Mexico and China's international trade structural decomposition analysis. 1995-2020

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Abstract. Given the similarities between Mexico and China's access to world markets at the end of the 20th and the beginning and 21st centuries, in this paper, we explore some reasons for the differences in their economic performance over more than two decades. Using OECD inter-country input-output tables and structural decomposition analysis, we provide evidence highlighting how the Mexican economy was left behind in its *Global Manufacturing Activities* and the rest of the economy by 1) higher imported intermediate inputs coefficients and 2) a lower capacity to depend less on its foreign trade.

Keywords: Input-output models, GVC, Mexico, China.

1. Introduction

Gereffi (2009) and Shafaeddin & Pizarro (2010), among many other scholars, have well-documented the differences between China and Mexico in their economic performance over the last thirty years. Regarding the reasons for such differences, Gereffi (2009) emphasized that while Mexico followed a textbook case of free-market policies, China engaged in "a more strategic, statist approach to its development." As a result, in the case of the Mexican economy, there was a consistent pattern of low diversification of its exports and low domestic value-added content in its manufacturing exports (Fujii & Cervantes, 2013; De la Cruz et al, 2011), while in the case of China, there is a more diversified basket of exports accompanied by the development of "supply-chain cities," the strategic attention to high-value activities, and its participation in the "intra-regional trade and production networks in East Asia," Gereffi (2009, 48)

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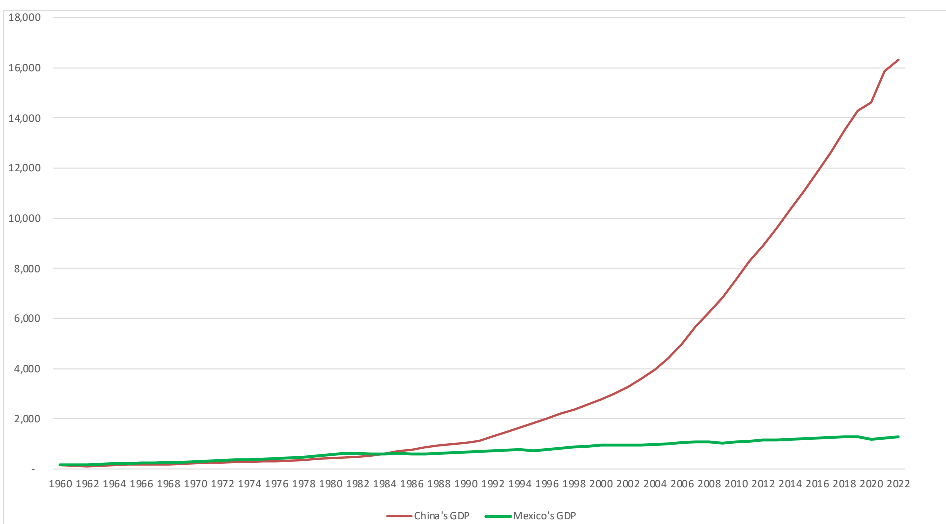
Shafaeddin & Pizarro (2010) also found that China's success can be explained by its capacity to develop a "comparative advantage in export and production of many industries, which had been initiated through import substitution." On the other hand, Mexico could not "sustain its rapid export growth"; at the time, most of its manufacturing exports were concentrated in two industries with few domestic linkages, as intermediate inputs suppliers or buyers (Fujii & Cervantes, 2017).

Ma, Wang, & Zhu (2015) distinguish the participation of Chinese-owned and foreign-invested enterprises and found that, in 2007, 52.6% of the total value-added of Chinese exports "was captured by foreign factor owners." Therefore, the effect of the export growth can be diminished when more than half of the domestic value-added does not return to the production system in the form of final demand. In this sense, if we extend the analysis before the change in the trade policies of China and Mexico, we can see that China's takeoff started before the country joined the World Trade Organization in 2001.

As shown in Figure 1, Mexico and China's GDPs were very similar in 1960: 152 253 and 158 907 constant 2015 million US dollars, respectively, but Mexico's GDP was larger from 1961 until 1984. And from 1994 to 2022, the Mexican economy stagnated, so the Chinese economy was almost thirteen times larger at the end of the period.

Figure 1. Mexico and China's GDP (constant 2015 million US dollars)



Source: World Bank Database (2024)

Economic growth rates better illustrate how, for both economies, there were two growth patterns before and after their liberalization processes. The average annual growth rates for the Mexican economy in the 1960s and 1970s were higher than the Chinese and World averages. After the 1980s decade, the Mexican economy consistently grew slower than the Chinese economy and the world average. Furthermore, as seen in Table 1, the difference in growth rates was much higher from the 1990s onward.

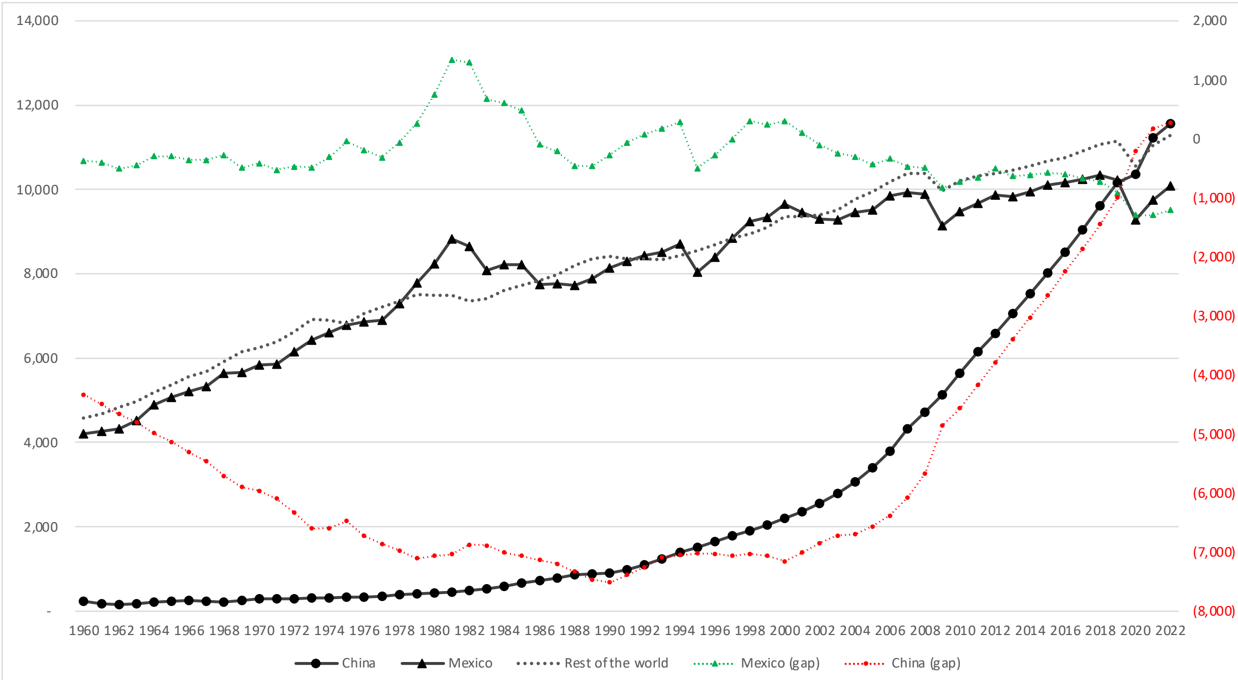
Table 1. Annual average economic growth rates (1961-2020)

	1961-1970	**1971-1980**	**1981-1990**	**1991-2000**	**2001-2010**	**2011-2020**
China	3.79	6.00	8.88	9.92	10.03	6.60
Mexico	6.56	6.43	1.76	3.51	1.21	0.91
Diference	2.77	0.43	(7.11)	(6.41)	(8.82)	(5.69)
World	5.05	3.75	3.10	2.96	2.94	2.35

Source: World Bank Database (2024)

Given the differences in territory and population in Figure 2, GDP per capita growth reflects that the Chinese economy achieved a higher income per capita than the world's average until 2021. In the case of the Mexican economy from 1960 until 2013, its per capita GDP was higher than the world's average, with an increasing difference in the first two decades of the whole period. The economic performance of both countries also shows a more stable growth pattern of the Chinese economy than the Mexican. On the other hand, if we remove the data for Mexico and China, the Mexican GDP per capita was higher than the rest of the world average in very short periods: 1979 to 1985, 1992-1994, and 1998-2001. In the case of the Chinese economy, from 1960 to 1990, there was an increasing gap between its GDP per capita and the rest of the world's average, so it is more evident that its economic boom started at least one decade before entering the World Trade Organization.

Figure 2. Mexico and China's per capita GDP (constant 2015 US dollars)



Source: World Bank Database (2024)

Nonetheless, it is still relevant to distinguish the impact that trade had on the economic performance of both countries. Since the global production system can be described as complex, we can argue that the development of a set of comparative advantages can be the result of changes in the whole production system, which in turn are also influenced by changes in the flows of trade and investment as well as technological progress. This means that contrary to what were the neoclassical predictions, the benefits of trade do not necessarily come from a pattern of specialization, but rather, the trade gains are the result of the development of a complex domestic web of firms and institutions able to produce a wide variety of goods and services, as discussed in Hidalgo & Haussman (2009) and (Tachella et al. 2012) among others.

In the next section, we describe how the structural decomposition analysis can provide more evidence about the reasons for this remarkable difference in economic performance. With the newest input-output database provided by the OECD (2023), it will also be possible to distinguish the *Export Processing Activities* from the rest of the Chinese economy and the *Global Manufacturing Activities* from the rest of the Mexican economy.

2. Method

Equation (1) represents how much of the final demand f_t, one industrial sector faces, will be transformed into value-added given the value-added and technical coefficient matrices V_t and A_t.

$$va_t = V_t(I - A_t)^{-1}f_t = V_tL_tf_t \quad (1)$$

Structural decomposition analysis in its multiplicative form will give us an insight into the sources of major changes occurring in the Mexican and Chinese economies. So, at the country and industry levels, we can explain the relative stagnation of the Mexican economy as a result of the changes in the value-added coefficients, the changes in the structure of the global supply network, represented by the Leontief inverse, $(I - A_t)^{-1}$, the changes in the final demand vector, and the joint effects that result from this decomposition and measured in the last four terms of equation (2).

$$\Delta va = \Delta VL_{t-1}f_{t-1} + V_{t-1}\Delta Lf_{t-1} + V_{t-1}L_{t-1}\Delta f + \Delta V\Delta Lf_{t-1} + \Delta VL_{t-1}\Delta f + V_{t-1}\Delta L\Delta f + \Delta V\Delta L\Delta f \quad (2)$$

If we further decompose the final vector into four variables that account for: 1) the domestic final demand supplied by the domestic economy, f^{dd}, 2) the imports of final goods, f^{ed}, 3) the exports of final goods, f^{de}, and 4) the foreign demand supplied by the foreign countries, f^{ee},the proposed estimation is represented by equation (3):

$$\Delta va = \Delta VL_{t-1}f_{t-1} + V_{t-1}\Delta Lf_{t-1} + V_{t-1}L_{t-1}\Delta f^{dd} + V_{t-1}L_{t-1}\Delta f^{ed} + V_{t-1}L_{t-1}\Delta f^{de} + V_{t-1}L_{t-1}\Delta f^{ee} + \Delta V\Delta Lf_{t-1} + \Delta VL_{t-1}\Delta f + V_{t-1}\Delta L\Delta f + \Delta V\Delta L\Delta f \quad (3)$$

The first six terms in equation (3) are the vectors that measure changes *a la ceteris paribus*; the remaining four elements represent the joint effect. Each vector is of dimension NC, where N represents the number of industries and C is the number of countries. Since the OECD (2023) inter-country input-output tables database for the extended version presents information for 76 countries but splits in two the Mexican and the Chinese economies, with the information for the rest of the world and forty-five industries, the dimension of each vector equals 3555.

For each economy, the procedure and interpretation of the elements in equation (3) will be as follows:

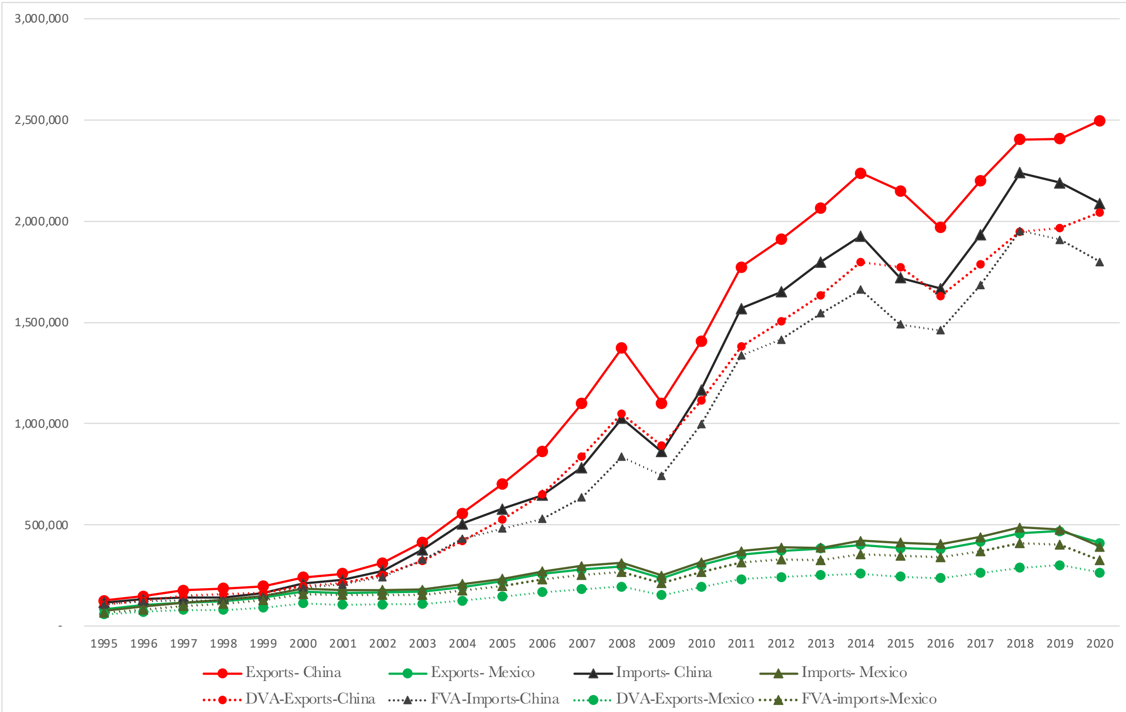
1. $\Delta V L_{t-1} f_{t-1}$, measures the changes in the allocation of value-added given the changes in the value-added coefficients if the structure of the Leontief inverse and the final demand of the previous period remained the same.
2. $\Delta V L_{t-1} f_{t-1}$, measures the changes in value-added allocation, given the changes in the Leontief inverse.
3. $V_{t-1} L_{t-1} \Delta f^{dd}$, measures the changes in value-added allocation, given the changes in the domestic final demand supplied by the domestic economy; therefore, this vector has elements equal to zero in every row that corresponds to other countries, i.e., not Mexico or China.
4. $V_{t-1} L_{t-1} \Delta f^{ed}$, measures the changes in value-added allocation, given the changes in the imports of final goods; therefore, this vector has elements equal to zero in every row that corresponds to the country of interest.
5. $V_{t-1} L_{t-1} \Delta f^{de}$, measures the changes in value-added allocation, given the changes in the exports of final goods; therefore, this vector has elements equal to zero in every row that corresponds to the countries that are not of our interest.
6. $V_{t-1} L_{t-1} \Delta f^{ee}$, measures the changes in value-added allocation, given the changes in the final demand of the rest of the world that it is not directly satisfied by domestic production.

So in vectors 3) and 5), we can measure the changes in the imports of intermediate inputs and how those changes imply more (or less) value-added for the domestic economy; in contrast, in vectors 4) and 6), we measure changes in domestic value-added as a result of the changes in exports of intermediate inputs.

3. Results and discussion

From 1995 to 2020, with the OECD (2023) ICIO Database, Figure 3 shows that, indeed, the trade expansion of the Chinese economy alone could explain the difference between the economic growth rates between Mexico and China. Nevertheless, as shown by the dotted lines, when we estimate the trade volume in domestic value-added (DVA) and foreign value-added (FVA), the lowest shares of trade in value-added correspond to the Mexican exports. Furthermore, the Chinese economy tends to increase its trade surplus, both in gross and domestic value-added, at a time when the Mexican economy exhibits a persistent trade deficit.

Figure 3. China and Mexico's total trade in gross and value-added. 1995-2020



Source: OECD (2023)

In Table 2, exports of final goods by firm heterogeneity show that although the Mexican Activities excluding global manufacturing (AEGM) exhibit a higher share of DVA than the Chinese Activities excluding export processing (AEEP), its share of the total volume of exports in gross value is always lower than 40%, while Chinese AEEP, on average account approximately 60% of the total exports of final goods.

Moreover, Table 2 also reveals the difference between the Export processing activities (EPA) in China and Global Manufacturing activities (GMA) in Mexico. EPA's domestic value-added share is always greater than 75%, and GMA's domestic value-added share is always lower than 50%. So, beyond the well-known iPhone case, where Chinese value-added content was approximately 14% of its total value, the EPA in China, on average, exhibits a significantly lower share of foreign value-added than the GMA in Mexico from 1995 to 2020.

Table 2. Exports of final goods by firm heterogeneity

China	Activities excluding export processing	%DVA	Export processing activities	%DVA	Activities excluding export processing %
1995-2000	351,049	89.4	220,847	78.8	61.4
2001-2005	1,655,176	86.2	1,243,324	71.8	57.1
2006-2010	3,019,905	87.4	2,030,963	74.9	59.8
2011-2015	3,392,463	88.9	2,137,928	77.0	61.3
2016-2020	3,392,463	88.9	2,137,928	77.0	61.3
Mexico	Activities excluding Global Manufacturing	%DVA	Global Manufacturing activities	%DVA	Activities excluding Global Manufacturing %
1995-2000	145,605	91.5	225,877	46.8	39.2
2001-2005	243,411	90.2	411,135	41.7	37.2
2006-2010	331,326	91.3	593,143	42.5	35.8
2011-2015	417,224	89.5	682,938	43.1	37.9
2016-2020	417,224	89.5	682,938	43.1	37.9

Source: Author's estimations based on OECD (2023)

Regarding the exports of intermediate inputs, Table 3 shows that from 1995-2000 to 2016-2020, the Chinese economy ten-folded its participation in the global economy by supplying intermediate goods in the rest of the world's final production. On average, the share of Chinese value-added in global production (excluding Chinese imports of final goods) rose from 0.2 percent to 1.4 percent. On the other hand, the increase of Chinese value-added content in its final goods imports rose from 0.9 to 3.1 percent.

In contrast, the share of Mexican value-added in the rest of the world's production only rose from 0.1 to 0.2 percent, and only about 0.5 percent of final goods imports correspond to Mexican value-added, despite Mexico having a higher share of intermediate inputs exports.

Table 3. Exports of intermediate inputs in Value-Added.

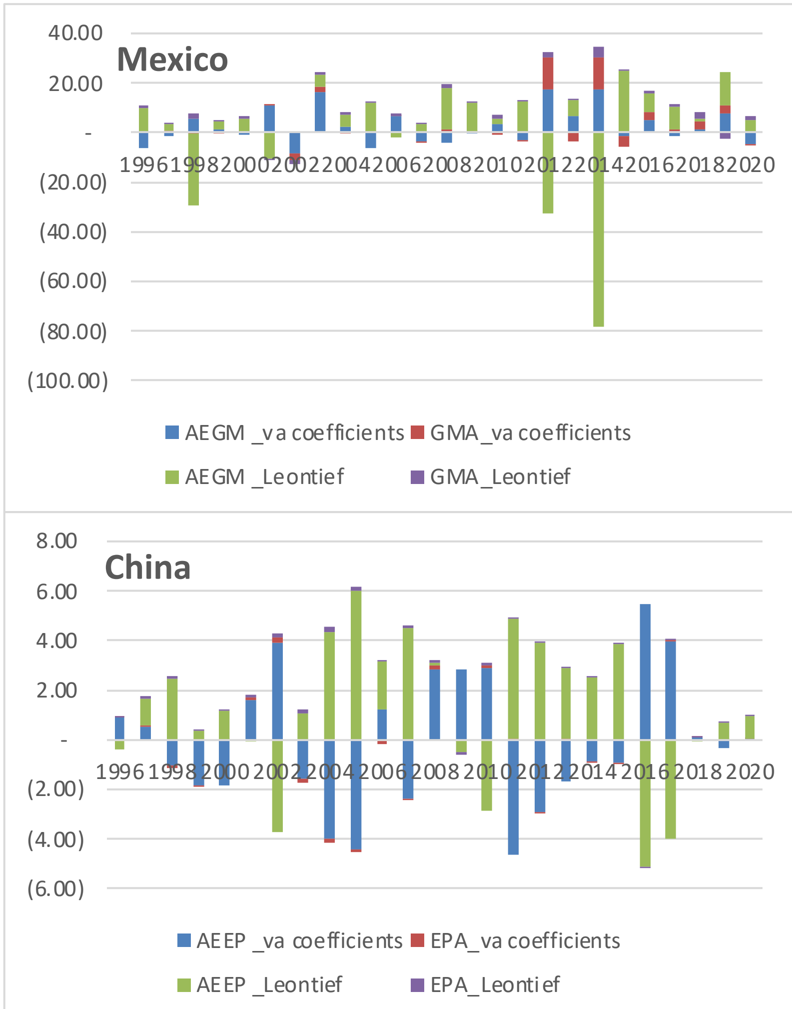
	Chinese VA in Foreign Production	%	Chinese VA in Final Goods Imports	%	Total share of VA in II Exports
1995-2000	416,335	0.2	2,205	0.9	46.2
2001-2005	820,212	0.5	8,032	1.6	47.7
2006-2010	2,200,389	0.8	24,774	2.6	49.0
2011-2015	3,870,729	1.2	61,850	3.1	48.6
2016-2020	4,631,676	1.4	83,085	3.1	50.3
	Mexican VA in Foreign Production	%	Mexican VA in Final Goods Imports	%	Total share of VA in II Exports
1995-2000	251,251	0.1	1,342	0.5	51.4
2001-2005	306,314	0.2	1,932	0.5	52.1
2006-2010	494,955	0.2	3,574	0.6	56.0
2011-2015	666,497	0.2	5,248	0.6	54.8
2016-2020	678,576	0.2	4,987	0.5	50.6

Source: Author's estimations based on OECD (2023)

So, for a more detailed examination of these trends, the structural decomposition analysis proposed in the previous section would show that: 1) year by year, there is no smooth variation in value-added, 2) if we evaluate the changes in value-added coefficients, the changes in the non-global manufacturing activities and the non-export processing activities are always more important, and 3) nonetheless, over the whole period, both economies experience major changes due to variations in the final demand vectors.

Figure 4 compares the experiences of Mexico and China's economies due to changes in the value-added and total requirement coefficients. As a share of total value-added change, in the upper panel of Figure 4, we can see that, in general, for the Mexican economy, major changes in value-added are explained by the changes in total requirement coefficients in the Activities Excluding Global Manufacturing (AEGM_Leontief). In the second place, changes in domestic value-added coefficients in the same industries explained up to 18 percent of the total change in 2003 and 2012.

Figure 4. Changes in value-added and total requirements coefficients as a share of total change. 1996-2020

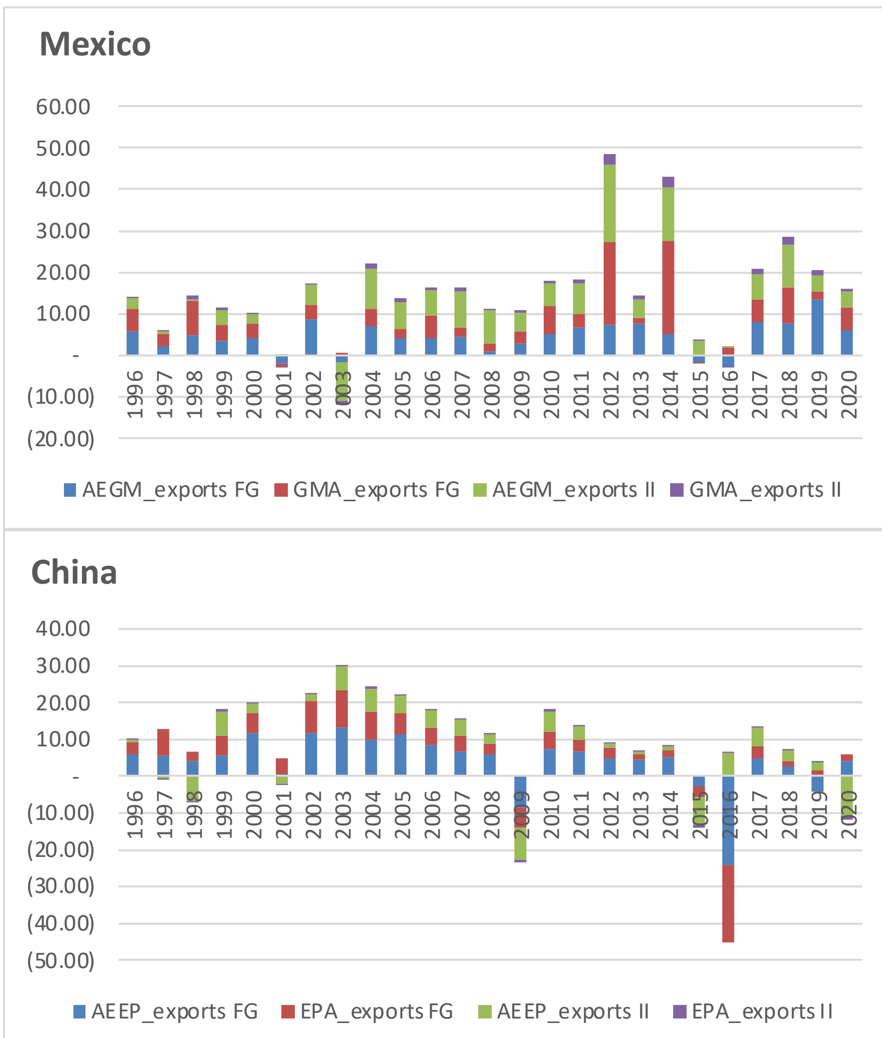


Source: Author's estimations based on OECD (2023)

In the case of the Chinese economy, although the percentages associated with the changes in value-added and total requirements coefficients are lower, it is also clear that firms engaged in non-export processing activities experience major changes in value-added. So, there were no significant structural changes for both economies in the *Global Manufacturing Activities* and *Export Processing Activities*.

On the other hand, Figure 5 summarizes the changes directly explained by the exports of final and intermediate goods and services. In the case of the Mexican economy, we can confirm that changes do not exhibit a steady pattern year by year. Instead, in 2012 and 2014, between 40 and 50 percent of the total value-added change was explained by the exports of goods and services, while in 1997, 2015, and 2016, these exports explained less than 10 percent of the total value-added change. By type of exports, it is noticeable that the exports of intermediate inputs by the Activities Excluding the Global Manufacturing sector and the exports of final goods by the Global Manufacturing Activities tend to explain most of the value-added creation.

Figure 5. Value-added change by exports of goods and services, 1996-2020



Source: Author's estimations based on OECD (2023)

For the Chinese economy in the lower panel of Figure 5, we can confirm that the *Export Processing Activities* create the least value-added by exporting intermediate inputs, in contrast with the exports of final goods made by the *Activities Excluding Export Processing*. We can also observe how, from 2016 onward, trade's contribution to value-added change was lower (probably) due to policy changes in the United States.

3. Conclusions

From 1960 to 2022, Mexico's and China's economic performance showed remarkable differences. In 1960, China's total GDP was larger than Mexico's (158 907 vs. 152 253 million constant 2015 US Dollars). From 1961 to 1980, the Mexican economic growth rates were higher and more stable than the ones experienced by China. On average, in the first two decades, Mexico grew at a 6.49 percent rate, and China grew at a 4.89 rate. After the so-called "Lost Decade" for the Mexican economy, the pattern inverted, and by 2022, the Chinese economy was more than twelve times larger than the Mexican (16 325 085 vs. 1 284 908 million US dollars).

Per capita, these patterns of GDP growth show that if, in 1960, the average income in China was equal to 238 dollars and 4 198 dollars in Mexico, in 2022, the average income in China was higher than in Mexico (11 560 vs. 10 077) and even slightly higher than the rest of the world's average (11 315).

On the other hand, as has been noted, both economies shared an export-oriented strategy at the end of the 20th Century and the beginning of the 21st. From 1995 to 2020, both countries had their highest export growth rates in gross value. Nevertheless, with the longest inter-country input-output matrix series, we found important differences between the Mexican and Chinese economies in this paper. First, the Export Processing Activities in China all over the period exhibit a higher share of domestic value-added than the exports of the Global Manufacturing Activities located in Mexico (on average 76 vs. 43 percent). In contrast, the Activities Excluding Global Manufacturing in Mexico tend to exhibit higher domestic value-added shares than the Activities Excluding Export Processing in China (90 vs. 88 percent). Given the weight that the Global Manufacturing exports had, over the whole period Mexico tends to create only 650 dollars of domestic value-added per every 1 000 dollars of exports, while China gets 810 dollars in domestic value-added. Moreover, China also creates more value-added from its exports of intermediate inputs.

Finally, the structural decomposition analysis shows that both economies had mixed results. In general, changes in domestic value-added are not smooth. Year by year, the relative importance of each variable in the decomposition changes significantly. Nonetheless, we can confirm that for the Chinese economy, *Export Processing Activities* tend to have a lower share of value-added contribution. Contrary to what was expected, the average contribution of the Chinese exports to its value-added change was lower than the average contribution of the Mexican exports to its domestic value-added.

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