ASSESSING THE EXPORT POTENTIAL OF BASIC AGRICULTURAL PRODUCTS IN MOLDOVA THROUGH THE LENS OF FOOD SECURITY

DOI: https://doi.org/10.36004/nier.es.2025.2-04
JEL Classification: Q11, Q18, Q18, I38, O13
UDC: 338.439.5:339.564(478)

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Received 18 september 2025

Accepted for publication 09 november 2025

[1] The opinions expressed in this paper by Alexandru Fala are solely those of the author and do not reflect the official opinion of the National Bank of Moldova (BNM).

SUMMARY

Moldova is a small landlocked country with the lowest GDP per capita among European economies, specialising in the export of agricultural products, particularly cereals and fruits. Recent economic crises and the war in Ukraine have amplified existing socio-economic constraints and raised concerns about national food security. This paper investigates the export potential of Moldova's main agricultural products and their implications for food security. The study integrates national data on agricultural production, food balances, international trade, and prices with global datasets and develops a comprehensive system of indicators reflecting agricultural production capacities, trade performance, and export competitiveness, with a focus on key agricultural commodities. An econometric ARDL model is employed to assess the impact of external price dynamics and climatic variability on the growth of cereal exports, which represent a significant share of Moldova's agri-food exports. The results indicate that Moldova has strengthened its export position in staple crops. However, the predominance of low-value-added raw commodities in agri-food exports and the country's exposure to international price volatility heighten pressures on food access and affordability in the domestic market. The findings underline the importance of diversifying agrifood exports and promoting higher value-added production as key strategies for enhancing resilience and strengthening food security policy.

Key words: *agricultural production, agricultural exports, food staples, food security*

INTRODUCTION

Moldova is one of the smallest economies in Europe in terms of GDP per capita, which amounted to 7.6 thousand USD in 2024. Convergence with EU member states and even with countries from Europe and Central Asia has been occurring at a very slow pace. In the long term, Moldova has experienced a visible slowdown in economic growth, despite still significant income gaps relative to the averages of these country groups. Since 2011, Moldova's GDP per capita, expressed in constant USD (PPP), has increased from around 20% to about 30% of the EU average by 2024.

Although the country has undergone significant structural transformations during its transition to a market economy, including a substantial expansion of the services sector, agriculture remains a key component of the national economy. The sector contributed around 7% to GDP formation in 2023–2024, with an average annual share of approximately 8.5% over 2020–2024. Agriculture also plays a vital role in employment, engaging about 18% of the population aged 15 and over in 2024. Moreover, agricultural products accounted for roughly 25–28% of total merchandise exports over the past five years, including large volumes of staple crops such as maize and wheat.

Agriculture is one of the primary economic activities in rural areas, where most multidimensional poor people live. According to the latest data, the incidence of multidimensional poverty in Moldova was 25.6% in 2024, with significant disparities between rural (37.6%) and urban (10.0%) areas (NBS, 2025).

Agri-food products represent a significant share of Moldova's merchandise exports. The agricultural sector faces structural challenges and has an untapped potential. The sector has low resilience to various internal and external shocks that have increasingly affected agricultural production in the past decade: climatic shocks, the high volatility of agricultural prices on international markets and persistent domestic–international price gaps, as well as the Russo–Ukrainian war, which has amplified global food security risks. In this context, assessing export potential through indicators linked to food security is conceptually and practically relevant for Moldova. The paper provides a robust analytical framework that supports research development in this field and helps justify economic policy measures to enhance the external competitiveness of the agricultural sector, thereby positively influencing national food security.

LITERATURE REVIEW

Food security is a multidimensional concept encompassing four key dimensions: availability (sufficient quantities of food), access (adequate resources for obtaining appropriate foods), utilisation (proper biological use, ensuring diet quality and safety), and stability (reliable access and availability over time) (FAO, 2024). Agricultural exports, including staples, influence these dimensions through various channels, producing both positive and negative effects depending on each country's specific context: its economic structure, global trade, environment, and national policies. Analysis of the export potential of the main agricultural products and their implications for food security requires understanding the main theoretical approaches and empirical findings at the intersection of these two important economic variables.

Mercantilism, one of the early trade theories, emphasised the importance of foreign trade for national economic prosperity. To be prosperous, countries should have a positive external trade balance. They advocated for stimulating the export of processed products and the import of raw materials as the price of the former is higher compared to that of the resources used in their production, making it possible to increase the value added in the country and consequently the accumulation of the population's wealth (Bjornskov, 2005). Meanwhile, this doctrine emphasises the role of trade in economic development, but it also promotes policies that conflict with global economic efficiency and food security. While the globalisation process and trade liberalisation have extended, protectionist policies have proved to be limited in explaining the realities. Therefore debates shifted towards revealed comparative advantages and efficiency gains that countries can have from free trade.

The Theory of Comparative Advantage (Ricardo, 1951) argues that countries benefit from external trade by specialising in merchandise with lower relative opportunity costs. In the agricultural sector, specialisation in high-value-added activities can improve farmers' export revenues, increase their capacity to import technology and agricultural inputs, and increase resilience to economic and climatic shocks. The entire population, especially the most vulnerable people, has greater access to affordable, diversified and higher-quality food. Thus, specialisation can strengthen all four dimensions of food security. Balassa's Revealed Comparative Advantage Index and Laffay Index have been widely used in empirical studies to measure a country's competitive position in international markets.

The Lafay Specialisation Index (1992) measures an economy's specialisation, taking into account the contributions of various sectors to achieving a balanced trade balance. Thus, a positive value of the index reveals a comparative advantage, and its increase – a higher level of specialisation. On the contrary, a negative value denotes a comparative disadvantage. The Balassa index (1965) compares the structure of a country's exports with world exports or those of trading partners, based on the assumption that countries can obtain a greater benefit from foreign trade if they specialise in those sectors in which they can benefit from a relative advantage. A value of revealed comparative advantage (RCA) less than 1 means that no comparative advantage is assessed for those goods. An RCA greater than 1 means that those goods have a comparative advantage, as attested.

John Stuart Mill's contribution to economic theory is relevant in this context. He highlighted the role of terms of trade, which depend on the demand for exported goods from trade partners. Favourable terms of trade enable a country to maximise the benefits from its exports, while adverse conditions may constrain producers' access to essential imports, including food staples and agricultural technologies (Fujimoto, 2017).

In the context of small economies, the Small Open Economy Model offers a relevant analytical framework. Such economies are considered price-takers in international markets (Guerron-Quintana, 2013) which are highly vulnerable to external shocks determined by the evolution of international food prices. Such events cause large fluctuations in domestic market prices, as during the 2007 and 2011 crises (Pourroy, Carton and Coulibaly, 2012), affecting the affordability and availability of agrifood products in local markets. Policy responses such as diversification, reducing product and export market concentration, and upgrading quality are essential for increasing the resilience of local food production. Also, focusing on markets that offer higher prices can increase exporters' revenues and human capital.

Meanwhile, existing literature highlights important trade-offs between agricultural products exports and food security. While exports may generate income, stimulate investments, and enhance competitiveness as mentioned earlier, excessive orientation toward foreign markets can reduce domestic food availability or divert resources away from staple production (Fiankor et al., 2021). Developed country markets, though more profitable, impose stricter standards, limiting export opportunities for many higher-value-added products, such as animal products, some fruits and vegetables, and processed agricultural products, for many developing economies.

Hence, the literature suggests that agricultural exports represent both opportunities and challenges for food security. Their impact depends on structural competitiveness, external demand, and domestic policies aimed at balancing export growth with national food needs. This ambivalence underscores the importance of evaluating the export potential of agricultural products not only from a competitiveness perspective, but also through the lens of food security.

DATA AND METHODS

To conduct this study, we identified a set of indicators that, on the one hand, reflect the export potential of the main agricultural products and, on the other hand, enable us to determine the challenges export activity poses for food security. The indicators, calculation formulas, data sources, and interpretations of the results from the perspective of food security are presented in Table 1 below.

Quantitative analysis was developed using primary national statistics on agricultural production, food balance sheets, and international merchandise trade obtained from the National Bureau of Statistics (NBS). To explore international trends and ensure comparability with other countries, data were obtained from the UN Comtrade database of the Food and Agriculture Organisation of the United Nations (FAO). The UN Comtrade (WITS) and FAO data used in this research for Moldova are consistent with the official statistics reported by the National Bureau of Statistics (NBS).

The study utilises time series of varying lengths, determined by data availability, consistency, and indicator relevance. Specifically, data spanning 1994–2024 are used for agricultural production, while the period 2010–2024—particularly 2020–2024—is employed for indicators such as the agricultural products self-sufficiency ratio and those assessing export performance and competitiveness. For the econometric analysis, the time series spans 2006–2024, the most extended available period for data derived from the Food Balance Sheet.

In the context of the present research, Agricultural and food products include the first 4 sections of the Harmonized Commodity Description and Coding System (HS): Live animals, animals products (I); Vegetable products (II): Animal, vegetal or microbial fats and oils (III); Prepared Foodstuff, beverages, spirits and vinegar, tobacco (IV).

Table 1.

Indicators for assessment the export potential of main agricultural products with respect to their implications for the country's food security

	Indicator	Formula	Data source	Interpretation of results
Production capacity and food and domestic food availability	**Production index**	PI=natural indicators (quantity) x comparable prices	*NBS*	Reflects the ability to sustain exports without depleting domestic supply. Low values of these indicators can influence both the capacity for export and food security.
	Yield per hectar	Yield/hectar =Total harvest/Total cultivated area	*NBS, FAO stat*	
	Self-sufficiency coefficient, %	SSC= Production/Internal consumption	*SSC according to NBS data*	The indicator gives an indication of a country's capacity to produce to cover its own needs. A value below 100% indicates that food production is insufficient to meet internal demand.
Export performance and competitiveness	**Export value (mln. USD), share in agricultural exports (%)**	EXP share = EXP value $_{I}$/EXP value $_{total}$	*NBSs, UNComtrade data*	Higher value and shares indicate better capacity to export the commodity. Especially for staples, higher values can increase pressure on local supply and prices
	Trade balance, mil. USD	TBij=Xij-Mij where Xij are exports of product I from country j and Mij are imports of product I of the country j	*NBS*	A positive balance of trade indicates that the country is a net exporter of that product/group of products. A positive balance of trade strengthens the financial capacity to import deficit products. In case of staples that may point to a country's low capacity to produce and export processed products, which will lead to higher earnings.

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	World export market share -n % years change	World market share = [[(EXPi,c,t/ EXPworld,i,t)-(EXPic,t-n/ EXPworld,t-n)]/(EXPi,c,t-n/ EXPworld,i,t-n)]*100 - where EXPi,c = exports of product i from country j in period t and accordingly t-n, and EXPworld,i = world exports of product I in period t and accordingly t-n	*UN Comtrade*	An increase in market share indicates that exports of the evaluated country grow faster than world exports, which is an indicator of export competitiveness. That would lead to revenue growth. Although if the increase in market share is the result of massive export of staples, this can indicate the reduced capacity to export high-value products. Also, if the products are staples, prioritising exports may reduce local availability and raise prices
	Export value growth rate, yoy, %	Export growth rate (%) = (EXPij$_1$-EXPij$_{to}$)*100-100 where Xij$_1$ are the value of the exports of product i form country j in period t and Xij$_{to}$ are the exports of product i form country j in period $_{to}$	*NBS and UN Comtrade*	Accelerated growth will contribute to income growth and can indicate an improvement in competitiveness. Exporting staples can threaten food security by creating a shortage of products on the domestic market and, accordingly, increasing prices.
	Compound Annual Growth Rate (CAGR), %	CAGR=((EXP$_t$/EXP$_{t-5}$)^(1/t-n)-1)*100	*Computed according to NBS data*	

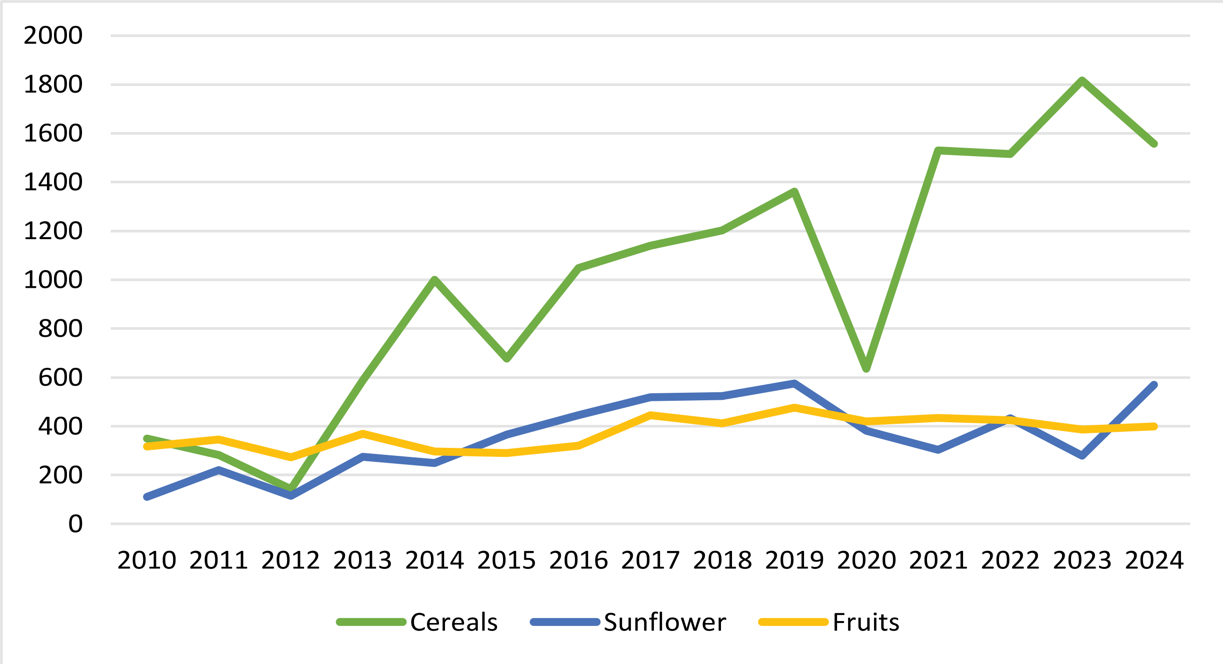
	Indicator	Formula	Data source	Interpretation of results
Export performance and competitiveness	**Unit Value Index, %**	$UVI = \frac{\sum Pi,t * Qi,t}{\sum Pi,t0 * Qi,t} *100$ where Pi,t are prices of the exported product at the observation period t, Qi,t is the exported volume of the product in the period t, Pi,0 and Qi,0 are corresponding prices and volume in the base period	*NBS*	High UVE may indicate quality/value addition, an increase in incomes; however, higher export prices can drive up domestic prices, reducing affordability for the low-income population.
	Export volume Index, %	$PVI = \frac{\sum Pi,t0 * Qi,t}{\sum Pi,t0 * Qi,t0} *100$ where Pi_{to} are prices of the exported product in the base period, Qi,t is the exported volume of the product in the period t, Pi,0 and Qi,0 are corresponding prices and volume in the base period	*NBS*	Export volume growth can result from production development. Although, an accelerated growth of the exported volume compared to production can lead to shortages of basic food in the local market.
	Balassa Revealed Comparative Advantage Index	RCA = $(X_i / X_t) / (W_i / W_t)$ where X_i = exports of product i from country, Xt = total exports, W_i= world exports of product i, W_t = total world exports	*Computed by authors based on UN comtrade statistics*	Values higher than 1 indicate that a country has a revealed comparative advantage of the analysed product. High RCA indicates strong export competitiveness, which can increase incomes but also risk diverting supply from domestic markets if not balanced.
	Export concentration index, %	HHI= $\sum(s_i^2)$ where s_i is the share of product i in total exports	*UNCtat statistics*	Values close to 10000 indicate a high concentration, and values closer to 1 indicate a low concentration. Lower concentration reduces producers' vulnerability to external price and demand shocks, ensuring stable incomes and supply.

Source: developed by the authors

Furthermore, the authors have conducted statistical analyses of agricultural export growth to assess its volatility. This is essential for assessing the sustainability of the agricultural sector's performance. High fluctuations in export growth point to vulnerabilities to different shocks such as climate change or international price variations.

To better understand the factors that influence the export of vegetable products in Moldova, we investigate the relationships between economic and climatic factors and the export of cereal products. The cereal was selected because, from a quantitative point of view, cereal represents the leading share of vegetable exports. In the last year, the exported mass of cereals exceeded several times the mass of exported sunflowers or the mass of exported fruits.

Figure 1.
The mass of the main exported agricultural products, thousand tons



Source: *developed by the authors based on the NBS data*

The dependent variable for the model was selected as the export growth dynamics, represented by the logarithmic first difference of cereal exports (*Δlog(export)*). A similar log-difference specification was employed by Khalilov, Fikratzade, and Huseyn (2025), who analysed agricultural productivity as a function of macroeconomic and environmental factors.

As the main economic explanatory variable, we include the difference between the changes in external and internal cereal prices: dlog (External prices) – *dlog (Internal prices)*, which reflects the evolution of relative price competitiveness.

Incorporating climatic factors into the model poses some challenges. Some studies use the levels or logarithms of temperature and precipitation as explanatory variables. For example, Amouzay and El Ghini (2025) adopt such an approach in their analysis of the impact of climate variability on agricultural production in Morocco. However, climatic effects are often non-linear: both insufficient and excessive precipitation, as well as unusually low or high temperatures, can reduce agricultural output. This is why many studies model these variables in a quadratic form, including both the level and its squared term in regression models. This specification enables the identification of threshold effects, where moderate temperature or rainfall may enhance agricultural output, while extreme values in either direction become detrimental. Such an approach has been widely applied in the empirical literature, including by Norboev, Fabri, Passel, and Moretti (2025) in *"Comparative Analysis of Climate Change Impact on Italian Agriculture: A Ricardian Regression Analysis"*, Belloumi (2014) in *"Investigating the Impact of Climate Change on Agricultural Production in Eastern and Southern African Countries"*, and Khalilov, Fikratzade, and Huseyn (2025) in *"The Influence of Average Annual Climatic Indicators on Agricultural Productivity: Considering the Threshold Effect."*

However, due to the limited sample size in this study (annual observations for the 2006–2024 period), introducing both levels and squared terms for each climatic variable would considerably increase the number of regressors, thereby reducing the degrees of freedom and potentially leading to biased coefficient estimates. To preserve parsimony while still capturing non-linear effects, this study adopts an alternative specification: the squared deviations of annual temperature and precipitation from their long-term averages (2006-2024), denoted *(Temperature-Average temperature)*^{2} and *(Rain-Average rain)*^{2}.

The empirical analysis relies on annual data for 2006–2024, collected from several official statistical sources. For example, data on cereal exports were obtained from the National Bureau of Statistics (NBS), specifically from the Food Resources Balance datasets. External price dynamics are proxied by the FAO Wheat Price Index, expressed with a base period of 2014–2016 = 100, while internal cereal prices are derived from nominal producer prices per tonne reported by the NBS, also converted into an index using the same base period (2014–2016 = 100). This approach ensures comparability between domestic and international price developments and captures the impact of relative price movements on export growth. The precipitation and temperature data were obtained from the NBS.

MAIN RESULTS

MAIN TRENDS AND PROSPECTS OF INTERNATIONAL TRADE WITH AGRICULTURAL PRODUCTS

According to the Global Report on Food Crisis 2025, in 2024, about 295.3 million people faced high levels of acute food insecurity in 53 of the 65 countries/territories selected for the analysis (GNAFC, 2025). As a result of the significant influx of refugees from Ukraine amid the war on the eastern border, as well as the economic shock from heightened geopolitical tensions, Moldova was included in this Report for the first time. Focusing on economic access to nutritious foods, updated estimates in the State of Food Security and Nutrition in the World Report (2024) show that more than one-third of people worldwide – about 2.8 billion – could not afford a healthy diet in 2022.

Agricultural international trade is very important for alleviating the severity of the global food crisis. Over the last 10 years, about 22% of global calories have been traded across borders, up from 17% two decades ago (OECD, 2025).

Over the last decade, international trade in agricultural products has grown but has been exposed to numerous shocks, mainly due to climate change, the COVID-19 crisis, geopolitical tensions, and trade barriers imposed by some countries amid the food crisis (WTO, 2024). Global agricultural production has expanded mainly in emerging economies, shifting toward higher-value and resource-intensive products such as oilseeds, fruits, and livestock, supported by technological innovation and productivity gains (OECD & FAO, 2024). However, rising input costs, environmental degradation, and increasing frequency of extreme weather events are constraining yield growth, particularly in poorer regions. Projections suggest that, to support the growing demand over the next decade, global agricultural and fish production will expand by 14% in constant prices. Middle-income countries are expected to play a leading role in the global agricultural production growth. Increasing capital investments and the adoption of innovations to strengthen resilience, along with inclusive trade policies coordinated with food security policies, will be important factors in supporting global agricultural production and food security (OECD, 2025).

AGRICULTURAL TRADE AND EXPORT POTENTIAL OF THE MAIN AGRICULTURAL PRODUCTS IN MOLDOVA

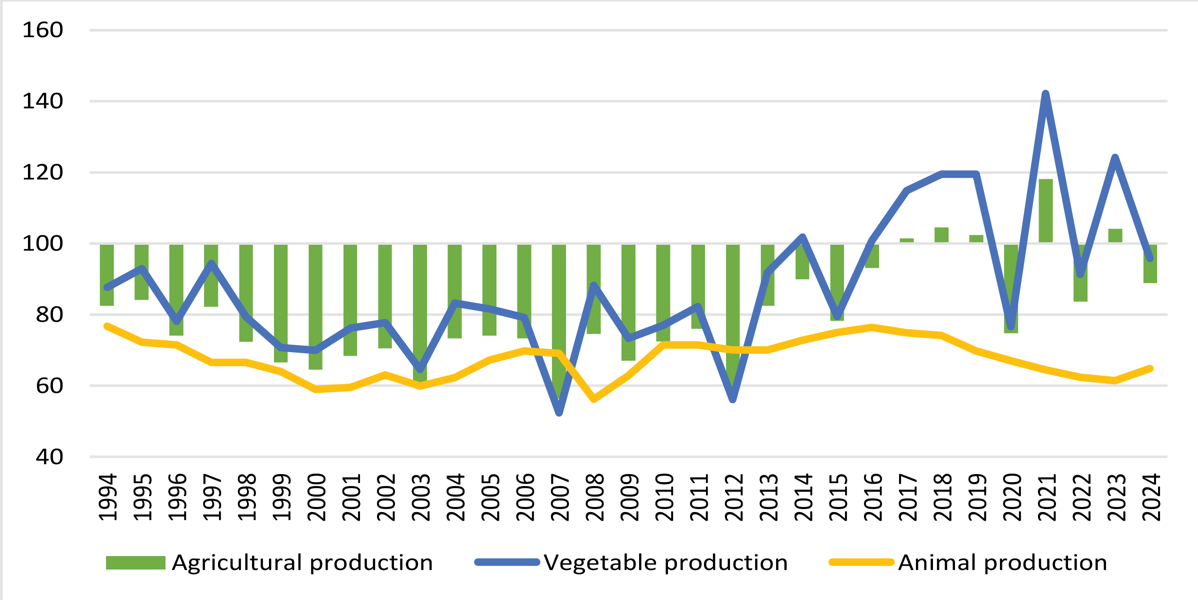
In Moldova, agricultural production relies on fertile chernozem soils and focuses on maize, wheat, sunflower, fruits (e.g., apples, plums), and viticulture (World Bank, 2016).

During the first two decades, the sector followed a generally downward trend, characterised by unstable output and frequent oscillations caused by high exposure to climate variability and insufficient adaptation capacity to climate conditions and transition reforms. In the second half of the 2010s, agricultural production began to recover and reached the 1992 level in 2017, primarily supported by the expansion and modernisation of vegetal production (figure 2). Despite this partial recovery, the sector remains highly vulnerable to adverse climate conditions, soil degradation, and fragmented farm structures, which limit productivity and competitiveness. Moreover, external factors—such as international price volatility, limited access to capital, and tariff and non-tariff barriers to trade—continue to constrain the sector's competitiveness in global markets and diminish long-term resilience.

Since 2020, Moldova's agricultural sector has been exposed to severe climate shocks occurring roughly every 2 years, resulting in substantial losses in crop yields and farm income (2020, 2022, 2024). In 2020 and 2022, Moldova recorded year-over-year reductions in cereal yields per hectare of more than 50%, including declines of approximately 45–46% in wheat yields and around 70% in maize yields. Sunflower seed production also fell by about 40% In 2024, the year-over-year contraction in cereal yield per hectare was less pronounced compared to 2020 and 2022 years—around 30% —yet decreases were registered across all major crops, including a 23% reduction in wheat and barley yield and a 44% decline in maize. In the case of fruits, this volatility is less pronounced. In 2024, Moldova's average yields (kg per hectare) were approximately 3,240 for wheat, 1,620 for maize, 1,480 for sunflower seeds, 10,770 for apples, and 5,480 for plums.

Figure 2.

Agricultural production index, 1992=100%



Source: developed by the authors based on NBS data

According to FAO data, yield volatility in Moldova was significantly higher than in countries such as Ukraine, Romania, Lithuania, Georgia, and Armenia during the period 2019–2023. In drought-prone years affected by other natural disasters (e.g., 2020 and 2022), cereal crop yields in Moldova fell below the levels recorded in these benchmark countries. In more favourable years, such as 2021 and 2023, Moldova achieved relatively high wheat yields — 4,133 kg/ha in 2023 — comparable to those of Ukraine (4,642 kg/ha), Lithuania (4,738 kg/ha), and Romania (4,152 kg/ha), and considerably higher than those of Georgia (2,639 kg/ha) and Armenia (2,527 kg/ha). In contrast, maize yields in 2023, although higher than in 2022, remained significantly lower in Moldova (2,804 kg/ha) compared to Armenia (7,749 kg/ha), Ukraine (7,806 kg/ha), and Lithuania (8,111 kg/ha), and to a lesser extent Romania (3,982 kg/ha). Apple yields in Moldova were consistently lower than those in Ukraine but exceeded those of the other benchmark countries in years with favourable weather conditions.

Despite the marked volatility observed in agricultural production, the data indicate that, for the most important agricultural crops, fruits, sunflower seeds, and grapes, domestic output is largely sufficient to meet Moldova's internal consumption needs. In the cases of wheat, maize, sunflower seeds, and fruits, production levels consistently remain above or close to internal consumption, sometimes even during years affected by adverse weather shocks. At the same time, in 2020, when productivity declined sharply due to extremely unfavourable climatic conditions, the self-sufficiency rate fell well below 100% for both wheat and maize. A similar situation occurred in 2022, when drought conditions led to a 70% decline in maize production compared to 2021. Nevertheless, the volume of maize exports in 2022 increased 2.4 times, driven by the considerable rise in international cereal prices amid the Russia–Ukraine war (Table 2).

Table 2.

Self-sufficiency ratio in Moldova computed as production to internal consumption, %

	2020	2021	2022	2023	2024
Cereals crops, incl.	71.0	219.8	95.8	190.2	148.2
Wheat	87.7	236.5	130.5	242.4	137.2
Maize	61.1	216.8	79.6	157.9	162.6
Sunflower seeds	215.7	301.8	191.2	203.3	182.1
Fruits, incl.	212.7	258.0	205.3	227.0	172.0
Apples	217.5	266.0	206.0	237.4	168.9
Grapes	102.6	109.1	109.4	112.6	113.2

Source: developed by the authors based on the Food Balance of the Republic of Moldova, NBS

The climate-related negative impacts on agricultural production in 2020 and 2022 coincided with two additional major and complex crises with far-reaching socio-economic implications at both regional and global levels: the COVID-19 pandemic and the war in Ukraine. The overlapping nature of these shocks has placed considerable pressure on agricultural producers, trade flows, and rural livelihoods. Consequently, the period has been marked by very weak economic performance. The stagnation of economic growth in recent years underscores the country's heightened vulnerability to compounded crises and raises concerns about its food security.

These food security concerns are also closely linked to Moldova's agricultural sector's trade openness. Moldova is not a major player on the international agri-food market, nor at the regional level. In 2024, it accounted for about 0,086% of global agricultural exports, increasing its share by 48% compared to 2010 and by 23% compared to 2020. In particular, Moldova has a more substantial presence on the global market for sunflower seeds, cereals, fruits, and sunflower oil (Appendix 1).

At the same time, agricultural and food products account for about half of Moldova's merchandise exports, amounting to 1.6 million. USD in 2024, or about 46% of merchandise gross exports (including 32% are agricultural products). In absolute terms, the value of agri-food exports of Moldova is comparable with countries of a similar development level, such as Georgia (1,7 mild USD) and Armenia (1,3 mild USD, but remains 5 times lower than that of Lithuania (7,8 mild USD) and 7 times lower than that of Romania (11,7 mild USD). Ukraine's agricultural exports amount to 24,6 mild USD. Their considerably larger geographic areas explain the significantly higher value in Romania and Ukraine.

In relative terms, Moldova's share of agri-food products in total merchandise exports far exceeds those of its regional peers: Armenia (10%), Georgia (26%), Lithuania (20%), and Romania (12%). This highlights the structural importance of the agricultural sector Moldovan economy, making it one of the major pillars of its export potential and food security resilience (Table 3).

Table 3.

The share of agri-food exports in merchandise gross exports of Moldova, Georgia, Armenia, Ukraine, Lithuania and Romania

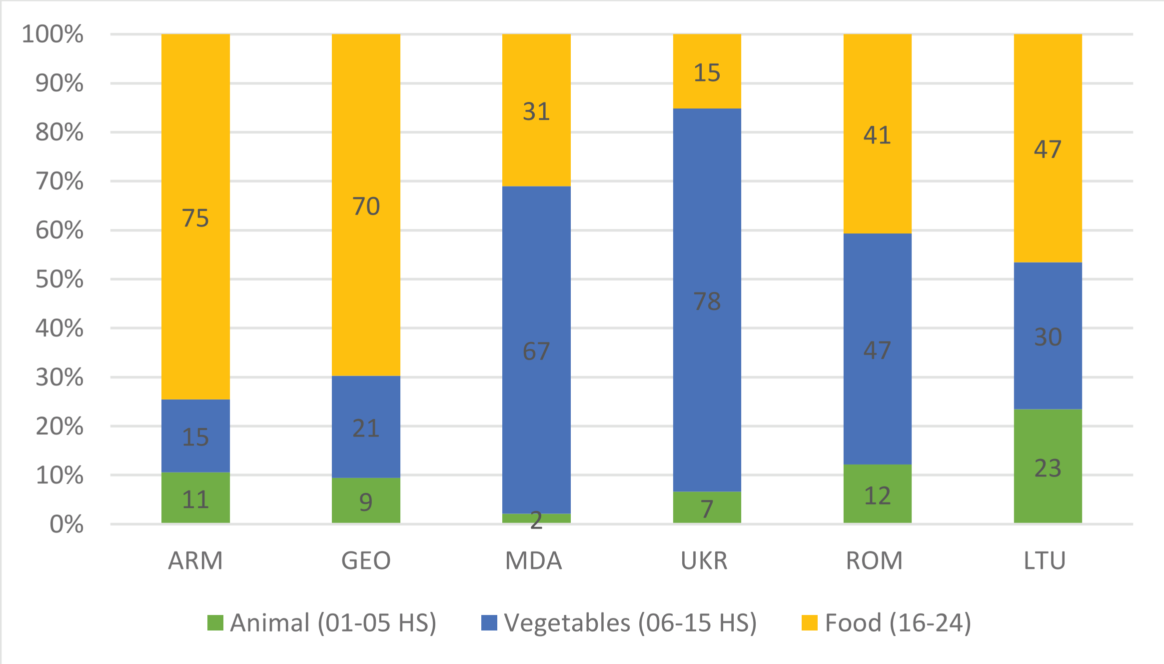
Country/ Year	2010	2015	2019	2020	2021	2022	2023	2024
ARM	16	26	30	30	29	23	13	10
GEO	21	28	23	28	27	22	24	26
LTU	18	19	18	21	18	18	20	20
MDA	48	46	44	44	46	45	43	46
ROM	8	11	10	11	13	13	13	12
UKR	-	38	44	45	40	53	61	59

Source: authors' calculations based on WITS statistics

However, Moldovan agricultural production, as seen earlier, and accordingly exports rely mainly on low value-added products. Moldova, like Ukraine, exports predominantly vegetable products, including vegetable and animal fats and oils, which accounted for 67% and 78% of their agri-food exports in 2024. In Moldova's case, processed food products represented about one-third of exports, compared to only 15% in Ukraine, while animal products formed a very marginal share (2%) (Figure 3). The transition period was characterised by a significant decrease in exports of processed agricultural products and accelerated growth in raw materials exports, which implies a substantially lower production and marketing effort for farmers. In contrast, the structure of agricultural exports in EU member states is more diversified and oriented towards adding value. For instance, in 2024, EU countries mainly exported processed food products (56.8%) and animal products (19.8%), whereas vegetable products accounted for about 24% of agricultural exports (Eurostat, 2025).

Figure 3.

The structure of agri-food exports decomposed by animal, vegetable and food products, 2024



Source: authors' calculations based on WITS data

The descriptive statistics presented in Table 4 indicate that the average annual growth rate of agricultural exports in Moldova between 2012 and 2024 was 7%, with a standard deviation of 21.4, suggesting relatively high volatility compared to other countries. The median value being lower than the mean further indicates that, in half of the analysed years, Moldova experienced annual export growth of less than 3.7%. This suggests that a few years of exceptional performance elevate the average, while most years see modest growth — confirming the episodic nature of export expansion.

Furthermore, due to Moldova's relatively small agricultural exports, the average growth rate stays modest. Essentially, the structure of agricultural production — and therefore exports — which mainly focuses on primary agricultural commodities, explains the slow and uneven pace of export growth. As a result, long-term export expansion depends mainly on increases in export volumes, while unit values tend to grow much more slowly. This pattern shows the limited value added domestically, as most products are exported in raw form. Consequently, the export sector remains very sensitive to changes in production volumes, weather patterns, and external price shocks.

In 2019, the unit value index of exported vegetable products and of vegetable and animal oils and fats accounted for approximately 71% and 81% of their 2010 levels, while their volume indices rose much more sharply, reaching about 298% and 232%, respectively. Beginning in 2020, the unit value of vegetable products grew faster, peaking at 114% in 2022 before easing to 94% in 2024 relative to 2010. During the same period, export volumes continued to expand, with the volume index reaching 315% in 2023 and 300% in 2024. For vegetable and animal fats and oils, both unit value and volume indices increased rapidly. In 2023, the unit value index climbed to 170%, while the volume index surged to 586% compared with 2010. In 2024, however, both indicators declined, with the unit value index dropping to 104% and the volume index to 338% relative to 2010.

Table 4.

Descriptive statistics on agricultural exports growth for the period 2012-2024

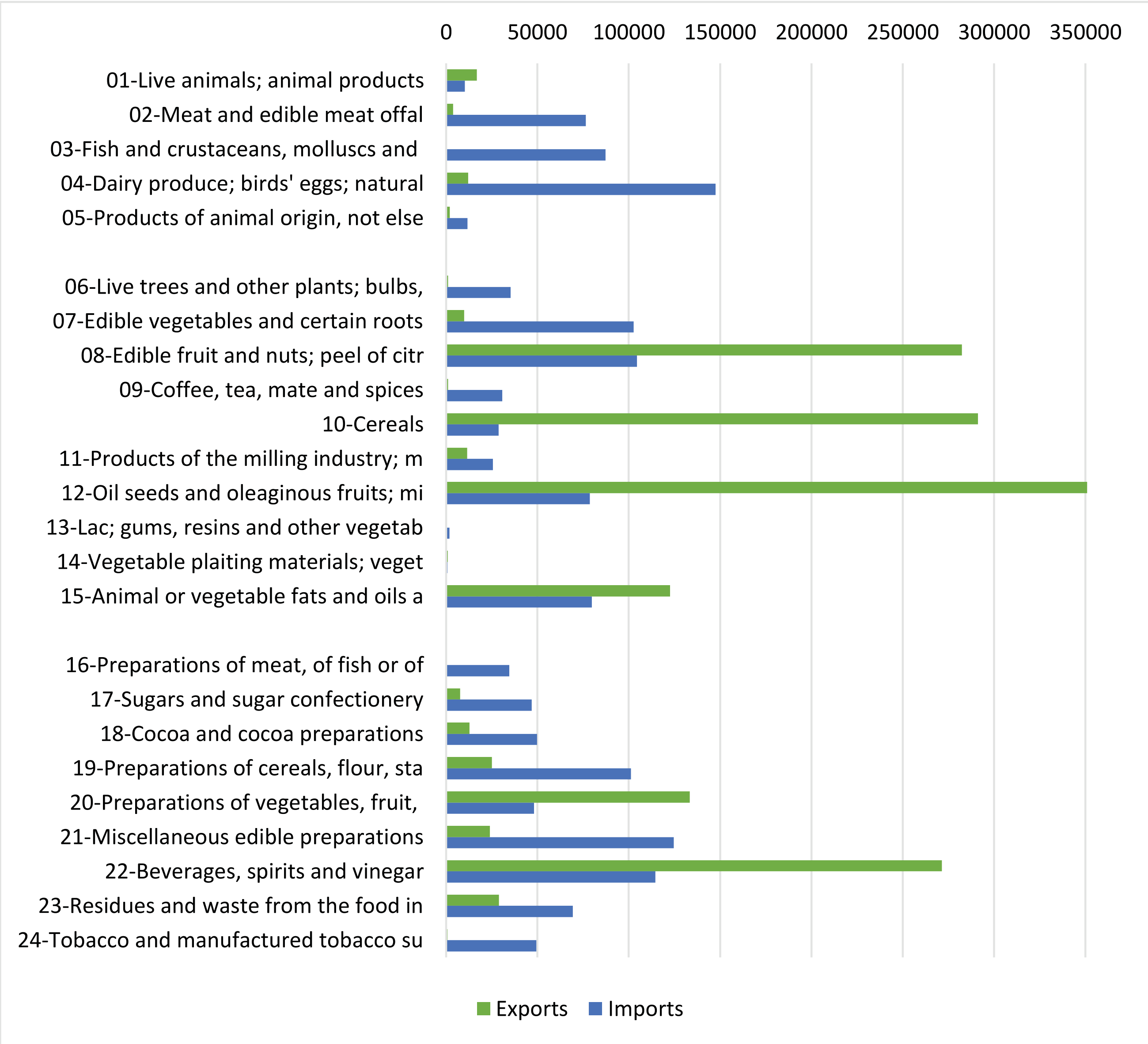
	ARM	GEO	LTU	MDA	ROM	UKR
Min	-29.4	-23.2	-18.4	-16.8	-22.6	-11.0
Max	55.2	51.5	21.4	45.0	60.6	45.1
Mean	20.2	8.2	3.3	7.0	6.5	7.0
Median	22.2	8.5	2.4	3.7	2.1	4.3
Standard Deviation	24.0	19.3	12.1	21.4	22.9	16.1

Source: authors' calculations based on WITS statistical data

According to 2024 data, the trade balance for vegetable products (HS06-14) and vegetable oils and fats totalled about 600 million USD, while the trade balance for animal products remained negative, amounting to 300.6 million USD in 2024 (Figure 4). Among Moldova's most exported agricultural products, which have also experienced rapid growth since 2010, are staple goods such as wheat, maize, sunflower seeds, apples, and grapes (table 4), for which the country has a positive trade balance (Appendix 2).

Figure 4.

Moldova's agricultural products exports and imports by product category in 2024, thousand USD



Source: authors' calculations based on the NBS data

Some vegetables exhibit relatively high RCA values compared to the benchmark countries in the region. But Moldova, along with Armenia and Romania, has a comparative disadvantage in the export of animal products, and its RCA for food is significantly lower than that for vegetable products. This trend emphasises food security challenges related to the export structure.

The risk of orientation toward external markets for the country's main agricultural raw materials, particularly staple crops and sunflower seeds, is increasing. Coupled with other relevant indicators—such as the high concentration of agricultural exports in a limited number of markets and the significant volatility of international prices—these factors increase the pressure on farmers' export incomes and heighten risks to food accessibility in the domestic market (Table 5).

Table 5.

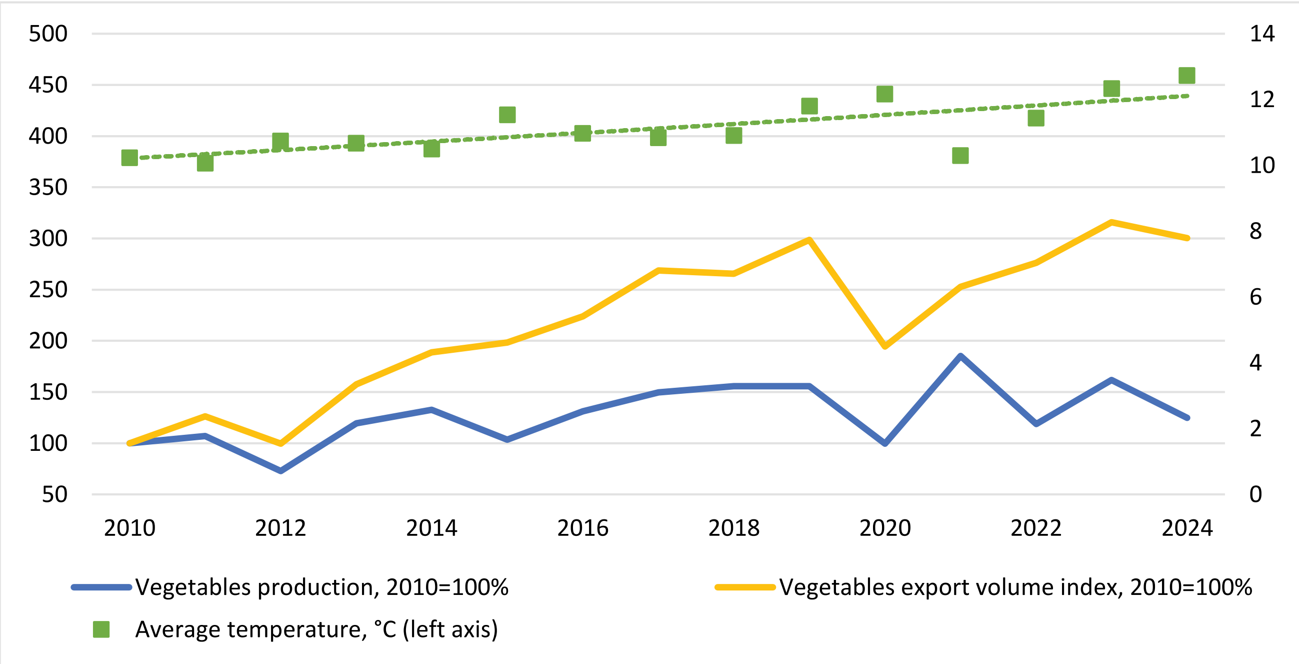
Revealed Comparative Advantage (RCA) and Herfindahl Hirshman Market Concentration Index (HHMI) for the main exported agricultural products by the Republic of Moldova

Product HS code	Product description	RCA 2010	RCA 2024	HHMI 2010	HHMI 2024
1206	Sunflower seeds, whether or not bro	228.75	398.3	0.0877	0.2857
1001	Wheat and meslin.	10.51	27.9	0.0295	0.4550
2204	Wine of fresh grapes, including for	46.13	22.4	0.1907	0.1015
1512	Sunflower-seed, safflower or cotton oils	97.31	50	0.3517	0.1038
2009	Fruit juices (including grape must)	18.02	29	0.1253	0.2962
0808	Apples, pears and quinces, fresh.	57.42	43.3	0.8403	0.3937
0809	Apricots, cherries, peaches (include)	49.55	41.6	0.6521	0.0830
1005	Maize (corn).	5.82	8.9	0.1031	0.1063
0806	Grapes, fresh or dried.	16.34	29.1	0.5566	0.2135
1205	Rape or colza seeds, whether or not	20.51	23.4	0.2410	0.3703

Source: developed by the authors based on the WITS database

Figure 5.

Temperature, Production, and Vegetable Exports in Moldova



Source: developed by the authors based on the NBS data

The growth in agricultural production over the past decade has supported the expansion of Moldova's agri-food export volumes, with both series following an upward trajectory (Figure 5). Rising average temperatures are also visible, but their trend does not appear to disrupt the overall co-movement between production and exports. At the same time, Moldovan export prices closely mirror international food price dynamics, indicating that the country is largely a price-taker in global agri-food markets.

ECONOMETRIC ANALYSIS

The first step for empirical analysis is to verify the stationarity of the variables to be included in the model and to select the most appropriate regression specification. For this purpose, the Augmented Dickey–Fuller (ADF) test is employed. Given the annual frequency of the data, a maximum of two lags is considered sufficient to capture possible dynamics without overparameterizing the test.

Table 5.
The results of the ADF test

Null Hypothesis: *dlog(EXPORT)* has a unit root			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.982609	0.0096
Test critical values:	1% level	-3.959148	
	5% level	-3.081002	
	10% level	-2.681330	
Null Hypothesis: *(Rain-Average rain)*² has a unit root			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.651775	0.0129
Test critical values:	1% level	-3.769597	
	5% level	-3.004861	
	10% level	-2.642242	
Null Hypothesis: *dlog (External prices)-dlog(Internal prices)* has a unit root			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.097618	0.0000
Test critical values:	1% level	-3.752946	
	5% level	-2.998064	
	10% level	-2.638752	
Null Hypothesis: (Temperature-Average temperature)2 has a unit root			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.024562	0.9504
Test critical values:	1% level	-3.808546	
	5% level	-3.020686	
	10% level	-2.650413	

Source: authors' estimates

Since the unit root tests indicate a mix of stationary and non-stationary variables, the modelling strategy must accommodate variables of different orders of integration. Specifically, the change in cereal exports, the difference between the change in external and internal prices, and the squared deviation of annual precipitation from its long-term mean are stationary, while the squared deviation of annual temperature from its long-term mean is non-stationary. To handle this structure, we employ an Autoregressive Distributed Lag (ARDL) model, which includes a lagged dependent variable and is particularly suitable when regressors are a combination of I(0) and I(1) processes. The regression for the change in export of cereals takes the following form:

$$dlog(export_t) = \alpha_0+\beta_1 \cdot dlog(export_{t-1})+\beta_2 \cdot [dlog\ (External\ prices_t)-dlog\ (Internal\ prices_t)]+\beta_3 \cdot (Temperature_t-Average\ temperature)^2+\beta_4 \cdot (Raint-Average\ rain)^2+\varepsilon_t$$

The results, expressed by F-statistic of 4.29 ($p = 0.022$), show that explanatory variables, taken jointly, have statistically significant explanatory power for the variation in cereal export growth. This confirms that the model provides a meaningful in-sample predictive relationship between exports and the included determinants. If we look at variables separately, the estimation output indicates that changes in external prices relative to internal prices have a statistically significant influence on the variation in cereal exports (Table 6). In contrast, the climatic factors exhibit statistically insignificant effects, suggesting that short-term fluctuations in weather conditions have a limited impact on export dynamics.

Table 6.
Change in the regression of cereal exports. The estimation output

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
dlog($EXPORT_{t-1}$)	0.228126	0.222061	1.027312	0.3245
dlog(External $prices_t$)-dlog(Internal pricest)	1.970071	0.617096	3.192485	0.0077
($Temperature_t$-Average temperature)²	-0.124495	0.127140	-0.979196	0.3468
($Rain_t$-Average rain)²	-7.27E-07	8.21E-06	-0.088547	0.9309
Constant term	0.248704	0.164861	1.508568	0.1573
R-squared	0.588554	F-statistic		4.291352
Adjusted R-squared	0.451405	Prob(F-statistic)		0.021984
Durbin-Watson stat.	2.219196			

Source: author's estimates

The F-bounds test developed by was applied to verify the existence of a long-run relationship among the variables. The calculated F-statistic (6.81) exceeds the 5% upper critical value (5.07) for the finite-sample distribution, allowing rejection of the null hypothesis of no cointegration (Table 7). This confirms a stable long-run equilibrium relationship between cereal exports and the explanatory variables

Table 7.
The result of F-Bound test

Test Statistic	Value	Signif.	I (0)	I (1)
Actual Sample Size	17		Finite Sample: n=30	
F-statistic	6.806289	10%	4.025	4.025
k	0	5%	5.07	5.07
		1%	7.595	7.595

Source: author's estimates
Note: Null hypothesis - no level relationship

The Breusch–Godfrey LM test was employed to verify the absence of serial correlation in the residuals of the estimated model. This test is preferred because it is valid even when the model includes lagged dependent variables, as in the ARDL specification. The obtained p-values (0.62 and 0.46) exceed 0.05 (Table 8), indicating that no autocorrelation is present, and the model's residuals are independent over time.

Table 8.
The Breusch-Godfrey Serial Correlation LM Test

F-statistic	0.507452	Prob. F(2,10)	0.6167
Obs*R-squared	1.566366	Prob. Chi-Square(2)	0.4569

Source: author's estimates
Note: Null hypothesis - no serial correlation at up to 2 lags

The Breusch–Pagan–Godfrey test was applied to assess heteroskedasticity in the residuals of the estimated model. This test assesses whether the errors' variance remains constant across observations. The high p-values, all above 0.05 (Table 9), indicate that the null hypothesis of homoskedasticity cannot be rejected, confirming that the model's residuals have a constant variance and are thus well-behaved.

Table 9.
Breusch-Pagan-Godfrey Heteroskedasticity Test

F-statistic	0.594706	Prob. F(4,12)	0.6732
Obs*R-squared	2.812468	Prob. Chi-Square(4)	0.5897
Scaled explained SS	0.730010	Prob. Chi-Square(4)	0.9476

Source: author's estimates
Note: Null hypothesis - Homoskedasticity

The distribution of residuals was tested to verify compliance with the normality assumption, which is particularly important for small samples such as in this study. The Jarque–Bera statistic (1.16) with a p-value of 0.56 indicates that the residuals follow a normal distribution.

The Cumulative Sum of Recursive Residuals (CUSUM) test was used to evaluate the stability of the estimated coefficients over time. The test results show that the CUSUM statistic stays within the 5% significance boundaries, indicating that the parameters of the ARDL model are stable across the sample period. This suggests no significant structural breaks in the model during the analysis period.

The estimated ARDL regression provides statistically consistent results, even within the limitations of a small sample. The results confirm cointegration, indicating a long-run equilibrium relationship between cereal exports and the explanatory variables. The residual diagnostics show that the model is free of autocorrelation and exhibits homoskedasticity, and that the residuals are normally distributed, which is especially important in a small-sample context, as it reduces the risk of inconsistent estimates. Furthermore, the CUSUM test confirms the stability of model parameters. In addition, the F-statistic demonstrates that the explanatory variables, taken jointly, have significant explanatory power, confirming that the model provides a meaningful in-sample predictive relationship.

DISCUSSIONS

The results of the research underscore Moldova's agricultural volatility to climatic shocks and export dependence on low-value commodities, aligning them with global trends of shock-exposed agricultural trade (WTO, 2024; OECD & FAO, 2024). Yield declines from climate shocks in the recent years: 2020, 2022, 2024 mirror findings in Vicente-Serrano et al. (2024), who concluded in their study that the weather conditions in Moldova will continue to get worse in the future. These factors significantly undermine farmers' incomes and reduce investments in high-value-added agricultural activities, thereby directly affecting the domestic availability of food products. Stratan et al. (2025), who examine the relationship between climate shocks and food security resilience, argue that climate pressures in Moldova are intensifying more rapidly than the adaptive capacity of its food system. If this trend persists, the risk of food insecurity will rise substantially.

Despite the considerable volatility in agricultural production, the data show that domestic output of the main crops—wheat and maize, fruits, sunflower seeds, and grapes — is generally sufficient to satisfy Moldova's internal consumption needs. These results are supported by Stratan et al. (2024). However, the self-sufficiency ratio for the main crops in 2020 and for maize in 2022 decreased, underscoring the low resilience of the agricultural sector and the food security system in conditions of extreme weather, amid two overlapping severe socio-economic international crises. This aligns with the IMF (2023) conclusions, which highlight the economy's heightened sensitivity to climatic conditions and its limited adaptive capacity to climate shocks that can have a major impact on crop yields and food security.

The structure of agri-food exports is dominated by primary agricultural products, whose share has been steadily increasing in total merchandise exports at the expense of processed agricultural products, reflecting post-transition deindustrialisation, as confirmed by Litvin (2024) and Coşer & Cimpoieş (2014). It is contrasting the EU agri-food exports diversification

(Eurostat, 2025), which focuses more on high-value-added products like food, while animal products have a significantly higher share in Moldova. Consequently, Moldova's food security remains vulnerable, as reliance on raw commodity exports increases exposure to production fluctuations, market volatility, and external shocks.

Descriptive statistics reveal modest, volatile growth in agricultural exports over the last decade (mean 7%, SD 21.4% during 2012-2024), driven predominantly by faster quantity increases than unit-value growth, increased volatility in international food prices, and making Moldova a price-taker. Surges in international food prices increase the risk of diverting basic agricultural products from the domestic market to export markets that offer higher prices, thereby reducing access to essential food products for the poor (Varghese, & Suppan, 2023; Aragie et al., 2023). A recent example derived from the research findings is the substantial increase in maize exports in 2022, which occurred amid a sharp rise in international prices. This happened despite the decline in agricultural production, including for this crop, which also led to a reduction in the self-sufficiency rate. Economically, the findings suggest that relative price competitiveness—measured as the difference between changes in external and internal cereal prices—plays a dominant role in explaining export dynamics. When external prices rise relative to domestic prices, Moldovan cereal exports tend to increase, reflecting more substantial incentives for producers to sell abroad.

Despite the positive trade balance generated by Moldova's agricultural sector, particularly vegetable exports, which partially offset the country's substantial merchandise trade deficit (Fala, 2024), the high market concentration of certain agricultural exports poses significant economic risks. Reliance on a narrow range of low-value-added export commodities and market concentration exposes the sector to international price volatility, demand shocks, and trade disruptions, increasing the vulnerability of export revenues. In Moldova, this dynamic is especially relevant because fluctuations in export income can impact not only the balance of payments but also household livelihoods and food security. As a result, policies focused on diversifying agricultural exports and strengthening domestic value chains are vital for reducing the risks associated with concentrated markets, supporting sustainable economic growth, and ensuring national food security.

CONCLUSIONS

The analysis indicates that Moldova has made some progress in strengthening its agricultural export potential, especially in international cereals markets. Despite recurring climate shocks, structural constraints, and soil degradation, domestic production of key staples—such as wheat, maize, sunflower seeds, and fruits—has generally remained sufficient to meet internal consumption, reflecting a relatively resilient primary production base. At the same time, the country holds a competitive advantage in global markets for certain vegetable products, as confirmed by export volumes and comparatively high revealed comparative advantage (RCA) values.

However, these achievements conceal significant vulnerabilities with direct consequences for Moldova's food security. The agri-food export structure remains heavily reliant on low-value-added raw materials, especially cereals and oilseeds. While exporting such staples provides short-term revenue, it adds little to long-term income growth and limits the ability to improve agricultural productivity. Furthermore, the country's heavy reliance on unprocessed commodity exports makes it vulnerable to international price fluctuations, increasing external risks and potentially affecting domestic food affordability. Econometric results also show that cereal exports are very sensitive to foreign price changes, meaning that periods of high international prices can boost exports while simultaneously decreasing domestic supply, creating conflicts between export motives and internal food security requirements.

To mitigate these risks and bolster food security, Moldova should pursue policies that diversify agricultural production and increase the proportion of high value-added agri-food products, such as fruits, vegetables, meat, and processed foods. Expanding the processing sector and improving value-chain integration would enable producers to earn higher incomes, build resilience, and contribute to a more stable domestic food supply. Simultaneously, public authorities must closely monitor international price trends and ensure sufficient domestic reserves and storage capacity to safeguard food availability during periods of increased external demand or unfavourable global market conditions.

Future research could further aid food security-focused policymaking by examining more closely the factors causing variations in agricultural output, as well as by directly predicting the production levels of key crops. Using econometric models with higher-frequency time series (quarterly or monthly data) would improve understanding of short-term changes and structural shifts in both production and export values.

Acknowledgements

This research was conducted as part of the project "Increasing the main agri-food products export from the perspective of strengthening the Republic of Moldova's food security," project number 23.70105.5107.07, funded by the National Agency for Research and Development of the Republic of Moldova (NARD).

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Writing - review and editing: Victoria Fala, Alexandru Fala

APPENDIX

Appendix 1.

Moldova's world agricultural market share

HS product code		Moldova's agricultural exports world share, %						Change in market share 2024/2010, %	Change in market share 2024/2020, %
	Product description	2010	2020	2021	2022	2023	2024		
Agricultural products HS 01-15		0.058	0.070	0.085	0.111	0.096	0.086	47.8	22.8
'01	Live animals	0.061	0.044	0.030	0.026	0.032	0.057	-5.5	31.1
'02	Meat and edible meat offal	0.011	0.005	0.005	0.002	0.003	0.002	-78.8	-50.4
'03	Fish and crustaceans, molluscs and other aquatic invertebrates	0.000	0.000	0.000	0.000	0.000	0.000	1.0	491.8
'04	Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere ...	0.007	0.019	0.020	0.017	0.012	0.010	38.3	-46.0

HS product code		Moldova's agricultural exports world share, %						Change in market share 2024/2010, %	Change in market share 2024/2020, %
	Product description	2010	2020	2021	2022	2023	2024		
'05	Products of animal origin, not elsewhere specified or included	0.001	0.005	0.005	0.005	0.012	0.018	1416.1	255.2
'06	Live trees and other plants; bulbs, roots and the like; cut flowers and ornamental foliage	0.009	0.010	0.005	0.005	0.006	0.004	-57.1	-61.0
'07	Edible vegetables and certain roots and tubers	0.016	0.004	0.008	0.010	0.011	0.010	-36.1	141.5
'08	Edible fruit and nuts; peel of citrus fruit or melons	0.224	0.169	0.159	0.178	0.181	0.174	-22.1	3.1
'09	Coffee, tea, maté and spices	0.001	0.002	0.002	0.002	0.002	0.002	15.7	-25.3
'10	Cereals	0.084	0.095	0.240	0.227	0.236	0.189	125.9	100.1
'11	Products of the milling industry; malt; starches; inulin; wheat gluten	0.004	0.007	0.007	0.020	0.032	0.041	831.5	467.4
'12	Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit; industrial or medicinal ...	0.133	0.203	0.197	0.257	0.190	0.272	105.0	33.7
'13	Lac; gums, resins and other vegetable saps and extracts	0.000	0.000	0.000	0.002	0.002	0.002	263.3	578.5
'14	Vegetable plaiting materials; vegetable products not elsewhere specified or included	0.025	0.061	0.049	0.059	0.059	0.046	84.4	-24.8
'15	Animal, vegetable or microbial fats and oils and their cleavage products; prepared edible fats; ...	0.058	0.101	0.081	0.213	0.167	0.082	40.0	-19.5

Source: authors' calculations based on INTRACEN trade statistics

Appendix 2.

Top agricultural products exported by Moldova

HS code	Product	2010			2024			Compound annual growth rate (2010-2024), %
		Exports, mil. USD	% of agricultural exports	Trade balance, mil. USD	Exports, mil. USD	% of agricultural exports	Trade balance, mil. USD	
1206	Sunflower seeds, whether or not bro	57.3	7.8	50.5	305.9	18.8	269.6	12.7
1001	Wheat and meslin.	35.5	4.9	34.4	197.7	12.2	197.0	13.0
2204	Wine of fresh grapes, including for	137.9	18.8	269.6	143.5	8.8	131.1	0.3
1512	Sunflower-seed, safflower or cotton oils	41.1	5.6	40.3	113.3	7.0	58.6	7.5
2009	Fruit juices (including grape must)	24	3.3	19.5	95.5	5.9	91.9	10.4
0808	Apples, pears and quinces, fresh.	51.3	7	49	76.0	4.7	73.2	2.8
0809	Apricots, cherries, peaches (includ	22.9	3.1	11	72.2	4.4	67.6	8.6
1005	Maize (corn).	14	1.9	13	66.6	4.1	47.6	11.8
0806	Grapes, fresh or dried.	13	1.8	10	60.9	3.7	56.4	11.7
1205	Rape or colza seeds, whether or not	15.4	2.1	13.6	50.8	3.1	46.2	8.9

Source: Wits database and authors' calculations