

THE ROLE OF CHINA IN THE BRICS: MODERN HIGH-TECH TRADE NETWORKS

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Abstract: In 2024, five countries (Egypt, Ethiopia, Iran, Saudi Arabia, and the United Arab Emirates) joined the original BRICS countries (Brazil, Russia, India, China, and South Africa), reflecting the group's clear commitment to becoming a relevant global actor. This study explores the reshaping of global trade patterns by estimating the determinants of exports with a focus on the technological content of traded goods between the extended BRICS network and China. By estimating the determinants of exports with a focus on the technological content of traded goods, we explore the importance of China within the BRICS network and examine how the BRICS modifies the trade pattern in mid- and high-technology products. Using a unique dataset, further augmented to include trade in technologically innovative products, this paper aims to understand how technological capacity plays a key role in the determination of China-BRICS technological trade. This paper employs modified gravity estimation methods to empirically investigate how China, within the context of the BRICS countries, has influenced or altered trade patterns in these countries, which have historically been shaped by the Global North. Results indicate that export patterns are driven by Chinese trade patterns within an increasingly complex BRICS network. Our findings suggest that greater R&D activities do not have a significant effect on high-tech exports, while some positive results are found for mid-tech exports. Furthermore, the trade patterns in the expanded BRICS network are potentially also determined by Chinese high-tech exports, as the drivers of more technologically advanced integration are based on the specific conditions of the participants. Thus, moving up the value chain is not necessarily made possible through technology imports, although China has been able to take advantage of greater exports of high-technology products.

Keywords: China, BRICS, trade, technical goods, innovation.

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INTRODUCTION

While initially popular only within the finance industry due to the BRIC nomination by Goldman Sachs as an investment category of countries in 2006, when the heads of state of Brazil, Russia, India, China, and South Africa (BRICS) held their first summit in 2009, they transformed themselves into a political club. Many economic and political analysts expected only a limited impact. Yet, the BRICS has defied expectations, and even the relatively significant ideological swings in member countries have not altered the members' commitment to the club. BRICS summits became more than a yearly photo-op as Egypt, Ethiopia, Indonesia, Iran, and the United Arab Emirates joined in 2024. Although it is not a given that countries would accept membership, Algeria and Argentina declined the invitation to join. Either as partners or candidates, Belarus, Bolivia, Cuba, Kazakhstan, Malaysia, Nigeria, Thailand, Uganda, and Uzbekistan were invited in 2024, and Turkey and Vietnam have submitted formal membership applications. Now, according to the Economist magazine, the BRICS¹ remains a globally recognised brand. It is expected that more countries may potentially join as the political and economic interests of existing and new members fuse into an alliance of states.

The enlargement of the BRICS group means that there is a more significant demographic and economic weight, accounting for nearly half the world's population (compared with just under 10% for the Group of Seven (G7))². Although the expanded BRICS constitutes a significant economic group, the G7 countries continue to dominate global output, accounting for 43.2% of global GDP (Ross, 2024). The gap between the BRICS and the G7 is closing due to robust economic growth in emerging countries. According to forecasts by the International Monetary Fund (IMF), an expanded BRICS will account for 37.6% of world GDP at PPP in 2027, compared with 28.2% for the G7 (Afota et al., 2024). The BRICS, however, accounts for more than 43% of global oil production and controls nearly 75% of rare earth minerals.

Because of the BRICS countries' limited trade integration and their recognition of the value of innovation in this environment, an effort was made in 2011 to negotiate agreements on science, technology, and innovation as part of the annual summit. Investments in innovations are important for firms and nations to compete and secure future competitive advantages in an increasingly globalised and uncertain economic environment (Vila, Pérez & Coll-Serrano, 2014). According to UN Trade and Development (UNCTAD) (2013), "Over the past decade, FDI inflows to the BRICS more than tripled to an estimated US\$263 billion in 2012. As a result, their share in world FDI flows kept rising even during the crisis, reaching 20% in 2012, up from 6% in 2000".

However, a "China shock" of low-cost exports of everything from steel and chemicals to machinery has the potential of exacerbating trade tensions within the network; a stronger BRICS could have a significant global impact in energy, trade networks, infrastructure, monetary policy, and technology (Azevedo et al., 2025). Zhao at the Carnegie Institute argues that, for China, BRICS engagement supplements the Belt and Road Initiative's geoeconomic focus as well as the Shanghai Cooperation Organisation's geopolitical-security role, leading to an expansion of China's global influence (Patrick et al., 2025). The BRICS group also expands Beijing's economic influence and shapes rules and standards in emerging technologies such as artificial intelligence. Thus, the effects of innovation on export production of high-technology goods are non-negligible. Given the increased tensions between the US and China, Beijing will likely further prioritise the Global South countries through the BRICS network.

¹ We refer to the BRICS, meaning all current members, the partners, and the application countries included in this study.

² The US, Canada, Japan, the United Kingdom, Germany, France, and Italy are the G7.

This paper contributes to the literature in three ways. First, we present a China-specific gravity model. There are few papers focusing on the specific trade patterns of China vis-à-vis its created trade networks, in this case, the BRICS countries. To do so, we use a unique dataset (BLOCS), as explained below. Second, we consider a trade relationship outside of the traditional mechanisms. The BRICS relationships, including those of their new partner countries, are potential drivers of world trade patterns. First, we investigate whether there is an increase in mid- and high-tech exports from or towards China due to participation in this trade group. Furthermore, we investigate the relationship between FDI and the BRICS, the resulting innovation, and the subsequent increase in trade with China in high-tech and medium-tech goods.

Third, the growing BRICS club has not been thoroughly studied, nor has the relationship between investment and innovation been examined in this regard. To close this gap, this paper looks at how investment has affected the BRICS countries' trade with China, with a focus on how innovation has affected the manufacturing of high- and medium-tech export items both domestically and internationally. The following section examines the relevant literature on the BRICS and its expansion, while the third section elucidates the proposed methodology. The fourth part of the paper provides some results from the empirical investigation, followed by a discussion of these results and a conclusion.

LITERATURE REVIEW

The majority of the literature concerning the BRICS countries revolves around questions of regional politics and evaluations of the geopolitical role of this group. It is therefore interesting to postulate as to the exact nature of the BRICS agreement. Khathoun and Trivedy (2023) revisited the debate on political and economic power among the BRICS countries and concluded that BRICS was an important alliance opposing the US and Europe. They further argued that to reach the level of developed countries, the BRICS countries must assess and address the shortcomings in economic growth plans that support South-South development generally.

The BRICS has already reached an important level of relevance in political power and economic regional status. Nach and Ncwadi (2024) provide a complete examination of the literature concerning BRICS cooperation. They conclude that although there is significant economic and policy diversity within the BRICS, there is also a noticeable trend towards convergence driven by increasing trade linkages. The constitution of a cooperative political organisation is a clear trend for the BRICS. However, it is debatable whether it acts as a regional trade agreement (in the sense of a trade institution) or a somewhat looser trade network. In this context, the literature has very little to say about how trade agreements affect the composition of products traded.

Since 2009, the BRICS has amplified the voices of its members to collectively address global issues, such as investment facilitation, climate change, poverty, and reforms in international organisations. The economic benefits of the bloc include the intensification of trade among members, the reduction of barriers towards investment from the outside world, and the establishment of related agreements. Economic cooperation is also aided by the structure of the economies of the first five BRICS members and their complementary endowments, particularly China's manufacturing expertise (Tse & Hartwich, 2025).

As investments are a significant component of trade creation, there is general agreement in the literature on the importance of FDI in economic growth and its relevance in the international fragmentation of production organised within Global Value Chains (GVC). It is

still unclear if growth discrepancies are due to the quality of FDI. Khan et al. (2023) attempt to explain the growth disparity between the four major emerging countries (Brazil, Russia, India, and China) and the non-BRIC countries. They find that FDI, gross capital formation, human capital, and infrastructure are crucial for economic growth. However, FDI, gross capital formation, and human capital are more efficacious in the BRICS. Moreover, the FDI seems to be more relevant in the presence of better-quality human capital and a higher level of domestic investments in the BRICS, potentially leading to higher technology product exports.

The absence of BRICS-wide free trade agreements, or agreements on the harmonisation of product standards, lends towards a focus on the growing economic weight and partial political alignment among the members. The countries focus on enhancing trade relations, industrial development, and fostering complementary economic growth across the members. Cheong (2023) finds that PTAs have a positive role in developing higher-technology export products. PTAs are shown to increase medium- and high-technology product trade volumes between member countries, although they have little impact on low-technology products. In a recent paper, Khachoo and Ah Sheikh (2023) analysed non-resident patenting and PTAs using a cross-country dataset on patent applications. Focusing on the BRICS, they examine the differentiation of shallow or deep trade agreements. They found that the BRICS countries are increasing patent applications, especially non-resident patent applications, in comparison to developed countries, suggesting a significant link between the acceleration of trade flows and an increase in cross-country patent applications.

The effect of FDI on innovation is positive in some studies and negative in other studies. In an empirical study from 2007 to 2019, augmented with Turkish data, Gür (2020) argued that what makes countries have higher global competitiveness is their ability to be innovative. This ability, when combined with trade openness, is important for learning and developing technology, thus contributing to an improvement in a country's innovation capability. They examined the importance of FDI for innovation, finding that exports have a positive effect on innovation, whereas imports and foreign direct investments adversely affect innovation. They further argued that FDI contribution to technological development and R&D activities, and its subsequent ability to create an innovative export effect, depended on whether the host country had reached a certain level of technological industry capacity. We find similar results in our examination below.

Furthermore, Antonietti et al. (2025) show that regions with greater access to digital technology are prone to higher levels of income inequality. However, this negative link is mitigated by strong formal and *informal* institutions. The BRICS' extended network of trade partners constitutes an informal cooperative institution. According to the IEA (2025), increased investment has resulted in increased production of electric vehicles. With an increase in FDI inflows to the BRICS countries, we would expect a concomitant increase in high-tech exports. Qin et al. (2025) analysed the impact of digital development on bilateral trade between China and the BRICS countries. They examined how institutional distance contributes and how trade effects vary with digital infrastructure and economic development levels. They found that digital advancement in the BRICS countries substantially boosts bilateral trade with China, highlighting the role of technology in modern trade and the complexity of interactions between investments, digital capability, and economic development. We further examine these concepts below.

METHODOLOGY

This paper aims to estimate China's role in the process of economic integration of the expanded BRICS countries, and especially its ability to lead to greater innovation in bilateral trade flows with partners. We, therefore, recognise China as an economic and political power,

capable of generating various direct and indirect economic effects that have an implication on its economic growth as well as that of its partners. We include all countries, partner countries and application countries in the empirical analysis (Brazil, Russia, India, South Africa, Egypt, Ethiopia, Indonesia, Iran, the United Arab Emirates, Belarus, Bolivia, Cuba, Kazakhstan, Malaysia, Nigeria, Thailand, Uganda, Uzbekistan, Turkey, and Vietnam).

This paper contributes to the literature on investment and trade regimes and innovation by investigating whether the BRICS is an empirically recognisable phenomenon resulting in increased bilateral trade flows through innovation capabilities and FDI. The application of a structural gravity model for trade and a new and unique database (BLOCS) will enable an empirical analysis of the trade patterns of these nations in high- and medium-tech industries, facilitating the formulation of trade policy recommendations and directions for future research (Yotov, 2022). The empirical gravity methodology has been recognised as one of the most robust approaches to modelling the determinants of international trade flows due to its theoretical basis and empirical success (Borchert et al., 2022). The gravity model for trade is derived from the *Law of Universal Gravity*. Its adaptation to international trade was first proposed by Poyhonen (1963) and Tinbergen (1964), who, following the postulates of Sir Isaac Newton, presented their adaptation and the first advances in the estimation of the determinants of international trade through this approach. Analogous to the *Law of Universal Gravity*, the model states that international trade between pairs of countries will be proportional to their economic masses and inversely proportional to their physical distance (Frankel, 1997). Therefore, the gravity model for a trade equation is commonly expressed as follows:

$$(1) \quad X_{ij} = \alpha_0 Y_i^{\alpha_1} Y_j^{\alpha_2} D_{ij}^{\alpha_3} Z_{ij}^{\alpha_4} \eta_{ij}$$

where X_{ij} represents the bilateral export flows from country i to country j , $Y_i^{\alpha_1}$ and $Y_j^{\alpha_2}$ represent the income or GDP of the countries as a proxy of the economic masses of the nations. $D_{ij}^{\alpha_3}$ indicates the geographical distance between the country of origin and destination of the trade flows, and $Z_{ij}^{\alpha_4}$ includes additional factors that may enhance or hinder bilateral trade between the parties, commonly known as multilateral resistant terms (MRTs). Following standard procedures, the gravity model considers the described control variables of interest and further considers the traditional control variables through the use of fixed effects, represented in equation 1 by η_{ij} . The inclusion of country-pair fixed effects results in the case that it is no longer possible to estimate coefficients on time-invariant country-pair specific variables, such as distance, common language, and contiguity, that have been commonly included in previous gravity models. Specifically for this set of countries, regional trade agreements are also included in the paired fixed effects because of the time-invariance in the sample selected. We also include explicit variables related to trade integration of the countries involved, such as whether the countries are members of the World Trade Organisation (WTO). Additionally, we include the product of the pair of the countries' populations as a proxy of the consumption power of the population (Frankel & Romer, 1999).

Our dependent variable is either mid-level technology or high-level technology, imports or exports from China. We, therefore, run a series of regressions including the log of existing stock domestically of either BRICS FDI in China (instock) or Chinese FDI in the BRICS (outstock). Since we choose to estimate our results for only high- and medium-tech goods, we employ the classification system for the definition of high- and medium-tech traded goods, which is established using the UNCTAD Standard Industrial Trade Classification (SITC) of products by technological categories (Lall, 2000). Lall (2000) mapped developing countries' manufactured goods export patterns, using a detailed classification by technological levels. This classification

system is still used when examining global value chains of manufacturing. We used this SITC classification system, transformed to HS-07, implemented with BACI data (contained in BLOCS), to discern the high- and medium-technology goods exported or imported in the context of the BRICS and the extended BRICS network countries.

We further include the R&D index variable. We are particularly interested in examining the impact of R&D activity and industry capacity on the exports and imports of these medium- and high-tech goods. We retrieve these measures from the Data Hub at UNCTAD (2025). R&D activity is imperative for the production of frontier technologies as well as for the modification and adjustment of these technologies for local usage. R&D activities are measured using the “number of publications and patents filed on the 11 frontier technologies in a country” (UN Trade and Development [UNCTAD], 2025). This measure may undercount the actual activity, as informal R&D activities most likely occur in our sample of the BRICS. These informal activities do not necessarily result in a publication or a patent. Therefore, the R&D scores we used probably do not reflect the actual scale of these activities. We hypothesise that it would result in a downward bias in the results, meaning that our results would be stronger in the direction given if these informal activities could be accounted for. We expect both R&D and industry activities to have a positive relationship with exports and imports.

Since the key indicator of high-tech manufacturing is the ability of the industry to adopt and adapt technologies for industrial use, we include an index of industry activity, also from the Data Hub at UNCTAD (2025). This measure considers three sectors that are early adopters: manufacturing, with high-tech manufacturing as the frontrunner; finance; and ICT, which tends to interact with other technologies. In developing countries, industrial activities are sometimes performed by informal sector firms, leaving their activities outside official statistics. The scores from these countries, which include our BRICS countries, are potentially lower than their actual activity might predict.

$$(2) \quad X_{ij,t} = \exp[\beta_1 FDI \text{ in}_{ij,t} + \beta_2 FDI \text{ out}_{ij,t} + \beta_3 R\&D_{i,t} + \beta_4 \text{Industry}_{i,t} + \beta_5 GDP_{ij,t} + \beta_6 \text{Pop}_{ij,t} + \beta_7 WTO_{i,t} + Z_{ij,t} + \eta_{i,t} + \lambda_t] + \varepsilon_{ij,t}$$

where X_{ij} is either the imports or exports of high-tech or medium-technology goods in year t ; $Z_{ij,t}$ and $\eta_{i,t}$ are the multilateral resistance terms and the fixed effects of the paired relationship, and λ_t is the time fixed effect. China is always the paired country, j . The other variables are as described above.

Following Yotov et al. (2016) and Yotov (2022), we use a Poisson Pseudo-Maximum Likelihood (PPML) estimation of the structural gravity model shown in equation 2. The objective of the empirical analysis is to determine whether the growing influence of the BRICS and partner countries is recognisable in their FDI exchange and whether the resulting presence of innovation is discernible in their trade patterns. Specifically, we use a newly created bilateral dataset (BLOCS) to separately identify the effects of investment and innovation in the context of their bilateral trade (Wu et al., 2024) of high- and medium-tech goods. Table 1, below, provides details of the included variables and their sources. Our data ranges from 2008 to 2021, as 2009 is the official start of BRICS cooperation, and 2021 is the last available year of UNCTAD data described below. We use only the relationship with China, thus generating 20 bilateral country pairs for all data. FDI in our analysis is considered as the change to the stock, incoming or outgoing, of investments. This information is taken from the BLOCS dataset (Wu et al., 2024). We expect that FDI should have a positive effect on the exports and imports of high- and medium-tech goods.

We further augment equation 2 with an interaction between industrial capacity and R&D expenditures ($\beta_9 Industry_{i,t} * R\&D_{i,t}$). That is because R&D and industrial capacity for technological goods production might be reinforcing each other. R&D leads to an increase in industrial activity. An increase in industrial activity would subsequently lead to increases in R&D. Therefore, both indicators would reinforce each other. To account for this possibility, we incorporate the interaction term in the second set of empirical results, shown in Table 3. Given the variables defined above, we use equation 2 to model the bilateral drivers of China's exports of high- and medium-tech goods to the BRICS and BRICS enlargement countries, as well as China's imports from the BRICS and BRICS enlargement countries of high- and medium-tech goods. We report our findings in the next section.

Table 1. Main Variables and Sources

Variable	Definition	Source
Exports or Imports	High-technology or medium technology goods exports and imports	Author calculations using BACI and UNCTAD, LALL (2000) classifications using HS-07.
Incoming FDI	Instock FDI (BRICS FDI to China)	BLOCS
Outgoing FDI	Outstock FDI (China to BRICS)	BLOCS
Research and Development (R&D)	Continuous variable from 0-1 capturing R&D activities using the number of publications and patents filed on the 11 frontier technologies in a country.	UNCTAD (2025) R&D activity in the Frontier technology readiness index.
Industrial activity	Continuous variable from 0-1 capturing ongoing activities in an industry related to the use, adoption and adaption of frontier technologies.	UNCTAD (2025) Industry activity in the Frontier technology readiness index.
Interaction term	Industry activity*R&D	Author calculations
GDP	GDP of home*GDP of China	BLOCS
Population	pop of home*pop of China)	BLOCS
WTO membership	Dummy variable of membership	BLOCS

RESULTS

In this section, we present the main findings from the empirical regressions described above. First, the results of the initial regression are shown and described. This regression captures imports into the BRICS sphere and BRICS exports to China and includes fixed effects for both year and country. In the second regression, in addition to the previously mentioned fixed effects, an interaction term between the R&D and industry indicators is included. It aims to explore, within the context of international trade, the potential complementary relationship between R&D and industrial capacity in the countries that trade with China. The result of the first regression is shown in Table 2.

While Chinese FDI in partner countries does not appear to exert a significant effect on either imports from China or exports to China, the BRICS countries' FDI in China shows significant results. Specifically, a 1% increase in BRICS FDI instock for China is associated with a reduction of 0.01% in imports from China of mid-tech manufacturing products and, simultaneously, an increase of 0.05% in exports to China. In the case of high-tech products, no significant results are found, either for import or export.

Furthermore, R&D and the industry index show significant results, as expected. In the case of the R&D index, a 1% increase in the R&D indicator in the country implies a reduction in the imports of mid-tech products from China by 0.6%. The opposite result is found for the high-tech import from China, which increases by 1.1% when the R&D index increases by 1%. When looking at the export to China, a 1% increase in the R&D index produces an increase of 1.9% in mid-tech products, while no significant results are seen for high-tech exports.

Table 2. Estimation of Imports from and Exports to China

	Import from China		Export to China	
	Mid tech	High tech	Mid tech	High tech
Log of instock FDI (BRICS FDI in China)	-0.01** (0.004)	-0.001 (0.008)	0.053** (0.014)	0.064 (0.390)
Log of outstock FDI (Chinese FDI in BRICS)	0.033 (0.062)	0.010 (0.082)	0.035 (0.022)	-0.020 (0.044)
R&D index	-0.597** (0.281)	1.130** (0.519)	1.946*** (0.628)	1.832 (1.152)
Industry index	0.273 (0.294)	2.457*** (0.608)	4.126*** (0.791)	7.900*** (2.177)
Log of GDP	0.610*** (0.064)	0.601*** (0.118)	0.379*** (0.101)	2.510*** (0.361)
Log of Population	-0.997*** (0.304)	-0.756 (0.570)	1.175 (0.881)	1.138 (1.662)
WTO	-0.146** (0.062)	-0.040 (0.082)	-0.424*** (0.145)	0.475** (0.210)
Constant	15.474 (8.412)	7.387 (15.129)	-35.066 (23.093)	-127.027 (46.569)
Ramsey RESET Test	0.049	0.072	0.109	0.416
N	235	235	231	231

Note: Using data as described in Table 1 and Section 3. Time and country fixed effects are included. Estimation method is PPML. Standard errors in brackets; * p<0.10 ** p < .05; *** p < .01

In the case of the industry index, it is possible to identify statistically significant and generally positive results. While the industry index appears to have no effect on mid-tech imports from China, it is observed that a 1% increase in the industry index leads to a 2.5% increase in high-tech imports from China. At the same time, with respect to exports to China, a

1% increase in the industry index would raise mid-tech exports by 4.1% and high-tech exports by 7.9%. Finally, control variables—including interactions between GDP in origin and destination countries, population interactions, and WTO membership—are included, yielding results that align with expected values. Table 3 displays the results for the estimation that includes the interaction variable between R&D and industry indicators.

In the case of the results presented in Table 3, similar patterns are observed for BRICS FDI in China. However, a notable difference emerges regarding Chinese FDI in the BRICS countries. While previous results showed no statistical significance, the new findings indicate that greater Chinese investment is now associated with an increase in imports from China of mid-tech products. Specifically, a 1% increase in the stock of Chinese FDI is associated with a 0.06% rise in imports from China.

Table 3. Estimation results including R&D and Industry Interaction

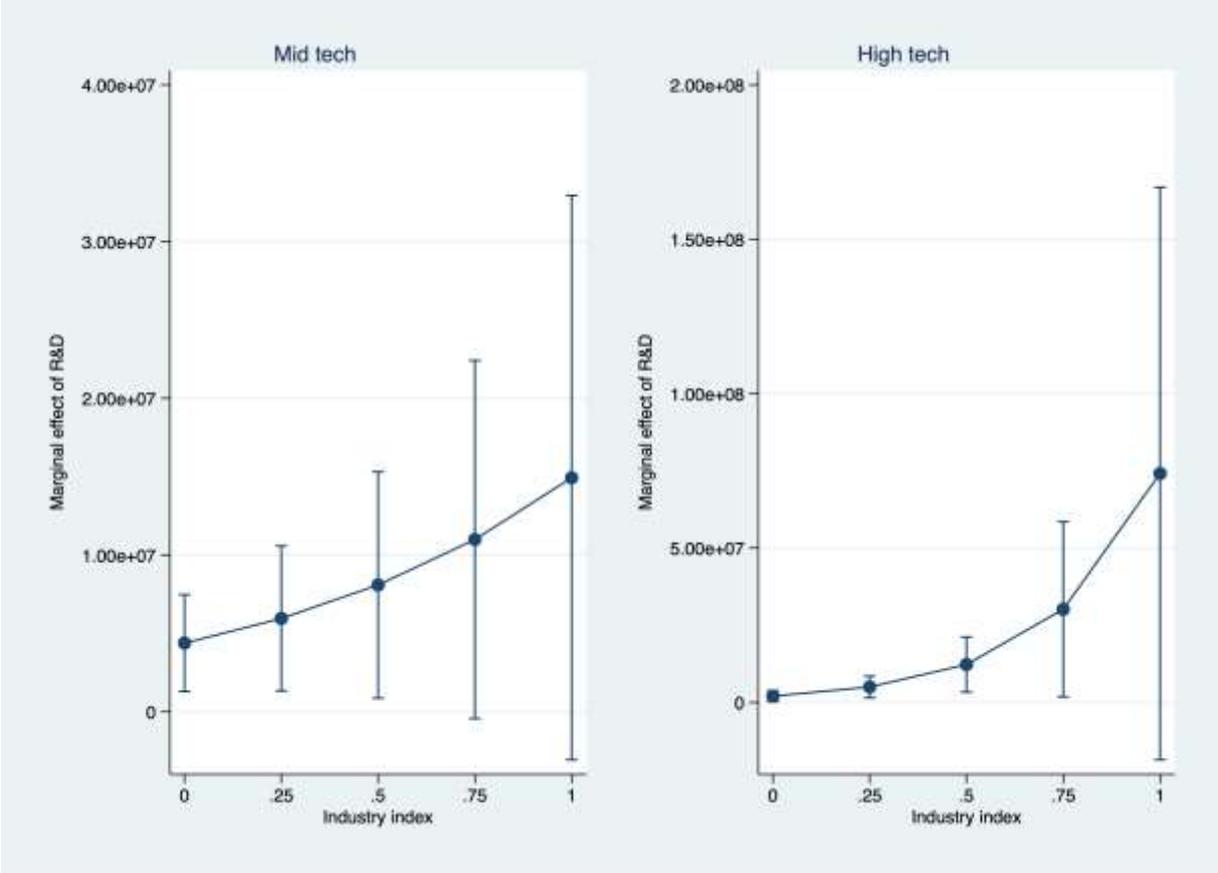
	Import from China		Export to China	
	Mid tech	High tech	Mid tech	High tech
Log of instock FDI (BRICS FDI in China)	-0.009** (0.004)	-0.001 (0.007)	0.054*** (0.014)	0.069* (0.041)
Log of outstock FDI (Chinese FDI in BRICS)	0.060** (0.027)	0.034 (0.046)	0.030 (0.022)	-0.034 (0.048)
R&D index	1.339** (0.661)	3.369** (1.334)	4.748*** (1.785)	5.212 (4.458)
Industry index	1.226*** (0.430)	3.598*** (0.820)	5.597*** (1.277)	9.381*** (2.802)
Industry, R&D Interaction	-2.979*** (0.952)	-3.350* (1.879)	-4.223 (2.584)	-4.620 (5.868)
Log GDP	0.632*** (0.059)	0.610*** (0.112)	0.435*** (0.098)	2.403*** (0.372)
Log Population	-1.377*** (0.287)	-1.034** (0.620)	1.004 (0.860)	1.293 (1.601)
WTO	-0.116* (0.060)	-0.004 (0.078)	-0.375** (0.147)	0.413* (0.227)
Constant	23.542 (8.028)	13.214 (16.249)	-34.122 (22.683)	-127.326 (46.273)
Ramsey RESET Test	0.078	0.571	0.430	0.878
N	235	235	231	231

Note: Using data as described in Table 1 and Section 3. Time and country fixed effects are included. Estimation method is PPML. Standard errors in brackets; * $p < 0.10$ * * $p < .05$; *** $p < .01$

The inclusion of the interaction term between the industry index and the R&D index yields similar results. However, the interaction variable proves to be statistically significant, particularly in the case of imports from China. In the case of mid-tech imports, the R&D

indicator now shows a positive coefficient. The interaction term shows a negative result, probably capturing the negative effect displayed in the first estimation. That suggests that the combined effect of the industry and R&D has a negative impact; however, it is important to note that the total effect of R&D remains positive across all levels of the industry index (see Figure 1), since the R&D coefficient more than compensates for the negative impact of the combined effect. Figure 1 shows the overall effect of the R&D Index on imports from China. As observed for mid-tech, the total effect for high-tech is also consistently positive, indicating that the negative interaction effect is more than offset by the standalone impact of R&D.

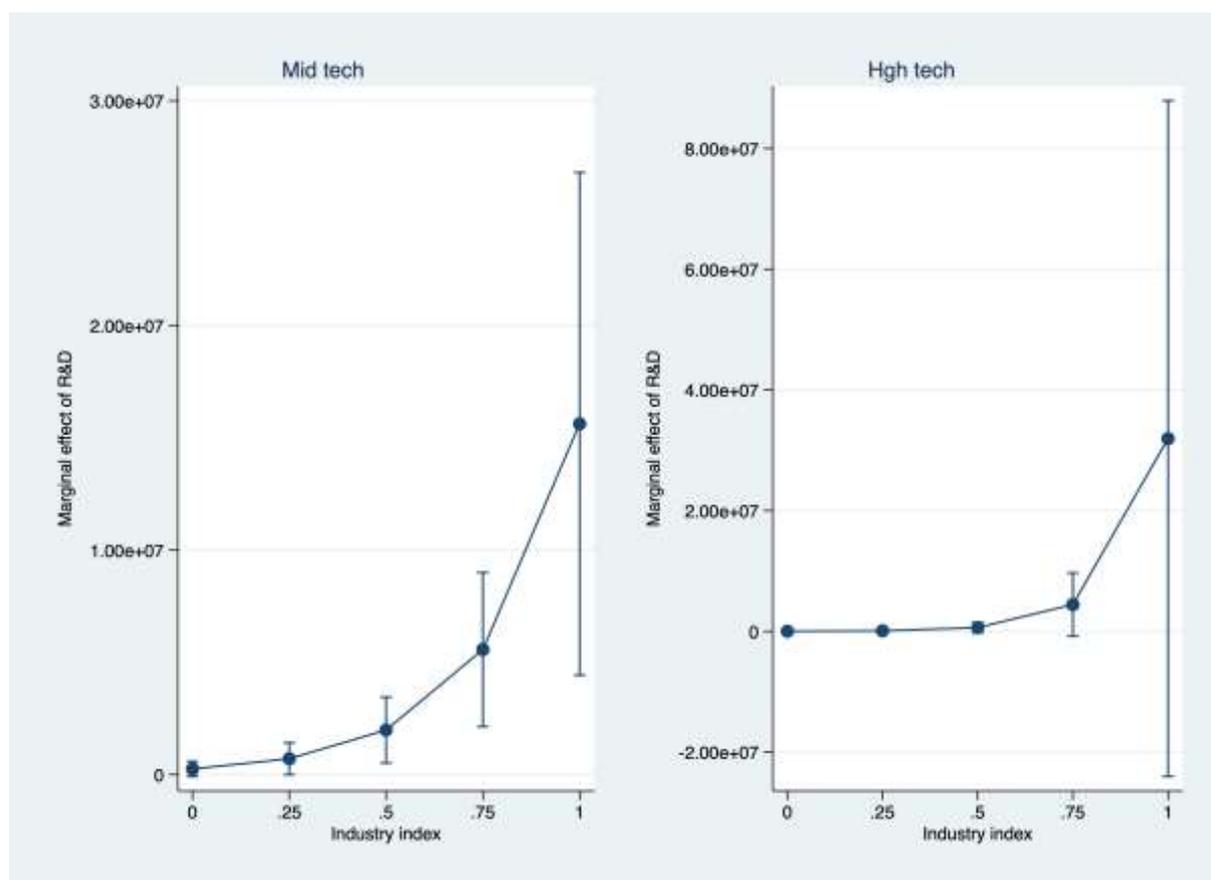
Figure 1. Marginal Effect of R&D Index on Imports by Industry index



Source: Authors' rendition using augmented BLOCS data.

Finally, in the case of exports from the BRICS to China, the results consistently show positive coefficients for R&D (only in the case of mid-tech) and for the industry index, although none of the interaction terms are statistically significant. Nevertheless, when examining the total marginal effect of R&D, it remains positive across all levels of the industry index. It is particularly interesting that the total effect of R&D on both mid-tech and high-tech exports becomes more substantial as the level of industrial development increases, an effect that is more pronounced for high-tech exports.

Figure 2: Marginal Effect of R&D Index on Export by Industry index



Source: Authors' elaboration using augmented BLOCS data.

DISCUSSION

The expansion of the BRICS has taken on various forms and degrees of formality. Some countries have been incorporated as full members, while others have been invited to participate as associated states. Additionally, several countries have submitted formal applications to join the group. In this paper, we propose to incorporate the notion of a sphere of influence of the BRICS, referring to countries that, while not formal members, maintain political, economic, or strategic proximity to this organisation. In particular, we aim to examine how this proximity may be shaping trade patterns with China, given its central economic role within the group.

Our estimations allow us to observe, on the one hand, the effects of FDI and the influence of R&D and industrial activity on trade flows. First, we consistently find that investment from BRICS countries into China is associated with a reduction in imports from China, while simultaneously increasing medium-technology exports to China. This pattern aligns with existing evidence on the organisation of international trade within global value chains. For instance, in the case of BRICS FDI into China, the associated increase in exports to China may reflect transactions between firms within the same value chain, suggesting that such trade is part of integrated production processes rather than conventional trade of final goods.

Overall, the results suggest that industrial activity is a stronger determinant of trade than R&D, although both indicators of R&D remain statistically significant. At the same time, it is crucial to consider the complementarity between these two factors. A consistent pattern across our estimations is that the effect of R&D on trade with China becomes more pronounced when industrial activity is higher. This complementarity is consistent with the idea that moving up

global value chains in more technologically advanced sectors requires not only the ability to invest in R&D but also the know-how and interdependence needed in industrial activities that can effectively enhance technological development. In other words, the effectiveness of R&D in promoting trade may depend on the existence of a robust industrial base capable of absorbing and deploying technological advances.

CONCLUSION

This paper contributes to the literature with several interesting findings. Using BLOCS, a unique data set augmented with the Frontier Technology Readiness Index data from UNCTAD, we examine Chinese trade with the BRICS countries. As the investment-innovation link with trade has not been explored in the context of the Global South, this paper seeks to fill this gap by examining the effect of FDI inflows and outflows of the BRICS countries and the R&D and industrial capacity on their export production of high- and medium-tech export goods in the context of trade with China. Furthermore, since little has been written regarding the expanding BRICS club, we first investigated whether there is an increase in mid- and high-tech exports from or towards China for the BRICS countries. Our findings indicate that investment by the BRICS countries in China reduces their imports from China and promotes BRICS exports to China only for mid-tech goods.

The potential contribution to technological exports boosted by R&D depends on whether the host country has reached a certain level of technological industrial capacity. We were particularly interested in examining the impact of R&D activity and industry capacity on the exports and imports of these medium- and high-tech goods. To this end, we included an interaction variable between R&D and industrial activity to assess their potential combined effect on trade between the BRICS countries and China. One of the key findings that emerges is that the impact of R&D tends to be greater when a country exhibits a higher level of industrial capacity. These results are consistent with the patterns observed in the organisation of global value chains. Examining the results of FDI, we saw that trade between the BRICS countries and China appears to be driven not only by the exchange of final goods but also by the integration of these countries into global production networks. This suggests the need for further research to better understand how engagement with China may yield benefits through participation in global value chains.

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