

## ARTIGOS

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### Analysis of the competitiveness of Brazilian poultry-meat exporting states (1999-2022)

Análise da competitividade dos principais estados brasileiros exportadores de carne de frango (1999-2022)



#### ABSTRACT:


This study analyzed the performance of Brazilian poultry-meat exporting federative units (states), using the Revealed Comparative Advantage (RCA) and the Relative Position (RPI) indices. Furthermore, the performance matrix based on the linear trend of the calculated indices was elaborated, covering the period from 1999 to 2022 with data obtained from the ComexStat database. The results reveal that the most efficient federative units in the sector are Distrito Federal, Paraná, Santa Catarina, Rio Grande do Sul and Mato Grosso do Sul. On the other hand, the other states examined presented comparative disadvantages. It is important to highlight that all analyzed states had surpluses in poultry meat exports, which contribute positively to their trade balance. Furthermore, throughout the period, most federative units presented stable indicators, which suggest a consistent and favorable scenario for the sector.

#### RESUMO:


Este estudo tem como propósito analisar o desempenho das principais unidades federativas brasileiras que exportam carne de frango, utilizando os índices de Vantagem Comparativa Revelada (IVCR) e de Posição Relativa (IPR). Além disto, abrange a construção de uma matriz de desempenho que considera a tendência linear ao longo da série histórica desses indicadores, abrangendo o período de 1999 a 2022, com dados obtidos do banco de dados ComexStat. Os resultados da análise revelaram que as unidades federativas mais eficientes no setor são o Distrito Federal, Paraná, Santa Catarina, Rio Grande do Sul e Mato Grosso do Sul. Por outro lado, os demais estados examinados apresentam desvantagens comparativas. É pertinente destacar que todos registraram um superávit nas exportações de carne de frango, o que contribui de forma positiva para o saldo da balança comercial na maioria das unidades federativas investigadas. Ainda nessa perspectiva, ao longo do período de análise, a maioria das unidades federativas demonstrou estabilidade em seus indicadores, indicando um cenário consistente e favorável para o setor.

**Keywords:** Poultry meat; Relative Position Index; Revealed Comparative Advantage Index

**Palavras-chave:** History; Fiction; Narrative

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## INTRODUCTION

International trade is extremely important for economic growth, and it is driven by comparative advantages, which motivate each country to concentrate its production in specific economic sectors (RICARDO, 1817). According to Krugman and Obstfeld (2001), international competition can encourage companies to increase their productivity and innovate, so that they can remain competitive.

Global competition also drives companies to improve their efficiency, quality, and innovation capacity, thus allowing the transfer of knowledge and technology between nations, accelerating technological advancements (BHAGWATI, 2004). The division of supply chains and the distribution of different stages of production in each country reflects this scenario. The "fragmentation of production", as highlighted by Baldwin (2016), can result in significant gains in efficiency and productivity, allowing developing countries to enter global value chains.

Furthermore, Krugman (1994) discusses how economic opening changed economies. The author argues that global competition requires nations to adapt and implement appropriate policies to ensure sustainable growth. Kliass and Salama (2008) characterize this trend as "globalization", which leads economies through a process of open-

ing over time.

In Brazil, this globalization process became more prominent in the 1990s, when economic stabilization and liberalization policies were implemented (CHIARINI; SILVA, 2016). Baer (2003) argues that Brazilian trade opening in the 1990s was characterized by the expansion of the commodities sector, which was driven by the economic growth of emerging and developed countries.

From the year 2000 onwards, commodities went through a very positive phase in terms of negotiation, as the contribution of basic goods to the global economy increased, driven mainly by Asian demand. The Brazilian poultry meat sector benefited from this new context, in which most commodities now end up being processed, transformed into manufactured products, and exported to other countries (BELLUZZO *et al.*, 2014).

Since 2004, Brazil has been the leader in global chicken meat exports, and it is responsible for 35% of this market (Brasil, 2022). According to the report by the Center for Advanced Studies on Applied Economics (CEPEA, 2023), the daily average of chicken meat shipments abroad reached, in 2023, the highest volume recorded in the entire historical series, which began in 1997, with a total of 22.7 thousand tons.

Data from the Brazilian Association of Animal Protection (ABPA, 2023) indicate that Brazil produced a total of 14.524 million tons of chicken

meat in 2022, reflecting a gross production value of R\$112.1 billion. The study also shows that Asia is the main trade partner in this market, representing approximately 36.25% of the imported volume and that among them, China stands out as the main destination for the exports, with a total of 540,555 tons in 2022.

These circumstances highlight that chicken meat has a significant impact on Brazil's economy, as it is the 7<sup>th</sup> most exported product from the country (Brasil, 2022), and corroborate the need to better understand the competitiveness of this sector. To this end, the objective of this study is to analyze the performance of Brazilian poultry-meat exporting federative units (states), using the Revealed Comparative Advantage (RCA) and the Relative Position (RPI) indices. Furthermore, we applied the performance matrix based on the analysis of the linear trend of the calculated indicators, according to the approach by Farias and Farias (2018).

The study covers the period from 1999 to 2022 and considers the main Brazilian federative units (states) that export poultry meat, that is, those that have export data for at least 50% of the sample period. Poultry meat is produced throughout the country, in different regions and states, with its local particularities. Because of that, we consider it important to analyze separately each Brazilian state involved in this market, which is al-

so a research gap.

As for the contributions, we argue that the results can be useful as an analysis tool to support more in-depth investigations, considering the particularities of each region of Brazil. This, in turn, can help in the development of economic policies aimed at stimulating exports and increasing resources available for other strategic sectors in each location.

The article is structured in five sections, in addition to this introduction. The second section addresses the theoretical basis of international trade. The third section is dedicated to the review of national literature on the competitiveness of poultry/chicken meat. The other two sections address the methodology and the analysis and discussion of the results, respectively. Finally, the conclusions are presented in the last section.

## THEORETICAL FRAMEWORK

The main objective of this section is to highlight the importance of international trade for the economy, in addition to presenting the theories behind the indices that were applied in this study. To this end, a brief explanation of the chronological transformation of economic thought in international trade is presented.

Bhagwati (2004) defines international trade as a "powerful force" that drives production spe-

cialization, enables the use of comparative resources from many nations, and promotes global economic efficiency. The author also explains how the market expands consumers' choices, giving them access to a wider range of goods at more affordable prices.

The classical school of economics played a leading role in the development of the scenario described above, at the same time as it presented a vision of the dynamics of the global market. In *The Wealth of Nations*, Smith indirectly expresses his opposition to mercantilism, by stating that the prosperity of a nation is intrinsically linked to the abundance of goods and services available to the population (MATTOS, 2007). For Smith (2017), the Theory of Absolute Advantage is the basis for international trade, as it shows that a country with an absolute advantage in the production of a specific good would have greater production due to lower costs and productive inputs. Based on this understanding, a country would not need to have a positive commercial relationship with the global market for trade to be favorable (COUTINHO *et al.*, 2006).

Beyond Smith's theory, David Ricardo formulated the Theory of Comparative Advantage in his book *Principles of Political Economy and Taxation*, which served as the basis for several macroeconomic concepts and indicators. The relevance of Ricardo's theory is because it fills the gaps left by

Smith. According to his theory, international trade would be advantageous for economies specialized in the production of comparatively more efficient goods and services, even if their total production is lower than that of other global economies (COUTINHO *et al.*, 2006).

In *Principles of Political Economy*, John Stuart Mill complemented Ricardo's theory. According to Mill (1996), nations with high production costs sell goods to nations capable of producing them at lower costs. This statement was based on the assumption that, whether or not countries were able to reduce their production costs, they would eventually specialize in creating more competitive products. In a sense, it means that these countries need to import goods to meet their demand, even if they can produce them at a lower cost (GONTIJO, 2007). This understanding emphasizes the importance of international trade as a source of access to more efficient and competitive goods.

The Heckscher-Ohlin model, which also derives from Ricardo's theory, brought a new perspective to the explanation of comparative advantages in international trade. According to these authors, comparative advantages are influenced by factors of production. This means that, even when countries have the same level of technology, their comparative advantages are influenced by production factors such as land, capital, and labor. As a result, differences in the availability and effi-

ciency of these factors determine the level of specialization and its competitive advantages abroad (KRUGMAN; OBSTFELD, 2001).

In opposition to classical approaches, Porter presented, in 1989, *The Competitive Advantage of Nations*. Unlike the Ricardian perspective, which emphasizes specialization based on a country's comparative economic advantages, Porter (1993) argues that the development of dynamic competitive advantages is what enables a country to become more competitive. This involves the creation of internal conditions that stimulate innovation, the development of sophisticated production processes, quality and efficiency improvements, and product differentiation.

Despite some criticism, David Ricardo's Theory of Comparative Advantage (1817) is widely accepted in the academic community and served as the basis for many economic indicators. Following the classic Ricardian economic theory, Balassa (1965) formulated the Revealed Comparative Advantage Index (RCA), which can be applied to analyze national or regional competitiveness based on trade flow. The RCA highlights the importance of a product in the context of exports, and at the same time, it provides information about its applicability in the global market.

Similarly, the Relative Position Index (RPI), introduced by Lafay *et al.* (1999), is a methodology to evaluate national and international exports.

However, since the purpose of the RPI is to measure the growth rate of net exports and imports, imports are also included in its calculation. Thus, the index evaluates a country's participation in the trade balance of a given good or service in the international market (FARIAS; FARIAS, 2018).

## LITERATURE REVIEW

Camara, Sereia, and Souza (2008) verified the performance and competitiveness of Brazilian chicken meat exports between 1990 and 2005, focusing on the state of Paraná. The authors applied the Constant Market Share (CMS) model, as well as the geometric growth rate method (using OLS) to verify the evolution of the sector over the period. The results evidenced that both Brazil and Paraná had high competitiveness and a considerable market share in the analyzed sector and period.

Similarly, Saggin (2017) evaluated the performance and competitiveness of poultry meat exports from cooperatives in Paraná, between 2006 and 2016. The exports of the six local cooperatives that export poultry in the state were examined. Data was analyzed using a variety of methodologies, including Constant Market Share (CMS), Export Effort Index (EE), Revealed Comparative Advantage (RCA), Regional Orientation Index (ROI), Trade Coverage (TC), and Frequency Index (FI). The results highlighted the strength of the coopera-

tives examined, whose indicators presented higher values than those for Brazil.

Bender, Schwertner, and Coronel (2019) also examined the competitiveness of Brazilian chicken meat exports from 1999 to 2018. To this end, the authors applied indicators such as the Revealed Comparative Advantage Index (RCA), the Regional Orientation Index (ROI), and the Trade Coverage (TC). The results evidenced that Brazilian chicken meat presented comparative advantages throughout the entire period and that exports were mainly directed to the Middle East and Asia, at a slow pace, but with a constant decrease over time.

Silva Filho, Santos, and Ribeiro (2020) examined the competitiveness of chicken meat exports from the southern region of Brazil, from 1997 to 2018. To do so, they also applied international trade indicators such as the Revealed Comparative Advantage Index of Vollrath, and the Relative Export Advantage Index (REA). The results showed a decline in the region's contribution to the country's total chicken meat exports over the years. The indicators also evidenced that the region had comparative and relative advantages for the entire analyzed period.

Alvares *et al.* (2022) verified the evolution of Brazilian chicken meat exports in comparison with exports from the United States, between 1997 and 2017. The analysis considered national

and international economic factors, and the competitiveness of exports was evaluated through the Revealed Comparative Advantage Index (RCA). The results evidenced that Brazil had a comparative advantage over the United States for the entire period, which corroborates the fact that chicken meat is one of the main products exported by Brazil, but the same does not apply to the United States. The next section contemplates the methodological procedures.

## METHODOLOGICAL APPROACH

### Method

The first part of this section details the Revealed Comparative Advantage (RCA) and the Relative Position (RPI) indices, which are generally used in studies on competitiveness, as demonstrated in the literature review. Both indicators serve as a basis for analyzing economic performance.

According to Carvalho (1995), the RCA formulated by Balassa (1965) analyzes the performance of a country's exports and allows determining the pattern of specialization of economies in the international market. This indicator is a useful tool for identifying the products for which an exporting country has the most significant comparative advantage, by comparing the levels of competitiveness between different countries in the global market. Maia (2002) argues that the RCA

index is a measure based on ex-post terms, as its quantification is based on post-trade data. The index is calculated as follows Equation (1):

$$RCA_{ij} = \frac{X_{ij}/X_j}{X_{iw}/X_w} \quad (1)$$

where: *i* represents the product, that is, poultry meat, in US\$; *j* corresponds to the Brazilian federal

units (states); *w* indicates the country, that is, Brazil;  $X_{ij}$  represents the exports (in US dollars) of product *i* from state *j*;  $X_j$  is the total amount (in US dollars) exported by state *j*;  $X_{iw}$  corresponds to the exports of product *i* from country *w*;  $X_w$  denotes the total amount exported by country *w*.

The possible outcomes for the RCA are detailed in Table 1.

Table 1 – Conditions for identifying revealed comparative advantage or disadvantage

Outcome	Description
$RCA_{ij} > 1$	Product <i>i</i> has revealed comparative advantage in state <i>j</i> .
$0 \leq RCA_{ij} < 1$	Product <i>i</i> has revealed comparative disadvantage in state <i>j</i> .
$RCA_{ij} = 1$	State <i>j</i> has no revealed comparative advantage or disadvantage in the exports of product <i>i</i> .

Source: Authors based on Almeida *et al.* (2007)

The RCA varies from 1 to  $\infty$ , while the comparative disadvantage varies from 0 to 1 (MARTINS *et al.*, 2010). The needs of the domestic market are met by local production when there are no advantages or disadvantages, indicating the absence of export spillovers (ALMEIDA *et al.*, 2007).

Another performance indicator commonly used in studies on trade relations is the Relative Position Index (RPI), which is used to evaluate the competitiveness of a country or region in the global market, through the analysis of exports of a certain product. According to the method proposed

by Lafay *et al.* (1999), the RPI is calculated based on the trade balance of the analyzed product in relation to the total value of the product traded by the country. Thus, the mathematical expression for calculating the RPI is as follows Equation (2):

$$RPI_{ij} = 100 \times \frac{X_{ij} - M_{ij}}{X_{iw} + M_{iw}} \quad (2)$$

where: *i* represents the product, that is, chicken meat in US dollars; The term *j* refers to the state, and *w* represents the country, that is, Brazil.  $X_{ij}$  in-

icates the total amount of exports of product  $i$  by state  $j$ ;  $M_{ij}$  represents the total amount of imports of product  $i$  by state  $j$ ;  $X_{iw}$  represents the total amount of exports of product  $i$  by country  $w$ ;  $M_{iw}$  refers to the total amount of imports of product  $i$  by country  $w$ .

The result obtained allows for measuring the level of regional or national competitiveness (for region/country  $j$ ) compared to other foreign competitors. The higher the indicator values, the more significant the presence of the region or country  $j$  in the international market regarding product  $i$ . Thus, the results obtained show the relevance of the region or country in international trade involving the analyzed product (ALMEIDA *et al.*, 2007).

The next step, which is necessary to elaborate the performance matrix, is to estimate the linear trend of the RCA and IPR indexes, using the OLS method. The linear trend of a time series ( $y_t$ ) is algebraically described by Equation (3):

$$y_t = \alpha_0 + \alpha_1 t + e_t \quad (3)$$

This equation is defined for a period denoted by  $t = 1, 2, 3$ , and so on;  $\alpha_0$  is the linear coefficient and  $\alpha_1$  is the angular coefficient multiplied by time, which results in a linear time trend coefficient. Furthermore,  $e_t$  represents the stochastic

error term, which is independently and identically distributed (i.i.d.) (WOOLDRIDGE, 2016).

Based on this theoretical model, the corresponding regressions to obtain the time trend of the RCA and RPI indices are described by equations (4) and (5).

$$RCA_{ijt} = \theta_0 + \theta_1 t + u_{ijt} \quad (4)$$

$$RPI_{ijt} = \delta_0 + \delta_1 t + \varepsilon_{ijt} \quad (5)$$

where:  $t$  represents time;  $i$  refers to the product (poultry meat);  $j$  refers to each Brazilian state;  $\theta_0$  and  $\delta_0$  are the linear coefficients;  $\theta_1$  and  $\delta_1$  are the angular coefficients;  $u_{ijt}$  and  $\varepsilon_{ijt}$  stand for the error terms.

After those steps, the classification proposed by Farias and Farias (2018) can be adopted as a basis to evaluate the performance of both indices. The interpretation for results is presented in Table 2.



Table 2 – RCA and IPR trend according to the coefficients

Trend		Angular coefficients	
		RCA	RPI
Stable	Regardless of the sign	$\theta_1 = 0$	$\delta_1 = 0$
Increasing trend	Positive sign	$\theta_1 > 0$	$\delta_1 > 0$
Decreasing trend	Negative sign	$\theta_1 < 0$	$\delta_1 < 0$

Source: Authors based on Farias e Farias (2018)

The estimated angular coefficients for the RCA and RPI can be classified into one of the following three categories: with an “increasing trend”, when  $\theta_1$  and  $\delta_1$  have positive values ( $\theta_1 > 0$  and  $\delta_1 > 0$ ); “stable”, when, regardless of the sign, they are equal to zero ( $\theta_1 = 0$  and  $\delta_1 = 0$ ); and with a “decreasing trend” when the values are negative ( $\theta_1 < 0$  and  $\delta_1 < 0$ ). These outcomes are evaluated using the Student's t test with a statistical significance level of 5% (FARIAS; FARIAS, 2018).

The performance matrix developed by Farias and Farias (2018) establishes a relationship between the RCA index and the RPI, based on the estimates of equations (4) and (5). This approach results in the positioning of each analyzed state in the categories described in Table 3.

From Table 3, each state can be classified based on their performance as poultry meat exporters as follows:

- Efficient: in terms of its commercial operations regarding poultry meat, the analyzed state will be considered “efficient” if RCA >

1 and RPI > 0. This occurs when the RCA index highlights the applicability of the product to export markets, while the RPI demonstrates the “efficiency” of the state in the commercialization of the commodity.

- With external potential: when RCA > 1 and RPI < 0. In this case, the RCA index confirms the relevance of the product in the export basket of the analyzed state, which shows “external potential”. However, the RPI suggests that there is a need for greater efficiency in the commercialization of the analyzed product, which means that is necessary to improve its relative position in the market.
- With internal potential: when RCA < 1 and RPI > 0. The RCA shows that the state has comparative disadvantages, but the RPI evidence that the state is efficient in the commercialization of poultry meat abroad, which suggests that it has the potential to increase its comparative advantage.

— Inefficient: when  $RCA < 1$  and  $RPI < 0$ . reflects the inefficiency in the commercialization of Considering that the RCA indicates that the state the analyzed product, it must be classified as has comparative disadvantages, and that the RPI “inefficient”.

Table 3 – Performance matrix

Indices and trend		$RPI > 0$			$RPI < 0$		
		↑	↔	↓	↑	↔	↓
$RCA > 1$	↑	Efficient and with an increasing trend			With external potential and an increasing trend	With external potential and stable	With external potential and a decreasing trend
	↔	Efficient and stable					
	↓	Efficient and with a decreasing trend					
$RCA < 1$	↑	With internal potential and an increasing trend			Inefficient and with an increasing trend	Inefficient and stable	Inefficient and with a decreasing trend
	↔	With internal potential and stable					
	↓	With internal potential and a decreasing trend					

Source: Authors adapted from Farias e Farias (2018)

## Data

The sample used in this study covers the period from 1999 to 2022, totaling 24 annual observations. These observations were obtained

based on exports of poultry (HS code 0105/SH4 - 207). The 27 Brazilian federative units (26 states and the Federal District) were analyzed, and observations from this time interval were collected from the *ComexStat* database from the Ministry of De-

velopment, Industry, Foreign Trade and Services (MDIC, 2023).

This twenty-four-year period was chosen considering the growing performance of chicken meat in Brazil since the beginning of the 21st century. Data from the Food and Agriculture Organization of the United Nations (FAO) show that, from January 2000 to February 2023, the average value of chicken meat exported by Brazil was 55% higher than that of exporters of North America.

During this period, 21 Brazilian federative units presented a constant flow of exports and imports in the poultry market: São Paulo (SP), Minas Gerais (SP), Rio de Janeiro (RJ), Rio Grande do Sul (RS), Paraná (PR), Mato Grosso (MG), Santa Catarina (SC), Goiás (GO), Mato Grosso do Sul (MS), and the Federal District (DF). The federative units are presented in order from the largest to the smallest exporter of poultry meat, in US dollars, according to the order of classification from the MDIC (2023).

## RESULTS AND DISCUSSION

To analyze the competitiveness of Brazilian federative units in poultry meat exports, the Revealed Comparative Advantage Index (RCA) and the Relative Position Index (RPI) were obtained for each location that maintained constant commercial activity in this sector throughout the entire period of analysis. In Table 4, in addition to the

mean and the standard deviation, the trends of the indices are presented, represented by coefficients  $\theta_1$  and  $\delta_1$ .

The results show that among the ten federative units analyzed in this study, only Rio Grande do Sul, Paraná, Santa Catarina, Mato Grosso do Sul and the Federal District presented RCA values above zero, indicating that these locations have revealed comparative advantages in the export of poultry meat. On the other hand, the other states did not demonstrate that they had comparative advantages in exporting this product during the period. Concerning the RPI, all federative units, except Rio de Janeiro, presented mean values above zero. This indicates that practically all the federative units analyzed are net exporters of poultry meat, that is, the export of this product contributes positively to the trade balance of most locations examined.

These results are in line with the country's regional production characteristics. Historically, the southern region of Brazil stands out as one of the strongest areas in poultry production in the country. This location is characterized by the significant presence of cooperatives that play an important role in organizing and supporting poultry breeders. Farms located in the South, as well as those located in the Southeast, have a considerable dependence on grains, often purchased from the Center-West (DE ZEN *et al.*, 2014). According

to Bandeira (1995), with the end of the expansion of agricultural areas throughout the 1970s, the growth of agriculture was no longer based on the expansion of land, but on the need to increase productivity and intensify land use. This occurred

through the introduction of new crops and the increased integration of primary production with agroindustry, in particular, poultry and pig farming.

Table 4 – Revealed Comparative Advantage (RCA) and Relative Position (IPR) indexes for the Brazilian poultry-meat exporting states – 1999 to 2022

Federative Unit	RCA				RPI			
	Mean	Std Dev.	$\theta_1$	p-value	Mean	Std Dev.	$\delta_{1.}$	p-value
São Paulo	0,20	0,08	0,0073	0,000	5,303	1,909	0,0831	0,143
Minas Gerais	0,31	0,10	0,0047	0,105	3,811	1,274	0,0759	0,040
Rio de Janeiro	0,00	0,00	-0,0001	0,000	0,000	0,004	-0,0002	0,052
Rio Grande do Sul	2,24	0,33	-0,0153	0,123	19,715	4,019	-0,4806	0,000
Paraná	3,88	0,94	0,1184	0,000	30,169	5,473	0,6532	0,00
Mato Grosso	0,49	0,34	0,0007	0,949	2,504	1,725	0,0884	0,082
Santa Catarina	6,69	1,09	-0,0775	0,012	28,972	7,680	-0,8437	0,000
Goiás	0,05	0,02	0,0011	0,113	4,227	2,131	0,1216	0,008
Mato Grosso do Sul	2,91	1,20	-0,1376	0,000	3,717	0,963	0,0977	0,000
Federal District	14,41	9,31	0,2117	0,453	1,179	0,764	0,0546	0,012

Source: Authors (2018)

Thus, according to Rizzi (1993), the progress of the poultry industry in Brazil and its geographic distribution are closely linked to the expansion of soybean and corn crops, which are essential ingredients in the formulation of poultry feed. The results obtained here (Table 4) corroborate this finding, since the Central-West and South regions stand out in the national production of corn, for example, as evidenced by Coêlho (2021), and they also stand out in the production and ex-

port of poultry meat.

The next step consisted of categorizing each federative unit, based on the RCA and RPI trends during the analyzed period (Table 5), following the performance matrix proposed by Farias and Farias (2018).

Table 5 – Performance matrix for Brazilian poultry-meat exporting states (1999 to 2022)

	Classification	RCA > 1	RPI > 0	Analyzed federative units
Efficient	Increasing trend	↑	↑	"_"
		↑	↔	"_"
	Stable trend	↔	↑	Federal District, Paraná
		↔	↔	"_"
	Decreasing trend	↑	↓	"_"
		↔	↓	Santa Catarina, Rio Grande do Sul
		↓	↑	"_"
		↓	↔	Mato Grosso do Sul
		↓	↓	"_"
		↓	↓	"_"
With external potential	Increasing trend	↑	↑	"_"
		↔	↑	"_"
		↓	↑	"_"
	Stable trend	↑	↔	"_"
		↔	↔	"_"
		↓	↔	"_"
		↓	↓	"_"
	Decreasing trend	↑	↓	"_"
		↔	↓	"_"
		↓	↓	"_"

To be continued

Table 5 – Conclusion

	Classification	RCA > 1	RPI > 0	Analyzed federative units
With internal potential	Crescente	↑	↑	"_"
		↔	↑	"_"
		↓	↑	"_"
	Stable trend	↑	↔	"_"
		↔	↔	São Paulo, Goiás, Minas Gerais, Mato Grosso
		↓	↔	"_"
		↑	↓	"_"
	Decreasing trend	↔	↓	"_"
		↓	↑	"_"
		↑	↑	"_"
Inefficient	Stable	↑	↔	"_"
		↔	↑	"_"
		↔	↔	Rio de Janeiro
	Decreasing trend	↑	↓	"_"
		↔	↓	"_"
		↓	↑	"_"
		↓	↔	"_"
		↓	↓	"_"

Source: Authors (2018)

In where: \* No federative units were classified as having “external potential”.

Based on the proposed classification, it was identified that five federative units (Federal District, Paraná, Santa Catarina, Rio Grande do Sul, and Mato Grosso do Sul) stood out in the export of poultry meat, as they presented revealed comparative advantages, and, at the same time, efficiency in the commercialization of this product to the foreign market. However, among these, only the Federal District and Paraná showed a stable trend, while the indices for the other locations presented a decreasing trend, which suggests that poultry meat may be losing relevance in the export basket of these federative units, and actions are necessary so that they can maintain their competitiveness in the long term.

The states of São Paulo, Goiás, Minas Gerais, and Mato Grosso, despite not having revealed comparative advantages, exhibited internal potential, presenting a stable trend for the RCA and the RPI indices. This means that these locations have favorable internal conditions to improve their competitiveness in the sector, but the stable trend suggests that this potential needs to be better explored in the long term.

Although poultry and pork production in the Brazilian Central-West has increased considerably in recent years, this is one of the regions that most depends on public investment, especially in infrastructure. It is also known that the expansion of chicken meat industries in several regions of

Brazil is subject to the viability of conditions. According to Azevedo *et al.* (2002), two main elements contribute to the increase in production costs in poultry farming in Brazil: the cost of food, and expenses related to taxes and labor issues. In this sense, the Brazilian federative units that produce and export poultry meat need to try to overcome internal structural challenges, in addition to those imposed by the international scenario.

The performance matrix also revealed that Rio de Janeiro was the only state included in this study that demonstrated fragility or ineffectiveness regarding poultry meat exports. The stable trend of the indices suggests that there are no prospects for significant changes in the industry's competitiveness in the coming years.

The results obtained here are in line with those by Bender, Schwertner, and Coronel (2019), who indicated that the country, as a whole, maintained its competitiveness throughout the entire period examined. The results found are also in line with the current dynamism observed in the Brazilian poultry meat market. The broiler chicken industry in Brazil shows competitive advantages due to its fast production cycle, its ability to operate with a vertical organizational structure, and its position as an affordable source of protein, attracting consumers from different social classes (RECK; SCHULTZ, 2016). Furthermore, the sector stands out for applying modern methods of planning, or-

ganization, coordination, and management practices, as well as a continuous commitment to adopt innovative technologies, which contributes significantly to the constant growth of production (OLIVEIRA *et al.*, 2015).

Another factor that may have contributed to the current competitiveness of most of the Brazilian federative units is the technological development of the broiler production chain. From the 1970s onwards, technological and production changes were observed, including a reduction in the breeding period, considerable advances in the selection of strains, greater use of balanced rations, adoption of cutting-edge industrial equipment, and the implementation of new management practices. These changes resulted in significant gains in production efficiency (ESPÍNDOLA, 2012). According to Sorj, Pompermayer, and Coradini (2008), research and technological development, especially related to genetic material and the use of advanced chemical veterinary supplies, have a strong connection with foreign capital, playing a fundamental role in the internationalization process of the poultry industry.

In the 1990s, according to Mior (2005), companies such as Sadia, Perdigão, and Seara invested in the construction of new industrial facilities dedicated to the slaughter of poultry and pigs in the Center-West and Southeast regions of Brazil. This fact contributed to the expansion and indus-

trialization of chicken meat production in these regions of the country.

More recently, the reorganization of the global animal protein market, influenced by the impacts of the conflict in Eastern Europe, the rising production costs in the European Union, and the health issues of poultry farming around the world, is one of the main factors that contributed to the records achieved in 2023. In this context, Brazil, which remained free from Avian Influenza (the country never recorded any cases in production), has consolidated itself as a reliable source for the global supply of chicken meat (ABPA, 2023).

The prospects, therefore, are promising for the sector; however, the performance matrix indicates that, in the long term, few Brazilian federative units show an increasing trend, a fact that demands attention. To overcome barriers, and maintain and ensure greater competitiveness, the country has increasingly invested in the quality of production, especially concerning sanitary conditions and sustainability. Furthermore, many producers have invested to meet the conditions imposed by Arab countries (Halal certification), and for this reason, exports to this part of the world have increased significantly (BRASIL, 2022). Another challenge is to reconcile the demands of the foreign market with those of the domestic market, since, despite being one of the main products on the Brazilian export basket, almost 70% of chicken meat



production in the country is destined to meet domestic consumption.

## CONCLUDING REMARKS

Brazil is currently the world's largest exporter of chicken meat. Given this context, this study analyzed the performance of Brazilian poultry-meat exporting federative units, determining the classification of each location according to a performance matrix. For this, the Revealed Comparative Advantage Index (RCA), the Relative Position Index (RPI), and the linear trend of these indicators were calculated, for the period from 1999 to 2022.

According to the performance matrix, Distrito Federal, Paraná, Santa Catarina, Rio Grande do Sul and Mato Grosso do Sul demonstrated comparative advantage and efficiency in the sector. This shows that the dynamics of poultry meat production in Brazil are, therefore, characterized mainly by the important role of the southern region of the country in this market, with its three states leading the ranking of exports and competitiveness.

The states of São Paulo, Goiás, Minas Gerais, and Mato Grosso were classified as having internal potential and a stable trend, which demonstrates that these locations have the potential to increase the role of poultry farming in ex-

ports, with the possibility of obtaining comparative advantages in the sector in the coming years. Rio de Janeiro, on the other hand, presented comparative disadvantage and inefficiency in the sector, since the RCA and RPI were negative and less than zero, with a stable trend.

Overall, the Brazilian poultry meat sector is solid and robust. Characterized by vast production, competitiveness, access to international markets, and investments in technology, Brazil maintains a strong position in the poultry industry. The high domestic demand, due to consumer preference for chicken meat, contributes to its stability.

Despite that, considering the intense global competition in the poultry meat market, the production chain in Brazil must maintain a proactive stance and develop solutions that adapt to the constantly evolving demands. This includes health concerns, an aspect that is fundamental in all segments of the chain. Even though costs and risks are high, investments in research and development can provide advantages for all components of the production chain. Beyond that, improving competitiveness in the sector can result in both social and economic gains for the nation, through increased product sales.

Although the objectives of this study were achieved, it is important to recognize some limitations, such as the nature of the indicators, which are static and might not be suitable for analysis

over time. Therefore, subsequent research can delve deeper into this topic through the incorporation of dynamic indicators, as well as exploring alternative approaches, such as Gravitational and Dynamic General Equilibrium Models, for a more comprehensive and accurate understanding.

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