Does China's business matter to South America?

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Abstract

The imports from China by South American countries have increased significantly in the last decade. From the consumers' perspective, it represents a benefit since there have been more low-cost goods available. However, from the producers' perspective, the import penetration increases the competition, and it has led to a substitution effect in favor of Chinese goods. In this context, this paper aims to explore the channels of interactions between China and South American countries. We explore the changes in China's traded goods prices through a global computable general equilibrium (GTAP) that considers some South American countries (Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, and Venezuela), China, and the Rest of the World. The paper contributes to the debate by implementing a systemic analysis considering the impacts of the Chinese expansion on the productive structure and export specialization, dealing with the complementarity between the exports of primary products – especially concentrated in iron ore, copper, and soybeans - and diversified import of industrial goods. We observe that there is an unbalanced relationship between China and South America and that China can compete with South American countries in a third country situation, mainly in the European Union and the United States.

Keywords: South America; China; Trade relations; Applied General Equilibrium Analysis.

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1. Introduction

The imports from China by South American countries increased significantly in the last decade. Observing the GTAP bilateral time series trade data, the share of imports from China by South America was 1.92% in 1995 and 17.10% in 2014. The import share in 2014 was equivalent to 21.84% in Chile, 20.58% in Paraguay, 19.03% in Peru, 18.38% in Uruguay, 16.87% in Colombia, and 16.37% in Brazil. On one hand, from the consumers' perspective, it represents a benefit since there have been more low-cost goods available. On the other hand, from the producers' perspective, the import penetration has increased the competition and it has also led to a substitution effect in favor of Chinese goods.

Although the direct effects are significant, the main concern in South America is related to the indirect effects. The Chinese goods compete with some export goods from South America, particularly those to developed countries. There is also a concern about the diversion of investment from South America to China. Further, the effects in the world commodities prices are also common, which has a positive effect on those countries which are the major exporters of these commodities.

Thus, the direct effect of the expansion of China's business is the increasing opportunities for exports to China. This has effects upon the prices and export volumes. The second effect is related to the substitution of Chinese exports for its trading partners' products, both in their own and third-country markets. The increase in the export volumes is linked to the similarity of export commodities between China and its developing country partners, the more similar they are, the stronger is the substitution effect. The impact on terms of trade between primary commodities and labor-intensive manufactured goods related to the role of China in international trade is another important issue to be considered (Jenkins et al., 2008). On one hand, the increase in Chinese demand for agricultural and mineral products has impacted the prices for primary commodities. On the other hand, the massive growth of Chinese production of labor-intensive goods has led to a decrease in the prices of such goods. Thus, the growth of China has impacted the South American countries even in the absence of bilateral links of competition in third markets. Furthermore, in relative terms, the Chinese economy is more important for South America than the opposite.

The Chinese expansion generated two distinct effects on countries, a "demand effect" or macroeconomic effect that is exerted through its impact on exports, trade balance, and investments and a "structure effect" or sectoral effect through its unequal impact on sectors or activities according to the degree of complementarity and rivalry. Depending on the characteristics of the countries, the endowment of natural resources, their size, the technological stage, and domestic economic policies, the combination of both effects generates different results on economic growth. Thus, the growth of China has presented positive and negative effects to some countries, sectors, and groups. The literature has shown the producers and exporters of raw material, particularly Argentina, Brazil, Chile, and Venezuela, and some sectors, such as agriculture, agroindustry, and industrial inputs, as winners in terms of trade with China. However, this also poses a challenge to policymakers due to the increased competitive strength of China.

Although competition exists, there is also a complementarity between the South American countries and Chinese economies in terms of their productive structure (Jenkins et al. 2008). Moreover, as suggested by Jenkins et al. (2008), this tendency tends to increase over time. Thus, the South American countries can take advantage of the expansion of China's market and of the increase of global production networks.

The literature deals with the role played by China in the international market and the consequences for a different group of countries. Ianchovichina and Martin (2003) and Yang (2006) analyze the implications of the entrance of China at WTO for other developing countries in a long-run context of opening and growth. Dimaranam et al. (2007) based on a scenario of the rapid growth of exports, the changes in the relative importance of goods and services, and changes in the composition of exports from China and India, developed global-economy wide modeling to measure all the potential impacts upon China and India and other developing countries. Lall et al. (2005), Blázquez-Lidoy et al. (2006), and Jenkins (2012) analyze the impacts of China on Latin American trade and foreign direct investment flows. Jenkins et al. (2008) identify the main channels through which the growth of China could impact Latin America. Afonso et al. (2018) also analyze China and Latin American countries to capture whether the trade agreements among these regions are complementary or if they strengthen the dependence.

In this context, this paper aims to explore the channels of interactions between China and South American countries. We explore the changes in the prices of China's traded goods through a global computable general equilibrium (GTAP) which considers some South American countries (Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, and Venezuela), China, and the Rest of the World. This price shock is justifiable due to the size of China and its influence on world prices. China has the second-largest GDP in the world and a high share in international trade, which gives the country an important price-forming status in the international market.

The paper contributes to the debate by implementing a systemic analysis considering the impacts of the Chinese expansion on the productive structure and export specialization, dealing with the complementarity between the exports of primary products – especially concentrated in iron ore, copper, and soybeans – and diversified import of industrial goods.

The applied general equilibrium analysis allows us to measure the impact in terms of welfare due to different policy scenarios. Furthermore, due to the numerical structure behind the CGE models, which includes the inter-sectoral interdependence within each economy, the analyses allow us to project the impacts on national output, employment, income, and other macroeconomics indicators.

In what follows, Section 2 presents an overview of the trade pattern between South American countries and China. Section 3 describes the methodology and database. Section 4 presents the main results. Finally, Section 5 brings the final remarks.

2. Trade Analysis

To have an overview of the trade pattern between South American countries and China, this section presents an exploratory analysis of the recent trade data among them. Furthermore, some trade indexes are calculated to identify possible trade opportunities among these countries.

Table 1 and Table 2 present the bilateral trade shares among China, South American countries, and the Rest of the World (ROW) based on the GTAP database (Aguiar et al., 2019). On one hand, the export share shows how China is an important destination for exports from South America. In 2014, 5.79% of Chilean exports, 23.92 of Uruguayan exports, 21.18% of Brazilian exports, 18.40% of Peruvian exports, 16.17% of Venezuelan exports, and 12.80% of Colombian exports were sent to China. On the other hand, the export share shows that South America is relatively less important to China than the opposite. In the same year, 2014, only 4.24% of Chinese exports were sent to South America, with the highest share sent to Brazil, 1.67%.

Table 1 – Export shares, 2014 (%)

Regions		Destination											
		CHN	**ARG**	**BOL**	**BRA**	**CHL**	**COL**	**ECU**	**PRY**	**PER**	**URY**	**VEN**	**ROW**
Origin	**CHN**	0.00	0.41	0.06	1.67	0.65	0.46	0.17	0.10	0.34	0.10	0.26	95.76
	ARG	6.94	0.00	1.16	20.80	4.11	1.37	0.60	1.82	1.71	2.19	2.93	56.36
	BOL	2.65	21.01	0.00	31.78	1.28	4.59	0.94	0.56	5.12	0.07	1.07	30.94
	BRA	21.18	6.17	0.70	0.00	2.45	1.08	0.37	1.42	0.83	0.85	2.02	62.93
	CHL	25.79	1.13	1.31	5.59	0.00	1.21	0.69	0.22	1.94	0.21	0.66	61.27
	COL	12.80	0.38	0.24	2.86	1.65	0.00	3.08	0.03	1.99	0.04	3.20	73.74
	ECU	2.01	0.99	0.10	0.53	8.67	3.52	0.00	0.02	5.97	0.08	2.14	75.97
	PRY	0.79	1.98	1.36	17.16	9.73	0.62	0.64	0.00	1.99	1.91	0.48	63.34
	PER	18.40	0.28	1.65	4.27	3.93	3.03	2.34	0.03	0.00	0.09	1.28	64.70
	URY	23.92	4.41	0.47	20.92	1.41	0.42	0.34	1.31	1.49	0.00	4.47	40.86
	VEN	16.17	0.01	0.01	1.62	0.11	0.63	0.05	0.00	0.04	0.62	0.00	80.74
	ROW	11.14	0.23	0.02	1.10	0.26	0.30	0.11	0.03	0.17	0.04	0.16	86.45

Source: GTAP database (Aguiar et al., 2019).

This relative importance of China to South America is also observed by the import side. Table 2 shows that China, in 2014, imported only 6.10% from South American countries while all the South American countries imported more than 10% from China – Chile, 21.84%; Paraguay, 20.58%; Peru, 19.03%; Uruguay, 18.38%; Colombia, 16.87%; Brazil, 16.37%; Ecuador, 15.73%; Bolivia, 15.19%; Argentina, 14.77%; and Venezuela, 14.89%. This relative importance is more evident when we compare these results with those from Mercosur countries. In 2014, Brazil, for example, has imported 6.45% from Argentina, 0.57% from Paraguay, and 0.87% from Uruguay. Only the share of Argentine imports from Brazil (23.51%) and Paraguayan imports from Brazil (29.60%) were greater than those observed between these countries and China.

Table 2 – Import shares, 2014 (%)

Regions		Destination											
		CHN	ARG	BOL	BRA	CHL	COL	ECU	PRY	PER	URY	VEN	ROW
Origin	CHN	0.00	14.77	15.19	16.37	21.84	16.87	15.73	20.58	19.03	18.38	14.89	14.18
	ARG	0.28	0.00	9.21	6.45	4.34	1.58	1.75	11.27	2.99	12.38	5.23	0.26
	BOL	0.02	4.23	0.00	1.76	0.24	0.94	0.48	0.61	1.60	0.07	0.34	0.03
	BRA	2.93	23.51	18.78	0.00	8.71	4.20	3.61	29.60	4.91	16.19	12.19	0.99
	CHL	1.13	1.36	11.07	1.84	0.00	1.49	2.12	1.45	3.61	1.28	1.25	0.31
	COL	0.46	0.37	1.63	0.77	1.51	0.00	7.74	0.16	3.03	0.18	4.96	0.30
	ECU	0.03	0.43	0.32	0.06	3.55	1.57	0.00	0.05	4.05	0.17	1.48	0.14
	PRY	0.00	0.24	1.15	0.57	1.10	0.08	0.20	0.00	0.37	1.16	0.09	0.03
	PER	0.44	0.18	7.55	0.76	2.39	2.01	3.91	0.10	0.00	0.28	1.32	0.17
	URY	0.13	0.67	0.50	0.87	0.20	0.06	0.13	1.09	0.35	0.00	1.07	0.03
	VEN	0.69	0.02	0.07	0.52	0.12	0.75	0.15	0.01	0.07	3.66	0.00	0.39
	ROW	93.90	54.22	34.54	70.03	56.01	70.46	64.19	35.08	60.01	46.24	57.18	83.17

Source: GTAP database (Aguiar et al., 2019).

Another import feature about China and South American countries is related to the trade pattern among them in terms of commodities. Table 3 and Table 4 show the export shares to China and import shares from China by commodities, respectively. The South American countries mainly export to China Other crops (crops), Mining and energy (minergy), and Metal products (metal). In 2014, about 64.92% of Argentina's exports to China were Other crops (crops); 35.06% and 48.81% of Brazil's exports to China were Other crops (crops) and Mining and energy (minergy), respectively; 93.79% of Colombia's exports to China were Mining and energy (minergy); 62.88% of Uruguay's to China were Other crops (crops).

Table 3 – Export shares to China by commodities, 2014 (%)

Com.	ARG	BOL	BRA	CHL	COL	ECU	PRY	PER	URY	VEN	ROW
grains	0.43	0.03	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.30
crops	64.92	0.06	35.06	5.66	0.09	25.22	9.04	3.23	62.88	0.00	2.08
animalprd	1.26	1.51	0.02	0.10	0.10	0.00	0.02	0.67	11.14	0.00	0.55
frsfsh	1.16	0.00	0.03	0.20	0.14	0.45	0.05	0.39	0.47	0.00	0.70
minergy	3.24	56.20	48.81	32.36	93.79	27.02	0.00	67.31	0.43	75.58	22.01
meatprd	3.24	0.00	1.08	0.54	0.00	0.00	0.00	0.00	17.38	0.00	0.33
otrfood	10.38	0.00	1.14	1.65	0.05	31.82	0.00	12.60	1.89	0.00	1.42
dairy	2.39	0.00	0.00	0.20	0.00	0.00	0.00	0.00	3.56	0.00	0.40
sugar	0.00	0.00	1.78	0.04	0.00	0.00	0.03	0.00	0.00	0.00	0.05
bt	2.57	0.00	0.69	0.90	0.00	0.01	0.00	0.00	0.01	0.00	0.37
textiles	0.05	0.00	0.02	0.00	0.02	0.00	0.00	0.07	0.02	0.00	1.47
waplea	5.93	1.45	2.18	0.11	0.55	0.43	37.16	0.10	1.17	0.07	0.88
woodpaper	0.63	5.41	3.90	7.65	0.06	6.02	5.09	0.63	0.60	0.00	1.85
chemicals	3.38	1.46	0.97	1.34	0.36	1.44	1.10	0.80	0.07	23.46	14.38
ferrous	0.10	0.05	1.18	0.03	2.44	0.01	1.28	0.08	0.00	0.23	2.12
metal	0.01	33.82	1.79	49.13	2.31	6.63	45.08	14.08	0.23	0.66	5.67
mqequip	0.23	0.00	0.78	0.06	0.08	0.35	1.01	0.02	0.06	0.00	35.97
motor	0.07	0.00	0.52	0.00	0.00	0.02	0.00	0.00	0.00	0.00	7.49
mnfc	0.01	0.01	0.08	0.00	0.02	0.59	0.12	0.00	0.09	0.00	1.96
services	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Source: GTAP database (Aguiar et al., 2019).

China, on the other hand, mainly exports Machinery and equipment (mqequip); Chemicals, rubber, and plastic (chemicals); Motor vehicles and parts (motor); Textiles (textiles); and Wearing apparels (waplea) to South America. In 2014, Brazilian and Argentine imports from China were concentrated in Machinery and equipment (mqeqip), 45.84% and 46.66%, and in Chemicals, rubber, and plastic (chemicals), 16.02% and 20.11%. The same pattern is observed in most of the South American countries, as shown in Table 4.

Table 4 – Import shares from China by commodities, 2014 (%)

Com.	ARG	BOL	BRA	CHL	COL	ECU	PRY	PER	URY	VEN	ROW
grains	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
crops	0.03	0.03	0.34	0.08	0.28	0.29	0.10	0.04	0.04	0.81	0.63
animalprd	0.04	0.02	0.07	0.02	0.02	0.02	0.00	0.04	0.05	0.01	0.26
frsfsh	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.09
minergy	0.66	0.05	0.09	0.02	0.11	0.16	0.01	0.02	0.01	0.07	0.31
meatprd	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19
otrfood	0.41	0.62	1.23	1.17	0.64	0.39	0.20	0.68	0.69	0.16	1.65
dairy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
sugar	0.01	0.02	0.01	0.05	0.06	0.04	0.01	0.13	0.01	0.01	0.03
bt	0.00	0.02	0.00	0.01	0.14	0.00	0.03	0.01	0.00	0.00	0.12
textiles	4.25	5.66	6.50	5.64	6.54	3.99	3.98	6.44	2.96	2.66	4.55
waplea	4.48	6.26	7.04	23.28	6.12	4.98	4.96	8.18	12.38	5.52	12.78
woodpaper	1.06	1.68	1.05	1.33	1.53	1.73	0.69	1.59	0.83	1.04	1.96
chemicals	20.11	14.56	16.02	10.86	12.60	12.66	17.67	12.77	16.68	7.77	10.11
ferrous	2.20	12.03	6.71	8.47	9.17	15.62	3.06	12.70	2.41	9.95	5.54
metal	5.16	6.79	5.02	5.89	5.10	6.67	2.57	5.55	3.37	7.98	5.97
mqequip	46.66	31.19	45.84	33.10	44.99	38.52	55.16	38.59	44.75	44.56	45.46
motor	11.36	16.83	6.38	5.36	7.08	10.54	8.10	8.85	11.57	15.86	4.12
mnfc	3.58	4.24	3.53	4.70	5.60	4.39	3.47	4.41	4.25	3.59	6.21
services	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Source: GTAP database (Aguiar et al., 2019).

Given the trade pattern between China and South American countries, it is relevant to evaluate the comparative advantage of each region and the complementarity among them. Based on Balassa's (1965) Revealed Comparative Advantage (RCA) index, a trade complementarity index[3] has been calculated. Basically, the index identifies those products that an exporter country has revealed to have comparative advantage and the importer has revealed to have comparative disadvantage.

[3] The trade complementarity index is calculated as follows:

$$IC_{ij} = \left[1 - \left(\sum\nolimits_k \left|\frac{M_j^k}{M_j} - \frac{X_i^k}{X_i}\right| \div 2\right)\right] \times 100$$

where M_j^k is the import of product k by country j; M_j is the total import of country j; X_i^k is the exports of product k by country i; and X_i is the total exports of country i. The index is expressed in percentage terms, where higher values indicate greater complementarity between the exports of country i and the imports of country j.

Table 5 shows the trade complementarity index among South American countries and China. The indexes greater than the country average is highlighted in grey. On one hand, it is possible to observe a trade complementarity among South American countries. In general, the trade complementary indexes are higher than the average for the South American countries. On the other hand, the results do not show a trade complementarity among China and South America. Considering the South American countries as importers, only Uruguay presents an index with China above the average. China, otherwise, presents an index above the average with Argentina, Brazil, Colombia, Peru, and Uruguay.

Table 5 – Trade complementary index, 2014

Regions		Importer										
		CHN	**ARG**	**BOL**	**BRA**	**CHL**	**COL**	**ECU**	**PRY**	**PER**	**URY**	**VEN**
Exporter	**CHN**	-	27.03	10.91	33.63	19.04	25.85	13.59	16.62	21.84	27.90	11.33
	ARG	26.75	-	29.87	54.84	33.57	35.33	27.35	43.69	35.92	46.36	17.19
	BOL	10.86	30.10	-	31.76	34.04	20.12	18.36	20.06	41.67	14.39	12.91
	BRA	33.17	55.35	31.14	-	42.85	38.56	27.25	36.01	43.13	45.31	21.01
	CHL	18.66	32.86	34.03	42.46	-	25.93	31.51	13.40	75.81	24.75	12.27
	COL	25.71	35.98	20.27	39.79	26.44	-	63.77	14.86	35.45	26.77	54.38
	ECU	13.24	25.44	17.52	26.42	30.59	62.42	-	11.25	31.78	18.78	54.94
	PRY	16.32	43.50	19.51	34.28	13.40	14.57	11.04	-	15.01	49.37	6.48
	PER	21.71	35.89	41.81	43.27	75.30	35.37	34.37	15.37	-	26.25	16.78
	URY	27.67	46.78	14.45	44.03	25.46	26.71	19.21	50.22	26.83	-	10.42
	VEN	11.37	17.46	12.87	21.66	12.39	54.91	57.82	6.70	16.67	10.59	-
	ROW	52.88	54.92	23.99	56.80	29.02	47.10	28.73	22.10	37.76	40.63	23.83
Average		**21.53**	**33.77**	**21.36**	**35.75**	**28.51**	**32.24**	**27.75**	**20.86**	**31.82**	**27.59**	**20.13**

Source: Own calculations.

To capture the complementarity by products, Table 6 presents the number of products by main activities (Agriculture, Mining, Industry, Trade, and Services) with IC[4]> 1 for each pair of countries. We observe that Uruguay, Argentina, and Brazil present the highest number of cases with IC > 1, 171, 151, and 138 cases, respectively.

For Agriculture, Argentina presents the highest number of products with IC > 1, with 55 cases, followed by Uruguay, with 51 cases, and Brazil, with 47 cases. For Industry, the first place is also occupied by Argentina, with 59 cases, followed by Brazil, with 58 cases, and Uruguay, with 55 cases. For services, Uruguay presents the highest number of cases, 62 cases, followed by Peru, with 39 cases.

[4] The IC is calculated as follows:

$$IC_{ij}^{k} = RCA_{i}^{k} \times RCD_{j}^{k}$$

where RCA_i^k is the Revealed Comparative Advantage Index and RCD_j^k is the Revealed Comparative Disadvantage Index. An index greater than 1 indicates complementarity in the trade of this good between country *i* and country *j*. Higher index indicate greater complementarity.

Table 6 - Distribution of products with IC > 1 for each pair of countries

Exporter	Sector	Importer											Total
		CHN	ARG	BOL	BRA	CHL	COL	ECU	PRY	PER	URY	VEN	
	Agriculture	-	5	2	4	3	2	3	2	4	4	-	29
	Mining	-	-	-	-	1	-	-	-	1	-	-	2
China	Industry	-	4	3	8	4	4	2	6	5	6	1	43
	Trade	-	-	-	-	-	-	-	-	-	-	-	0
	Services	-	-	-	-	-	-	-	1	-	3	-	4
	Agriculture	5	-	4	9	6	4	5	6	7	8	1	55
	Mining	-	-	1	1	1	1	1	-	1	-	1	7
Argentina	Industry	3	-	4	11	9	6	2	9	5	9	1	59
	Trade	-	-	-	-	-	-	-	-	-	-	-	0
	Services	-	-	2	2	2	4	2	2	7	8	1	30
	Agriculture	-	2	-	4	4	2	2	2	2	4	4	26
	Mining	-	-	-	1	1	1	2	2	-	2	-	9
Bolivia	Industry	-	3	-	4	6	3	3	4	4	2	6	35
	Trade	-	-	-	-	-	-	-	-	-	-	-	0
	Services	-	-	-	2	1	1	2	2	1	4	8	21
	Agriculture	-	4	9	-	4	4	4	5	6	5	6	47
	Mining	-	1	1	-	1	1	1	2	-	1	-	8
Brazil	Industry	-	8	11	-	6	9	7	4	7	6	1	59
	Trade	-	-	-	-	-	-	-	-	-	-	-	0
	Services	-	-	2	-	1	2	2	1	3	5	9	25
	Agriculture	-	3	5	2	-	4	2	3	3	5	7	34
	Mining	-	1	1	1	-	1	1	1	-	1	1	8
Chile	Industry	-	4	9	3	-	9	4	4	8	4	9	54
	Trade	-	-	-	-	-	-	-	-	-	-	-	0
	Services	-	-	2	1	-	1	3	2	1	5	6	21
	Agriculture	-	2	4	2	3	-	2	3	4	2	4	26
	Mining	-	-	1	2	1	-	1	1	-	-	-	6
Colombia	Industry	-	4	6	3	7	-	3	2	3	5	5	38
	Trade	-	-	-	-	-	-	-	-	-	-	-	0
	Services	-	-	3	2	2	-	3	2	2	6	8	28
	Agriculture	-	3	5	2	5	3	-	3	5	4	5	35
	Mining	-	-	1	2	2	1	-	1	-	1	-	8
Ecuador	Industry	-	2	2	4	4	4	-	2	5	4	6	33
	Trade	-	-	-	-	-	-	-	-	-	-	-	0
	Services	-	-	2	2	1	2	-	2	2	3	6	20
	Agriculture	-	2	6	2	6	4	4	-	5	6	6	41
	Mining	-	-	-	-	-	-	-	-	-	-	-	0
Paraguay	Industry	-	6	8	5	7	8	3	-	5	4	7	53
	Trade	-	-	-	-	-	-	-	-	-	-	1	1
	Services	-	1	2	2	3	1	2	-	2	4	7	24
	Agriculture	-	4	7	4	5	5	2	4	-	5	8	44
	Mining	-	1	1	2	1	1	-	1	-	-	1	8
Peru	Industry	-	5	5	2	7	4	5	4	-	4	7	43
	Trade	-	-	-	-	-	-	-	-	-	-	-	0
	Services	-	-	7	4	4	5	6	3	-	3	7	39
	Agriculture	-	4	8	4	6	7	4	5	6	-	7	51
	Mining	-	-	-	-	-	1	-	-	-	-	1	2
Uruguay	Industry	-	6	9	6	1-	9	5	6	7	-	7	55
	Trade	-	-	-	-	-	-	-	-	1	-	-	1
	Services	-	3	8	8	9	6	8	6	7	-	7	62
	Agriculture	-	-	1	-	1	1	1	1	1	-	-	6
	Mining	-	-	1	2	2	1	2	1	-	2	-	11
Venezuela	Industry	-	1	1	2	1	2	1	1	-	2	-	11
	Trade	-	-	-	-	-	-	-	-	-	-	-	0
	Services	-	-	1	1	2	2	1	1	1	1	-	10

Source: Own calculations. Note: The sectoral coverage is available on the annex.

Considering each bilateral trade, it is possible to observe the highest number of cases with IC > 1 in the trade between China and Uruguay, with 12 cases, and between China and Brazil, with 11 cases). For Argentina, the trade with Uruguay and Brazil are those with the highest number of cases, 25 and 23, respectively. Venezuela, Uruguay, and Chile present a higher number of cases in the trade with Bolivia. In the case of Brazil, we can also highlight the number of cases with Bolivia and Uruguay, 23 and 17, respectively. Venezuela and Bolivia are the countries with the highest number of cases in trade with Chile. For Colombia, Ecuador, Paraguay, and Peru, the trade with Venezuela presents the highest number of cases of IC > 1, 17 for Colombia and Ecuador, 21 for Paraguay, and 23 for Peru. The trade between Uruguay and Bolivia is the one with most cases. For Venezuela, the trade with Chile and Colombia is the most important in terms of the number of cases of IC > 1.

3. Methodology and database

To explore the channels of interactions among China and South American countries, this study uses an applied general equilibrium analysis. The following subsections describe the methodology, the empirical strategy, and the database.

3.1. Methodology and empirical strategy

Since the early 1990s, Computable General Equilibrium (CGE) models have been used to investigate the effects of trade policy (e.g., trade liberalization, regional agreements, and impact of reforms implemented by the WTO) on industries, production factors, and welfare (Burfisher, 2011). In this context, the Global Trade Analysis Project (GTAP) was established in 1992 (Hertel, 1997). Besides a global network of researchers, the GTAP includes a global database and models to conduct applied general equilibrium analysis of global economic issues.

In this paper, we use a global CGE model derived from the GTAP Data Base. The standard modeling framework, the GTAP model structure, and the database are well described in Hertel (1997), Walmsley et al. (2012), and Burfisher (2011).[5] In the GTAP model, producers maximize their efficiency according to the cost of inputs, sales prices, and technological constraints, and consumers maximize their utility according to their budgets and prices. Furthermore, production assumes constant returns to scale and the markets are perfectly competitive. Finally, global investments are equal to global savings (Burfisher, 2011).

In general, the model can be represented by three core modules: i) database with input-output/social accounting matrices, tax matrices, and other data that provide the numeric structure of the model; ii) system of mathematical equations that provides the functional and theoretical structure of the model by describing an economy as a whole, including the producer and consumer behavior, and equilibrium conditions, and other constraints, identity, and behavioral equations; and iii) macroeconomic closure that determines the endogenous and exogenous variables.

The functioning of the global economy structure modeled in the GTAP model can be explained by performing an analysis through an arbitrary region and therefore its interactions with the other regions. These interactions occur through the imposition of conditions of equilibrium between the global players.

To capture the impact of China's business upon South American countries, we consider a decrease in China's traded goods prices. Our strategy is based on the idea that China currently has significant participation in the international market, the second-largest GDP in the world, and a solid exportation model, which gives the country an important price-forming status in the global foreign market. Based on this assumption, we implement a shock at the market price (*pm*) of all Chinese commodities. Since there is an explicit

[5] Technical papers are also available at https://www.gtap.agecon.purdue.edu.

structure of interrelations between internal and external economic agents, it affects the whole economic system.

To implement this shock, we have changed the traditional GTAP closure. The market prices in China have been fixed as follows. It allows us to capture the impact of a decrease in the price of Chinese goods upon the South American countries and the Rest of the World.

The new closure includes de following modifications:

```
swap walraslack = pfactwld;
swap incomeslack("China") = y("China");
swap profitslack(PROD_COMM,"China") = qo(PROD_COMM,"China");
swap endwslack(ENDW_COMM,"China") = pm(ENDW_COMM,"China");
swap tradslack(TRAD_COMM,"China") = pm(TRAD_COMM,"China");
swap cgdslack("China") = pm(CGDS_COMM,"China");
```

In other words, since a decrease in the price of Chinese commodities means a decrease in import prices of Chinese products by South American countries and the Rest of the World, it allows us to see how China's business matters to South America.

3.2. Database

The Global Trade Analysis Project Data Base, version 10 (GTAP-10), was used in this study. The full description of this version is available in Aguiar et al. (2019), including the improvements over previous versions. The GTAP-10 considers four reference years (2004, 2007, 2011, and 2014) and it covers 65 sectors, 141 regions, and five factors of production (land, skilled labor, unskilled labor, capital, and natural resources). However, to assess the systemic effects of the trade relationship among South American countries and China, we have used 2014 as the base year (reference year). Furthermore, we have aggregated the database to consider the following spatial dimension: China (CHN), Argentina (ARG), Bolivia (BOL), Brazil (BRA), Chile (CHL), Colombia (COL), Ecuador (ECU), Paraguay (PRY), Peru (PRY), Uruguay (URY), Venezuela (VEN), and the Rest of the World (ROW).

In general, the GTAP database consists of goods and services flows in USD for the entire world economy in some benchmark (reference) years. As described by Walmsley et al. (2012), the database considers matrices related to bilateral trade, transport, and protection, which links the regional economic databases. Thus, the database includes input-output data, such as sales and uses of domestic and imported commodities, of factors of production, and uses of inputs into production, and additional data related to trade margins, trade taxes, commodity taxes, income taxes, savings, capital stock, depreciation, and population for each region (Walmsley et al., 2012).

Considering our empirical strategy described in Section 3.1, it is important to highlight some structural data, such as regional endowments, regional capital stock, and savings shares in the reference year (2014). These shares are important to explain the productive

specialization, the trade pattern, and the region/country insertion in the global trade market.

Table 7 shows the factor endowment (land, skilled labor, unskilled labor, capital, and natural resources), in percentage, in each region/country considered in our database. Paraguay (5.75%), Peru (3.43%), Bolivia (3.25%), and Uruguay (2.46%) are the most intensive countries in land use in the base year (2014). In terms of unskilled labor, Argentina (22.12%), Paraguay (16.94%), Brazil (15.10%), and Peru (13.79%) are the countries with the larger shares. In terms of skilled labor, we can highlight the shares of Peru (45.11%), Venezuela (41.44%), and Paraguay (37.35%). However, China (36.33%), Brazil (34.80%), and Chile (37.20%) also show shares above the average for skilled labor. The most intensive countries in terms of capital are Colombia (60.62%), Ecuador (56.88%), Uruguay (55.41%), Chile (52.05%), and China (48.77%). Finally, in terms of natural resources, we can highlight the shares of Bolivia (8.00%), Ecuador (5.90%), Colombia (3.25%), and Venezuela (3.09%).

Table 7 – Regional endowments in the base year – 2014 (%)

Regions	Land	Unskilled Labor	Skilled Labor	Capital	Natural Resources	Total
China	1.75	11.54	36.33	48.77	1.61	100
Argentina	1.68	22.12	27.45	47.20	1.56	100
Bolivia	3.25	11.57	33.40	43.79	8.00	100
Brazil	0.91	15.10	34.80	47.88	1.31	100
Chile	0.88	8.45	37.20	52.05	1.42	100
Colombia	1.24	9.16	25.73	60.62	3.25	100
Ecuador	1.91	11.58	23.72	56.88	5.90	100
Paraguay	5.75	16.94	37.35	39.76	0.19	100
Peru	3.43	13.79	45.11	35.69	1.99	100
Uruguay	2.46	9.82	32.17	55.41	0.15	100
Venezuela	1.00	12.39	41.44	42.08	3.09	100
Rest of the World	0.91	10.93	38.81	47.69	1.66	100
Average	2.10	12.78	34.46	48.15	2.51	-

Source: GTAP database (Aguiar et al., 2019).

Table 8 presents the regional share of capital stock and savings. We observe that China and Brazil are the countries with the largest share. On one hand, China has 15.91% and 36.76% of the capital stock and savings in the base year (2014) respectively. Brazil, on the other hand, has 2.59% and 1.85% respectively. The Rest of the World has a significant share since it includes all the other regions in the World, excluding China and the South American countries considered individually in our database.

Table 8 – Capital stock and savings in the base year – 2014 (regional share - %)

Regions	Capital Stock	Savings
China	15.91	36.76
Argentina	0.51	0.50
Bolivia	0.02	0.07
Brazil	2.59	1.85
Chile	0.30	0.32
Colombia	0.43	0.49
Ecuador	0.14	0.17
Paraguay	0.03	-0.01
Peru	0.21	0.30
Uruguay	0.08	0.01
Venezuela	0.55	0.76
Rest of the World	79.22	58.78
Total	100	100

Source: GTAP database (Aguiar et al., 2019).

4. Results

This section reports the main results related to a decrease in the prices China's traded goods. We presented first the macroeconomic effects, following by the welfare, sectoral, and trade effects.

Table 9 shows the macroeconomic effects, including those in terms of real GDP, export and import volume, terms of trade, trade balance, equivalent variation, and real consumption. It is possible to observe that all regions had increased their real GDP due to a decrease in the prices of the Chinese traded goods. China, as expected, had the greater increase, 6.30%. These findings indicate that the increase of China's business has positive effects for all the regions in terms of real GDP.

However, the trade results show that China may increase its exports while all the other regions experience decreases. The opposite is observed in terms of imports. Thus, the trade balance indicates, on one hand, that Argentina, Bolivia, Chile, Ecuador, Venezuela, and the Rest of the World may worsen. On the other hand, China, Brazil, Colombia, Paraguay, Peru, and Uruguay may improve their trade balance.

Through the equivalent variation (EV) and real consumption expenditure, we can observe welfare gains.[6] Table 9 shows a positive effect on the EV for all countries. China and the Rest of the World are the two regions with the highest positive impacts, followed by Brazil, Argentina, and Uruguay. The impact is also positive in real consumption expenditure for all regions.

Thus, considering the macro results and demand effects, we can affirm that China's business matters to South American countries. Through our simulation, we observed positive impacts in terms of welfare and real consumption for all countries and a heterogeneous impact upon the trade balance.

[6]According to Brown et al. (2005) and Siriwardana (2006; 2007), the EV measures the amount of income that would have to be given or taken away from an economy before trade liberalization to leave the economy as well off as it would be after the policy has been changed.

Table 9 - Macroeconomic effects

Regions	Real GDP (%)	Export Volume (%)	Import Volume (%)	Terms of Trade (%)	Trade Balance (US$ million)	Equivalent Variation (US$ million)	Real Consumption (%)
China	6.3008	2.7767	-0.6070	-0.4842	20757.49	597357.94	6.3432
Argentina	0.0100	-0.4499	0.3391	0.1806	-742.42	441.72	0.0881
Bolivia	0.0098	-0.0439	0.0615	-0.0482	-294.28	33.31	0.1044
Brazil	0.0148	-0.6239	0.5024	0.2047	2606.58	1901.91	0.0868
Chile	0.0075	-0.1969	0.1341	0.0660	-259.54	227.55	0.0986
Colombia	0.0073	-0.3742	0.3292	0.0397	143.83	294.55	0.0858
Ecuador	0.0154	-0.4320	0.2332	0.1153	-345.38	124.50	0.1386
Paraguay	0.0222	-0.3283	0.1048	0.1373	281.06	21.17	0.0750
Peru	0.0016	-0.1677	0.2185	0.0648	210.58	180.26	0.0950
Uruguay	0.0664	-0.9112	0.4865	0.3241	128.43	95.96	0.1961
Venezuela	0.0116	-0.3066	0.4891	-0.0303	-653.68	406.53	0.0874
Rest of the World	0.0085	-0.3074	0.1142	0.0621	-21832.65	45458.45	0.0816

Source: Own calculations.

Table 10 reports the welfare decomposition. It shows that the resource allocation effect contributes to EV more than the terms of trade and investment-savings terms of trade. The resource allocation effect contributes positively to all regions while the terms of trade contribute negatively to China, Bolivia, and Venezuela. Investment-savings terms of trade contribute negatively to China. Brazil is the country with the highest change in welfare, followed by Argentina and Venezuela. The positive results for these three countries are strongly related to the investment-savings terms of trade.

The terms of trade and the demand derived from the Chinese expansion remain favorable to regional economic growth, taking advantage of them; however, they depend on industrial policies whose absence in recent years or the low priority given to them has certainly collaborated to reduce the prospects for productive diversification in the region.

Table 10 – Welfare decomposition (US$ million)

Regions	Resource Allocation Effect	Terms of Trade	Investment-Savings terms of trade	Total
China	52279.58	-11916.80	-53555.59	-13192.81
Argentina	54.94	147.36	239.42	441.72
Bolivia	3.25	-5.49	35.55	33.31
Brazil	358.53	542.68	1000.71	1901.91
Chile	19.51	55.47	152.57	227.55
Colombia	27.49	23.25	243.81	294.55
Ecuador	15.51	34.05	74.94	124.50
Paraguay	6.85	13.31	1.01	21.17
Peru	3.20	28.90	148.16	180.26
Uruguay	38.00	43.90	14.07	95.96
Venezuela	59.11	-14.36	361.78	406.53
Rest of the World	5401.85	11271.73	28784.99	45458.57
Total	58267.81	224.00	-22498.59	35993.22

Source: Own calculations.

To see the contribution to each sectoral shock in the trade balance, Table 11 shows the effects decomposition by the 20 sectors. The results may be interpreted as a subtotal related to the decrease in China's traded prices of each commodity. For Brazil, the trade balance, for example, was 2,606.58 US$ million after the shock. Of this change, -28.88 US$ million was associated with the Chinese price change of Grains, 600,25 US$ million with the Chinese price change of crops (Other crops), and so on. Similarly, we can interpret the trade balance changes for the other countries.

On one hand, we observe that China, as expected, has the highest positive result (2,0757.49 US$ million), followed by Brazil (2606.58 US$ million) and Paraguay (281.06 US$ million). On the other hand, the Rest of the World has the highest trade balance deficit (-21832.65 US$ million), followed by Argentina (-742.42 US$ million) and Venezuela (-653.68 US$ million).

Considering these subtotals, we can affirm that the decrease in imports prices from China on Other food products (otrfoof), Wearing apparels (waplea) and Beverage and tobacco (bt) are the sectors that most influence the positive total variation at trade balance. For Brazil, we can highlight trade balance change associated with Chinese price changes of Metal products (metal), Other crops (crops), and Ferrous metals (ferrous). These results are partially linked to the IC index presented in Section 2 since we did not observe a trade complementarity among China and South American countries and partially linked to the sectoral effect, which we had expected an unequal impact on sectors according to the degree of complementarity and rivalry (See Table 5).

Table 11 - Trade balance changes by subtotal* (US$ million)

Com.	CHN	ARG	BOL	BRA	CHL	COL	ECU	PRY	PER	URY	VEN	ROW
grains	1167.57	-6.55	-0.28	-28.88	-3.69	-6.52	-2.04	-0.19	-3.15	-1.13	-6.52	-1108.62
crops	1124.10	8.77	-2.95	600.25	-15.05	1.46	3.66	9.56	-23.28	46.05	-11.58	-1740.99
animalprd	2020.06	4.32	-1.71	233.76	-6.83	-6.87	1.75	7.26	-23.32	19.98	-13.63	-2234.76
frsfsh	1046.14	-5.23	-0.47	-24.28	-4.33	-4.43	-0.63	0.32	-2.88	2.00	-5.33	-1000.87
minergy	75.48	-50.45	-17.16	305.18	5.62	384.14	92.49	28.65	40.75	11.68	290.61	-1166.98
meatprd	2170.94	-9.95	-1.47	87.50	-8.24	-16.33	-4.78	6.52	-7.29	53.35	-19.90	-2250.36
otrfood	9035.77	-14.97	-4.56	-133.84	-24.60	-58.82	13.23	6.34	-19.76	10.46	-72.12	-8737.13
dairy	487.31	-0.83	-0.45	-11.95	-1.63	-4.23	-1.25	0.45	-1.99	9.89	-5.32	-470.02
sugar	70.04	-1.35	-0.20	79.39	-0.55	-0.33	-0.33	0.16	-0.43	0.47	-1.87	-145.00
bt	3158.97	-18.64	-0.54	-113.86	-6.56	-20.14	-6.96	-1.74	-7.61	-6.62	-19.28	-2957.01
textiles	332.82	-19.07	-7.84	211.20	-44.61	4.09	-1.68	10.80	-2.24	12.96	-41.48	-454.96
waplea	3351.77	13.43	-15.87	108.57	-54.96	-4.03	-10.74	33.79	61.29	161.15	-168.15	-3476.25
woodpaper	52.00	9.25	-4.29	349.73	55.12	7.42	10.94	9.24	-2.08	33.44	-12.98	-507.78
chemicals	978.14	-184.90	-44.83	-224.67	-104.97	150.32	-2.14	23.98	12.89	-31.23	141.36	-713.93
ferrous	75.62	22.73	-9.62	445.00	-51.83	17.84	-74.07	4.90	19.95	-5.80	-3.96	-440.77
metal	135.66	1.58	-11.35	652.98	568.01	63.36	-9.27	23.82	164.96	22.71	-75.59	-1536.88
mqequip	393.76	-32.92	-25.33	-47.35	-71.87	-81.78	-58.17	2.13	-45.36	-130.31	-121.85	219.04
motor	1172.15	-477.07	-120.99	-405.69	-426.94	-357.63	-329.81	64.10	22.82	-183.39	-440.74	1483.23
mnfc	200.46	-5.32	-10.10	163.15	-33.92	21.95	23.54	16.11	7.18	20.57	-40.08	-363.54
services	-6290.94	24.74	-14.25	360.39	-27.70	54.35	10.86	34.87	20.13	82.22	-25.26	5770.60
Total	20757.49	-742.42	-294.28	2606.58	-259.54	143.83	-345.38	281.06	210.58	128.43	-653.68	-21832.65

Source: Own calculations. Note: *The table shows the trade balance changes related to the decrease in China's traded prices of each commodity.

5. Final Considerations

The rapid economic growth, the degree of openness, and the dimension of China's economy has led to a controversial discussion in the literature. Questions were raised looking for the best understanding of who could win and who could lose. Specifically, the literature has based on different methodological approaches, raised hypotheses about the impact upon export prices, jobs, international prices of commodities, income, and other economic dimensions.

Thus, this paper aimed to answer the following question: Does China's business matter to South America? By the exercise proposed, it is possible to affirm that China's business matters to South American countries. We observe that there is an unbalanced relationship between China and South America and that China can compete with South American countries in a third country situation, mainly in the European Union and the United States.

Besides the first question, a complementary question can be raised: Is China's business good or not for South American countries? There are positive and negative effects. Positive impacts were observed in terms of GDP, real consumption, and welfare in all countries. However, they are not balanced. Furthermore, we can also highlight the importance of imports. For all South American countries, there is a positive variation in imports.

Finally, one more question can be raised: For which sectors is China's business more important? To answer it, we analyzed the contribution to each sectoral shock in the trade balance by making a decomposition by the 20 sectors. On one hand, we observed that China, as expected, had the highest positive result, followed by Brazil and Paraguay. On the other hand, the Rest of the World had the highest deficit at trade balance, followed by Argentina and Venezuela.

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Annex

GTAP 10 Data Base Sectors

Original GTAP classification		Aggregate classification*	
Code	**Description**	**Code**	**Description**
pdr	Paddy rice	grains	Grains
wht	Wheat	grains	Grains
gro	Cereal grains nec	grains	Grains
v_f	Vegetables, fruit, nuts	crops	Other crops
osd	Oil seeds	crops	Other crops
c_b	Sugar cane, sugar beet	crops	Other crops
pfb	Plant-based fibers	crops	Other crops
ocr	Crops nec	crops	Other crops
ctl	Bovine cattle, sheep and goats	animalprd	Animal products
oap	Animal products nec	animalprd	Animal products
rmk	Raw milk	animalprd	Animal products
wol	Wool, silk-worm cocoons	animalprd	Animal products
frs	Forestry	frsfsh	Forestry and fishing
fsh	Fishing	frsfsh	Forestry and fishing
coa	Coal	minergy	Mining and energy
oil	Oil	minergy	Mining and energy
gas	Gas	minergy	Mining and energy
oxt	Minerals nec	minergy	Mining and energy
cmt	Bovine meat products	meatprd	Meat products
omt	Meat products nec	meatprd	Meat products
vol	Vegetable oils and fats	otrfood	Other food products
mil	Dairy products	dairy	Dairy
pcr	Processed rice	otrfood	Other food products
sgr	Sugar	sugar	Sugar
ofd	Food products nec	otrfood	Other food products
b_t	Beverages and tobacco products	bt	Beverages and tobacco
tex	Textiles	textiles	Textiles
wap	Wearing apparel	waplea	Wearing apparels
lea	Leather products	waplea	Wearing apparels
lum	Wood products	woodpaper	Wood and paper products, publishing
ppp	Paper products, publishing	woodpaper	Wood and paper products, publishing
p_c	Petroleum, coal products	chemicals	Chemicals, rubber, and plastic
chm	Chemical products	chemicals	Chemicals, rubber, and plastic
bph	Basic pharmaceutical products	chemicals	Chemicals, rubber, and plastic
rpp	Rubber and plastic products	chemicals	Chemicals, rubber, and plastic
nmm	Mineral products nec	ferrous	Ferrous metals
i_s	Ferrous metals	ferrous	Ferrous metals
nfm	Metals nec	metal	Metal products
fmp	Metal products	metal	Metal products
ele	Computer, electronic and optic	mqequip	Machinery and equipment
eeq	Electrical equipment	mqequip	Machinery and equipment
ome	Machinery and equipment nec	mqequip	Machinery and equipment
mvh	Motor vehicles and parts	motor	Motor vehicles and parts
otn	Transport equipment nec	motor	Motor vehicles and parts

continue on next page

GTAP 10 Data Base Sectors

Original GTAP classification		Aggregate classification*	
Code	**Description**	**Code**	**Description**
omf	Manufactures nec	mnfc	Miscellaneous manufacturing
ely	Electricity	services	Services
gdt	Gas manufacture, distribution	services	Services
wtr	Water	services	Services
cns	Construction	services	Services
trd	Trade	services	Services
afs	Accommodation, Food and servic	services	Services
otp	Transport nec	services	Services
wtp	Water transport	services	Services
atp	Air transport	services	Services
whs	Warehousing and support activi	services	Services
cmn	Communication	services	Services
ofi	Financial services nec	services	Services
ins	Insurance	services	Services
rsa	Real estate activities	services	Services
obs	Business services nec	services	Services
ros	Recreational and other service	services	Services
osg	Public Administration and defe	services	Services
edu	Education	services	Services
hht	Human health and social work a	services	Services
dwe	Dwellings	services	Services

Note: *This classification has been used to aggregate the sectoral results, such as the trade balance changes.