The Chinese Export Displacement Effect: an empirical analysis for Latin American economies (2001-2019)

50º Encontro Nacional de Economia - Área 7 - Economia Internacional

Marcos Tadeu Caputi Lélis (PPGE – Unisinos e CNPq), Luciane Franke (PPGE-UFRGS) e André Moreira Cunha (PPGE-UFRGS e CNPq)

Abstract: This paper investigates the relationship between Latin America and the Caribbean (LAC) selected countries' exports of manufactured products and China's increased international competitiveness. We have tested if market share gains from Chinese manufacturing exports have affected those countries' competitive positioning in exports of manufactured products to some selected countries. The LAC economies' lack of dynamism and competitiveness in global markets, particularly when it comes to the production and exportation of manufactured goods, has coincided with China's rise as a global powerhouse. This is why we considered whether an increase in China´s market share in a third country's market is associated with an increase or a decrease of LAC´s market share. Our main results have identified that the effect of Chinese competitiveness on the competitiveness of LAC countries is limited by the size of the partner economy. Moreover, the research has also shown that Mexico is affected by Chinese competitiveness in a different way from Argentina, Brazil, and Chile.

Key Words: Chinese export displacement effect; China; Latin America; international trade.

Resumo: Este artigo investiga a relação entre as exportações de produtos manufaturados de países selecionados da América Latina e Caribe (ALC) e o aumento da competitividade internacional da China. Testamos se os ganhos de participação de mercado das exportações de manufaturados chineses afetaram o posicionamento competitivo dos países latino-americanos nas exportações de produtos manufaturados direcionados para terceiros mercados. A falta de dinamismo e de competitividade das economias da ALC nos mercados globais, principalmente quando se trata de produção e exportação de bens manufaturados, coincidiu com a ascensão da China como potência global. É por isso que consideramos se um aumento da participação de mercado da China em terceiros países está associado a um aumento ou a uma diminuição da participação de mercado de economias da ALC. Nossos principais resultados revelam que o efeito da competitividade chinesa na competitividade dos países latino-americanos é limitado pelo tamanho da economia parceira. Além disso, a pesquisa mostrou que o México é afetado pela competitividade chinesa de forma diferente que a Argentina, o Brasil e o Chile.

Palavras-Chave: efeito-deslocamento; China; América Latina; comércio internacional.

JEL: F14; F12; F63

Introduction

This paper investigates the relationship between Latin America and the Caribbean (LAC) selected countries' exports of manufactured products and China's increased international competitiveness. We have tested if market share gains from Chinese manufacturing exports have affected those countries' competitive positioning in exports of manufactured products to some selected countries. The LAC economies' lack of dynamism and competitiveness in global markets, particularly when it comes to the production and exportation of manufactured goods, has coincided with China's rise as a global powerhouse. This is why we considered whether an increase in China´s market share in a third country's market is associated with an increase or a decrease of LAC´s market share.

Since the late 1970s, under the umbrella of Deng Xiaoping's strategy of reforms and economic opening China has been re-emerging as a global power. Its rapid economic growth and internationalization process culminated with China in 2021 being responsible for 13% of global trade of goods and services, 19% of the world's GDP (World Bank, 2022; IMF, 2022). China's re-emergence as a global power is part of a broader process, which is the consolidation of Asia as the most dynamic growth pole of the globalized economy. To put this process in perspective, while LAC accounted for 8% of the world's GDP (measured in constant prices) in the 1980s, Asia's share (excluding Japan and other high-income countries) was 5%. Nearly four decades later, Latin America kept it 8%, while Asian countries reached 20% of the world´s income. During this period, emerging and developing countries of Asia averaged a GDP growth of 7.9% per year, while LAC countries experienced much lower rates, between 2% to 3% (World Bank, 2022). China's rapid modernization markedly contrasts with LAC quasi-stagnation.

Considering the exports of manufactured goods, China and LAC performances were also radically different. Before its accession to the World Trade Organization (WTO), in 2001, China´s market share in global markets averaged 1.5% (1980s) and 2.9% (1990s). Now (2020) it is 14.8%. In the same period, LAC´s share has kept almost the same, averaging 5%. Moreover, China´s GDP *per capita* rapidly converges to LAC´s average in market prices: in the 1990s it was equivalent to 13%; in 2020 it was basically the same. Therefore, LAC´s economies lack of economic dynamism and competitiveness in global markets, particularly when it comes to the production and exportation of manufactured goods, has coincided with China's rise as a global powerhouse. This is why we have evaluated if an increase in China´s market share in a third country's market is associated with an increase or a decrease of LAC-4´s market share. In this context, we have explored here the so-called "Chinese export displacement effect" (Eichengreen *et al*., 2007), considering the LAC main economies: Argentina, Brazil, Chile, and Mexico (LAC-4), which accounted for 93% of the regions' manufacturing exports, on average, from 2001 to 2019.

After 2001, when China was admitted to the WTO, its exporters' presence in global markets has gained intensity, particularly in manufactured goods. Mexico also experienced an increase in its market-share, while Argentina, Chile and Brazil decreased or stagnated their participation in international markets (see Appendix A). Even when the LAC-4 market share increased, it was in a less pronounced way compared to China. This phenomenon has also happened with other economies, where Chinese manufacturing exports apparently displaced their exports. In order to test such "Chinese displacement effect", previous studies usually applied panel data econometrics and modified versions of the so-called "gravity model" to test if the exports from China displace other countries exports to third markets considering the level of exports (Eichengreen *et al*., 2007; Greenaway, *et al*., 2008; Athukorala, 2009; Giovannetti et al., 2013; Módolo and Hiratuka, 2017). Here we have followed a similar procedure, focusing on market-shares instead of exports levels. We have also explicitly tested the interaction between the trade partner´s market size and the Chinese displacement effect, which has not been done in the previous literature. We also highlight that the interaction between the size of the large country's consumer market, production costs, and transportation costs may result in smaller economies becoming net exporters. If transportation and production costs in smaller economies are low, this region may achieve greater gains in scale by exporting to countries with high demand potential (see section 2).

The methodological approach applied allows to evaluate the interaction between the trade partner´s market size and the Chinese displacement effect, controlling for other factors (section 4). The GMM equations estimated corroborate the hypothesis that the effect of Chinese competitiveness on the competitiveness of LAC-4 is limited by the size of the partner economy, where the negative effect of China's market share on the share of the LAC-4 is greater in countries with lower GDP. A similar result, however, characterizing even more accentuated losses, is observed when the effect on Argentina, Brazil, and Chile is isolated. Finally, when particularizing the effect on Mexico's market share, a different pattern is observed: the smaller the size of the economy, the greater the positive effects. Thus, Mexico was affected by Chinese competitiveness in a different way from Argentina, Brazil, and Chile. To the best of our knowledge, this research offers fresh evidence that adds to the previous empirical efforts that try to explain how China´s rise as a global powerhouse has affected other countries' economic performance focusing in the LAC. In order to achieve our goals, we begin with a brief literature review (section 3). Next, section 4 presents our methodological framework. Section 5 shows the results of our exercises. Finally, we summarize our findings.

2. International Trade Theories

International trade theories have developed upon the seminal contributions of Adam Smith (1776), with his theory of absolute advantages, and David Ricardo (1817), who founded the basis for understanding international trade with the theory of comparative advantages (TCA). Ricardo demonstrated that a country, by specializing in producing a good that has comparative advantages, not necessarily absolute, obtain gains from trade. The main contribution of comparative advantages was to consider that, even if a country does not have an absolute advantage in any product, both countries will benefit from international trade (Martin, 2015; Cho and Moon, 2000). The TCA states that the specialization of production and the pattern of international trade is determined by the relative productivity of the factors of production. With this, it is possible to establish that countries will specialize in producing and exporting goods in which they have a comparative advantage. At the same time, these countries will import products that are characterized by relatively minor labor productivity. This concept is useful for countries that define productive structures with non-similar technological standards. Besides, it becomes suitable for different product commercial exchanges (Rivera-Batiz and Oliva, 2003).

Ricardo's model considers two sectors, one-factor economy (unit labor requirement) and two countries: domestic and foreign, endowed with labor factor, L (domestic) and L* (foreign), potentially employed in sectors I and II[1]. Each sector produces Q_j as a function of the quantity of L_j and a sectorial productivity parameter A_j, where j is between I and II.

$$Q_I = A_I L_I, \qquad Q_{II} = A_{II} L_{II}, \qquad Q_I^* = A_I^* L_I^*, \qquad Q_{II}^* = A_{II}^* L_{II}^* \qquad (1)$$

When establishing full employment: $L = L_I + L_{II}$ e $L^* = L_I^* + L_{II}^*$. Furthermore, it is stated that the domestic economy has comparative advantages in the production of I: ${A_I}/{A_{II}} > {A_I^*}/{A_{II}^*}$. Thus, if the domestic economy exhibits comparative advantages in asset I, the foreign economy must display comparative advantages in asset II. The previous relationships can be defined in terms of relative labor cost, measured by an input-output relationship: $a_{Lj} \equiv {L_j}/{Q_j} \equiv {1}/{A_j}$. With that, it is possible to establish the following inequality for the suggested case: ${a_{LII}}/{a_{LI}} < {a_{LII}^*}/{a_{LI}^*}$, depending on the specialization pattern of the foreign economy, two results can be established[2]: (i) Total Specialization: the foreign country is specialized and uses all its labor endowments in sector II. So, both countries are specialized; (ii) Partial specialization: the foreign country is not specialized but prefers to produce both products.

By extending the TCA, incorporating three factors of production - land, capital, and labor - the theoretical model of Heckscher-Ohlin and Samuelson, became dominant in the traditional theory of international trade. In this model, comparative advantages result from differences in factor endowments. Thus, the theory of the proportions of the factors sought to unite the pattern of exports and imports worldwide with the allocation of factors and production of each country (Jones, 1956). According to Gandolfo (1994), in addition to the traditional hypotheses of the standard models of international trade, three more are pointed out: (i) production functions show positive but decreasing returns on each production factor and constant returns to scale; (ii) the demand structure is identical in both countries regardless of the level of income; (iii) each good is produced according to a single production technique, technical coefficients are fixed and constant.

The Heckscher-Ohlin theorem is expressed by two countries, two factors of production, and two commodities (2x2x2). Countries differ in the abundance of factors of production, and commodities differ in

---

[1] Furthermore, the model assumes the free mobility of the labor factor between sectors of the domestic economy, disregarding the mobility between the domestic and foreign economy.

[2] For more details on the two types of specialization see Rivera-Batiz and Oliva (2003).

the intensity of the use of factors in production. When considering hypothesis (i) it is possible to define the production function of each country and its sectors:

$$Q_I = F_I(K_I L_I), \quad Q_{II} = F_{II}(K_{II} L_{II}), \quad Q_I^* = F_I(K_I^* L_I^*), \quad Q_{II}^* = F_{II}(K_{II}^* L_{II}^*) \qquad (2)$$

The constant returns to scale establish that the production functions are homogeneous in the factors K and L. That is, these production factors are multiplied by a constant "c", resulting in a production-level multiplied by this same constant, $cQ_j = F_j(cK_j, cL_j)$. When replacing "c" with $1/L_j$ we have the production function expressed per unit of work, $Q_j/L_j = F_j\left(1/L_j\, K_j, 1/L_j\, L_j\right) = f_j(k_j)$, where $k_i = K_j/L_j$.

Hypothesis (ii) establishes that, for any relative price (p), both countries consume (D) goods in the same proportion: $D_{II}/D_I\,(p) = D_{II}^*/D_I^*\,(p),\ p = p_I/p_{II}$. When considering hypothesis (iii), it is pointed out that the order of the sectorial capital-labor relationship is invariant to changes in the wages (w) cost of use or rent (r) ratio of capital services. That is, for any wage-cost ratio, an asset I is capital-intensive and asset II is labor-intensive: $k_I(\omega) = K_I/L_I\,(\omega) > k_{II}(\omega) = K_{II}/L_{II}\,(\omega)$, being $\omega = w/r$.

Finally, the full use of the factors of production is achieved by the economy by adding the supply of capital and labor used in sectors I and II. So, for the case of the work factor, $L = L_I + L_{II} = a_{LI}(\omega)Q_I + a_{LII}(\omega)Q_{II}$, for the capital factor, $K = K_I + K_{II} = a_{KI}(\omega)Q_I + a_{KII}(\omega)Q_{II}$. Unlike the Ricardian model, input-output coefficients a_{ij} they are a function of wages and the cost of using capital. Thus, when fixing this set of propositions, four theorems are established. According to Jones and Neary (1984), these theorems became the cornerstone in the theory of international trade for the great postwar period.

1. Factor Price Equalization Theorem: under certain conditions, freedom of trade in final goods allows for complete equality of prices for factors of production[3]
2. Stolper-Samuelson theorem: an increase in the relative price of good increases the real return of the factor used intensively in the production of that good and, at the same time, a drop in the real return of the other factor [4].
3. Rybczynski's theorem: when fixing the prices of goods, the increase in the relative endowment of one of the factors results in a more than proportional expansion in the relative production of the intensive good in the factor that suffered the increase and an absolute drop in the production of the other good[5].
4. Heckscher-Ohlin theorem: a country tends to produce and export goods that use its abundant factor in the production process, importing those that use its scarce factor[6]

Given all that has been mentioned so far, traditional international trade theories consider relative prices and the supply structure and the demand component as fixed. As a result, the size and market characteristics of the partner country are not considered. To fill this gap, Vernon (1966) and Linder (1961) seek to deepen international trade theory. Linder hypothesis (1961), emphasizing the central role of the demand structure in determining international trade, assumes two basic propositions: (1) countries export manufactured products for which there is already a significant domestic market[7]; and (2) countries trade more with those with similar income levels. (Cho and Moon, 2000). Linder's (1961) main contributions lie in the identification of two important variables in explaining the pattern of international trade and competitiveness: domestic demand and economies of scale. The first being explored, later, by Porter (1990), and the second becoming the main explanatory variable in Krugman's (1979) approach on intra-industry trade.

To integrate innovative processes, foreign direct investment, and domestic demand in determining countries' exports, the theoretical approach defined as "product cycle" was presented by Vernon (1966). The

[3] In the case of wages, the trend would be a fall in developed countries and an increase in developing countries. For more details see Lerner (1952) e Samuelson (1948, 1949).
[4] See Stolper and Samuelson (1941).
[5] See Rybcynski (1955).
[6] See Heckscher (1919) and Ohlin (1933).
[7] For Cho and Moon (2000), the hypothesis that countries will export products that are first demanded in the domestic market (home-oriented) is similar to Vernon's (1966) product cycle theory, when explaining the initial life stage of a product.

theoretical conception of the product cycle is essentially determined by demand, so that high levels of income and the sophisticated pattern of the consumer induce innovative responses from local firms. (Dosi *et al.*, 1990, p. 31). Both Linder's (1961) approach and the product cycle approach argue that the consumer market is important in the export process and in the competitive gains of countries. In this sense, the size of the partner's economy becomes relevant, with economies of scale being one of the main channels for transmitting these competitiveness gains. With that, the perception of competitive gains through economies of scale becomes a relevant factor in the "New Theory of International Trade" (Grimwade, 2000; Martin, 2015, World Bank, 2017). The works of Krugman (1979; 1981) and Lancaster (1980) were pioneers in delimiting its theoretical scope, clarifying the prevalence of trade between economies with technological and resource similarities, economies of scale, and imperfect competition.

Krugman's formalizations (1979; 1980) consider industry and a factor of production (labor) used in the same proportions. Consumers demand varieties of products, and all goods are perfect substitutes so that there is an equal utility function for all individuals. On the supply side, there is a cost and production function for each product variety with a fixed component (fixed cost), implying economies of scale in production (average decreasing cost), limiting the number of varieties produced by each country. What stands out in this approach is that the limiting factor of product variety is associated with the size of demand. Thus, the partner being an identical country (same preferences, technologies, and endowment of factors), expanding the size of the market would increase the production of each product category and, at the same time, increase the number of varieties produced. The result would be an increase in well-being in both countries, due to the reduction in prices - and increase in real wages - (scale effect) and an increase in varieties available to consumers in both markets (differentiation effect).

When addressing the effects of the market size of the exporting economy, Krugman (1995) suggests an interaction effect between transport costs and economies of scale. The author provides evidence on Linder's (1961) hypotheses. In this sense, due to economies of scale, each good is produced in one country and consumed in both countries. If the production costs are the same, then the production location factor is associated with the transportation cost. If transportation costs are low, production will occur in the country with the largest market size. When considering high transport costs or countries with close market size, the full concentration of scale gains in the country with the greatest demand will not occur. However, the country with the largest domestic market will continue to be a net exporter of that industry.

We also highlight that the interaction between the size of the large country's consumer market, production costs, and transportation costs may result in smaller economies becoming net exporters. If transportation and production costs in smaller economies are low, this region may achieve greater gains in scale by exporting to countries with high demand potential. This corroborates the empirical hypothesis to be tested in the econometric exercise applied in our paper.

3. China effect on developing countries: a literature review

In 2000, China was not among the world's top five exporters of goods, lagging behind the United States, Germany, Japan, France, the United Kingdom, and Canada. However, year after year the country registered an increase in its exports at a faster pace than other countries. China became the second main exporter in the world in 2007, only ahead of Germany. But in 2009, while the main economies were still looking to recover from the global financial crisis, China reached the position of the world's main exporter of goods, maintaining it since then. Because of the expressive growth of Chinese participation in world exports in the last twenty years, research on the subject has received attention. The literature on the China Effect has highlighted several results in different directions: some countries seem to have benefited from the Chinese economic growth and its consequent expansion in the demand for products offered internationally; other countries experience the negative impacts of Chinese competition, especially on manufactured products. More recent attention has focused on the effects on Latin American and other developing countries with discussions that account for general effects (Medeiros; Cintra, 2015; Silva; Gomes; Teixeira, 2018; Qian; Rafique; Wu, 2020) until sectoral analyzes (Durán Lima; Pellandra, 2017; Módolo; Hiratuka, 2017; Lin, 2018; Franke et al., 2019). The empirical strategies vary, but most of the results converge to the negative effects of Chinese competition on several Latin American countries.

This view is supported by Medeiros and Cintra (2015) who investigate the expansion of economic relations between China and Latin American countries in the 2000s. The authors investigated the effect of the Chinese rise on Latin America, underlining the different impacts and open possibilities, under a two-pronged approach: the demand effect and the structure effect. The first effect, macroeconomic is associated with the impact of China on: (i) exports, through a direct route with the increase of Latin American exports to China, as well as, indirectly, due to the expansive effect on the third markets; (ii) trade balance; and (iii) investments. On the other hand, the second effect reflects the uneven impact on sectors or activities according to the degree of complementarity, through the Chinese demand for commodities and their capacity to offer industrialized products and rivalry between China and Latin American countries. The rivalry is present precisely in the Chinese exports of industrialized products with the economies that produce these goods in Latin American countries.

From another perspective, Durán Lima and Pellandra (2017) explores the structural change that has occurred in the world economy since the beginning of the 21st century, which has China as one of the main world players in production and trade. Among the main elements of the analysis, the authors point out that China's position in world trade has contributed to the boom in commodities prices and collaborated to sustain the growth of many Latin American economies in the first decade of the 2000s. However, if Latin American sustains such a trade relationship with China, it may not lead to long-term regional economic growth. This difficulty can already be seen in the face of China's economic slowdown since the global financial crisis in 2008. Latin American countries have been facing a combination of the “Dutch disease” effect and competition from cheaper imports of Chinese manufactured goods. These elements are considered determinants in the process of deindustrialization in Latin American countries and put in the light the Latin American dependence on China. (Durán Lima; Pellandra, 2017)

In the same vein, Módolo and Hiratuka (2017) investigate Chinese competition and how its exports affect other countries in international trade. The authors performed a gravitational model to investigate whether Chinese exports displaced exports from other countries in third markets from 2000 to 2009. The empirical assessment covered countries in the following regions: Developing Asia; Developed Asia; Hong Kong and Macao; Europe; North America; Central America and Mexico; South America; and countries in the rest of the world. Módolo and Hiratuka (2017) conducted their empirical strategy taking into account the sectorial classification by technological intensity developed by Lall (2000), focusing on manufactured products.

Módolo and Hiratuka (2017) found that the product categories most affected by Chinese export competition were those of low and medium-technology. When considering Latin American exports to the world, the most negative effect was observed in the medium-technology products. The authors highlighted that China expanded its exports of products of medium-technology at a faster pace than those of low-technology in the period under analysis, 2000-2009.

In regional terms, North America was the only region not impacted by Chinese competition. Módolo and Hiratuka (2017) claim that American companies are specialized in segments that do not compete directly with China. On the other hand, among developed countries, Asians are the most threatened by Chinese competition. And finally, in the analysis of Chinese competition with other developing countries, Módolo and Hiratuka (2017) conclude that the negative impact is even more pronounced when compared to that perceived in developed countries in general. The results demonstrated that developing countries have been intensely negatively affected by competition from Chinese exports in three segments of manufactured products: low, medium, and high- technology. Regarding Latin American countries, the strong negative impact of Chinese competition was not offset by Chinese demand for manufactured products - which occurs in Asian developing countries -, except for countries that export commodities. The net effect is negative in countries like Mexico and others in the Caribbean.

With the central objective of analyzing the spillover effect of China's growth on the growth of the main South American economies - Argentina, Brazil, Chile, and Colombia - between 1981 and 2014 -, Silva, Gomes, and Teixeira (2018) estimated whether the increase in participation China's trade agenda since 2001 changed this effect. The attention for the year 2001 is due to the Chinese insertion in the South American markets, becoming one of the main commercial partners of the South American countries and reaching a similar level of market share that the United States and the European Union. As a methodological strategy, Silva, Gomes, and Teixeira (2018) used a dynamic panel data model, following the estimator of the generalized method of moments (GMM-DIF). The authors found a positive relation between Chinese economic growth and the growth of South American countries, but with a low coefficient (0.23). However, the results also suggest that the increase in trade flows between the countries of South America and China did not significantly alter the spillover effect of Chinese growth on the South American growth rate. Silva, Gomes, and Teixeira (2018) observe that the volume of trade flow between the region and China is not the main determinant of the spillover effect. The authors maintain that the expansion of exports from the traditional sectors of South American economies, especially commodities, is not enough to increase the gains with China's growth.

Considering a later period, Lin (2018) turns his attention to the effect of the global financial crisis in the short and long term on industrial and commercial policies implemented by China, Argentina, and Brazil. The investigation covers the post-crisis period, 2009-2014. The author's empirical strategy is the Constant Market Share methodology. Lin (2018) listed three points: (i) persistence of the asymmetric trade pattern of China with Argentina and Brazil, but a decline in the weight of China as an explanatory element due to the decrease in the intensity of bilateral trade between Argentina and Brazil ; (ii) the divergent performance of Argentine and Brazilian exports to China, mainly due to the change in competitiveness in the soy sector; and (iii) the increase in the competitiveness gap between South American countries and China upstream of the industry's production chain. The author considers that Brazil obtained competitive advantages in soy exports compared to Argentina, however, the penetration of intermediate goods of Chinese origin caused more losses to Brazil than to Argentina, because in Mercosur, Brazil is the only country that has a complete industrial system.

Franke et al. (2019) investigate the impact of Chinese exports on exports of industrialized products from Brazil and Mexico in world trade, in the period from 2001 to 2016. The authors applied a two-stage dynamic panel data model. Franke et al. (2019) argue that Chinese exports displace Brazilian and Mexican exports of industrialized products in world trade only when the Asian country enters in third markets. The authors estimated a quadratic relationship between exports from Latin American countries and Chinese exports, which established points of minimum. For Brazil, the estimated point is reached when China reaches the mark of approximately US$ 15.4 million exported to the trade partner. While for Mexico, the same analysis reveals a value of US$ 42.0 million. After this displacement effect on exports, the models suggest that Brazil and Mexico tend to a possible loss of market share in their partners over time.

Qian, Rafique, and Wu (2020) start from the growth opportunities for exporters created by China to their trading partners. The authors explore the effects of expanding exports to China on the local labor markets of exporting developing countries - 80 countries selected based on data availability - for the years 1992 to 2018. Brazil and Mexico are among the top ten main exporters to China. The authors used two-stage least square and ordinary least square estimations. They suggest that demand shocks in China have significantly affected labor markets in developing countries, generating job gains. However, the authors do not rule out the possibility that part of the growing trade with China may be due to the growth of developing countries, including unobservable shocks and changes in productivity. The authors also point out that there are additional jobs created in developing economies due to adjustments in the industrial structure that were accelerated by the increase in exports to China.

In summary, most of the papers investigate the sensitivity of Latin American countries exports to Chinese competition, including effects on economic growth and the labor market. One of the analyzes assesses the effect of the developing countries’ trade relationship with China, considering the countries' exports to the Asian country (Qian; Rafique; Wu, 2020). The studies provide evidence that the challenges faced by Latin American countries, because of the consolidation of China as a manufacturing center in the world, affect their exports of manufactured products negatively. Although some analyzes reveal positive impacts for Latin American exporters of commodities due to Chinese demand, such persistence in the commercial relationship may not lead to long-term regional economic growth and accentuate a condition of center-periphery. However, such studies remain narrow in focus dealing with China Effect on other countries exports and do not define an analysis that assesses the effects in terms of competitiveness[8] of Chinese exports against exports from Latin American countries, as proposed in this paper.

4. Data and Methodology

To evaluate if China´s market share of exports of manufactured goods have displaced the Latin American countries' market share of exports of these products in third markets, we used data from 59 countries (see Appendix B). It is worth mentioning that: (i) we have chosen the sample considering the data available between 2001 and 2019; (ii) the trade partners selected account for 96% of LAC-4 exports of manufactured goods. However, it is noteworthy that among these partners are Argentina, Brazil, Chile, and Mexico. Thus, the number of observations of the model estimated is 4,408.

The variables used in our exercise[9] were: (i) Latin American countries market share (%) in imports of manufactured products from trade partners ($MS\_LA_{i,j,t}$) in %; (ii) Manufacturing Value Added as % of GDP of Latin American countries ($MANUF_{i,t}^{LA}$); (iii) Chinese market share (%) in imports of manufactured products from trade partners ($MS\_CHINA_{j,t}$); (iv) Gross Domestic Product of Latin American countries ($GDP_{i,t}^{LA}$) in current PPP international dollars; (v) Gross Domestic Product of trade partners ($GDP_{j,t}^{PART}$) in current PPP international dollars; (vi) Exchange rate of Latin American countries ($EXC_{i,t}^{LA}$), annual average of local currency exchange rates against US Dollar, nominal rate converted to index number; (vii) Exchange rate of trade partners ($EXC_{j,t}^{PART}$), annual average, local currency exchange rates against US Dollar, nominal rate converted to index number; (viii) Exchange rate of Latin American countries ($REXC_{i,t}^{LA}$), annual average, local currency exchange rates against US Dollar, real effective rate converted to index number; (ix) Exchange rate of trade partners ($REXC_{j,t}^{PART}$), annual average, local currency exchange rates against US Dollar, real effective rate converted to index number; (x) Trade Freedom in Latin American countries ($TRADE\_FR_{i,t}^{LA}$) and in trade partners ($TRADE\_FR_{j,t}^{PART}$), index number from *The Heritage Foundation*; (xi) Business freedom in Latin American countries ($BUSI\_FR_{i,t}^{LA}$) and in trade partners ($BUSI\_FR_{j,t}^{PART}$), index number from *The Heritage Foundation;* (xii) Geographic distance ($DIST_{i,j}$) in kilometers between the principal population and economic clusters of exporters and their partners from CEPII; (xiii) Dummy $LANGUAGE_{i,j}$, 1 if countries share common official or primary language; (xiv) Dummy equal to 1 if countries are contiguous ($CONT_{i,j}$); (xv) Dummy for Mexico ($DU\_ME_{j,t}$), in order to isolate the relation between China's market share and Mexico's market in trade partners from other Latin American countries (Argentina, Brazil and Chile).

It is noteworthy that the variables mentioned above, $GDP_{i,t}^{LA}$, $GDP_{j,t}^{PART}$, $EXC_{i,t}^{LA}$, $EXC_{j,t}^{PART}$, $REXC_{i,t}^{LA}$, $REXC_{j,t}^{PART}$, $TRADE\_FR_{i,t}^{LA}$, $TRADE\_FR_{j,t}^{PART}$, $BUSI\_FR_{i,t}^{LA}$, $BUSI\_FR_{j,t}^{PART}$ e $DIST_{i,j}$ are treated in logarithms. The variable $MANUF_{i,t}^{LA}$ represents a relation with GDP, and $MS\_LA_{i,j,t}$ e $MS\_CHINA_{j,t}$ represent shares in imports from Latin American countries and China, on total imports on industrialized products in trade partners. Table 1 shows the summary statistics for all variables.

Table 1 – Summary Statistics

Variables	Mean	Std. Deviation	Minimum	Maximum
Latin American countries market share (% of manufactured goods imported by each country)	1.47	3.95	0.00003	39.19
Manufacturing Value Added as % of GDP of Latin American countries, %	14.40	2.79	10.14	22.49

8 Ferraz, Kupfer, and Haguenauer (1996) define competitiveness as a performance, and market share is used as a proxy for competitiveness.

9 The main sources are World Bank (2022), UN Comtrade (2022), OECD National Accounts data files, UNCTAD, Heritage Foundation, and Euromonitor International.

Chinese market share (% of manufactured goods imported by each country)	13.67	8.50	1.01	45.42
GDP of Latin American countries, PPP current international dollars (billions)	1,385.43	973.55	183.46	3,247.68
GDP of trade partners, PPP current international dollars (billions)	1,143.85	2,279.79	14.90	21,433.23
Exchange rate of Latin American countries, local currency exchange rates against US Dollar, index number	321.71	653.57	91.47	4825.80
Exchange rate of trade partners, local currency exchange rates against US Dollar, index number	121.48	169.10	44.23	4825.80
Real Effective Exchange rate of Latin American countries, local currency exchange rates against US Dollar, index number	95.95	21.86	51.24	234.93
Real Effective Exchange rate of trade partners, local currency exchange rates against US Dollar, index number	101.61	16.39	51.24	234.93
Trade freedom in Latin American countries, index number	73.43	9.06	53.00	88.80
Trade freedom in trade partners, index number	78.83	9.71	21.80	94.80
Business freedom in Latin American countries, index number	66.88	9.36	52.80	87.30
Business freedom in trade partners, index number	72.22	13.82	35.50	100.00

Source: Calculated by the authors using Stata 16.

To compose the sectorial aggregation of industrialized products, the classification by technological standard originally suggested by Pavitt (1984) and adapted by Guerrieri (1991 and 1998) followed. Six groups are considered: (i) Primary Products; (ii) Resource-intensive Products; (iii) Labor-Intensive Products; (iv) Scale-Intensive; (v) Specialized Suppliers; e (vi) R&D Intensive. In this paper, we propose an econometric exercise that considers only the technological patterns from (iii) to (vi). When defining this stratification, within the industrial sectors, the Food and Beverages sector, classified as Intensive in Natural Resources, is excluded. Thus, we aim to focus on industrialized products, except for those belonging to the Food and Beverages[10] sector. The following subsection covers the methodological approach.

We have investigated the Chinese export displacement effect by applying the Generalized Method of Moments (IV-GMM) in a panel data framework. Among a set of advantages of using panel data, the quality of establishing heterogeneous behavior in the cross-sectional units of the model to be estimated. However, correct identification of this behavior is important. With this, it is possible to define the basic structure of panel data models as follows:

$$Y_{it} = \alpha + X_{it}\beta + v_{it} \qquad i = 1, \dots, N; t = 1, \dots, T \qquad (3)$$

$$v_{it} = \mu_i + u_{it} \qquad (4)$$

Where (Equations 3 and 4), "i" indicates the cross section dimension and "t" defines time dimension, Y_{it} represents the dependent variable, with variations in "i" and "t"; X_{it} establishes a vector of independent variables, measured in "i" and "t" or, just, "t"; v_{it} represents the composite error term, being μ_i characterized by an individual and Fixed (or Random) Effects; and u_{it} is the error term with mean of zero and constant variance (σ^2). These last two components are the factors not observed or not included directly in the econometric specification and which affect the component Y_{it}.

The individual effect (μ_i) places the distinction between Fixed Effects and Random Effects. In Fixed Effects models, the term μ_i of each cross-sectional unit manifests correlation with one or more independent variables of the model, which means $E(X_{it}\mu_i) \neq 0$. A statistically efficient strategy is to estimate μ_i as an individualized parameter for each cross-sectional unit. That is:

[10] The products from Food and Beverage sector were excluded from the statistical analysis because the Chinese competition pattern in international trade does not seem to have great advantages in this sector.

$$Y_{it} = (\alpha + \mu_i) + \beta . X_{it} + u_{it} \quad (5)$$

In random effects models, the term $\mu_i + u_{it}$ characterizes a compound error as described in equations 3 and 4. This structure, however, has residual correlation overtime associated with the individual effect μ_i. Thus, through their use, it is not possible to observe any correlation between μ_i and X_{it}, as in fixed effects models, which leads to $E(X_{it}\mu_i) = 0$.[11]

It should be noticed, however, that the source of endogeneity in panel data models may stem from the relationship between X_{it} and u_{it}, so that $E(X_{it}u_{it}) \neq 0$. To control this endogeny, the estimator IV-GMM is proposed[12]. Regarding this estimator, it is necessary to make a definition between Fixed Effects[13] or Random Effects[14], specifying models with configurations close to equations (3) and (4) or (5). In turn, the source of the endogeny is basically from 4 factors: (a) omitted variables; (b) bidirectional causality relationship; (c) measurement error; and (d) construction of variables. In this sense, the variables used in the proposed model reveals the problem of the construction of variables. By establishing the market share of Brazilian exports in its partners as the dependent variable, a relationship is built between Brazilian exports and trade partners' imports. Consequently, Brazilian exports are present in the GDP regressors and the manufacturing/GDP ratio in Brazil. At the same time, trade partners' imports are part of the independent variables, China's market share, and the proposed interaction. Thus, it is necessary to establish exogeneity in these four regressors in the proposed[15] econometric structure, making the IV-GMM estimator essential.

Indeed, when checking the vector X_{it} on equation (3) we arrive at two partitions $[X_{it}^{EX}\ X_{it}^{EN}]$, the set of exogenous regressors are X_{it}^{EX} and the set of endogenous regressors are X_{it}^{EN}. At the same time, there is a vector of instruments (Z_{it}), which is decomposed into two other instrument sets $[Z_{it}^1\ Z_{it}^2]$[16]. The vector Z_{it}^1 represents the included instruments, on the other hand, the vector Z_{it}^2 represents the instruments that were excluded. The instruments included must accomplish two characteristics: relevance and validity. Therefore, the instruments included must be correlated with the endogenous regressors (X_{it}^{EN}), and orthogonal to the estimated residue. We used two lags[17] for the vector Z_{it}^2 of endogenous variables.

So, we defined the two models estimated in this paper as follow:

$$MS\_LA_{i,j,t} = \alpha^{LA} + \gamma_1^{LA}\Phi_{jt}^1 + \gamma_2^{LA}\Phi_{jt}^2 + \beta^{LA}X + \eta_{it} \quad (6)$$

$$MS\_LA_{i,j,t} = \alpha^{ME} + \gamma_1^{ME}\Phi_{jt}^1 + \gamma_2^{ME}\Phi_{jt}^2 + \gamma_3^{ME}\Phi_{jt}^3 + \gamma_4^{ME}\Phi_{jt}^4 + \beta^{ME}X + \varepsilon_{it} \quad (7)$$

Equation (6) establishes the model for the LAC-4 countries, and equation (7) the model that specifies the effect on Mexico from the others (Brazil, Argentina, and Chile). Indeed, Φ_{jt}^1 is $MS\_CHINA_{j,t}$; Φ_{jt}^2 represents ($GDP_{j,t}^{PART}*\ MS\_CHINA_{j,t}$); Φ_{jt}^3 represents ($MS\_CHINA_{j,t} * DU\_ME_{jt}$); Φ_{jt}^4 is ($GDP_{jt}^{PART} * MS\_CHINA_{j,t} * DU\_ME_{jt}$); the X matrix is compound by the following control variables: $MANUF_{i,t}^{LA}$, $GDP_{i,t}^{LA}$, $GDP_{j,t}^{PART}$, $EXC_{i,t}^{LA}$, $EXC_{j,t}^{PART}$, $REXC_{i,t}^{LA}$, $REXC_{j,t}^{PART}$, $TRADE\_FR_{i,t}^{LA}$, $TRADE\_FR_{j,t}^{PART}$, $BUSI\_FR_{i,t}^{LA}$, $BUSI\_FR_{j,t}^{PART}$, $DIST_{i,j}$, $CONT_{i,j}$, and $LANGUAGE_{i,j}$; finally, η_{it} and ε_{it} are the estimated residues, chosen between Fixed Effects and Random Effects Models. We highlight two main subjects. First, we focus on the effect on Mexico, because it is expected to be different from the effect on other Latin American countries. This choice was mainly established by the commercial relationship between the Mexico and United States,

[11] For more details on Fixed Effect and Random Effect panel data models, see: Hsiao (2014), Arellano (2003), and Baltagi (2013).

[12] The basic conception of the method of moments is to state that the sample moments estimate the population moments. Thus, it is possible to reach the parameters of interest. For more details see Wooldridge (2010) chapter 8.

[13] The option for GMM estimator compared to the Ordinary Least Square 2 stages (2SLS) is applied because of the heteroscedastic residues. According to Baum, Schaffer, and Stillman (2003), the GMM estimator is more efficient than 2SLS in models with heteroscedastic residues. However, Hayashi (2000) in chapter 3, argues that When applying GMM estimator is necessary large samples. For details about the GMM estimator, see Wooldridge (2010) chapter 8.

[14] IV-GMM estimator is consistent if μ_i is a Random Effect. However, the effects of invariant regressors over time are controlled without observing the size of this effect on the dependent variable. The option for G2SLS allows us to observe the size of this effect.

[15] The dependent variable and this set of regressors are established at the same time, defining the problem of the regressors' endogeny.

[16] Notice that between regressors and instruments, there are variables that change in "*i*" and "*t*" and others just in "*t*".

[17] The lags used in these instruments are close to the proposed by Ding and Hadzi-Vaskov (2017).

in addition to the significant presence of multinationals that use Mexico as an export platform. The second point is about the interaction of $MS\_CHINA_{j,t}$ with $GDP_{j,t}^{PART}$. We believe that the effect of Chinese competitiveness on the competitiveness of Latin American countries is limited by the size of the partner economy. This hypothesis is based on two characteristics: (1) the type of trade policy adopted by Latin American countries and China: countries with larger domestic markets generate greater disputes over share, since the absolute benefits are significantly relevant, reaching economies of scales; (2) the competitive position of Latin American countries: exports of industrialized products from Latin American economies have a greater market share in regions with the same or lesser pattern of development, reflecting in the size of the $GDP_{j,t}^{PART}$. Finally, we remember that the choice between Fixed Effects or Random Effects will define the possibility of estimating the parameters of fixed time regressors ($DIST_{i,j}$, $CONT_{i,j}$, and $LANGUAGE_{i,j}$). In Fixed Effects model, the relation among these variables and $MS\_LA_{i,j,t}$ is controlled by the individual effect. In Random Effects model, regressors fixed in time are included in matrix X.

5. Results and Discussion

This section presents our results. Appendix C details the econometric procedures and tests, while Table 2 shows the statistical results of the two models, following equations (6) and (7). In this sense, the equations are estimated considering the G2SLS estimator of Random Effect, with robust standard errors adjusted for clustering on trading partners. The models I, II, and III considered the LAC-4 countries, the Models IV, V, and VI considered the effects over Mexico separate from other countries (Brazil, Argentina, and Chile). The models I, III, IV, and VI considered the nominal exchange rate ($EXC_{i,t}^{LA}$ and $EXC_{j,t}^{PART}$), while models II and V considered real exchange rates ($REXC_{i,t}^{LA}$ and $REXC_{j,t}^{PART}$). The models III and VI did not include the variables with interaction between GPD and China's market share. The changes among the models aim to offer an answer regarding the robustness of the effect of China's market share on the market share of the Latin America selected countries.

Table 2 shows that the Sargan-Hansen overidentification constraint test confirms the validity of the instruments. The statistical results for the control variables of the six models, $GDP_{i,t}^{LA}$, $TRADE\_FR_{i,t}^{LA}$, $BUSI\_FR_{i,t}^{LA}$, $DIST_{i,j}$, $CONT_{i,j}$, and $LANGUAGE_{i,j}$, were statistically relevant. The first three variables are exclusively related to Latin American countries, while geographic distance, land contiguity, and sharing of the same main language involve the relationship of countries with their trading partners. These results indicate that the competitive gains of Latin American countries in exports of industrialized products are determined, above all, by internal factors, such as taking advantage of economies of scale through the economic growth of the exporting countries, as well as the improvement in freedom of trade and freedom of business.

Negative signs of $DIST_{i,j}$, and $LANGUAGE_{i,j}$, reveal: (i) the more distant the trading partner is from Latin American countries, the less is the $MS\_LA_{i,j,t}$; and (ii) $MS\_LA_{i,j,t}$ is lower when the trading partner country speaks the same language as the Latin American country. This result was expected, Mexico's main trading partners are the United States and Canada, whose main language is English, different from Mexico, where the official language is Spanish. Argentina and Chile carry out foreign sales of their industrialized products, mainly, to countries such as the United States and Brazil. Finally, Brazil also has among its main partners only countries that do not have Portuguese as their main language.

On the other hand, the control variables $EXC_{i,t}^{LA}$, $EXC_{j,t}^{PART}$, $REXC_{i,t}^{LA}$, $REXC_{j,t}^{PART}$, and $BUSI\_FR_{j,t}^{PART}$ were not statistically significant. Except for the exchange rate coefficient of Latin American countries, the variables are related to trade partners. These results suggest that Latin American countries do not take advantage of changes in the trade partner's economies, such as the increase in income, improvement in the business and trade environment. This also accords with our earlier observations, which showed that the competitive gains of LAC-4 countries are more associated with domestic issues. The exception to this analysis occurs in the variable $TRADE\_FR_{j,t}^{PART}$, which is statistically significant in model III, when the LAC-4 countries are considered in aggregate, but the interaction variable is not analyzed.

Table 2 – G2SLS Random Effects IV regression – Robust Standard Errors Adjusted for Clustering on trading partners

Variables	I - G2SLS random-effects IV regression		II - G2SLS random-effects IV regression		III - G2SLS random-effects IV regression		IV - G2SLS random-effects IV regression		V - G2SLS random-effects IV regression		VI - G2SLS random-effects IV regression	
$MS\_LA_{i,j,t}$	Coefficient	z	Coefficient	z	Coefficient	Z	Coefficient	z	Coefficient	z	Coefficient	z
$MANUF_{i,t}$	0.1356068***	4.72	0.1240511***	5.19	0.1394047***	5.00	-0.0079059	-0.28	-0.0139497	-0.66	-0.0144504	-0.48
$MS\_CHINA_{j,t}$	-0.5955013**	-2.54	-0.5325157***	-2.58	-0.0565562***	-3.15	-0.9062292***	-3.56	-0.8700826***	-3.78	-0.0978565***	-4.40
$GDP_{i,t}^{LA}$	0.9579031***	4.69	0.8571538***	4.52	0.9299234 ***	4.55	0.5626285***	3.23	0.4955702***	2.90	0.517927***	3.04
$GDP_{j,t}^{PART}$	-0.2795941	-1.43	-0.3106096*	-1.91	-0.033429	-0.21	-0.2704532	-1.55	-0.3005581**	-2.07	-0.0599459	-0.40
$EXC_{i,t}^{LA}$	0.0695484	0.75	-	-	0.0807249	0.86	0.0181818	0.19	-	-	0.04679	0.49
$EXC_{j,t}^{PART}$	-0.3782412	-1.11	-	-	-0.2619643	-0.76	-0.2531426	-0.75	-	-	-0.142139	-0.41
$REXC_{i,t}^{LA}$	-	-	-0.3553594	-1.36	-	-	-	-	-0.174647	-0.71	-	-
$REXC_{j,t}^{PART}$	-	-	0.0105087	0.02	-	-	-	-	0.018523	0.03	-	-
$TRADE\_FR_{i,t}^{LA}$	1.390809***	5.08	1.437601***	5.05	1.379123***	4.97	0.8893408***	3.45	0.97997***	3.66	0.8300707***	3.11
$TRADE\_FR_{j,t}^{PART}$	0.2671871	1.23	0.4043756	1.62	0.4613499*	1.70	0.0333703	0.19	0.1192023	0.63	0.1920173	0.77
$BUSI\_FR_{i,t}^{LA}$	1.351134***	4.41	1.347161***	4.44	1.376578***	4.34	0.809776***	2.93	0.8156631***	3.03	0.9908048***	3.33
$BUSI\_FR_{j,t}^{PART}$	0.3258515	0.90	0.3292121	0.99	0.4995089	1.43	0.1871408	0.54	0.2023492	0.63	0.3868545	1.19
$GDP_{j,t}^{PART} * MS\_CHINA_{j,t}$	0.0201432**	2.44	0.0176571**	2.41	-	-	0.029931***	3.38	0.0285008***	3.56	-	-
$MS\_CHINA_{j,t} * DU\_ME_{j,t}$	-	-	-	-	-	-	1.212648***	3.56	1.212538***	3.61	0.1287328***	6.09
$GDP_{j,t}^{PART} * MS\_CHINA_{j,t} * DU\_ME_{j,t}$	-	-	-	-	-	-	-0.0394884***	-3.27	-0.0394961***	-3.32	-	-
$DIST_{i,j}$	-3.139056***	-6.21	-3.070151***	-6.55	-2.981737***	-5.93	-3.258633***	-6.10	-3.214123***	-6.33	-3.087043***	-5.90
$CONT_{i,j}$	6.345946***	3.31	6.352563***	3.29	6.476942***	3.36	7.25324***	3.71	7.252541***	3.69	6.925782***	3.58
$LANGUAGE_{i,j}$	-1.523456**	-2.07	-1.702095**	-2.29	-1.605526**	-2.25	-2.1954***	-2.65	-2.323742***	-2.80	-2.098009***	-2.70
$CONSTANT$	-3.216722	-0.48	-0.5770872	-0.07	-12.68119*	-1.64	16.50954**	2.32	17.69509**	1.98	8.004176	1.17
Mean effect $MS\_CHINA_{j,t}$	-0.0550267***	-3.23	-0.0587453***	-2.89	-	-	-	-	-	-	-	-
Mean effect $MS\_CHINA_{j,t}LA$	-	-	-	-	-	-	-0.1031313***	-4.83	-0.1053575***	-4.50	-	-
Mean effect $MS\_CHINA_{j,t}ME$	-	-	-	-	-	-	0.0499763***	3.72	0.0474338***	2.73	-	-
Sargan-Hansen statistic (P-value)	χ^2 (6) 0.6806		χ^2 (6) 0.3233		χ^2 (4) 0.4584		χ^2 (2) 0.3477		χ^2 (2) 0.1031		χ^2 (2) 0.3132	

Notes: (I) z-statistics in the parentheses are computed based on the robust standard errors adjusted for clustering on trading partners. (II) *** p<0,01, ** p<0,05, * p<0,1.

Source: Calculated by the authors using Stata 16.

The variable that measures the influence of manufacturing as a proportion of the GDP of Latin American countries ($MANUF_{i,t}$), was statistically significant in models I, II, and III, which consider the LAC-4 countries together. However, in models IV, V, and VI, which separate the effect in Mexico, the variable did not confirm its statistical significance.

In models I and II[18], the variable of interest corresponds to the interaction between $GDP_{j,t}^{PART} * MS\_CHINA_{j,t}$. It means the size of the trading partner's economy multiplied by China's market share in the country. Our hypothesis is that the effect of Chinese competitiveness on the competitiveness of LAC-4 countries is delimited by the size of the trade partner economy. As a result, the variables $MS\_CHINA_{j,t}$ and $GDP_{j,t}^{PART}$ cannot have their statistical significance assessed in isolation in this proposal. It is necessary to delimit the effect size of the $MS\_CHINA_{j,t}$ by $GDP_{j,t}^{PART}$. Thus, when establishing the average "i" and "t" for $GDP_{j,t}^{PART}$, arrives at the statistic reported in Table 2 and indicated as "Mean effect $MS\_CHINA_{j,t}$". In this sense, when establishing a value of USD 450 billion in purchasing power parity or 26.83 in log for the $GDP_{j,t}^{PART}$, a variation of 1 percentage point in $MS\_CHINA_{i,t}$ leads to an average reduction between 0.055 and 0.059 percentage points in the $MS\_LA_{i,j,t}$. Nevertheless, this relationship changes in accordance with the GDP size of the trade partner (see Figure 1, graphs (A) and (B)).

This particular result suggests that the smaller the size of the economy, the greater the effects of $MS\_CHINA_{j,t}$ on $MS\_LA_{i,j,t}$. In addition, from a value of $GDP_{j,t}^{PART}$ close to 28.40 (for example, Rep. of Korea in 2019), the negative effects of Chinese competitiveness on LAC-4 countries are no longer observed. As matter of fact, in the models I and II, the Chinese competitiveness effect is not statistically significant for thirteen countries[19]: Brazil[20], France, Germany, India, Indonesia, Italy, Japan, Mexico[21], Rep. of Korea, Russian Federation, Turkey, United Kingdom, and United States. Nevertheless, in these trade partners LAC-4 had, in 2019, low market shares in manufacturing goods, except for Mexico in United States. This result reinforces the precarious competitive pattern of industrial exports from Latin American countries.

When observing a value for the $GDP_{j,t}^{PART}$ between 26.40 and 26.90 (in log), an interval that belongs to the average value of the sample of 26.83, we arrive at an estimated average effect between -0.066 to -0.053. When considering the estimated confidence interval for these averages, it can be delimited that trade partners of LAC-4 with $GDP_{j,t}^{PART}$ in the range above, have a statistically similar effect. Among the countries presenting the $GDP_{j,t}^{PART}$ in this stratum it is possible to highlight Chile[22], Czechia, Denmark, Greece, Hungary, Ireland, Israel, Norway, Peru, and Portugal.

However, the results of the models I and II shows the effect of the interaction variable ($GDP_{j,t}^{PART} * MS\_CHINA_{j,t}$) in general for the four countries in the analysis, Argentina, Brazil, Chile, and Mexico. With that, we have new topics to evaluate, especially in relation to two elements: (i) commercial relationship between the Mexican and United States; and (ii) significant presence of multinationals that use Mexico as an export platform. Thus, models IV and V, which isolate the effect on Mexico's market share from the other countries in the analysis (Argentina, Brazil, and Chile), aim to present results that assess the existence of a distinct pattern.

In models IV and V, the variable of interest corresponds to the interaction between $GDP_{j,t}^{PART} * MS\_CHINA_{j,t} * DU\_ME_{j,t}$. That is, the size of the trading partner's economy multiplied by China's market share in the country and by the dummy Mexico. This last variable establishes the interaction of the China effect only in the pairs that contemplate the relationship with Mexico. The hypothesis that motivates the analysis stems from the mentioned elements, in particular, the commercial relationship between Mexico and the United States. Consequently, in these models, the effect in Mexico is limited by the variables that

[18] The differences between these two models are in the nominal or real exchange rate, being representative for all countries in the sample.

[19] See Appendix B for information on the GDP of trading partners on a logarithmic scale.

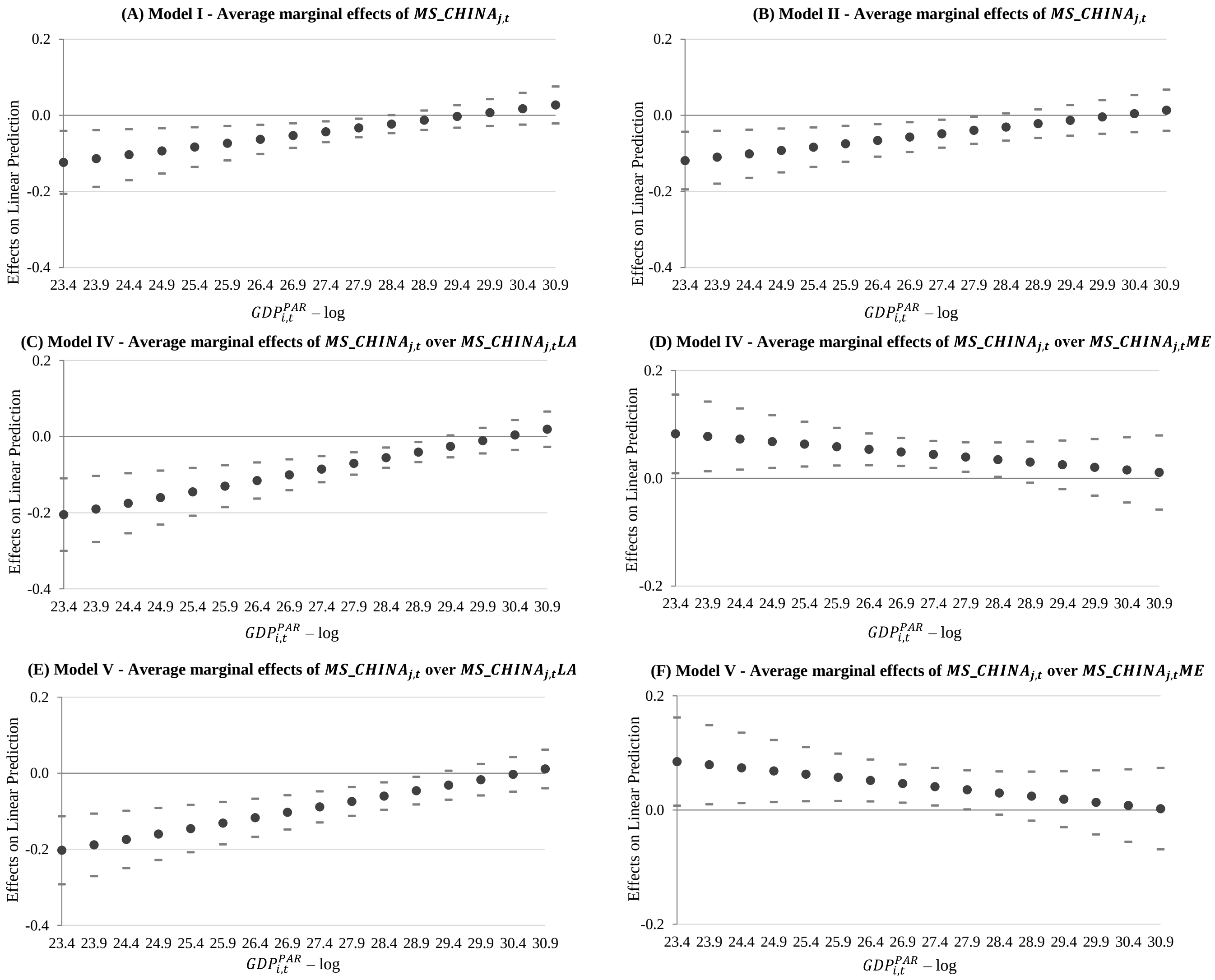
[20] Brazil is a partner of Argentina, Chile, and Mexico.

[21] Mexico is a partner of Argentina, Brazil, and Chile.

[22] Chile is a partner of Argentina, Brazil, and Mexico.

interact with $DU\_ME_{j,t}$, and the effect on the other Latin American countries are the control. As in models I and II, the effects of $MS\_CHINA_{j,t}$ on the market share of the controlling group (Brazil, Chile, and Argentina) and Mexico is influenced by the $GDP_{j,t}^{PART}$. In this sense, when establishing a value of 26.83 in log for the $GDP_{j,t}^{PART}$, a variation of 1 percentage point in $MS\_CHINA_{i,t}$ leads to an average increase between 0.047 (model V) and 0.050 (model IV) percentage points in the Mexico market share (Mean effect $MS\_CHINA_{j,t}ME$). At the same time, the coefficient of the Mean effect $MS\_CHINA_{j,t}LA$ remains negative, where the estimated effect is significantly greater vis a vis models I and II. This confirms the hypothesis that the effect of $MS\_CHINA_{j,t}$ on Mexico changes according to the size of the partner's economy and, at the same time, goes in the opposite direction to the general result of models I and II. For Mexico, the effect is a gain in participation, this result is shown in Figure 1, graphs (D) and (F).

Figure 1 – Average marginal effects, 95% Confidence Interval



Source: elaborated by the authors through the software Stata 16.

With this, it is possible to establish that the smaller the size of the economy, the greater the positive effects of the $MS\_CHINA_{j,t}$ on Mexico's market share. In addition, from a value of $GDP_{j,t}^{PART}$ close to 28.90 in log (model IV) and 28.40 in log (model V), the effects of Chinese competitiveness on Mexico competitiveness are no longer observed. As matter of fact, considering the GDP in 2019, in the model IV the result is applicable to Germany, India, Japan, Russian Federation, and the United States. In model V, it is applicable to twelve countries: Brazil, France, Germany, India, Indonesia, Italy, Japan, Rep. of Korea, Russian Federation, Turkey, United Kingdom, and the United States. In these countries, except for the United States, Mexico's market share was less than 4.0% in 2019. Still considering the $GDP_{j,t}^{PART}$ in 2019, it is noted that the greatest positive effects of China's market share on Mexico's share occurred in Central American countries (Costa Rica, El Salvador, Guatemala, and Nicaragua) and in Latin America (Bolivia, Paraguay, and Uruguay), such countries have a value of $GDP_{j,t}^{PART}$ between 23.40 and 25.90 (in log).

Finally, graphs (C) and (E) in Figure 1 show the effect on the other Latin American countries, Argentina, Brazil, and Chile, considering models IV and V. It is observed that the impact is similar to that of verified in models I and II through graphs (A) and (B), but the negative effect is even more pronounced. Thus, the average value for $GDP_{j,t}^{PART}$ is 26.83, establishing that a 1 percentage point change in $MS\_CHINA_{j,t}$ leads to an average decrease between 0.103 (model IV) and 0.105 (model V) percentage points in the South American countries (Argentina, Brazil, and Chile) market share. This confirms the hypothesis that the effect of $MS\_CHINA_{j,t}$ on the control group (Argentina, Brazil, and Chile) changes according to the size of the partner's economy and, more pronounced than the general result of models I and II, which contain the Mexico effect.

From the results it is possible to establish that the smaller the size of the economy, the greater the negative effects of the $MS\_CHINA_{j,t}$ on the market share of the control group. In addition, from a value of $GDP_{j,t}^{PART}$ close to 29.40, the negative effects of Chinese competitiveness on South American countries are no longer observed. This value is higher than that observed in models I and II (28.40), which include Mexico. Therefore, considering the 2019 GDP, Argentina, Brazil, and Chile do not see losses due to Chinese competitiveness only in the United States and India.

The biggest losses for Argentina, Brazil, and Chile market shares with the impact of the $MS\_CHINA_{j,t}$ are countries in Central and South America. In this sense, economies such as Paraguay, Uruguay and Argentina are examples, in which Brazil has a market share of more than 20.0%. Paraguay and Uruguay, along with Brazil, are among the most important industrialized product partners for Argentina. Chile, in turn, also has its largest market shares in industrialized products also in South American countries, all with GDP in the strata negatively affected by the gains in market share from China.

Finally, models III and VI, which do not consider the interaction between GDP and China's market share, also confirm what has already been exposed by the other models. In the model III, the variable of interest, the $MS\_CHINA_{j,t}$, had a negative sign and was statistically significant, as well as models I and II. In the model VI, the variables of interest are $MS\_CHINA_{j,t}$, regarding the effect on Argentina, Brazil, and Chile together, and $MS\_CHINA_{j,t} * DU\_ME_{j,t}$, regarding the impact on the market share of Mexico. In that sense, the $MS\_CHINA_{j,t}$, once again had a negative sign and was statistically significant, and the $MS\_CHINA_{j,t} * DU\_ME_{j,t}$, had a positive sign and was statistically significant, both corroborate the results found in models IV and V.

6. Summary and Conclusion

This paper investigated the relationship between Latin America and the Caribbean selected countries' exports of manufactured products and China's increased international competitiveness. We begin from the observation that the LAC-4 economies' lack of dynamism and competitiveness in global markets, particularly when it comes to the production and exportation of manufactured goods, has coincided with China's rise as a global powerhouse. This is why we have evaluated if an increase in China´s market share in a third country's market is associated with an increase or a decrease of LAC-4's market share. We have tested if market share gains from Chinese manufacturing exports have affected those countries' competitive positioning in exports of manufactured products to some selected countries.

Our main results suggest that the effect of Chinese competitiveness on the competitiveness of Latin American countries is limited by the size of the partner economy. Models I and II establish that the negative effect of China's market share on the share of the LAC-4 countries is greater in countries with lower GDP. A similar result, however, characterizing even more accentuated losses, is observed in models IV and V, when the effect on Argentina, Brazil, and Chile is isolated. Finally, also in models IV and V, however, when particularizing the effect on Mexico's market share, a different pattern is observed: the smaller the size of the economy, the greater the positive effects. Thus, the analysis of models IV and V confirm the hypothesis that Mexico is affected by Chinese competitiveness in a different way from Argentina, Brazil, and Chile.

To the best of our knowledge, our research offers fresh evidence that adds to the previous empirical efforts that try to explain how China´s rise as a global powerhouse has affected other countries' economic performance focusing on the LAC. As usual, the evidence provided here is contingent upon the empirical methodology, timeframe, and sample. In our exercise we have not converged integrally with the standard "gravity equation" used in the displacement effect literature. Since the objective of the exercise is associated with the competitiveness effect, measured by market share. Instead, we have chosen control variables that combine the gravity model concerns with the relationship between size and trade with variables associated with the international trade literature. Therefore, our evidence cannot be compared without a proper qualification. Future research can help improve our conclusions by dealing with related problems, alternative methodologies, and datasets.

References

Arellano, M. 2003. ***Panel data econometrics***. Oxford: Oxford University Press, 2003.

Athukorala, P. C. The Rise of China and East Asian Export Performance: Is the Crowding-Out Fear Warranted? ***The World Economy***, v. 32, 234-266, 2009.

Bajo, O. ***Teorías del comercio internacional***. Barcelona: Antoni Bosh editor S.A., 1991.

Baltagi, B. H. 2013. ***Econometric analysis of panel data***. 5th ed. England: John Wiley & Sons.

Baum, C. F., Schaffer, M. E., & Stillman, S. (2003). Instrumental variables and GMM: Estimation and testing. ***The Stata Journal***, 3(1), 1-31.

Cho, D.; Moon, H. ***From Adam Smith to Michael Porter*****:** evolution of competitiveness theory. Singapore: World Scientific, 2000.

Dosi, G; Pavitt, K.; Soete, L. ***The economics of technical change and international trade***. New York: New York University Press, 1990.

Drukker, D. M. Testing for serial correlation in linear panel-data models. ***The Stata Journal***, 3(2), 168-177, 2003.

Durán Lima, J. E., & Pellandra, A. La irrupción de China y su impacto sobre la estructura productiva y comercial en América Latina y el Caribe. ***Naciones Unidas Comisión Económica para América Latina y el Caribe*** (CEPAL), 2017.

Eichengreen, B. et al. China and the Exports of Other Asian Countries, ***Review of World Economics***, 143 (2), 201-226, 2007.

Euromonitor. Euromonitor International. http://www.portal.euromonitor.com/portal/, access on March 2020).

Ferraz, J. C., Kupfer, D., & Haguenauer, L. ***Made in Brazil***: desafios competitivos para a indústria. *Rio de janeiro: Campus*, 386 p., 1995

Franke, L. et al. The Impact of Chinese Exports on Brazilian and Mexican Exports: A Model Using Dynamic Panel Data. ***Emerging Markets Finance and Trade***, 1-17, 2019.

Gandolfo, G. ***International Economics I*****:** the pure theory of international trade. 2 ed. Berlin: Springer-Verlag, 1994.

Giovannetti, G. et al. The 'China Effect' on EU Exports to OECD Markets: A Focus on Italy, in Gomel, G., et al. (eds.). ***The Chinese Economy: Recent Trends and Policy Issues***. Berlin, Springer, 2013.

Greenaway, D. et al. Has China displaced other Asian countries' exports? ***China Economic Review***, 19(2), 152-169, 2008.

Grimwade, N. ***International trade*****:** new patterns of trade, production and investment. 2. ed. London and New York: Routledge, 2000.

Guerrieri, P., ***Technology and international trade performance in the most advanced countries***. Berkeley: BRIE, University of California. (Working Paper, n. 49), 1991.

Guerrieri, P., ***Trade patterns, FDI, and industrial restructuring of Central and Eastern Europe***. UC Berkeley, (Working paper) n. 124, 1998.

Harris, R. D., & Tzavalis, E. (1999). Inference for unit roots in dynamic panels where the time dimension is fixed. ***Journal of econometrics***, 91(2), 201-226.
Hayashi, F. ***Econometrics***, Princeton University Press, 2000.
Heckscher, A. C. Factor Price Relations under Free Trade. ***Ekonomisk Tidskrift***, Vol. 21, pp. 497–512, 1919
Hosny, A. S. Theories of economic integration: a survey of the economic and political literature. ***International Journal of Economy***, Management and Social Sciences, v. 2, n. 5, p. 133-155, 2013.
Hsiao, C. 2014. ***Analysis of Panel Data***. 3rd ed. Cambridge: Cambridge University Press, 2014.
Im, K. S., Pesaran, M. H., & Shin, Y. Testing for unit roots in heterogeneous panels. ***Journal of econometrics***, 115(1), 53-74, 2003.
IMF. ***World Economic Outlook***, April. Washington, DC: International Monetary Fund, 2022.
Jones, R. W. Factor Proportions and the Heckscher-Ohlin Theorem. ***The Review of Economic Studies***, v. 24, n. 1, p. 1-10, 1956.
Jones, R. W; Neary, J. Peter; The Positive Theory of International Trade. In: JONES, R. W; KENEN, P. B. ***Handbook of International Economics*****:** Volume 1. Amsterdam: North-Holland, 1984.
Kao, C. "Spurious regression and residual-based tests for cointegration in panel data". ***Journal Econometrics***, v. 90, p. 1-44, 1999.
Kemp, M. C. An Essay on Trade and Transformation by S. B. Linder. ***The Economic Journal***, v. 75, n. 297, p. 200-201, 1965.
Krugman, P. Increasing Returns, Imperfect Competition and the Positive Theory. In: Grossman, G. M.; Rogoff, K. ***Handbook of International Economic***: Volume 3. Amsterdam: North-Holland, 1984.
Krugman, P. Increasing returns, monopolistic competition, and international trade. ***Journal of International Economics***, v. 9, p. 469-479, 1979.
Krugman, P. Intraindustry specialization and the gains from trade. ***Journal of Political Economy***, v. 89, n. 5, p 959-973, 1981.
Krugman, P. Making sense of the competitiveness. ***Oxford Review of Economic Policy***, v. 12, n. 3, p. 7-12, 1988.
Lancaster, K. Intra-industry trade under perfect monopolistic competition. ***Journal of International Economics***, v. 10, n. 2, p. 151-175, 1980.
LEAMER, E.; LEVINSOHN, J. International trade theory: the evidence. In**: *Handbook of international economics***. Elsevier Science, v. 3, p. 1339-1394, 1995.
Leontief, W. Domestic produtction and foreign trade: the American capital position reexamined. ***American Philosophical Society***, v. 97, n. 4, p. 332-349, February 1953.
Lerner, A. P. Factor Price and International Trade. ***Economia***, V. 19, n. 73, p. 1-15, 195, 1952.
Levin, A., Lin, C. F., & Chu, C. S. J. Unit root tests in panel data: asymptotic and finite-sample properties. ***Journal of econometrics***, 108(1), 1-24, 2002.
Lin, Y. Post-crisis China impact on trade integration and manufacturing competitiveness between Argentina and Brazil. ***Journal of Chinese Economic and Business Studies***, *16*(2), 147-170, 2018.
Linder, S. B. ***An Essay on Trade and Transformation*****.** Stockholm - Göteborg - Uppsala - New York, 1961.
Marrewijk, C. V**. *International trade & the world economy***. New York: Oxford University Press, 2002.
Martin, L. L. ***The Oxford handbook of the political economy of international trade***. New York: Oxford University Press, 2015.
Medeiros, C. A. D., & Cintra, M. R. V. P. Impacto da ascensão chinesa sobre os países latino-americanos. ***Brazilian Journal of Political Economy***, *35*(1), 28-42, 2015.
Módolo, D. B., & Hiratuka, C. The impact of Chinese competition on third markets: An analysis by region and technological category. ***Development Policy Review***, *35*(6), 797-821, 2017.
Morgan R. E.: Katsikeas C. S. Theories of international trade, foreign direct investment and firm internationalization: a critique. ***Management Decision***, v. 35, n. 1, p. 68-78, 1997.
Ohlin, B. ***Interregional and International Trade***. Cambridge: Harvard University Press, 1933
Pavitt, K. "Sectoral patterns of technical change: towards a taxonomy and a theory". ***Research Policy***, v. 13, p. 343-373, 1984.
Porter, M.E. ***The competitive advantage of nations***. New York: The Free Press, 1990.

Qian, X., Rafique, K., & Wu, Y. Flying with the Dragon: Estimating Developing Countries' Gains from China's Imports. ***China & World Economy***, *28*(5), 1-25, 2020.
Ricardo, D. ***On The Principles of Political Economy and Taxation***. London: J. McCreery, 1817.
Rivera-Batiz, L. A; Oliva M. A. ***International Trade*: **theory, strategies and evidence. New York; Oxford Press, 2003
Rodrik, D. What's so special about China's exports? ***China & World Economy***, v. 14, n. 5, p. 1-19, 2006.
Rybczynski, T. M. Factor Endowments and Relative Commodity Prices. ***Economica***, v. 22, n. 88, p. 336-341. 1955.
Samuelson, P. A. International Factor-Price Equalization Once Again. ***The Economic Journal***, v. 58, n. 234, p. 181-197, 1949.
Samuelson, P. A. International Trade and the Equalisation of Factor Price. ***The Economic Journal***, v. 58, n. 230, p. 163-184, 1948.
Silva, G. D., Gomes, M. F. M., & Teixeira, E. C. (2018). Efecto derrame del crecimiento de China en América del Sur: un análisis basado en el comercio internacional. ***Revista CEPAL***.
Smith, A. ***An Inquiry into the Nature and Causes of the Wealth of Nations***. London: W. Strahan and T. Cadell, 1776.
Stolper, W; Samuelson, P. A. Protection and Real Wages. ***Review of Economic Studies***, v. 9, n. 1, p. 58-73, 1941.
UN COMTRADE. ***United Nations Commodity Trade Statistics Database***. Available at: <http://comtrade.un.org/db/>. Access on March 2022.
United Nations. ***National Accounts - Analysis of Main Aggregates***. New York, United Nations (https://unstats.un.org/unsd/snaama/Downloads, access on March, 2022.
Vernon, R. Investimento externo e comércio internacional no ciclo do produto. In: SAVASINI, J. A. A.: Malan, P. S.: Baer W. ***Economia Internacional***. São Paulo: Saraiva, 1970.
Vernon, R. The product cycle hypothesis in a new international environment. ***Oxford Bulletin of Economics and Statistics*,** v. 41, n. 4, p. 255-267, 1979.
Wooldridge, J. M. ***Econometric analysis of cross section and panel data***. Cambridge: Massachusetts Institute of Technology Press, 2002.
Wooldridge, J. M. ***Econometric Analysis of Cross Section and Panel Data***. 2. ed. Cambridge: The MIT Press, 2010.
World Bank. ***Global Value Chain Development Report 2017***. Washington, DC: Th World Bank, 2017.
World Bank. ***World Bank Open Data***. Washington, DC, 2022. (https://data.worldbank.org, access on March 2022).

APPENDIX A – Selected Indicators – China, Argentina, Brazil, Chile and Mexico, 1970-2021

GDP per capita - USD PPP

	1980s	1990s	2000s	2010s	2021
Argentina	15,767	17,972	19,991	**23,193**	**21,478**
Brazil	10,872	11,200	13,023	**15,058**	**17,710**
Chile	8,287	13,075	18,292	**23,173**	**24,316**
Mexico	14,898	16,141	17,877	**19,218**	**18,820**
China	1,071	2,468	5,51	**12,989**	**17,531**

GDP - PPP Share (World = 100%)

	1980s	1990s	2000s	2010s	2021
Argentina	1.05	0.92	**0.78**	**0.79**	**0.72**
Brazil	3.95	3.31	**3.05**	**2.70**	**2.35**
Chile	0.26	0.33	**0.34**	**0.36**	**0.35**
Mexico	2.88	2.52	**2.22**	**1.99**	**1.84**
China	3.34	5.83	**10.32**	**16.18**	**18.78**

Merchandise Exports - Market-Share (World = 100%)

	1970s	1980s	1990s	2000s	2010s
Argentina	0.48	0.38	0.40	**0.41**	**0.36**
Brazil	1.01	1.17	0.91	**1.10**	**1.22**
Chile	0.23	0.22	0.28	**0.39**	**0.39**
Mexico	0.48	1.26	1.75	**2.08**	**2.19**
China	0.86	1.48	2.89	**7.38**	**12.5**

Manufactured Goods Exports - Market-Share (World = 100%)

	1970s	1980s	1990s	2000s	2010s
Argentina	0.21	0.13	0.15	**0.18**	**0.17**
Brazil	0.48	0.82	0.76	**0.77**	**0.68**
Chile	0.03	0.02	0.06	**0.08**	**0.09**
Mexico	0.23	0.25	0.40	**1.75**	**2.50**
China	0.00	0.42	2.85	**9.25**	**18.01**

Source: elaborated by the authors using World Bank (2022) and IMF (2022).

APPENDIX B – Market share in industrialized goods from Argentina, Brazil, Chile, Mexico and China in the selected countries in 2019 and log of GDP from trade partner

Trade partner	Argentina's market share in 2019 (%)	Brazil's market share in 2019 (%)	Chile's market share in 2019 (%)	Mexico's market share in 2019 (%)	China's market share in 2019 (%)	Log - GPD Trade Partner
Argentina	-	23,04	0,68	2,80	22,62	22,62
Australia	0,07	0,26	0,03	1,15	30,94	27,93
Austria	0,03	0,08	0,00	0,27	7,61	26,98
Belgium	0,01	0,34	0,04	1,03	3,59	27,16
Bolivia	5,02	17,69	1,45	3,41	29,38	25,37
Brazil	5,29	-	0,97	3,71	25,42	28,81
Canada	0,13	0,88	0,14	6,89	15,32	28,29
Chile	2,14	5,96	-	3,60	33,22	26,89
Colombia	1,48	6,89	0,51	9,16	27,53	27,37
Costa Rica	0,76	2,57	0,51	7,59	17,61	25,39
Czechia	0,02	0,11	0,00	0,57	18,40	26,84
Denmark	0,01	0,06	0,02	0,14	9,64	26,58
Dominican Rep.	0,76	3,52	0,14	5,11	23,66	26,05
Ecuador	1,06	5,79	1,28	4,50	27,94	26,05
Egypt	0,05	0,34	0,01	0,29	24,71	27,84
El Salvador	0,78	1,49	0,13	10,55	22,20	24,80
Finland	0,00	0,18	0,01	0,68	11,73	26,36
France	0,02	0,20	0,14	0,49	11,95	28,80
Germany	0,05	0,24	0,02	1,05	12,96	29,17
Greece	0,00	0,06	0,13	0,09	13,86	26,53
Guatemala	0,94	1,84	0,25	12,60	16,45	25,73
Hungary	0,01	0,11	0,00	0,27	7,65	26,54
India	0,12	0,45	0,05	0,44	24,08	29,89
Indonesia	0,01	0,49	0,04	0,21	34,37	28,83
Ireland	0,14	0,06	0,00	0,52	6,98	26,84
Israel	0,01	0,21	0,01	0,74	17,98	26,66
Italy	0,03	0,36	0,11	0,25	10,02	28,61
Japan	0,02	0,23	0,03	0,94	35,46	29,34
Kazakhstan	0,01	0,68	0,01	0,20	19,05	26,95
Malaysia	0,01	0,15	0,01	0,27	24,34	27,57
Mexico	0,09	0,94	0,10	-	22,69	28,60
Morocco	0,02	0,11	0,00	0,32	13,69	26,40
Netherlands	0,01	0,14	0,02	0,41	13,75	27,66
New Zealand	0,03	0,18	0,06	0,82	25,73	26,11
Nicaragua	0,89	1,05	0,16	12,39	18,70	24,33
Norway	0,03	0,99	0,01	0,38	12,68	26,59
Paraguay	6,53	21,71	4,01	1,39	19,67	25,26
Peru	1,84	6,93	2,49	5,76	33,82	26,81
Philippines	0,01	0,08	0,01	0,20	25,03	27,63
Poland	0,03	0,31	0,00	0,34	15,80	27,90
Portugal	0,03	0,38	0,01	0,12	4,81	26,65
Rep. of Korea	0,01	0,23	0,38	0,70	31,31	28,47
Romania	0,02	0,04	0,00	0,16	6,50	27,13
Russia	0,02	0,33	0,03	0,50	25,11	29,06
Saudi Arabia	0,10	0,25	0,00	0,85	23,90	28,15
Singapore	0,01	0,15	0,00	0,90	15,39	27,09
Slovakia	0,05	0,05	0,00	0,21	7,57	25,95
Slovenia	0,13	0,12	0,02	0,24	7,17	25,17
South Africa	0,20	0,90	0,03	0,83	26,99	27,36
Spain	0,05	0,26	0,10	0,44	12,30	28,33
Sweden	0,03	0,13	0,01	0,12	8,54	27,07
Switzerland	0,70	0,43	0,30	0,34	5,94	27,18
Thailand	0,10	0,25	0,11	0,43	26,19	27,92
Turkey	0,03	0,44	0,08	0,36	12,60	28,54
Ukraine	0,04	0,24	0,01	0,36	22,69	27,05
United Kingdom	0,01	0,27	0,01	0,57	11,84	28,81
Uruguay	10,04	20,29	0,77	3,46	27,87	25,14
USA	0,09	0,82	0,21	15,64	22,95	30,70
Vietnam	0,03	0,18	0,04	0,29	34,81	27,65

Source: elaborated by the authors using UN Comtrade (2022) and World Bank (2022).

APPENDIX C – Results of Statistical Tests

This section presents and discusses the estimated results for the econometric model proposed in this paper. Table B.1 offers the Hausman Test (Robust), Wooldridge autocorrelation tests[23] and the heteroscedasticity likelihood-ratio test. It is observed that the Hausman test establishes fixed effect models, while the Hausman Robusto test defines random effect models. In this sense, we decided to use G2SLS estimator. Since the likelihood ratio test (indicated for random effect models) establishes heteroscedasticity, and the Wooldridge test, the presence of autocorrelation, we estimated the robust residues clustered by trading partners.

Table B.1 – Fixed vs Random Effects, Autocorrelation, and Heteroskedastic tests

Test/Model	(I)	(II)	(III)	(IV)	(V)	(VI)
Hausman Test - Fixed vs Random Effects - Robust	χ^2 (11)	χ^2 (11)	χ^2 (10)	χ^2 (13)	χ^2 (13)	χ^2 (11)
	10.10	12.50	8.95	12.62	15.47	9.67
Wooldridge test	F (1, 231)	F (1, 231)	F (1, 231)	F (1, 231)	F (1, 231)	F (1, 231)
	44.779***	44.932***	44.865***	44.588***	44.724***	45.402***
Likelihood-ratio test – Heteroskedastic test for Random Effect	χ^2 (180)	χ^2 (180)	χ^2 (180)	χ^2 (180)	χ^2 (180)	χ^2 (180)
	22243.58***	21932.83***	22244.43***	22637.90***	22491.74***	22669.53***

Note: (I) *** p<0,01, ** p<0,05, * p<0,1.

Source: Calculated by the authors using Stata 16

[23] For details, see Wooldridge (2002) and Drukker (2003).