China's Structural Change and Brazil's Manufacturing Exports

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Abstract: This paper analyses how Chinese increased trade openness and international competitiveness have affected Brazil´s export performance. This line of investigation converges, to a certain extent, to the literature on the so-called Chinese exports displacement effect. By using an alternative empirical framework we were able to conclude that: (i) Brazilian exporters did not take advantage of "economies of scale" offered by the country's internal market; and (ii) China´s market share increases in third countries were associated to decreases in Brazil´s share. Nevertheless, this later relationship is nonlinear. The main policy implication of our result is that China competitiveness improvements cannot be blamed as the only cause, or even as the main determinant, of Brazil's long-term relative decline in global markets. This should be considered because, even though Brazil's industrial decline has been mostly result of its own doing, the goal of becoming an industrialized country continuous to be a much cherished one. Thus, a trade pattern where Brazil seems to be scarifying its industrial sector in favour of its primary exports becomes a very sensitive issue to the bilateral relationship.
Key Words: Chinese Exports; Manufactured products; Brazil; Displacement Effect.

Resumo: Este artigo analisa como a competitividade internacional da China afetou o desempenho das exportações brasileiras. Essa linha de pesquisa converge, em certa medida, com a literatura sobre o chamado efeito deslocamento das exportações chinesas. Usando uma estrutura empírica de dados em painel, pudemos concluir que: (i) os exportadores brasileiros não aproveitaram os ganhos de economias de escala oferecidas pelo mercado interno do país; e (ii) os aumentos de participação de mercado da China em terceiros países foram associados a reduções de participação do Brasil. No entanto, esse relacionamento posterior não é linear. A principal implicação política dos resultados observados é que as melhorias na competitividade da China não podem ser responsabilizadas como a única causa, ou mesmo o principal determinante, do declínio relativo de longo prazo do Brasil nos mercados globais. Isso deve ser considerado porque, embora o declínio industrial do Brasil tenha sido resultado principalmente de sua própria iniciativa, o objetivo de se tornar um país industrializado continua sendo muito almejado. Assim, um padrão comercial em que o Brasil parece estar preterindo seu setor industrial em favor de suas exportações primárias torna-se uma questão muito sensível à relação bilateral.
Palavras-Chave: Exportações chinesas; Produtos manufaturados; Brasil; Efeito deslocamento.

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1. Introduction

In the late 1970s and early 1980s, Brazil had outpaced China in terms of economic strength. While the South American country accounted for 3.0% (in constant prices) to 4.5% (in international PPP adjusted prices) of global GDP, Asia's giant represented half as much. In terms of merchandise exports both economies had 1.4% of the world's total. GDP per capita in Brazil reached USD 6,000 in 2015 prices (or 18% of the United States' GDP per capita) against the USD 500 that China had (2% of the United States' figure). Since then, China's impressive process of rapid economic growth, technological modernization and integration into the global trade and production networks has radically changed this picture. In the last decades, particularly since early 2000s, China has become a global economic superpower, while Brazil has stagnated or even declined in terms of its relative global position.

The Brazilian economy long term economic decline is expressed, among other things, in its poor performance in international trade, particularly considering exports of manufactured goods. This fact has been recognized by different analytical views in economics (Unctad, 2016; Rodrik, 2016; Spilimbergo and Srinivasan, 2019; Bresser-Pereira et al. 2020; Nassif and Castilhos, 2020). There is, of course, no consensus on the determinants of Brazil's lack of dynamism in the global markets. However, it is possible to suggest that its market share decline has coincided temporarily with China's rise.

In this context, this paper analyses how Chinese increased trade openness and international competitiveness have affected Brazil´s export performance. We investigate if China's exports of manufactured goods have displaced Brazilian global sales of those kinds of products to some selected countries. More specifically, we are interested in evaluating if an increase in China´s market share in a third country's market is associated with an increase or a decrease of Brazil´s market share.

Previous works on the displacement effect of Chinese exports (Eichengreen *et al*., 2007; Greenaway *et al*., 2008; Amann *et al*., 2009; Athukorala, 2009; Kong and Kneller, 2016; Mau, 2019) usually apply panel data econometrics and modified versions of the so-called "gravity model" to test if exports from China displaced other countries exports to third markets. We have followed this strategy, but focused on the analysis of market-share and not on the level of exports. Additionally, we have focused on the relationship between Brazil and China, which has not been fully explored so far. The literature reviewed emphasizes the relations between China and other economies, particularly the Asian ones. When comes to the Latin American countries, the Brazilian case is not so fully considered in its specificities, with the important exceptions of Jenkins (2014) and Módolo and Hiratuka (2017). Consequently, there is room to study further an economy that is one of the ten largest in the world and represents one third of the Latin American GDP.

To the best of our knowledge, this research offers potentially original 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, on the one hand; and to shed light on the Brazil's falling behind dynamics, on the other hand. In order to achieve our goals, we begin with a brief literature review on this particular topic (section 2). Following, section 3 presents our methodological framework. Section 4 shows the results of our exercises. Finally, we sum up our considerations.

2. Literature Review

2.1 China's and Brazil's Structural Change in the Globalization Era

Since the late 1970s, under the umbrella of Deng Xiaoping's strategy of reforms and economic opening (Zheng Bijian, 2005; Kissinger, 2011; Naughton, 2018; Shambaugh, 2020), China has been re-emerging as a global power. Its rapid economic growth and internationalization process ended with China in 2018 being responsible for 11% of global trade of goods and services,

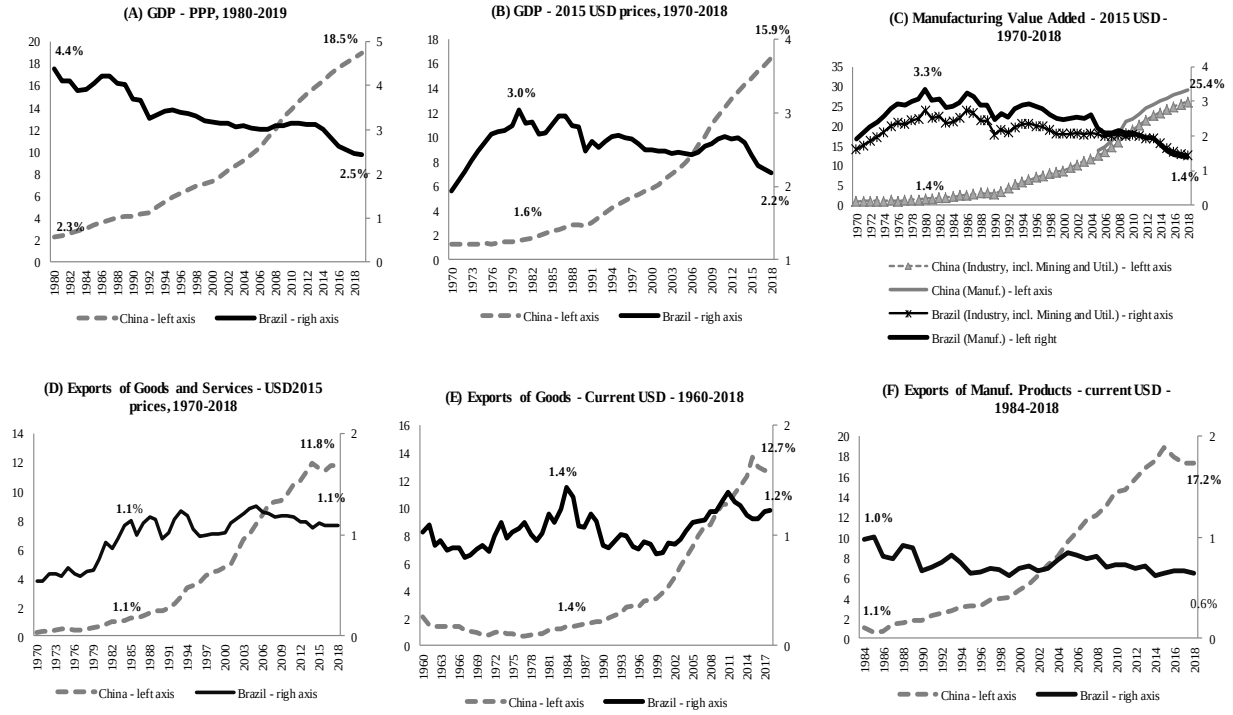
15% of the world's GDP measured at market prices, and 18% of the world's GDP measured using purchasing-power-parity (IMF, 2019b). The Asian superpower has also become an important player in global financial markets, holding at the end of 2018, USD 3,168 billion in foreign exchange reserves and USD 1,939 billion in foreign direct investment (FDI) abroad. The country is the world's third largest net creditor after Japan and Germany. Its net international investment position at the end of 2018 was USD 2,130 billion. This amount is equivalent to 2.5 of the world's GDP (IMF, 2019a, 2019b, Unctad, 2019).

As argued by Kissinger (2011), Gallagher (2016), Allison (2017) and Jenkins (2019), China might still be a middle-income economy, but it is no longer a weak country. On the contrary, its companies have been reducing their technological gaps in comparison to Western counterparts and, in some areas, are even ahead (USCC, 2019; World Bank, 2019). 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 (Eclac, 2018; Unctad, 2016, 2019a). In 2018, Asia's emerging and developing countries shares in world population, income and trade of goods and services were, respectively, 48%, 33% and 18%[1].

To put it in perspective, in the early 1980s, Latin America accounted for 8% of the world's GDP (measured in constant prices), while Asia's share (excluding Japan and other high-income countries) was 3%. Nearly four decades later, Latin America had 6.5% and Asia, 16%. During this period, Asian emerging and developing countries averaged a GDP growth of 7.9% per year, while Latin American countries experienced much lower rates, between 2% to 3% (World Bank, 2020).

China's rapid modernization markedly contrasts with Latin American and Brazilian semi-stagnation. Figure 1 compares Brazil and China in terms of GDP (PPP and constant prices), manufacturing value added, and international trade in goods and services, particularly manufactured goods exports.

Figure 1- Brazil and China in the World Economy, 1960-2019 (World's total = 100%)



Source: Authors' elaboration based on IMF (2019b), United Nations (2020) and World Bank (2020).

[1] By adding Japan, Korea, Singapore, Hong Kong and Taiwan those figures would increase to half of the World's GDP and population and 1/3 of global goods and services' trade (IMF, 2019b; World Bank, 2020).

Figure 1 reveals that up to the early 1980s, Brazil was a well-succeeded emerging economy forging ahead China in global economy. Since then, Brazil has fallen behind, while China has boomed. The Asian giant has experienced impressive records in capital accumulation and productivity improvements measured both by labor productivity and total factor productivity (World Bank, 2019; Unctad, 2019; Unido, 2019). Let us take GDP per capita as a broad measure of these dynamics. In early 1980s, Brazil´s per capita GDP was ten to fifteen times bigger than the Chinese one, depending on the type of measurement (constant USD or PPP). Four decades later, Chinese income per capita outpaced Brazil's in at least 30%.

China has massively invested in productive capabilities and technology. Consequently, this ancient civilization has been catching up with its international peers. For instance, China has invested, on average, 43% of its GDP since the early 2000s. In the same period Latin American economies have invested 18% of their GDP. In 2018, China's gross fixed capital formation reached USD 5,020 billion, while all Latin American economies invested only USD 1,013 billion. China´s investment in 2018 was equivalent to eleven years of cumulative investment in Brazil[2]. Moreover, China's investment per worker evolved from USD 594 in 1995 to USD 6,288 in 2018, while Brazilian figures were, respectively, USD 4,049 and USD 3,829 (World Bank, 2020).

As a result of its investments in capital stock, human resources and technology, and its development strategy, China has become the world's largest manufacturing powerhouse. Chinese manufacturing sector produced USD 3,884 billion in 2018, more than three times the production (USD 770 billion) observed in all Latin America (United Nations, 2020). China has surpassed Latin America in research and development expenditures as a share of GDP. Between 2010 and 2018, Chinese technology outlays averaged 2.1% of its GDP, while Latin American countries had in averaged 0.7% and high-income countries 2.4% (World Bank, 2020).

China's presence in global markets has become a major source of its dynamism, deeply affecting trade and financial channels in both advanced and emerging economies (IMF, 2019a; World Bank, 2019; Shambaugh, 2020). This also indicates that China's rise has not been perceived as neutral in a geopolitical sense (Kissinger, 2011; Allison, 2017; Mearsheimer, 2018; Rosales, 2020). Since its accession on the World Trade Organization, in 2001, China has become a major partner for most countries in Latin America (Eclac, 2018; Jenkins, 2019; Stallings, 2020). Trade and FDI have boomed and China's demand for raw materials has represented an important source of dynamism for countries rich in natural resources, particularly in South America.

Studies about the impacts of China's rise on Latin America can be divided into, at least, three different perspectives[3]. The optimistic view stresses that China's pattern of development and internationalization increases export revenues for countries rich in natural resources, particularly being the case during the *commodities* prices' surge from 2003 to 2014. The rise in terms of trade helps Latin America countries to improve their fiscal and external accounts, while imports of cheap consumer goods and low-cost machinery and parts increases consumers' welfare and producers' competitiveness. Also, China becomes a new source of capital to finance infrastructure projects. Moreover, local companies would be able to integrate into global production networks through strategic partnerships with Chinese companies.

The pessimistic view usually admits those potential benefits**.** Nevertheless, it emphasizes that China's rise represents a return to the classic center–periphery dichotomy, in the sense that it tends to reinforce regional specialization in primary commodity production, while the manufacturing sector contracts in the face of increased Chinese competition both at home and abroad. Other adverse effects could be exports displacement and FDI diversion, where multinational companies relocate their plants from Latin America to China in Asia.

A third perspective explores the differentiated impacts of China on the region, where Mexico, Central America and the Caribbean emerge as potential losers, because they face competition from Chinese manufactured goods in the United States' market and have not been major exporters to

[2] Figures in 2010 constant USD. See World Bank (2020).

[3] For details and further references see, among others, Bichara *et al*. (2015), Gallagher (2016), Jenkins (2014, 2019), Stallings (2020).

China, while South American countries would be the winners who have benefited from Chinese demand for raw materials and food, and supply of cheaper consumer goods.

We consider that Brazil must be treated as a mixed case, because, while it is a major producer and exporter of natural resources, it has also a large manufacturing sector. As a consequence, the country has experienced both positive stimulus from Chinese demand for raw material and food and competitive pressures on its exports, particularly to Latin American countries, which are the main destinies for Brazilian exports of manufactured products.

The Brazilian economy has experienced a long-term economic decline, particularly when it comes to its participation in global trade flows. Brazil´s market share in exports of goods, in general, and manufactured products in particular, are an important indication of its structural problems regarding international competitiveness. This fact has been recognized by different views in economic analyses. There is, of course, no consensus on the determinants of Brazil's lack of dynamism in the global markets (Unctad, 2016; Rodrik 2016; Spilimbergo and Srinivasan, 2019; Bresser-Pereira et al., 2020; Nassif and Castilhos, 2020). However, it is possible to suggest that its market share decline has coincided with China's rise.

2.2 Chinese Exports Displacement Effect

Previous works on the Chinese exports displacement effect usually applies panel data econometrics and modified versions of the so-called "gravity model"[4] to test if the exports from China displace other countries exports to third markets considering the level of exports. This is the case in the works of Eichengreen *et al*. (2007), Greenaway *et al*., (2008), Amann *et al*. (2009), Athukorala (2009), Kong and Kneller (2016), Módolo and Hiratuka (2017) and Mau (2019). These papers use versions of the general "gravity model" as follows:

$$lnEXP_{ijt} = \alpha_0 + \alpha_1 lnChEXP_{jt} + \alpha_2 X_{ijt} + \delta_{ijt} \qquad (1)$$

Where: $lnEXP_{ijt}$ is the log of exports from source country i to destination j in year t; $lnChEXP_{jt}$ denotes the log of export from China to j; X_{ijt} is a vector of additional controls, such as importer and exporter GDP, distance between i and j etc. Therefore, a negative and statistically significant α_1 suggests that Chinese exports are displacing exports from other countries.

Evidences from those studies are inconclusive. For example, the seminal work of Eichengreen *et al*. (2007) leads to a statistically insignificant overall displacement effect for Asian countries. Nevertheless, when the authors split up the trade data into capital goods, intermediates and consumer goods the displacement effect becomes significant. More precisely, for consumer goods there is a negative effect, while for capital goods and intermediates there is a positive relationship. Consequently, according to estimations by Eichengreen *et al*. (2007), China's export growth has benefitted more developed Asian countries which are large exporters of capital goods and intermediates, whereas other Asian countries, that are more dependent on consumer goods, were negatively affected.

Greenaway et al. (2008) apply an empirical strategy similar to Eichengreen *et al*. (2007), but reach different conclusions. They split up their dataset according to the income level of Asian countries, which led to a negative displacement effect for high income Asian exporters, whereas low income Asian exporters have not been affected. It is worth mentioning that they used aggregated trade flows. Athukorala (2009) analysed trade in machinery and transport equipment and manufactures. He found no evidence of the displacement effect and concluded that the public debate on the implication of China´s rise introduced an unjustifiable fear of China as the main source of an export crowding-out in other Asian countries.

[4] This will be the main focus of our research. Nevertheless, other methodologies are also used, such as the constant-market share analysis (CMS). For instance, Yan Liu et al. (2018) found evidence that Chinese exports crowd-out other countries manufacturing exports, particularly at the lower end of the quality spectrum of products. Jenkins (2014; 2019) also uses CMS to show how Chinese exports crowd-out African and Latin American countries' exports.

Eichengreen et al. (2007), Greenaway et al. (2008), Athukorala (2009)[5] Módolo and Hiratuka (2017) did not include country-year fixed effects in their models. To overcome this limitation, Kong and Kneller (2016) considered the factor endowment and found that this aspect helped to explain how a country is affected by Chinese exports. Specifically, countries with higher capital-labor ratios and human capital levels relative to China experienced more export growth or less export displacement than countries in the opposite situation.

Similarly, Edwards and Jenkins (2014) did not find evidence of a level effect, but only evidence of the relative effect of Chinese exports on the exports of South Africa relative to that of other exporters. They concluded that exports from China had a negative relative effect on exports from South Africa to other African countries for all product groups considered.

Giovannetti *et al*. (2013) focused on European Union countries. They estimated the Chinese exports displacement effect by using two-digit SITC sectors. The sign and significance of the level effect estimated varied according to the sectorial aggregation and the exporting countries considered. Therefore, they did not find evidence of a general displacement effect.

The opposite result was found by Pham *et al*. (2017) on the effects of China's high-tech exports on other exporters of high-tech products. The authors concluded that there had occurred Chinese displacement over its developing countries competitors in South America and South East Asia in most high-tech products. Their results also pointed out that high-tech exports from Korea and Japan were not negatively affected by Chinese exports. This evidence suggests that Chinese high-tech exports are substitutes for other developing countries' exports of these kinds of goods whereas they are complements to those of advanced countries. Mau (2019) studies how US exports revenues were affected by Chinese competitive pressure in terms of price, quantity and market shares. As a general result, he finds that China increase competitiveness is associated with a lower US exports' revenue. This research explicit uses market-shares as a proxy to analyse the Chinese displacement effect.

In sum, the survey of the literature on Chinese exports displacement effect is inconclusive. As usual, results are contingent to the empirical strategy adopted and the data, time-period and controls used in the exercises. Therefore, in the next sections we analyse the potential impact of China´s rise as a global manufacturing powerhouse on the competitiveness of Brazilian manufactured goods exports. In doing so, we have adopted a different proxy to check the displacement effect, which is market share and not level of exports.

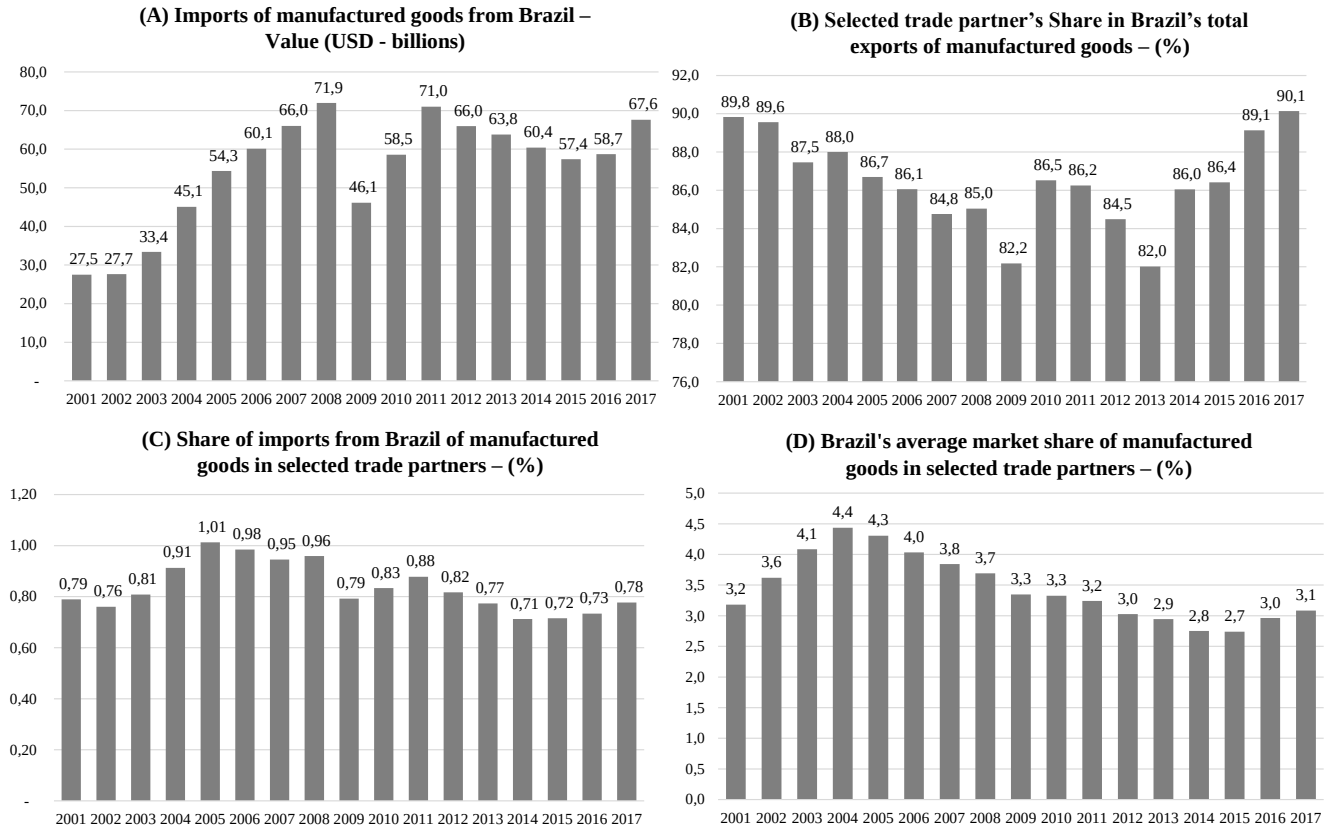
3. Methodology and Data

In order to evaluate if China´s exports of manufactured goods have displaced the Brazilian exports of these products in third markets, we use data from 45 countries (see Appendix A). It is worth mentioning that: (i) we have chosen the sample considering the data availability between 2001 and 2017; (ii) the trade partners selected respond for 90% of Brazilian exports of manufactured goods. Thus, the number of observations of the model estimated is 765.

Figure 2 depicts the evolution of Brazilian exports of manufactured goods to the 45 selected trade partners. It is possible to see the decline trend in the relative importance of Brazil's exports in our sample.

[5] For the African countries case, the works of Giovannetti and Sanfilippo (2009) and Geda and Meskel (2008) analyzed the manufacturing sector exports. Both found evidence that Chinese exports crowd-out African countries exports.

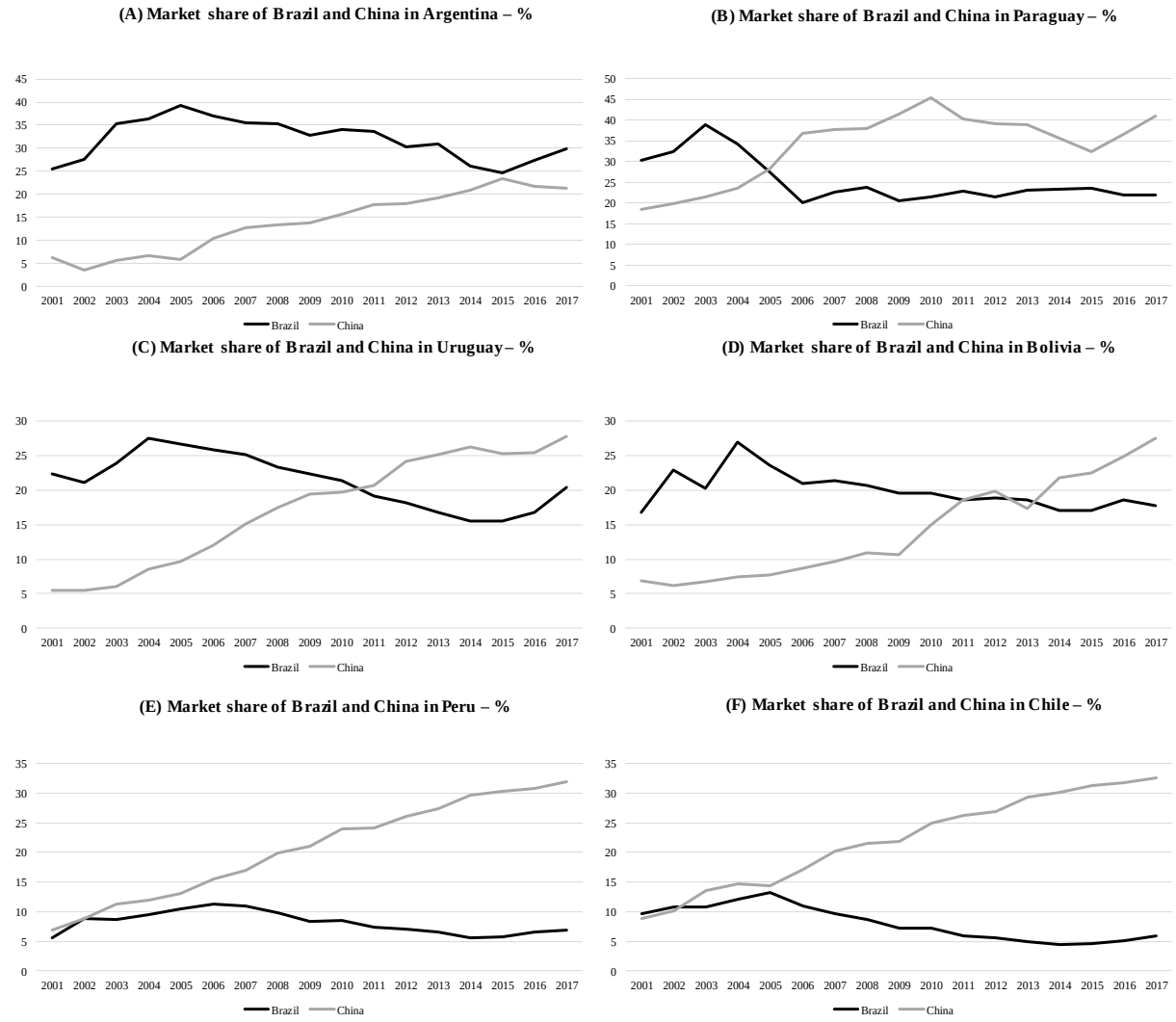
Figure 2 – Brazil's Exports of Manufactured Goods to the Selected Partners, 2001-2017



Source: elaborated by the authors using UN Comtrade (2020).

Thus, there is an overall decline in Brazil's exports of manufactured goods worldwide (Figure 1, panel F) including its main trade partners (Figure 2, panels C and D). At the same time, China has experienced the opposite dynamics. Figure 3 shows how both countries performed in Brazil´s top destinies. It apparently suggests that the China's displacement effect might be relevant for the Brazilian case.

Figure 3 – Market share in industrialized goods of Brazil and China in the Brazil's main markets, by market share, 2001-2017.



Source: elaborated by the authors using UN Comtrade (2020).

We have investigated the Chinese exports displacement effect regarding the Brazilian case by applying the Generalized Method of Moments (IV-GMM) in a panel data framework. Our main interest is to test if an increase in China´s market share in a third country is associated with an increase or a decrease of Brazil´s market share in that same country. This strategy differs from most of the previous literature on this topic.

The basic structure of our models is given in (2) and (3):

$$Y_{it} = \alpha + X_{it}\beta + v_{it} \qquad i = 1, \dots, N; t = 1, \dots, T \qquad (2)$$

$$v_{it} = \mu_i + u_{it} \qquad (3)$$

Where: "*i*" indicates a 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}.

To deal with the endogeneity problem, the statistically efficient strategy is to estimate μ_i as an individual parameter for each cross-section. Thus, we have established the equation that follows:

$$Y_{it} = (\alpha + \mu_i) + \beta . X_{it} + u_{it} \quad (4)$$

Regarding the Random Effects, the term $\mu_i + u_{it}$ represents a compound error (see equations 1 and 2). This structure, however, has a residual correlation over time associated with the individual effect μ_i. That way, it is not possible to observe any correlation between μ_i and X_{it}, as in fixed effects models. Therefore, it is defined that $E(X_{it}\mu_i) = 0$.[6]

The variables used in our exercise[7] were: (i) Brazilian market share (%) in imports of manufactured products from trade partners (MS_BR_t) in %; (ii) Manufacturing Value Added as % of GDP of Brazil ($MANUF_t^{BR}$); (iii) Chinese market share (%) in imports of manufactured products from trade partners ($MS\_CHINA_{i,t}$); (iv) Gross Domestic Product of Brazil (GDP_t^{BR}) in constant 2011 PPP international dollars; (v) Gross Domestic Product of trade partners ($GDP_{i,t}^{PAR}$) in constant 2011 PPP international dollars; (vi) Exchange rate of Brazil (EXC_t^{BR}), annual average of local currency exchange rates against US Dollar, nominal rate converted to index number; (vii) Exchange rate of trade partners ($EXC_{i,t}^{PAR}$), annual average, local currency exchange rates against US Dollar, nominal rate converted to index number; Foreign direct investment, inward Brazil (FDI_t^{BR}), US dollars at current prices; (viii) Business freedom in Brazil ($BUSINESS_t^{BR}$), index number from *The Heritage Foundation;* and (ix) Interaction between $GDP_{i,t}^{PAR}$ and $MS\_CHINA_{i,t}$ ($GDP_{i,t}^{PAR} * MS\_CHINA_{i,t}$), the interaction variable takes into account the hypothesis that the effect of China's market share on Brazil's market share may vary according to the size of the partner's economy.

Table 1 shows the summary statistics for all variables.

Table 1 – Summary Statistics

Variable	Mean	Standard deviation	Minimum	Maximum
Brazilian market share (% of manufactured goods imported by each country)	3.45	7.17	0.03	39.19
Manufacturing Value Added as % of GDP of Brazil, %	14.77	2.07	12.01	17.79
Chinese market share (% of manufactured goods imported by each country)	13.92	8.64	1.01	45.42
GDP of Brazil, constant 2011 international dollars using purchasing power parity rates, billions	2,57813	584.05	1,638.21	3,307.41
GDP of trade partners, constant 2011 international dollars using purchasing power parity rates, billions	1,269.09	2,416.03	14.50	19,390.60
Exchange rate of Brazil, local currency exchange rates against US Dollar, index number	106.65	24.48	73.91	152.17
Exchange rate of trade partners, local currency exchange rates against US Dollar, index number	111.85	98.80	52.63	1,660.00
Foreign direct investment to Brazil, US dollars at current prices, millions	388.85	214.09	96.86	664.21
Business freedom in Brazil, index number	59.51	7.17	53.00	70.00

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

[6] Details in Arellano (2003), Baltagi (2013) and Hsiao (2014).

[7] Main sources are: World Bank (2020), UN Comtrade (2020), OECD National Accounts data files, UNCTAD, Heritage Foundation and Euromonitor International.

It is noteworthy that the variables listed, GDP_t^{BR}, $GDP_{i,t}^{PAR}$, EXC_t^{BR}, $EXC_{i,t}^{PAR}$, FDI_t^{BR} and $BUSINESS_t^{BR}$ are treated in logarithms. The variable $MANUF_t^{BR}$ represents a relation with GDP, and MS_BR_t and $MS\_CHINA_{i,t}$ are expressed as shares in imports from Brazil and China on total imports of manufactured products[8] in each trade partner.

Our main focus are on two variables: $MS\_CHINA_{i,t}$ and the interaction between the variables $GDP_{i,t}^{PAR}$ and $MS\_CHINA_{i,t}$. All other independent variables are included as control variables in our regressions. We have chosen them based on the previous literature on the Chinese displacement effect (see section 2.2) and on the determinants of exports competitiveness (Baldwin, 2016; European Commission, 2017; Unctad, 2016, 2019a; Unido, 2019; Mau, 2019).

4. Results and Discussion

Following the specifications in the equations (2), (3) and (4), we have applied the IV-GMM model to test if changes in China's market share related to the exports of manufactured goods affect the Brazilian market share of the same goods in third markets. After the tests reported on the Appendix B it was possible to define X_{it}^{EX} as being composed by: $GDP_{i,t}^{PAR}$; EXC_t^{BR}; $EXC_{i,t}^{PAR}$; FDI_t^{BR}; and $BUSINESS_t^{BR}$. At the same time, X_{it}^{EN} comprehends the following variables: GDP_t^{BR}; $MANUF_t^{BR}$; $MS\_CHINA_{i,t}$; e ($GDP_{i,t}^{PAR} * MS\_CHINA_{i,t}$). Finally, Z_{it}^2 includes the variables from X_{it}^{EN} with two lags. Table 2 reports our results.

Table 2 – IV-GMM Fixed Effects estimator - Robust Standard Errors

Variables	IV-GMM	
$MS\_BR_{i,t}$	Coefficient	z
$MANUF_t^{BR}$	0.172***	2.50
$MS\_CHINA_{i,t}$	-1.450***	-3.93
GDP_t^{BR}	0.796	0.84
$GDP_{i,t}^{PAR}$	0.470	0.49
EXC_t^{BR}	0.756**	2.24
$EXC_{i,t}^{PAR}$	-0.981	-1.27
$GDP_{i,t}^{PAR} * MS\_CHINA_{i,t}$	0.047***	3.52
FDI_t^{BR}	0.444***	2.55
$BUSINESS_t^{BR}$	-0.044	-0.10
Mean effect $MS\_CHINA_{i,t}$+ ($GDP_{i,t}^{PAR} * MS\_CHINA_{i,t}$)	-0.189***	-5.03
Under-identification test (Kleibergen and Paap rk LM statistic)	χ^2 (5) 37.052***	
Hansen-Sargan test (p-value)	χ^2 (2) 0,261	
	Shea partial R2 (first-stage)	F (8, 44)
GDP_t^{BR}	0.735	5,703.32***
$MANUF_t^{BR}$	0.720	42,376.82***
$MS\_CHINA_{i,t}$	0.905	130.80***
$GDP_{i,t}^{PAR} * MS\_CHINA_{i,t}$	0.917	134.30***

Notes: (I) Z statistics calculated considering Robust Standard Errors Adjusted for Clustering on trading partners. (II) *** p<0.01, ** p<0.05, * p<0.1.

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

[8] We have applied the sectorial aggregation by technological patterns originally suggested by Pavitt (1984) and excluded "Primary Products" and "Food and Beverage" from total exports and imports. Consequently, we were able to focus on manufactured products subject to competence between Brazil and China determined for reasons not associated with natural resources endowments.

Table 2 shows that: (i) the Kleibergen-Paap and Sargan-Hansen tests confirm the validity of the instruments; (ii) Shea R^2 statistics and F-statistics ratify the relevance of the instruments in all estimated first stage equations; (iii) for the second stage equation, it is noted that only three control variables did not reach statistical significant: GDP_t^{BR}, $EXC_{i,t}^{PAR}$ and $BUSINESS_t^{BR}$. It is worth mentioning that the variable $GDP_{i,t}^{PAR}$, which has not showed statistical significance as well, is part of the interaction variable $GDP_{i,t}^{PAR} * MS\_CHINA_{i,t}$, which is statistically significant. Our interest relies on this particular interaction, that is, the relationship between China´s export of manufactured goods and the GDP of the trade partner.

Among the control variables that did not reach statistical significance, GDP_t^{BR} stands out. This result suggests that the Brazilian manufacturing sector did not take much advantage of "economies of scale" of the country's internal market. According to United Nations (2020), in 2018 Brazil had the ninth largest market in terms of final consumption worldwide. Brazilian governments and families spent USD 1.499 billion (in 2015 constant prices) in goods and services in that year. China had the second largest consumption market - USD 7.426 billion – and the United States had the first one with USD 16.063 billion. It was expected that GDP size would positively influence Brazilian exports throughout the impacts of economies of scale in firms' competitiveness. Our result indicates that this is not the case.

At the same time, statistical significance is not rejected for the following control variables: $MANUF_t^{BR}$, EXC_t^{BR}, FDI_t^{BR}. They represent Brazil's productive structure main characteristics and its macroeconomic performance. Since the early 1980s Brazil has experienced an intense process of deindustrialization (Unctad, 2016; Nuvolari and Russo, 2019). Consequently, it is not a surprise that the reduction in its manufacturing exports' market share (see Figure 2, panels C and D) comes along with an overall lack of dynamism in its manufacturing sector (see Figure 1). This is exactly what is suggested by our result. We have estimated that an increase (or decrease) of 1 percentage point in $MANUF_t^{BR}$ results in an average increase (decrease) of 0.172 percentage point in $\text{MS\_BR}_{i,t}$.

Deindustrialization is one important source of the problems Brazilian firms face in international markets. It should be noted that the estimated low sensitivity in the parameter estimated were expected since Brazil's industrial production is fundamentally aimed at the domestic market and not as exports. In other words, Brazilian economy is much more inward oriented that Chinese and other Asian economics that have been catching-up with advanced countries through export-oriented strategies (Rodrik, 2016; Spilimbergo and Srinivasan, 2019; Bresser-Pereira et al., 2020; Nassif and Castilhos, 2020).

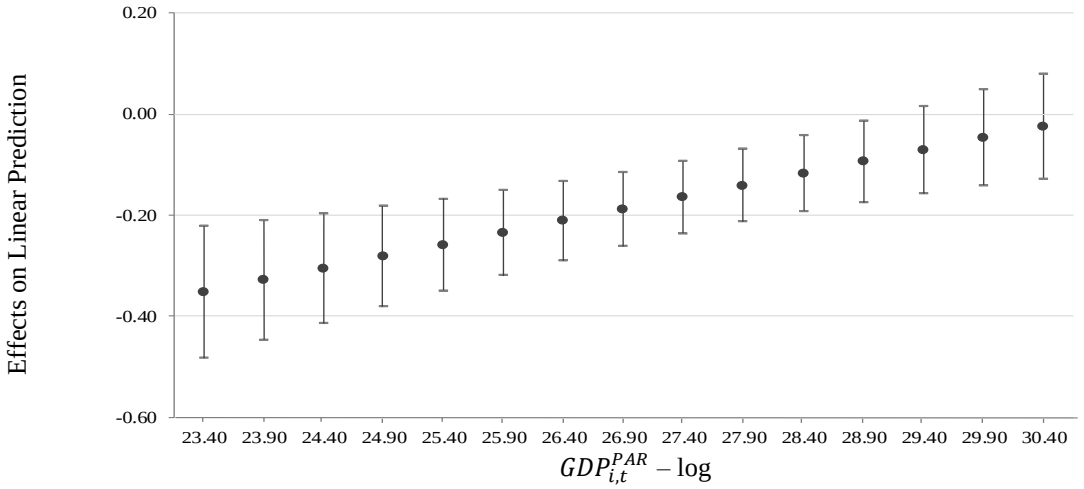
The estimated sensitivity between EXC_t^{BR} and $MS\_BR_{i,t}$ points out that a devaluation of 1% in the nominal exchange rate results, on average, in a 0.756 percentage point of gain in market share. It is confirmed, in a way, that a devalued exchange rate can help the competitive gains of Brazilian exports of manufactured goods. Of course, a strong Real undermines exports competitiveness. FDI has also been statically significant with the expected signal. Thus, for every 1% growth in the FDI_t^{BR} results, in average, an increase of 0.444 percentage points in $\text{MS\_BR}_{i,t}$. As suggested by previous literature, there is a strong connection between FDI and exports. Transnational corporations control most of the global value chains, trade, research and development, marketing and finance. Consequently, 2/3 of global exports originate in their global operations (Baldwin, 2016; Unctad, 2019b).

The interaction variable ($GDP_{i,t}^{PAR} * MS\_CHINA_{i,t}$) was also statistically significant. It offers us an alternative interpretation of the Chinese displacement effect on Brazilian exports of manufactured products. More specifically, it helps us to observe if the size of the economy, measured by the trade partner's GDP, matters to explain how Chinese market-share changes affect Brazilian market-share. Formally, considering average *"i"* and *"t"* for $GDP_{i,t}^{PAR}$, it is possible to calculate the "average effect for $MS\_CHINA_{i,t} + (GDP_{i,t}^{PAR} * MS\_CHINA_{i,t})$".

For example, let us consider Chile. In 2017, its GDP was approximately USD 411 billion in purchasing power parity or 26.88 in log. For this parameter of the $GDP_{i,t}^{PAR}$ it is estimated an interaction where a variation of 1 percentage point in $MS\_CHINA_{i,t}$ reduces by 0.189 percentage

point the $MS\_BR_{i,t}$. Nevertheless, this relationship chances in accordance with the GDP size of the trade partner (see Figure 4).

Figure 4 - Average marginal effects of $MS\_CHINA_{i,t}$, 95% Confidence Interval



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

Figure 4 shows that, in fact, size matters. That is, the effect of $MS\_CHINA_{i,t}$ on $MS\_BR_{i,t}$ changes according to the size of the partner's economy. This particular result suggests that the smaller the size of the economy, the greater the effects of $MS\_CHINA_{i,t}$ on $MS\_BR_{i,t}$. In addition, from a value of $GDP_{i,t}^{PAR}$ close to 29.40 (for example, India in 2017), the effects of Chinese competitiveness on Brazil are no longer observed. As matter of fact, this result is only valid for three countries: India, Japan and the USA. Nevertheless, in these countries Brazil had, in 2017, low market shares in manufacturing goods: 0.45%, 0.27% and 0.81%, respectively. To put it in perspective, China´s market shares in those same countries were 28.7%, 37.1% and 27.3% (see Appendix A).

For $GDP_{i,t}^{PAR}$ values between 26.40 (Denmark in 2017 with a GDP of USD 269 billion) and 26.90 (Sweden in 2017 with a GDP of USD 473 billion), an interval that belongs to the average value of the sample of 26.88, we arrive at an estimated average effect between -0.212 to -0.188. This interval includes the major final destinies for Brazilian exports of manufactured goods, particularly Argentina, Chile, Colombia and Peru.

Bolivia, Paraguay and Uruguay belong to the $GDP_{i,t}^{PAR}$ interval between 24.40 and 24.90. These countries are also import destinies of Brazil´s exports of manufactured products (see Appendix A). In this case, the interactive effect estimated varies from -0.31 to -0.28. Similar effect is found on other regional partners that are important destinies for Brazilian exports of manufactured goods: Ecuador, Costa Rica and Dominican Republic.

As argued on section 2, the previous literature on Chinese exports displacement effect is inconclusive. This is because results are contingent to the empirical strategy adopted and the data, time-period and controls used in the exercises. In this sense, our empirical exercise is not different, since it provides evidence on the displacement effect by applying an alternative empirical framework. When it comes to the case of Brazil, there is a well-established literature that analyses the country's long-term competitiveness decline (Spilimbergo and Srinivasan, 2019; Bresser-Pereira et al. 2020; Nassif and Castilhos, 2020), on the one hand, and the consequences of the competitive pressures from Chinese exports (Jenkins, 2014, 2019; Módolo and Hiratuka, 2017), on the other hand. Our paper has tried to combine both of these views to offer some fresh evidence on this topic.

5. Final Considerations

In this paper we have tried to explain how Chinese increased trade openness and international competitiveness have affected Brazil´s export performance. This line of investigation converges, to

a certain extent, to the literature on the so-called Chinese exports displacement effect. Such an expression might induce one to assume that China is the ultimate source of other countries competitiveness problems. Our present investigation sustains that it is not the case regarding Brazilian exports.

After 2001, when China accessed to the WTO, its exporters' presence in global markets has gained intensity. Consequently, China's market share in manufactured products has markedly increased in most of the countries that composed our sample. At the same time, Brazil's market share in the same destines have increased in some cases and decreased for others. Moreover, even when Brazilian market share increased, it was in a less pronounced way in comparison to China (see Appendix A and the Figures 1 and 2).

These stylized facts inspired our empirical exercise. We have tested if changes in China's market share related to the exports of manufactured goods affected the Brazilian market share of the same goods in third countries. We have chosen the control variables based on the previous literature on the Chinese displacement effect and on the determinants of exports competitiveness. Our main results suggest that for the independent variables, $MANUF_t^{BR}$, EXC_t^{BR}, FDI_t^{BR} were statistically significant with the expected signals. That is, the deindustrialization process and Brazilian Real overvaluation undermined Brazilian competitiveness, while inward FDI tended to improve it. Brazil's market size, proxied by its GDP, was not statistically significant. This result suggests that Brazilian exporters did not take much advantage of "economies of scale" of the country's internal market.

Our variable of interest $(MS\_CHINA_{i,t})$ and the interaction variable $(GDP_{i,t}^{PAR} * MS\_CHINA_{i,t})$ also presented statistical significance. The displacement effect measured through the market share was negative in general. In other words, China´s market share increases were associated to decreases in Brazil´s share. Nevertheless, once "economy size" is controlled, another picture emerges, where the effect of $MS\_CHINA_{i,t}$ on $MS\_BR_{i,t}$ changes according to the size of the partner's economy. More precisely, the smaller the size of the economy, the greater the effects of $MS\_CHINA_{i,t}$ on $MS\_BR_{i,t}$. Mau (2019) also used market-share, among other proxies, to test how Chinese exports affected US exports revenue. Nevertheless, he did not focus on the interaction variable $(GDP_{i,t}^{PAR} * MS\_CHINA_{i,t})$ that was pivotal in our analysis. To the best of our knowledge this particular result might be a contribution the previous literature on both the Chinese exports displacement discussion and on the Brazil´s lack of international trade competitiveness debate.

As noted by others (see section 2) this result is contingent to 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. Instead, we have chosen control variables that combine the gravity model concerns with the relationship between "size" and "trade", with variables associated with literature on competitiveness. We have also analysed market share and not the level of exports. Therefore, our evidence cannot be compared without a proper qualification. Future research can help to improve our conclusions by dealing with related problems, alternative methodologies and datasets.

To sum up, the main implication of our result is that China's competitiveness improvements cannot be blamed as the only cause, or even as the main determinant, of Brazil's long-term relative decline in global markets. As suggested by different authors who follow alternative theoretical perspectives, structural domestic microeconomic and macroeconomic problems and policies have also played an important role in the Brazilian downturn, most probably the crucial part (Unctad, 2016; Rodrik, 2016; Spilimbergo and Srinivasan, 2019; Bresser-Pereira *et al*. 2020). Consequently, Brazilian policymakers should emphasize the design of more robust and effective development strategies.

Our results are also important for China. According to the country´s Ministry of Foreign Affairs, China´s international relations with Latin American countries, in general, and Brazil, in particular, are based on a "win-win cooperation on the economic front" (MOFA, 2016). China´s official perspective also sustains that the "… development of China cannot be possible without the

development of other developing countries, including countries in Latin America and the Caribbean.". Therefore, Brazil´s lack of economic dynamism and international competitiveness might not be good news for China, once it increases protectionist demands from its companies and stimulates anti-China political discourses (Gallagher, 2016; Liang, 2019; Jenkins, 2019; Stallings, 2020). This should be considered because, even though Brazil's industrial decline has been mostly result of its own doing, the goal of becoming an industrialized country continuous to be a much cherished one. Thus, a trade pattern where Brazil seems to be scarifying its industrial sector in favor of its primary exports becomes a very sensitive issue that can be used against China.

In this context, China´s strategists should consider different approaches to deal with Brazil's private sector aspiration to recover its manufacturing sector strength (CNI, 2018). A promising path would be the development of partnerships between Chinese and Brazilian companies in technology-intensive sectors, expanding Chinese investments in Brazilian infrastructure and granting more access to the Chinese market for manufactured goods produced in Brazil (Bichara *et al*., 2015; Eclac, 2018; Rosales, 2020).

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APPENDIX A – MARKET SHARE IN INDUSTRIALIZED GOODS FROM BRAZIL AND CHINA IN THE SELECTED COUNTRIES IN 2017 AND VARIATION 2001-2017, BY MARKET SHARE

Trade partner	Continent	Brazil's market share in 2017 (%)	Variation in market share in Brazil, 2001-2017, percentage points	China's market share in 2017 (%)	Variation in China's market share, 2001-2017, percentage points
Argentina	South America	29.89	4.37	21.24	15.10
Paraguay	South America	21.91	-8.35	41.03	22.57
Uruguay	South America	20.43	-1.95	27.79	22.27
Bolivia (Plurinational State of)	South America	17.77	0.94	27.50	20.66
Peru	South America	6.87	1.27	31.93	25.04
Chile	South America	5.82	-3.90	32.67	23.83
Colombia	South America	5.82	0.68	25.08	20.55
Ecuador	South America	5.80	1.32	26.58	23.17
Dominican Rep.	North America	3.64	2.08	19.86	18.31
Costa Rica	North America	2.24	0.38	17.20	15.40
Guatemala	North America	1.97	0.51	15.19	14.08
El Salvador	North America	1.92	0.03	20.27	18.61
Nicaragua	North America	1.75	0.15	20.12	17.74
South Africa	Africa	1.26	-2.00	26.05	20.41
Mexico	North America	1.14	-0.24	21.16	18.83
Norway	Europe	1.03	0.55	11.94	8.37
Portugal	Europe	0.90	0.24	3.84	2.83
USA	North America	0.81	-0.41	27.26	15.65
Canada	North America	0.76	0.41	15.47	11.12
India	Asia	0.45	0.02	28.66	23.95
Italy	Europe	0.45	-0.12	9.57	5.84
Egypt	Africa	0.45	0.03	20.97	14.37
Belgium	Europe	0.44	0.14	6.05	3.26
Turkey	Europe	0.43	0.05	13.05	10.03
Indonesia	Asia	0.43	0.16	31.22	25.65
Russian Federation	Europe	0.38	0.30	24.20	19.22
United Kingdom	Europe	0.34	0.06	11.82	5.63
Switzerland	Europe	0.32	-0.14	5.42	3.61
Netherlands	Europe	0.32	-0.01	13.04	6.79
Germany	Europe	0.29	-0.02	12.88	8.12
Poland	Europe	0.29	-0.28	15.53	11.75
Japan	Asia	0.27	-0.05	37.13	13.06
Spain	Europe	0.23	-0.03	11.59	7.84
Saudi Arabia	Asia	0.22	-0.21	20.04	14.94
Australia	Oceania	0.21	-0.03	27.21	17.01
Vietnam	Asia	0.21	0.18	31.56	21.76
Israel	Asia	0.21	0.05	12.76	9.58
Rep. of Korea	Asia	0.19	-0.16	29.09	18.00
Singapore	Asia	0.18	0.04	16.77	9.97
France	Europe	0.18	-0.13	11.68	7.52
Hungary	Europe	0.17	-0.05	6.39	1.76
Sweden	Europe	0.15	-0.12	6.34	4.23
Malaysia	Asia	0.10	-0.02	23.07	18.00
Denmark	Europe	0.06	-0.01	9.58	5.77
Ireland	Europe	0.06	-0.06	7.11	4.76

Source: elaborated by the authors using UN Comtrade (2020).

APPENDIX B – STATISTICAL PROCEDURES AND TESTS

The first step of the empirical analysis was to perform the unit root, cointegration and residual adjustment tests for the four proposed models (table B1).

Table B1 – Unit-root test for Panel Data

Variables	Im-Pesaran-Shin Test *W-t-bar* Statistic	Levin-Lin-Chu Test Adjusted t statistic	Harris-Tzavalis Test *rho* statistic
$MS\_BR_{i,t}$	-5.982***	-7.569***	0.763***
$MANUF_t^{BR}$	9.950	4.358	0.990
$MS\_CHINA_{i,t}$	-2.665***	-10.558***	0.915
GDP_t^{BR}	-6.379***	-16.122***	0.923
$GDP_{i,t}^{PAR}$	-1.274	-10.002***	0.968
EXC_t^{BR}	-8.825***	-11.579***	0.863
$EXC_{i,t}^{PAR}$	-	-1.397*	0.831
$GDP_{i,t}^{PAR} * MS\_CHINA_{i,t}$	-2.324***	-10.248***	0.919
FDI_t^{BR}	2.685	-3.541***	0.904
$BUSINESS_t^{BR}$	-1.307*	-3.140***	0.741***

Note: (I) Insufficient number of time periods to compute W-t-bar. (II) *** p< 0.01, ** p< 0.05, * p< 0.1.
Source: elaborated by the authors through the software Stata 16.

When Im-Pesaran-Shin approach is considered, $MS\_BR_{i,t}$, $MS\_CHINA_{i,t}$, GDP_t^{BR}, EXC_t^{BR}, $(GDP_{i,t}^{PAR} * MS\_CHINA_{i,t})$ and $BUSINESS_t^{BR}$ are stationary at a 10% significance. With the Levin-Lin-Chu's test, all variables are stationary at a 10% significance level, except $MANUF_t^{BR}$. Following the Harris-Tzavalis test, only $MS\_BR_{i,t}$ and $BUSINESS_{i,t}^{BR}$ can be considered stationary. Thus, it was necessary to apply a cointegration test. Considering the Kao (1999) it is possible to state that the variables used are cointegrated at a 1% significance level (table B2).

Table B2 – Statistics from Kao test for cointegration in Panel Data

	Kao Test
Modified Dickey-Fuller	-3.942***
Dickey-Fuller	-4.887***
Augmented Dickey-Fuller	-6.916***
Unadjusted modified Dickey-Fuller	-5.110***
Unadjusted Dickey-Fuller	-5.401***

*** p < 0.01, ** p < 0.05, * p < 0.1.
Source: elaborated by the authors through the software Stata 16.

Table B3 reports all tests regarding: (i) our model specification; and (ii) problems of autocorrelation, heteroscedasticity and endogeneity.

Table B3. Hausman Tests (Fixed vs Random Effects), autocorrelation and heteroscedasticity

Test	
Hausman Test - Fixed vs Random Effects	χ^2 (4) 66.87***
Wooldridge Test	F (1. 44) 19.69***
Modified Wald Test	χ^2 (45) 32,492.43***
Hausman Tests for Endogeny – IV-GMM Fixed Effects vs OLS Fixed Effects	
GDP_t^{BR}	χ^2 (1) 60.17***
$MANUF_t^{BR}$	χ^2 (1) 73.91***
$MS\_CHINA_{i,t}$	χ^2 (1) 70.10***
$GDP_{i,t}^{PAR} * MS\_CHINA_{i,t}$	χ^2 (1) 62.48***
$GDP_t^{BR}\ MANUF_t^{BR}\ MS\_CHINA_{i,t}\ \ GDP_{i,t}^{PAR} * MS\_CHINA_{i,t}$	χ^2 (4) 68.92***

Note: *** p<0.01, ** p<0.05, * p<0.1.
Source: elaborated by the authors through the software Stata 16.