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Capability of Manufacturing Exports to Generate Domestic Employment and Value Added in North America, 1995-2020

Capacidad de las exportaciones manufactureras para generar empleo y valor agregado interno en Norteamérica, 1995-2020

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ABSTRACT

The aim of this study is to estimate the employment and domestic value added generated by manufacturing exports in North America countries between 1995 and 2020. To achieve this, a multi-regional input-output model is applied, utilizing data from the Trade in Value-Added (TiVA-OECD) and Trade in Employment (TiM-OECD) databases. The results indicate that economies engage in manufacturing activities with different inputs to domestic indicators. In Mexico, exports are generators of employment, in the United States, they contribute to domestic value-added, and in Canada, the composition is intermediate. It is concluded that developed countries (the U.S. and Canada) participate in stages of greater generation of domestic value added. The originality and contribution of this document lies in the application of a widely used method for the analysis of the decomposition of value added to the employment variable.

Keywords: 1. exports in value added, 2. employment, 3. manufacture, 4. multi-regional input-output, 5. North America.

RESUMEN

El objetivo de este artículo es calcular la generación de empleo y valor agregado interno a partir de las exportaciones manufactureras de los tres países de Norteamérica de 1995 a 2020. Para ello, se utiliza un modelo de insumo-producto multirregional con la base de datos de comercio en valor agregado (TiVA-OCDE) y del empleo contenido en el comercio (TiM-OCDE). Los resultados muestran que las economías participan en actividades manufactureras con diferentes aportaciones a los indicadores internos. En México, las exportaciones son generadoras de empleo, en Estados Unidos de valor agregado interno y en Canadá la composición es intermedia. Se concluye que los países desarrollados (EE. UU. y Canadá) participan en fases de mayor generación de valor agregado interno. La originalidad y aportación de este documento reside en la aplicación de un método ampliamente utilizado para el análisis de la descomposición del valor agregado a la variable empleo.

Palabras clave: 1. exportaciones en valor agregado, 2. empleo, 3. manufactura, 4. insumo-producto multirregional, 5. Norteamérica.

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INTRODUCTION

The trade liberalization and market openness observed in Mexico and globally since the mid-20th century have increased the flow of goods, services, and production factors across countries. At the same time, technological advancements and declining transportation costs have driven productive internationalization. Consequently, large corporations, aiming to reduce production costs and maintain competitiveness in international markets, have fragmented their production processes and relocated parts of their operations abroad.

In this context, Mexico has aimed to expand its role in global manufacturing production. The trade liberalization strategy, particularly through the North American Free Trade Agreement (NAFTA), was intended to boost manufacturing exports, with the expectation that this would drive higher national production and employment growth. However, various scholars argue that these anticipated benefits have not fully materialized due to the manufacturing sector's heavy dependence on intermediate imports (Murillo Villanueva, 2020; Vázquez Muñoz & Avendaño Vargas, 2012) and Mexico's specialization in activities with low value-added generation (Chiquiar & Tobal, 2019; Fuentes Flores et al., 2020).

Following the signing of NAFTA and the increasing trend of production fragmentation, production and value chains began to take shape. Koopman et al. (2010) define global value chains as integrated systems of value-added origins and destinations within a worldwide production network. However, recent evidence suggests that value chains are more regional than global, with production offshoring primarily occurring between neighboring or geographically proximate countries (Xiao et al., 2020). Additionally, larger, more developed nations play a decisive role in shaping other countries' participation in global value chains (GVCs), highlighting the strategic importance of the North American region.

According to Baldwin (2006), participation in GVCs offers developing economies the most accessible pathway to industrialization, as they benefit from the technological spillovers of large corporations. In this regard, Baldwin et al. (2014) note that developed countries typically dominate the high-value stages of production, while developing nations are involved in phases where labor and raw material costs are lower—segments associated with lower value generation. This dynamic may help explain why Mexico's export growth has not translated into the expected gains in employment and value creation.

The segmentation of production requires a shift in how the effects of international trade on employment and value generation are measured. The presence of imported components in exports means that the total export value consists of both domestic and foreign-origin elements. This distinction is particularly important within the context of GVCs, as only a portion of the exported value is generated and retained by the exporting country. Similarly, imported inputs incorporated into exports contribute to job creation in other countries.

The objective of this article is to identify the domestic proportion of employment and value added generated by the manufacturing exports of the three North American countries and to compare their ability to create employment and value added. The calculation of domestic proportions is carried out using the methodology proposed by Koopman et al. (2014), which

utilizes multiregional input-output matrices. The originality of this study lies in applying a widely used method for analyzing the decomposition of value added in exports, distinguishing its domestic and foreign components, to identify the number of domestic and foreign jobs generated through exports in each country.

Based on the premise that countries specialize in activities where they have a comparative advantage, given the availability of their productive factors, it would be expected that Mexican exports would have a greater impact on employment compared to those of the United States and Canada. Similarly, it would be anticipated that the domestic value-added content in the U.S. would be higher due to its greater resources of physical, human, and intellectual capital. If this holds true, it would confirm that, the labor-intensive production processes are carried out in Mexico, prioritizing the use of labor over other production factors.

This document is structured into four sections: the first reviews and discusses studies related to employment generation and value added as a result of participation in GVCs; the second presents conventional statistics on manufacturing exports, employment, and value added generated in the three North American countries; the third outlines the methodology used to decompose the domestic and foreign components of employment and value added in manufacturing exports; the fourth discusses the results obtained for the three countries analyzed. Finally, the conclusions are presented.

GLOBAL VALUE CHAINS AND THEIR EFFECTS ON DOMESTIC VARIABLES

Several authors have highlighted the economic benefits of participating in GVCs, such as technological spillovers, technical progress, and the generation of employment and value added. Regarding employment, Shepherd (2013) points out that the effects of GVCs on the labor market have become increasingly significant from an economic policy perspective. The economic and social upgrading of countries with a strong presence in GVCs can create better opportunities for workers, both in terms of job quantity and quality. As a result of vertical specialization, a country's exports may generate increased demand for employment in both upstream and downstream activities within the GVC in which it participates (Lin et al., 2017).

Farole (2016) argues that countries with large employment surpluses and low wages have seen a significant increase in job creation due to their integration into GVCs. Patterns show that as sectors and countries shift toward activities with higher value added, wages tend to rise, net employment decreases, and skilled workers benefit. This suggests that the impact of GVC integration on employment varies by country, sector, value chain, and, most importantly, by the stage of the value chain and the nature of the activities carried out in each country. Additionally, Foster (2019) highlights that some countries rely on intermediate exports to generate employment, while others depend on exports of final goods, reflecting the distinct roles of the former as suppliers of intermediate inputs and the latter as assemblers within GVCs.

Following this approach, Los et al. (2015) identified that, for China, the external market, in addition to the domestic market, has been a significant source of job creation. In contrast,

Acemoglu et al. (2016) and Autor et al. (2013) found that U.S. imports from China negatively impacted manufacturing jobs and the overall economy. Acemoglu et al. (2016) estimate that the U.S. lost 985,000 manufacturing jobs, and that 1.98 million jobs were affected nationwide.

In contrast, a more recent study by Lin et al. (2017) argues that the benefits of participating in GVCs should not be viewed as a zero-sum game, where one country's gains from exports are offset by another's losses through imports. The authors suggest that a positive-sum outcome is more likely, with all participants benefiting in terms of economic development and job creation. However, they emphasize that this does not imply universally positive effects across all industries or countries. For instance, they find that China's exports tend to create more job opportunities in the U.S. services sector than in manufacturing, whereas U.S. exports are more effective at creating jobs in China's manufacturing sector.

From the GVC perspective, this implies that a country's exports not only create job opportunities in the exporting nation but also across all countries involved in different stages of the value chain. Due to production fragmentation and vertical specialization, exports are composed of elements sourced from various countries, meaning that employment generated by exports includes both domestic and foreign-origin jobs. As a result, a country's exports contribute to job creation not only at home but also in the countries participating in the GVCs.

The literature on value added is extensive, and from the GVC perspective, analyzing trade in value added becomes crucial, as it allows for a distinction between the export value generated and absorbed within the exporting country, and that which originates and belongs to other countries (Murillo Villanueva et al., 2022). Johnson and Noguera (2012a) argue that with the international segmentation of production, the accounting of international trade should be approached with caution, as it often overestimates trade exchanges between countries. This underscores the importance of analyzing trade in value added and identifying its origin. In this context, authors such as Foster et al. (2011) suggest that the differences between analyzing trade in gross terms versus value added can be so substantial that a country may report a gross trade deficit but actually have a surplus in value added.

Johnson and Noguera (2012b) observe that, globally, the domestic content of value added in exports has been declining since 1970, with the most significant drops occurring after 1990, the decade of intensified trade liberalization. They estimate that between 1970 and 2010, domestic content fell by 10 to 15%. Along similar lines, Foster et al. (2011) note that as countries integrate into GVCs, the foreign content of value added tends to increase, particularly in developing nations. In Mexico, studies suggest that the value embedded in exports is relatively low, especially when compared to countries such as the United States. Murillo Villanueva et al. (2022) find that from 2005 to 2015, the domestic value added in Mexico's manufacturing exports ranged from 40 to 65%, while in the U.S., this range was between 70 and 90%. Furthermore, research indicates that the domestic content of value added varies significantly across manufacturing sectors (Castillo & De Vries, 2018), with some sectors showing particularly low domestic value added (De la Cruz et al., 2011). These variations are even more pronounced when distinguishing between

manufacturing for export and for the domestic market (Fujii Gambero & Cervantes Martínez, 2017).

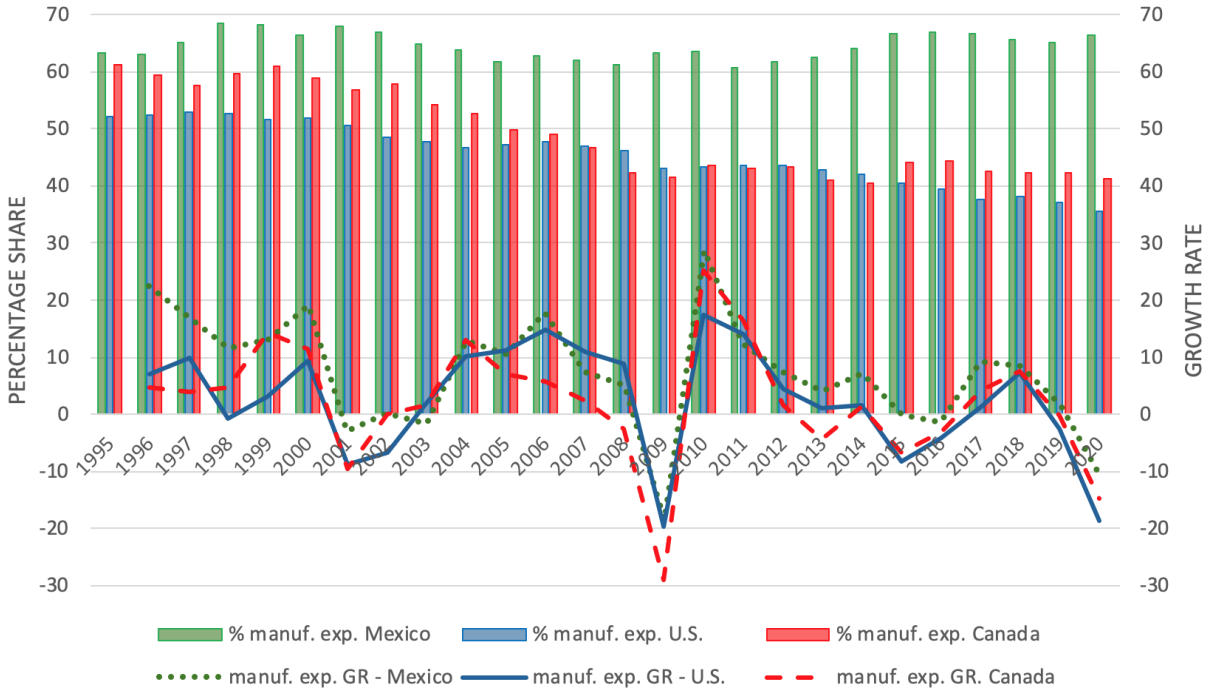
THE CONTEXT OF MANUFACTURING EXPORTS, EMPLOYMENT, AND VALUE ADDED IN NORTH AMERICA, 1995-2020

The North American region is one of the world's most significant economic areas due to the level of economic activity it generates. It accounts for 19.1% of global gross domestic product (GDP) (World Bank Group, n.d.), with the United States holding the largest share at 15.8%, while Mexico and Canada contribute 1.8% and 1.4%, respectively. These figures position the U.S. as the dominant economy in North America, generating 83.4% of the region's total GDP, with Canada and Mexico each contributing approximately 8.3%.

The economies of the three countries share a similar structure, with the service sector dominating, though manufacturing remains significant in all cases. According to data from the World Bank Group (n.d.) and the National Institute of Statistics and Geography (*Instituto Nacional de Estadística y Geografía*; INEGI) (Cuéntame de México, n.d.), in 2020, the manufacturing sector contributed 10.6% to the total production of the United States, 20% to Mexico, and 9% to Canada. Additionally, manufacturing plays a key role in international trade of all three countries, especially considering its relative importance in each nation's total exports.

In Mexico, manufacturing exports have become the primary export activity, consistently accounting for more than 60% of the total since 1995. From 2015, this share has exceeded 65%, even during 2020, a year heavily impacted by COVID-19 (see Graph 1). In contrast, the share of manufacturing exports has significantly declined in both the United States and Canada. In 1995, manufacturing exports in the U.S. represented 52.2% of total exports, but by 2020, dropped to 35.6%, marking a decrease of 16.6 percentage points over 26 years. Canada's decline was even more pronounced, with its share falling by 20 percentage points. In 1995, manufacturing exports made up 61.3% of total exports, but by 2020, they accounted for only 41.3% (see Graph 1).

Graph 1. Percentage share of manufacturing exports in the national total and annual growth rate, 1995-2020



Source: Own elaboration using data from TiVA (Organization for Economic Co-operation and Development [OECD], 2023).

Graph 1 also reveals that the Great Recession of 2008-2009 was a pivotal event that shifted the trend in the share of manufacturing in total exports in the United States. Following the crisis, the sector was unable to recover its previous levels, and instead, the downward trend accelerated.

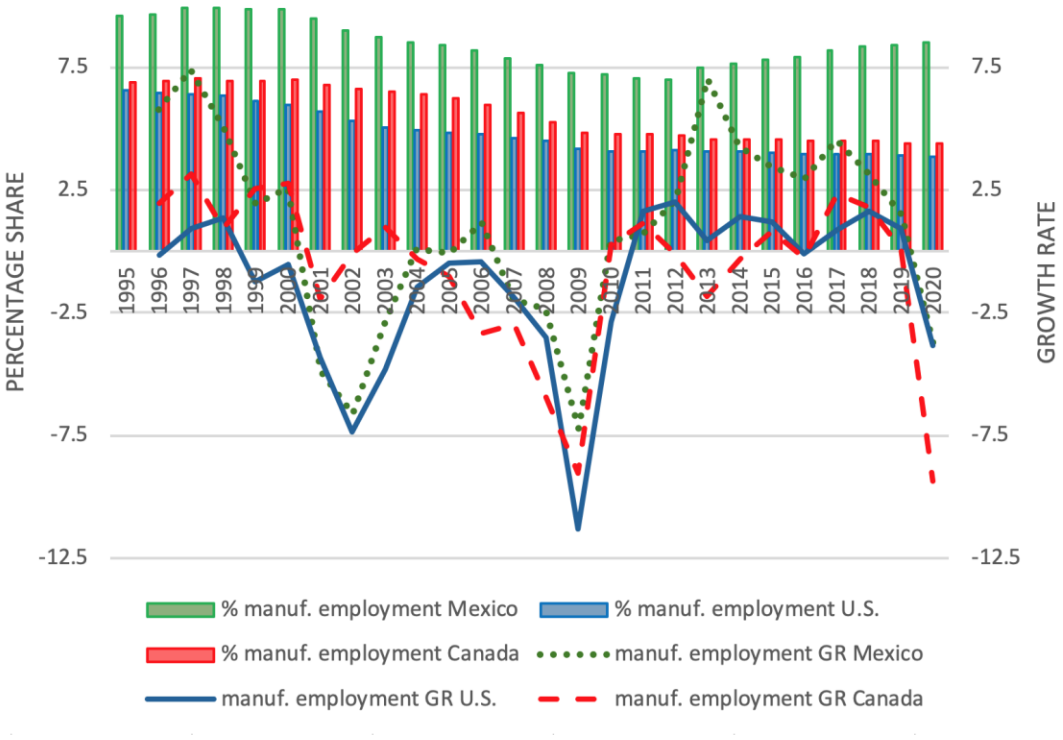
On the other hand, Graph 1 highlights a strong synchronization in the growth of manufacturing exports from the three countries throughout the entire analyzed period, with this trend becoming even more evident in recent years. In 2020, due to the COVID-19 pandemic, exports from all three countries saw significant declines, with growth rates of -18.6%, -14.8%, and -10.8% in the United States, Canada, and Mexico, respectively.

It is important to note that the manufacturing sectors with the highest share in Mexico's exports are: computer and electronic equipment (C26),[3] electrical equipment (C27), and transportation equipment (C29). On average, these three sectors account for 65.4% of Mexico's manufacturing exports. In the United States, the most prominent sectors are: chemicals (C20), computer and electronic equipment (C26), and machinery and equipment (C28), which together represent 38.7% of total manufacturing exports. For Canada, the key sectors include: food and beverage production (C10T12), basic metals (C24), and transportation equipment (C29), collectively accounting for 45.5% of manufacturing exports during the period (OECD, 2023).

[3] The code in parentheses refers to the industry code according to the International Standard Industrial Classification (ISIC), Revision 4 (United Nations, 2008).

In terms of employment generation across the three economies studied, manufacturing activities have progressively accounted for a smaller share, with notable differences between countries, particularly when comparing Mexico to the United States and Canada. At the beginning of the period, manufacturing accounted for approximately 10% of total employment in Mexico, 6.5% in the United States, and 7% in Canada. By the end of the period, it represented about 8.5% of employment in Mexico, and only 4% in both the U.S. and Canada (see Graph 2). In Mexico, the decline has been around 1.5 percentage points, and it remains the economy with the highest manufacturing contribution to total employment. For the U.S. and Canada, this decline represents a reduction of more than two percentage points, nearly equivalent to 50% of their initial contribution. In this sense, both countries experienced negative growth rates almost throughout the entire period analyzed.

Graph 2. Percentage share of manufacturing employment in the national total and annual growth rate, 1995-2020



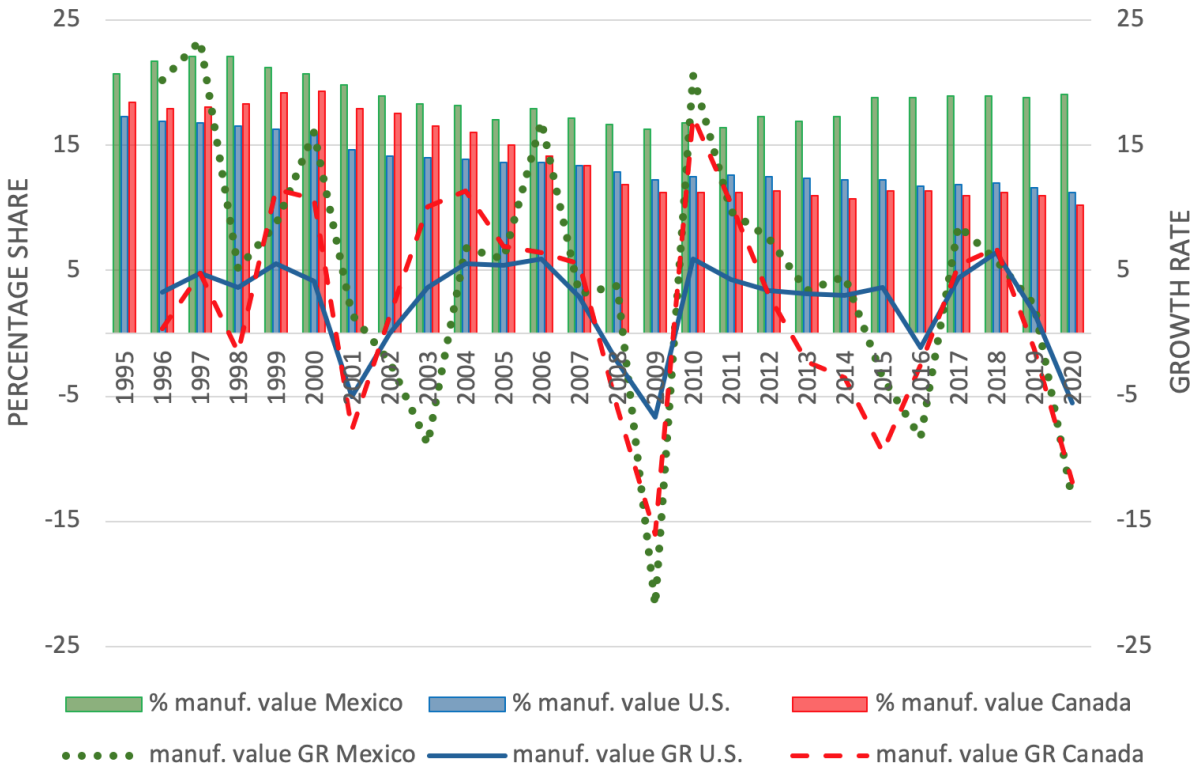
Source: Own elaboration using data from TiM (OECD, 2021).

Graph 2 also illustrates that the Great Recession of 2009 and the 2020 health crisis significantly impacted the growth rate of manufacturing employment in all three countries. However, these events had a less severe effect on Mexico, which experienced a swift recovery starting in 2010 and continued this trend until just before the pandemic. This suggests that manufacturing in the U.S. and Canada has been following a downward trajectory in terms of job creation in the industrial sector. This shift can be attributed to two main factors: the automation of production processes and

the offshoring of labor-intensive manufacturing activities to other countries. According to the International Monetary Fund (IMF, 2018), advanced economies are generating fewer jobs in the industrial sector over time.

Finally, Graph 3 shows the contribution of the manufacturing sector to the total national value added in the three countries analyzed from 1995 to 2020. In Mexico, the manufacturing sector accounts for between 16% and 20% of national value added, highlighting its significant role in generating national income. The lower contributions, around 16%, occurred before and after the Great Recession of 2009. However, since 2015, this share has remained stable at 19%.

Graph 3. Percentage share of manufacturing value added in total national value and annual growth rate, 1995-2020



Source: Own elaboration using data from TiVA (OECD, 2023).

When comparing the percentage share of manufacturing value added in Mexico with that of the United States and Canada, significant differences emerge. For instance, between 1995 and 2009, the U.S. experienced a steady decline of five percentage points, from 17.3% to 12.5%. However, since 2010, the manufacturing sector's share has stabilized around 12%. Canada's situation is even more concerning, as it has shown a consistent downward trend over the entire period: in 1995, the sector accounted for 18.4% of national value added, but by 2020, it had dropped to just 10.2%.

The interpretation of these results must be approached with caution. While Graph 3 shows that in Mexico manufacturing generates around a fifth of national value added, it is possible that the

domestic proportion remains relatively low. Additionally, these trends indicate that the United States and Canada are generating increasing value added in sectors and activities outside of manufacturing, reflecting a diversification of economic activities and a transition towards higher value-added activities. In contrast, Graphs 2 and 3 suggest that Mexico remains highly dependent on the manufacturing sector, which in 2020 accounted for double the value added and employment compared to the United States and Canada. In this regard, De Jesús-Almonte et al. (2021) argue that manufacturing continues to be the sector that generates the highest value-added jobs in Mexico and plays a defining role in the overall growth dynamics of its economy.

METHODOLOGY

Domestic Component of Employment and Value Added Contained in Exports

This document employs the multiregional input-output methodology to identify the domestic share of employment and value added generated by the manufacturing exports of North American countries. Given that exports often include imported components from other countries, they contribute to employment and value added not only in the exporting country but also in the countries supplying the inputs. This concept is particularly relevant within the context of GVCs.

When comparing the domestic shares of employment and value added in manufacturing exports, it is possible to discern, on one hand, each country's capacity to generate national employment and value added from exports, and, on the other hand, the type of participation each country has in the value chain. According to Baldwin et al. (2014), this is because developed economies lead GVCs and focus on activities that generate the highest value, while developing countries specialize in employment-intensive activities.

The analysis uses multiregional input-output matrices from the Organization for Economic Cooperation and Development (OECD) (OECD, n.d.), covering annual data from 1995 to 2020. These matrices are disaggregated by 77 countries and 45 economic sectors, and are valued in millions of U.S. dollars at current prices. This dataset is chosen due to its annual availability throughout the entire period up to 2020, its detailed sectoral breakdown, and its compatibility with the OECD's employment-by-sector database (OECD, 2021). However, a key limitation of this dataset is that it does not further disaggregate value added into its two most significant components—wages and operating surplus—which restricts a deeper examination of the impact of economic integration on income distribution.

Based on the selected database, the methodology proposed by Koopman et al. (2014) is applied to account for the following components within the manufacturing exports of the three North American countries: a) domestic value added, b) foreign value added, c) domestic employment, and d) foreign employment. The sum of elements a and b represents the gross value of each country's manufacturing exports, while the sum of elements c and d reflects the total employment generated by manufacturing exports. From these totals, the domestic proportions are then calculated.

To achieve this, two multiregional input-output models are defined: one for value added and another for employment, following the original approach of Koopman et al. (2010, 2014). In the first model, the production needed to meet the export demand x^e (equation 1) is multiplied by the diagonalized vector of value-added coefficients (equation 2). In the second model, it is multiplied by the diagonalized vector of employment coefficients (equation 3).

$$x^e = (I - A)^{-1}\, e = L\, e \qquad (1)$$

From equation (1), the production required to meet the total export demand (x^e) of magnitude ($rN \times 1$) is obtained, where A is the matrix of multiregional technical coefficients of dimension ($rN \times rN$), with r =77 countries, including Mexico, the United States, and Canada, and N =45 sectors, of which 17 are manufacturing sectors. L is the inverse of the Leontief matrix of multiregional technical coefficients ($rN \times rN$), derived from solving the multiregional matrix A, and e is the export vector ($rN \times 1$).

$$VAX = \hat{v}\, L\, \hat{e} \qquad (2)$$

$$MX = \hat{\lambda}\, L\, \hat{e} \qquad (3)$$

From equations 2 and 3, value added and employment are decomposed into their domestic and foreign components. In equation 2, the diagonalized vector of value-added coefficients $\hat{v}$ represents the proportion of each sector's gross production value attributed to value added, calculated by dividing the value added by the gross production value. Similarly, in equation 3, the diagonalized vector of employment coefficients $\hat{\lambda}$ calculates the employment content per unit of sectoral output, which is determined by dividing the employment in each sector by the gross production value. The matrices for both models, VAX (equation 2) and MX (equation 3), are of dimension ($rN \times rN$).

In matrix form, the models from equations 2 and 3 can be expressed as in equation 4, where country 1 represents Mexico, country 2 represents the United States, country 3 represents Canada, and country 4 represents the rest of the world. The matrix notation corresponds to the vectors and matrices specific to each country.

$$MX = \hat{\lambda}\, L\, \hat{e} = \begin{pmatrix} \lambda_1 L_{11} e_1 & \lambda_1 L_{12} e_2 & \lambda_1 L_{13} e_3 & \lambda_1 L_{14} e_4 \\ \lambda_2 L_{21} e_1 & \lambda_2 L_{22} e_2 & \lambda_2 L_{23} e_3 & \lambda_2 L_{24} e_4 \\ \lambda_3 L_{31} e_1 & \lambda_3 L_{32} e_2 & \lambda_3 L_{33} e_3 & \lambda_3 L_{34} e_4 \\ \lambda_4 L_{41} e_1 & \lambda_4 L_{42} e_2 & \lambda_4 L_{43} e_3 & \lambda_4 L_{44} e_4 \end{pmatrix} \qquad (4)$$

From the MX matrix of employment embedded in exports (equation 4), employment is decomposed by origin into domestic and foreign components. Domestic employment (MI) represents the domestic-origin employment contained in each country's exports and is found in the submatrices along the main diagonal of the MX matrix, where it holds that $MI_r = \lambda_r L_{rr} e_r$. For example, for country 1, it is expressed as $MI_1 = \lambda_1 L_{11} e_1$. Meanwhile, foreign employment (ME) refers to the foreign-origin employment embedded in a country's exports and is calculated by summing the corresponding columns of submatrices outside the main diagonal: $ME_r = \sum_{s \neq r} \lambda_s L_{sr} e_r$. Thus, for country 1, $ME_1 = \lambda_2 L_{21} e_1 + \lambda_3 L_{31} e_1 + \lambda_4 L_{41} e_1$. The total employment

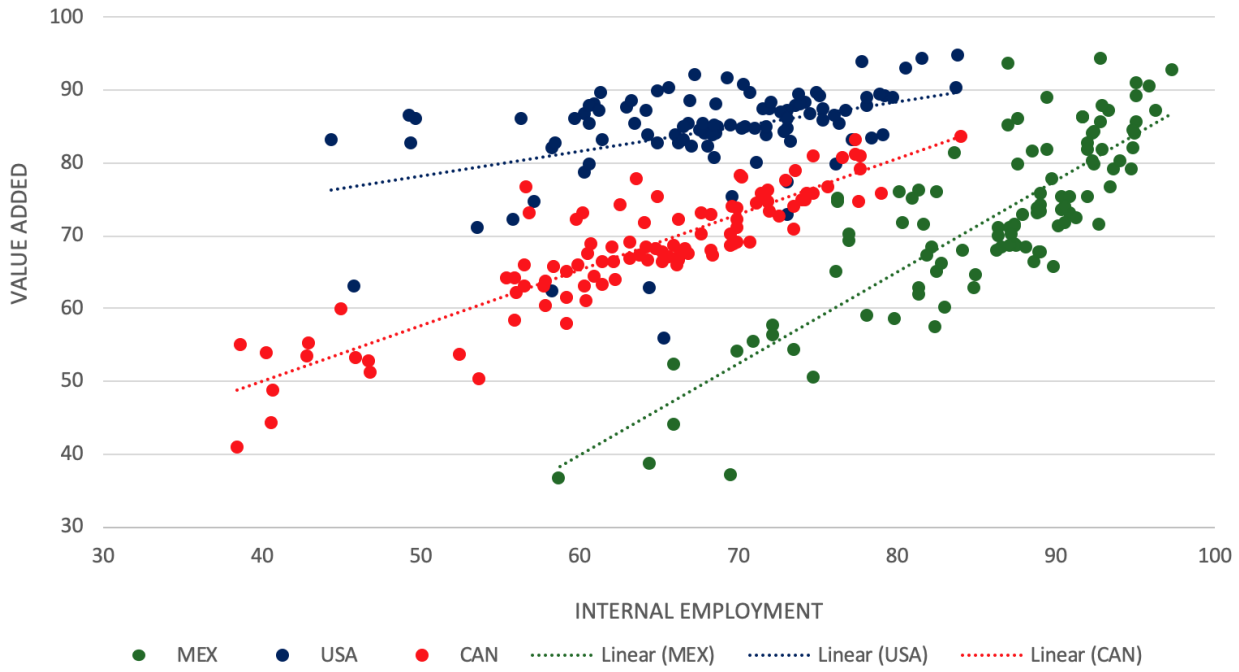
embedded in a country's sectoral exports is the sum of domestic (MI) and foreign (ME) employment. The proportions of domestic and foreign employment are derived by dividing the MI and ME indicators by the total sectoral employment. The same procedure and interpretation apply to the VAX model, which has been extensively explored in the GVCs literature (Murillo Villanueva, 2022; Fuentes Flores et al., 2023).

Although this methodology has been widely applied to analyze the domestic and foreign components of value added in exports, there are relatively few studies that extend it to the employment variable (Lin et al., 2017). Nevertheless, the concepts of domestic and foreign employment embedded in exports align with the literature on global value chains (GVC). In this context, this study aims to differentiate between the domestic and foreign impacts of manufacturing exports on the employment and value added generated in each country within the region. The results for the three countries will enable a comparative analysis of the employment and value added profiles derived from manufacturing exports.

DOMESTIC EMPLOYMENT AND VALUE ADDED IN THE MANUFACTURING EXPORTS OF NORTH AMERICA, 1995-2020

The results indicate a significant difference in the composition of domestic employment and value added within the manufacturing exports of the three North American economies, highlighting distinct production structures and export profiles. Graph 4 illustrates the proportion of domestic value added in the manufacturing exports of each country from 1995 to 2020 on the abscissa axis, with the proportion of domestic employment shown on the ordinate axis. The remaining percentage, which completes 100%, represents the foreign component of value added and employment. In Graph 4, U.S. exports are marked by blue dots, each representing a manufacturing sector for one of the six years analyzed (1995, 2000, 2005, 2010, 2015, & 2020). Red dots correspond to Canada, and green dots to Mexico. While the graph distinguishes results by country, it does not differentiate by year, meaning that the data for all six years are represented by a single color.

Graph 4. General composition of manufacturing exports from North American countries in the period 1995-2020



Source: Own elaboration.

Graph 4 shows that the average distribution of employment and domestic value added in U.S. sectors is generally positioned in the upper part of the graph. This suggests that U.S. manufacturing exports have a high domestic value-added content, which during the analysis period ranges from 75% to 90%, with most of it concentrated around 85%.

Regarding domestic employment participation, the proportion ranges from 45% to 85%. Although this range is fairly broad, most sectors concentrate around 70%. This indicates that U.S. manufacturing exports generate substantial domestic value added, but they create less domestic employment, with approximately 30% of jobs being 'imported' from countries that supply inputs (as shown in Graph 4). This combination of high domestic value added and lower domestic employment suggests that the U.S. specializes in manufacturing activities that are less labor-intensive, supporting the findings of Foster (2019) and Baldwin et al. (2014).

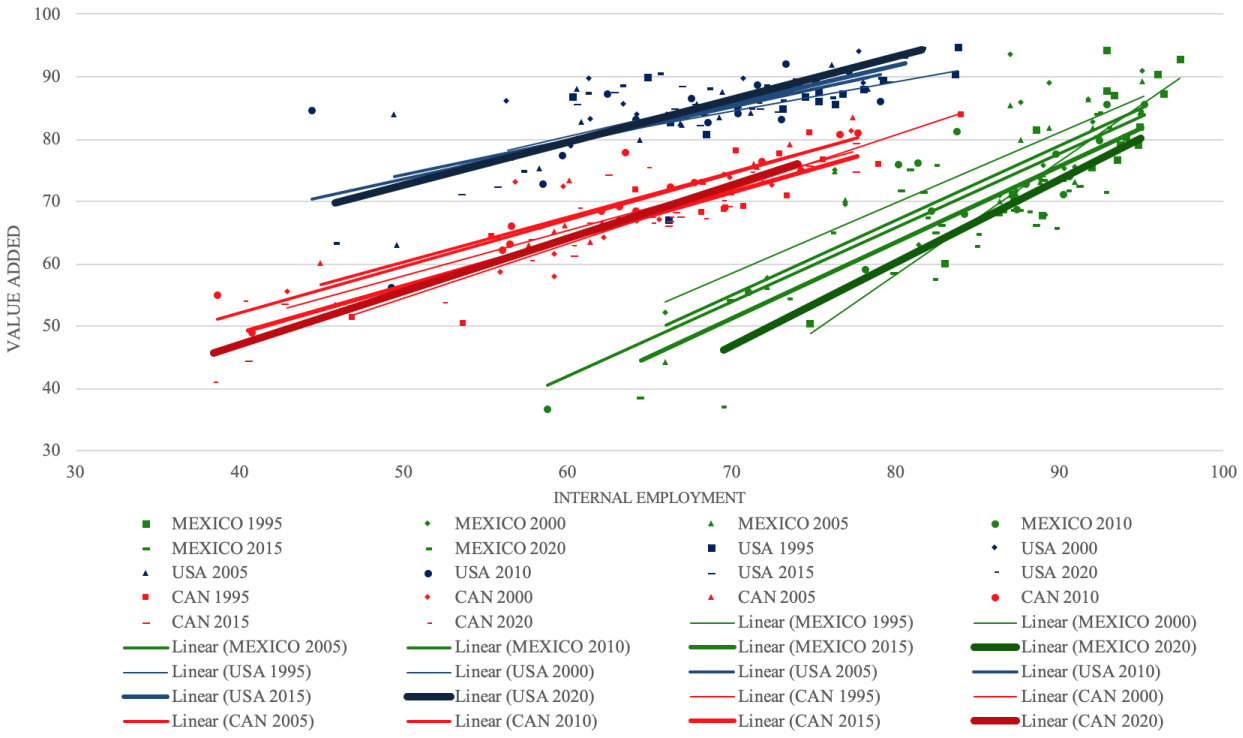
Slightly lower and to the left, the trend line summarizing Canada's results for the 1995–2020 period is visible in Graph 4. This trend suggests that Canada's manufacturing exports generate both lower domestic value added and lower domestic employment compared to those of the United States. Most sectors cluster around 65% for both domestic employment and domestic value added, indicating a notable reduction in value added content relative to the U.S., but only a slight decrease in domestic employment. Some sectors stand out in the lower part of the trend line, with 45% domestic employment and 55% domestic value added, meaning that more than half of the employment generated is foreign. This suggests that the imported inputs used in export production

are labor-intensive. Overall, these results indicate that Canada specializes in manufacturing activities with lower domestic value added and employment compared to the United States.

Mexico, on the other hand, exhibits a lower and steeper trend line, reflecting a combination of higher domestic employment and lower domestic value added. Unlike the United States and Canada, the composition of employment in Mexico's manufacturing exports is more heavily weighted toward the domestic component. Throughout the analysis period, the lowest share of domestic employment in Mexico was 60%, compared to 46% in the United States and 38% in Canada.

In fact, most sectors are concentrated at the upper end of the trend line, with domestic employment and domestic value added reaching 90% and 80%, respectively. This trend line highlights the predominance of domestic employment content, which remains above 60%, while domestic value-added content exhibits greater variability (ranging from 35% to 95%) depending on the sector and year analyzed, as reflected in the more dispersed data points. These results reinforce the notion that Mexican exports have a stronger impact on employment.

Graph 5. Five-year composition of the manufacturing exports from North American countries, 1995, 2000, 2005, 2010, 2015, and 2020



Source: Own elaboration.

Graph 5 presents the same results as Graph 4, with the distinction that it differentiates by year of study. The trend lines vary in thickness and color, with the thinnest and lightest line representing the first year (1995) and the thickest and darkest line representing the last year (2020). The purpose of this graph is to highlight the dynamics of each country's export structure over the past 25 years.

In the case of the United States Graph 5 shows that the domestic participation of value added and employment in manufacturing exports has remained relatively stable throughout the entire period. When comparing the results from the first year (1995) with those from the last year (2020), a slight increase in the slope is observed. This suggests that the domestic content of value added rose by five percentage points, from 90% to 95%, while the domestic content of employment decreased by approximately three percentage points. However, this change is notably smaller compared to the shifts experienced by Canada and Mexico.

In the case of Canada, the composition of manufacturing exports shows slight downward shifts, with a subtle change that expands the difference in domestic value added between 1995 and 2020 for sectors at the lower end of the trend line, while narrowing the difference for sectors at the upper end. This suggests that while some sectors have maintained a steady proportion of domestic value added, others have seen a decline of up to 10 percentage points. It is likely that these sectors are more integrated into GVCs, leading to a higher share of foreign value added and employment.

In Mexico, the structure of manufacturing exports has shown greater dynamism compared to the United States and Canada. As seen in Graph 5, the trend line for domestic employment and value added content in each sector has shifted downward in parallel every five years. As a result, domestic value added content has generally decreased by an average of 2.5 percentage points every five years across all sectors. In contrast, the domestic employment content has increased, with more national employment being generated through manufacturing exports. By 2020, the sector with the lowest domestic employment content reported 70%, a 10 percentage point increase compared to 2010. In other sectors, this indicator is even higher. This composition of manufacturing exports indicates a significant transition in the Mexican economy toward activities that generate less domestic value added but more domestic employment, a trend that shows no signs of slowing down through 2020.

These results provide evidence of each country’s role in regional GVCs. The manufacturing sector in the United States has strengthened the domestic value-added content of its exports, aligning with the theory of Baldwin et al. (2014), which posits that developed economies specialize in activities with higher domestic value added and set the framework for the participation of other countries. In contrast, developing countries like Mexico focus on activities with lower domestic value added generation but higher employment content. Canada, on the other hand, exhibits relatively low participation in domestic employment and intermediate levels of domestic value added.

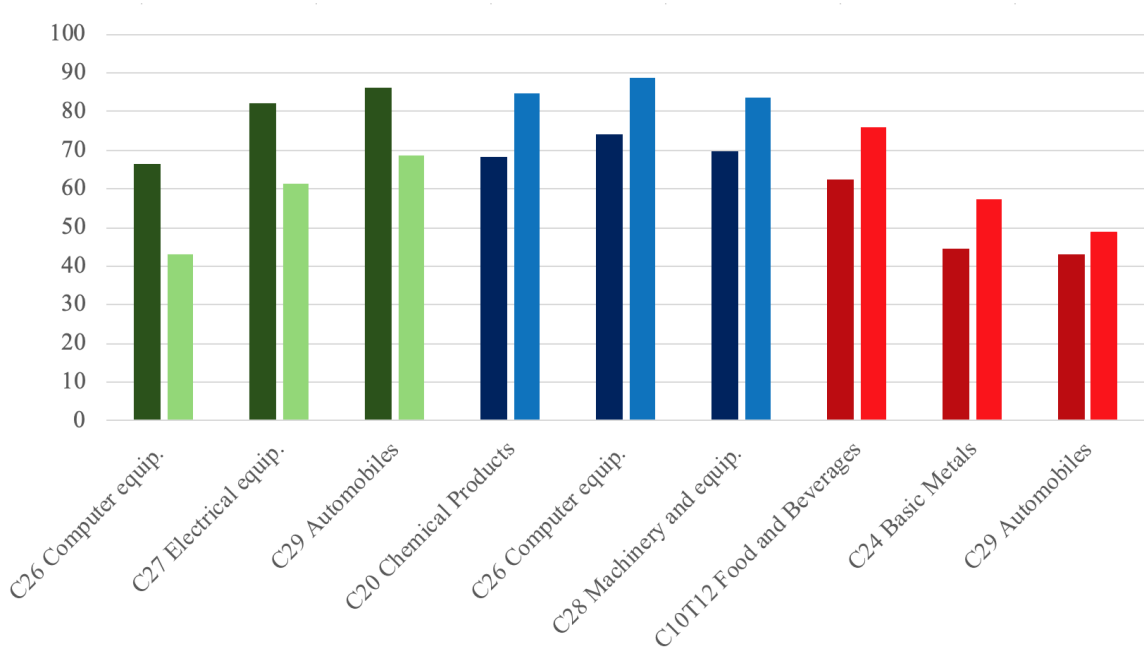
The results for Canada and Mexico align with the findings of Johnson and Noguera (2012b) and Foster et al. (2011), which state that domestic value added has declined by 10 to 15 percentage points since 1970, with sharper reductions from 1990 onwards, driven by deeper integration into international production processes. These results can be explained by the linkages between each country’s manufacturing sectors and the North American regional system. For instance, in a study on NAFTA countries, Boundi Chrak (2017) found that the United States has the most significant absolute linkages within North America, indicating a greater capacity to absorb the benefits of

regional trade. In contrast, Mexico, while exhibiting high forward and backward production linkages, tends to export its benefits to the broader regional system.

In the same context, the works of Fujii Gambero and Cervantes Martínez (2013, 2017) suggest that the weakness of domestic linkages between export sectors and the broader economy accounts for the low domestic value added content of Mexican manufactured exports. In this regard, Vázquez Muñoz and Avendaño Vargas (2012), as well as Murillo Villanueva (2020), argue that Mexico's export sector is becoming increasingly dependent on imported inputs, a trend that further contributes to the reduction of domestic value-added content.

Finally, in Graph 6, the top three export sectors from each country are presented, along with their average composition in terms of value added and domestic employment. It is observed that, among the three countries, Mexican sectors had by far the highest domestic employment content during the period. In contrast, U.S. sectors recorded a higher domestic value added content, exceeding 80%, while Canadian sectors showed considerably lower levels of both domestic employment and value added content. The composition varies significantly depending on the sector. In 2020, exports from these three industries accounted for 65.4% of total manufacturing exports in Mexico, 38.7% in the United States, and 45.5% in Canada.

Graph 6. Average domestic employment and value added: top exporting industries of Mexico, the U.S., and Canada, 1995-2020.



Note: The left bar represents domestic employment, and the right bar represents domestic value-added.
Source: Own elaboration based on the ISIC industrial classification system, rev. 4 (United Nations, 2008).

It is also observed that the computer equipment sector (C26) is prominent in the exports of both Mexico and the United States, but with a significantly different composition. Between 1995 and 2020, the average domestic value-added content in Mexico was 45%, while in the U.S., this

indicator was 89%—almost double. Fujii Gambero and Cervantes Martínez (2017) note that, in the case of Mexico, this disparity arises because the parts and components used in this industry are primarily imported.

Regarding the participation of domestic employment, surprisingly, it is higher in the United States (74%) than in Mexico (67%) during the analysis period. This suggests that, although the computer equipment sector in Mexico is highly export-oriented (28.8% of manufacturing exports), it relies heavily on imported inputs, leading to foreign value added exceeding 50% per unit exported and domestic employment being lower than in the U.S.

On the other hand, the automobile manufacturing sector (C28) ranks among the top three exporting manufacturing industries in both Mexico and Canada. Mexico, in addition to being highly export-oriented, had a relatively high average domestic value-added content between 1995 and 2020, at 69%, with domestic employment at 86%.

According to Gaytán Alfaro (2022), this can be explained by the sector's integration with various national value chains, including some that may seem disconnected. However, its effects are limited in terms of the scope of commercialization networks. In Canada, this sector exhibits a considerably low composition of both domestic value-added (49%) and domestic employment (43%) over the analysis period, indicating that these exports have a relatively low domestic impact.

In the United States, the chemical industry (C20) and the machinery and equipment (C28) sectors were significant, both exhibiting similar compositions, with approximately 70% domestic employment and 85% domestic value-added. In Canada, the two remaining sectors show very different compositions. The food and beverage manufacturing sector (C10T12) has a high average content of both domestic value added and employment, while the basic metals sector (C24) has a relatively low composition. Unlike the United States, Canada's participation in the GVC of its three most representative manufacturing industries has centered on activities that rely heavily on imported inputs.

Therefore, from Graph 6, it can be concluded that the composition varies significantly across sectors and countries, as suggested by Lin et al. (2017). While Mexico tends to have a higher proportion of domestic employment, the United States shows a greater share of domestic value added, and Canada falls between the two for both variables. However, when comparing matching sectors, these patterns do not always hold. This explains why each country participates in distinct activities within the value chain, resulting in different compositional outcomes.

CONCLUSIONS

In the North American region, with the United States as the leading country, distinct patterns emerge in the composition of manufacturing exports across the analyzed countries from 1995 to 2020: a) U.S. manufacturing exports are characterized by a high proportion of domestic value added; b) Mexican exports show a greater emphasis on domestic employment; and c) Canada's export composition falls in between, with moderate levels of both domestic value added and domestic employment.

The findings demonstrate that developed countries, such as the United States and Canada, specialize in phases that generate higher domestic value added, whereas developing countries like Mexico focus on activities with lower value added. Since 1995, both Canada and Mexico have experienced a decrease of 10 to 15 percentage points in the domestic value-added content of their manufacturing exports, reflecting their growing integration into global production networks. In Mexico's case, this decline has averaged 2.5 percentage points every five years, with no indication of this trend slowing down.

The manufacturing sectors in the United States and Canada have shifted toward a trend of job reduction, largely due to the offshoring of labor-intensive production processes to developing countries like Mexico. As anticipated, Mexican exports reflect a significant employment impact, indicating that the country has specialized in labor-intensive stages of production, often associated with lower wages.

The results reveal significant differences in the dynamics of export composition over time. While the United States has maintained a high and relatively stable domestic composition of both employment and value added throughout the period analyzed, Canada and Mexico have experienced a decline in domestic value added. Sector-specific results further show that the domestic composition of employment and value added varies across countries, highlighting the distinct phases in which each country participates.

Translation: Erika Morales.

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