

BRAZIL'S ECONOMIC COMPLEXITY: A COMPARATIVE ANALYSIS ACROSS GLOBAL POWERS AND THE GLOBAL SOUTH

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Abstract

As the world's tenth-largest economy, Brazil has witnessed a marked and sustained decline in its economic complexity over the past three decades. This downward trajectory presents significant challenges to the country's ambition of assuming a more influential role in global economic governance. Despite Brazil's structural potential and geopolitical relevance, it continues to face considerable obstacles in its transition towards high-income status. This study addresses the following research question: How has Brazil's economic complexity evolved in relation to major global powers and the Global South? What factors have led to the continuous decline in Brazil's economic complexity? To explore this, we adopt a comparative methodology that examines Brazil's economic trajectory alongside both leading global economies and prominent actors within the Global South. Using the Economic Complexity Index (ECI) as the principal analytical framework, the research identifies critical development gaps and strategic opportunities. Through case studies and cross-national comparisons, our findings demonstrate that, despite notable political efforts to enhance Brazil's economic complexity, the country has yet to establish the necessary conditions to reverse its long-standing decline. Brazil remains in an intermediate position, lacking the technological sophistication and export diversification that typify high-complexity economies. These insights underscore the urgent need for targeted industrial policies, innovation-led strategies, and institution reforms, providing policy guidance for Brazil to reposition itself within the global economic hierarchy and advance its development agenda.

Keywords

Economic Complexity, Brazil, Economic diversification, Global south, Economic Complexity Index (ECI).

Resumo

Sendo a décima maior economia do mundo, o Brasil tem registado, ao longo das últimas três décadas, um declínio marcado e sustentado na sua complexidade económica. Esta trajetória descendente coloca desafios significativos à ambição do país de assumir um papel mais influente na governação económica global. Apesar do seu potencial estrutural e da sua relevância geopolítica, o Brasil continua a enfrentar obstáculos substanciais na sua transição para o estatuto de país de alto rendimento. Este estudo responde às seguintes questões de investigação: Como tem evoluído a complexidade económica do Brasil em relação às grandes potências globais e ao Sul Global? E quais os fatores que explicam o declínio contínuo da complexidade económica brasileira? Para tal, adotamos uma metodologia comparativa que examina a trajetória económica do Brasil paralelamente às economias globais líderes e a atores proeminentes do Sul Global. Recorrendo ao Índice de Complexidade Económica (ECI) como principal enquadramento analítico, a investigação identifica lacunas críticas de desenvolvimento e oportunidades estratégicas. Por meio de estudos de caso e comparações transnacionais, os resultados demonstram que, apesar de esforços políticos significativos para aumentar a complexidade económica do Brasil, o país ainda não estabeleceu as condições necessárias para reverter o seu declínio persistente. O Brasil permanece numa posição intermédia, sem a sofisticação tecnológica e a diversificação exportadora que caracterizam economias de elevada complexidade. Estas conclusões sublinham a necessidade urgente de políticas industriais direcionadas, estratégias baseadas na inovação e reformas institucionais, oferecendo orientações de política pública que permitam ao Brasil reposicionar-se na hierarquia económica global e avançar a sua agenda de desenvolvimento.



Palavras-chave

Complexidade Económica, Brasil, Diversificação Económica, Sul Global, Índice de Complexidade Económica (ECI).

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Introduction

The Federative Republic of Brazil is widely recognized as a regional power and a foundational member of the BRICS+ coalition (Esteves & Coelho, 2025). It maintains a robust and strategic engagement with the Global South, positioning itself not only as an integral actor within this geopolitical bloc but also as a regional leader with aspirations for greater influence in the global economic system (Heine, 2025). In both contexts - regional leadership and global ambition - Brazil's status as an economic powerhouse is a critical determinant of its international standing (Bernal-Meza, 2019). Therefore, in order to anticipate Brazil's potential trajectory within the global economic arena, it is essential to analyze its development through the lens of comparative economic complexity, which offers valuable insights into the sophistication, diversity, and resilience of its productive capabilities.

Economic complexity captures the depth of productive knowledge embedded within a nation's economy, as evidenced by the diversity and sophistication of its export portfolio - an indicator considered a strong predictor of long-term economic growth (Romero et al., 2022). This type of embedded knowledge is tacit, context-specific, and difficult to transfer across borders, making economic complexity a key driver of sustained development and structural transformation (Teixeira, Missio & Dathein, 2022).

The Economic complexity index (ECI) has demonstrated considerable predictive power in forecasting future GDP growth. Mealy et al. (2019) observe that "countries that increase their economic complexity tend to experience higher future income growth," underscoring the ECI's strategic relevance for policymakers. Similarly, Hidalgo and Hausmann (2009) argue that "economic complexity is a better predictor of income levels than many other commonly used indicators." This correlation stems from the inherent

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adaptability and resilience of complex economies, which are better equipped to absorb global shocks, reallocate production, and foster innovation.

Moreover, economic complexity acts as a catalyst for technological advancement and industrial diversification. As Hidalgo (2021) emphasizes, "the accumulation of capabilities enables countries to move into more sophisticated industries." This process enhances productivity, generates higher-value employment, and contributes to inclusive and sustainable economic development.

As of 2023, the world's ten largest economies by gross domestic product - namely, the United States of America (USA), China, Germany, Japan, India, the United Kingdom (UK), France, Italy, Canada, and Brazil - exhibit considerable variation in economic complexity, as measured by the ECI. Japan ranks highest with an ECI of 2.43, reflecting its advanced manufacturing base and technological sophistication (Hausmann et al., 2014). Germany follows with an ECI of 2.01, underscoring its global leadership in engineering and industrial exports. The UK (1.81), USA (1.51), and China (1.47) also demonstrate high levels of complexity, driven by diversified and technologically advanced export structures. France (1.26) and Italy (1.40) maintain moderate economic complexity, benefiting from strong industrial sectors and globally competitive luxury goods industries. In contrast, Canada (0.29) and India (0.45) exhibit lower complexity, indicative of a greater reliance on natural resource exports and less diversified production capabilities. Brazil, with an ECI of -0.16, ranks lowest among the top ten economies, highlighting its dependence on commodity exports and limited industrial diversification. These disparities in economic complexity have significant implications for long-term growth trajectories and resilience to global economic shifts.

The ECI, developed by Hidalgo and Hausmann (2009), measures the diversity and sophistication of a country's productive capabilities by analyzing the range and complexity of its export products. Countries with higher ECI scores tend to possess more advanced knowledge systems and institutional capacities, enabling them to innovate, adapt to shifting global market dynamics, and sustain inclusive economic development. The most effective institutional capacities are (Vu, 2022; Araujo, Azevedo & Ferreira, 2025): 1) Robust research and development (R&D) infrastructure, supported by universities and public research institutions; 2) Efficient regulatory frameworks that facilitate entrepreneurship and protect intellectual property; 3) Strategic industrial policies that promote high-value sectors and incentivize technological adoption; 4) Skilled labor force development, through vocational training and higher education aligned with industry needs; 5) Public-private partnerships that foster collaboration in innovation and export promotion; 6) Strong governance and coordination mechanisms, ensuring policy coherence across ministries and agencies.

Empirical studies have demonstrated that economic complexity is strongly correlated with future GDP growth. For instance, Albeaik et al. (2017) found that a one standard deviation increase in an improved version of the index (ECI+) is associated with a 4–5% increase in annualized economic growth, even when controlling for physical capital, human capital, and institutional quality. Similarly, Yıldırım (2021) shows that productivity estimates derived from complexity metrics align closely with country-level indicators such



as GDP per capita, human capital, and governance quality, reinforcing the predictive power of ECI for long-term development trajectories. Moreover, the multidimensional approach to economic complexity - incorporating trade, research, and technological outputs - provides a more comprehensive framework for forecasting growth. According to the Observatory of Economic Complexity(2025), countries with higher ECI scores are expected to outperform their peers in terms of GDP per capita growth over the next decade, with Brazil, for example, projected to grow at an annual rate of 2.97% due to its increasing complexity.

This study adopts a comparative approach to examine Brazil's economic trajectory, positioning it relative to major global powers and leading economies within the Global South. Using the framework of economic complexity, it identifies key gaps and opportunities in Brazil's development strategy, with implications for its future role in the global economic order.

Economic complexity offers a valuable lens for assessing a country's developmental potential, capturing both its current production structure and the underlying capabilities needed for diversification and innovation. As Hausmann et al. (2014) note, "*economic complexity reflects the amount of productive knowledge in a society*" while Mealy et al. (2019) find that increases in complexity are strongly associated with future income growth. The central aim of this study is to provide empirical evidence that can support low-ECI countries in formulating targeted industrial policies. By highlighting the link between productive capabilities and long-term growth, the research underlines the importance of strategic investment in education, infrastructure, and innovation systems to foster structural transformation and inclusive development.

Literature Review

The influential contribution of Hidalgo and Hausmann (2009) introduced a novel analytical framework for assessing national economic development through the composition of export baskets. Rather than evaluating exports solely by volume, their approach emphasizes the diversity and sophistication of exported products, encapsulated in the ECI. This index quantifies the embedded productive knowledge within an economy, offering a robust metric for what development economists have traditionally recognized qualitatively: sustainable economic growth necessitates the accumulation of layered productive capabilities and institutional competencies (Felipe et al., 2012).

Central to this framework is the "product space" concept (Hidalgo et al., 2007), which represents a global network where complex products occupy densely connected core positions, while simpler goods remain in sparsely connected peripheral areas. This structural configuration reflects path dependence in industrial upgrading: countries find it easier to move into products that are closely related to their existing capabilities. The ECI aggregates the complexity of a country's export portfolio, and nations with higher scores are better positioned to diversify into more sophisticated products, creating a self-reinforcing cycle of development. (Hidalgo & Hausmann, 2009). This dynamic underscore the strategic importance of fostering complexity in national production systems, as it



facilitates entry into the dense core of the product space and promotes long-term economic resilience and growth.

Brazil serves as a salient example of the constraints imposed by capability traps within the framework of the product space. Empirical evidence suggests that economic complexity exerts a significant positive influence on micro-regional economic growth (Morais et al., 2021; Teixeira et al., 2022; Mewes & Broekel, 2022). Brazil's Economic Complexity Index (ECI) has shown no significant progress between 1995 and 2020, accompanied by a relative decline in its global ranking. This stagnation and relative setback in complexity evolution reflect the structural obstacles Brazil faces in industrial upgrading and technological deepening. Andreoni & Tregenna (2020) further argue that Brazil has experienced premature deindustrialization and has failed to achieve sustained technological upgrading through effective industrial policy, making it a typical case of being caught in a "middle-income technology trap." Closer examination reveals that the manifestation of Brazil's complexity trap is not uniform across its territory. Recent studies indicate that increases in economic complexity do not uniformly translate into regional economic growth, thereby exposing limitations in the applicability of complexity theory at the sub-national level (Cardoso et al., 2024; Morais et al., 2021). These findings underscore the need for a more nuanced understanding of how productive capabilities are distributed and mobilized within a country, particularly in large, diverse economies such as Brazil. They also highlight the importance of incorporating spatial and sectoral heterogeneity into analyses of economic complexity, as national-level metrics may obscure critical regional disparities in development potential.

This study addresses key gaps in the literature on economic complexity, particularly in the context of Brazil. While the relevance of economic complexity for national development and industrial upgrading is well established, three critical gaps remain.

First, there is a methodological comparative gap. Much of the foundational work on economic complexity - such as the ECI and product space framework - has been applied primarily to industrialized or export-oriented Asian economies. As a result, large, resource-rich emerging economies like Brazil remain underexplored in comparative analyses.

Second, a spatial and regional heterogeneity gap persists. Although Brazil is often cited as a case of the middle-income trap, existing studies rarely account for internal disparities across its diverse regions. National-level metrics may obscure significant sub-national variations in industrial structure, institutional capacity, and innovation ecosystems.

Third, a data gap is manifest. Much of the literature relies on datasets predating 2014, which may not reflect Brazil's current economic structure or recent shifts in trade, technology, and regional development policy. Updated empirical analysis is needed to capture these changes and assess their implications for economic complexity.

This study focuses on addressing the first and third gaps by offering a comparative analysis of Brazil's economic complexity and incorporating more recent data to better understand its evolving industrial capabilities.



Methodology

This study adopts a mixed-method design to examine the dynamic complexity of the Brazilian economy through a two-stage analytical integration. The first stage employs a quantitative approach to map macro-level trends, while the second stage incorporates qualitative analysis to contextualize and explain these patterns.

The initial quantitative phase analyzes Brazil's ECI rankings, trade volumes, and structural indicators alongside major global powers and selected Global South economies for the period 2018–2023. This stage systematically identifies Brazil's relative position and trade performance trajectories. However, quantitative data alone cannot uncover the underlying mechanisms driving these trends. Therefore, specific findings - such as episodes of declining complexity, increased reliance on primary commodities, or export performance gaps relative to comparator economies - inform the second, qualitative stage. These findings shape guiding questions for the collection and interpretation of academic literature, historical accounts, and Brazilian policy documents. This approach enables the qualitative analysis to explain how observed trends emerged and to explore associated policy frameworks, structural constraints, and historical pathways.

By integrating macro-level statistical evidence with in-depth contextual interpretation, the study seeks to provide a comprehensive understanding that transcends the limitations of single-method approaches. This dual strategy ensures that conclusions are both empirically grounded and enriched by historical and policy insights, offering a nuanced explanation of the factors behind Brazil's declining economic complexity.

Furthermore, comparative analysis is consistently employed throughout. Given Brazil's aspirations for greater influence in the global economic system, its trajectory is most meaningful when assessed relative to major powers and other Global South economies. Comparative inquiry also facilitates the identification of lessons from countries that have successfully diversified their economic structures. While each nation exhibits unique characteristics, examining their strategies and outcomes provides a valuable framework for understanding the challenges and opportunities inherent in Brazil's pursuit of a more sophisticated and diversified economic model.

Brazil and the Global Economies

Despite its status as one of the world's ten largest economies by nominal GDP (IMF, 2025), - behind Canada and ahead of Russia Federation - Brazil has experienced the steepest ECI drop among its peer nations over the past three decades, revealing a paradox of high gross domestic product coexisting with low productive sophistication. This trend reflects Brazil's overreliance on commodity exports and its limited capacity to internalize and build upon high-complexity imports. The stagnation and subsequent decline in export sophistication signal a weakening of the country's underlying productive capabilities.

Figure 1 presents a comparative analysis of Brazil and ten major global economies - namely, the USA, China, Germany, Japan, India, the UK, France, Italy, Canada, and

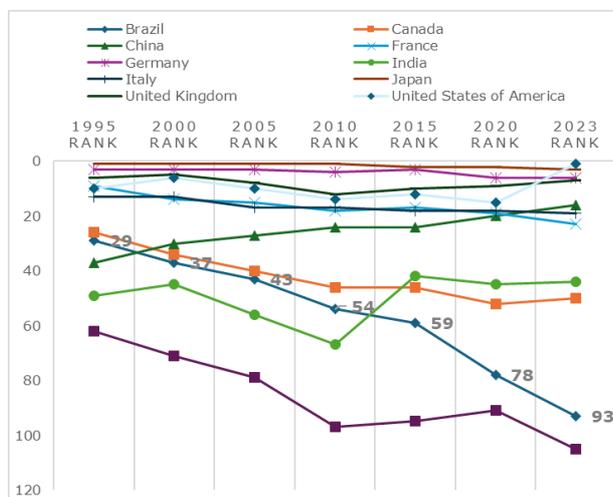


Australia - in terms of their ECI between 1995 and 2023. The figure illustrates Brazil's relative position in product complexity rankings over time, highlighting its persistent underperformance within this group. Since 1995, Brazil has consistently ranked third from the bottom among these economies, initially occupying the 29th position globally. Between 1995 and 2000, it was overtaken by China, and between 2010 and 2015, by India - both countries that have significantly improved their economic complexity through targeted industrial and innovation policies. The decline in Brazil's relative complexity became more pronounced from 2015 to 2023, with the gap between Brazil and its peers widening substantially. Notably, Brazil has remained only marginally ahead of Australia, a country traditionally characterized by its agricultural export base and relatively low complexity. However, the gap between the two has steadily narrowed, underscoring Brazil's stagnation in productive knowledge accumulation.

Brazil's deterioration in ECI rankings can be largely attributed to its overreliance on primary commodities, which imposes structural constraints on the development of more sophisticated productive capabilities. As shown in Table 1, Brazil's export profile remains heavily concentrated in low-complexity goods. Energy minerals, including crude petroleum, are primarily exported to the US, India, and China. Soybeans - Brazil's largest export by volume - are predominantly shipped to China, while metallic ores are traded with China, Japan, France, and Germany.

These commodities are consistently classified among the bottom five products in terms of complexity (Hausmann et al., 2014), as they require a relatively narrow base of productive knowledge and involve limited inter-sectoral linkages. This export structure reflects a limited diversification of Brazil's industrial capabilities and contributes to its stagnation in economic complexity. The dominance of low-complexity exports not only constrains innovation and value-added production but also limits Brazil's ability to transition toward a more knowledge-intensive and resilient economic model.

Figure 1. Comparison Between Brazil and the Major Global Economies (ECI)



Source: Authors, based on Harvard Kennedy School, atlas of Economic Complexity Rankings.



We also notice Brazil has formed a three-level industrial chain externalization through exports of soybeans (raw materials), soybean oil (edible oil), and soybean meal (feed protein). Among them, soybeans dominate trade with China, while soybean meal enjoys a competitive edge in the European market. These three products are in the high proximity area within the product space and a typical case of path-dependent upgrade. However, this industrial chain is still located in the sparse peripheral area of the product space (agricultural cluster), far away from highly complex industries. While the total export volume to these nine countries shows a fluctuating increase, this growth is overwhelmingly driven by raw materials and agricultural products that need minimal productive knowledge and little intricate interaction, makes its economic complexity difficult to evolve. In contrast to Brazil's declining export sophistication, the country's import profile is increasingly dominated by high-complexity goods from advanced economies.

Table 1. Brazil's Exports by Top Economies by GDP (2018–2023, Billions USD)

Trading Partner	Total Trade Volume						Major exported products	
	2018	2019	2020	2021	2022	2023	2018	2023
USA	29.00	29.80	21.70	31.90	36.40	35.10	Gas turbines (1.93), Semi-finished iron (2.08), Aircraft/spacecraft (2.06)	Crude petroleum (4.78), Semi-finished iron (1.68), Aircraft/spacecraft (1.67)
China	64.10	63.60	68.10	88.20	90.20	105.00	Soybeans (27.20), Iron ore (11.00), Crude petroleum (14.40)	Soybeans (38.90), crude petroleum (19.80), iron ore (19.70)
Germany	5.52	5.21	4.64	5.62	7.58	6.40	Coffee (0.75), Soybean meal (0.49), Gas turbines (0.35)	Coffee (1.07), Soybean meal (0.97), Copper Ore (0.90)
Japan	6.46	7.14	6.08	6.51	7.35	9.32	Iron ore (2.90), Poultry meat (0.71), Coffee (0.33)	Iron ore (3.31), Poultry meat (0.94), Corn (1.49)
India	4.23	2.96	3.04	4.93	6.49	4.91	Crude petroleum (1.16), Raw sugar (0.54), Soybean oil (0.54)	Soybean oil (1.30), Raw sugar (1.23), Crude Petroleum (0.67)
UK	3.12	3.14	2.66	3.20	4.02	3.68	Gold (0.76), Soybeans (0.16), hydrogen (0.16)	Gold (0.45), Soybeans (0.34), Other prepared meat (0.25)
France	2.98	2.92	2.17	2.62	3.66	3.06	Soybean meal (0.58), Iron ore (0.43), Sulfate chemical woodpulp (0.31)	Soybean meal (0.82), Crude petroleum (0.29), iron ore (0.21)
Italy	3.84	3.41	3.16	4.16	5.28	4.57	Sulfate chemical wood pulp (0.81), Coffee (0.47), Iron ore (0.37)	Sulfate chemical woodpulp (0.64), Coffee (0.70), Soybeans (0.63)
Canada	3.51	3.60	4.45	5.12	5.62	6.00	Aluminum Oxide (1.14), Gold (0.34), Raw sugar (0.31)	Aluminum Oxide (1.22), Gold (1.61), Aircraft/spacecraft (0.73)
Australia	0.51	0.50	0.53	0.60	0.80	0.81	Large construction vehicles (0.09), Coffee (0.05), Fruit juice (0.03)	Large construction vehicles (0.17), Coffee (0.10), Sulfate chemical woodpulp (0.06)

Source: Compiled by the authors based on data from OEC World Trade Database (OEC World, 2025).

Table 2 illustrates that the USA exports value-added industrial products to Brazil, while China has significantly increased its exports of semiconductors. The share of automotive components from Germany, Japan, and Italy has remained stable, and pharmaceuticals



constitute major exports from Germany, India, and the UK. These products rank among the top five in terms of complexity (Hausmann et al., 2014), requiring advanced technological capabilities and specialized skills that are not closely aligned with Brazil's existing production structure.

Trading partner	Total Trade Volume						Major imported products	
	2018	2019	2020	2021	2022	2023	2018	2023
USA	33.80	36.30	28.90	41.40	51.60	39.90	Refined petroleum (7.08), Gas turbines (1.85), Coal briquettes (1.23)	Refined petroleum (4.70), Gas turbines (4.10), Coal briquettes (1.68)
China	36.50	37.90	37.40	53.80	64.20	57.80	Special purpose ships (3.36), Telephones (2.31), Broadcasting accessories (1.18)	Semiconductor devices (4.09), Telephones (3.35), Pesticides (1.61)
Germany	11.30	11.30	9.64	12.40	13.40	13.60	Motor vehicles (0.88), Packaged medicaments (0.65), Nitrogen heterocyclic compounds (0.50)	Nitrogen heterocyclic compounds (0.73), Motor vehicles (0.73), Packaged medicaments (0.62)
Japan	4.79	4.63	4.08	5.19	5.46	5.19	Motor vehicles (0.84), Cars (0.26), Engine parts (0.17)	Motor vehicles (1.00), Papermaking machines (0.15), Engine parts (0.12)
India	3.89	4.54	4.15	6.96	9.64	7.07	Non-retail synthetic filament yarn (0.29), Pesticides (0.38), Motor vehicles (0.24)	Refined petroleum (1.19B), Pesticides (0.53), Nitrogen heterocyclic (0.47)
UK	2.72	2.72	2.40	2.69	3.20	3.34	Gas turbines (0.37), Packaged medicaments (0.16), Refined petroleum (0.14)	Gas turbines (0.41), Packaged medicaments (0.22), Cars (0.17)
France	5.45	4.43	4.09	4.46	4.78	5.41	Aircraft/spacecraft (0.57), Gas turbines (0.28), Motor vehicles (0.32)	Gas turbines (0.69), Aircraft/spacecraft (0.54), Motor vehicles (0.24)
Italy	4.78	4.59	4.13	5.46	5.52	5.76	Motor vehicles (0.33), Refined petroleum (0.31), Combustion engines (0.26)	Motor vehicles (0.40), Vaccines (0.22), Transmissions (0.15)
Canada	2.07	2.01	1.76	2.29	3.37	3.31	Potassic fertilizers (0.81), Coal briquettes (0.17), Gas turbines (0.09)	Potassic fertilizers(1.95), Aircraft/spacecraft(0.14) gas turbines(0.13)
Australia	1.13	0.98	0.58	1.21	2.81	2.00	Coal Briquettes (0.85), Raw aluminum (0.05), Pesticides (0.02)	Coal Briquettes (1.52), Coke (0.22), Therapeutic appliances (0.03)

Source: Compiled by the authors based on data from OEC World Trade Database (OEC World, 2025).

Applying the product space framework (Hidalgo et al., 2007) to Brazil's trade data reveals a structural disconnect: Brazil's agricultural and mineral exports occupy peripheral positions in the global product network, far removed from the central nodes represented by high-complexity imports such as semiconductors. This spatial and technological distance results in a mismatch of skills, fragmentation of supply chains, and divergence in innovation trajectories. Consequently, Brazil struggles to absorb and integrate external



technologies into its domestic economy. If this pattern persists, Brazil risks long-term disadvantages - paying premium prices for essential high-tech goods while exporting low-value commodities and thereby limiting its prospects for income growth and sustained economic prosperity.

Brazil and the Global South

Despite being the Global South's third-largest economy, Brazil exemplifies the complexity trap facing middle-income countries, with its ECI ranking plummeting from regional leader to bottom position over three decades. While Global South markets provide important export destinations and revenues, Brazil remains trapped in its low complexity export yet high complexity import pattern. The country has not leveraged these partnerships to climb the complexity ladder yet, but there are emerging opportunities for industrial diversification and economic complexity upgrading.

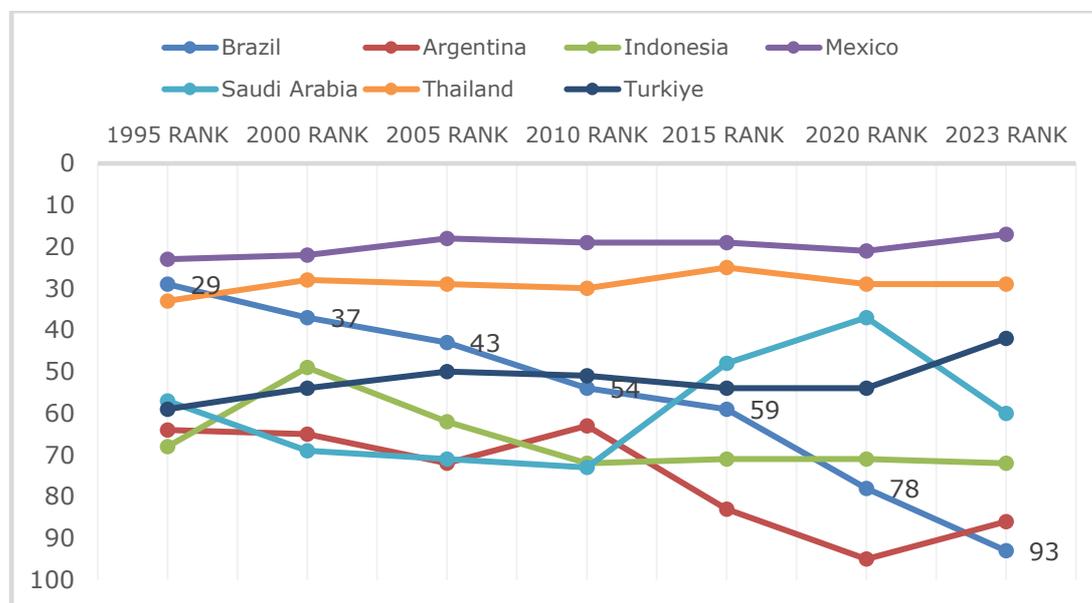
Figure 2 illustrates Brazil's relative position in terms of product complexity rankings compared to six major countries in Global South. This section narrows its focus to the comparison with Argentina, Indonesia, Mexico, Saudi Arabia, Thailand and Turkiye, excluding China and India due to listed data in section 3. Although Brazil was ranked second among the countries of the global south in 1995 (below Mexico), it was surpassed by rising Thailand during the period from 1995 to 2000. Subsequently, the decline in its ECI continued to accelerate, and it was overtaken by Turkey after five years. The gap then widened even further. From 2015 to 2023, the dropping was even more significant, and it was successively surpassed by the fluctuating Indonesia and Argentina. At this point, its economic complexity ranked 93rd, being the last position among these countries. The continuous decline in the ECI ranking indicates that Brazil has not only failed to acquire new capabilities, but may also be losing its existing manufacturing capabilities.

Looking closer to its trade profile, the trade pattern of the Global South strengthens Brazil's export structure instead of diversifying it. Still, Brazil's exports remain heavily concentrated in low-complexity products. Table 3 shows raw materials account for a significant proportion in Brazil's export: raw sugar, raw cotton, iron ore, poultry meat and soybeans emerged as key export commodities. Namely, soybeans appear in 5 out of 6 export destination countries. These products were also previously exported by Brazil to the global economies. Rather than using Global South partnerships to diversify into higher-complexity manufacturing, Brazil has simply replicated its commodity export model across different markets, making limited progress in addressing the ECI decline.

Beyond trade patterns, the productive capacity hierarchy of Brazil exhibits systematic deficiencies that explain its complexity decline. While the country possesses strong natural endowments and basic extraction capabilities, its primary processing remains incomplete, and intermediate manufacturing capabilities suffers from severe deficiencies - particularly in automotive, machinery, electronics, and chemical production. This creates a "missing middle" in Brazil's capability structure. However, isolated successes like aircraft production represents a "leap away" from existing product clusters in Brazil, but without the support of sequential capability building, may not be sustainable.



Figure 2 – Comparison Between Brazil and Selected Countries of Global South (ECI)



Source: Data adapted from Harvard Kennedy School, atlas of Economic Complexity Rankings

Table 3 - Brazil's Exports by Countries in Global South by GDP (2018–2023, Billions USD)

Trading Partner	Total Trade Volume						Major imported products (typical annual value range)	
	2018	2019	2020	2021	2022	2023	2018	2023
Argentina	14.9	9.81	8.51	11.9	15.3	16.8	Cars (3.84), Motor vehicles; Parts & accessories (1.03), Delivery trucks (1.09)	Soybeans (2.04B), Motor vehicles; Parts & accessories (1.70), Cars(1.40)
Indonesia	1.65	2.10	2.49	2.13	3.20	4.33	Soybean meal (0.66), Raw tobacco (0.13), Raw cotton (0.26)	Soybean meal (0.53), Raw sugar (0.82), Iron ore (0.21)
Mexico	4.50	4.90	3.83	5.67	7.11	8.59	Delivery trucks(0.26), Spark-ignition engines (0.35), Poultry meat (0.20)	Cars(1.1), Soybeans(0.82), Poultry meat(0.43)
Saudi Arabia	2.10	2.03	1.89	2.74	3.98	4.42	Poultry meat (0.81), Raw sugar (0.43), Soybeans (0.12)	Raw sugar(1.76), Poultry Meat(0.85), Corn(0.36)
Turkiye	2.66	2.46	3.13	3.51	3.8	3.52	Soybeans (0.52), Bovine (0.39), Semi-finished iron (0.29)	Soybeans(0.97), Iron ore(0.42), Bovine(0.30)
Thailand	1.96	1.79	2.08	2.8	3.61	3.93	Soybeans (0.47), Soybean meal (0.90), Motor vehicles; Parts & accessories (0.05)	Soybean meal(1.56), Soybeans(1.40), Crude petroleum(0.50)

Source: Compiled by the authors based on data from OEC World Trade Database (OEC World, 2025).



Brazil's import patterns from Global South countries reveal both structural vulnerabilities and emerging industrial integration opportunities. The composition of these imports confirms Brazil's continued dependence on higher-complexity manufactured goods, even within South-South trade relationships. Table 4 shows that Brazil imports manufactured goods from all listed countries except Saudi Arabia, which primarily supplies energy products. The country imports motor vehicles and parts from Mexico, Turkey, and Thailand, computers from Mexico, and delivery trucks from Argentina. Brazil is importing finished products rather than intermediate goods such as garments, textiles and food processing that could be further processed domestically then re-exported. This approach would create value-added production chains that connected to many product categories. By failing to do so, Brazil misses opportunities for using specific capabilities relevant within communities and therefore industrial upgrading through South-South cooperation.

Looking at the positive aspects: Firstly, Brazil maintains a positive trade balance with most Global South partners, with total import volumes consistently lower than export volumes; Secondly, Argentina stands out as Brazil's most significant Global South trading partner, representing a complexity-enhancing bilateral relationship that demonstrates Brazil's untapped upgrading potential. With Brazilian exports growing from \$14.9 billion in 2018 to \$16.8 billion in 2023, and imports of \$11.9 billion in 2023, this partnership achieves the near-balanced trade flows that complexity theory associates with successful industrial integration. Most significantly, Argentina absorbs \$1.28-3.84 billion annually in Brazilian automotive products alone - proving that Brazil possesses manufacturing capabilities sophisticated enough to compete in regional markets when proper industrial complementarity exists.

Brazil's automotive trade with Argentina and Mexico illustrates successful intra-industry specialization, which contributes to economic complexity and growth. Brazil exports cars, motor vehicles, and parts to both countries, while importing delivery trucks, cars, and accessories. These exchanges involve differentiated yet functionally related products, allowing each country to specialize in distinct segments of the industry. The growing export volume from Brazil to Argentina and Mexico reflects the benefits of deepening industrial specialization.

Trading partner	Total Trade Volume						Major imported products	
	2018	2019	2020	2021	2022	2023	2018	2023
Argentina	11.30	10.50	7.71	11.60	12.90	11.90	Delivery trucks (2.50), Cars (1.87), Wheat (1.31)	Delivery trucks (2.48), Cars (2.24), Wheat (0.82)
Indonesia	1.39	1.35	1.19	1.79	1.96	1.54	Coconut oil (0.18), Rubber (0.16), Motor vehicles; parts & accessories (0.13)	Coconut (0.22), Palm oil (0.13), Telephones (0.11)
Mexico	5.45	5.26	4.00	4.71	5.53	5.74	Motor vehicles; Parts & accessories (0.73), Cars (1.09), Computers (0.16)	Motor vehicles; Parts & accessories (0.73), Cars (0.70), Delivery trucks (0.34)



Table 4 - Brazil's Imports by Countries in Global South by GDP (2018–2023, Billions USD)

Trading partner	Total Trade Volume						Major imported products	
	2018	2019	2020	2021	2022	2023	2018	2023
Saudi Arabia	2.39	2.40	1.63	3.22	5.49	3.70	Crude petroleum (1.68), Mixed mineral or chemical fertilizers (0.30), Propylene polymers (0.14)	Crude petroleum (3.26), Mixed mineral or chemical fertilizers (0.52), Refined petroleum (0.60)
Turkiye	0.63	0.69	0.73	1.25	1.24	1.00	Motor vehicles; Parts & accessories (0.05), Raw iron bars (0.03), Carbonates (0.05)	Carbonates (0.10), Motor vehicles; Parts & accessories (0.05), Synthetic rubber (0.05)
Thailand	1.76	1.72	1.51	2.25	2.37	2.05	Motor vehicles; Parts & accessories (0.25), Rubber (0.20), Engine parts (0.10)	Motor vehicles; Parts & accessories (0.30), Rubber (0.09), Engine parts (0.09)

Source: Compiled by the authors based on data from OEC World Trade Database (OEC World, 2025).

Analysis and Discussion

The fact that Brazil ranks among the world's ten largest economies stands in stark contrast to its declining performance in the ECI. Over the past three decades, Brazil's pronounced loss of ground in the ECI rankings among major economies highlights a critical divergence: its high GDP coexists with a level of productive sophistication that has failed to advance relative to global competitors. This downward trend reflects deep-rooted structural weaknesses in Brazil's industrial base and a persistent reliance on import-intensive, low-complexity exports.

Figure 1 illustrates Brazil's position relative to ten other large economies - namely, the USA, China, Germany, Japan, India, the UK, France, Italy, Canada, and Australia - since 1995. Brazil has consistently ranked near the bottom of this group. Despite maintaining a trade surplus with China since 2019, which reached US\$12 billion in 2024 and accounted for 41% of Brazil's total trade surplus (BCB, 2025), Brazil was overtaken by China between 1995 and 2000, and later by India between 2010 and 2015. From 2015 to 2023, Brazil's complexity gap widened further, approaching that of Australia - a country similarly characterized by a commodity-dependent export structure (Mesquita, Merlo, & Gremaud, 2021). This trajectory underlines the urgent need to address Brazil's limitations in productive knowledge accumulation and industrial upgrading. Without strategic interventions to diversify its export base and strengthen innovation ecosystems, Brazil risks remaining trapped in a cycle of low complexity and constrained development.

Table 1 indicates that Brazil's export report remains dominated by primary commodities. Crude petroleum is exported mainly to the USA, India, and China, while soybeans - Brazil's top export product - rose from \$27.2 billion in 2018 to \$38.9 billion in 2023, mainly to China. Metallic ores are exported to China, Japan, France, and Germany. These products are the simplest, with minimal productive information and minimal technological contact (Hausmann et al., 2014). Brazil's three-step soybean value chain for exports -



raw soybeans, soybean oil, and soybean meal - is an example of path-dependent upgrading, with incremental innovation in a narrow technological niche (Araujo & Lima, 2006). Although soybean meal has gained competitiveness in the EU market, such a chain remains embedded in the agriculture cluster of the product space outside central nodes pertaining to high-complexity industries (Hidalgo et al., 2007). Overall export volume growth is driven by low-complexity products, which limits Brazil's evolution toward increasingly complex production.

On the other hand, the import composition of Brazil is increasingly comprised of high-income economies' high-complexity goods. Aircraft and gas turbines are exported by the USA, semiconductors by China, and motor vehicles' parts by Germany, Japan, and Italy with regular shipments. Germany, India, and the UK also have prominent pharmaceuticals. These are part of the top five highest in complexity (Hausmann et al., 2014), requiring high-tech capabilities and special skills.

Despite being the third-largest economy in the Global South, Brazil has experienced a pronounced decline in its ECI, falling from a regional leader to the lowest-ranked among key Global South economies over the past three decades. In 1995, Brazil trailed only Mexico in ECI, but was subsequently surpassed by Thailand by 2000, Turkiye by 2005, and more recently by Indonesia and Argentina between 2015 and 2023. By 2023, Brazil ranked 93rd globally, a position that reflects not only stagnation but also a potential deterioration of existing productive capabilities (Britto, Romero, Freitas, & Coelho, 2015). As illustrated in Figure 2, this trajectory underscores Brazil's failure to capitalize on South-South cooperation as a mechanism for industrial upgrading. Table 3 further demonstrates that Brazil's export structure remains heavily concentrated in low-complexity products - such as soybeans, iron ore, poultry meat, raw sugar, and cotton. The fact that soybeans appear as a major export to five of the six key Global South partners exemplifies the replication of Brazil's traditional commodity-based model, rather than a strategic shift toward higher-complexity manufacturing (World Bank, 2015).

Brazil's import patterns from Global South countries also reveal structural weaknesses. Although Brazil maintains a trade surplus with most of its regional partners (Table 4), it continues to import high-complexity finished goods - including motor vehicles, computers, and delivery trucks - from Mexico, Turkiye, Thailand, and Argentina. Saudi Arabia, by contrast, primarily exports energy commodities. Notably, Brazil's import basket lacks intermediate goods such as textiles and processed foods, which could otherwise support domestic value-added production and re-exporting. This absence suggests limited integration into regional value chains and reflects Brazil's underdeveloped productive linkages. As Moreira (2022) argues, Brazil's industrial structure lacks the coordination and capability-building mechanisms necessary for deeper insertion into global value chains.

Brazil's bilateral trade with Argentina stands out as a complexity-enhancing relationship. Between 2018 and 2023, Brazilian exports to Argentina increased from \$14.9 billion to \$16.8 billion, while imports reached \$11.9 billion (Table 4). Argentina absorbs \$1.28-\$3.84 billion annually in Brazilian automotive products, demonstrating Brazil's capacity to compete in regional manufacturing when industrial complementarity is present.



Crucially, Argentina has recently surpassed Brazil in ECI rankings, underscoring the urgency for Brazil to revise its industrial policy (Sert, 2017). Brazil's automotive trade with Argentina and Mexico exemplifies successful intra-industry specialization: Brazil exports cars and motor vehicle components while importing differentiated products such as delivery trucks and high-value parts. This division of labor enables each country to specialize in distinct segments of the automotive sector, achieving economies of scale and fostering innovation. As Fullerton, Sawyer, and Sprinkle (2011) note, intra-industry trade yields greater benefits than inter-industry trade by stimulating innovation and exploiting scale efficiencies. Despite isolated successes such as aircraft production, Brazil's broader productive structure suffers from a "missing middle." While the country demonstrates strength in natural resource extraction and basic processing, it lacks robust intermediate manufacturing capabilities in sectors such as electronics, chemicals, and machinery. Without sustained capability development, these successes remain exceptions rather than indicators of systemic transformation (Hamaguchi, 2020). There are three leading reasons to be considered and one additional aspect:

Firstly, Brazil's steady fall in the ECI is directly related to its own long-standing process of deindustrialization. Since the 1980s, Brazil has suffered from what scholars have described as "premature deindustrialization," where the manufacturing sector falls behind before the economy has achieved high-income status. The experience has been worsened by structural issues such as low productivity growth, fragile innovation systems, and Dutch disease effects, most importantly caused by the real overvaluation during commodity booms (Bresser-Pereira, 2018). Disorganization of Brazil's manufacturing structure has limited it from diversifying its exports to more advanced, knowledge-based industries, which directly affected its ECI performance (Kupfer, Ferraz & Marques, 1995; Cano, 2011).

A critical factor in this trajectory has been the absence of a consistent and strategic industrial policy. Brazil's shift toward market liberalization in the late 20th century, particularly during the 1990s, marked a turning point in its development model. During this period, many state-led industrial initiatives were dismantled, and no coherent strategy was put in place to foster technological upgrading or strengthen domestic production chains. This policy vacuum contributed to the erosion of productive capabilities, limiting the country's ability to move into more complex and knowledge-intensive sectors - a key requirement for improving its position in the Economic Complexity Index (Stemmler, 2019).

Compounding this institutional void, trade liberalization and financial openness introduced additional structural challenges. The neoliberal reforms of the 1980s and 1990s prioritized openness over strategic development, weakening Brazil's industrial structure. Iasco-Pereira and Morceiro (2024) show that these reforms led to a decline in total factor productivity and manufacturing labor productivity, as liberalization was not accompanied by policies to support domestic industry. Their empirical analysis reveals that Brazil's industrial sector lost its capacity to generate structural change, with the country increasingly specializing in low-complexity activities. The lack of coordination between liberalization and industrial development resulted in a national-level



deindustrialization, constraining Brazil's ability to sustain diversified and technologically advanced economic activities - and ultimately, to climb the Economic Complexity Index.

In response to this scenario, recent efforts such as the Nova Indústria Brasil [The New Industry of Brazil] policy represent a strategic attempt to reverse premature deindustrialization and reinsert Brazil into more complex global value chains. The policy, launched in 2024, emphasizes innovation, sustainability, and technological upgrading, with BRL 300 billion allocated to support industrial transformation until 2026. It aims to stimulate sectors with high value-added potential, such as health technologies, electromobility, and digital infrastructure, while also promoting local content and green industrialization. However, as Belloc (2014) cautions, the effectiveness of such policies depends on the design of subsidy mechanisms and the ability to foster productivity-enhancing firm entry. Without a firm commitment to rebuilding domestic industry and aligning incentives with long-term development goals, Brazil risks establishing itself as a commodity-dependent economy, deepening its structural vulnerabilities and limiting its capacity to climb the economic complexity ladder.

Secondly, the privatization wave that commenced in the late 1980s and escalated in the 1990s under Collor and Cardoso governments was a revolutionary shift in the economic trend of Brazil. Privatization was originally being justified on the basis of the reduction of the external debt and efficiency, but it was exposed to disassembling major state-owned enterprises (SOEs) without an appropriate industrial policy to cultivate national champions (Silva, 2019). This was done in the 2000s and gained a new life in the 2010s and 2020s, particularly under the financially tight agendas. This resulted in the industrial climate of Brazil, especially in sectors like energy, telecommunications, and infrastructure, which are all columns of economic complexity (Fagundes & Caciatori, 2020). The absence of a well-coordinated industrial strategy at the time of, and after, privatization further entrenched the country's vulnerability to foreign shocks as well as technological dependence.

Contrary to the expectations of traditional privatization advocates, the reforms failed to generate the anticipated industrial dynamism. Rocha and Ruiz (2008) show that Brazilian industries remained heavily reliant on production-intensive knowledge and lacked integration with scientific and technological institutions, which are essential for innovation. The privatized sectors did not reinvest sufficiently in R&D or technological upgrading, and innovation was often limited to meeting regulatory standards rather than pursuing breakthroughs. Guimarães (2004) further argues that Brazil's state lacked the institutional capacity and strategic coherence to replicate the success of developmental states like Japan and Korea, which used privatization selectively and always within a broader industrial policy framework. In Brazil, the absence of such coordination led to fragmented innovation ecosystems and technological dependence on foreign actors. Nolan (2018) adds that privatization, when not aligned with social and economic rights frameworks, can erode the state's ability to fulfill long-term development goals. Moreover, the lack of mechanisms to ensure that privatization proceeds were reinvested into productive sectors further entrenched Brazil's vulnerability to foreign shocks and reinforced its specialization in low-complexity exports. A telling example is Petrobras, which, despite remaining partially state-owned, saw its strategic role diluted during



liberalization, limiting its capacity to act as a sovereign agent of industrial transformation and innovation (Zanotelli & Ferreira, 2021). These dynamics collectively undermined Brazil's ability to build the productive capabilities necessary for climbing the Economic Complexity Index.

Finally, Brazil's declining performance in the ECI can be attributed to a combination of structural and institutional factors. The country's export structure remains heavily concentrated in primary commodities such as soybeans, crude petroleum, and iron ore. These products rank among the lowest in complexity because they require limited productive knowledge and minimal inter-sectoral linkages (Hausmann et al., 2014). This overreliance on low-complexity exports restricts the development of more sophisticated industries and limits opportunities for technological spillovers and innovation-driven growth (Cardoso et al., 2024). Furthermore, Brazil has struggled to diversify its industrial base beyond traditional sectors. Unlike countries that have successfully transitioned into high-tech manufacturing or knowledge-intensive services, Brazil's industrial upgrading has been slow and uneven. This stagnation is partly due to weak innovation ecosystems, limited investment in research and development (R&D), and insufficient integration into global value chains (Mazzucato, 2023; Suzigan et al., 2020). In addition, there is significant regional heterogeneity in economic complexity across Brazil. While some states - such as São Paulo - possess relatively advanced industrial structures, others remain dependent on agriculture and extractive industries. National-level ECI metrics often mask these disparities, yet they contribute to the overall stagnation in complexity when aggregated (Cardoso et al., 2024; Bandeira Morais, Swart, & Jordaan, 2021). Additionally, Brazil's economic complexity is further hindered by institutional and policy constraints. These include inconsistent industrial policy, bureaucratic inefficiencies, and limited support for innovation and entrepreneurship. Such barriers reduce the country's ability to accumulate productive knowledge and transition into more complex sectors (Suzigan et al., 2020; Baer, 2020).

Brazil's industrial landscape, though marked by structural challenges, includes several niche sectors that have achieved notable global competitiveness through sustained innovation and strategic policy support. The aeronautical industry, led by Embraer, exemplifies this trajectory. Emerging from mid-20th-century state-led initiatives and bolstered by institutions like ITA and CTA, Embraer has positioned Brazil as the third-largest commercial aircraft manufacturer globally, integrating advanced engineering, global partnerships, and a robust innovation ecosystem (Fonseca, 2010). In the electrical machinery and automation sector, WEG S.A. stands out as a globally competitive firm, with operations in over 135 countries and a strong focus on R&D, energy efficiency, and industrial automation. Its ability to innovate and scale production has made it a key player in the global market for electric motors and industrial solutions (Ministério de Minas e Energia, n.d.). Additionally, EMBRAPA (Brazilian Agricultural Research Corporation) has played a transformative role in agricultural innovation, particularly in tropical agriculture. Through cutting-edge research in biotechnology, precision agriculture, and sustainable practices, EMBRAPA has significantly increased productivity and enabled Brazil to become a global leader in agribusiness. Its international partnerships and technology transfer initiatives further underscore its role as a driver of



economic complexity and global competitiveness (IPEA, 2022). These cases illustrate that Brazil possesses the institutional and technological foundations necessary for broader industrial upgrading. By leveraging these successful models, the country can foster innovation-driven growth across other strategic sectors of its economy.

In addition to these three reasons, stands the recent (2026) MERCOSUR–EU partnership is expected to raise Brazil–EU trade by BRL 94.2 billion and add roughly BRL 37 billion to GDP by 2044, while fostering regulatory cooperation and integration into European value chains (Agência Brasil, 2024; Ministério das Relações Exteriores, 2024). Translating these gains into durable upgrading requires progress in human capital (skilled labor). Brazil's 2022 PISA scores - 379 (mathematics), 410 (reading), and 403 (science) - remain below OECD averages, with fewer than half of students reaching baseline proficiency in maths and science (Agência Brasil, 2023; Statista, 2025). These skill gaps constrain the diffusion of tacit, production-specific knowledge that supports diversification into higher value activities - knowledge captured by the ECI (Teixeira, Missio, & Dathein, 2022). Empirical evidence from Brazil indicates that higher levels of economic complexity are positively correlated with sustained growth and structural transformation at subnational scales, particularly when industrial policies promote strategic diversification toward technologically proximate and more sophisticated sectors (Romero et al., 2022; Teixeira, Missio, & Dathein, 2022). Nevertheless, human capital remains a decisive enabling factor for this transformation, as the accumulation of tacit knowledge and advanced skills is essential for upgrading production capabilities and sustaining complexity-driven development.

Accordingly, the MERCOSUR–EU framework should be coupled with targeted education and training reforms - STEM curriculum strengthening, teacher professional development, and vocational pathways aligned with EU standards - to build the capabilities needed for complex manufacturing and services (Agência Brasil, 2023; Ministério das Relações Exteriores, 2024). By linking market access to human capital upgrading, Brazil can move into products closer to the core of the product space, raise its ECI, and convert trade liberalization into sustained competitiveness and inclusive growth (Romero et al., 2022; Teixeira et al., 2022).

Conclusion

This study set out to examine how Brazil's economic complexity has evolved in relation to major global powers and leading economies within the Global South, and to assess Brazil's relative position in the global economic. The findings reveal a concerning trajectory: despite rising trade volumes, Brazil has experienced a steady decline in economic complexity, losing competitive ground both globally and regionally.

Although Brazil remains a major exporter, its trade profile has become increasingly concentrated in low value-added goods, underscoring limited progress in integrating productive knowledge into its industrial base. Structural and institutional barriers - such as fragmented innovation ecosystems, inadequate logistics infrastructure, and inconsistent industrial policies - have constrained the transformative potential of trade



expansion. Consequently, Brazil has faced challenges in sustaining its leadership role within the Global South and in ascending global value chains. However, it is necessary to point out that this analysis has some limitations. This study mainly relies on the ECI, which is a single measurement criterion. Although it is powerful, it cannot fully cover the various determinants of trade patterns. Factors such as bilateral agreements, geopolitical relations, logistics frameworks, and specific national demand structures - all of which are key elements shaping a country's trade content and trading partners - are beyond the scope of ECI's research. Moreover, although the comparison method has explanatory value, it cannot encompass all the differences in scale, history, and resource endowments of the studied economies. These limitations indicate that although the ECI effectively diagnoses the trend of declining trade complexity, it is still necessary to combine more in-depth and context-specific analyses to provide targeted policy recommendations.

Nevertheless, despite these enduring constraints, the country continues to host several domestically developed niche industries that are both globally competitive and technologically advanced. The success of Brazil's globally competitive and technologically advanced niche sectors demonstrates the country's latent capacity for broader industrial transformation. These sectors - such as aerospace, electrical machinery, and agricultural innovation - not only exemplify the potential of targeted industrial policy and institutional coordination but also serve as catalysts for upgrading other segments of the economy. Their technological spillovers, supply chain linkages, and innovation ecosystems can foster productivity gains and knowledge diffusion across less developed industries, promoting a more diversified and resilient industrial base. By leveraging these strategic sectors as models and anchors, Brazil can accelerate its structural transformation, enhance its position in global value chains, and climb the ECI. This approach aligns with recent calls for a renewed industrial strategy that integrates long-term innovation and sustainability goals, aiming to reverse premature deindustrialization and restore the country's capacity for robust, inclusive growth (Feijó, 2025).

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