

**THE TRADE DEPENDENCE OF MEXICO AND CANADA
TOWARDS THE USA: AN INPUT-OUTPUT
APPROACH (1965-1990)**

**LA DEPENDENCIA COMERCIAL DE MÉXICO Y CANADÁ
HACIA LOS ESTADOS UNIDOS: UN ENFOQUE DE
INSUMO-PRODUCTO (1965-1990)**

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Resumen: Este trabajo estudia la integración de Canadá y México con Estados Unidos previo al Tratado de Libre Comercio de América del Norte. Se utilizaron técnicas de Insumo-Producto y se encontró que Canadá y México estaban integrados con Estados Unidos, pero con características distintas. Ya que la mayoría de las industrias canadienses con mayor integración no están vinculadas a la industria automotriz, estos resultados son curiosos porque durante prácticamente todo el periodo el tratado de libre comercio vigente era el de la industria automotriz. Entre las industrias mexicanas más integradas se encuentran algunas asociadas con las maquiladoras, lo cual sugiere una concordancia entre las políticas de México y su integración con Estados Unidos.

Abstract: This paper studies the integration of Canada and Mexico with the United States of America (USA) prior to the North American Free Trade Agreement. Input-Output techniques were used, and it was found that Canada and Mexico were integrated with the USA but with different characteristics. Since most Canadian industries with greater integration are not linked to the automotive industry, these results are curious because, during practically the entire period, the free trade agreement in force was that of the automotive industry. Among the most integrated Mexican industries are some associated with maquiladoras, which suggests a concordance between Mexico's policies and its integration with the USA.

Clasificación JEL/JEL Classification: F1, F140, R150

Palabras clave/keywords: international trade; intra-regional trade; input output; North America; dependence

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1. Introduction

Before the North American Free Trade Agreement (NAFTA) entered into force in 1994, there were established integration strategies in North America because Canada and the United States of America (USA) had experience negotiating free trade agreements for their bilateral relations. Such as the 1965 free trade agreement for the automotive industry and the 1987 Canada-United States Free Trade Agreement (CUSFTA) (McCaffery, 1991; Aroche, 2001, 2003a; Aroche and Márquez, 2016). According to McCaffery (1991), the automotive agreement was the first to eliminate the tariffs on cars manufactured in Canada and the USA. However, the agreement did not contemplate the elimination of tariffs for other industries. Subsequently, both countries negotiated the CUSFTA, which entered into force in 1989 (Villarreal and Fergusson, 2017; Irwin, 2017). Under this agreement, all tariffs applied by both countries for 1998 would be eliminated. In addition, import substitution strategies were eliminated.

In recent decades, Mexico has established several transformations in its trade and industrial policies. For example, the import substitution model can be mentioned as the first stage (Moreno-Brid *et al.*, 2005). Later, during the first half of the 1980s, one can speak of a stage known as the gradual opening of the economy (Molina, 2017). Since Mexico entered the General Agreement on Tariffs and Trade (GATT), reforms were established to eliminate industrial policies and, finally, the total opening of the economy during the 1990s.

In the case of Mexico/USA relations, essential transformations were required in how both countries related to each other. According to Salinas (2017), Mexico considered its bilateral relations with the USA as a relationship with many problems, and for a long time, the USA was not interested in establishing rules that would regulate trade relations between the two countries. Besides, Lindau (1991) points out that bilateral relations were consolidated because Mexico shared (for the first time) the same opinion and position as the USA on various issues. Finally, as of January 1, 1994, NAFTA entered into force, establishing a free trade zone for North America. In this context of trade liberalization, multiple studies have been done on the integration of North American economies (Boundi, 2017; Torre *et al.*, 2020; Romero, 2022). However, the discussion about integration in North America before NAFTA is limited to informal arguments. For example, exports from Mexico to the USA before NAFTA represented 70% of Mexican exports, and by 1985, Canadian exports to the USA represented three-quarters of total exports (Torre *et al.*, 2020; Irwin,

2017). In addition, to the best of our knowledge, no study has examined the integration of Canadian and Mexican industries with the USA prior to NAFTA. Therefore, the discussions about the integration in North America during that period have focused on informal arguments without empirical evidence.

The relations that Mexico and Canada had with the USA and the informal arguments about the integration prior to NAFTA make an excellent case to know: Did Canada and Mexico had a trade dependence relationship with the USA prior to NAFTA? This paper aims to determine if they did. Besides, it also aims to evaluate and analyze Canada's and Mexico's trade relations with the USA. Canada's and Mexico's trade relations with the USA must be one of dependency during the period prior to NAFTA.

Determining which Canadian and Mexican industries were more dependent on the USA would be a contribution that would allow the evaluation of the integration of both economies with the world's leading economy in a stage with different characteristics from the NAFTA era. Since between 1965 and 1990, the trade relationship between Canada and the USA, during practically the entire period, had characteristics of partial liberalization limited to the automotive industry. While in the case of Mexico, it will be possible to evaluate the integration with the USA during two stages: import substitution and gradual opening of the economy. In addition, it will be possible to know if any industry experiences volatility in its dependence/integration on the USA, among other analyses. The input-output model will be used, and the dependency variable developed by Motohashi (1998) will be estimated.

This paper is organized as follows: the second and third sections present a literature review of industrial and trade policies of Canada and Mexico and dependency, and the fourth and fifth sections present a literature review of the methodology and the methodology used in this paper, and the sixth section presents the results, and the seventh section discussed the concluding remarks.

2. Industrial and trade policies of Canada and Mexico

In the case of Canada, Britton (1993) points out that during the 20th century, the industrialization strategies established by the Government focused on protecting manufacturing. Stone (2008) points out that no industrial policies have been established in Canada since the early 1980s; this is because establishing industrial policies can be

controversial in Canada. Industrial policies can become controversial because people may associate industrial policies with initiatives to increase or decrease wealth. However, Pelling (2013) points out that industrial policies have been established in Canada since the 1990s. Regarding trade policy, Canada and the USA negotiated and signed the 1965 free trade agreement for the automotive industry and later the CUSFTA of 1987, which entered into force on January 1, 1989 (Irwin, 2017). In addition, CUSFTA established that the tariffs of both countries would be eliminated by 1998, and financial services and cross-border travel for professionals would be liberalized (Villarreal and Fergusson, 2017).

Canada, Mexico, and the USA negotiated NAFTA, which entered into force on January 1, 1994. As part of this agreement, tariff and non-tariff barriers would be gradually eliminated over 15 years (Villarreal and Fergusson, 2017). However, if the three countries agreed, the periods established to eliminate the tariffs could be accelerated. After NAFTA, Canada established new trade and preferential agreements with other countries (WTO, 1998). The USA, Mexico, Chile, Israel, and Costa Rica were among the countries with which Canada signed free trade agreements. In addition, it established preferential agreements with Australia and New Zealand (WTO, 2007). All this is part of the strategies of the Government of Canada to participate in world trade. In summary, Canada's trade policy has focused on seeking new trading partners in the world, but during the period 1968-2009, each Prime Minister of Canada established the objective of reducing dependence on exports to the USA, and each one failed in this initiative (Gecelovsky and Kukucha, 2011).

The Mexican economy has undergone several transformations in its trade and industrial policies in recent decades. The first stage was focused on an import substitution model (Moreno-Brid *et al.*, 2005). Under this model, manufacturing was stimulated, and a transfer of employment from agriculture to manufacturing was stimulated (Molina, 2017). Other sub-stages can be found within the import substitution stage (De Mateo, 1988). The first was characterized by the import substitution of non-durable consumer goods, which occurred during the 1940s and 1950s. Later, during the 1960s, the substitution of durable consumer goods and industrial inputs was stimulated, and finally, during the 1970s, the substitution of imports of refined intermediate inputs and capital goods was stimulated (De Mateo, 1988). In this context, the maquiladora program was conceived; this program had a restrictive legal framework, such that firms had to export the entire production because it was not in line with import substitution

industrialization policies (Castillo and de Vries, 2018). According to Bergin *et al.* (2009), the primary maquiladora industries are the assembly of clothing, electronic materials and accessories, and transportation equipment. Later, during the Government of Miguel de la Madrid (1982-1988), reforms were established to dismantle industrial policies (Calderón *et al.*, 2019; Moreno-Brid and Sánchez, 2016). As part of these reforms, Mexico entered the GATT; entering the GATT meant that Mexico agreed to reduce and consolidate tariffs (Agama and McDaniel, 2002). Therefore, this stage is considered one of the gradual opening of the economy (Molina, 2017).

Later, during Carlos Salinas de Gortari's government, NAFTA was negotiated, agreed upon, and signed. On January 1, 1994, NAFTA entered into force and established a free trade area between Mexico, Canada, and the USA. In addition, this agreement established that tariffs and non-tariff barriers would be eliminated immediately and others during the first 15 years of the agreement (Villarreal and Fergusson, 2017; Irwin, 2017). This period can be known as an accelerated opening to international trade (Molina, 2017). It is important to note that trade liberalization is not limited to this period since liberalization and participation in the global economy are still strategies established by Mexico (Kuntz, 2015); this is because, for example, Mexico has negotiated free trade agreements with Japan and the European Union (López and Zabludovsky, 2015).

3. Dependency: Theoretical approaches and applied research

When the Latin American countries ceased to be colonies, it was pointed out that the new republics depended on their former colonizers because they imported large quantities from European countries (Vaca, 2017). However, this manifestation of dependency is not limited to that historical period since, during the 20th century, high imports were still linked to dependency. Seers (1979) points out that Latin American, Asian, and African countries depended on imports of oil and technology. While to facilitate the acquisition of such imports, underdeveloped countries exported coffee, bananas, sugar, and others.

Valenzuela and Valenzuela (1979) point out that the development status of a particular country can be understood if it is considered how the country has been inserted into the global system characterized by the Core and the Periphery. This dependency approach suggests that

uneven combinations of development characterize the world. However, there are approaches to dependency that link this concept to political and sociological aspects. In this sense, Cardoso and Faletto (1978) point out that in the internal context of a country, groups and classes that compete for power establish alliances with foreign entities that condition the development of society. Therefore, the approach to the dependency of Cardoso and Faletto (1978) is more linked to political and sociological aspects than economic ones.

Girvan (1973) points out that dependency is the absence of manipulating the economic system; this definition implies that there is interdependence when the economic system can be manipulated. According to Lacourt (2021), in dependency dynamics, one agent benefits more from the bilateral relationship than the other. However, extreme cases may exist where one agent benefits while the other suffers (Lacourt, 2021). Besides, Luciano (2005) proposes another approach to dependency. This approach proposes that dependency can be studied as the sensitivity of the production system (of a particular country) to changes in the final demand of another country. Therefore, the more focused the production system is on satisfying the final demand of another country, the more intensely it will respond to those changes in the final demand (Luciano, 2005).

In addition, Boundi (2017), using an input-output method called hypothetical extraction, points out that the drag capacity can be interpreted as an indicator of the dependence of country i regarding the production of country j . In comparison, the pushing capacity can be interpreted as a measure of the dependence of country i regarding the purchases made by country j to country i . Therefore, Boundi's (2017) definition of dependency as a pushing capacity is similar to Luciano's (2005) position on dependency.

Due to globalization and the increase in bilateral and multilateral relations globally, free trade agreements, preferential agreements, regional blocs, and other forms of cooperation between countries have been established. The relations between Japan and the USA, Puerto Rico and the USA, and the trade relations between Mexico, Canada, and the USA are examples of studies on dependency in an international trade context (Motohashi, 1998; Luciano, 2005; Romero, 2022; Boundi, 2017).

In the case of bilateral relations between Japan and the USA, it has been estimated that Japan's dependence on the USA has decreased since the dependency index was 5.80% in 1985, and in 1990 it was 3.77% (Motohashi, 1998). In contrast, the USA's dependency on Japan was 0.61% in 1985 and 1.02% in 1990. Therefore, Motohashi

(1998) concludes that bilateral relations between these two countries are directed toward a relationship with an interdependent nature. Besides, these results could be explained by the yen's appreciation towards the US dollar.

Luciano (2005) studied the dependency of the Puerto Rican economy on the USA between 1972 and 1987. This analysis found that the manufacturing, mining, and construction sectors were the most dependent on changes in final demand from the USA during the study period. However, dependency indices have declined over time. Said results (especially manufacturing) can be explained by the approval and eventual amendments of Section 936 of the USA Internal Revenue Code.

Regarding relations between NAFTA members, Romero (2022) found that bilateral relations between the USA and Canada have a dependent nature since Canada had average indices of 23.28% in 1995 and 17.73% in 2011. During this period, the industries most dependent on the USA were Leather, Leather and Footwear, Chemical and Chemical Products, Electrical and Optical Equipment, Transport Equipment, and Mining and Quarrying. At the same time, the least dependent Canadian industries were Construction, Public Admin, and Defense, Compulsory Social Security, Education, Health, and Social Work.

For bilateral relations between the USA and Mexico, it was found that this bilateral relationship presents dependency characteristics since it was estimated that Mexico had average dependency indices of 15.08% in 1995 and 15.15% in 2011 (Romero, 2022). In sectoral terms, the Mexican industries most dependent on the USA were: Electrical and Optical Equipment, Transport Equipment, Machinery, Nec, Manufacturing, Nec; Recycling, and Textiles and Textile Products. However, there were fluctuations since, in some cases, the indices increased and decreased between 1995 and 2011. In addition, it is essential to point out that the Mexican industries less dependent on the USA were: Health and Social Work, Education, Public Admin and Defence, Compulsory Social Security, and Construction.

Romero (2022) points out that relations between Mexico and the USA present characteristics of trade relations between a country from the Core and another from the Periphery. The same is concluded for the relations between Canada and the USA. In addition, bilateral relations between Canada and Mexico were heading towards dependency since Canada presented indices of 0.29% in 1995 and 0.72 in 2011. At the same time, Mexico presented indices of 0.60% in 1995 and 1.47% in 2011. In sectoral terms, North America's most dependent indus-

tries in bilateral relations are those associated with manufacturing, and the least dependent are those associated with services (Romero, 2022).

Another study on North America during the NAFTA era was carried out by Boundi (2017), in which it was found that Canada shows a greater absolute dependence on the USA. Besides, it was found that Mexico shows a growing dependence on USA inputs and demand. Therefore, it is concluded that Mexico had a high dependency between 1996 and 2009 (Boundi, 2017). In addition, the author points out that Mexico's dependence on the USA is slightly higher than that of Mexico regarding its trade relations with Canada; even in some years, Mexico's dependence on Canada was higher.

Finally, the dependency approach of Luciano (2005) is adopted as a position for this study. Luciano's (2005) definition indicates that dependency can be studied as the sensitivity of an economy to changes in the final demand of another country. This approach does not include internal considerations of the countries and excludes sociological or political considerations, which facilitates modeling.

4. Models

Different methodological approaches are used in economic analysis to research regional phenomena. Some of these methodologies are gravitational models, input-output models, integrated input-output/econometrics models, and spatial econometric models. Cafiero (2005), argues that gravitational models are inspired by the gravitational models of Isaac Newton, and the author points out that in these models, there is a relationship of attraction between two objects. However, said attraction may depend on the size of the objects and the distance between them. According to Nijkamp and Ratajczak (2021), the Newtonian gravitational models were developed in physics. In recent decades they have been applied to other disciplines, such as regional sciences, geography, and economics. López (2018) points out that when applying these models to international trade, a relationship is established between the size of the economy of two countries and the distance between them.

In the case of input-output models, it can be noted that they are a general equilibrium model (Ortíz and Castro, 2008; Aroche and García, 2018). Molina (2017) argues that through the input-output model, the economic structure of a particular country and international trade, among others, can be studied. Besides, the input-output

matrices are built from data from a particular country (in the case of international trade, several countries) and present the activities of industries that produce goods and are consumer goods produced by other industries during their production processes (Miller and Blair, 2009).

Another methodological approach to regional phenomena is the integrated input-output and econometrics models. These models allow the estimations of a given economy or region's transformations, growth, or decline (West, 1995; Rey, 2000). Also, it can be noted that one of its main attractions is the dynamic analyzes that allow this type of model integration, and its main disadvantage is that there is an assumption that the coefficients are fixed parameters and have no uncertainty (Luciano, 2005). Besides, Rey (2000) points out that integrating these models has generated methodological problems.

While in spatial econometrics, these models are considered a time series application to geographic space, and these models assume disequilibrium or partial disequilibrium (Luciano, 2005). Another critical aspect of these models is that maximum likelihood estimates are used frequently, and these techniques have complications due to the use of numerical methods to solve nonlinear optimization processes (Moreno and Vayá, 2002). Examples of this are the asymptotic properties and restrictions on the value of the autoregressive parameters.

As mentioned above, there are different theoretical approaches to dependency and methodological approaches to regional phenomena. Although each of the models mentioned above may have its advantages and disadvantages, it was chosen to use the input-output model for the analysis proposed in this paper. This decision was made due to the structural and sectoral analysis (across industries) that the model allows. However, within the input-output model, there are several approaches, which can be separated into two categories: quantitative and qualitative.

Within the quantitative approach, different measures can be used to examine the relationships between industries or countries (in the case of international trade matrices). One of the measures that can be used is the hypothetical extraction method. This method makes it possible to measure the effect of sector i on a given economy by comparing its production with the production of a hypothetical economy where sector i was extracted (Wang *et al.*, 2013). Yang *et al.* (2014) add that the hypothetical extraction method can also extract a group of economic sectors, then it is possible to identify important sectors in an economy. However, Dietzenbacher and Lahr (2013) point out that hypothetical extraction methods are too restrictive. Since most of the

analyzes only present the implications and effects on the rest of the economy when extracting a sector and the mathematical formulations of these methods suggest that other approaches are inappropriate or, in some cases, impossible to carry out.

In terms of applied research, Boundi (2017) used the hypothetical extraction method to study Mexico's trade relations with the USA and Canada during the NAFTA period. The author used this technique to study the drag capacity (backward linkages) and the pushing capacity (forward linkages) of the three NAFTA member countries. In addition, as mentioned above, Boundi (2017) points out that this technique allows for studying the dependency regarding the purchases that country j makes from country i .

Another example is the dependency variable developed by Motohashi (1998). Said author developed an index that calculated Japan and the USA's dependency in their bilateral relations. In other words, the variable of Motohashi (1998) allows the estimation of how sensitive the production system is to changes in the final demand of the other country. Subsequently, Luciano (2005) applied the same model and dependency variable as Motohashi (1998) to study trade relations between Puerto Rico and the USA. Besides, Romero (2022) modify the model of Motohashi (1998) into a trilateral model to calculate the dependency variable for Mexico, Canada, and the USA between 1995 and 2011.

However, according to Aroche (2003b), the quantitative input-output approach has failed to explain and describe the connections between sectors, and this causes interactions to be not clearly understood. While qualitative approaches to the input-output model reveal various structure characteristics, these results are presented as a graph. Therefore, there is a link between network analysis and qualitative input-output analysis. Network analysis has been applied in sociology, anthropology, computer science, mathematics, and physics (De Benedictis *et al.*, 2014; Aroche, 2003b). This interdisciplinary evolution has led to using these techniques in econophysics projects, where interactions in international trade are studied (Amador and Cabral, 2017).

Several measures can be found within network analysis, such as density, diameter, indegree, and outdegree. In the case of indegree, it can be indicated that this measure represents the number of incoming edges, which symbolizes significant import relationships (in an international trade context). While outdegree represents the number of outgoing edges, which symbolizes significant export relationships (Vélez, 2020). Therefore, with these measures is possible to

determine which industries may have significant links with another country's economy through imports and exports.

When considering the different approaches and measures of the input-output model, it was chosen to use the model and the dependency variable of Motohashi (1998). However, the model will be defined in the same way that Romero (2022) used, a trilateral model for North America. This choice was made because the variable of Motohashi (1998) allows estimating how sensitive the production system is to changes in the final demand of the other country and because, unlike network techniques, the dependency variable of Motohashi (1998) allows knowing the magnitudes of dependency and integration over time. While with network techniques, it is impossible to differentiate in which year the significant relationships experience increases or decreases in integration.

In addition, the Motohashi (1998) dependency variable was chosen over the hypothetical extraction method as Boundi (2017) and Torre *et al.* (2020) used it. In the case of Boundi (2017), the author makes an aggregate analysis and does not consider a sectoral analysis, which is not consistent with the analysis proposed in this paper. It is important to mention that Torre *et al.* (2020) used the hypothetical extraction method for a sectoral analysis. However, the integration approach used by these authors focuses on changes in gross output and gross value added when a sector is extracted from the model. Therefore, this integration approach is different from the one proposed in this study, which leads to discarding the hypothetical extraction method such as the one used by Torre *et al.* (2020).

5. Quantitative input-output analysis: Regional model for North America

The trilateral model used by Romero (2022) will be used to estimate the dependency variable for Canada and Mexico's relationship with the USA in 1965, 1970, 1975, 1980, 1985, and 1990. It is essential to clarify that dependence will only be estimated in one direction; in other words, it will only be estimated how dependent country i is on its trade relations with country j and not vice versa. The matrices used in this paper are those published by the World Input-Output Database (Woltjer *et al.*, 2021). These matrices present the international trade between 25 countries and are in current prices denoted in millions of dollars. The open model for relations between Canada, Mexico, and the USA is defined as:

$$\begin{bmatrix} A_{CC} & A_{CM} & A_{CU} \\ A_{MC} & A_{MM} & A_{MU} \\ A_{UC} & A_{UM} & A_{UU} \end{bmatrix} \begin{bmatrix} X_C \\ X_M \\ X_U \end{bmatrix} + \begin{bmatrix} F_{CC} + F_{CM} + F_{CU} \\ F_{MC} + F_{MM} + F_{MU} \\ F_{UC} + F_{UM} + F_{UU} \end{bmatrix} = \begin{bmatrix} X_C \\ X_M \\ X_U \end{bmatrix} \quad (1)$$

Where $A_{\alpha\beta}$ is the coefficient submatrix from country α to country β . Besides, $F_{\alpha\beta}$ is the final demand submatrix from country α to country β , and X_α is the total production vector of the country α . The solution of the open model can be read as:

$$\begin{bmatrix} X_C \\ X_M \\ X_U \end{bmatrix} = \begin{bmatrix} I - A_{CC} & -A_{CM} & -A_{CU} \\ -A_{MC} & I - A_{MM} & -A_{MU} \\ -A_{UC} & -A_{UM} & I - A_{UU} \end{bmatrix}^{-1} \begin{bmatrix} F_{CC} + F_{CM} + F_{CU} \\ F_{MC} + F_{MM} + F_{MU} \\ F_{UC} + F_{UM} + F_{UU} \end{bmatrix} = \begin{bmatrix} B_{CC} & B_{CM} & B_{CU} \\ B_{MC} & B_{MM} & B_{MU} \\ B_{UC} & B_{UM} & B_{UU} \end{bmatrix} \begin{bmatrix} F_{CC} + F_{CM} + F_{CU} \\ F_{MC} + F_{MM} + F_{MU} \\ F_{UC} + F_{UM} + F_{UU} \end{bmatrix} \quad (2)$$

For example, the production of Canada (X_C) is induced by the sum of Canadian demand for Canadian goods (F_{CC}) and Mexican demand for Canadian goods (F_{CM}) multiplied by the submatrix B_{CC} , plus the sum of Canadian demand for Mexican goods (F_{MC}) and Mexican demand for Mexican goods (F_{MM}) multiplied by the submatrix B_{CM} . In equation 2, each country's production could be decomposed into different parts. One of the parts is induced by the country's final demand. For example, $B_{MM}F_{MM}$ in the case of Mexico and another is induced by exports of final demand to the other country, $B_{CC}F_{CM}$. Another part is induced by the feedback effects from the final Canadian demand for Mexican products, $B_{CM}F_{MC}$. The final part is induced by the repercussion's effects of Canadian demand for Canadian products, $B_{MC}F_{CC}$. The following indices (equations 3 and 4) can estimate how much Canada's and Mexico's production depends on the USA.

$$Dependent_{CU} = \frac{(B_{CC}F_{CU} + B_{CU}F_{UU})}{X_C} \quad (3)$$

$$Dependent_{MU} = \frac{(B_{MM}F_{MU} + B_{MU}F_{UU})}{X_M} \quad (4)$$

$Dependent_{CU}$ represents the dependence of the Canadian economy on the USA's economy and $Dependent_{MU}$ represents Mexico's dependence on the USA. For example, if the dependency is equal to 1%, the production of Mexico will change proportionally to the changes in the final demand of the USA. Besides, the changes will be less proportional if dependency is less than 1%. However, if dependency is higher than 1%, the production of Mexico will change more proportionally (Luciano, 2005).

6. Dependency variable: Share in total production (%)

This section presents the dependency variable for the relationship of Canada and Mexico with the USA. In other words, it was estimated how dependent and sensitive to changes in USA's final demand are the Canadian and Mexican economies. Under this analysis, the higher the indices, the more sensitive Canada and Mexico will be. The results are shown in sectoral terms from 1965 to 1990.

Table 1 shows Canada's dependence on the USA, on average, increased from 10.58% in 1965 to 19.94% in 1990. However, between 1970 and 1975 and 1985 and 1990, some decreases in the average indices were observed. These results suggest that Canada will respond more proportionally to changes in USA's final demand because Canada's average indices are well above 1%. One of the main observations that can be made from table 1 is that most of the industries and the average indices show an upward trajectory; this should not be surprising because economic policy decisions were headed in that direction. In addition, no higher volatility was found in the dependency indices. The industries that show the highest indices are: Mining and Quarrying, Pulp, Paper, Paper, Printing and Publishing, Rubber and Plastics, Basic Metals and Fabricated Metal, Electrical and Optical Equipment, Transport Equipment, and Manufacturing, Nec; Recycling. In contrast, the less dependent industries are construction, hotel, and restaurants.

Table 1
Canada's dependency on the USA (1965-1990)

| <i>Industries</i> | <i>1965</i> | <i>1970</i> | <i>1975</i> | <i>1980</i> | <i>1985</i> | <i>1990</i> |
|--|-------------|-------------|-------------|-------------|-------------|-------------|
| Agriculture, Hunting, Forestry and Fishing | 13.05 | 12.39 | 9.84 | 15.34 | 20.37 | 17.73 |
| Mining and Quarrying | 31.01 | 31.54 | 32.12 | 22.52 | 28.22 | 32.41 |
| Food, Beverages and Tobacco | 6.67 | 7.01 | 5.29 | 6.64 | 10.19 | 10.70 |
| Textiles, Textile, Leather and Footwear | 4.36 | 7.97 | 7.09 | 8.98 | 14.51 | 17.16 |
| Pulp, Paper, Printing and Publishing | 40.34 | 35.76 | 36.06 | 35.31 | 34.48 | 38.03 |
| Coke, Refined Petroleum and Nuclear Fuel | 7.38 | 10.46 | 9.33 | 12.11 | 16.67 | 20.53 |
| Chemical and Chemical Products | 13.61 | 15.52 | 15.32 | 19.96 | 23.90 | 24.81 |
| Rubber and Plastics | 9.23 | 18.69 | 18.32 | 23.51 | 34.16 | 32.97 |
| Other Non-Metallic Mineral | 6.70 | 14.55 | 13.36 | 15.83 | 22.62 | 20.69 |
| Basic Metals and Fabricated Metal | 24.35 | 24.65 | 25.73 | 34.31 | 38.24 | 33.54 |
| Machinery, Nec | 13.79 | 20.75 | 18.66 | 21.6 | 26.20 | 22.54 |
| Electrical and Optical Equipment | 7.37 | 15.88 | 12.52 | 21.83 | 33.99 | 34.05 |
| Transport Equipment | 9.10 | 49.58 | 47.48 | 48.91 | 71.14 | 74.12 |
| Manufacturing, Nec; Recycling | 24.16 | 26.23 | 24.37 | 31.93 | 38.39 | 28.58 |
| Electricity, Gas and Water Supply | 8.55 | 9.64 | 10.25 | 16.83 | 15.39 | 11.28 |

Table 1
(Continued)

| <i>Industries</i> | <i>1965</i> | <i>1970</i> | <i>1975</i> | <i>1980</i> | <i>1985</i> | <i>1990</i> |
|---|-------------|-------------|-------------|-------------|-------------|-------------|
| Construction | 0.62 | 0.76 | 0.68 | 0.82 | 1.04 | 0.95 |
| Wholesale and Retail Trade | 2.42 | 3.28 | 3.00 | 3.74 | 4.66 | 4.57 |
| Hotel and Restaurants | 0.51 | 0.74 | 0.75 | 0.84 | 1.22 | 1.27 |
| Transport and Storage | 4.56 | 5.85 | 5.19 | 5.72 | 8.00 | 7.73 |
| Post and Telecommunications | 2.96 | 3.84 | 3.22 | 4.05 | 5.43 | 5.08 |
| Financial Intermediation | 2.37 | 3.08 | 3.04 | 3.68 | 5.22 | 4.56 |
| Real Estate, Renting and Business Activities | 4.32 | 7.06 | 5.92 | 6.73 | 10.00 | 8.21 |
| Community Social and Personal Services | 5.98 | 6.57 | 5.89 | 6.40 | 8.00 | 7.22 |
| Total Industry Average | 10.58 | 14.43 | 13.63 | 15.98 | 20.52 | 19.94 |

Source: Author's calculations.

The results of the industries that show higher dependency/integration indices may come as a surprise from the perspective that most of these industries are not associated with the automotive industry, and the free trade agreement that was in force during practically the entire period was the automotive industry agreement of 1965. However, it is essential to mention that among the industries that show higher dependence, Basic Metals and Fabricated Metal is the industry that may have significant links with the production processes of cars. Furthermore, these results suggest that non-automotive industries did not need a free trade agreement to have strong ties to the USA economy, which can be explained by the fact that Canada and the USA are neighboring countries and have comparative advantages to exploit. Another observation that can be made from the results in table 1 is that once CUSFTA came into effect in 1989, it can be seen that 14 of the 23 Canadian industries experienced declines in their dependency indices. Most of these decreases are between 2% and 4%, so they are not large decreases. Nevertheless, it is curious because integration would be expected to increase, given that CUSFTA was not focused on a single industry.

Another aspect that should be highlighted is some industries' dependency indices, such as Post and Telecommunications, Financial Intermediation, Real Estate, Renting and Business Activities, and Community Social and Personal Services. These industries sometimes show indices between 5% and 10%. These results are surprising because they are not industries linked to manufacturing and show that Canada has strong links with the USA economy, even in industries that are not usually linked to international trade. Besides, when comparing the results in table 1 with the results of Romero (2022), no industry was found that maintained significant integration with the USA between 1965 and 1990 and then, during NAFTA, ceased to be significantly integrated with the USA; this may suggest that NAFTA did not discourage the upward trajectory of the integration of Canadian industries with the USA economy.

Table 2 shows the results for the relationship of Mexico with the USA. The table shows that, on average, the dependence of Mexico increased from 2.63% in 1965 to 12.78% in 1990. However, between 1970 and 1975, a minimal decrease in the dependency index can be observed. These results suggest that between 1965 and 1990, Mexico responded more proportionally to changes in USA's final demand. Since the mentioned period, all the average indices are higher than 1%.

Table 2
Mexico's dependency on the USA (1965-1990)

| <i>Industries</i> | <i>1965</i> | <i>1970</i> | <i>1975</i> | <i>1980</i> | <i>1985</i> | <i>1990</i> |
|---|-------------|-------------|-------------|-------------|-------------|-------------|
| Agriculture, Hunting, Forestry and Fishing | 3.83 | 4.84 | 2.27 | 5.81 | 7.33 | 9.19 |
| Mining and Quarrying | 13.30 | 8.18 | 8.86 | 20.08 | 22.90 | 18.29 |
| Food, Beverages and Tobacco | 4.15 | 3.54 | 2.06 | 2.38 | 4.68 | 5.17 |
| Textiles, Textile, Leather and Footwear | 2.81 | 3.45 | 5.50 | 4.69 | 8.36 | 18.81 |
| Pulp, Paper, Paper, Printing and Publishing | 2.71 | 3.11 | 2.42 | 3.87 | 9.05 | 13.64 |

Table 2
(Continued)

| <i>Industries</i> | <i>1965</i> | <i>1970</i> | <i>1975</i> | <i>1980</i> | <i>1985</i> | <i>1990</i> |
|--|-------------|-------------|-------------|-------------|-------------|-------------|
| Coke, Refined Petroleum and Nuclear Fuel | 12.76 | 4.06 | 1.03 | 15.16 | 25.16 | 8.53 |
| Chemical and Chemical Products | 3.77 | 2.96 | 2.98 | 4.07 | 9.80 | 11.74 |
| Rubber and Plastics | 1.18 | 1.50 | 1.31 | 3.2 | 9.72 | 18.52 |
| Other Non-Metallic Mineral | 1.90 | 2.00 | 2.24 | 3.46 | 10.94 | 11.54 |
| Basic Metals and Fabricated Metal | 2.59 | 2.41 | 2.04 | 3.55 | 10.87 | 19.48 |
| Machinery, Nec | 0.54 | 4.13 | 3.42 | 9.55 | 15.79 | 21.21 |
| Electrical and Optical Equipment | 0.60 | 7.03 | 2.67 | 25.35 | 41.24 | 59.35 |
| Transport Equipment | 0.30 | 2.51 | 2.91 | 2.43 | 14.06 | 21.01 |
| Manufacturing, Nec; Recycling | 2.20 | 3.58 | 3.34 | 7.05 | 14.03 | 31.29 |
| Electricity, Gas and Water Supply | 3.85 | 3.22 | 4.39 | 9.52 | 12.18 | 6.92 |
| Construction | 0.02 | 0.03 | 0.02 | 0.03 | 0.10 | 0.13 |
| Wholesale and Retail Trade | 0.54 | 0.69 | 0.49 | 0.68 | 2.06 | 3.73 |
| Hotel and Restaurants | 0.23 | 0.28 | 0.21 | 0.27 | 0.84 | 1.27 |
| Transport and Storage | 1.07 | 1.36 | 0.79 | 0.83 | 2.24 | 3.96 |
| Post and Telecommunications | 0.40 | 0.48 | 0.33 | 0.34 | 1.07 | 1.75 |
| Financial Intermediation | 0.73 | 0.84 | 0.63 | 0.73 | 3.02 | 5.27 |
| Real Estate, Renting and Business Activities | 0.29 | 0.37 | 0.37 | 0.47 | 1.35 | 2.13 |

Table 2
(Continued)

| <i>Industries</i> | <i>1965</i> | <i>1970</i> | <i>1975</i> | <i>1980</i> | <i>1985</i> | <i>1990</i> |
|--|-------------|-------------|-------------|-------------|-------------|-------------|
| Community Social and Personal Services | 0.70 | 0.67 | 0.32 | 0.40 | 0.76 | 1.10 |
| Total Industry Average | 2.63 | 2.66 | 2.20 | 5.39 | 9.89 | 12.78 |

Source: Author's calculations.

As in Canada's trade relations with the USA, Mexico shows an upward trajectory in its dependence on the USA between 1965 and 1990. These results respond to the gradual opening of the economy during the 1980s. Besides, the three countries are neighbors and have comparative advantages to exploit. In addition, only one industry showed volatility in its dependence on the USA. Said industry was Coke, Refined Petroleum, and Nuclear Fuel, and an example of its volatility is that for 1965 it had an index of 12.76%; for 1970, an index of 4.06%; and for 1975, an index of 1.03%. Said decrease in the indices should be linked to the oil price shocks of the 1970s since the price per barrel in January 1970 was \$3.35, and by the end of the 1970s, it was \$32.50 per barrel (Hammes and Willis, 2005). However, the index had two increases, 15.16% in 1980 and 25.16% in 1985, to fall sharply to 8.53% in 1990.

In sectoral terms, some of the industries that show the highest dependency indices are: Mining and Quarrying, Textiles, Textile, Leather and Footwear, Rubber and Plastics, Basic Metals and Fabricated Metal, Machinery, Nec, Electrical and Optical Equipment, Transport Equipment, and Manufacturing, Nec; Recycling. On the contrary, the less dependent industries are Construction, Hotels and Restaurants, Post and Telecommunications, Real Estate, Renting and Business Activities, and Community Social and Personal Services.

Most of the results on the industries with the highest indices should not be surprising since many of them can be associated with the maquiladoras in Mexico (Bergin *et al.*, 2009), such as Textiles, Textile, Leather and Footwear, Electrical and Optical Equipment, and Transport Equipment. Furthermore, by comparing the results of 1980 and 1985, it is possible to observe how the dependency indices of all Mexican industries increased during 1985 and, in some cases, increased by more than 10%. These results clearly show the establishment of the gradual opening of the economy during the 1980s.

Other results in sectoral terms that are worth discussing are the indices for Post and Telecommunications, Financial Intermediation, Real Estate, Renting and Business Activities, and Community Social and Personal Services. These Mexican industries show indices below 1% during most of the period, which is very different behavior from that presented by Canada in those same industries and during the same period. Therefore, unlike Canada, Mexico shows dependency indices practically only in industries associated with manufacturing, and those associated with services or not linked to international trade; do not show much evidence of being integrated into the USA economy. When comparing the results shown in table 2 with the results of Romero (2022), it was found that between 1975 and 1990, Community Social and Personal Services showed an upward trajectory in its indices to the point that by 1990 it showed dependency relationships with the USA. However, once NAFTA entered into force, said industry ceased to be dependent since it presented indices of 0.71% in 1995 and 0.54% in 2011 (Romero, 2022). Therefore, NAFTA could have discouraged the integration of said Mexican industry with the USA economy.

7. Concluding remarks

Between 1965 and 1990, Canada and the USA negotiated two free trade agreements, both of which were the first to be established in North America. The first agreement was in 1965 and focused on the automotive industry. The second was called CUSFTA and was not limited to a single industry. For its part, Mexico, between 1965 and 1990, did not maintain a free trade agreement with the USA but had several stages of industrial and trade policies. Within these stages, it is essential to highlight the import substitution industrialization stage and the economy's gradual opening. Furthermore, it is essential to note that even when Mexico established import substitution policies, the maquiladora program had strong ties to international trade because the firms were required to export their entire production (Castillo and de Vries, 2018). While with the gradual opening of the economy, Mexico joined the GATT and established other trade liberalization initiatives.

This paper found that Canada and Mexico had a trade dependence relationship with the USA prior to NAFTA. Besides, the increasing integration that Canada and Mexico had with the USA during the period 1965-1990 constituted their main similarity: this should not

be surprising because economic policies, particularly those associated with trade liberalization, were heading in that direction (reaching up to NAFTA). In addition, Canada and Mexico are neighbors of the USA, which is why they have comparative advantages that could and can be exploited. However, Canada and Mexico show significant differences in their integration with the USA between 1965 and 1990.

For example, no Canadian industry experienced volatility in its integration with the USA between 1965 and 1990. However, the Mexican Coke, Refined Petroleum, and Nuclear Fuel industry experienced volatility. The oil shocks could explain the volatility between 1965 and 1975 (Hammes and Willis, 2005). Nevertheless, this volatility was not limited to that decade since the dependency indices went from 25.16% in 1985 to 8.53% in 1990. Therefore, the volatility in integration with the USA could have generated even more uncertainty. These results are highly relevant if we consider that there is evidence that the uncertainty of the oil market has negative influences on economic activity in Mexico (Rodríguez and López, 2019).

Another aspect that is important to mention is that in the case of Canada, the majority of the industries that are most integrated into the USA are those that are not linked to the automotive industry; this is highly relevant because the only free trade agreement in force during most of the years focused on the automotive industry. Therefore, the economic integration between Canada and the USA during this period was more profound than what was stimulated by the free trade agreement. In the case of Mexico, different behaviors can be observed because there was an import substitution policy; however, the maquiladora program stimulated exports and international trade. Under this context, several industries with higher integration with the USA can be associated with the maquiladora program, such as Textiles, Textile, Leather and Footwear, Electrical and Optical Equipment, and Transport Equipment. Consequently, there is a concordance between the economic policies of Mexico and its integration with the USA.

In addition, there are other differences between the integration of Mexico and Canada with the USA. For example, Canada shows significant integration in industries not usually linked to international trade, such as Post and Telecommunications, Financial Intermediation, Real Estate, Renting and Business Activities, and Community Social and Personal Services. While in the case of Mexico, those same industries do not show a significant integration with the USA; this shows evidence that the integration between Canada and the USA is more diverse and cannot only be associated with manufacturing.

The last significant difference between Canada and Mexico is linked to the transition between the pre-NAFTA and post-NAFTA periods. Since comparing this paper's results with the results of Romero (2022), no Canadian industry shows evidence that it maintained significant levels of integration with the USA before NAFTA, and then, with trade liberalization, it ceased to be significantly integrated with the USA. However, in the case of Mexico, Community, Social and Personal Services showed no evidence of being significantly integrated with the USA once NAFTA came into force, suggesting that trade liberalization affected the integration of this industry with the USA.

This paper's main limitation is that matrices before 1965 were not available, with matrices before that year would make it easier to calculate the dependency variable for periods further back in time. In this sense, these estimates could be made if those matrices are published. In addition, once post-2011 matrices are published with all the data necessary to carry out this type of analysis, dependency variables could be estimated for the North American countries in the last years of NAFTA and the Trump era (2012-2020). Specifically, it would be interesting to know if President Donald Trump's policies influenced Canada and Mexico's integration into the USA during that period. Furthermore, the trilateral input-output model used in this paper can be used to study other trilateral or multilateral relationships in global trade.

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