BRICS JOURNAL OF ECONOMICS
DOI 10.3897/brics-econ.6.e154692
2025 Volume 6 Number 4

Analyzing Integration of BRIC into GVCs: A Value-Added Trade Perspective

José Firmino de Sousa Filho[1], Gervásio Ferreira dos Santos[1], Luiz Carlos de Santana Ribeiro[2], Rodrigo Barbosa de Cerqueira[3]

1 *Federal University of Bahia (Brazil)* **2** *Federal University of Sergipe (Brazil)* **3** *Innovation and Data Science Department at Superintendence of Economic and Social Studies of Bahia (Brazil)*

Corresponding author: José Firmino de Sousa Filho (jose.sousa@ufba.br)

Academic editor: Sheresheva M. | Received 2 April 2025 | Accepted 26 May 2025 | Published 8 December 2025

Citation: de Sousa Filho, J. F., dos Santos, G. F., de Santana Ribeiro L. C., & de Cerqueira R. B. (2025). Analyzing Integration of BRIC into GVCs: A Value-Added Trade Perspective. *BRICS Journal of Economics, 6*(4), 61–85. https://doi.org/10.3897/brics-econ.6.e154692

Abstract

This paper examines the involvement of Brazil, Russia, India and China (BRIC) in the global value chains (GVCs) between 2000 and 2014. It focuses on domestic value-added exports and vertical specialization. We use WIOD tables to assess the position of these countries in GVCs and a decomposition of their trade in terms of value added. China exhibits substantial growth in all indicators, whereas the other countries' results appear to be mixed. The study also considers the economies of Mexico and South Korea, highlighting Mexico's declining participation in GVCs in contrast to the steady growth of South Korea's involvement. To ensure sustained long-term economic growth, the BRICS countries and other emerging economies should create a common growth agenda and increase their participation in global value chains. The paper provides insights into the dynamics of trade and vertical specialization and thus contributes to better understanding of economic relations between the BRICS countries and other emerging economies.

Keywords

Emerging economies, Global Value Chains, BRICs, Trade in Value-Added.

JEL: F01, F10.

Introduction

Economic stagnation in many high-income countries has led to an increase in the number of agreements and partnerships between low- and middle-income economies (Baldwin & Lopez-Gonzalez, 2015; Daudin et al., 2011; Ponte et al., 2019). In a globalized world, international trade is an important driver of economic growth. This is especially true for the export-driven Chinese economy (Dunford & Liu, 2023; Lohani, 2021). According to Daudin et al. (2011), the expansion of international trade resulted in a production model based on "cross-border production." Different stages of production are spread across multiple regions, including developing countries. Vertical specialization thus emerged as a concept based on the new international division of labour, unlike the traditional approach, which separated production of primary goods and manufactured products. (Krugman & Venables, 1995). The segmentation of production has become increasingly complex, enabling more efficient exploitation of each country's comparative advantage. This international division of labour has increased trade flows, because many inputs, including intermediate goods, are shipped across multiple borders. (Koopman et al., 2014).

Recent theories and developments in international trade have highlighted a significant economic transformation, often referred to as "the second phase of globalization" by Baldwin and López-González (2015). This shift is linked to the globalized production that is distributed between the North and South. The authors suggest three key concepts related to the global supply chains: i) import for production, ii) import for export, and iii) importance of value-added trade. Any goods produced using imported inputs are part of an international production network that involves inputs such as raw materials, goods and services.

Global value chains encompass the activities undertaken in agriculture, manufacturing or service sectors to move products from design to final use, recycling or reuse. These functions are carried out by many companies in different countries within the global supply chains. Organizations that dominate production processes in an industry or a GVC are called "lead firms". They play an important role in shaping the behavior of the entire production chain. (Gereffi et al., 2005; Ponte & Sturgeon, 2014).

We use the input-output tables of the World Input-Output Database (WIOD) to assess the participation of emerging countries in the global value chains between 2000 and 2014[1]. This period witnessed the rise of the BRIC nations as major players in the

[1] We acknowledge that our analysis uses data from the World Input-Output Database (WIOD), which ended in 2014. While this presents a limitation in capturing the most recent developments in GVCs, the selected period from 2000 to 2014 remains significant. This timeframe encompasses the formation and early integration of the BRIC bloc and the impacts of the global financial crisis, providing a robust foundation for understanding the initial trade dynamics and vertical specialization patterns among the BRIC countries. WIOD ensures consistency and robustness in our analysis despite the need for more recent data. Future research can build on our findings by incorporating newer data sources to explore ongoing developments in GVCs.

global economy, including China's rapid economic growth and India's emergence as a leading IT powerhouse. Russia's late entry into the World Trade Organization (WTO) and Brazil's resource boom also occurred during this period. Major global events, such as the financial crisis of 2008 and its aftermath, had a significant impact on trade and production worldwide. While previous studies examined emerging economies' roles in GVCs, our research focuses on the intra-BRIC value-added trade. Using a detailed decomposition methodology, we show how the BRIC countries integrate into GVCs, revealing distinct patterns of vertical specialization and technological intensity that have significant implications for their economic strategies and policies. This study contributes to the literature by describing intra-BRIC trade dynamics and providing technological profiles of these countries.

The main objective of this study is to examine the trade profile of the BRIC countries within global value chains. The central research question is: what are the prevailing patterns of value-added trade among BRIC and how do they differ in terms of technological intensity and vertical integration? We hypothesize that intra-BRIC trade is mostly characterized by asymmetries in technological content and limited depth of integration into value chains, with China taking a more advanced position than its partners. This hypothesis guides our empirical research and supports the overall effort to understand the role of emerging economies in the changing global trade system.

We have classified the industries analyzed in the WIOD input-output table (WIOT) according to the United Nations Technological Intensity (United Nations, 2008) and the amendments proposed by the OECD (OECD, 2017) to assess intra-BRIC trade in value-added and vertical specialization patterns[2]. Technological intensity or "R&D intensity" is the ratio of R&D investment to GDP at basic prices. One of the benefits of this classification system is the ability to create hierarchies for technological development in both industry and services. Industries are classified based on characteristics such as capital accumulation, organizational behavior and technology development (Morceiro, 2019).

This research is motivated by the need to explore the process of increasing trade in intermediate inputs supported by reductions in tariff and non-tariff barriers under bilateral and multilateral trade agreements, alongside a growing wave of trade liberalization, particularly among emerging economies (Baldwin, 2011). It is based on the fact that vertical specialization is inherently cost-sensitive since it involves crossing more and more state borders for each product (Daudin et al., 2011). According to Daudin et al., the development of intra-regional trade in Asia was a precursor to the phenomenon of vertical specialization. They note that Asian trade is largely dependent on the links with countries from other continents, with the Americas playing a significant role. Baldwin & Lopez-Gonzalez (2015) argued that global supply chain trade had been an important tool for developed countries for decades, but the international trade "revolution" began when connections

---

[2] WIOD tables did not include South Africa; for this reason, we will only refer to BRIC.

between high-tech global supply chains expanded to countries with low labor costs.

Our study fills a significant gap in the literature by examining trade patterns and the value-added contributions of the BRICs countries. Despite the increasing importance of BRIC in the global economy, there has been a lack of comprehensive analysis regarding their trade interactions and participation in the global value chains. While previous studies may have employed similar methodologies, they have not specifically applied them to the context of intra-BRIC trade. Our paper extends the existing literature by focusing on the trade relationships among the BRIC countries, shedding light on how these emerging economies engage with each other in global value chains.

We conducted a comprehensive study of the issues related to the integration of developing economies into global supply chains, taking into account the growing importance of the BRIC countries and the persistent inequalities associated with them (Dunford et al., 2022). This should form the basis for assessing the impact of further developments, such as technological advances, trade agreements, and political shifts, on these economies. Our analysis suggests that, while there may be changes in the integration profiles of individual BRICS countries within global value chains, the overall profile of integration within intra-BRICS trade may not experience significant shifts. The varying levels of integration among the BRIC nations suggest that intra-BRIC trade may still be dominated by traditional trade patterns rather than by deep integration into the value chains. This study offers a detailed examination of trade in value-added patterns and vertical specialization components within these economies. It addresses the disparities and challenges faced by the BRIC countries, presents perspectives on their involvement in global value chains, and gauges the impact of development in emerging markets on the global production chains.

Adapting to GVCs: trade dynamics for BRIC

The expansion of the global value chains as a model for organizing global production and trade is associated with significant changes in the international trade regime caused by the growing number of regional, bilateral and multilateral trade agreements and signatory countries. Political changes have also accompanied this expansion (Dunford et al., 2016). While trade was once viewed primarily through tariff agreements and export / import quotas, GVC densification has substantially transformed these relations. Significant historical events, such as the completion of the Uruguay Round and the creation of the World Trade Organization (WTO), served as catalysts for the structural transformation of trade. As the multilateral regime expanded, so did the scope of regional and bilateral agreements: issues such as intellectual property rights, services, investment, and competition received increased attention (Ponte et al., 2019).

Research suggests that the densification of GVCs has opened new avenues for growth and industrialization (Ponte et al., 2019). There is evidence that GVC participation, on average, can increase foreign investment, promote economic growth and improve social indicators (UNCTAD, 2013; UNCTAD, 2023). Not all countries, however, have equally benefited from GVC participation; the trajectory of GVC is largely determined by the institutional and political environment (Kummritz, 2016; Rodrik, 2018).

According to Rodrik (2016), there is a long-standing trend of deindustrialization, even in emerging economies. GVC involvement can make industrial policies more effective because it may help to expand infrastructure, acquire new working skills and achieve sustainable use of natural resources and energy potential. That is why industrialization is a critical factor in driving structural changes. Without active industrial policy, the integration of middle- and lower-middle-income economies into GVCs makes them net importers of industrial inputs from developed countries. In this case a country's policies support trade, but they are not conducive to efficient GVC participation (Ponte et al., 2019).

Furthermore, entering a global production system requires a national development plan that can generate technological progress to make the region's economy more competitive (Rodrik, 2018). Morrison et al. (2008) and Ponte & Ewert (2009) outlined two general directions for such a plan. The first highlights the sources of firms' capabilities that enable them to create or access new markets. The second relates to pathways that can lead to creating favorable conditions for disadvantaged firms within GVCs. These are usually medium-sized producers from emerging economies. It is important that structural changes along the trade route and a country's economic growth can facilitate upward movements within global production chains and allow the less developed economies to engage in a wider range of productive activities (WTO, 2011).

Kummritz & Quast (2016) show that GVCs have expanded and become increasingly dynamic over time, with emerging and lower-middle-income countries becoming the major GVC drivers. At the same time, the integration of high-income countries has reached a point of stagnation, albeit at a high level. Developed countries typically serve as the initial and final points of the global value chains. They provide upstream inputs and eventually serve as consumer markets for final goods. In contrast, emerging and low-middle-income countries tend to specialize in downstream activities. They often assemble machinery and equipment, and so export less domestic value added (Koopman et al., 2014).

Regional market integration can help emerging economies accelerate specific planning and investment processes by development banks and international organizations (Gereffi & Lee, 2012; Gereffi, 2018). In Latin America, Africa, and Asia, regional trade reduces the reliance on global markets by local economies. It serves as a significant counterbalance to the hierarchical relationships within GVCs of developed economies. The Asian regional market is a good example of trade relations with high potential for improvement and technological spillover among the economies involved (Suder et al., 2015).

The BRIC countries are emerging economies that aim to lead regional and global markets through bilateral and multilateral trade partnerships and political cooperation agreements. A comparative analysis of these nations' trade activities reveals the differences and similarities between them, offering new insights for policy interventions and informing future research directions.

Since the formation of the BRIC group, these countries have demonstrated a strategic vision by actively pursuing trade agreements and partnerships in order to foster economic cooperation and boost intra-trade (Coning, Mandrup & Odgaard, 2015; Kumar et al., 2023). One significant example of their foresight is the BRICS Trade and Investment Cooperation Framework, which was established to boost trade and promote investment cooperation and economic integration among member countries (Halis and Castilhos, 2017). It facilitated negotiations for preferential trade agreements (PTAs) and free trade agreements (FTAs) within the group, which helped to reduce tariffs and streamline customs procedures. This improved market access for goods and services produced by BRICS (Rahman, Fatima & Rahman, 2020).

These trade agreements have been instrumental in driving substantial growth in the trade between the BRIC countries. They provide preferential treatment to intra-group trade, reduce trade barriers and promote economic complementarity (Kollamparambil, 2017). For example, the bilateral China-Russia Comprehensive Strategic Partnership and the India-Brazil Strategic Partnership have strengthened trade relations between the countries involved, creating new opportunities for cooperation and investment (Kollamparambil, 2017). The BRIC Free Trade Agreement (FTA), which is still under negotiation, aims to eliminate tariffs on a wide range of goods traded between member countries. Such an agreement is expected to increase trade flows and foster closer economic ties within the group.

The existing agreements have stimulated economic growth and enhanced the BRIC countries' positions within GVCs by promoting deeper economic integration and trade cooperation (Baumann, 2017; Yilmaz, 2022). Increased trade flows have facilitated the exchange of intermediate goods, raw materials, and components between the member states (Brazil, 2017). This integration allows the BRIC nations to capitalize on their comparative advantages, optimize production processes, and enhance their competitiveness in global market trade (Coning, Mandrup & Odgaard, 2015).

Trade agreements within the BRIC association have also facilitated investment and technology transfer among the participants, which is essential for upgrading industrial capabilities and enhancing value chain linkages. By providing a predictable and transparent investment environment, these agreements attract foreign direct investment (FDI) and encourage the transfer of advanced technologies and managerial expertise from the more developed BRIC countries to the other group members (Coning, Mandrup & Odgaard, 2015).

However, each country's advantages in international trade are not solely based on traditional comparative advantages. They are determined by many factors, including natural resource endowments, the capacity to attract foreign direct investment (FDI), technological advancements, and knowledge differentials. Empirical studies, particularly on Brazil, show that engagement in international trade agreements can have both positive and negative outcomes. Some agreements facilitate technology transfer and increase FDI, while others may lead to deindustrialization and a shift towards exports of primary goods, undermining industrial growth (Naudé et al., 2015; Gereffi, 2018; Mukherjee, 2017). Therefore, it is crucial to consider these diverse factors when analyzing the trade dynamics and economic growth of the BRIC countries.

It is also necessary to understand how the countries' growth models have influenced their GVCs involvement and what challenges they face when designing industrial policies capable of generating value-added exports. The paper emphasizes the importance of cooperation between emerging economies to advance trade and policy initiatives beneficial for BRICS and other developing countries, integrating them into discussions previously dominated by developed nations.

Data and Methodology

Data

The World Input-Output Database (WIOD) comprises input-output tables that connect 44 nations (43 plus the rest of the world) through bilateral flows of international trade. These tables summarize global economic transactions, showing the interactions between different countries and economic sectors. Some industries' products are used as inputs by other industries or as final products by various economic agents. Imports are detailed by industry and country of origin, making it possible to trace the source of goods used in other countries (Dietzenbacher et al., 2013; Timmer et al., 2015). The WIOTs (world input-output tables) are compiled using national and international statistics, which ensures their accuracy. They quote basic prices reflecting production costs in the US dollars. International trade, including trade estimates and transport margins, is expressed as "free on board" (FOB) prices. To estimate the WIOTs, one needs to construct a time series of national production, disaggregate imports by origin and use, and integrate all nations. The robustness of WIOTs is ensured by reliable methods and ongoing updates, particularly concerning the inter-industry use of goods and services. The matrix of intermediate coefficients **Z** reflects this robustness.

WIOTs are used to analyze international trade over time by constructing time series of production, value-added, trade and consumption. They are based on a conceptual framework aligned with national accounts, official input-output data, the System of National Accounts, and international trade statistics. To properly understand the functioning of global value chains, it is essential to identify the input flows in international trade and trace them to their end use. WIOD employs the Broad Economic Categories (BEC), which provide detailed information on intermediate inputs and final goods in bilateral trade (Johnson, 2018; Timmer et al., 2014). This is the main reason why the present study prefers WIOD to other databases that use proportionality assumptions or mathematical algorithms to estimate bilateral input flows.

By analyzing the BRIC economies' involvement in GVCs, we can gain insights into the quality of their economic growth, competitiveness, and vulnerabilities. WIOT facilitates the analysis of the impact of economic shocks, such as pandemics or resource price fluctuations, and enables comparisons between BRIC and other countries in terms of production structure, trade patterns, and dependence on imported inputs. While WIOD covers 44 countries, data availability and quality may vary across nations, particularly for developing countries. This can lead to limitations in the accuracy and generalizability of the analysis. Besides, aggregating data into Broad Economic Categories (BECs) may mask important details about specific products and industries within each category limiting the ability to analyze nuanced patterns of trade and specialization.

Methodology

This study applies the method of value-added trade decomposition developed by Wang et al. (2018). Their supplementary materials have become a valuable reference in the literature for understanding the structure of global value chains (GVCs) and vertical specialization. In accordance with this method, gross export from the source country *s* to the destination country *r* is decomposed into 16 components, grouped into eight major categories. This results in a disaggregation of the domestic and foreign value-added content and identification of double counting.

The decomposition includes four main domestic value-added indicators:

1. **DVA_FIN –** Domestic Value Added in exports of final goods from country *s* to country *r*, reflecting upstream domestic contributions absorbed abroad.

2. **DVA_INT –** Domestic Value Added in intermediate exports used by country *r* to produce final goods for its domestic consumption.

3. **DVA_INTrex –** Domestic Value Added in intermediate exports used by country *r* to produce goods for third countries, capturing forward linkages.

4. **RDV_G –** Domestic Value Added that returns home via imports, whether directly from the partner country or via third countries. This indicator is particularly useful for identifying the circular flow of inputs within GVCs.

These four categories together form **DVA_G**, the total domestic value added embedded in gross exports from country *s* to country *r*.

The method also helps to detect **Domestic Double Counting (DDC)**, which results from repeated circulation of intermediate goods between borders, often due to fragmented production processes. This is important for separating the genuine domestic value creation from inflated gross export values.

The decomposition also includes foreign components:

1. **FVA_FIN –** Foreign Value Added embedded in final goods exports, distinguishing inputs from the direct importer *r* and from third countries *t*.

2. **FVA_INT –** Foreign Value Added in intermediate exports from *s* to *r*, used in the production of final goods in *r*.

3. **FDC –** Foreign Double Counting, which accounts for repeated foreign value added in intermediate goods returning through trade cycles.

Together, **FVA_FIN**, **FVA_INT**, and **FDC** quantify the total foreign content in exports, enabling a precise assessment of **vertical specialization,** i.e., the extent to which a country is integrated into international production through imported inputs that are re-exported.

All indicators are calculated at the bilateral and sectoral levels in order to analyze the trade intensity and technological patterns in the intra-BRIC relations. This method provides a more accurate picture of each country's contribution to global production, avoiding the double-counting bias present in gross export data.

Results

The expansion of GVCs has reshaped traditional trade metrics, challenging the notion that certain products are made in one particular country. The prevailing practice of assigning the entire product value to a single nation fails to capture the intricate geographical dispersion within GVCs. That is why the "trade in value added" (TiVA) approach is gaining prominence: it attributes domestic export value to each country participating in the global value chain responsible for the final product and thus provides a better understanding of the overall picture (Nixson, 2015).

To summarize the results, we present the indicators of the BRIC countries' and other nations' positions in GVCs in Table SM1 (see supplementary material): (i) Domestic value-added in the exports of final goods (*DVA final*) and (ii) Domestic value-added in the exports of intermediate goods (*DVA intermediate*). These two indicators are the most significant in terms of their monetary export value. The remaining components of domestic value-added were aggregated because of their low monetary value (*DVA others*). Additionally, we aggregated the components of domestic value-added returning home (*RDV total*). The components of external value-added and pure double-counting terms were grouped into *External VA* and *double-counting*.

Thus, we provide a comprehensive overview of the countries' participation in GVCs between 2000 and 2014. It is notable that the BRIC countries, except China, have a relatively modest share in the aggregated indicators. Brazil's participation increased from 0.9% (*DVA final*), 1.2% (*DVA intermediate*), and 1.1% (*DVA others*) in 2000 to approximately 1.1%, 1.9%, and 1.7% in 2014. India showed slightly better progress than Brazil, increasing from 1.1%, 1.0%, and 1.0% in 2000 to 2.4%, 1.8%, and 1.6% in 2014. Russia outperformed India, with a share of 0.4%, 2.3%, and 2.9% in 2000, increasing to 0.7%, 4.1%, and 5.1% in 2014.

China's involvement in GVC was steadily increasing throughout the study period, including the time of the 2008 global financial crisis. Its indicators of domestic added value grew from 5.4%, 3.0%, and 3.2% in 2000 to approximately 18.7%, 10.4%, and 9.1% in 2014. That is, they nearly tripled over the analyzed period.

Based on these indicators, the worst performance was demonstrated by Brazil. It means that Brazilian exports of domestic value-added are stagnating. It is probably one of the reasons why Brazil's economic growth, particularly its export-led growth, is lower compared to that of China, (Viola & Lima, 2017).

In terms of value-added that returns home (*RDV total*), even in aggregated terms, the BRIC countries have a relatively small representation. In 2000, Brazil and India held a share of only 0.1%, Russia had 0.2%, and China had 1.3% for the same period. By 2014, Brazil and India made marginal progress, Russia's share grew to 0.8% and China increased its share to 11.4%. The indicator of domestic added value that returns home is a good measure of a country's involvement in GVCs as it reveals the extent to which a country is engaged in global value chains through exports.

At the beginning of the study period, Brazil, India, and Russia had the same level of GVC participation, with the indicator of external added value in exports of about 0.5%; China's share was 3.0%. By 2014, Brazil and Russia made only marginal progress, with increases of 0.7% and 0.6%, respectively. India made a more substantial advance, reaching around 1.6%, while China expanded its share to 8.2%. External added value is one of the main components of vertical specialization. One factor that contributed to its record increase in Chinese exports was the high level of foreign investment that China attracted during this period. The same principle can be applied when it comes to pure double counting terms.

According to Naudé et al. (2015), the BRIC countries have different priorities in international trade owing to their respective growth models. China prioritizes the foreign market, with state and private Chinese companies playing an important role in guiding the country's foreign policy. India and Brazil focus on domestic market development through demand expansion and inflation control, with international trade as a secondary element. Russia was the last BRIC country to join the WTO (in 2011); it is still working to reduce its dependence on commodity exports, such as oil and natural gas.

The emerging economies of Indonesia, Mexico, and Turkey exhibited similar performance patterns to those of Brazil, India, and Russia, but Mexico's indicators of global value chain participation have been deteriorating over time, suggesting a worse position than the other countries. South Korea stands out, as it initially had export indicators similar to those of China, although its growth was less dramatic. All its value-added indicators rose over the study period meaning that its exports grew and integration into global value chains increased.

This analysis highlights the need to create a growth and development agenda among the BRICS countries and other emerging economies. Cattaneo et al. (2010) emphasize the importance of emerging economies' participation in GVCs for sustained long-term growth. They see China as a "big winner" as it diversifies export markets and forms relevant partnerships to import intermediate goods from emerging countries, such as India, Brazil, Turkey, Indonesia, Bangladesh, and Vietnam. Thus, China's role as the leader of the BRICS association and a global advisor for developing countries should be guided by a broad range of opportunities to improve and benefit all participating economies. (Lin, 2017). In the following section, we use the value-added trade approach to analyze in detail the BRIC countries' trade relationships at an aggregated technological level.

Intra-BRIC trade

Examining the domestic content of exports provides a granular perspective on industrial activity within the host economy but interpreting the data requires caution. A low level of vertical specialization could indicate an underdeveloped manufacturing sector that mainly serves the domestic market and produces low-tech exports. Conversely, a high VS index indicating sophisticated assembly or processing also suggests heightened import intensity (WTO/IDE-JETRO, 2011; Nixson, 2015). The risk is that emerging economies may become 'trapped' in low-tech, labor-intensive stages, which may prevent swift upgrades and the creation of new competitive advantages and technologies. The progression within GVCs is intricately linked to the transfer of technology and skills from the lead firms to host country enterprises, as well as to the development of capacities within those enterprises. Technology, intellectual property, machinery, capital equipment, organizational knowledge and various skills can be transferred or acquired through GVCs channels (Naudé et al., 2015).

Aggregating domestic value-added and vertical specialization components by country and by the level of technological intensity allows for a broader analysis of trade relationships between the BRIC countries. Figure 1 shows Brazil's domestic value-added exports to the other BRIC nations in the last year of our analysis, 2014. Despite advances in the trade volumes and monetary values, the terms of trade remained unchanged, except for China. In the case of Brazil, domestic value-added exports are primarily associated with medium- to low-technology industries. There is no significant change to the pattern of Brazil's trade with the other BRIC countries.

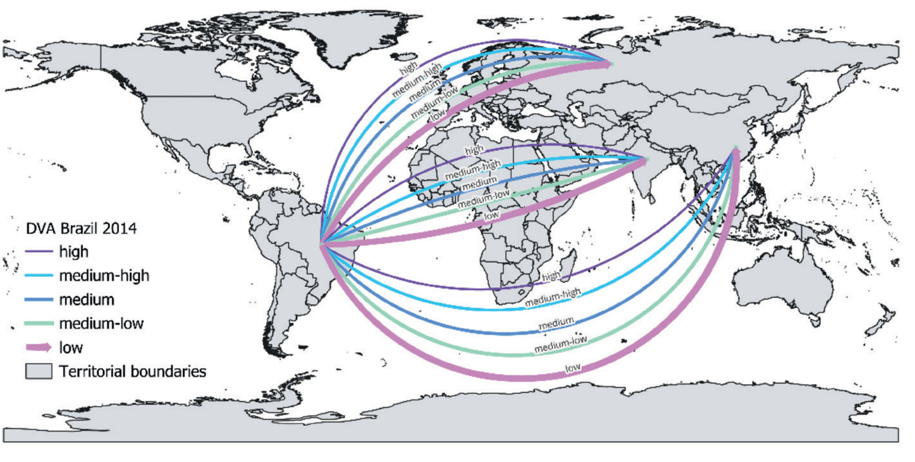

Figure 1. Domestic value-added in Brazil's total exports to other BRIC countries in 2014 by technological activity level

For Brazilian industries, the level of vertical specialization in production follows a similar pattern to the export of domestically produced value-added products. However, trade flows of vertically specialized components are much less significant (Figure 2). Trade is minimally integrated, resulting in low vertical specialization of Brazilian industries in high, medium-high, and medium technologies. At the same time, Brazil's industries in the medium- to low-technology sectors exhibit the highest indicators of vertical specialization in production (Santos-Paulino, 2011).

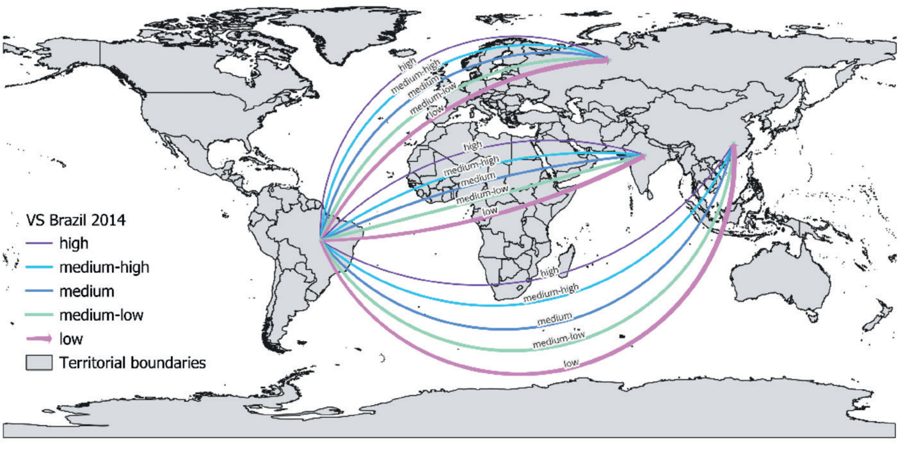

Figure 2. Vertical specialization level of Brazil exports to the other BRICs countries in 2014 by technological activity level

In contrast to Brazil, China's trade relations with the other BRIC countries are based on the export of domestic value-added goods from high and medium-high technology industries, as shown in Figure 3. This aggregate analysis confirms the earlier results. Chinese exports stood out among all trade components for high, medium-high, and medium technology industries. It is important to note that the trade volumes and benefits from trade for China during the study period were significantly higher compared to those of other BRICS countries.

The analysis of domestic added value can serve as a basis for understanding vertical specialization relationships. Chinese industry at high and medium-high technology levels is the most vertically integrated into trade between BRIC, and the patterns of trade integration with the other countries are similar, as illustrated in Figure 4.

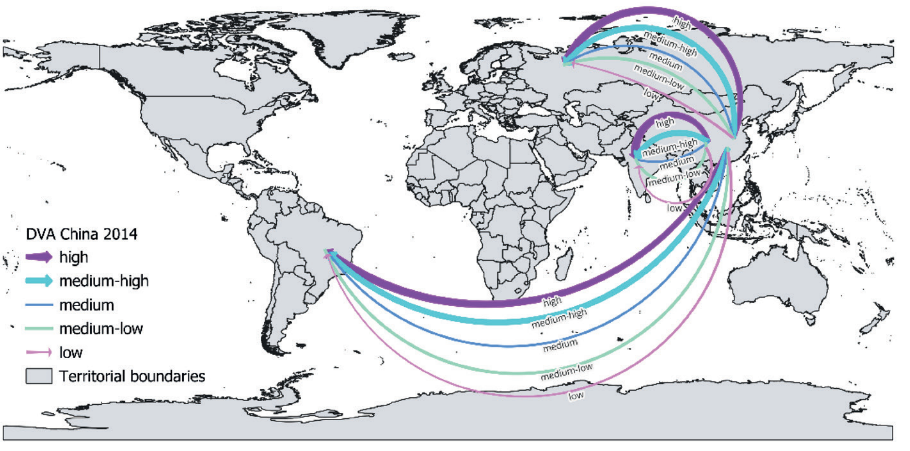

Figure 3. Domestic value-added in China's total exports to other BRIC countries in 2014 by technological activity level

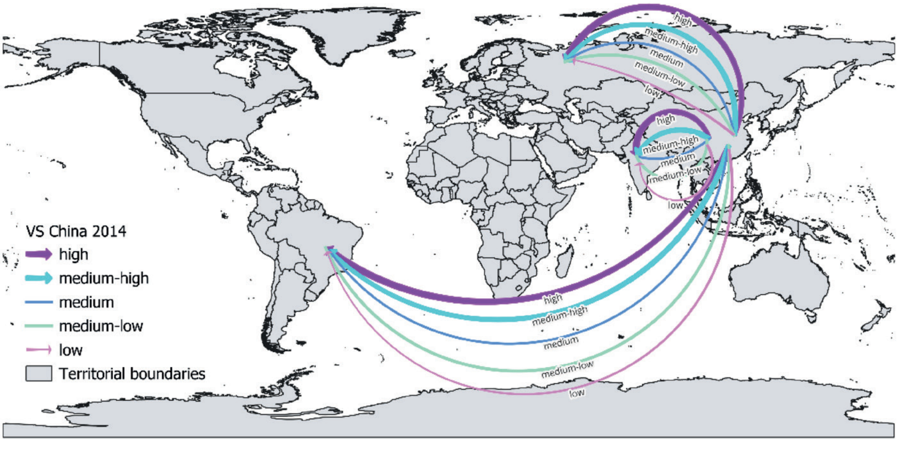

Figure 4. Vertical specialization level of China's exports to the other BRIC countries in 2014 by technological activity level

India's domestic value-added exports are more intense in low, medium-low, and medium technology industries, as shown in Figure 5. Following the formation of the BRIC group, India's trade relations with the other BRIC countries advanced as expected. Although India's relations with the EU, the USA, and the United Arab Emirates remain the most significant for the country, its links with the other BRIC had grown considerably in volume and monetary value.

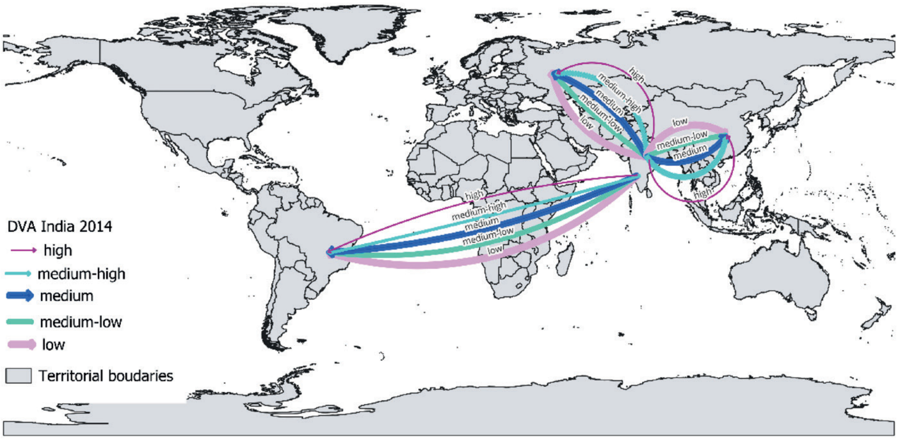

Figure 5. Domestic value added in India's total exports to the other BRIC countries in 2014 by Technological Activity Level

The process of vertical specialization in India's industries does not follow the same pattern as the value-added exports. Indian industries, regardless of their technological level, are not integrated into trade within the BRIC group. Vertical specialization flows are more significant for medium-high, medium, and medium-low technology industries, as shown in Figure 6.

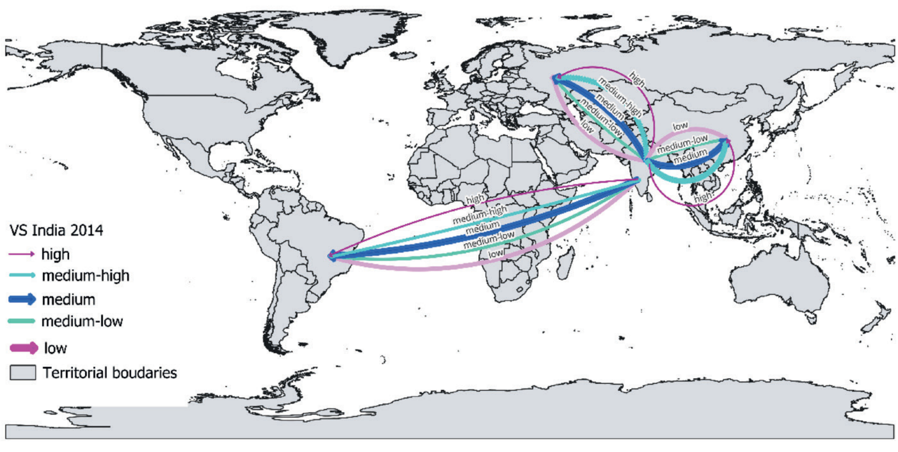

Figure 6. Vertical specialization of India's exports to other BRIC countries in 2014 by technological activity level

Russia and India have similar patterns in value-added trade and vertical specialization. Russia's trade with India and Brazil, both in goods and services, was relatively active during the study period. Much of Russia's value-added exports came from low, medium-low, medium, and medium-high technology industries, as shown in Figure 7.

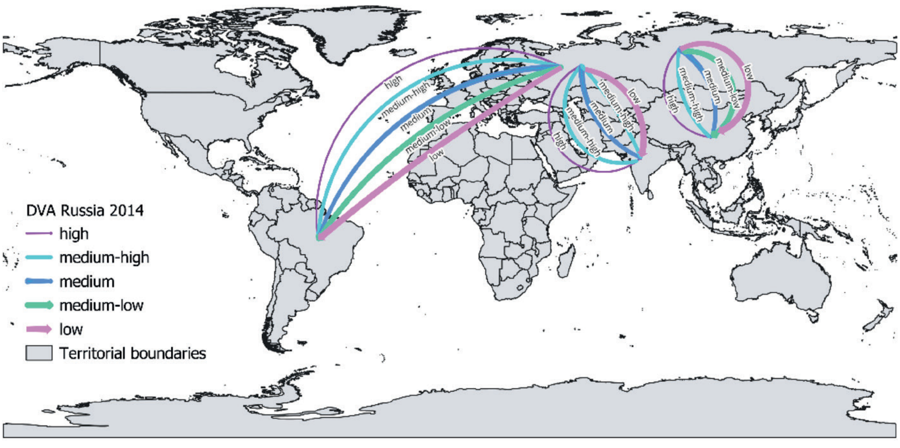

Figure 7. Domestic value added in Russia's exports to India and Brazil in 2014 by technological activity level

In terms of vertical specialization of production, there is a noticeable increase in trade flows from Russia's medium-low, medium, and medium-high technology industries to the other BRIC countries, as shown in Figure 8. We found similar patterns for Indian and Russian industries, while China and Brazil had opposite technological intensity trends.

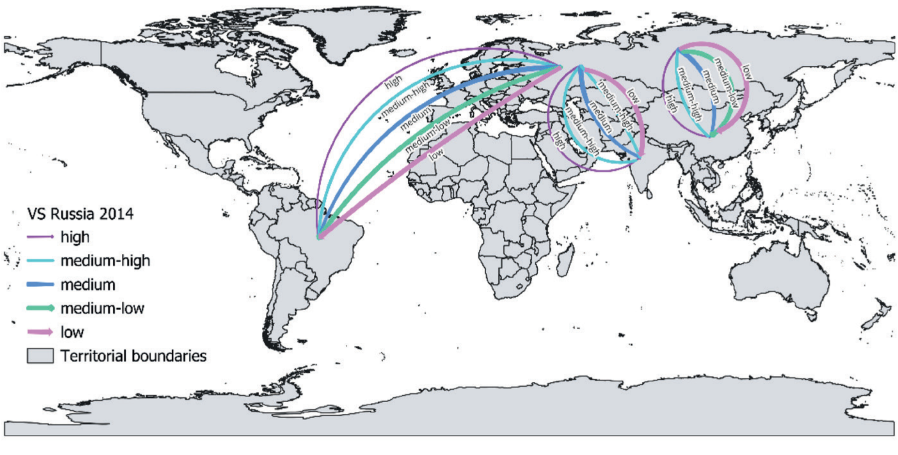

Figure 8. Vertical specialization of Russia's exports to other BRICs countries by technological activity level in 2014

The development of trade and political relations is a fundamental tool for ensuring stability, economic growth and investment cooperation. The BRIC countries' shift from bilateral trade to a multilateral paradigm for trade and investment is expected to strengthen the group members. Improved economic relations should enhance their competitiveness at macroeconomic level and promote synergy effects through expanded cooperation and harmonized trade policies.

Nixson (2015) notes that the literature lacks a clear model of the BRICS involvement in GVCs. Vertical Specialization (VS) measures and rankings based on trade in manufactured intermediate goods exhibit substantial variations. China is the most active and successful participant in GVCs, while the other four economies lag significantly. Russia appears to be a newcomer in GVC participation. It is important to recognize that GVC involvement is only one facet of the broader industrialization and development process. Domestic market has an essential role in larger economies like China, India, and Brazil, influencing the development of both consumer goods and intermediate goods sectors (Stuenkel, 2020). The sustainability of 'upgrading' in products, functions, and chains relies on developing endogenous technological capacities, notably through establishing a robust capital goods sector.

Discussion

To better understand the theoretical foundations of the global value chains and vertical specialization (VS), it is useful to evaluate countries' participation in technological activities. Assessment methodologies associate trade flows with value-added and VS activities by establishing thresholds, which indicate technological links and the significance of intermediate imports in production processes. Integrating this methodological approach with the empirical data on the participation of BRIC in GVCs enhances the theoretical discussion concerning the implications of vertical specialization for international trade and economic growth strategies.

Our findings indicate that participation of BRIC and other emerging countries in the global value chains remained stable throughout the 2000's, with the exception of China. Brazil and Russia had a low level of GVC involvement and India only made a marginal progress in its value-added trade. It means that intra-BRIC relations did not contribute to the development of trade in value-added or vertical specialization in the member countries. Measuring DVA in exports provides an understanding of the countries' contributions to final products beyond mere export volumes. We gauged the depth of a country's integration in global value chains by assessing the ratio of DVA to total exports. This analysis illustrates the level of global value chain (GVC) integration and highlights the roles of countries in global production.

While overall trade volumes within the group increased, there are notable differences in the trading patterns among member countries. China stands out as the primary driver of trade growth, with a remarkable evolution in domestic value-added exports across high and medium-high technology industries. This expansion can be attributed to China's proactive trade policies, robust manufacturing base and strategic investments in infrastructure (Gereffi, 2018). By contrast, the other BRIC countries had modest growth rates, indicating varying degrees of success in taking advantage of intra-BRIC trade opportunities.

The analysis shows a notable divergence in the integration profile of value chains in the intra-BRICs trade. China's dominance in high and medium-high technology exports highlights its increasing participation in global value chains, particularly in the electronics, machinery, and automotive sectors. Intra-BRICS trade has facilitated greater economic interaction among the member countries, but its benefits were unevenly distributed. Brazil, India, and Russia sought to use intra-BRICS trade to enhance their industrial competitiveness and promote regional economic integration (UNIDO, 2020; Kumar et al., 2023). However, structural constraints and competitive pressure hampered their efforts (Li, 2019). While intra-BRICS trade created opportunities for collaboration and knowledge exchange, realizing its full potential requires concerted efforts to address disparities in industrial development and regulatory frameworks (Kollamparambil, 2017). The sectoral profile of intra-BRIC trade reflects a complex interplay of industrial structures, technological capabilities, and market dynamics. A disparity in sectoral profiles reveals the challenges faced by the BRIC countries in diversifying their exports and engaging in higher-value-added activities.

GVCs have brought about profound changes in the global economy and shaped forms of production and trade for specific industries and countries. As supply chains expanded internationally, more intermediate goods were traded between countries, and more imported inputs and components became integrated into exports (Krugman, 1995). In 2009, the exports of intermediate goods surpassed the combined exports of both final goods and capital goods, for the first time ever. The role of the emerging economies in GVCs is most significant. During the 2000s, emerging economies became major exporters of primary products and intermediate and final manufactured goods, with notable examples being China, South Korea, Mexico, Brazil, Russia, and South Africa (Gereffi, 2018).

The growth of emerging markets also led to changes in the final consumption of developed economies in GVCs, as the trade intensity of the global South increased dramatically, especially after the 2008 financial crisis. New governance structures reinforced the organizational consolidation in GVCs and geographic concentration associated with the growing prominence of emerging economies as significant economic and political actors (Hooijmaaijers, 2021). Gereffi (2018) also points to other historical landmarks, such as the dissolution of the Soviet Union, the shift of China towards a market economy focused on investments and international trade, and liberalization of trade in India and Brazil during the 1990s, as key factors in the rise of developing economies.

China's success through the creation of Special Economic Zones (SEZs) was essential for the attraction of investment from both domestic and international sources, leading to positive spillover effects. (Ponte et al., 2019). The concentration of export-oriented industries was a decisive factor in China's increased participation in GVCs, making it an important international buyer. In addition, foreign value-added analysis emphasizes countries' dependence on foreign inputs for production. This insight is crucial for devising strategies to reduce dependencies and enhance economic resilience. Countries specialize in certain stages of the global value chains based on relative costs and abilities. From a growth or national development perspective, China's export-driven growth model is notable for economic dynamism, sectoral diversification, strong domestic market and productive connections within its industries. Continued investment in industry, energy, information, and communication technologies advanced pro-growth policies and resulted in China's superior performance.

Russia' entry into GVCs increased its production potential for computers and electronic components. The country's electronics market experienced significant growth following its recovery from the 2008 financial crisis (World Economic Forum, 2013). Russia is an attractive market for electronics, computer parts, and software.

In India, the government reduced tariffs on high-tech goods to promote technological development and create incentives for local technology companies (Davis et al., 2019). Basic manufacturing is also an essential part of the Indian economy, particularly in the production of plastic and metal goods (Brazil, 2017). It is expected that investments in the service sector will generate strong, productive linkages to modernize the industry. However, there are concerns about the inefficiency of the country's financial sector and setbacks in foreign investor protection laws (Mukherjee, 2017). Another issue is the early deindustrialization. This is a problem because a significant portion of India's population still lives in rural areas and lacks the skills needed to access modern, technology-based services.

Brazil's growth model is based on developing its domestic market and exporting commodities and other low value-added products. This has made the country highly vulnerable to the adverse effects of recessions and international economic crises (Sousa Filho et al., 2021). Because of Brazil's high agricultural potential its economy favored companies in the food and beverage sectors, turning agribusiness into a major success story (UNCTAD, 2018). Brazil was the only economy among the BRICs, with an annual growth rate of less than 1.0% (0.8%) during the second decade of the 21st century. After 2012, growth based on domestic demand slowed, and the country had to make fiscal and monetary adjustments (Sousa Filho et al., 2021). Only low-tech industries have developed significant linkages in the intra-BRIC trade and there is still more that needs to be done to increase Brazil's involvement in global value chains.

Russia's growth model is similar to that of Brazil (Armijo, 2007). It depends heavily on exports of goods, especially fuel, and has low investment in industry, except for defense (Gerasimova & Dunford, 2017). The decisive state intervention in the country's extractive industries and the regulations oriented toward government interests make the Russian economy unattractive for foreign investors. As suggested by the results of Russia's trade with the other BRIC countries, even Russian low-tech industries have yet to make significant advances in their vertical specialization process.

The analysis of the BRIC countries' participation in GVCs through the lens of value-added and vertical specialization offers insights into the complex nature of the related processes. While China's success is in line with theoretical expectations of comparative advantage and strategic participation, the other BRIC countries appear to face difficulties in their integration in the global value chains. Exploring GVCs through this methodological framework contributes to understanding the role of foreign inputs, intra-BRICs trade patterns and importance of creating domestic added value. This analysis highlights the interplay between theoretical frameworks, methodological tools, and empirical findings in unraveling the dynamics of GVCs and guiding countries toward sustainable development within the globally interconnected landscape.

Limitations

The present study is constrained by the 2014 cutoff of the WIOD database, but other datasets may offer opportunities to extend the analysis of BRIC participation in global value chains to more recent years. Databases such as the EORA Multi-Region Input-Output (MRIO) and the OECD Trade in Value Added (TiVA) initiative provide updated trade indicators and sectoral-level insights that could support the construction of new GVC-related measures. These sources may help examine the post-2014 developments, including the impacts of recent trade realignments, geopolitical shifts, and global shocks, such as the COVID-19 pandemic. However, the major limitation is likely to remain since the full inter-country input-output tables necessary for comprehensive value-added decomposition are not publicly accessible in these databases. This restricts their immediate applicability for replicating the detailed methodological framework adopted in this study but, once full data are made available, the research will certainly be continued. We encourage scholars to use alternative datasets and new methodologies to investigate the BRICS countries' involvement in the global value chains. This will address the time gap in our findings and provide a more comprehensive understanding of the factors that influence the trade activities of BRICS and other emerging countries.

Future research should examine how recent global disruptions, such as the COVID-19 pandemic, the reorganization of supply chains, and escalating geopolitical tensions, have redefined the role of emerging economies within global value chains. These developments have heightened the relevance of regional trade resilience, technological self-sufficiency, and strategic diversification in production networks. Additionally, the recent expansion of the BRICS group introduces new dynamics in trade cooperation and economic alignment. Analyzing how the enlargement of the group influences GVC participation through differentiated industrial structures and trade capacities offers a promising direction for understanding the evolution of South-South integration. These inquiries are essential to assess whether the BRICS organization will be able to maintain relevance and cohesion as a platform for alternative global economic governance.

Conclusions

Our study looks at how Brazil, Russia, India, and China (the BRIC countries) take part in global supply chains and specialize in certain parts of production. While China's remarkable success is in line with theoretical expectations of strategic participation, the varying degrees of progress made by the other BRIC countries illustrate the complexities inherent in GVC integration. Investing in medium- and high-tech industries is essential for emerging countries to integrate into the global value chains and generate significant added value. The paper emphasizes the importance of creating domestic added value, the role of foreign inputs, and the necessity of considering the intra-BRIC trade patterns. The results of this study have important implications for policymakers and international trade negotiators. They indicate the need for the strategies tailored to support emerging countries' involvement in global value chains and maximize their potential for economic growth. International trade agreements could promote cooperation and facilitate smoother integration of emerging economies into the global value chains.

The analysis highlights the increasing importance of intra-BRICs trade, particularly in the context of GVCs. The formation of the BRIC group facilitated trade between the member countries through various mechanisms, such as preferential trade agreements, enhanced diplomatic relations and joint initiatives to promote economic cooperation. The growing economic strength of the BRIC countries, coupled with their complementary industrial profiles, may have contributed to increased trade flows within the bloc. So far, however, there have been no significant changes to the value-added export profiles.

Our findings provide insights into the distinct patterns of intra-BRIC trade, highlighting China's significant advancements, the varying degrees of progress in Brazil, Russia, and India, and the importance of strategic investments in medium- and high-tech industries to enhance GVC participation. Our research contributes to the existing literature by revealing how the BRIC countries' trade dynamics influence their competitiveness. By focusing on the technological intensity patterns of BRIC, this paper points out the importance of technology in promoting trade and specialization within the group.

Trade between the BRICS countries is an integral part of a new framework for organizing international relations between emerging markets, which provides a counterweight to the economic power of the United States, the European Union, and Japan. While trade with the US, EU, and Japan continues to represent a significant portion of the BRIC countries' economic activity, its share has decreased. Recent changes in the international market and South-South cooperation have led to significant changes in production, trade and consumption patterns, with a focus on emerging and developing markets.

The study of the 14-year period allows for longitudinal analysis, which enables the tracking of changes in trade patterns, production specialization, and GVC participation over time within the BRIC countries. The analysis reveals emerging trends and long-term developments in their economic trajectories. When comparing the performance of BRIC with that of other countries during this period, we can gain insight into their relative competitiveness. We can also identify areas where they converge or diverge, and assess their overall contribution to global economic growth. WIOD's coverage of this period is particularly accurate and detailed, with consistent methodologies and data collection practices. This allows for reliable comparisons and robust analyses across various countries and sectors within the BRICS countries.

Although trade agreements between countries in the group are meant to promote global cooperation and economic integration, empirical evidence suggests that most of the trade gains have gone to China. It means that trade itself is not the only factor that matters. Trade benefits are certainly determined by such factors as resource endowment, the ability to attract FDI, technological advancements and knowledge differentials. To benefit more significantly from trade agreements, it may also be necessary to build capacities to compete more effectively within the global value chains. Our findings suggest that China's leadership in these trade agreements does not always translate into equitable benefits for all member countries, highlighting the need for specific strategies that can help other BRIC nations enhance their industrial and technological capabilities. The development of mutually beneficial relations between the BRIC countries may be hampered by their desire to gain or maintain regional economic and political influence. In addition, each country faces specific internal challenges that also impede progress.

Funding

No funding was received from any organization for this paper.

Competing interests

We declare that we do not have any competing interests.

References

Armijo, L. E. (2007). The BRICS Countries (Brazil, Russia, India, and China) As Analytical Category: Mirage Or Insight? *Asian Perspective*, *31*(4,), 7–42.

Baldwin, R. (2011). *Trade And Industrialisation After Globalisation's 2nd Unbundling: How Building And Joining A Supply Chain Are Different And Why It Matters* (w17716; p. w17716). National Bureau of Economic Research. https://doi.org/10.3386/w17716

Baldwin, R., & Lopez-Gonzalez, J. (2015). Supply-chain Trade: A Portrait of Global Patterns and Several Testable Hypotheses. *The World Economy*, *38*(11), 1682–1721. https://doi.org/10.1111/twec.12189

Baumann, R. (2017) BRICS: Opportunity and challenge for the international insertion of Brazil. BRICS Studies and Documents. Institute of Research on International Relations.

BRAZIL. (2017). BRICS Studies and Documents. Institute of Research on International Relations.

Coning, C., Mandrup, T. & Odgaard, L, (2015). The BRICS and coexistence: an alternative vision of world order. Global Institutions. Routledge.

Daudin, G., Rifflart, C., & Schweisguth, D. (2011). Who produces for whom in the world economy? *The Canadian Journal of Economics / Revue Canadienne d'Economique*, *44*(4), 1403–1437.

Davis, C. L., Fuchs, A., & Johnson, K. (2019). State Control and the Effects of Foreign Relations on Bilateral Trade. *Journal of Conflict Resolution*, *63*(2), 405–438. https://doi.org/10.1177/0022002717739087

Dietzenbacher, E., Los, B., Stehrer, R., Timmer, M., & De Vries, G. (2013). THE CONSTRUCTION OF WORLD INPUT–OUTPUT TABLES IN THE WIOD PROJECT. *Economic Systems Research*, *25*(1), 71–98. https://doi.org/10.1080/09535314.2012.761180

Dunford, M., Aoyama, Y., Campolina Diniz, C., Kundu, A., Limonov, L., Lin, G., Liu, W., Park, S. O., & Turok, I. (2016). Area development and policy: An agenda for the 21st century. *Area Development and Policy*, *1*(1), 1–14. https://doi.org/10.1080/23792949.2016.1158621

Dunford, M., & Liu, W. (2023). China's evolving international economic engagement: China threat or a new pole in an equitable multipolar world order? *Area Development and Policy*, 1–38. https://doi.org/10.1080/23792949.2023.2225092

Dunford, M., Liu, W., & Pompeani, C. (2022). *Area Development and Policy* , the Greater BRICS and a new world order? *Area Development and Policy*, *7*(4), 365–379. https://doi.org/10.1080/23792949.2022.2128384

Gerasimova, I., & Dunford, M. (2017). Russian regional evolutions: Comparative gross regional product dynamics of the subjects of the Russian Federation, 1995–2013. *Area Development and Policy*, *2*(3), 332–359. https://doi.org/10.1080/23792949.2017.1359638

Gereffi, G. (2018). *Global Value Chains and Development: Redefining the Contours of 21st Century Capitalism* (1st ed.). Cambridge University Press. https://doi.org/10.1017/9781108559423

Gereffi, G., Humphrey, J., & Sturgeon, T. (2005). The governance of global value chains. *Review of International Political Economy*, *12*(1), 78–104. https://doi.org/10.1080/09692290500049805

Gereffi, G., & Lee, J. (2012). Why the World Suddenly Cares About Global Supply Chains. *Journal of Supply Chain Management*, *48*(3), 24–32. https://doi.org/10.1111/j.1745-493X.2012.03271.x

Halis, D. C. ; Castilhos, G. V. (2017). The BRICS Investment Framework: Catching Up with Trade. In: In: The BRICS-Lawyers' Guide to Global Cooperation. Neuwirth, R. J., Svetlicinii, A., Halis, D. C. Cambridge University Press.

Hooijmaaijers, B. (2021). China, the BRICS, and the limitations of reshaping global economic governance. *The Pacific Review*, *34*(1), 29–55. https://doi.org/10.1080/09512748.2019.1649298

Instituto Brasileiro de Geografia e Estatística. (2023). Participação da Indústria de transformação no PIB do Brasil. Available in: https://www.ibge.gov.br/estatisticas/economicas/industria.html

Johnson, R. C. (2018). *Measuring Global Value Chains*. 207–236. https://doi.org/10.1146/annurev-economics- 080217-053600

Johnson, R. C., & Noguera, G. (2012a). Accounting for intermediates: Production sharing and trade in value added. *Journal of International Economics*, *86*(2), 224–236. https://doi.org/10.1016/j.jinteco.2011.10.003

Johnson, R. C., & Noguera, G. (2012b). Proximity and Production Fragmentation. *American Economic Review*, *102*(3), 407–411. https://doi.org/10.1257/aer.102.3.407

Kollamparambil, U. (2017). Diversity and Intra-BRICS Trade: Patterns, Risks and Potential. In: The BRICS-Lawyers' Guide to Global Cooperation. Neuwirth, R. J., Svetlicinii, A., Halis, D. C. Cambridge University Press.

Koopman, R., Wang, Z., & Wei, S.-J. (2014). Tracing Value-Added and Double Counting in Gross Exports. *American Economic Review*, *104*(2), 459–494. https://doi.org/10.1257/aer.104.2.459

Krugman, P. (1995). Growing World Trade: Causes and Consequences. *Brookings Papers on Economic Activity*.

Krugman, P., & Venables, A. J. (1995). Globalization and the Inequality of Nations. *The Quarterly Journal of Economics*, *110*(4), 857–880. https://doi.org/10.2307/2946642

Kumar, R. et al. (2023). Locating BRICS in the Global Order: perspectives from the Global South. Routledge Group: New York, 358 p.

Kummritz, V. (2016). *Do Global Value Chains Cause Industrial Development?*

Kummritz, V., & Quast, B. (2016). *Global Value Chains in Low and Middle Income Countries*.

Li, L. (2019). BRICS: A Limited Role in Transforming the World. *Strategic Analysis*, *43*(6), 499–508. https://doi.org/10.1080/09700161.2019.1677017

Lin, J. Y. (2017). The rise of China and its implications for economics and other developing countries. *Area Development and Policy*, *2*(2), 109–119. https://doi.org/10.1080/23792949.2017.1298971

Lohani, K. K. (2021). Trade and Convergence: Empirical Evidence from BRICS Countries. *Global Business Review*, 097215092199305. https://doi.org/10.1177/0972150921993057

Morceiro, P. C. (2019). *Nova Classificação de Intensidade Tecnológica da OCDE e a Posição do Brasil*.

Morrison, A., Pietrobelli, C., & Rabellotti, R. (2008). Global Value Chains and Technological Capabilities: A Framework to Study Learning and Innovation in Developing Countries. *Oxford Development Studies*, *36*(1), 39–58. https://doi.org/10.1080/13600810701848144

Mukherjee, D. (2017). The Political Economy Challenges of Financial Regulation in BRICS Economies: A Case Study of Capital Markets Regulation in India. In: The BRICS-Lawyers' Guide to Global Cooperation. Neuwirth, R. J., Svetlicinii, A., Halis, D. C. Cambridge University Press.

Naudé, W., Szirmai, A., & Haraguchi, N. (Eds.). (2015). *Structural Change and Industrial Development in the BRICS*. Oxford University Press. https://doi.org/10.1093/acprof:oso/9780198725077.001.0001

OECD. (2017). *OECD Science, Technology and Industry Scoreboard 2017: The digital transformation*. OECD. https://doi.org/10.1787/9789264268821-en

Ponte, S., & Ewert, J. (2009). Which Way is "Up" in Upgrading? Trajectories of Change in the Value Chain for South African Wine. *World Development*, *37*(10), 1637–1650. https://doi.org/10.1016/j.worlddev.2009.03.008

Ponte, S., Gereffi, G., & Raj-Reichert, G. (Eds.). (2019). *Handbook on Global Value Chains*. Edward Elgar Publishing. https://doi.org/10.4337/9781788113779

Ponte, S., & Sturgeon, T. (2014). Explaining governance in global value chains: A modular theory-building effort. *Review of International Political Economy*, *21*(1), 195–223. https://doi.org/10.1080/09692290.2013.809596

Rahman, M. N., Fatima, Z., Rahman N. (2020). Quantitative dynamics of intra-BRICS trade. *Brics Journal of Economics, 1(4), 6-23. https://doi.org/10.38050/2712-7508-2020-1-4-2*

Rodrik, D. (2016). Premature deindustrialization. *Journal of Economic Growth*, *21*(1), 1–33. https://doi.org/10.1007/s10887-015-9122-3

Rodrik, D. (2018). *New Technologies, Global Value Chains, and Developing Economies* (w25164; p. w25164). National Bureau of Economic Research. https://doi.org/10.3386/w25164

Santos-Paulino, A. U. (2011). Trade specialization, export productivity and growth in Brazil, China, India, South Africa, and a cross section of countries. *Economic Change and Restructuring*, *44*(1–2), 75–97. https://doi.org/10.1007/s10644-010-9087-3

Sousa Filho, J. F. D., Santos, G. F. D., & De Santana Ribeiro, L. C. (2021). Structural changes in the Brazilian economy 1990–2015. *Economic Systems Research*, *33*(4), 555–575. https://doi.org/10.1080/09535314.2020.1802234

Suder, G., Liesch, P. W., Inomata, S., Mihailova, I., & Meng, B. (2015). The evolving geography of production hubs and regional value chains across East Asia: Trade in value-added. *Journal of World Business*, *50*(3), 404–416. https://doi.org/10.1016/j.jwb.2014.05.003

Timmer, M. P., Dietzenbacher, E., Los, B., Stehrer, R., & De Vries, G. J. (2015). An Illustrated User Guide to the World Input–Output Database: The Case of Global Automotive Production. *Review of International Economics*, *23*(3), 575–605. https://doi.org/10.1111/roie.12178

Timmer, M. P., Erumban, A. A., Los, B., Stehrer, R., & De Vries, G. J. (2014). Slicing Up Global Value Chains. *Journal of Economic Perspectives*, *28*(2), 99–118. https://doi.org/10.1257/jep.28.2.99

United Nations (Ed.). (2008). *International Standard industrial classification of all economic activities (ISIC)* (Rev. 4). United Nations.

United Nations Conference on Trade and Development. (2013). *World Investment Report 2013: Global Value Chains - Investment and Trade for Development*. UN. https://doi.org/10.18356/a3836fcc-en

United Nations Conference on Trade and Development. (2023). *UNCTAD HANDBOOK OF STATISTICS 2022*. UNITED NATIONS.

United Nations Industrial and Development organization. (2020). The role of industrial policies in the BRICS economic integration process. Inclusive and Sustainable Industrial Development Working Paper Series WP 1 | 2020.

Viola, E., & Lima, J. S. (2017). Divergences Between New Patterns of Global Trade and Brazil/Mercosur. *Brazilian Political Science Review*, *11*(3). https://doi.org/10.1590/1981-3821201700030001

Wang, Z., Wei, S.-J., & Zhu, K. (2018). *Quantifying International Production Sharing at the Bilateral and Sector Levels* (w19677; p. w19677). National Bureau of Economic Research. https://doi.org/10.3386/w19677

World Economic Forum. (2013) *Enabling Trade Valuing Growth Opportunities, 2013.* (n.d.).

World Trade Organization. (2011). *Making Globalization Socially Sustainable* (M. Bacchetta & M. Jansen, Eds.). WTO. https://doi.org/10.30875/4604906e-en

WTO/IDE-JETRO. (2011). Trade Patterns and Global Value Chains in East Asia: From trade in goods to trade in tasks, Geneva: WTO/IDE-JETRO.

Yilmaz, A. (2022). Intra-BRICS Trade: A Panel Data Analysis with Structural Breaks. *Istanbul Journal of Economics,* (72), 2022/2, s. 653-687. https://doi.org/10.26650/ISTJECON2022-1096747.