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# ASSESSMENT OF THE INTERNATIONAL COMPETITIVENESS OF BEEF OF LITHUANIAN ORIGIN

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**Abstract**
The production and export of Lithuanian beef constitute a significant component of the national economy. However, in recent years, its competitiveness in international markets has been substantially affected by major external factors, including the COVID-19 pandemic, Russia's war in Ukraine, shifting conditions in export markets, fluctuations in raw material and feed prices, and increasingly stringent environmental requirements. This study examines the international competitiveness of the Lithuanian beef sector by evaluating export dynamics and key competitiveness indicators. Using the Revealed Comparative Advantage (RCA) and Relative Trade Advantage (RTA) indices, it was determined that both the COVID-19 pandemic and the war in Ukraine exerted a negative impact on the sector under investigation. Export volumes fluctuated, and significant changes in demand were observed in certain markets. The analysis of international competitiveness demonstrated that, during the period under review, the Lithuanian beef sector exhibited a dynamic character and, despite considerable challenges, managed to adapt to evolving conditions. The findings reveal that although competitiveness declined in some segments, Lithuanian beef exports maintained strong positions within specific product categories. This indicates that the sector possesses the capacity to respond effectively to external shocks and to adjust to the continuously changing international market environment.

***Keywords:*** *International Competitiveness, Beef Sector, Exports, RCA, RTA Index.*
***JEL Codes:*** *E22, F21.*

## Introduction

The food industry is regarded as one of the most significant dynamically developing sectors from both an economic and social perspective. Strengthening competitiveness within the food industry constitutes a prerequisite for sustainable national development (Buturac, Lovrinčević, & Mikulić, 2018). Academic literature acknowledges that the benefits of international trade for countries were identified as early as the period of classical economics; however, the determinants of international competitiveness have evolved continuously within economic theory. Contemporary research examines a broad spectrum of factors influencing international competitiveness. Although numerous definitions of competitiveness can be found in the literature, no universally accepted conceptualization exists. This lack of consensus stems from the complexity of the category and its application across different levels of economic analysis microeconomic and macroeconomic. The importance of competitiveness remains a persistent theme in assessments of advanced economies, and the increasing scholarly and policy-oriented attention to this concept encourages countries to enhance their competitive performance in order to sustain their position in the global economy.

**Research problem.** The cattle sector in Lithuania occupies a significant position within the structure of agriculture and the food industry. It represents one of the most export-oriented branches, with its output demonstrating strong demand in international markets. The recent growth in consumption and trade of beef products indicates considerable competitive potential. Nevertheless, intensifying international competition, rising input costs, geopolitical disruptions, and pandemic-related challenges necessitate a more comprehensive evaluation of the sector's

competitiveness. To assess the sector's development prospects and strategic opportunities, it is essential to identify the determinants of competitiveness, evaluate the impact of external shocks, and analyze the possibilities for strengthening the sector's position in international markets. Although the scientific literature provides general methodologies and theoretical frameworks for assessing competitiveness, there remains a shortage of studies focusing on the specific conditions of the Lithuanian cattle sector, particularly in the context of recent global shocks, including the COVID-19 pandemic and the war in Ukraine. Therefore, this study seeks to address the following research question: how has the international competitiveness of the Lithuanian cattle sector evolved, which factors determine it, and how has it been affected by recent external shocks? **Research objective** – to assess the international competitiveness of Lithuanian beef. **Research tasks:** 1) to analyze the determinants of competitiveness in the cattle sector; 2) to conduct an empirical assessment of the international competitiveness of Lithuanian beef.

This study contributes to the existing body of literature on international competitiveness and may serve as a practical analytical basis for evaluating the competitive performance of agri-food sectors and supporting evidence-based policy and strategic decision-making in international trade.

## Literature review

To enhance the competitiveness of the Lithuanian cattle sector, it is essential to assess the factors influencing its development trajectory. Agricultural policy exerts multifaceted effects on the evolution of international competitiveness, depending on the specific policy instruments employed, their implementation mechanisms, and prevailing international trade conditions. As a Member State of the European Union, Lithuania is committed to implementing the Common Commercial Policy and, together with other Member States, shaping a unified trade framework based on common objectives, principles, and procedures (Jakutis, 2006). Consequently, most institutional and regulatory measures applied to the meat sector are harmonized across the EU. Member States implement a wide range of instruments that directly or indirectly affect the competitiveness of domestic farms and shape international trade flows.

To identify the principal determinants of international competitiveness in the cattle sector, a systematic classification is required. Based on a review of the academic literature and the specific characteristics of the sector, several key groups of determinants may be distinguished: agricultural policy, market opportunities, technological advancement, environmental requirements, state support, and international market conditions. These factors interact dynamically and exert both direct and indirect effects on the sector's competitive advantage in international markets.

Agricultural policy constitutes one of the primary external determinants, shaping the framework of financing, subsidies, and regulatory standards. The level of technological development directly influences production efficiency and productivity, while public support mechanisms facilitate capital accumulation, investment attraction, and farm modernization. Market opportunities, including export destinations and trade partnerships, determine the sector's capacity to adjust to shifts in global demand. Environmental and sustainability considerations are exerting an increasingly significant impact, ranging from livestock production standards to climate change mitigation requirements. Collectively, these determinants define the sector's ability to sustain and strengthen its competitive position internationally.

Gutu (2024) emphasizes that increasing production potential and maintaining a country's international competitiveness require investment in biological innovation, particularly advanced breeding selection and genetic improvement. According to the author, these measures enhance animal productivity, improve feed conversion efficiency, and facilitate the implementation of resource-saving technologies. Insufficient investment in research and development may lead to a deficit in high-technology trade, inadequate workforce skills, and declining productivity,

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thereby undermining a country's competitive advantage in international markets.

One of the most significant structural factors affecting the Lithuanian cattle sector has been the country's accession to the European Union. EU market regulation and support instruments have contributed to strengthening the competitiveness of Lithuania's meat sector in international markets (Jurkėnaitė, 2021). This integration enabled an increase in production volumes and value added, job creation, technological modernization of farms and processing facilities, and numerous additional benefits for the agri-food sector. However, accession also exposed the sector to intensified competition within the EU internal market.

Gapšys et al. (2013), in their analysis of the competitiveness of the Lithuanian cattle sector, identified the most influential determinants affecting the meat industry. Their findings highlight several key factors shaping international competitiveness and farm-level strategic decisions: accumulated farming experience, modernization of slaughterhouses and processing industries, the availability and quality of the feed base, farms' financial capacity, and environmental requirements.

The level of state support constitutes a critical determinant ensuring the competitiveness of beef production. International experience from countries with advanced and efficient agricultural systems demonstrates that intensive sectoral development is unattainable without systematic and long-term government regulation. In many countries, public financial support ensures the profitability threshold necessary for agricultural producers (Dunin, 2011). Beef production, like other agricultural activities, is characterized by objective structural constraints that cannot be eliminated through organizational adjustments alone. These include slow capital turnover, technological continuity requirements, and unpredictable climatic conditions. The objective persistence of these factors substantiates the need for public intervention in the form of subsidies and preferential credit schemes.

Trade liberalization and economic integration can foster international competitiveness by promoting efficiency gains, innovation diffusion, and expanded market access (Cader, Koneczna, & Smol, 2022). Nevertheless, the development of international competitiveness may be significantly constrained by economic and social challenges such as trade deficits, labor shortages, political instability, and related structural vulnerabilities. Moreover, rapid technological progress may generate additional challenges, as it necessitates continuous adaptation and the acquisition of new skills to maintain competitive performance.

Erokhin, Ivolga, and Heijman (2014) argue that state intervention in agriculture and the food industry may be not only necessary but also beneficial for enhancing international competitiveness. Through price stabilization mechanisms, subsidies, and the provision of public goods, governments can create an enabling environment for agribusiness and farmers. Such measures encompass the adoption of advanced technologies, marketing support, infrastructure development, and the strengthening of financial and transport networks. Furthermore, governments may promote crop insurance systems, advisory services in rural areas, and the overall improvement of rural infrastructure. These actions contribute not only to national sectoral growth but also to deeper integration into international trade and broader economic development.

Enhancing production potential requires the application of biological innovation systems and advances in selective breeding that strengthen genetic potential—an essential determinant of productivity, efficient feed utilization, and the development of resource-saving technologies aimed at improving production intensity and efficiency (Mazurenko, 2012). The advancement of innovation processes in the sector is closely linked to increasing animal productivity while simultaneously reducing production costs, particularly feed-related expenditures.

In summary, the Lithuanian cattle sector remains one of the most significant components of the national agricultural system, exerting a substantial impact on economic performance, social stability, and regional development. Its international competitiveness depends on a complex set of determinants, including the intensity of state support, investment in technological

modernization, research and innovation, and the capacity to adapt to global shocks. Lithuania's accession to the European Union ensured broader access to financial instruments and expanded export opportunities, while simultaneously introducing new competitive pressures. The sector's resilience has been demonstrated by its successful adaptation to the consequences of the COVID-19 pandemic and the war in Ukraine, which altered trade flows and market conditions. In this context, the cattle sector emerges not merely as an economic activity but as a strategic instrument capable of contributing to the strengthening of Lithuania's competitiveness in the global agri-food market.

## Methodology

In examining the international competitiveness of the Lithuanian cattle sector, statistical data published in the databases of the United Nations and the International Trade Centre of UNCTAD/WTO (International Trade Centre, ITC) are employed. The analysis is conducted according to the Combined Nomenclature (CN) product codes, specifically:

020120 – Fresh or chilled bovine cuts, bone-in (excluding carcasses and half-carcasses).

020130 – Fresh or chilled boneless bovine meat.

020110 – Fresh or chilled bovine carcasses and half-carcasses.

020230 – Frozen boneless bovine meat.

020220 – Frozen bovine cuts, bone-in (excluding carcasses and half-carcasses).

020210 – Frozen bovine carcasses and half-carcasses.

The data provided in the United Nations and WTO International Trade Centre databases are expressed both in monetary terms (thousand euros) and in physical quantities (tones). In assessing the international competitiveness of the Lithuanian cattle sector using the most recent statistical data, the sector's performance will be analyzed across different phases of the economic cycle. Accordingly, the selected study period covers 2006–2024.

One of the principal indicators used to evaluate the international competitiveness of the Lithuanian cattle sector is the Revealed Comparative Advantage (RCA) index. The RCA index is calculated as the ratio of a given product's share in a country's total exports to the corresponding share of that product in global exports or in a selected group of countries (Wosiek & Visvizi, 2021). Kuzmenko, Rumankova, Benešová, and Smutka (2022) present the RCA formula as follows:

$$RCA_{ij} = \frac{\left(X_{ij} / \sum_j X_{ij}\right)}{\left(\sum_i X_{ij} / \sum_i \sum_j X_{ij}\right)} \quad (1)$$

Where:

$RCA_{ij}$– the revealed comparative advantage index of the country under analysis for a specific product.

$X_{ij}$– exports of product $i$by country $j$;

$\sum_j X_{ij}$– total exports of the country under analysis.

$\sum_i X_{ij}$– global (or group-of-countries) exports of product $i$;

$\sum_i \sum_j X_{ij}$– total world exports.

The Relative Trade Advantage (RTA) index is calculated as the difference between the Relative Export Advantage (RXA) and the Relative Import Advantage (RMA). The calculation of RXA is identical to that of the RCA index, i.e.:

$$RXA = RCA \quad (2)$$

where $RXA$denotes the relative export advantage.

Thus, to compute RTA, it is necessary to calculate the RMA index and determine the difference between these two indicators. Pawlak and Smutka (2022) provide the following formula for the Relative Import Advantage (RMA) index:

$$RMA = \frac{\left(M_{ij} / \sum_j M_{ij}\right)}{\left(\sum_i M_{ij} / \sum_i \sum_j M_{ij}\right)} \quad (3)$$

Where:

$M_{ij}$– imports of product $i$by country $j$;

$\sum_j M_{ij}$– total imports of the country under analysis.

$\sum_i M_{ij}$– global (or group-of-countries) imports of product $i$;

$\sum_i \sum_j M_{ij}$– total world imports.

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The study also employs the Export Specialization Shift Level (SL), calculated according to Vitunskienė and Serva (2014). The SL indicator is defined as the ratio between the International Competitiveness Position in a selected market (LCI) and the Revealed Comparative Advantage (RCA):

$$SL = \frac{\left(X_{ij}^{k} / \sum_{k} X_{ij}^{k}\right) \Big/ \left(\sum_{k} M_{ij}^{k} / \sum_{k} \sum_{i} M_{ij}^{k}\right)}{\left(X_{ij}^{k} / \sum_{k} X_{ij}^{k}\right) \Big/ \left(\sum_{k} X_{ij}^{k} / \sum_{k} \sum_{i} X_{ij}^{k}\right)} \quad (4)$$

Where:

$SL$– export specialization shift level.
$k$– specific product.
$i$– exporting country.
$j$– importing country.

These methodological instruments enable a comprehensive evaluation of Lithuania's competitive performance in the international beef market, incorporating both export structure and trade balance dimensions.

## Research results

Table 1 presents an assessment of the competitiveness of Lithuanian beef products over the period 2010–2024 based on the RCA and RTA indices. The evaluation is grounded by the average values of both indices calculated for the entire period under analysis. A positive ("+") sign indicates that the respective product group was competitive according to the given index, whereas a negative ("–") sign denotes the absence of a revealed competitive advantage.

**Table 1. Assessment of the competitiveness of Lithuanian beef products in 2010–2024 based on the RCA and RTA indices**

| Product code | Product description | RCA | RTA |
|---|---|---|---|
| 020120 | Fresh or chilled bovine cuts, bone-in (excluding carcasses and half-carcasses) | + | + |
| 020130 | Fresh or chilled boneless bovine meat | + | + |
| 020110 | Fresh or chilled bovine carcasses and half-carcasses | + | + |
| 020230 | Frozen boneless bovine meat | - | - |
| 020220 | Frozen bovine cuts, bone-in (excluding carcasses and half-carcasses); | - | - |
| 020210 | Frozen bovine carcasses and half-carcasses | - | - |

According to the RCA index, three product groups demonstrated competitiveness: fresh or chilled bovine cuts, bone-in (020120); fresh or chilled boneless bovine meat (020130); and fresh or chilled bovine carcasses or half-carcasses (020110). These groups recorded average RCA values exceeding the threshold value of one, indicating a revealed comparative advantage in the context of global export structures.

The RTA index, which additionally incorporates the import dimension, assigned a positive competitiveness evaluation to the same three product groups. This finding suggests that these products were not only significant within Lithuania's export structure but also maintained a relative advantage when compared to imports, thereby exhibiting a stronger net trade position.

The remaining product groups frozen boneless bovine meat (020230), frozen bone-in cuts (020220), and frozen carcasses or half-carcasses (020210) were assessed as non-competitive ("–") under both the RCA and RTA indices. Their average values did not exceed the critical benchmark, implying the absence of a distinct trade advantage.

In summary, only a subset of Lithuanian beef products primarily fresh or chilled categories demonstrated international competitiveness, whereas frozen products did not exhibit significant competitive performance indicators in the global market.

Table 2 presents the average values of the RCA, RTA, and SL indices calculated for various Lithuanian beef product groups during the period 2010–2024. These data enable an evaluation of Lithuania's level of export specialization in beef products, its international competitiveness, and its trade balance position, applying relative advantage and trade flow analysis methodologies.

**Table 2. Average values of the RCA, RTA, and SL indices by Lithuanian beef product groups in 2010–2024**

| Product code | Product description | Average RCA (2010–2024) | Average RTA (2010–2024) | Average SL (2010–2024) |
|---|---|---|---|---|
| 020120 | Fresh or chilled bovine cuts, bone-in (excluding carcasses and half-carcasses) | 2.93 | 0.86 | 4.47 |
| 020130 | Fresh or chilled boneless bovine meat | 1.01 | 0.44 | 1.92 |
| 020110 | Fresh or chilled bovine carcasses and half-carcasses | 3.01 | 2.47 | 16.87 |
| 020230 | Frozen boneless bovine meat | 0.49 | -0.77 | 0.46 |
| 020220 | Frozen bovine cuts, bone-in (excluding carcasses and half-carcasses) | 0.05 | -0.29 | 0.35 |
| 020210 | Frozen bovine carcasses and half-carcasses | 0.03 | -0.07 | 0.33 |
| The Lithuanian beef sector | | 1.25 | 0.44 | 4.07 |

According to the average value of the Revealed Comparative Advantage (RCA) index, the highest competitive advantage during the period under analysis was observed in the product group "fresh or chilled bovine carcasses and half-carcasses" (code 020110), with an average value of 3.01. This indicator suggests that Lithuania demonstrates a substantially higher level of export specialization in this product category compared to the global average. A high RCA value reflects a strong capacity to compete in international markets and may be associated with a well-developed processing infrastructure, efficient supply chains, and relatively stable external demand for this product segment.

The second-highest RCA value was recorded for the product group "fresh or chilled bovine cuts, bone-in (excluding carcasses and half-carcasses)" (020120), with an average of 2.93. This confirms the structural tendency that the competitive potential of the Lithuanian beef sector is concentrated primarily in the export of fresh and chilled meat products.

In contrast, the remaining product groups exhibit RCA values close to or below the threshold value of one, indicating limited or absent comparative advantage. The lowest RCA values were observed in the frozen beef segments specifically product groups 020210 and 020220 where the index values did not reach 0.1. Such results imply either negligible export volumes or an almost non-existent export orientation in these categories, potentially due to technological constraints, logistical inefficiencies, or insufficient demand in target markets.

The analysis of the Relative Trade Advantage (RTA) index reveals an even more pronounced differentiation among product groups. The highest average RTA value was again recorded for product group 020110, reaching 4.07, which indicates clear export specialization and a positive trade balance in this segment. Conversely, the frozen beef categories

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(020210 and 020220) exhibited negative RTA values (–0.28 and –0.07, respectively), suggesting either higher import volumes than exports or extremely weak export performance. These findings point to insufficient competitive capacity within this particular market niche.

The additional evaluation using the Specialization Level (SL) index provides further insight into the degree of export orientation of each product group. The highest average SL value was likewise recorded for product group 020110, reaching 16.87 substantially exceeding the values observed for other product categories. The second highest SL value (4.47) was identified for product group 020120, while the remaining products displayed low or negative SL values. Particularly weak results were observed in the frozen meat categories, where the index values were close to zero or negative, indicating a minimal degree of export specialization. Such outcomes suggest a predominance of domestic market orientation or an underdeveloped production base for export purposes.

In summary, during the period 2010–2024, the Lithuanian beef sector demonstrated pronounced specialization in the export of fresh and chilled beef products, particularly carcasses and their components. The indicators of comparative advantage, trade balance, and export specialization consistently reveal significant competitive potential within this segment. In contrast, the export performance of frozen beef products remains notably weak, suggesting the presence of technological or logistical constraints and highlighting untapped development potential. To enhance the overall competitiveness of the sector in the future, it may be strategically appropriate to consider investments in cold-chain infrastructure, product diversification, and targeted international marketing strategies aimed at expanding market presence in frozen beef segments.

## Conclusion

Competitiveness encompasses not only economic performance, but also the capacity to adapt to changing market conditions, sustain export volumes, and generate competitive advantage at both the national and sectoral levels. The principal determinants of competitiveness, particularly international competitiveness are commonly identified as productivity, innovation, technological advancement, macroeconomic stability, a favorable institutional environment, and the ability to respond swiftly and effectively to global shocks.

Considering the specific characteristics of the sector, three principal indicators were selected: the Revealed Comparative Advantage (RCA) index, the Relative Trade Advantage (RTA) index, and the Specialization Shift Level (SL) index. These indicators enable a comprehensive assessment of the sector's competitive position, revealing its structural strengths and dynamic performance in international markets.

The empirical analysis of the international competitiveness of Lithuanian beef was conducted using the RCA, RTA, and SL indices. The results indicate that during the period 2010–2024, the Lithuanian beef sector underwent a significant structural transformation—from a strong dependence on the Russian market toward increased orientation to Western European markets. The findings reveal that the most competitive product groups were fresh or chilled bovine carcasses (CN 020110) and fresh or chilled bone-in bovine cuts (CN 020120), which recorded the highest RCA, RTA, and SL values.

In contrast, the frozen beef segments particularly CN 020230 and CN 020220 remained structurally weak, characterized by a negative trade balance and a low level of export specialization. Although the overall competitive position of the sector remained positive, a downward trend has been observed in recent years. This decline can be attributed to external shocks, including the COVID-19 pandemic and Russia's war against Ukraine, which disrupted trade flows and altered market condition.

The results of this study may be valuable for the formulation of agricultural and trade policies, particularly in assessing the international competitiveness of the Lithuanian beef sector and identifying priority export markets. The findings can be applied by public authorities when designing

sectoral development strategies, export promotion programs, and policy measures aimed at strengthening structurally weaker product segments. Furthermore, the conclusions may be useful for business entities such as meat processing companies, exporters, and other stakeholders in the agricultural sector when making strategic decisions related to production structure, market diversification, and investments in higher value-added products. From an academic perspective, the study may also serve as an empirical basis for further research on international competitiveness, agricultural trade, and structural transformation within agri-food sectors.

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