and Puchet Anyul, 2012; Nassif and Castilho, 2020). Generally speaking, the country exports medium-technology and medium-high-technology goods to MERCOSUR and LAIA and lower-technology goods to other countries, such as China, the United States and Europe. Another interesting point is that while Mexico is one of Brazil's top two trade partners, the opposite is not the case. Brazilian exports to Mexico are dominated by transport equipment (63% in 2000 and 55% in 2019).

As table 1 shows, the main changes in Brazilian exports have been in the shares of the rest of the world and China. The rest of the world accounted for 60% of all Brazilian exports in 2000 but

<sup>2</sup> As Alves-Passoni (2022c) shows, notwithstanding a significant price effect that tends to result in the share of oil being overestimated, the volume of oil exports also increased.

only 40% at the end of the period. This change occurred because of the increase in China's share, from 2% to 31% of the total. The bulk of this shift occurred from 2010 onward.

In this context, Hiratuka and Sarti (2017) argue that the 2008 economic crisis increased international competition, since countries developed strategies to stimulate their exports as a demand source to counteract the drop in their growth rate. China increased its share of the Latin American market, becoming a competitor to Brazilian exports in MERCOSUR and LAIA.

Table 2 shows the increase in China's share of Brazilian exports of commodities (agricultural and mining products). In 2000, agricultural and mining exports to the country represented 6.5% and 5.5%, respectively, of total Brazilian exports; by 2019, the figures had grown to 27% and 21%. China by itself is the destination for 50% of the goods produced by the extractive mining sector. The composition of Brazilian exports to China changed: whereas 15% of exports to China were associated with agriculture in 2000, this proportion was 44% in 2019, while the share of the mining and quarrying sector grew from 11% in 2000 to 35% in 2019.

After increasing steadily, the shares of these sectors in Brazilian exports rose particularly strongly between 2015 and 2019. The share of Brazilian exports taken by the rest of the world also decreased in the period. Although the world input-output tables published by the Asian Development Bank (ADB) do not provide information about other Latin American countries, Nassif and Castilho (2020) identify a decline in the importance of these countries, particularly Argentina. This has affected sectoral composition, since most technological goods are exported to Latin America, as Castilho and Puchet Anyul (2012) and Nassif and Castilho (2020) show. Consequently, the share of Brazilian capital-intensive manufacturing exports fell from 26% to 10%. All the sectors that compose this group lost ground, but electrical and optical equipment and chemical products were particularly affected. The finding holds for all major trade partners other than China.

### III. Methodology

#### 1. Structural decomposition analysis

Structural decomposition analysis is a methodology used within the input-output framework to examine changes in an economic variable using a set of comparative static changes in the parameters of an input-output table (Rose and Chen, 1991; Rose and Miernyk, 1989). The model is suitable for this study because it can be used for sectoral analysis, demonstrating connections through production relationships and the structure of demand for goods and services.

We focus the structural decomposition analysis on sectoral value added ( $v$ ), representing the value added for each commodity at the end of the production process. This is calculated within the traditional input-output model using the value added coefficient (value added per unit of output, calculated as the share of  $v$  in gross sectoral output ( $x$ ), ( $c = vx^{-1}$ ), the inverse Leontief matrix  $L = (I - A_d)^{-1}$ , which incorporates the direct technical coefficients ( $A_d$ ) i.e., the amount of inputs used by each sector to produce an additional unit of output) and final demand ( $f$ ) (Miller and Blair, 2009):<sup>3</sup>

$$v = \hat{c} \times (I - A_d)^{-1} \times f \quad (1)$$

$$v = \hat{c} \times L \times f \quad (2)$$

<sup>3</sup> Here we follow the regular notation, denoting matrices with bold capital letters and vectors with bold lower-case letters; vectors are column vectors, and thus a row vector is represented by a transposed column vector.

where  $\hat{c}$  is the diagonal vector of the value added coefficient, in the range  $0 < c_j \leq 1$ , depending on the usage of primary factors of production (wages, capital and land) in sector  $j$ .

We propose a breakdown of final demand into domestic demand ( $d$ ), which is composed of household and government expenditures and gross fixed capital formation; exports ( $e$ ); and changes in inventories ( $s$ ), such that:

$$f = d + e + s \quad (3)$$

Putting together (2) and (3), we have:

$$v = \hat{c} \times L \times (d + e + s) \quad (4)$$

Next, we define  $v_d$ ,  $v_e$  and  $v_s$  as the value added generated by domestic demand, exports and changes in inventories:

$$v_d = \hat{c}Ld \quad (5)$$

$$v_e = \hat{c}Le \quad (6)$$

$$v_s = \hat{c}Ls \quad (7)$$

So, merging (5), (6), (7) and (4), sectoral value added can be expressed as:

$$v = v_d + v_e + v_s = \hat{c}Ld + \hat{c}Le + \hat{c}Ls \quad (8)$$

The decompositions presented here will concentrate on  $v_d$  and  $v_e$ , since changes in inventories have no economic significance.

Inspired by the final demand decomposition presented by Miller and Blair (2009), we disaggregate the export vector ( $e$ ) into terms of trade, composition of trade partners, sectoral composition (product mix) and level of exports. For this, we treat  $E$  as a partitioned matrix formed of the three main partners ( $e_{st}$ ,  $e_{nd}$ ,  $e_{rd}$ , identified by the annual averages for each country) and the rest of the world ( $e_{rw}$ ):

$$E = [e_{st} \mid e_{nd} \mid e_{rd} \mid e_{rw}] \quad (9)$$

These countries are the United States, Canada and China for Mexico, and the United States, China and Japan for Brazil.

In addition, let total exports ( $e$ ) be:

$$e = i'Ei \quad (10)$$

The second step is to set  $\delta$  as a vector ( $4 \times 1$ ) that represents total exports for the three main partners and the rest of the world:

$$\delta = (i'r)' \quad (11)$$

Dividing  $\delta$  by total exports gives the share of total exports going to the main export partners and the rest of the world ( $\psi$ ,  $4 \times 1$ ):

$$\psi = \left(\frac{1}{e}\right) \hat{\delta} \quad (12)$$

Lastly, we compute the share of products exported to each country ( $T$ ,  $n \times 4$ ):

$$T = (E)(\hat{\psi})^{-1} \quad (13)$$

Combining (10), (12) and (13) allows us to express  $e$  in terms of product mix, composition of partners and level:

$$e = T\psi e \quad (14)$$

We now have the main equation required to proceed with the structural decomposition analysis, which includes the value added generated by domestic demand and external demand while also incorporating export partners:

$$v = \hat{c}Ld + \hat{c}LT\psi e + v_s \quad (15)$$

In the structural decomposition analysis, the change in value added ( $\Delta v$ ) between two years, 0 ( $v^0$ ) (the start year) and 1 ( $v^1$ ) (the end year), is given by:

$$\Delta v = v^1 - v^0 \quad (16)$$

Because each decomposition has several alternative forms, we use the mean of the polar decomposition to calculate the changes, as Dietzenbacher and Los (1998) suggest. So the structural decomposition analysis for (16), following, Miller and Blair (2009), is:

$$\Delta v = \left(\frac{1}{2}\right)\Delta\hat{c} \times (L^1 d^1 + L^0 d^0) + \left(\frac{1}{2}\right)\Delta\hat{c} \times (L^1 e^1 + L^0 e^0) + \quad (17a)$$

$$\left(\frac{1}{2}\right)(\hat{c}^1 + \hat{c}^0) \times \Delta L \times (d^1 + d^0) + \left(\frac{1}{2}\right)(\hat{c}^1 + \hat{c}^0)\Delta L \times (e^1 + e^0) + \quad (17b)$$

$$\left(\frac{1}{2}\right)(\hat{c}^1 L^1 + \hat{c}^0 L^0) \times \Delta d + \quad (17c)$$

$$\left(\frac{1}{2}\right)(\hat{c}^1 L^1 + \hat{c}^0 L^0) \times \Delta e + \quad (17d)$$

$$\left(\frac{1}{2}\right)\Delta\hat{c} \times (x_s^1 + x_s^0) + \left(\frac{1}{2}\right)(\hat{c}^1 + \hat{c}^0) \times \Delta x_s \quad (17e)$$

Following the suggestion of Oosterhaven and Van der Linden (1997) and Miller and Blair (2009), we use a hierarchical structural decomposition analysis to express the changes of  $\Delta L$  (17b) as  $\Delta A_d$ :

$$\Delta L = L^1 \Delta A_d L^0 \quad (18)$$

We also decompose  $\Delta e$  (17d), in accordance with the definition presented in (14), as:

$$\Delta e = T^1 \psi^1 e^1 - T^0 \psi^0 e^0 \quad (19)$$

$$\Delta e = \left(\frac{1}{2}\right)\Delta T \times (\psi^1 e^1 + \psi^0 e^0) + \left(\frac{1}{2}\right)(T^1 + T^0) \times \Delta \psi \times (e^1 + e^0) \quad (20)$$

$$+ \left(\frac{1}{2}\right)(T^1 \psi^1 + T^0 \psi^0) \times \Delta e$$

By combining (19) and (21) with (18), we can carry out the value added structural decomposition analysis by changes in seven sources, namely the value added coefficient ( $\Delta\hat{c}$ ), technology ( $\Delta A_d$ ), domestic demand ( $\Delta d$ ), export product mix ( $\Delta T$ ), composition of export partners ( $\Delta\psi$ ), export level ( $\Delta e$ ) and inventories ( $\Delta v_s$ ):

Value added coefficient

$$\left(\frac{1}{2}\right)\Delta\hat{c} \times (L^1 d^1 + L^0 d^0) + \left(\frac{1}{2}\right)\Delta\hat{c} \times (L^1 e^1 + L^0 e^0) \quad (21a)$$

Technology

$$\left(\frac{1}{2}\right)(\hat{c}^1 + \hat{c}^0) \times L^1 \Delta A_d L^0 \times (d^1 + d^0) + \left(\frac{1}{2}\right)(\hat{c}^1 + \hat{c}^0) \times L^1 \Delta A_d L^0 \times (e^1 + e^0) \quad (21b)$$

Domestic demand

$$\left(\frac{1}{2}\right)(\hat{c}^1 L^1 + \hat{c}^0 L^0) \times \Delta d \quad (21c)$$

Exports (sectoral composition)

$$\left(\frac{1}{2}\right)(\hat{c}^1 L^1 + \hat{c}^0 L^0) \times \left[ \left(\frac{1}{2}\right)\Delta T \times (\psi^1 e^1 + \psi^0 e^0) \right] \quad (21d)$$

Exports (composition of partners)

$$\left(\frac{1}{2}\right)(\hat{c}^1 L^1 + \hat{c}^0 L^0) \times \left[ \left(\frac{1}{2}\right)(T^1 + T^0) \times \Delta \psi \times (e^1 + e^0) \right] \quad (22e)$$

Exports (level)

$$\left(\frac{1}{2}\right)(\hat{c}^1 L^1 + \hat{c}^0 L^0) \times \left[ \left(\frac{1}{2}\right)(T^1 \psi^1 + T^0 \psi^0) \times \Delta e \right] \quad (21f)$$

Inventories

$$\left(\frac{1}{2}\right)\Delta\hat{c} \times (x_s^1 + x_s^0) + \left(\frac{1}{2}\right)(\hat{c}^1 + \hat{c}^0) \times \Delta x_s \quad (21g)$$

Note that  $\Delta v$  as presented above shows sectoral changes in value added. If we want the total for the economy, we must multiply each change by a summary vector  $i'$  (transposed column vector of ones). The  $\Delta\hat{c}$  contribution represents changes in value added per unit of output over the period. As Oosterhaven and Hoen (1998) point out, a negative/positive contribution indicates an increase/decrease in production efficiency, since fewer/more primary factors of production are used to generate the same value added per unit of output. This contribution can be interpreted to ascertain whether the value added is related to more indirect or direct production techniques.

The  $\Delta A_d$  contribution shows how changes in the technical coefficient impact sectoral value added. If it is positive/negative, the whole economy uses more/fewer domestic intermediate inputs to produce one additional unit of value added. We also show sectoral contributions to the supply of the domestic and external markets (the two terms of 21.b) so that the difference by demand source can be identified. The contribution associated with  $\Delta d$  can be positive or negative; if it is positive, changes in the domestic market in year one compared to year zero positively affected value added; the opposite applies when it is negative.

Concerning the external contribution ( $\Delta e$ ), changes in  $\Delta T$  show how differences in the product mix between years 0 and 1 positively/negatively contributed to the generation of value added. If  $\Delta \psi$  is positive/negative, changes in export destinations were beneficial/disadvantageous to  $\Delta v$ . It also shows the magnitude and sign of the effect of the level of exports on changes in  $\Delta v$ , irrespective of the sectoral composition or export market. Because inventories in the national accounts have no economic significance, we only show them to keep the model consistent, and they are not analysed.

## 2. Database and sectoral classification

We used the world input-output tables in constant prices estimated by the Asian Development Bank (ADB), which extend those originally published by the University of Groningen (Consing and others, 2020; ADB, 2021). The database has information for both Brazil and Mexico, and its multiregional character allows the export vector to be disaggregated by trade partner. The data are deflated using sectoral deflators of gross output, a procedure very similar to the double deflation method.

The database contains 35 sectors, which we group into five categories:

- (i) Agriculture, hunting, forestry and fisheries.
- (ii) Mining and quarrying.
- (iii) Traditional manufacturing industry: food, beverages and tobacco; textiles and textile products; leather, leather products and footwear; wood and products of wood and cork; pulp, paper, paper products, printing and publishing; coke, refined petroleum and nuclear fuel; rubber and plastics; other non-metallic minerals; primary metals and fabricated metal.
- (iv) Capital-intensive manufacturing industry: chemicals and chemical products; machinery, not elsewhere classified; electrical and optical equipment; transport equipment.
- (v) Other sectors: public utilities; construction; services.

To better characterize manufacturing industry, we divided it into traditional and capital-intensive manufacturing. The first group is generally classified as low- and medium-low-technology, and the second group as medium- and high-technology (see, for example, the Organisation for Economic Co-operation and Development (OECD) technology intensity classification by Galindo-Rueda and Verger, 2016). We prefer not to use the OECD nomenclature because these technology intensity categories are based on developed countries and do not map on to the research and development done by firms in Latin American countries such as Brazil and Mexico (Cassini and Robert, 2017). We are particularly interested in the second group of sectors, so we provide disaggregated information for the sectors within capital-intensive manufacturing industry.

The database is available for the years from 2000 to 2020. We excluded the last year because of the economic crisis caused by the coronavirus disease (COVID-19) pandemic, which would have affected the analysis of general trends in the economic processes experienced by the countries. The decomposition was performed from 2000 to 2019, taking the following subperiods: 2000–2008, 2010–2014 and 2015–2019. Since not all years in the series are available, we only use the beginning and end years to calculate growth rates. This means that developments within a period cannot be examined and may affect comparisons with other research that uses a chained growth method.

## IV. Discussion of results

From 2000 to 2019, Mexico and Brazil had annual value added growth rates of 1.21% and 1.22%, respectively. Table 3 provides a breakdown of the structural decomposition analysis components for the entire period (2000–2019) and subperiods (2000–2008, 2010–2014 and 2015–2019).

**Table 3**  
Mexico and Brazil: structural decomposition of growth, 2000–2019 and subperiods  
(Percentage points of value added growth)

Structural decomposition analysis variable	Brazil				Mexico				
	2000–2019	2000–2008	2010–2014	2015–2019	2000–2019	2000–2008	2010–2014	2015–2019	
Value added coefficient	Domestic	-1.99	-3.74	0.29	-0.25	-1.79	-3.57	-0.11	-0.53
	Export	-0.71	-1.13	0.52	0.26	0.60	-0.47	0.33	-0.72
	Total	-2.70	-4.87	0.81	0.01	-1.19	-4.04	0.22	-1.24
Technology	Domestic	-2.70	-0.53	-1.76	-0.38	-2.90	-1.54	-1.93	0.39
	Export	-0.53	0.18	-0.76	-0.42	-0.29	0.45	0.28	-0.80
	Total	-3.23	-0.34	-2.52	-0.80	-3.19	-1.08	-1.65	-0.41
Domestic demand	40.11	24.38	8.01	0.77	38.09	24.75	7.80	0.38	
Exports	Product	0.40	0.02	0.01	0.34	-3.24	0.72	-0.35	-1.82
	Partners	0.24	0.10	0.00	0.06	-0.37	0.12	0.02	-0.48
	Level	12.53	6.73	1.88	3.75	12.85	6.63	1.85	3.87
	Total	13.17	6.86	1.89	4.15	9.25	7.47	1.52	1.56
Inventories	-1.13	0.97	-0.27	0.36	-2.85	-0.28	-1.55	2.20	
Cumulative growth	46.22	27.00	7.93	4.49	40.10	26.82	6.34	2.49	
Annual growth	1.22	1.51	1.68	1.46	1.21	1.51	1.59	1.26	

**Source:** Prepared by the author, on the basis of R. M. Consing III and others, “The wellness economy: a comprehensive system of national accounts approach”, *ADB Economics Working Paper Series*, No. 631, December 2020; and Asian Development Bank (ADB), *Capturing the digital economy: a proposed measurement framework and its applications. A special supplement to key indicators for Asia and the Pacific 2021*, Manila, 2021.

Over the whole period, the contribution of the value added coefficient was negative in Mexico and Brazil, with approximately -4% total growth in value added. This suggests a decrease in these economies’ ability to generate value added per unit of output, but it could also mean an increase in production efficiency. In Mexico, interestingly, the export-related value added coefficient made a positive contribution (0.60 percentage points), while that for the domestic sector had a negative effect (-1.79 percentage points). In Brazil, changes in  $\hat{c}$  related to the domestic sector (-1.99 percentage points) and external sector (-0.71 percentage points) both made negative contributions to value added growth.

Regarding the domestic contribution of technology, Brazil and Mexico experienced a decrease in the use of intermediate production inputs, as evidenced by their negative technical coefficients. This could mean a loss of linkages in production activities, but it could also indicate that more efficient production techniques were utilized.

Between 2000 and 2019, most value added growth in Mexico and Brazil came from domestic demand. This is classified as “inward” value added generation by Torracca (2017), because domestic demand components contributed the most significant portion to the overall creation of value added. Specifically, 95% of total value added growth in Mexico and 87% in Brazil are attributed to domestic demand. In nations with large populations and extensive territories, there is often a need to meet domestic requirements by producing goods and services locally. Alves-Passoni and Blancas (2022) have noted that in Mexico and Brazil, approximately 80% and 90%, respectively, of final demand consists of domestic components such as household consumption, gross fixed capital formation and government expenditure.

Significant differences between the two countries are found when the contribution of exports to value added growth is analysed. In Mexico, the shift in the product mix from 2000 to 2019 affected value added growth. However, when changes in gross output are examined, the outcome is entirely different. Table 4 shows that the transport sector had the largest share of gross output, but its value added coefficient was lower because imports were included. Only the agricultural sector contributed positively to the changes in the product mix.<sup>4</sup> Conversely, the mining and quarrying sector (-1.34 percentage points) and other sectors (-1.5 percentage points) were negatively affected by the changes in the product mix.

<sup>4</sup> The value added coefficient of this sector was 0.65 in 2000 and 0.69 in 2019.

**Table 4**  
Mexico: structural decomposition analysis, 2000–2019 and subperiods  
(Percentage points of value added growth)

	$\Delta\hat{c}$			$\Delta A_d$			$\Delta v_D$	$\Delta e$			$\Delta v_s$	$\Delta v$	
	Domestic	Export	Total	Domestic	Export	Total		$\Delta T$	$\Delta\psi$	$\Delta e$			Domestic
2000–2019													
AGR	0.05	-0.18	-0.13	-0.75	1.05	0.29	0.62	1.05	-0.03	1.03	2.04	-1.19	1.64
MNQ	-0.42	0.09	-0.33	0.06	-1.34	-1.28	0.01	-1.34	-0.01	2.77	1.42	0.61	0.43
TRM	1.02	-0.24	0.78	-0.62	-0.57	-1.19	3.61	-0.83	-0.45	2.60	1.32	0.69	5.20
CIM	0.02	-0.94	-0.93	-0.38	1.31	0.93	2.38	-0.64	-0.29	1.27	0.33	-0.55	2.16
CHM	-0.13	-0.16	-0.28	-0.15	-0.08	-0.23	0.78	-0.11	-0.04	0.44	0.30	0.15	0.71
MAC	0.06	-0.18	-0.12	-0.07	0.65	0.58	0.46	-0.06	-0.06	0.25	0.14	-0.47	0.58
EOP	0.33	-0.48	-0.16	-0.28	-0.72	-1.00	0.23	-0.27	-0.06	0.20	-0.13	1.21	0.15
TRA	-0.24	-0.12	-0.37	0.11	1.46	1.57	0.92	-0.21	-0.13	0.38	0.03	-1.44	0.71
OTH	-2.46	1.87	-0.59	-1.20	-0.74	-1.94	31.46	-1.48	0.42	5.19	4.13	-2.40	30.67
Total	-1.79	0.60	-1.19	-2.90	-0.29	-3.19	38.09	-3.24	-0.37	12.85	9.25	-2.85	40.10
2000–2008													
AGR	-0.04	-0.07	-0.10	-0.48	0.14	-0.34	0.73	0.14	0.00	0.20	0.34	0.13	0.76
MNQ	0.14	0.02	0.16	0.36	1.53	1.89	1.44	1.53	0.13	1.21	2.87	-1.61	4.74
TRM	-2.31	-0.05	-2.36	-0.14	-0.25	-0.39	1.92	-0.34	-0.13	1.38	0.92	-0.18	-0.09
CIM	-1.41	-0.42	-1.83	0.21	0.16	0.38	2.27	-0.10	-0.07	0.80	0.62	0.11	1.55
CHM	-0.96	-0.02	-0.98	0.00	0.08	0.08	0.34	0.01	-0.02	0.22	0.20	-0.27	-0.62
MAC	-0.08	-0.13	-0.20	0.02	0.39	0.41	0.43	0.02	-0.02	0.16	0.16	-0.27	0.52
EOP	-0.19	-0.22	-0.41	-0.11	-0.14	-0.25	0.08	-0.10	-0.02	0.14	0.02	0.31	-0.24
TRA	-0.19	-0.05	-0.24	0.30	-0.17	0.14	1.42	-0.03	-0.01	0.28	0.24	0.35	1.89
OTH	0.04	0.06	0.10	-1.49	-1.13	-2.62	18.39	-0.51	0.19	3.03	2.72	1.27	19.86
Total	-3.57	-0.47	-4.04	-1.54	0.45	-1.08	24.75	0.72	0.12	6.63	7.47	-0.28	26.82
2010–2014													
AGR	-0.03	-0.01	-0.04	-0.05	0.17	0.12	0.17	0.17	0.00	0.09	0.27	-0.25	0.27
MNQ	-0.12	0.10	-0.02	-0.10	-0.42	-0.52	0.26	-0.42	0.05	0.48	0.11	0.27	0.09
TRM	1.00	-0.04	0.96	-0.99	0.10	-0.89	0.40	0.08	0.00	0.39	0.46	-0.19	0.75
CIM	0.22	0.08	0.30	-0.20	0.14	-0.06	0.32	-0.06	-0.01	0.17	0.10	-0.21	0.45
CHM	0.06	-0.01	0.05	-0.07	0.00	-0.07	0.11	0.01	0.00	0.06	0.07	0.03	0.19
MAC	0.04	0.00	0.04	-0.06	-0.04	-0.10	0.02	0.00	0.00	0.03	0.03	0.06	0.06
EOP	0.13	0.02	0.15	-0.07	-0.21	-0.28	0.05	-0.03	0.00	0.02	-0.01	0.19	0.10
TRA	-0.02	0.08	0.06	0.00	0.39	0.40	0.14	-0.04	-0.01	0.05	0.00	-0.49	0.10
OTH	-1.17	0.20	-0.97	-0.59	0.29	-0.30	6.65	-0.12	-0.03	0.72	0.57	-1.17	4.78
Total	-0.11	0.33	0.22	-1.93	0.28	-1.65	7.80	-0.35	0.02	1.85	1.52	-1.55	6.34
2015–2019													
AGR	0.07	-0.09	-0.02	-0.25	0.25	0.00	0.21	0.25	-0.01	0.42	0.66	-0.46	0.39
MNQ	-0.29	-0.16	-0.45	0.32	-1.43	-1.10	-0.46	-1.43	-0.04	1.00	-0.46	2.20	-0.27
TRM	0.71	-0.19	0.51	0.34	-0.69	-0.35	0.62	-0.39	-0.16	0.70	0.16	1.16	2.11
CIM	0.35	-0.38	-0.03	-0.06	0.81	0.75	0.17	-0.20	-0.07	0.29	0.02	-0.26	0.65
CHM	0.11	-0.07	0.05	-0.01	-0.18	-0.18	0.15	-0.07	0.00	0.12	0.05	0.34	0.40
MAC	0.05	-0.01	0.04	0.01	0.03	0.03	0.02	-0.01	-0.02	0.07	0.03	0.01	0.14
EOP	0.07	-0.01	0.06	-0.01	0.09	0.07	0.06	-0.04	-0.01	0.03	-0.02	-0.06	0.11
TRA	0.11	-0.29	-0.17	-0.04	0.87	0.83	-0.06	-0.08	-0.04	0.08	-0.04	-0.54	0.01
OTH	-1.36	0.10	-1.26	0.04	0.25	0.29	-0.16	-0.06	-0.21	1.46	1.19	-0.45	-0.39
Total	-0.53	-0.72	-1.24	0.39	-0.80	-0.41	0.38	-1.82	-0.48	3.87	1.56	2.20	2.49

**Source:** Prepared by the author, on the basis of R. M. Consing III and others, “The wellness economy: a comprehensive system of national accounts approach”, *ADB Economics Working Paper Series*, No. 631, December 2020; and Asian Development Bank (ADB), *Capturing the digital economy: a proposed measurement framework and its applications. A special supplement to key indicators for Asia and the Pacific 2021*, Manila, 2021.

**Note:**  $\Delta\hat{c}$ : value added coefficient;  $\Delta A_d$ : technical coefficients;  $\Delta v_D$ : domestic value added;  $\Delta e$ : sectoral exports;  $\Delta T$ : product mix;  $\Delta\psi$ : composition of export partners;  $\Delta e$ : export level;  $\Delta v_s$ : value added from changes in inventories;  $\Delta v$ : sectoral value added; AGR: Agriculture, hunting, forestry and fisheries; MNQ: Mining and quarrying; TRM: Traditional (low- and medium-low-technology) manufacturing; CIM: Computer-integrated (medium-high- and high-technology) manufacturing; CHM: Chemicals and chemical products; MAC: Machinery, not elsewhere classified; EOP: Electrical and optical equipment; TRA: Transport equipment; OTH: Other industries.

In section 2, it was observed that Mexico's trade partners had changed. The share of the United States has declined, while those of China and Canada have increased. This has negatively affected value added growth by -0.37 percentage points, with the greatest impact in the traditional manufacturing and transport equipment sectors. However, the contribution of the export vector has been positive, with a 9.25 percentage point increase. This is because the level effect (12.85 percentage points) outweighs the negative contribution of other factors. The export vector has contributed 23% of total value added growth.

The difference in the decompositions for Mexican value added and gross output is interesting. When performing the same decomposition for gross output, we observed a considerable difference in the importance of the transport equipment sector. While this sector has contributed only 2% of value added growth, its contribution to gross output is 11%. One of the main differences between the decompositions of gross output and value added is the value added coefficient, which weights all the structural decomposition components. Since it was only 0.40 in 2000 and 0.39 in 2019, the transport equipment sector has a limited capacity to generate value added. This result is one of the points addressed by Fujii and Cervantes (2013) and Fuentes, Brugués and González (2020): that although this sector is an essential part of Mexican production, its capacity to generate value added is limited. Other factors that could increase the importance of the sector, even with this value added coefficient, could be indirect effects such as the generation of well-paid jobs. However, as Murillo, Puchet Anyul and Fujii (2018) point out, the sector's capacity to generate jobs is limited.

Brazil's economy experienced positive growth in 2000–2019 because of changes in export products (0.40 percentage points), trade partners (0.24 percentage points) and the level effect (12.5 percentage points). These factors contributed 28% of total growth, as shown in table 5. Agriculture (1.98 percentage points) and mining (1.37 percentage points) had a positive impact on the product mix breakdown, while traditional manufacturing (-0.83 percentage points) and capital-intensive manufacturing (-0.64 percentage points) had a negative impact. The agricultural and mining industries also played a positive role in the recomposition of trade partners, mainly because of China's importance to the Brazilian economy. Traditional industry was the most important sector as regards the level of exports, contributing 2.6 percentage points, followed by the agricultural and mining sectors, contributing 2.0 percentage points and 1.5 percentage points, respectively. It is worth noting that a relationship exists between  $\Delta T$  and  $\Delta \psi$ .

It is crucial to note that the primary sectors and service industries have a high value added coefficient because they require fewer inputs. This means they have greater value added per unit of output than manufacturing and other industries that require more inputs. For example, the agricultural sector coefficient was 0.57 and 0.59 and that of mining and quarrying 0.62 and 0.49 in 2000 and 2019, respectively. Thus, when the economy specializes in these sectors, it will positively affect value added. In interpreting the results, the impact of relative prices must be considered. Although the series used is in constant prices, eliminating the effect of inflation, this does not apply to relative prices. Alves-Passoni (2022c) has demonstrated that these sectors were particularly affected by higher relative prices during the period, which may lead to their significance being overestimated.

**Table 5**  
Brazil: structural decomposition analysis, 2000–2019 and subperiods  
(Percentage points of value added growth)

	$\Delta\hat{c}$			$\Delta A_d$			$\Delta d$	$\Delta e$				$\Delta v_s$	$\Delta v$
	Domestic	Export	Total	Domestic	Export	Total		$\Delta T$	$\Delta\psi$	$\Delta e$	Total		
2000–2019													
AGR	0.13	0.10	0.23	-0.57	-0.18	-0.75	1.32	1.98	0.33	2.01	4.32	-0.10	5.02
MNQ	-0.70	-0.65	-1.35	0.08	0.03	0.11	1.33	1.37	0.23	1.47	3.07	0.01	3.18
TRM	1.02	0.34	1.37	-0.62	-0.19	-0.81	3.61	-0.83	-0.45	2.60	1.32	-0.28	5.20
CIM	0.02	-0.04	-0.02	-0.38	-0.07	-0.45	2.38	-0.64	-0.29	1.27	0.33	-0.08	2.16
CHM	-0.13	-0.03	-0.15	-0.15	-0.03	-0.18	0.78	-0.11	-0.04	0.44	0.30	-0.03	0.71
MAC	0.06	0.02	0.07	-0.07	-0.02	-0.09	0.46	-0.06	-0.06	0.25	0.14	0.00	0.58
EOP	0.33	0.05	0.38	-0.28	-0.04	-0.32	0.23	-0.27	-0.06	0.20	-0.13	0.00	0.15
TRA	-0.24	-0.07	-0.32	0.11	0.02	0.13	0.92	-0.21	-0.13	0.38	0.03	-0.05	0.71
OTH	-2.46	-0.46	-2.92	-1.20	-0.13	-1.33	31.46	-1.48	0.42	5.19	4.13	-0.68	30.67
Total	-1.99	-0.71	-2.70	-2.70	-0.53	-3.23	40.11	0.40	0.24	12.53	13.17	-1.13	46.22
2000–2008													
AGR	-0.13	-0.04	-0.17	0.38	0.10	0.48	0.98	0.11	0.09	0.66	0.86	0.08	2.24
MNQ	0.07	0.04	0.11	0.51	0.11	0.62	0.81	0.86	0.02	0.86	1.74	0.16	3.44
TRM	-2.31	-0.58	-2.89	-0.14	0.02	-0.12	1.92	-0.34	-0.13	1.38	0.92	0.08	-0.09
CIM	-1.41	-0.36	-1.77	0.21	0.06	0.28	2.27	-0.10	-0.07	0.80	0.62	0.15	1.55
CHM	-0.96	-0.24	-1.19	0.00	0.01	0.01	0.34	0.01	-0.02	0.22	0.20	0.02	-0.62
MAC	-0.08	-0.02	-0.10	0.02	0.01	0.03	0.43	0.02	-0.02	0.16	0.16	0.01	0.52
EOP	-0.19	-0.04	-0.23	-0.11	-0.02	-0.13	0.08	-0.10	-0.02	0.14	0.02	0.00	-0.24
TRA	-0.19	-0.06	-0.25	0.30	0.07	0.37	1.42	-0.03	-0.01	0.28	0.24	0.12	1.89
OTH	0.04	-0.19	-0.15	-1.49	-0.11	-1.60	18.39	-0.51	0.19	3.03	2.72	0.49	19.86
Total	-3.74	-1.13	-4.87	-0.53	0.18	-0.34	24.38	0.02	0.10	6.73	6.86	0.97	27.00
2010–2014													
AGR	-0.05	-0.02	-0.08	-0.12	-0.05	-0.17	0.33	0.32	0.02	0.26	0.61	0.01	0.70
MNQ	0.30	0.30	0.60	0.14	0.02	0.16	0.32	-0.21	0.02	0.34	0.15	0.03	1.25
TRM	1.00	0.29	1.28	-0.99	-0.24	-1.23	0.40	0.08	0.00	0.39	0.46	-0.17	0.75
CIM	0.22	0.04	0.25	-0.20	-0.05	-0.25	0.32	-0.06	-0.01	0.17	0.10	0.03	0.45
CHM	0.06	0.01	0.07	-0.07	-0.02	-0.09	0.11	0.01	0.00	0.06	0.07	0.02	0.19
MAC	0.04	0.01	0.06	-0.06	-0.02	-0.08	0.02	0.00	0.00	0.03	0.03	0.03	0.06
EOP	0.13	0.02	0.15	-0.07	-0.01	-0.09	0.05	-0.03	0.00	0.02	-0.01	0.00	0.10
TRA	-0.02	0.00	-0.02	0.00	0.00	0.00	0.14	-0.04	-0.01	0.05	0.00	-0.02	0.10
OTH	-1.17	-0.08	-1.25	-0.59	-0.44	-1.02	6.65	-0.12	-0.03	0.72	0.57	-0.17	4.78
Total	0.29	0.52	0.81	-1.76	-0.76	-2.52	8.01	0.01	0.00	1.88	1.89	-0.27	7.93
2015–2019													
AGR	0.03	0.02	0.05	-0.87	-0.28	-1.15	-0.08	0.84	0.29	0.78	1.91	0.03	0.77
MNQ	0.03	0.03	0.05	0.16	0.03	0.19	0.23	0.15	0.20	0.52	0.87	0.01	1.36
TRM	0.71	0.21	0.92	0.34	0.02	0.37	0.62	-0.39	-0.16	0.70	0.16	0.05	2.11
CIM	0.35	0.08	0.43	-0.06	-0.02	-0.08	0.17	-0.20	-0.07	0.29	0.02	0.12	0.65
CHM	0.11	0.03	0.14	-0.01	0.00	-0.01	0.15	-0.07	0.00	0.12	0.05	0.07	0.40
MAC	0.05	0.01	0.06	0.01	0.00	0.00	0.02	-0.01	-0.02	0.07	0.03	0.02	0.14
EOP	0.07	0.01	0.08	-0.01	0.00	-0.02	0.06	-0.04	-0.01	0.03	-0.02	0.01	0.11
TRA	0.11	0.03	0.14	-0.04	-0.01	-0.06	-0.06	-0.08	-0.04	0.08	-0.04	0.02	0.01
OTH	-1.36	-0.08	-1.44	0.04	-0.16	-0.12	-0.16	-0.06	-0.21	1.46	1.19	0.14	-0.39
Total	-0.25	0.26	0.01	-0.38	-0.42	-0.80	0.77	0.34	0.06	3.75	4.15	0.36	4.49

**Source:** Prepared by the author, on the basis of R. M. Consing III and others, “The wellness economy: a comprehensive system of national accounts approach”, *ADB Economics Working Paper Series*, No. 631, December 2020; and Asian Development Bank (ADB), *Capturing the digital economy: a proposed measurement framework and its applications. A special supplement to key indicators for Asia and the Pacific 2021*, Manila, 2021.

**Note:**  $\Delta\hat{c}$ : value added coefficient;  $\Delta A_d$ : technical coefficients;  $\Delta v_p$ : domestic value added;  $\Delta e$ : sectoral exports;  $\Delta T$ : product mix;  $\Delta\psi$ : composition of export partners;  $\Delta e$ : export level;  $\Delta v_s$ : value added from changes in inventories;  $\Delta v$ : sectoral value added; AGR: Agriculture, hunting, forestry and fisheries; MNQ: Mining and quarrying; TRM: Traditional (low- and medium-low-technology) manufacturing; CIM: Computer-integrated (medium-high- and high-technology) manufacturing; CHM: Chemicals and chemical products; MAC: Machinery, not elsewhere classified; EOP: Electrical and optical equipment; TRA: Transport equipment; OTH: Other industries.

Brazil and Mexico had similar growth rates not only over the whole period but also in the subperiods. Between 2000 and 2008, value added growth was approximately 1.51% in both. Mexico grew slightly less than Brazil between 2010 and 2014, by 1.59% a year as compared to 1.68% a year. The most significant difference was in 2015–2019, when Mexico grew by 1.26% a year and Brazil by 1.46% a year.

In the subperiods 2000–2008 and 2010–2014, the domestic sector was vital in generating value added in these countries. Alves-Passoni and Blancas (2022) and Fraga-Castillo and Moreno-Brid (2015) identify a considerable increase in gross fixed capital formation in both countries between 2000 and 2008, which contributed to the importance of the domestic sector in explaining changes in value added, since it has an “inward” pattern. In the 2000–2008 period,  $\Delta d$  accounted for 92% (24.75 percentage points) of total value added growth in Mexico and 90% (24.38 percentage points) in Brazil.

In 2010, the two countries adopted special measures to combat the effects of the 2008 subprime crisis. The Brazilian government increased public investment and implemented subsidies, lower interest rates and tax incentives to stimulate private investment, especially in residential properties. The Mexican government likewise introduced expansionary fiscal policies. These policies lasted a few years and contributed to the positive role of the domestic sector in the generation of value added, representing 123% of value added growth in Mexico (7.8 percentage points) and 101% in Brazil (8 percentage points).

However, the subperiods analysed differ in two respects. The first is the contribution of the value added associated with export products, which was negative during 2000–2008 (-0.47 percentage points and -1.12 percentage points in Mexico and Brazil, respectively) and positive during 2010–2014 (0.33 and 0.52 percentage points).

Meanwhile, the change in the composition of exported goods had a positive effect on value added in the Mexican economy in the first subperiod (0.72 percentage points) and a negative one in the second (-0.35 percentage points). In both cases, the mining and quarrying sector contributed decisively to the trend. The commodity boom of 2003–2008 entailed an increase in the production of goods that relied on the mining and quarrying sector, such as steel, iron and oil exports for industrial production.

The boom experienced by Brazil and Mexico was primarily due to the rise in demand from China (Carvalho, 2018; Schneider, 2013). As was seen in table 1, China increased its share of Mexico's exports between 2000 and 2008. As Alves-Passoni (2022a) points out, part of this increase may have been due to relative sectoral goods prices. The share of mining and quarrying in the Mexican economy rose from 6% of total value added to 8% between 2000 and 2008. The negative contribution of sectoral composition in Mexico in 2010–2014 was also related to the transport equipment sector, which showed the second-highest contribution for  $\Delta T$  (-0.12 percentage points) and the most negative one for  $\Delta \psi$  (-0.03 percentage points). In this period, economic recovery in the United States helped to stimulate growth in Mexican exports of transport equipment.

In the Brazilian case, the change in the product mix made a positive contribution in 2000–2008 (0.02 percentage points) and 2010–2014 (0.01 percentage points). While the mining and quarrying sector was most influential in the first subperiod, agricultural industry had a positive effect in the second. Regarding the impact of changes in trade partners, the mining and quarrying and agricultural sectors had a positive effect in both subperiods. Both effects ( $\Delta T$  and  $\Delta \psi$ ) were associated with the increase in Chinese demand for their products.

The subperiod that differed most from the others was 2015–2019. It was the only one in which the contribution of exports was more significant than that of domestic demand in Brazil and Mexico. In Brazil, this was partially because the government implemented robust fiscal policies, such as reductions in social transfers, the overall budget and government investment (mainly in the area of civil construction) and increases in taxation to expand revenues. As an induced effect, gross fixed capital formation declined in the period (Alves-Passoni and Blancas, 2022).

In the Mexican case, the government adopted a strategy of stimulating growth through private investment and exports. The instruments used were interest rate cuts, reductions in public

investment (based on the assumption of a crowding out effect), exchange-rate devaluation and tax incentives to stimulate exports. All these policies concentrated on price competitiveness as opposed to non-price competitiveness.

There was a difference between the two countries in 2015–2019 where the contribution of exports was concerned. In Brazil, changes in the export agenda and trade partners positively affected the generation of value added associated with the exports to China of the agriculture and mineral extraction sectors. In Mexico, the opposite occurred, with exports of automotive goods to the United States increasing and the transport equipment sector contributing negatively to the value added growth associated with exports. Although the effect of changes in the product mix and trade partners was negative, the change in the level of exports offset this.

## V. Final remarks

This study has employed a quantitative input-output structural decomposition analysis with a view to ascertaining how sectoral changes and shifts in export trade partners affected Brazilian and Mexican value added between 2000 and 2019. We found a strong relationship between changes or stability in trade partners and the structure of the export basket, considering product quality, design and differentiation.

There is a crucial difference between the changes in the composition of Brazilian and Mexican exports. While movements in the export basket and trade partners had a negative effect on value added growth in Mexico, the repercussions were positive in Brazil. In part, the difference in this result arises from the export composition of the two countries. Brazil has specialized (regressively) in agricultural and mineral goods exports to China, whereas Mexico has maintained its specialization in the transport equipment sector, exporting to the United States and Canada.

Even though exports contributed more to value added growth than the domestic sector between 2015 and 2019, average value added growth did not increase in these countries. From a sectoral point of view, changes in the composition of the manufacturing export basket and trade partners made a largely negative contribution to value added growth in all subperiods in both Brazil and Mexico. This effect was partly offset by the positive contribution of the level of exports, but it indicates that structural changes in exports did not contribute to the countries' ability to generate value added from these.

After analysing the structural decomposition results for both countries in the context of Latin American structuralist theory, we recommend a re-evaluation of the continued focus on these specific activities. In the case of Brazil, the increase in commodity exports to China has had some positive effects. However, these are limited. Singer (1950 and 1998) and Prebisch (1951) have already argued that relative price effects tend not to last. This increase in exports may also have skewed Brazil's production structure. In seeking to specialize in activities with higher international prices, production activities such as manufacturing may neglect others with a greater chain effect. It is important to consider the potential negative impact of these activities on the environment, including deforestation. According to Pérez (2008), investing in nanotechnology, biotechnology, new materials and energy generation is a good way for Brazil to benefit from these "regressive" markets. This would encourage the development of technology and capabilities, thereby contributing to long-term growth. The aim of these strategies is to create non-price competitiveness, but they often require time and political effort to put into effect.

Mexico faces even greater challenges because of its export dependency, with 70% of exports going to a single destination and 40% being in the transport and electronic equipment sectors. Unfortunately, the high import coefficient of these industries means that only a portion of their output contributes to value added. Additionally, the relative prices of these goods have fallen recently. Although they are industrial sectors, they have limited capacity for generating economic development because the country lacks the technological infrastructure to support them.

Latin American structuralist studies have shown that improving non-price competitiveness is the most effective way to positively impact value added, especially in the manufacturing sector. These studies include works by Prebisch (1951) and Singer (1950), as well as more recent ones by Cimoli, Porcile and Rovira (2010), Thirlwall (1979), McCombie (1993) and Nell (2003). Additionally, manufacturing sectors can compete through product differentiation and mark their prices up by more than producers of more uniform products like commodities. It is crucial to prioritize domestic capacity-building. A weak production structure can result in excessive dependence on imported materials, which has the potential for severe disruption of production chains and ultimately hinders growth. This makes it imperative to take the measures needed to strengthen a country's production structure and reduce its reliance on external sources.

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