VISUAL ANALYSIS OF AVERAGE IMPORT AND EXPORT PRICES OF KEY AGRI-FOOD PRODUCTS: TRENDS, NETWORKS, AND REGIONAL PATTERNS

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Abstract

This paper explores the evolution of average import and export prices for 24 agri-food categories of products in 2005-2024 period, using data for international trade, provided by Intracen.org. The analysis focuses on identifying cross-country differences and product-level price asymmetries. To enhance the interpretability of results, the study employs VOSviewer for mapping keyword networks derived from Web of Science database, querying the "average import and export prices of key agri-food products". Also, in this paper the Export Potential Map was used for a multi-dimensional understanding of how agri-food trade prices evolve within global and regional contexts. By combining visual analytics and network mapping, the study offers an accessible approach to understanding the dynamics of agri-food price formation and its economic implications.

Keywords: *agri-food trade, Intracen.org, import/export prices, visualization*

JEL Classification: *Q17, F14, R12*

1. Introduction

International trade is essential for agri-food markets because it improves global food availability and efficiency. It allows countries to specialize according to their comparative advantages and to exchange surplus and deficit products. Trade helps stabilize food supplies and prices, especially during climate or production shocks. It also supports income growth for farmers and improves access to more diverse and nutritious diets. Academic studies show that open agri-food trade strengthens food security and increases resilience in national food systems (Anderson & Strutt, 2014; Dithmer & Abdulai, 2017; Martin & Anderson, 2012).

The objective of the paper is to analyze trends and differences in average import/export prices of 24 categories of agri-food products. This paper helps at understanding price movements helps assess competitiveness, market integration, and food security. The key research questions proposed for the paper: "How have import and export prices evolved over time?" and „Which products show the highest price volatility?".

Many studies have examined international trade in agri-food products, focusing on how prices are formed and what they say about competitiveness and market trends. The average import and export prices are important indicators that show how competitive a country's agricultural products are on the world market (Anderson & Nelgen, 2012). These prices depend not only on production costs, but also on product quality, trade policies, and transport costs (Baffes & Dennis , 2013).

Higher export prices compared to import prices generally indicate that a country supplies more competitive or higher-quality products. Research also shows that global food prices are strongly influenced by shocks such as financial crises and geopolitical conflicts, with uneven effects across countries. Major global crises have been a key driver of price volatility in agri-food markets. Studies by Clapp (2020) and Glauber (2023) demonstrate that the 2008 financial crisis, the COVID-19 pandemic, and the 2022 war in Ukraine severely disrupted agri-food supply chains, leading to significant divergences between import and export prices, especially for cereals, vegetable oils, and meat products.

For a deep understanding of the literature regarding import and export prices, the first 3 most recent and the first 3 most cited in Web of Science, when query the expression "average import and export prices of key agri-food products" were analyzed in Table 1 and Table 2.

Table 1. Top 3 new articles on Web of Science in the field of "average import and export prices of key agri-food products"

Title	Authors	Summary	Methodology	Results
Navigating Global Agri-food Markets: An Entropy-Based TOPSIS Approach for Strategic Diversification of Türkiye's Dried Apricot Exports	Meral, Huseyin; Ozdemir, Yunus Emre; Gunduz, Orhan	The study explores alternative export markets for Türkiye's dried apricots through a data-driven approach. The findings highlight the importance of market diversification for achieving sustainable export growth. A combined entropy–TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) multi-criteria decision model was applied to 15 importing countries, incorporating trade, tariff, and distance data to assess market attractiveness. The analysis identified the U.S., Canada, the U.K., France, Germany, and China as priority markets. To ensure long-term growth, Türkiye should focus on diversified and sustainable markets while implementing supportive trade and quality policies.		
Livestock Sector in Serbia: Challenges, Structural Gaps, and Strategic Pathways Towards Sustainability	Milicevic, Dragovan; Samolovac, Ljiljana; Lukic, Milos; Milicevic, Dragan	Serbia's livestock sector is challenged by declining animal numbers, low productivity, and weak competitiveness in both domestic and EU markets. Contributing factors include fragmented farms, outdated technologies, limited innovation, rural depopulation, poor alignment of policies with the EU Common Agricultural Policy (CAP) and Green Deal, climate change, animal diseases, and broader macroeconomic pressures. The sector should modernize production systems, strengthen farmer organizations, enhance biosecurity and animal welfare, and align policies with EU sustainability objectives.		
Heterogeneous regulations and imports: evidence from China's agri-food standards	Zhou, Huiying; Wang, Xuejun	The study examines the trade effects of China's agri-food standards using country-product-level data from 2000 to 2022 and a structural gravity model. Matched trade data are analyzed to estimate how different types of standards affect imports and product quality. The results indicate that agri-food standards generally reduce imports in both value and volume, with national mandatory standards being the most trade-restrictive. In contrast, voluntary and international standards, especially for differentiated and		

				processed products, can promote trade. The restrictive effects are largely driven by compliance costs, and the impacts vary across source countries, with stronger trade gains observed from low-income exporters.

Source: author's own contribution

Table 1 illustrates current academic efforts to apply quantitative methodologies to understand the interaction between trade policies, standards, and sustainability in the agri-food sector. The Table presents an overview of the three most recent articles indexed in the Web of Science that address key issues in agri-food trade and sectoral sustainability. The studies examine how international markets, regulatory frameworks, and structural conditions shape competitiveness and trade performance.

Table 2. Top 3 most cited articles on Web of Science in the field of "average import and export prices of key agri-food products"

Title	Authors	Summary	Methodology	Results
Agricultural tariffs or subsidies: Which are more important for developing economies?	Hoekman, B; Ng, F and Olarreaga, M	The article analyzes the impact of reducing agricultural subsidies and border protection in OECD countries on the exports, imports, and welfare of developing economies. A simple partial equilibrium model of global trade in commodities receiving domestic support or export subsidies is employed, estimating relevant elasticities to assess effects on trade flows and welfare. Results indicate that a 50% reduction in border protection has a substantially larger positive effect on exports and welfare of developing economies compared with a 50% reduction in agricultural subsidies.		
Sit down at the ball game: How trade barriers make the world less food secure	Rutten, M; Shutes, L and Meijerink, G	The study examines the effects of wheat trade policies on producers, consumers, terms of trade, and trade tax revenues, emphasizing implications for food security through price and income changes. Stylized experiments in the wheat market are conducted using the GTAP model. The results show that major exporters benefit from export taxes aimed at food security, while net importers generally experience losses. Export restrictions by large exporters contribute to greater world price volatility. Liberalizing wheat trade helps mitigate price increases and supports food security, but it also reduces production in Africa and Asia, increasing these regions' dependence on global markets.		
Simulating the two views of the British Industrial Revolution	Harley, CK and Crafts, NFR	A computational general equilibrium (CGE) model demonstrates that productivity gains in cotton and iron industries drove export growth during the British Industrial Revolution, while the demand for food imports further supported overall exports, reinforcing the "new view" of industrial growth. The model incorporates diminishing returns in agriculture, reflecting land scarcity under rapid population expansion. Sector-specific productivity improvements in cotton and iron were the primary drivers of exports in those sectors, while the need for food imports stimulated wider export activity, highlighting the interconnected nature of trade patterns.		

Source: author's own contribution

Table 2 provides a synthesized narrative of the three most cited studies that examine the role of trade policy and structural change in shaping economic and food security outcomes.

The studies highlight, in an academic context, the central role of trade policies, market structures, and productivity dynamics in influencing trade patterns, welfare, and food security across different economic settings.

2. Data and Methodology

The study is based on statistical data provided by Intracen.org, an internationally recognized platform for global trade analysis. The analysis focuses on the first 24 categories of agrifood products available on Intracen.org, selected due to their economic relevance and the consistency of reported data. These product categories allow for a coherent and comparable assessment of trade developments within the agrifood sector. Before of this analysis, a short bibliometric analysis was presented in order to understand the research topic most important for the theme of "average import and export prices of key agri-food products".

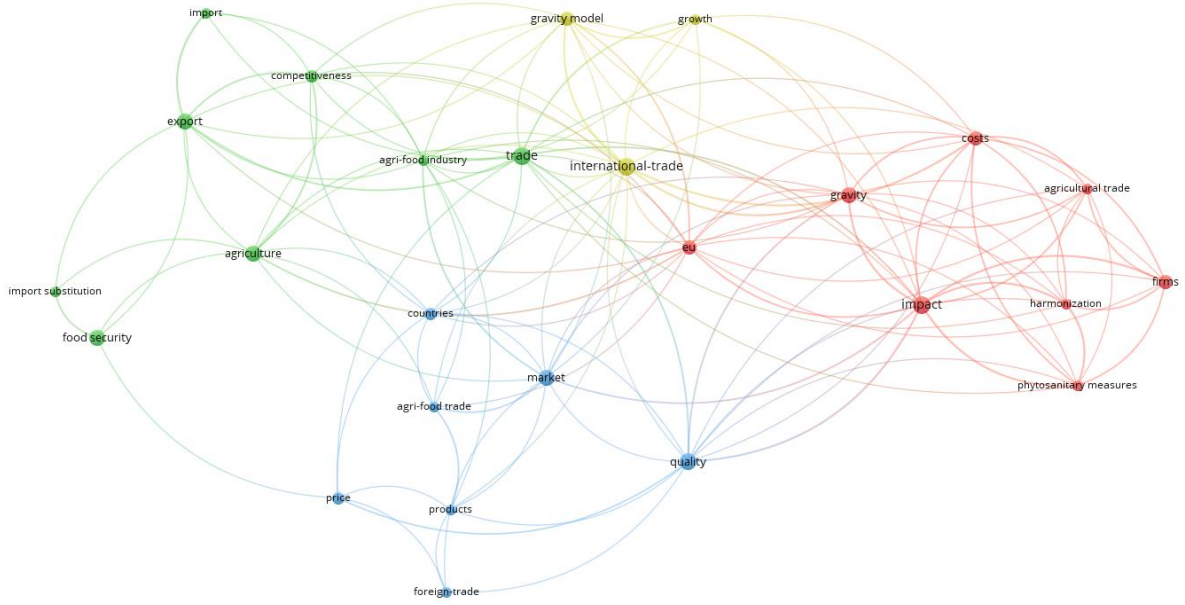
The indicators analyzed include trade value (expressed in thousand euros), trade quantity (tonnes), and calculated price, defined as the ratio between trade value and quantity (thousand euros per tonne). The study covers the period 2005–2024, enabling the identification of long-term trends, short-term fluctuations, and structural changes in agrifood trade. This methodological approach provides a solid basis for evaluating market dynamics and product competitiveness.

The Export Potential Map was used and analyzed for the two key agri-food product categories that experienced significant changes between 2005 and 2024 regarding the import and export average prices: cocoa butter and fats & oils for exports, and vegetables for imports

3. Results and discussions

A review of the scientific literature using the Web of Science database yielded 127 relevant records, comprising 112 articles and 17 proceedings papers, when searching for studies related to the "average import and export prices of key agri-food products". A keyword analysis of these publications highlighted recurring themes and concepts associated with international trade, price fluctuations, and market dynamics in the agri-food sector, as represented in Figure

Figure 1. Keywords analysis

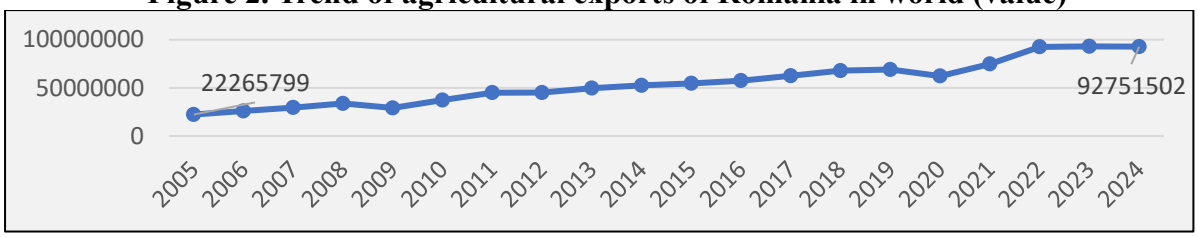


Source: authors own contribution

The thematic analysis of the literature on agri-food trade reveals distinct research focuses across different conceptual clusters. The green cluster highlights the relationship between exports and food security, indicating studies that explore how agricultural exports can either support or challenge domestic and global food availability. The orange cluster positions "international trade" as the central conceptual hub, reflecting the prominence of trade-related issues in the examined literature. The blue cluster emphasizes market structure, product differentiation, and quality standards, illustrating the attention given to competitive dynamics and regulatory frameworks in international markets. Finally, the red cluster points to the role of firms and policy impacts, suggesting an interest in the microeconomic effects on agricultural and agricultural food trade. Together, these clusters provide a structured overview of the diverse research directions in the field, linking macro-level trade considerations with firm-level and policy-driven analyses.

3.1. Exports

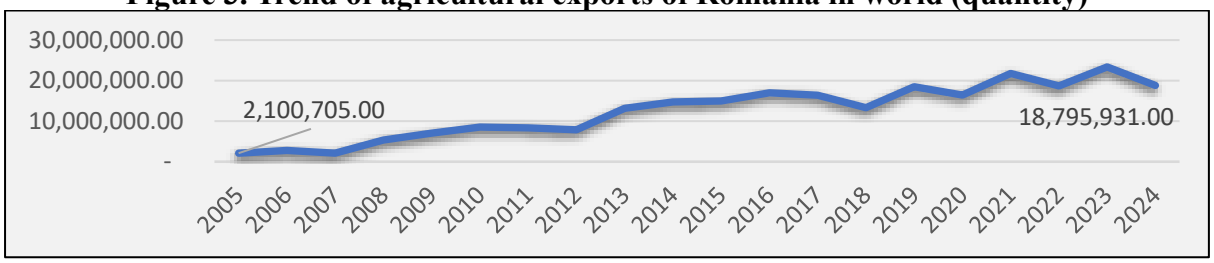
Figure 2. Trend of agricultural exports of Romania in world (value)



Source: authors own contribution

The evolutionary trajectory of Romania's agricultural exports to the global market between 2005 and 2024 reveals a sustained and robust upward trend, reflecting the sector's increasing competitiveness. According to the data presented in Figure 2, the export value rose from 22,265,799 thousand euro in 2005 to 92,751,502 thousand euro by 2024. This represents an overall growth of 416.56% over the two-decade period. This expansion underscores Romania's strengthening position as a key regional provider of agricultural commodities and suggests a successful alignment with international quality standards and market demands.

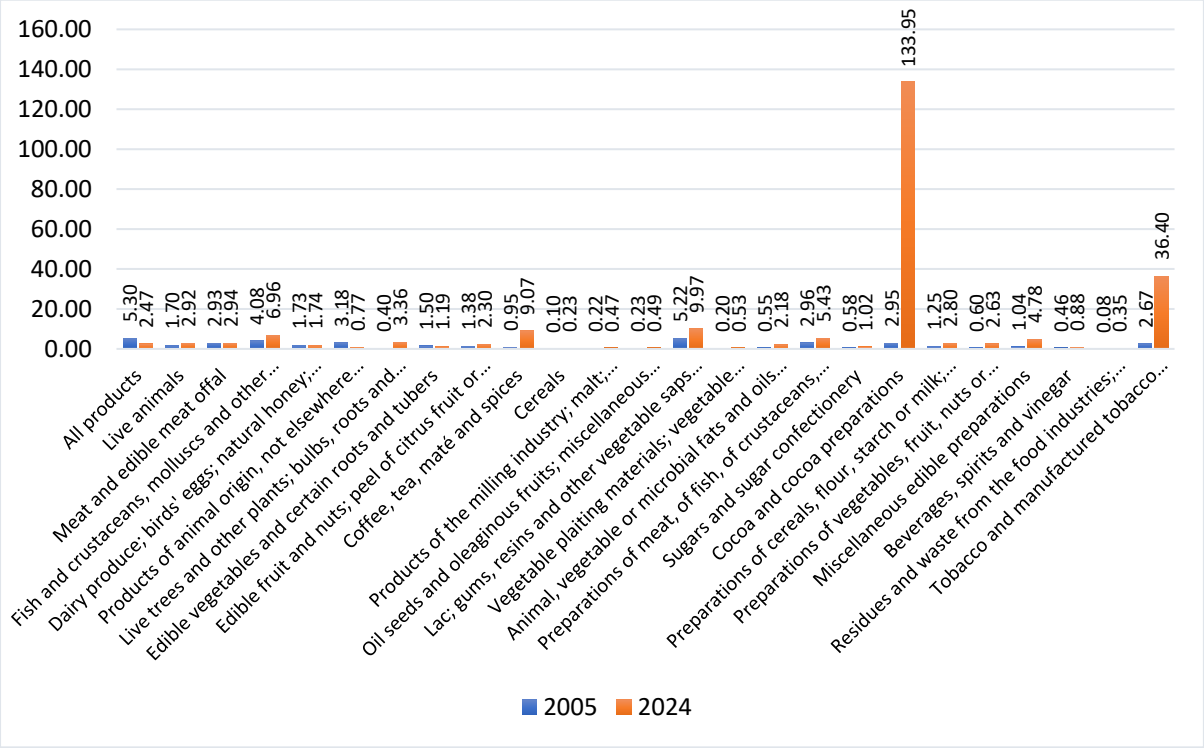
Figure 3. Trend of agricultural exports of Romania in world (quantity)



Source: authors own contribution

In terms of physical volume, Romania's agricultural exports have demonstrated an even more aggressive expansion than their monetary value, as illustrated in Figure 3. Starting from a base of 2,100,705 tons in 2005, the total quantity of exported products climbed to 18,795,931 tons by 2024. This progression represents a total increase of 894.7% over the period analyzed. The nearly tenfold increase in exported volume underscores a massive scaling of Romania's logistical and production capacity within the global agricultural trade network.

Figure 4. Dynamics of average export prices of agricultural products in 2005 and in 2024 (tousand euro/tonne)

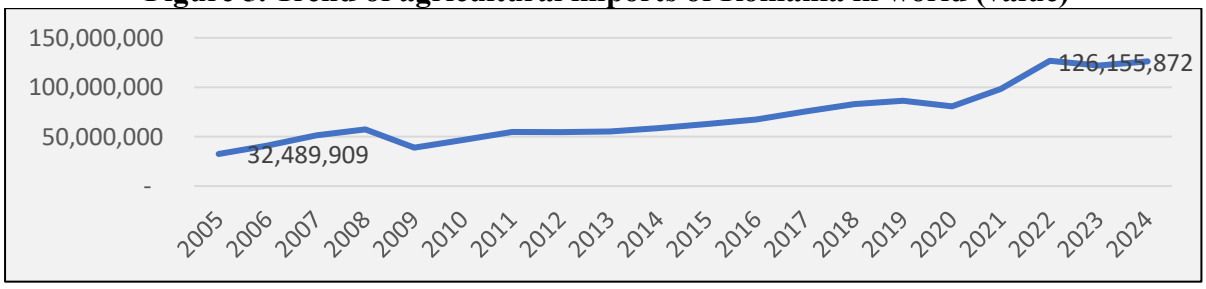


Source: authors own calculations

An analysis of the average export prices for Romanian agricultural products reveals a significant shift in the value proposition of specific sectors over the nearly two-decade period. While the aggregate average price for "All products" saw a slight shift from 5.30 to 2.47 thousand euro/tonne, this figure hides large increases in high-value-added categories. The most prominent growth is observed in "Cocoa and cocoa preparations," where average prices rose from 2.95 in 2005 to 133.95 thousand euro/tonne in 2024, indicating a deep shift toward premium processed goods. Other sectors, such as "Coffee, tea, maté and spices" (increasing from 0.95 to 9.07 thousand euro/tonne) and "Lac; gums, resins and other vegetable saps" (increasing from 5.22 to 9.97 thousand euro/tonne), underscore a trend toward the export of more expensive, specialized commodities. These data points suggest that while the total volume of exports has expanded, the economic impact is increasingly driven by niche industrial processing and high-value product groups rather than primary raw materials alone.

3.2. Imports

Figure 5. Trend of agricultural imports of Romania in world (value)

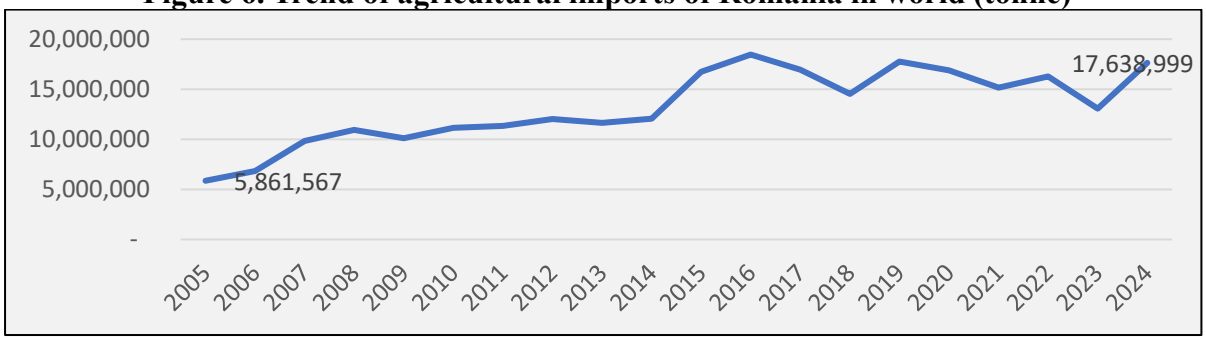


Source: authors own contribution

The data presented in Figure 5 illustrates a significant rise in the value of Romania's agricultural imports between 2005 and 2024, characterized by a cumulative growth of 388.29%. While the period between 2010 and 2019 shows a steady, linear increase in import reliance, an acceleration is observed following the 2020 pandemic period, culminating in a peak of 126,155,872 thousand euro by 2024. This exponential rise likely reflects the combined

impact of heightened domestic demand for processed food products, the erosion of local processing capacities, and the global inflationary pressures on commodity prices.

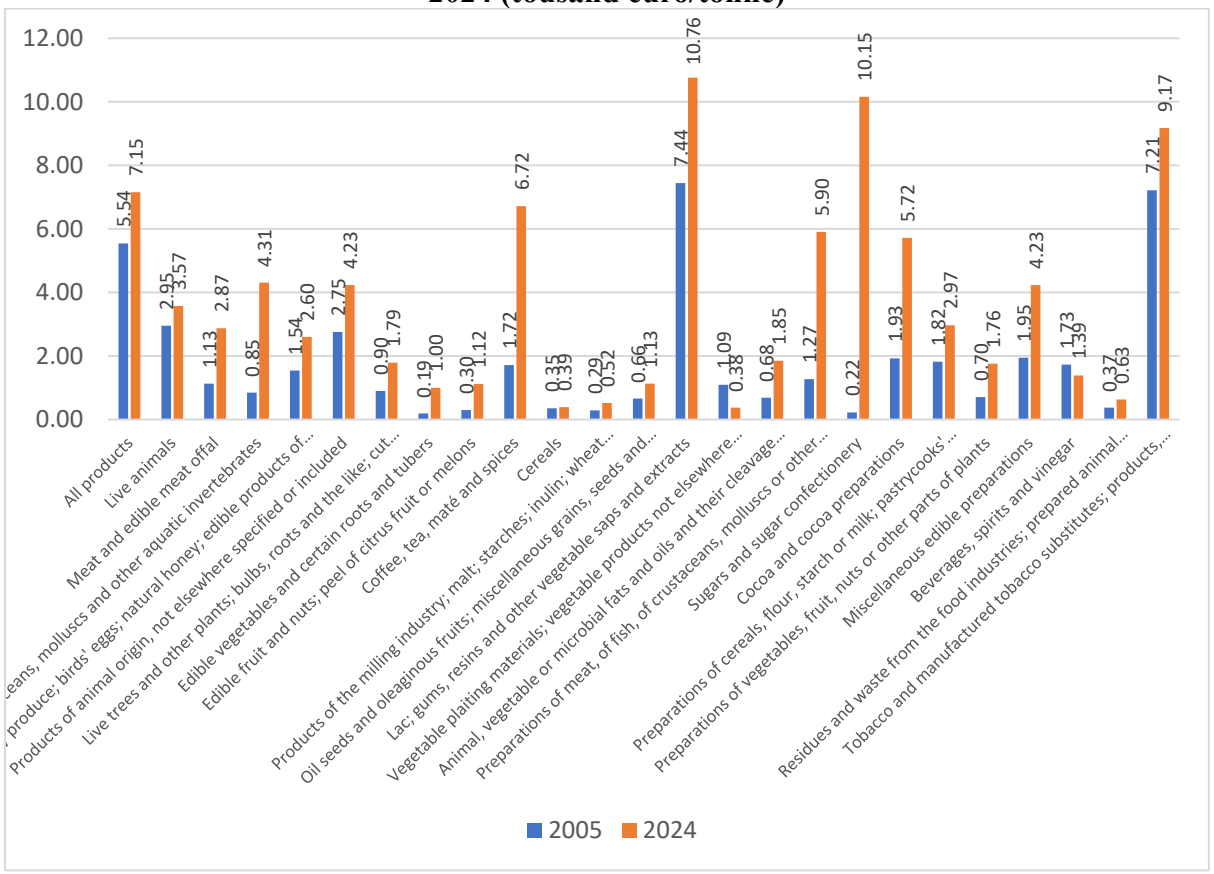
Figure 6. Trend of agricultural imports of Romania in world (tonne)



Source: authors own contribution

The data presented in Figure 6 reveals a substantial growth in the quantity of agricultural products imported by Romania between 2005 and 2024. Starting from approximately 5.86 million tons in 2005, imports reached a peak of 17.64 million tons by 2024, representing a total increase of 300.93%. While the trend shows a steady climb during the first decade, a more volatile pattern emerges after 2014, characterized by a spike in 2016. These variations reflect shifts in domestic production capacities, changing consumer demands, and Romania's deeper integration into global supply chains.

Figure 7. Dynamics of average import prices of agricultural products in 2005 and in 2024 (tousand euro/tonne)



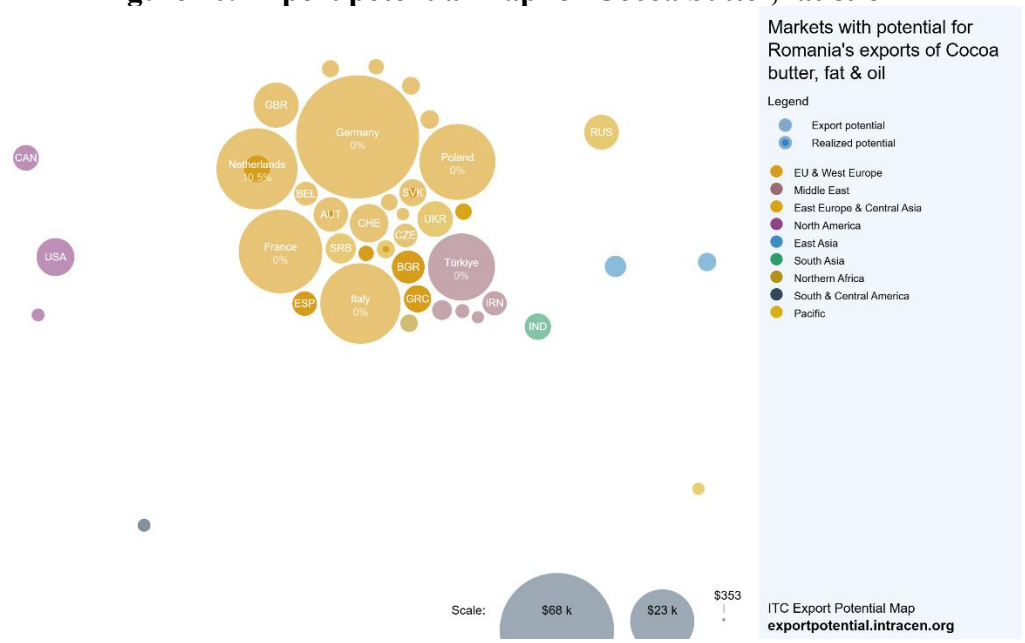
Source: authors own calculations

The comparative analysis of average import prices for agricultural products between 2005 and 2024 reveals a upward trend, reflecting broader global inflationary pressures and shifting supply chain costs over the nearly two-decade period. "All products" category shows

a significant increase, rising from 5.54 to 7.15 thousand euro/tonne. However, the most evident fluctuations are observed in specialized high-value sectors: Sugar and sugar confectionery, from 0.22 to 10.15 thousand euro/tonne, Coffee, tea, maté, and spices from 1.72 to 6.72 thousand euro/tonne, Fish and crustaceans, from 0.85 to 4.31 thousand euro/tonne, which may correlate with declining wild stocks and the higher operational costs of aquaculture. A few sectors remained stable or experienced minor declines, such as Vegetable plaiting materials and Beverages, spirits, and vinegar, suggesting more resilient supply chains or stabilized market demand in these specific niches.

The Export Potential Map was used and analyzed for the 2 important categories of agri-food products that had major changes during the period 2005-2024, such as: cocoa butter, fat & oil in case of exports and vegetables in case of imports.

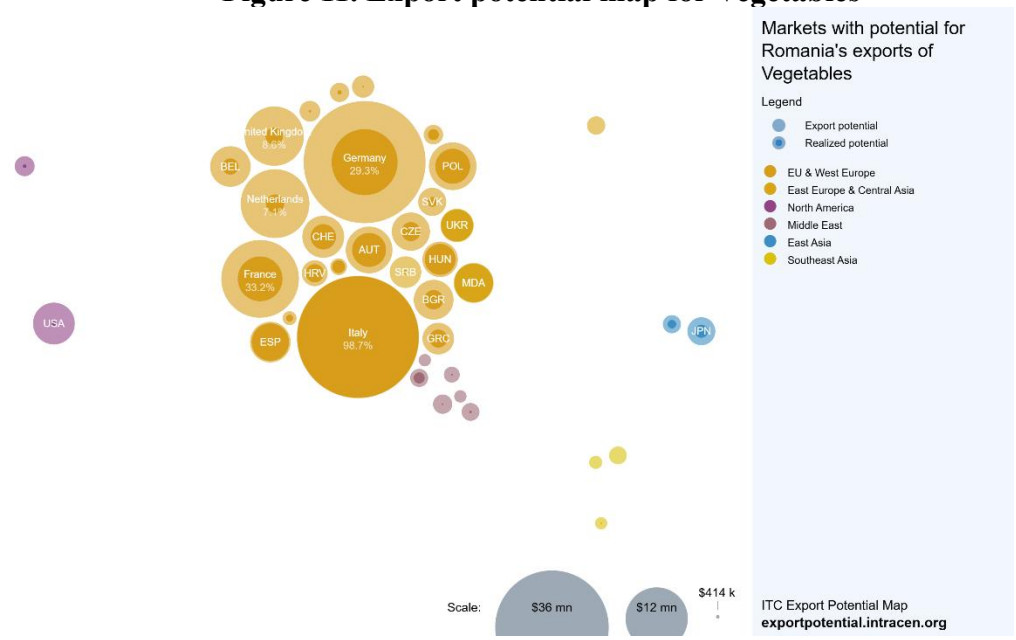
Figure 10. Export potential map for Cocoa butter, fat & oil



Source: Export Potential Map provided by Intracen.org

The Figure 10 reveals that Germany, the Netherlands, France, and Poland are the markets with the highest export potential for Romania's cocoa butter, fat, and oil, heavily concentrated within the EU and Western Europe. A critical takeaway is the severe underutilization of this potential: except for the Netherlands, which shows a modest 10.5% realization, all other major markets (Germany, France, Italy, Poland, and Türkiye) stand at 0% realized potential. This indicates a near-total absence of actual exports to these high-demand regions. Despite theoretical opportunities in North America (USA, Canada) and parts of Central Asia, the lack of blue "realized" indicators across almost the entire map suggests that Romania is currently failing to capitalize on its production capacity for these goods, leaving a vast, untapped market right on its doorstep.

Figure 11. Export potential map for Vegetables



Source: Export Potential Map provided by Intracen.org

Based on the ITC Export Potential Map, the export landscape for Romanian vegetables is heavily concentrated within EU & West Europe, with Italy and Germany emerging as the most significant markets. Italy stands out for its high level of market saturation, having achieved 98.7% of its potential, whereas Germany (29.3%), France (33.2%), and the United Kingdom (8.6%) represent substantial untapped opportunities where the total export potential (indicated by the light outer circles) far exceeds current trade levels. While regional neighbors like Poland, Hungary, and Moldova show clear relevance due to proximity, more distant markets such as the USA and Japan remain largely aspirational or underutilized, suggesting that Romania's competitive advantage in this sector is currently strongest within the European single market's logistics and regulatory framework.

4. Conclusions

The bibliometric analysis, through the keyword analysis, shows that the research field is centered on international trade within agricultural and agri-food contexts, suggesting a strong focus on price volatility, trade policies, and the economic factors influencing both imports and exports, providing a comprehensive overview of the current state of knowledge in this field.

The data shows a significant upward trend in Romania's agricultural exports between 2005 and 2024. The export value increased by 416.56%, while the export quantity grew by an impressive 894.7%. The trend reflects improvements in production capacity, competitiveness, and possibly diversification of exported agricultural products. Regarding the exports, between 2005 and 2024 the value increased by 388%, while the import quantity grew by 300%.

Between 2005 and 2024, Romania's agricultural exports shifted toward high-value, processed, and specialized products, with premium sectors like cocoa, coffee, and resins driving most of the economic gains despite modest changes in the overall average price. In the same period, average import prices for Romanian agricultural products generally increased, especially in high-value sectors like sugar, coffee, and fish, while a few categories remained stable, reflecting both global cost pressures and sector-specific supply dynamics.

The analysis of export potential highlights a significant underutilization of Romania's agricultural production capacity, particularly for high-value products like cocoa butter, fat, and oil, as well as vegetables. While EU and Western European markets, especially Germany,

France, Italy, the Netherlands, and Poland, offer the largest opportunities, actual exports remain minimal or highly concentrated, with Italy being nearly saturated for vegetables but other key markets largely untapped. This indicates that Romania has substantial room to expand exports within its closest and most accessible markets, while opportunities in North America, Central Asia, and other distant regions remain mostly unrealized.

To fully realize the export potential, Romania should focus on enhancing processing and value-added capabilities. Developing strong branding, quality certification, and market-specific promotion strategies would further strengthen Romania's competitiveness, particularly in high-income and niche markets. Lastly, improved market intelligence, partnerships, and participation in international trade networks will be key to translating export potential into tangible results.

Acknowledgement

This work was supported by a grant offered by the Bucharest University of Economic Studies, project title "The Economic and Social Effects of European Funds on the Development of Romania's Rural Environment (RURALIS)"

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