



COMPETITIVENESS OF BRAZILIAN STATES' AGRO-INDUSTRIAL EXPORTS TO CHINA

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Abstract: This study analyzed the competitive performance of state-level agro-industrial exports to China. To this end, an export performance matrix was employed, constructed using indices of revealed comparative advantage and the relative position of agro-industrial products, as well as their trends over time. The results indicated efficiency among the majority of states; however, many are experiencing a decline in efficiency, a trend that warrants attention. Mato Grosso do Sul was the top-performing state, showing growing comparative advantage and net exports. A large number of states fell into the “Efficient and declining” category, indicating that while they maintained a comparative advantage on average over the years, they are currently losing that competitiveness. Rio de Janeiro was the least efficient state; it is heavily specialized in the export of extractive industry goods, which do not contribute to agro-industrial production.

Keywords: Agro-industry; International trade; Competitiveness.

COMPETITIVIDADE DAS EXPORTAÇÕES AGROINDUSTRIAIS DOS ESTADOS BRASILEIROS PARA A CHINA

Resumo: Este trabalho visa analisar o desempenho competitivo das exportações agroindustriais estaduais em relação à China. Nesse sentido, utilizou-se uma matriz de desempenho das exportações construída por meio dos índices de vantagem comparativa revelada e de posição relativa dos produtos agroindustriais, bem como de suas inclinações ao longo do tempo. Os resultados mostraram eficiência por parte da maioria dos estados. No entanto, muitos vêm perdendo eficiência, o que exige atenção. O estado de melhor desempenho foi o Mato Grosso do Sul, com vantagem comparativa e exportação líquida crescentes. Grande parte dos estados se posicionou como “Eficiente e decrescente”, indicando que apresentaram, na média dos anos, uma vantagem comparativa; contudo, vêm perdendo essa competitividade. O menos eficiente foi o Rio de Janeiro, o qual possui forte especialização na exportação de bens da indústria extrativa, que não contribui para a produção agroindustrial.

Palavras-chave: Agroindústria; Comércio internacional; Competitividade.

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1 Introduction

Agribusiness has played a central role in the Brazilian economy in recent years, primarily due to its contribution to exports and foreign currency generation. As international trade has expanded, the sector becomes a key vehicle for Brazil's integration into foreign markets, particularly through the sale of agro-industrial products. Data from the Ministry of Agriculture and Livestock (Mapa) and foreign trade statistics indicate that agribusiness exerts a strong influence on the country's trade balance performance, underscoring its strategic importance to the Brazilian economy (Mapa, 2020).

Between September 2023 and August 2024, Brazil exported US\$ 165.76 billion in agribusiness products, a 1.6% increase compared to the previous twelve months. According to Roberto Perosa, the Secretary of Trade and International Relations from Mapa, federal government incentives supported export growth and the country's prominence on the international stage. Furthermore, product quality and rigorous sanitary oversight stand out as key differentiators for the agribusiness sector (Mapa, 2024).

The strengthening of trade relations between Brazil and China played a decisive role in this process. With the expansion of trade, the Asian nation became Brazil's primary trading partner and the largest destination for its agribusiness exports. According to Nonnenberg et al. (2021), this trend was linked to structural transformations in the Chinese economy, such as sustained economic growth and rising demand for food.

Considering this, Brazil has assumed a strategic position as a supplier of agro-forestry products to the Chinese market—particularly commodities such as soybeans, meat, and pulp. This reflects Brazil's production specialization and the complementarity between the two economies, while also highlighting the high concentration of its export portfolio in products with low levels of processing (Nonnenberg et al., 2021; Leite; Rodrigues, 2024).

Although this export pattern has contributed to the growth of the agribusiness sector and the expansion of bilateral trade, it also raises concerns regarding dependence on a limited range of products and a single market. Such export concentration leaves the country more vulnerable to fluctuations in external demand, international prices, and the trade policies of its importing partner (Leite; Rodrigues, 2024).

So, this study analyzed the competitive performance of Brazilian states' agro-industrial exports to the Chinese market. We identified regional specialization patterns and assessed competitiveness using indicators commonly employed in economic literature. By adopting a subnational approach, the study contributed to an understanding of Brazil's regional integration



into agro-industrial trade with China, playing a crucial role in comprehending how the expansion of the agro-industrial system acts as a catalyst for progress and regional growth patterns.

This paper is divided into four sections, in addition to this introduction. The second section presents the literature review; the third describes the methodological procedures; the fourth analyzes and discusses the results obtained; and, finally, the conclusions are presented.

2. Literature review

2.1 Agro-industrial trade between Brazil and China

Since the 2000s, the relationship between Brazil and China has intensified significantly, with international trade serving as the primary driver of this partnership. Brazilian exports to the Chinese market are heavily concentrated in agribusiness products—accounting for approximately 80% of Brazil's total exports to China during the period analyzed—thereby highlighting the importance of the agricultural sector in the bilateral trade relationship (Nonnenberg et al., 2021).

Agricultural goods exported to China accounted for approximately 34% of Brazil's total agricultural exports, demonstrating the importance of this market for the national agribusiness sector. Economic growth and transformations within the Chinese economy have expanded the demand for imported food, particularly in light of challenges related to food security. Consequently, Brazil has established itself as a key agricultural supplier to China (Nonnenberg et al., 2021).

A study by the Brazilian Trade and Investment Promotion Agency (ApexBrasil, 2024) indicated that trade between Brazil and China reached US\$ 157.5 billion in 2023. In 2025, Brazil and China marked 50 years of diplomatic relations, an occasion that reinforced the partnership's importance as a source of foreign currency for Brazil, given that more than half of the country's trade surplus stems from commercial ties between the two nations. Furthermore, Brazilian exports to China are highly concentrated, focusing on three product groups that account for 75.1% of the total exported to the country; these consisted predominantly of commodities—specifically agricultural and extractive industry products—alongside lower-tech manufactured goods (ApexBrasil, 2024).

According to Leite and Rodrigues (2024), this pattern is linked to China's increasing share of Brazilian foreign trade and the growth of Chinese demand for primary products, which ultimately reinforced Brazil's specialization in this type of export. While this has contributed to the expansion of trade between the two countries, it also highlighted the lack of diversification in Brazil's export basket, characterized by a low share of products with higher value added.



Also according to the authors, exports relying on few products and in a single market makes the country more vulnerable to external factors. Shifts in Chinese demand, fluctuations in international prices, or changes in trade policies can affect the performance of Brazilian exports. Furthermore, the authors highlight that the growth of trade with China—driven primarily by commodities—tends to reinforce Brazil's external dependency and hinder its integration into more sophisticated segments of global value chains.

Medina, Ribeiro and Brasil (2016) demonstrated that this pattern of specialization is not explained solely by the country's natural advantages, such as climate and land availability. In the case of soybeans, the main product of Brazilian agribusiness and of great importance in exports to China, the authors pointed out that the most strategic links in the production chain, such as technology, financing, industrial processing and marketing, are generally controlled by multinational companies. This form of organization limits the country's ability to export more processed products, such as oil and meal, and reduces the share of profits that remain in the country.

Brazil's export portfolio is concentrated primarily in products such as soybeans, iron ore, oil, and meat, reflecting a presence in foreign markets characterized by limited product diversification and low value-added content. Although, the growth of exports and trade surpluses is significant for the Brazilian economy, it remains insufficient to ensure long-term development, thereby reinforcing structural challenges such as regressive specialization and low productive sophistication (Leite; Rodrigues, 2024).

Thus, foreign policy dynamics have significant effects on local productive capacity. Wesz Junior, Escher, and Fares (2021) highlighted China's move to reduce its soybean dependence on markets in which Brazil operates, as well as the growing trend of Chinese corporate internationalization. The case of the China Oil and Foodstuff Corporation (COFCO) illustrates this process. The state-owned company's strategy—based on mergers and acquisitions (M&A) involving major agribusiness firms—has consolidated its position as a sector giant and serves as an instrument of China's interest in food self-sufficiency (Wesz Junior; Escher; Fares, 2021).

Escher, Schneider, and Ye (2017) highlighted the differences between the agribusiness sectors of Brazil and China and warned of the risk of regressive specialization for the former; Brazil relies on commodities to balance its balance of payments, whereas China seeks to move up the agro-industrial value chain.

2.2 International and subnational competitiveness of agro-industrial exports



The concept of competitiveness in international trade relates to an economy's ability to sustain and expand its share of foreign markets over time. According to Porter (1990), competitiveness does not depend solely on relative costs or natural resource endowments; rather, it stems from a combination of factors such as productivity, production efficiency, infrastructure, the organization of production chains, and institutional environment. This approach broadens the traditional view, which is based exclusively on price, and provides analyses that consider structural differences in export performance, as seen in the case of Brazilian agribusiness.

In agro-industrial exports, competitiveness is linked to the ability to generate exportable surpluses and meet the requirements of foreign markets. According to Ferreira and Vieira Filho (2023), the gains in competitiveness achieved by Brazilian agribusiness in recent decades are primarily driven by increased productivity and expanded production scales, particularly in sectors such as oilseeds, meat, and forest products.

In this scenario, Brazil holds a comparative advantage in various agricultural products, whereas China faces a disadvantage in this sector and relies on food imports (Ferreira & Vieira Filho, 2023). This context underscores the importance of the Chinese market as a strategic destination for Brazilian agro-industrial exports.

However, this competitiveness does not manifest uniformly across the national territory. In a country marked by significant regional disparities, competitive performance is linked to the specific characteristics of each state, such as its production structure, logistics conditions, and institutional environment. This state-level approach is particularly relevant for sectors that rely heavily on logistics and production coordination, such as agribusiness (National Confederation of Industry – CNI, 2019).

Institutional aspects and public policies also exert significant influence on export competitiveness at the state level. Cardoso and Teixeira (2013) demonstrated that agricultural policies, such as subsidized rural credit, contribute to reducing production costs and expanding regional productive capacity, thereby boosting agricultural export performance. However, the effects of these policies vary depending on the productive structure and specific characteristics of each state.

Furthermore, evidence indicated that agro-industrial competitiveness is not uniform, even within a single region. Souza, Shikida, and Martins (2005) highlighted that differences in firms' productive, technological, and organizational capabilities result in varying levels of competitive performance. This heterogeneity underscores the importance of state-level analyses to understand the diverse patterns of regional economies' integration into international agro-industrial trade, including the Chinese market.



Considering this, a gap remains in the literature regarding the analysis of the competitive performance of Brazilian agro-industrial exports at the state level, particularly concerning the Chinese market. By employing established competitiveness indicators, this study contributed to a more detailed understanding of regional patterns of specialization and competitiveness.

In this study, the competitive performance of state-level agro-industrial exports to the Chinese market is defined as the capacity of Brazilian states to specialize in, maintain, and expand their position in agro-industrial exports destined for China. This competitiveness is assessed using indicators of observed trade performance, which make it possible to identify comparative advantages, shifts in the states' relative positions, and the dynamics of their integration into this market over time.

3 Methodology

Employing a quantitative approach of a descriptive-analytical nature, the adopted methodology assessed the competitive performance of agro-industrial exports from Brazilian states using indicators validated in the international trade literature. To this end, the methodology is structured into four parts: (i) calculation of revealed comparative advantage, (ii) estimation of the relative position index, (iii) linear trend analysis of the indicators, and (iv) construction of the performance matrix.

To construct the RCA and RPI, it was necessary to select a classification for representative agro-industrial products. Accordingly, we used Lall's (2000) classification, which ranks products by technological intensity. Among these organized groups is the category of resource-based manufactures, which comprises two subgroups: "agro-based" and "other". For this study, the "agro-based" product subgroup was considered the most appropriate. Appendix Table 4 lists the codes and descriptions for each product; these are aligned with the Standard International Trade Classification (SITC) groups—available in ComexStat (MDIC, 2025) as the *Classificação Uniforme do Comércio Internacional* (CUCI)—from which the Brazilian data were obtained. For the Chinese data, the source was the United Nations Conference on Trade and Development (UNCTAD, 2025).

3.1 Revealed Comparative Advantage (RCA) index

Originally proposed by Balassa (1965), the Revealed Comparative Advantage index is applied to determine whether an economic unit exhibits relative specialization in the export of a specific product. It is an *ex post* measure, that is, based on actual foreign trade flows.

In accordance with Equation 1, the RCA index is represented by the following expression:

$$RCA = \frac{X_{ia}/X_i}{X_{ca}/X_{cca}} \quad (1)$$

Where:

X_{ia} = the value of exports of agro-industrial products (a) by state i to China;

X_i = the value of total exports from state i to China;

X_{ca} = the value of Chinese exports of agro-industrial products (a); and

X_c = the value of China's total exports.

Such that:

$RCA > 1$, the country has a comparative advantage in the product observed;

$RCA = 1$, the country has a proportional share equal to the world average; and

$RCA < 1$, the country has a comparative disadvantage in the product.

3.2 Relative Position Index (RPI)

Additionally, the relative position index is employed. Developed by Lafay (1990), this indicator allows the assessment of an economic unit's net trade position regarding a specific product. It differs from the RCA index by simultaneously incorporating exports and imports, making it possible to determine whether the unit operates predominantly as a net exporter or a net importer. It is represented by Equation 2.

$$RPI = \frac{X_{ia} - M_{ia}}{W_{ca} + M_{ca}} * 100 \quad (2)$$

Such that:

$RPI = 1$: exporter only;

$RPI = -1$: importer only;

$RPI > 0$: net exporter position;

$RPI < 0$: net importer position; and

$RPI = 0$: exports = imports.

Where:

X_{ij} = value of agro-industrial product exports from state i to China;

M_{ij} = value of agro-industrial product imports from state i to China;

i = unit of analysis (Brazilian states); and

a = product (agro-industrial) analyzed.

3.3 Linear trend analysis

To capture the dynamic dimension of export performance, Farias and Farias (2018) suggested analyzing the linear trend of the time series for the RCA and RPI indices. This step makes it possible to determine whether the observed competitiveness follows a trajectory of expansion, contraction, or stability over time. To this end, the calculated RCA and RPI indicators were estimated against the time trend variable, as follows:

$$RPI = \alpha_{IPR} + \beta_{IPR}t$$

$$RCA = \alpha_{IVCR} + \beta_{IVCR}t$$

Under null hypothesis that the slope coefficient (β) of “t” equals zero is not rejected—the indicator is considered to have exhibited “stability” over the period (Greene, 2012).

To construct the performance matrix, we used the mean values of the indicators calculated for each state and the sign of the indicator's slope coefficient over time. For example, if a given state's RCA is greater than one, it is considered efficient or to have external potential, depending on its RPI indicator. Furthermore, the estimated slope coefficient helps classify the state as increasing, stable, or decreasing. This organization is presented in Chart 1.

Chart 1 – Performance matrix

Index and trends		RPI > 0			RPI < 0		
		↑	↔	↓	↑	↔	↓
RCA > 1	↑	Efficient and increasing			With external potential and increasing	With external potential and stable	With external potential and decreasing
	↔	Efficient and stable					
	↓	Efficient and decreasing					
RCA < 1	↑	With internal potential and increasing			Inefficient and increasing		
	↔	With internal potential and stable			Inefficient and stable		
	↓	With internal potential and decreasing			Inefficient and decreasing		

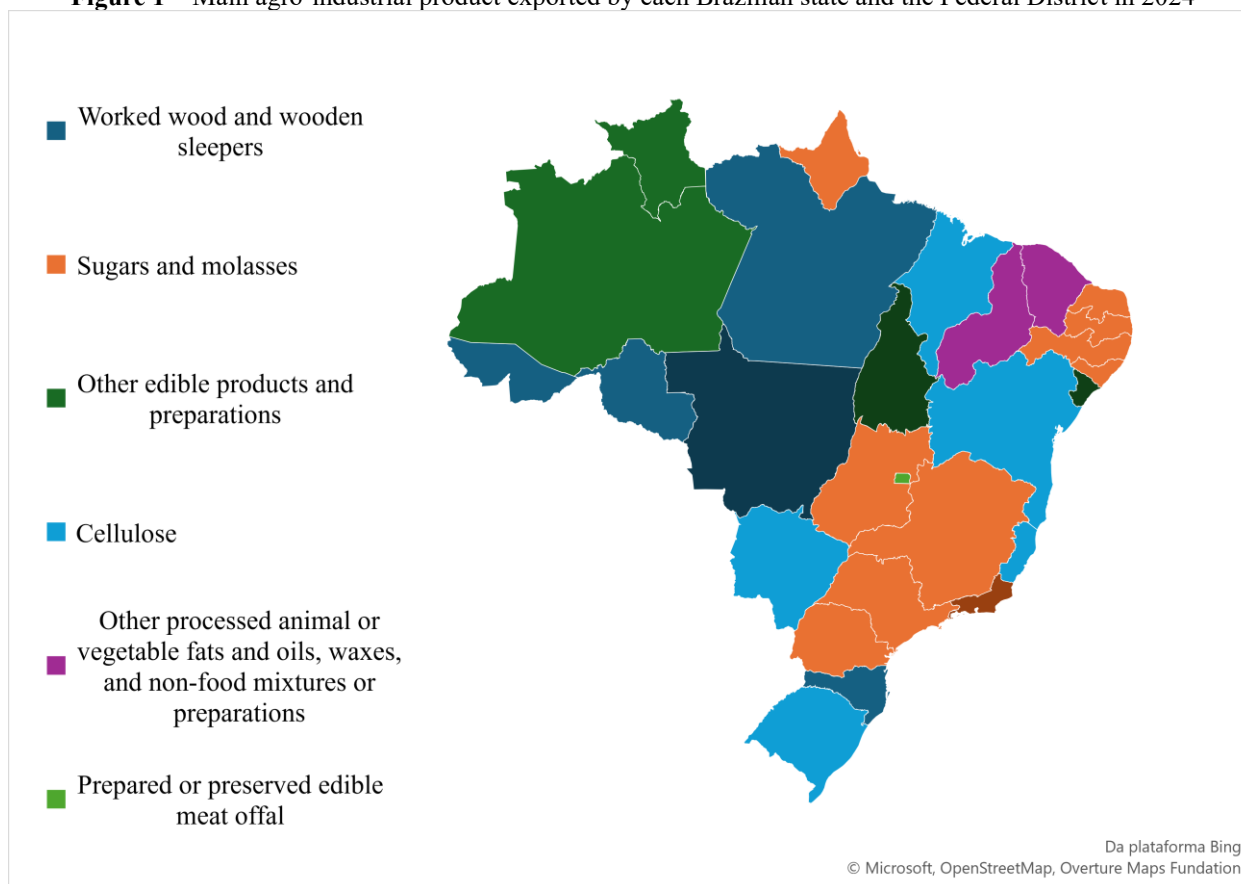
Source: Adapted from Farias and Farias (2018).

This method of grouping makes possible to analyze how the state competed with China in agro-industrial products and whether, over the period, it gained, lost, or maintained competitiveness.

4 Analysis and discussion of the results

In 2024, “Sugar and molasses”, “Cellulose”, and “Wood, partially worked, and wooden railway sleepers” were the products that appeared most frequently in the agro-industrial exports of Brazilian states (Figure 1). The map below illustrates, in part, the agro-industrial specialization of the states. The results showed diversification across the states, with no single region “specialized” in just one product; however, the Northeast region stands out as being most focused on food products and derivatives—specifically “Sugar and molasses”, “Other processed animal or vegetable fats and oils, waxes, mixtures, or non-food preparations”, and “Fruit or vegetable juices”.

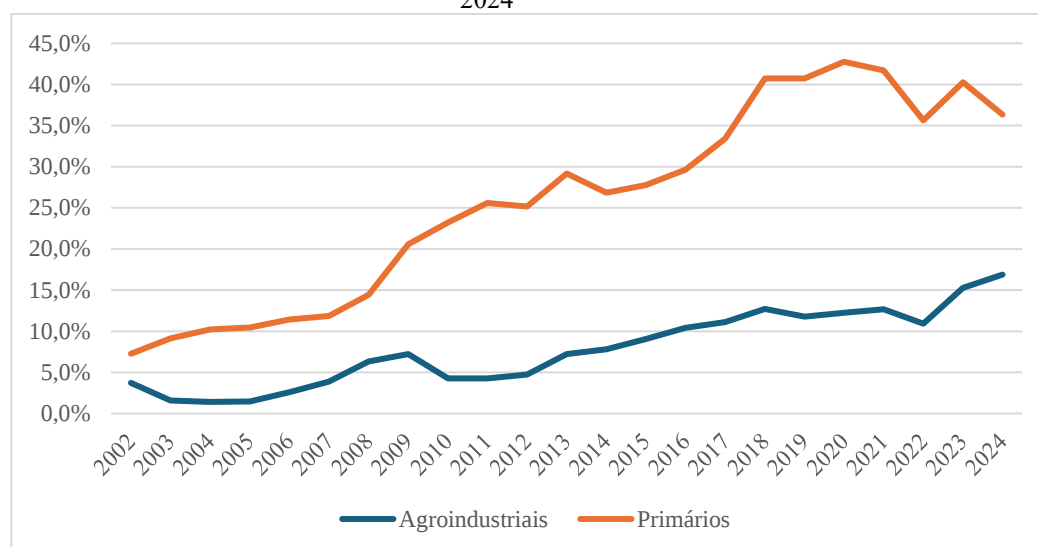
Figure 1 – Main agro-industrial product exported by each Brazilian state and the Federal District in 2024



Source: Elaborated by the authors with MDIC data (2025).

Trade relations between Brazil and China in the agricultural and agro-industrial sectors showed an upward trend during the period studied (Figure 2). The strengthening of trade ties between Brazil and China in the 21st century had a significant impact, particularly on primary products. China's share of Brazilian primary product exports stood at 7.3% in 2003 and reached 42.8% by 2020. Agro-industrial products also hold significant growth potential—a trend evidenced over time, as they accounted for 3.7% of Brazilian exports to China in 2003 and rose to 16.9% in 2024. Studies such as Medina (2024) highlighted the limited participation of domestic capital in upstream ("pre-farm gate") and downstream ("post-farm gate") segments of key supply chains, including soybeans, meat, dairy, and sugarcane. For instance, multinational companies dominate all four of these supply chains in the segments involving the production of pesticides and animal health products (Medina, 2024). Furthermore, according to Colussi et al. (2025), China aimed to increase its own production of commodities like soybeans, and the rate of growth in its demand is expected to slow in the coming years. In other words, the growth in primary product exports observed over recent decades is likely to decelerate.

Figure 2 – Share of primary and agro-industrial products exported to China relative to total exports, 2002–2024



Source: Elaborated by the authors with MDIC data (2025).

According to Ferreira and Vieira Filho (2023), Brazil has maintained a consistent performance in the international trade of agricultural products over recent decades and has increased its competitiveness in various goods, such as oils and fats, cotton, oilseeds, and meat. However, for a few products, such as dairy and cereals, the country has remained without a comparative advantage. Regarding coffee and spices; although, the country is a major player, it has experienced a significant decline in competitiveness (Ferreira & Vieira Filho, 2023).

Table 1 provides an overview of the share of agricultural and livestock products, extractive industry goods, and agro-industrial products in the total exports of each state and the country in 2024. Three states, Piauí, Mato Grosso, and Tocantins, rely heavily on agricultural and livestock products, with these goods accounting for more than half of their exports. Despite this reliance, there does not appear to be a clear relationship between the share of primary agricultural products and agro-industrial exports. Regarding the agro-industrial sector, the most specialized exporters, meaning those with the highest share of agro-industrial goods in their total exports—are Mato Grosso do Sul and Bahia, at 15.1% and 8.1%, respectively. However, in terms of the total volume of these Brazilian products exported, the leading states are São Paulo, Mato Grosso do Sul, Bahia, and Minas Gerais. São Paulo ranks first, even though the agro-industrial sector does not represent a major portion of its total exports, due to the great magnitude of its agro-industrial exports compared to the other states.

When analyzing the states' share of the national total for this product, Mato Grosso and Minas Gerais were the only ones with a share exceeding 10% (27.5% and 15.1%, respectively).



Table 1 – Share of agricultural, extractive industry, and agro-industrial products in the state's total exports and relative to the national total (2024)

State	Agriculture and Livestock		Extractive industry		Agroindustry	
	State	Brazil	State	Brazil	State	Brazil
Acre	38,3%	0,0%	0,0%	0,0%	1,1%	0,0%
Alagoas	1,0%	0,0%	20,4%	0,2%	0,0%	0,0%
Amapá	1,3%	0,0%	11,0%	0,0%	0,0%	0,0%
Amazonas	2,2%	0,0%	0,0%	0,0%	0,0%	0,0%
Bahia	33,5%	5,5%	5,8%	0,9%	8,1%	14,6%
Ceará	9,3%	0,2%	3,3%	0,1%	1,5%	0,3%
Espírito Santo	21,1%	3,1%	38,6%	5,1%	1,6%	2,5%
Goiás	45,8%	7,8%	4,9%	0,7%	0,6%	1,2%
Maranhão	41,0%	3,2%	5,5%	0,4%	0,1%	0,1%
Mato Grosso	72,1%	27,5%	0,5%	0,2%	0,0%	0,2%
Mato Grosso do Sul	31,7%	4,4%	2,8%	0,3%	15,1%	22,8%
Minas Gerais	26,1%	15,1%	31,8%	16,5%	1,8%	11,3%
Pará	10,3%	3,3%	70,1%	19,9%	0,0%	0,2%
Paraíba	3,3%	0,0%	6,9%	0,0%	0,0%	0,0%
Paraná	26,3%	8,5%	0,1%	0,0%	1,1%	4,0%
Pernambuco	14,8%	0,4%	0,1%	0,0%	0,3%	0,1%
Piauí	90,1%	1,7%	2,5%	0,0%	0,2%	0,0%
Rio de Janeiro	0,0%	0,0%	81,1%	45,8%	0,0%	0,1%
Rio Grande do Norte	19,0%	0,3%	3,0%	0,0%	0,0%	0,0%
Rio Grande do Sul	26,0%	7,9%	0,0%	0,0%	2,0%	6,6%
Rondônia	49,5%	1,8%	1,3%	0,0%	0,0%	0,0%
Roraima	22,5%	0,1%	0,2%	0,0%	0,0%	0,0%
Santa Catarina	6,9%	1,1%	0,3%	0,0%	0,8%	1,4%
São Paulo	5,4%	5,3%	4,6%	4,0%	3,2%	34,6%
Sergipe	0,5%	0,0%	56,2%	0,3%	0,1%	0,0%
Tocantins	67,6%	2,3%	0,2%	0,0%	0,0%	0,0%

Source: Elaborated by the authors based on MDIC data (2025).

Note: Agriculture and Livestock and Extractive Industry are classified according to the sections of the International Standard Industrial Classification (ISIC); Agroindustry is classified as described by the methodology.

Data showed that ten Brazilian states—Piauí, Rio de Janeiro, Pará, Mato Grosso, Tocantins, Espírito Santo, Minas Gerais, Sergipe, Rondônia, and Goiás—are more heavily oriented toward trade in natural resource-based products; that is, they concentrate over 50% of their exports in agriculture and the extractive industry, whereas the remaining states exhibited relatively greater diversification, supported more significantly by the manufacturing industry and other products. Data from the MDIC (2025) indicated that Piauí's exports are heavily concentrated in the cultivation of “cereals (excluding rice), legumes, and oilseeds”. Rio de Janeiro stood out for the export of “petroleum and petroleum products”, while Pará accounts for a significant share of “ore” exports.

Analysis of the agro-industrial competitiveness of Brazilian states revealed that, on average, the majority recorded a Revealed Comparative Advantage index (RCA) greater than 1 throughout the study period (Table 2). The North region stood out with the three highest competitiveness indices—Acre, Roraima, and Rondônia. Conversely, among the states analyzed,



only Goiás and Rio de Janeiro failed to demonstrate a comparative advantage, showing an RCA of less than 1.

Table 2 – Average RCAI and RPI for each state and calculated trend for the indicators

Estado	β RCA	β RPI	RCA	RPI
AC	0,00	-0,00	24,89	0,00
RR	-1,43	-0,00	18,84	-0,00
RO	-1,67	-0,00	12,85	0,01
BA	-0,42	0,01	12,50	0,38
ES	0,44	0,00	7,72	0,11
MS	0,35	0,03	7,68	0,25
SP	0,00	0,03	6,62	0,40
PE	0,00	-0,00	6,59	-0,02
CE	0,28	0,00	6,27	0,00
PI	-0,81	0,00	5,56	0,00
PR	-0,18	-0,01	4,01	0,20
SC	-0,39	-0,01	3,63	-0,07
RN	-0,69	-0,00	3,49	-0,00
RS	-0,18	-0,01	3,41	0,22
AM	-0,60	-0,00	2,98	-0,02
MA	0,00	0,00	1,89	0,02
MT	-0,28	-0,01	1,84	0,09
PA	-0,21	-0,00	1,31	0,05
MG	0,00	0,01	1,28	0,19
GO	0,00	0,00	0,92	0,02
RJ	-0,01	0,00	0,12	-0,00

Source: Elaborated by the authors.

Note: AC – Acre; AM – Amazonas; BA – Bahia; CE – Ceará; ES – Espírito Santo; GO – Goiás; MA – Maranhão; MT – Mato Grosso; MS – Mato Grosso do Sul; MG – Minas Gerais; PA – Pará; PR – Paraná; PI – Piauí; RJ – Rio de Janeiro; RN – Rio Grande do Norte; RS – Rio Grande do Sul; RO – Rondônia; RR – Roraima; SC – Santa Catarina; SP – São Paulo. Alagoas, Amapá, Paraíba, Sergipe, Tocantins and Distrito Federal did not record agro-industrial exports for more than 50% of the period.

The Relative Position Indicator (RPI) identified Roraima, Pernambuco, Santa Catarina, Rio Grande do Norte, Amazonas, and Rio de Janeiro as nets importers ($RPI < 0$). In other words, on average over the period, these six states imported more agro-industrial goods than they exported.

Linear regression of the RCA against the time trend indicated that most states (12) experienced a decline in the indicator over the period. Notably, the sharpest declines were observed in two states that exhibit high RCA values: Roraima and Rondônia. On the positive side, Ceará, Mato Grosso do Sul, and Espírito Santo saw gains in competitiveness within the agro-industrial sector. Elias (2020) highlighted the food agro-industry in Ceará—particularly the fruit sector—which features a high concentration of companies. Regarding Mato Grosso do Sul, Casarotto and Caldarelli (2015) identified three key milestones in agribusiness exports: the 1997–2004 period, driven by the soybean and meat complexes; 2005, marked by the growth of the sugar-alcohol sector; and 2009, driven by the pulp industry. The authors pointed to the state's abundant natural resources as a major factor in this growth. As for the trends recorded by the RPI, eleven

states showed a negative coefficient, indicating a decline in state net exports as well. Chart 2 was prepared based on this information.

Chart 2 – Performance matrix of states exporting agro-industrial products to China (2002–2024)

Index and trends		RPI>0			RPI<0		
		↑	↔	↓	↑	↔	↓
RCA>1	↑	MS	CE, ES	AC			PE AM, RN, RR, SC
	↔	MG, SP	MA				
	↓	BA	PI				
RCA<1	↑			MT, PA, PR, RS, RO			
	↔	GO					
	↓					RRJ	

Fonte: Elaborated by the authors.

A large proportion of Brazilian states are competitive in the trade of agro-industrial products—with an RCA greater than one when averaged over the years. However, for most of them, this efficiency showed a downward trend throughout the period analyzed.

Only Mato Grosso do Sul was classified as “Efficient and Growing”. This result is strongly linked to the pulp agro-industry, as shown in Figure 1 (MDIC, 2025). Perpetua, Kröger, and Thomaz Júnior (2017) highlighted the 2006 “Horizonte Project” by Votorantim Celulose e Papel, which brought significant investment to the sector and attracted competitors. From this same perspective, the authors also emphasized the role of the federal government following the 2008 crisis, specifically the support provided to companies in the sector.

In the “Efficient and Stable” category, five states were observed, representing 23.8% of the sample. This group demonstrated the ability to be competitive in the agro-industrial sector and to maintain that competitiveness throughout the period, reflecting resilience in the competitive local capacity and an aptitude for attracting investment. According to Perpetua, Kröger, and Thomaz Júnior (2017), the pulp industry in Maranhão experienced significant growth after the first half of the 2000s, driven by substantial investments—particularly from Suzano Papel e Celulose, which acquired properties from other companies and expanded production with ambitious goals.

The “Efficient and Declining” group accounted for most of the states in the sample, at 38.1%. However, Acre was the only state to maintain a competitiveness level of at least “stable”, showing neither a decline nor an increase, while experiencing a relative reduction in net exports; its RPI trend showed a downward slope. Trevisan et al. (2018) identified timber as one of Acre’s key exports—corroborating the data in Figure 1—and highlighted the state’s competitive



advantage in the sector, as well as the importance of establishing an Export Processing Zone (EPZ) in 2012 to support the state's foreign trade.

Five other states were classified as having "External and Declining Potential". This classification indicated that, while these states possess competitive advantages vis-à-vis China, they imported more than they exported. This situation calls for an assessment of the states' market share in China, aiming to boost sales and identify potential opportunities. Although, Pernambuco showed a negative RPI over the period analyzed, it was the only state to consistently maintain this status. According to Vidal (2024), productivity in regions with large sugarcane cultivation areas, where Pernambuco stood out alongside Paraíba and Alagoas—is the primary challenge faced. The authors attributed this low productivity to adverse weather conditions and poor soil quality. Pernambuco also benefits from the fact that, together with Alagoas, it concentrates the Northeast's main sugar production factories, facilitating further advancement along the production chain (Vidal, 2024).

Goiás was the only state classified as "Stable internal potential", result that, in a way, runs counter to expectations given the export capacity already noted in Table 1, which ranks it among the top five states specializing in agricultural and livestock products (with the sector accounting for 45.8% of the state's exports). However, the lack of advancement within the production chain is evident in agro-industrial exports, which make up only 0.6% of total exports, which lowers the state to tenth among Brazilian states (Table 1). Fernandes et al. (2023) explained that; although, the state offers some of the lowest production costs in the country, its logistics infrastructure is inadequate, complicating productive development.

Finally, only Rio de Janeiro is classified as "Inefficient and Declining". This position is explained by the state's high degree of specialization in the extractive industry—particularly petroleum products and derivatives—which, in 2024, accounted for 45.8% of Brazil's exports in this sector. A state's specialization in a specific sector can lead to a shift of productive factors away from other economic sectors not involved in that specialization. The 2006 discovery of the pre-salt reserves played a pivotal role in redirecting the state's oil production. In this regard, Franck et al. (2016) concluded that the state specializes in "Minerals" (including petroleum), "Base metals", "Non-precious minerals", and "Plastics and rubber". The latter category is particularly notable, as it encompasses the material essential for manufacturing "Rubber tires, interchangeable treads, flaps, and inner tubes"—Rio de Janeiro's top agro-industrial export in 2024, as shown in Figure 1 (MDIC, 2025).



Chart 3 – Efficiency matrix of states regarding agro-industrial exports to China

Efficiency and trend	Country	Country Percentage *
Efficient and increasing	Mato Grosso do Sul	4,76%
Efficient and stable	Ceará, Espírito Santo, Maranhão, Minas Gerais and São Paulo	23,81%
Efficient and decreasing	Acre, Mato Grosso, Pará, Paraná, Rio Grande do Sul, Rondônia, Piauí and Bahia	38,09%
External and increasing	Pernambuco, Amazonas, Rio Grande do Norte, Roraima and Santa Catarina	23,81%
Stable internal potential	Goiás	4,76%
Inefficient and decreasing	Rio de Janeiro	4,76%

Source: Elaborated by the authors.

Note: * Number of states on the efficiency frontier out of the 21 countries analyzed. Percentages rounded to two decimal places.

Classifying Brazilian states based on their efficiency in the international trade of agro-industrial products with China highlights their external potential; however, the decline in efficiency observed in many of these states over the period warrants particular attention. Indeed, China expanded its production capacity for these goods (Colussi et al., 2025), explaining the loss of competitiveness among several Brazilian states. Nevertheless, given the importance of the partnership with the Asian nation, it is essential to strive for increased productivity and to leverage the benefits that this relationship continues to bring to the Brazilian economy. This partnership should be viewed not only as a prime avenue for selling Brazilian primary goods (Monte; Lopes; Contini, 2017) but also as an opportunity to advance the export of products further along the value chain. Dorneles (2024), for instance, identified a positive relationship between the development of agro-industrial systems—in research focused on the Center-West region—and regional progress, demonstrating the potential to extend such progress to other regions through the agro-industrial sector.

Sesso Filho et al. (2019), using 2008 input-output matrices for Brazilian states, indicated that Mato Grosso, Mato Grosso do Sul, Rondônia, and Goiás had the largest shares of agribusiness in their respective GDPs: 60%, 42%, 40%, and 38%. However, regarding the share of agro-industries within the agribusiness sector for these same states, the figures are 13.5%, 17.2%, 13.4%, and 25.4%. These percentages confirmed the states' specialization in agribusiness and their capacity to leverage agro-industry; yet, they also highlight a need for attention regarding Goiás, which—despite having a relatively large agro-industry share within its agribusiness sector—experienced a significant decline in the competitiveness of these exports, as shown by the efficiency matrix. In contrast, Mato Grosso do Sul stood out as a major national player and, according to the efficiency matrix, was the Brazilian leader in capitalizing on this area of specialization.



The study by Rainer et al. (2019), which used the 2012 input-output matrix for Mato Grosso do Sul, to analyze agribusiness competitiveness, confirmed an increase in the agro-industry's share of the agribusiness sector, rising to approximately 21.1%. When broken down into subsectors, the authors identified food and beverages, alcohol, and pulp and paper as the most prominent activities within the agro-industry. This study, along with that of Sesso Filho et al. (2019), confirmed the productive evolution of the agro-industry in Mato Grosso do Sul, at least during part of the period analyzed in the present study.

5 Conclusion

This study analyzed the competitive performance of Brazilian state-level agro-industrial exports to China. The matrix developed in the study showed that most Brazilian states demonstrated competitive efficiency in agro-industrial product exports during the analyzed period. Mato Grosso do Sul stood out most prominently among these states, showing production efficiency that has increased over time. States such as Ceará, Espírito Santo, Maranhão, Minas Gerais, and São Paulo exhibited stable efficiency. Both groups appeared to have capitalized on the partnership with China—which saw a significant surge following China's trade liberalization in the early 2000s—and advanced within primary goods value chains; this is particularly true for Mato Grosso do Sul, which possesses a high degree of specialization in these primary and agro-industrial products. States classified as having "efficient but declining" performance need to pay closer attention to vertical agricultural value chains and rethink their sectoral activities to regain lost competitiveness.

States with external, declining potential possess the sectoral capabilities to regain a foothold in the Chinese market but must quickly adjust their course, as they have been losing ground to Chinese products in the sector; in other words, their trading partner is effectively replacing imports from these states. Goiás, meanwhile, was the only state classified as having internal, stable potential. This state should focus on supplying the domestic market, given its lack of international competitiveness vis-à-vis China. Its location, situated in the country's primary agricultural hub and at the very center of the national territory could prove advantageous for producing inputs for more competitive Brazilian states.

Finally, Rio de Janeiro was the only state identified by the matrix as inefficient and declining. This result indicated that agro-industrial products are not significant within its export mix. Indeed, its strong specialization in extractive activities, most notably the export of oil and oil derivatives, limits the capacity to allocate factors of production to other primary sectors and their associated industrial linkages.



The fact that the study focused on China as a reference point can be viewed as a major limitation, as it does not account for competitiveness to other markets important to the agro-industrial sector, such as Europe or the United States. However, this issue could be further explored in future research, including robust yet more parsimonious econometric models, to achieve a more precise analysis of Brazilian agro-industrial exports.

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APPENDIX

Quadro 4 – Agro-based manufacture groups of the Standard International Trade Classification (SITC)

Code	Description
016	Meat and edible offal, salted or dried
017	Meat and edible offal prepared or preserved, n.e.p.
023	Butter and other fats and oils derived from milk
024	Cheese and curd
035	Dried, salted, or brined fish
037	Fish and aquatic invertebrates, prepared or preserved, n.e.p.
046	Wheat and meslin flours and semolina
047	Other cereal flours and semolinas
048	Preparations based on cereals, fruit flours, or vegetable flours
056	Vegetables, roots and tubers, prepared or preserved, n.e.p.
058	Preserved fruits and fruit preparations (excluding juices)
059	Fruit and vegetable juices not fermented, without added alcohol
061	Sugar, molasses and honey
062	Confectionery sugar
073	Chocolate and other food preparations containing cocoa, n.e.p.
098	Food products and preparations, n.e.p.
111	Non-alcoholic beverages, n.e.p.
112	Alcoholic beverages
122	Manufactured tobacco
232	Synthetic rubber
247	Raw or squared wood
248	Worked wood and wooden sleepers
251	Paper pulp and paper recycling
264	Jute and other bast fibers, raw or processed but not spun, n.e.p.
265	Jute and other bast fibers, raw or processed but not spun, n.e.p.
269	Used clothes and other used textile articles
421	Fixed vegetable fats and oils, whether refined or fractionated
422	Fixed vegetable fats and oils, whether refined or fractionated
431	Processed animal or vegetable oils and fats, n.e.p.
621	Rubber materials (pastes, slabs, sheets, etc.)
625	Rubber tires, tire treads, rim flaps, and inner tubes
629	Rubber art. n.e.p.
633	Cork products
634	Veneers, plywood, and other worked wood products, n.e.p.
635	Wood products, n.e.p.
641	Paper and board

Source: Elaborated by the authors, based on Lall (2000).