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Original article

ARGENTINA'S TRADE POTENTIAL WITH BRICS: THE GRAVITY MODEL APPROACH

COMERCIO POTENCIAL DE ARGENTINA CON LOS BRICS: APLICACIÓN DEL MODELO DE GRAVEDAD

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Abstract

The study investigates the trade potentiality of Argentina with BRICS countries applying the gravity model approach. The estimation is performed on a panel data set containing information on BRICS countries through the years 2009 to 2022. Empirical findings expose that Argentina's total bilateral trade with BRICS countries is positively influenced by GDP, population, openness index and FDI. On the other hand, distance and real bilateral exchange rate show a negative influence on Argentina's total bilateral trade flow with BRICS. Besides, the effect of Covid-19 is also analysed showing a negative and significant relationship. Based on these findings, the empirical analysis show that overall exist a trade potential between Argentina and BRICS countries. This research recommends that the Argentinian

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government for enhancing trade and production within the BRICS countries. Especially with South Africa, China, and Brazil due to their higher trade potential.

Keywords: gravity model, trade potential, BRICS, panel data

Resumen

El estudio investiga el comercio potencial de Argentina con los BRICS aplicando el enfoque del modelo de gravedad. La estimación se realiza en un conjunto de panel de datos que contiene información sobre los países BRICS desde 2009 a 2022. Los hallazgos empíricos revelan que el comercio bilateral total de Argentina con los países BRICS se ve positivamente influenciado por el PIB, la población, el índice de apertura y la IED. Por otro lado, la distancia y la tasa de cambio bilateral real muestran una influencia negativa en el flujo comercial bilateral total de Argentina con los BRICS. Además, se analiza el efecto del Covid-19, mostrando una relación negativa y significativa. Basándose en estos hallazgos, el análisis empírico muestra que en general existe un comercio potencial entre Argentina y los países BRICS. Esta investigación recomienda al gobierno argentino que fomente el comercio y la producción dentro de los países BRICS, especialmente con Sudáfrica, China y Brasil debido a su mayor comercio potencial.

Palabras claves: modelo gravitacional, comercio potencial, BRICS, datos de panel

Introduction

The economic literature shows that countries participate in trade mainly for two reasons. The first holds that countries trade due to they are different and such dissimilarities generate profits through interaction between them; each country then produces those goods it produces relatively more efficiently (competitively), which enables it to achieve economies of scale through trade. Second, trade relations allow countries to specialize and export products they make more efficiently (principle of comparative advantage), in turn, this exchange can be seen as an indirect production method since a country produces another good and changes it for the desired good, thereby expanding its entree to an extensive variety of consumer products.[1]

In recent decades, the greatest interdependence between the economies of different nations has led to a steady growth in international commerce. One of the causes has been the promotion and increase of regional trade agreements (RTA), which have positioned the place as a dynamic and influential element within the trading system.

There are also other reasons besides international agreements that describe the growth of international trade flows, including the incorporation of technological improvements that have implicated a significant fall in transport and communications costs. The change in the internal model and structures of many companies have led to their internationalization, as well as the efforts made by many countries to

implement unilateral liberalization steps of trade and rules to attract and facilitate the inflow of investment from abroad.[2]

In line with the above, it is of great interest then to analyse Argentina's international trade over the past years and determine the importance that the external sector has gained within the domestic field, especially with new growing economies such as BRICS countries. There are many reasons behind the interest of Argentina in trading with BRICS countries such as the particular characteristics of the group of countries as also the main trade partner of Argentina are part of this regional trade agreement, Brazil and China. Hence, the present study aims to assess the actual trade potential between Argentina and BRICS.[3]

BRICS countries started to occupy an important place not just regionally[4], as models, otherwise also in the world, in the worldwide GDP and projecting a potential perspective of development in the future[5,6]. For Argentina, looking for support into BRICS countries can aid to achieve the main objective of the nation is to industrialize and grow in the national economy as well as in the international. For this reason, analysing the international trade between Argentina with those countries can help us to build new policy suggestions and create a new perspective on Argentinian trade.

Applied research on the gravity model in Latin American countries is limited[7,8,9,10]. These studies, for the most part, have been based on analysing the impact of trade policy on trade and regarding the trade potentiality analysis. Therefore, this study will uniquely apply the gravity model approach to explore the potential trade and based on those results we will provide economic recommendations to enhance Argentina's trade with BRICS shortly.

Argentina and BRICS: Overview

Argentina is the second largest economy in South America. It has always been an important part of international trade relations, together with Brazil; they are the great economies and powers of the region. Argentina has been a WTO's founder member from the Uruguay Round and a member of the commercial G-20. It is important to highlight that currently, Argentina's average Most Favoured Nation (MFN) tariff rate stands as one of the highest in the region, as estimated by the WTO at 13.7%.

Regarding the participation in the WTO, Argentina has an important participation in dispute resolution. Until May 2019, Argentina participated in 62 commercial disputes, where the country appeared as a claimant 21 times and as claimed 22 times. According to these data, the country stands as the sixth developing country that most often reserved its rights as a third party interested in disputes in the WTO. Argentina focuses on negotiations at the multilateral level, and has one of the highest average tariffs in the region, maintaining a protectionist stance despite greater economic integration[11.]

BRICS nations played varying roles, to some degree, in the revival of the Argentine economy. During the 20th century, Argentina sought different ways to reduce the historical rivalry with Brazil and to establish constructive and mutually beneficial bilateral relations. In 1988, the two countries began a process of deepening the liberalization of bilateral trade, through the signing of the Buenos Aires Act.

The deepening of economic integration between the countries guided the signing of the Asunción Agreement for the constitution of MERCOSUR in 1991 (Argentina, Brazil, Paraguay, and Uruguay).[12]

Brazil is the main trade partner of Argentina. During the last 25 years, the total bilateral trade increased 421%. The main characteristic related to the industries traded is specialization, both countries specialize in transport sectors, whereas Argentina and Brazil have an agreement on different production related this industry. Besides, we would like to mention that Argentina has a few participation percentage in the Global Chain Value (GVC) but this participation corresponds to the bilateral trade with Brazil related to the transport sector.

Russia is a market with a lot of fluctuation related to the bilateral trade. Both have a strong political relationship. However, their trade relationship is still not defined by a patron. From 1993 to 2022, the total bilateral trade increased 824%. The balance of payment in this relationship is with the surplus in favour of Argentina. However, this surplus had decreased during the last years due to the barriers to trade imposed by the Russian government related to animal and vegetable sector regulations, implying a decrease in Argentinian exports to this country.

India is a new market for Argentina. During the last time, Argentina have taken advantage of the increase in the agricultural products of India. For this reason, the increase in total bilateral trade during the last 25 years was 3392% where Argentina duplicated the exports against the imports coming from this country. In this relationship with Russia, the balance of payments is in favour of Argentina with a surplus.

China is the second main trade partner of Argentina. From 1993 to 2022, the bilateral total trade increased by 4307%. It represents the industrialization of China, due to Argentina's exports to China the third part that is receiving from China. Balance of payment has a negative balance for Argentina. The trade, between these countries, is characterized by exporting raw materials from Argentina to China and receiving industrial products as imports. Besides, China is the main investor in Argentina related to the oil, infrastructure, iron, and other sectors as well.

Regarding South Africa is also a new market for Argentina. The main characteristic of those countries is the disinterest from each other in trading. However, the total bilateral trade increased by 417% during the last 25 years. Argentina's exports are twice the imports received from them.

Additionally, **Table 1** outlines Argentina's overall exports to BRICS nations. In 2022, Argentina's exports to BRICS countries constituted 30% of its total exports. Brazil emerged as the primary export destination, accounting for 14% of the total exports, followed by China and India at 9% and 5%, respectively. Notably, Argentina's exports to Russia and South Africa represented only 1% of its total exports.

Similarly, Argentina's overall imports from BRICS nations constituted 44% of its total imports in 2022. Among the BRICS members, China emerged as the primary import partner, representing 21%, followed closely by Brazil at 20%, with India accounting for 2%. Hence, the data demonstrates significant trade potential for Argentina with BRICS countries, particularly with emerging markets like South Africa, Russia, and India.

Table 1. Argentina exports and imports to BRICS, 2022

Details	Exports (MM US$)	Total Exports (%)	Imports (MM US$)	Total Imports (%)
Brazil	12.637,34	0,14	15.978,63	0,20
Russia	498,41	0,01	277,83	0,00
India	4.542,50	0,05	1.849,37	0,02
China	8.014,63	0,09	17.516,21	0,21
South Africa	460,71	0,01	195,35	0,00
Worldwide	88.445,72	1,00	81.522,68	1,00

Source: Reported by Argentina UN Comtrade Database

Materials and methods

The investigation focuses on Argentina's trade potential with BRICS countries, employing the gravity model methodology. This model considers various variables including GDP, distance, population, total trade, and other relevant trade variables. The trade value shows a positive correlation with the economic size (GDP) of nations and a negative correlation with the distance between them. In essence, trade volume increases with the product of the GDPs of involved economies while decreasing with greater distances between them.

Gravity Model: Overview

A gravity model is an empirical tool that predicts the potential of bilateral trade as we review in the literature review. Its theoretical basis is based on Newton's law of universal gravitation (1687), which states that the force of attraction between two objects is directly proportional to the magnitude of their masses and inversely proportional to the distance separating them.

Tinbergern and Pöyhönen were the pioneers in employing this principle to elucidate international trade patterns using the gravity trade model. This model explains that the force of commercial attraction between countries *i* and *j* is directly relative to their economic size, expressed through their GDP; and the opposite is equivalent to their distance.

Although the successful of the gravity model of trade, the main criticism of this, at first, was its lack of theoretical basis, as evidenced by the attempts of Linneman, Learmer and Stern who did not have successful in justifying it theoretically[13]. Subsequently, however, several investigations legitimized the theoretical validity of the model[14,15,16,17,18].

Given the theoretical robustness of the gravity model, the emphasis has been placed on the study of the theoretical basis of the model in its empirical uses. In addition, according to recent methodological

contributions, the importance and validity of the increased gravity model and the study of the terms of resistance to trade in it have been highlighted[13]. Thus, Anderson and Wincoop found that the bilateral flow of trade is affected by barriers to trade, by the existence of bilateral resistances, and by multilateral resistances, the latter represents the relative importance of such barriers to trade concerning other countries.[19] From this, multilateral resistances have been considered a source of bias, and therefore a topic of importance to all researchers who empirically use the gravity model[11].

Empirical Analysis

Hence, this model offers a broader scope compared to the fundamental gravity model. The equation below outlines the dependent and independent variables considered in this study.

$$ln(Y_{ijt}) = \beta_0 + \beta_1 \ln(GDP_{it} * GDP_{jt}) + \beta_2 \ln(POP_{it} * POP_{jt}) + \beta_3 \ln(DIST_{ij}) + \beta_4 \ln(BRER_{ijt}) + \beta_5 \ln(Open_{jt}) + \beta_6 \ln(FDI_{jt}) + Covid19 + \delta_t + \mathcal{E}_{ijt}$$

The variables are described as Ln (Yijt) represents the natural logarithm of total trade, encompassing both net exports and imports from country i to country j, denoted in US$. Where "i" represents Argentina and "j" is the BRICS countries. The independent variables are GDP, population, distance, bilateral real exchange rate, openness index, and foreign domestic investment (FDI). Finally, COVID-19 as dummy variable.

Therefore, "δ" represents the time-fixed effect, "ε" stands for the error term, "t" indicates the time duration, while β's represent the parameters. Likewise, detailed descriptions of the aforementioned variables can be found in Table 2.

Thus, "δ" is the time-fixed effect, "ε" stands for the error term, "t" indicates the time duration, while β's represent the parameters. Likewise, detailed descriptions of the aforementioned variables can be found in Table 2. The data has been built up from 2009 to 2022.

Table 2. Explanation of variables

Variables	Description	Source
Ln(Yijt)	Natural log Total Trade US$	UN COMTRADE
Ln(GDPit*GDPjt)	Natural log GDP (current GDP) US$	World Development Indicators
Ln(POPit*POPjt)	Natural log Population	World Development Indicators
Ln(DISTij)	Natural log Distance	Centre D'Etudes Prospectives et D'Informations Internationales
Ln(BRERijt)	Natural log Bilateral Real Exchange Rate	International Financial Statistics
Ln(Openjt)	Natural log Openness index	World Development Indicators
Ln(FDIjt)	Natural log FDI	World Development Indicators

Source: Made by the authors

Results and discussion

Table 3 presents the findings of regression analysis, indicating the influence of independent variables on the dependent variable. It indicates that all independent variables are statistically significant. The results also show a higher R-squared 0,98 which explains that the variables selected in this model explain clearly the bilateral trade between Argentina and the BRICS countries.

The findings indicate that a 1% increase in the GDP of partner countries significantly boosts Argentina's total trade by 0.83%. Similarly, a 1% rise in the population of partner countries corresponds to a 0.32% increase in Argentina's total trade. This relationship stems from the fact that as incomes rise in partner nations, the demand for imported goods tends to increase. Concerning distance, the results reveal that a 1% increase in the distance between partner countries results in a 1.46% decrease in Argentina's total trade. This implies that countries sharing close borders with Argentina exhibit greater trade potential compared to those with greater distances. Regarding the bilateral real exchange rate, the result shows that if it rises by 1% then the impact on Argentina's total trade decreases by 0,08%. Any appreciation or depreciation of currency concludes with a negative influence on bilateral trade. Moreover, the openness rate indicates that a 1% increase corresponds to a 0.50% rise in Argentina's total trade. Similarly, a 1% increase in partner countries' FDI leads to a 0.20% increase in Argentina's total trade. This is because the openness index determinates how important is international trade for a country and the FDI impacts the growth economy consequently it influences bilateral trade. Additionally, we explored the effect of COVID-19 on the bilateral trade. It shows a negative effect on Argentina's total trade decreasing it by 0,83% during the pandemic.

The standard error represents the spread of data points around the fitted line, which is known as the Standard Error. Thus, **Table 3** demonstrates the gap between the fitted line and data points for the variables. Conversely, to evaluate the significance of coefficients, the p-value indicates the importance of GDP, population, distance, bilateral real exchange rate, FDI, and COVID-19 variables are significant at a 1% significant level while the openness index is significant at a 5% significant level.

Table 3. Regression results

Variable	Coefficient	Std. error	z	p-value
Ln(GDPit*GDPjt)	0,833	0,078	10,63	0,000***
Ln(POPit*POPjt)	0,326	0,036	8,98	0,000***
Ln(DISTij)	-1,465	0,093	-15,77	0,000***
Ln(BRERijt)	-0,084	0,012	-7,23	0,000***
Ln(Openjt)	0,501	0,250	2,00	0,045**
Ln(FDIjt)	0,205	0,053	3,87	0,000***
COVID-19	-0,845	0,182	-4,63	0,000***

Source: Author's simulation

Potential Trade between Argentina and BRICS countries

This section presents the estimation of bilateral trade potential. We applied the coefficients obtained from the gravity equations. This estimation is characterized as the variance between anticipated trade and existing trade (Martinez & Nowak, 2003). This is expressed as:

$$Tp_{ij} = \frac{Et_{ij}}{At_{ij}}$$

Where Tp_{ij} is the trade potential between country i and j, Et_{ij} is the estimated trade between country i and j, and At_{ij} is the actual trade between country i and j.

The ratio of trade potential (Tp_{ij}) is applied to analyse the future trajectory of Argentina's trade, as prognosticate by the estimation and actual trade namely (Et_{ij}/ At_{ij}), if the value exceeds one, it shows the potential expansion of trade with the respective country. The absolute difference between the potential and actual level of trade is the trade potential (Tp_{ij}). A positive value suggests future trade prospects, while a negative value indicates that Argentina has surpassed the trade potential with the partner country.

Table 4. Estimates of the potential bilateral trade between Argentina and the BRICS countries

Description	Brazil	Russia	India	China	South Africa
$\boldsymbol{At_{ij}}$	24.057	21.453	21.642	23.442	20.410
$\boldsymbol{Et_{ij}}$	24.196	21.374	21.585	23.503	20.432
$\boldsymbol{Tp_{ij}}$	1.006	0.996	0.997	1.003	1.001

Source: Author's calculation.

Based on the findings presented in Table 4, the study assessed Argentina's trade potential with BRICS countries. This analysis allows for a comparison between actual trade values and predicted trade values, thereby enabling the estimation of the actual trade ratio. The outcomes are depicted in Table 4, where At_{ij} denotes the actual trade value, Et_{ij} represents the predicted trade value, and the last row indicates the estimated actual trade ratio. It is observed that the overall trade potential between Argentina and BRICS countries exceeds one, signifying considerable potential for trade expansion. Particularly, Argentina shows potential for trade with Brazil, China, and South Africa. Conversely, the results indicate trade levels surpassing the potential with Russia and India.

Conclusion and recommendations

This study explores Argentina's trade prospects with BRICS nations through a gravity model methodology. It delves into globalization and political economy concepts, providing detailed examples of how trade influences Argentina's international relations. The model analyses Argentina's trade dynamics with BRICS countries, offering insights into trade volumes, economic growth, and GDP trends

for each nation involved. Key parameters of the gravity model include country size, GDP, and distance. It highlights Argentina's economic position within the BRICS bloc and its growth potential. Results indicate significant trade potential between Argentina and BRICS nations, with Brazil (1.006%), China (1.003%), and South Africa (1.001%) showing notable potential. Brazil emerges as a primary trading partner due to shared borders and participation in MERCOSUR. Moreover, the alignment of economic structures contributes to higher trade potential between Argentina and Brazil, China, and South Africa.

Based on the findings, we strongly recommend for enhancing trade and production within the BRICS countries. Specifically, we urge relevant authorities to initiate bilateral trade discussions with South Africa. There are several compelling reasons for fostering trade within BRICS. Firstly, it represents one of the fastest-growing bloc economies globally. Secondly, beyond trade, BRICS serves as a significant hub for investment and technology transfer. Recognizing Argentina's potential with South Africa, India, and Brazil, we propose promoting private sector involvement through establishing new business missions or participating in international trade fairs. These initiatives would facilitate gathering updated market data and insights, aiding in the process of industrialization.

Furthermore, we recommend the implementation of new policies aimed at mitigating the impact of exchange rate volatility, which should significantly enhance total bilateral trade. The government ought to incentivize exporters and importers by providing effective solutions for dealing with foreign currency issues prevalent in Argentina. Moreover, Argentina must broaden its range of commodity and semi-finished exports to augment value creation, with BRICS countries offering promising opportunities in this regard. Argentina should explore deeper engagement in the regional trade agreement known as Mercosur, which includes Brazil, to leverage its trade potential. A thorough examination of this regional trade pact would yield numerous benefits for Argentina and the wider Latin American region, bolstering their international standing.

It is worth mentioning that Argentina was invited to join the BRICS countries starting in 2024[20], but the new government has opted against participation[21]. Consequently, we believe that decisions should be guided by empirical analysis, prioritizing the country's interests over political considerations.

In conclusion, this paper has provided a comprehensive overview of Argentina's economic connections with BRICS nations, drawing from existing literature along with factual data and statistics.

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Conflict of interests

The authors report no conflicts of interest.

Authors' contribution

- Karen Giselle Gomez: Conceptualization, Data Curation, Formal Analysis, Research, Methodology, Project administration, Resources, Software, Monitoring, Validation, Visualization, Writing, Original Draft, Writing: review and editing.
- Hasmik Lazyan: Research, Validation, Visualization.
- Amer Ma'en Hussein Hussein: Research, Validation, Visualization.