

Market Risk Factors Analysis on Public-Private Partnerships in the Livestock Sector

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Abstract. *Currently, the projects that can be carried out through Public Private Partnerships in the livestock sector are under the influence of specific market risk factors, with a great impact on the efficiency of public or private investments and their success. This research aims to analyze some of the market risk factors that affect the organization and operation of Public Private Partnerships in the livestock sector. Therefore, the paper seeks to obtain the answer to the question: What is the way in which market factors influence the functionality of Public Private Partnerships? In this context, we considered necessary and appropriate to achieve a comparative analysis of the main indicators in the field of demand, supply and prices of livestock products in Romania, EU 27 average and some EU developed countries. The data were provided by Eurostat, AgriData and Faostat and cover the period 2014-2022. The analysis of available data for the period 2014-2022 suggests that fluctuations in the supply, demand and prices of livestock products can be considered factors affecting the functionality of PPPs, through two-way transmission mechanisms. This can help in developing more robust strategies and policies for managing risks and capitalizing on opportunities within Public Private Partnerships.*

Keywords: Public Private Partnerships in agriculture, livestock sector, demand of livestock products, supply of livestock products, prices of livestock products

Introduction

The development strategy of Romanian agriculture should consider livestock breeding as one of the important branches because products of livestock origin and especially meat and meat products, milk, dairy products and eggs represent significant products in the food consumption of the population and important sources of foreign trade. Thus, covering the food consumption of livestock products from domestic production, as well as ensuring the availability of such products for export, should constitute the objectives of this strategy.

The challenges faced by the livestock sector, as well as its reduced capacity to achieve economic, social and environmental goals, can be overcome by prioritizing public investments for development and modernization and clearly establishing the directions for the allocation of public funds according to well-defined strategic guidelines. In this context, the paper tries to clarify a current issue starting from the question: *how is the functionality of Public Private Partnerships (PPP) influenced by factors related to demand and price fluctuations.*

Literature review

Public Private Partnerships are commonly defined as collaborations between public and private sector entities in which partners jointly plan and execute activities to achieve agreed objectives while sharing the costs, risks and benefits incurred in the process (Spielman, et al., 2010). PPPs have become an inevitable part of project delivery in many countries (Warsen, et al., 2018) and offer several advantages for both public and private partners.

They enable public partners to increase efficiency, gain access to private financing, import management expertise (Brinkerhoff & Brinkerhoff, 2011) or implement cost-saving mechanisms. Private partners, on the other hand, can share or exchange risks and gain access to public projects that they might not otherwise be able to support. However, PPPs also have their drawbacks. Partners pursue different interests when engaging in PPPs, and PPPs may have more and a higher degree of risk than other projects.

According to the experience of developing countries, Public Private Partnership has taken a stable place in the development of agriculture and has proven its practical efficiency, acquiring the status of an integral element of ensuring food security (Dustmurodov, et al., 2020). In a PPP, each member has its own benefits. The state has advantages in the form of: modernization of agri-food value chains; increasing the economic efficiency of projects due to the reduction of costs and risks; efficiency in decision-making; access to alternative sources of capital; access to innovative technologies; and implementation of strategic projects at the macro level.

PPPs have brought positive changes in the development of agricultural product markets, strengthening the capacities of agricultural holdings, reducing risks and uncertainties, social mobilization and economic strengthening of farmers, in the creation and implementation of new technological platforms. They have also contributed to the formation of an informative base and methodological measures to ensure the risks of agricultural producers, to the development of agricultural businesses whose purpose is also to insert the education and training component, as well as to the development of the infrastructure in agriculture and the creation of their management units (Singh, 2020).

Le Turioner (2016) state that in agriculture a basic context for a PPP to work is to create good conditions for an effective value chain and to ensure that all actors in this value chain gain something. For this reason, it is important to know what is the interest and benefit for each stakeholder. For example, in a project that might aim to grant subsidies for fertilizers, the national government involved would want to know what the impact of the program might be, while the private sector would want to be sure that it would be paid. This heterogeneity shows how important it is for the implementation of PPP projects to know this information about all the actors involved before designing operations.

Starting from the finding that agriculture in underdeveloped countries is not sustainable, Ferroni and Castle (2011) analyze the opportunity of PPPs in agriculture, highlighting their importance and how they can contribute to the sustainability of agriculture in poor countries.

Agarwal et al (2023) investigate how issues associated with PPPs in the agricultural sector can be addressed to promote sustainable agriculture. The authors analyze the various challenges and obstacles encountered in the implementation of PPPs in the agricultural field and propose solutions and strategies to overcome these problems.

The specialized literature identifies a *series of risk factors that can affect the functionality of PPPs in the livestock sector*, such as: supply, demand and price fluctuations for livestock products (Ayyappan et al, 2007; Tegegne et al 2010; Shapiro et al , 2017), livestock health issues

(Ekboir, 1999; Dione et al, 2019; Gizaw & Berhanu, 2020; Poupaud et al, 2022), livestock safety regulations and norms (Galière et al, 2019), waste management, etc.

There are a number of obstacles to the development of PPPs in agriculture in general (Moreddu, 2016; Dudin et al, 2020) and those targeting the livestock sector, in particular. Thus, Poupaud (2022) presents the results of an extensive literature review aimed at evaluating public-private partnerships (PPPs) for livestock health programs.

To assess the existing literature on the risks that may affect the functionality of PPPs in the livestock sector we will use a bibliometric analysis, a quantitative research approach that has gained prominence for examining research trends. For this analysis, we will use VOSviewer version 1.16.19 which facilitates the creation of network maps that illustrate the intensity of relationships between the metadata of the queried publications. To assess the existing literature on the risks that may affect the functionality of PPPs in the livestock sector we will use a bibliometric analysis, a quantitative research approach that has gained prominence for examining research trends. For this analysis, we will use VOSviewer version 1.16.19 which facilitates the creation of network maps that illustrate the intensity of relationships between the metadata of the queried publications. Our analysis focuses on metadata from research papers in the Web of Science (WoS) database using a few keywords. The search yielded 108 publications that matched the topics specified in the titles, abstracts, or keywords.

The Green Cluster places considerable importance on disease management and socio-economic difficulties within Public-Private Partnerships (PPPs), as seen by its focus on keywords such as "burden of disease," "deltamethrin-impregnated collar," "poverty," "anthrax," and "vaccination."

The Red Cluster entails an examination of governance frameworks and health management systems, as evidenced by the presence of key terms such as "bovine trypanosomiasis," "veterinary services," "empirical application," "delivery," "health," "livestock," "cattle," "food systems," "governance," and "sustainability." This cluster highlights the operational advantages of Public-Private Partnerships (PPPs) in improving livestock health management and fostering long-term sustainability. It demonstrates how governance can be applied practically to ensure the success of health initiatives.

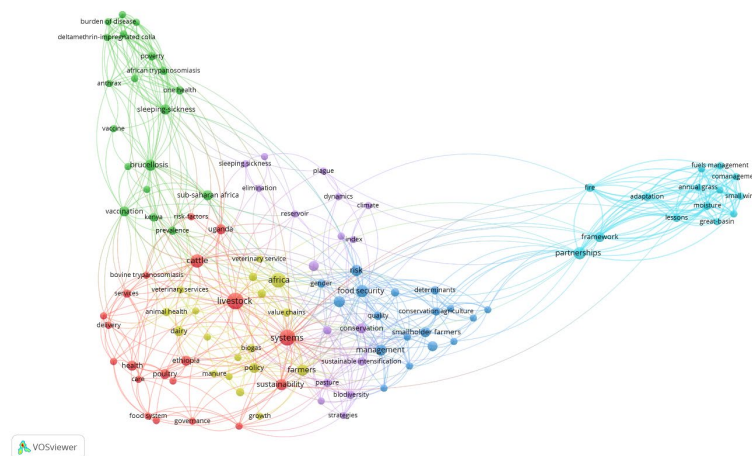


Figure 1. Cluster analysis—network visualization

Source: Authors' own computation in VOSviewer 1.6.19.

The Yellow Cluster is located next to this, focusing on the economic and environmental effects. It includes keywords such as "impact," "value chain," "biogas," "circular economy," and "cost-benefit analysis." The aforementioned emphasis implies a comprehensive analytical methodology in comprehending the financial viability and long-term viability of agricultural methods that contribute to a circular economy, emphasizing the economic efficiencies that may be attained within public-private partnership (PPP) frameworks. The subsequent conversation delves into the Purple Cluster, whereby the utmost importance is placed on environmental policies and sustainable practices. This cluster emphasizes the importance of sustainable intensification and strategic land-use planning in the PPP debate, using phrases like as "plague," "climate," "index," "strategy," "biodiversity," "pasture," and "land-use." The statement underscores the significance of integrating livestock management with wider environmental objectives, promoting strategies that align agricultural practices with ecological sustainability. Transitioning to the Blue Cluster, the focus transitions towards the importance of adaptation techniques and risk management in agricultural practices within the context of Public-Private Partnerships (PPPs). The highlighted terms, namely "risk," "agriculture," "adoption," "quality," "management," "conservation agriculture," "change adaptation," and "small holder farmers," exemplify the emphasis placed on the adoption of inventive agricultural methodologies that bolster resilience and alleviate risks, with a specific emphasis on smallholder farmers. The examination concludes with the Light Blue Cluster, which examines the structural and strategic frameworks of public-private partnerships (PPPs). This cluster focuses on key elements such as partnerships, framework, lessons, fuel management, moisture, and dynamics. This cluster highlights the significance of drawing insights from previous collaborations in order to enhance the dynamics and operational structures of public-private partnerships (PPPs) in the cattle industry. It proposes a reflective methodology that seeks to enhance and optimize partnership dynamics and results.

Together, these clusters offer a comprehensive perspective on the various tactics and complex methods used to handle market risks in public-private partnerships (PPPs) in the cattle sector. The authors emphasize particular fields of research while simultaneously illustrating the interconnectedness of these specific domains with broader concepts such as sustainability, economic feasibility, and strategic adaptability. An all-encompassing viewpoint is essential for enhancing the effectiveness of Public-Private Partnerships (PPPs) in modern agricultural environments, demonstrating the intricate interaction of tactics that promote sustainable growth and handle the complexities of the livestock sector.

Table 1. Top twenty most used words identified in the metadata (title, abstract or keywords) of the analyzed papers

No.	Keyword	Occurrences	Percentage of total occurrences (Top-20)	No.	Keyword	Occurrences	Percentage of total occurrences (Top-20)
1	systems	10	12.05%	11	co-management	2	2.41%
2	partnerships	6	7.23%	12	fuels management	2	2.41%
3	livestock	11	13.25%	13	great-basin	2	2.41%
4	framework	4	4.82%	14	invasive annual grass	2	2.41%
5	fire	3	3.61%	15	moisture	3	3.61%
6	brucellosis	5	6.02%	16	organizations	2	2.41%
7	lessons	3	3.61%	17	rangelands	2	2.41%

No.	Keyword	Occurrences	Percentage of total occurrences (Top-20)	No.	Keyword	Occurrences	Percentage of total occurrences (Top-20)
8	sleeping-sickness	4	4.82%	18	small wins	2	2.41%
9	adaptation	3	3.61%	19	food security	6	7.23%
10	annual grass	2	2.41%	20	farmers	9	10.84%

Source: Authors' own computation of the Web of Science-extracted metadata.

Examining the frequency of keywords in Table 1 offers a detailed understanding of the main topics explored in research on market risk factors in Public-Private Partnerships (PPPs) in the livestock industry. The high occurrence of keywords such as "livestock" (13.25%) and "farmers" (10.84%) emphasizes their essential significance, emphasizing the emphasis on the main participants and their crucial responsibilities in the agricultural domain. The aforementioned terms signify a notable focus on the stakeholders who are directly impacted by market risks and the operational dynamics within the sector.

The keyword "Systems" is referenced most frequently, accounting for 12.05% of the total, indicating a thorough analysis of the interconnected systems, including ecological, economic, and managerial aspects, that regulate the livestock sector. The comprehension of the intricate dynamics that impact risk management and resilience in agricultural practices necessitates the adoption of a systemic perspective.

Also, expressions such as "partnerships" (7.23%) and "framework" (4.82%) have aroused interest in the specialized literature. These phrases indicate significant research focused on examining how organized partnerships could reduce market risks and improve sustainability. Another topic addressed is that of "food security" (7.23%) which establishes a link between the effectiveness of public-private partnerships (PPPs) and outcomes affecting the stability and reliability of food production systems. This demonstrates a keen understanding of the wider consequences of market risks on the supply and accessibility of food, which are crucial aspects of agricultural sustainability.

Keywords such as "brucellosis" (6.02%) and "sleeping-sickness" (4.82%) are utilized to draw attention to health-related concerns, highlighting targeted investigations into certain diseases that present hazards to the well-being of cattle and, subsequently, to the economic sustainability of the industry. The significance of disease management in managing risks that have the potential to disrupt agricultural operations and market dynamics is underscored by these themes.

In summary, the examination of keywords in Table 1 provides a comprehensive understanding of the diverse research environment pertaining to public-private partnerships (PPPs) in the livestock industry. This study highlights the significant focus on systemic management, the effects on stakeholders, health considerations, and measures for environmental adaptation. Each keyword serves the purpose of indicating a particular area of emphasis and also adds to a more comprehensive comprehension of how public-private partnerships (PPPs) can effectively manage intricate market risks in order to improve agricultural sustainability and effectiveness.

Overall, studying the specialized literature highlights the fact that, as a rule, private sector participants are not interested in long-term projects, as many private sector participants aim to get maximum profit in a short time. Another obstacle is the lack of experience in managing PPP projects and the assumption of unexplored risks. For this reason, choosing the right partner or partners is extremely important. The aim is to put together a PPP with a maximum of complementary skills and resources to generate the best possible result.

Methodology

Starting from the study of specialized literature (Ekboir, 1999; Ayyappan et al, 2007; Tegegne et al 2010; Shapiro et al, 2017; Dione et al, 2019; Galière et al, 2019; Gizaw & Berhanu, 2020; Poupaud et al , 2022), this research aims to analyze some of the market risk factors that affect the organization and operation of PPPs in the livestock sector.

In this context, we will use a temporal analysis of the main indicators in the field of demand, supply and prices of livestock products in Romania compared to the EU 27 average and some developed EU countries. The analyzed data are provided by Eurostat, AgriData and Faostat and cover the period 2014-2022.

Thus, economic indicators regarding livestock production, food consumption, internal demand for food consumption, self-sufficiency, prices of the main livestock products for the period 2014-2022 were presented and analyzed. From the analysis and interpretation of the data it emerged that fluctuations in supply, demand and prices for livestock products can have a significant influence on the functionality of PPPs.

Results and discussions

Currently, projects that can be carried out through PPPs in the livestock sector are under the influence of major risk factors in the market sphere, with a great impact on the efficiency of public or private investments and their success. Among these, we mention the predictability and stability of the offer, the predictability and stability of demand, and price fluctuations of livestock products.

Fluctuation in the supply of livestock products

Livestock production in Romania, after Romania's accession to the EU, shows a considerable decline, mainly generated by the reduction of livestock numbers, low returns per head of livestock compared to the European average, fragmented supply dependent on the existence of numerous small farms, the lack of specialized slaughterhouses, reduced processing capacities in the food industry. In addition, the productions of the main products of livestock origin decreased because many companies in the field of livestock slaughter, meat processing or milk did not meet the conditions imposed by the European standards of quality and food hygiene.

In the period 2014-2020, cattle herds decreased in Romania by 9%, and in the EU27 by 3%, pig herds decreased in Romania by 8% and increased by 6% in the EU27, sheep herds increased by 14 % in Romania and decreased by 8% in the EU27 (Faostat, 2020). The yields of products of livestock origin in Romania are much lower than the average recorded in the EU, which indicates a considerable productivity deficit.

Table 2. Domestic production (thousands of tons)

		2014	2015	2016	2017	2018	2019	2020
Romania	Cattle meat	108	119	116	111	99	74	87
	Sheep and goat meat	77	80	87	83	81	55	55
	Pork meat	460	470	501	492	481	399	388
	Chicken meat	397	411	419	436	480	507	487
	Milk	4803	4677	4586	4439	4440	4349	4372
	Eggs	332	328	309	300	286	278	261

		2014	2015	2016	2017	2018	2019	2020
EU (27)	Cattle meat	6597	6827	6999	6993	7112	6999	6936
	Sheep and goat meat	613	619	623	614	622	585	568
	Pork meat	21746	22569	22946	22824	23223	22996	23219
	Chicken meat	11883	12267	12880	12946	13381	13290	13438
	Milk	148395	151332	152930	154090	156350	159012	160790
	Eggs	6250	6347	6266	6370	6400	6490	6546

Source: Faostat (2020) <https://www.fao.org/faostat/en/#data/FBS>.

In the period 2014-2020, in Romania, the domestic production of the main products of livestock origin registered an oscillating evolution with obvious downward trends, with the exception of chicken meat, while at the EU27 level this indicator registered sustained increases, with the exception of meat of sheep.

Thus, beef production in Romania decreased by 19%, sheep and goat meat production by 29%, pork production by 16%, milk production by 9%, egg production by 21%. Chicken meat production is up 23%. In the EU27 beef production increased by 5%, chicken production by 13%, pork production by 7%, milk production by 8%, egg production by 5%. Sheep and goat meat production falls by 7%.

As for the total production of cow's milk at the EU 27 level, it stands annually at over 150 thousand tons, being provided in a percentage of over 70% by Germany, France, the Netherlands, Italy, Poland and Ireland (European Commission, 2023).

Table 3. Available for food consumption* (thousand tons)

		2014	2015	2016	2017	2018	2019	2020
Romania	Cattle meat	134	143	130	104	101	83	101
	Sheep and goat meat	73	74	76	78	77	44	50
	Pork meat	627	676	707	694	702	698	664
	Chicken meat	366	406	428	451	377	458	460
	Milk	4316	4620	4635	4560	4608	4060	4103
	Eggs	293	286	280	267	262	261	250
EU (27)	Cattle meat	6112	6051	6116	6022	6237	6246	6115
	Sheep and goat meat	784	739	721	689	698	654	631
	Pork meat	17812	18361	17991	18218	18671	18189	17457
	Chicken meat	9462	9655	9932	9831	9979	9846	10206
	Milk	77459	79141	80126	80850	83483	84339	84608
	Eggs	5343	5360	5392	5385	5452	5808	5833

Source: Faostat (2020) <https://www.fao.org/faostat/en/#data/FBS>.

*(domestic production + import-export+/-stock variation)-losses-industrial uses

In the analyzed period, in Romania, in 2020 compared to 2014, the available for food consumption registers a different evolution compared to the evolution of domestic production, in the sense of a 6% increase in pork (with a maximum point in 2017, the increase was 13%) and 26% in chicken meat. These positive developments were due to pork and chicken imports which far

exceeded exports. The evolution of the available for the other products of livestock origin was a downward one, thus, for beef there was a decrease of 25%, for sheep and goat meat of 32%, for milk of 5% and for eggs of 15%.

At the EU 27 level, the availability of beef remains relatively constant, the availability of pork registers an increase of 2%, the availability of chicken meat an increase of 8%, the availability of milk and eggs an increase of 9%. The only contradictory evolution is that of the available for sheep and goat meat which registers decreases throughout the period, reaching in 2020 a level 20% lower than in 2014.

The evolution of the indicators related to the supply of livestock products reflects, to the greatest extent, the effects of the intensification of the requirements regarding livestock welfare, the requirements regarding the reduction of greenhouse gas emissions, especially in the cattle, poultry and pig breeding sector, and not least row, the negative effects generated by the swine fever epidemic and the Covid19 pandemic in Europe.

Fluctuations in demand for livestock products

The evolution of food consumption of the main products of livestock origin is the basis for determining the domestic demand for these products. According to Faostat data, in Romania, pork is in first place with a consumption of 34.5 kg/inhabitant in 2020, 10% more than in 2014. Poultry meat consumption recorded the highest increases, thus that in 2020 it was 23.9 kg/inhabitant, 31% higher than in 2014 (Faostat, 2020). The consumption of beef, mutton and goat meat, eggs and milk registered reductions of 22% (5.2 kg/ inhabitant), respectively 29.3% (2.6 kg/inhabitant), 11% (13 kg/inhabitant) and 1% (213 kg/inhabitant), in 2020 compared to 2014 (own calculations based on Faostat data, 2020).

Table 4. Domestic demand for food consumption* (tons)

		2014	2015	2016	2017	2018	2019	2020
România	Cattle meat	134,4	143,5	129,7	104,4	101,2	83,1	100,8
	Sheep and goat meat	73,1	74,3	75,8	78,0	77,0	44,3	49,6
	Pork meat	626,5	676,1	707,5	693,6	702,0	698,1	663,7
	Chicken meat	365,9	406,5	427,6	450,7	376,7	458,0	460,4
	Milk	4316,2	4619,6	4635,0	4559,9	4607,7	4060,0	4103,0
	Eggs	292,5	285,7	280,1	267,3	261,8	260,6	249,7
EU (27)	Cattle meat	6113,7	6051,0	6117,6	6023,8	6237,3	6247,6	6113,3
	Sheep and goat meat	785,9	738,0	721,3	691,1	696,5	654,1	632,3
	Pork meat	17812,6	18361,9	17992,0	18218,7	18671,6	18186,6	17458,3
	Chicken meat	9461,3	9656,7	9933,2	9831,7	9978,7	9847,6	10205,1
	Milk	77457,4	79142,9	80124,9	80851,4	83482,1	84338,3	84606,5
	Eggs	5345,6	5361,9	5391,8	5386,2	5451,5	5807,1	5832,8

Source: own calculations based on Faostat data (2020) <https://www.fao.org/faostat/en/#data/FBS>.

*Food consumption (kg/inhabitant/year) x with Population (inhabitants)

The consumption of some food products of livestock origin has increased, as a result of the increase in the population's income, but to a considerable extent it is achieved through imports. At the EU27 average level, the consumption of beef registers significant reductions, so that in 2020 it

was 13.7 kg/inhabitant, 0.3% lower than in 2014. The same trend is found in the case of pork consumption with a decrease of 2% (39.2 kg/inhabitant in 2020). The consumption of chicken meat, milk and eggs register increases of 8% (22.9 kg/capita), respectively 9% (190 kg/capita), 9% (13 kg/capita), in 2020 compared to 2014 Meat consumption of chicken, milk and sheep and goat meat, in 2020, in Romania, exceeds the EU27 consumption average, while beef consumption is below half of the European average.

According to Faostat data, in Romania, domestic demand for food consumption registers the highest increases in the case of chicken meat 460.4 tons in 2020, 26% more than in 2014. From a quantitative point of view, the first place is pork with a domestic demand of 663 tons in 2020, 6% higher than in 2014. The domestic demand for beef, mutton and goat meat, eggs and milk is down by 25% (100.8 tons), respectively 32% (49.6 tons), and 5% (4103 tons), in 2020 compared to 2014.

At the EU27 level, the internal demand for beef registers a relatively constant evolution, so that in 2020 it was 6113.3 tons. We encounter a downward trend, however, in the case of the demand for pork with a decrease of 2% (17458.3 tons in 2020) and the demand for mutton and goat meat with a decrease of 20% (17458.3 tons in 2020) . The demand for chicken meat, milk and eggs shows increases of 8% (10205.1 tons), respectively 9% (84606.5 tons), 9% (5832.8 tons) in 2020 compared to 2014.

Table 5. The level of self-sufficiency* (%)

		2013	2014	2015	2016	2017	2018	2019	2020
Romania	Cattle meat	88,1	75,0	77,3	83,5	97,4	90,8	82,2	79,8
	Sheep and goat meat	102,7	102,7	105,3	113,0	103,8	103,8	122,2	107,8
	Pork meat	71,2	73,0	69,1	70,5	70,6	68,1	56,8	58,2
	Chicken meat	96,7	108,2	100,5	97,2	95,8	126,3	109,7	104,7
	Milk	95,2	96,9	94,2	91,9	90,5	89,7	89,3	87,7
	Eggs	100,6	98,5	99,7	96,6	98,7	101,4	99,3	97,4
EU (27)	Cattle meat	102,3	108,2	113,1	116,2	117,6	114,3	112,7	114,3
	Sheep and goat meat	85,2	76,4	81,8	84,4	87,2	88,5	88,8	89,4
	Pork meat	117,6	121,4	122,2	126,8	125,0	124,2	126,3	133,0
	Chicken meat	112,7	119,4	120,6	122,8	126,4	125,9	127,1	124,7
	Milk	109,2	108,0	108,5	108,3	108,6	106,8	107,6	108,3
	Eggs	104,3	104,5	105,8	104,6	106,6	106,9	104,6	103,2

Source: Faostat (2020) <https://www.fao.org/faostat/en/#data/FBS>.

*(domestic production / available supply)x100

The degree of self-supply or the rate of self-sufficiency, together with the availability of supply, provides a first indication of the situation of some products or groups of products, from the perspective of food security. (Luca, L., 2023) In Romania, with the exception of sheep and goat meat, for which consumption is ensured from domestic production throughout the analyzed period and in some years for chicken meat, all other products of livestock origin have a low degree of self-sufficiency, respectively the decline of domestic production to most products are identified in the low values of this indicator.

At the level of the EU27 average, the situation is quite different, so that for all products of livestock origin, in the period 2014-2020, the degree of self-sufficiency exceeds 100%, pork meat with an indicator value of 133% and meat of chicken by 124.7% in 2020. The only product for which the degree of self-sufficiency is reduced (89.4% in 2020) is sheep and goat meat.

Price fluctuation and instability

The fluctuation of the prices of agricultural products in general and those of livestock origin in particular, their instability in amplitude and frequency were generated by the instability of demand or supply.

Against the background of the health crisis generated by the recent pandemic situation, the military conflict in Ukraine and the energy crisis, production costs for livestock products have seen significant expansion. This was due to significant increases in fuel and energy prices (Drăcea et al, 2020), which decisively influenced the prices of all agricultural inputs and also the prices of agricultural products at the farm gate.

In the coming period, the role of public power will be very important in supporting the prices of agricultural products of livestock origin and supporting livestock farms in Romania, to stimulate domestic production and reduce imports, especially pork and milk.

Cattle

The price of young cattle meat in live weight had an upward evolution during the 10 years in Romania, so that from 167 euros/100 kg in 2013 it increased to 372.1 euros/100 kg in 2022, respectively by 123%. In 2017 (155 euros/100kg) and 2019 (167 euros/100kg) the prices were below those recorded in 2013.

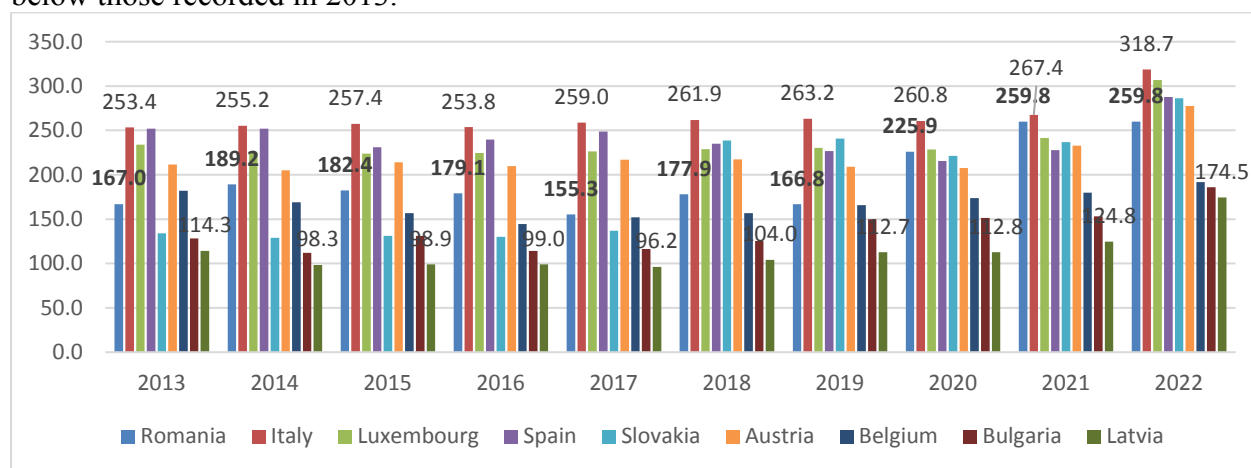


Figure 2. Young cattle prices (euro/100 kg live weight)

Source: Eurostat

(2022) https://ec.europa.eu/eurostat/databrowser/view/APRI_AP_ANOUTA__custom_7538151/default/table?lang=en

In the hierarchy of European countries, in 2022, Romania is in 6th place after Italy (318.7 euros/100kg), Luxembourg (306.9 euros/100kg), Spain (287.8 euros/100kg), Slovakia (286.2 euro/100kg) and Austria (277.5 euro/100kg). At the opposite pole were countries that registered the lowest price, thus, Belgium (191.6 euros/100kg), Bulgaria (186 euros/100kg), Latvia (174.5 euros/100kg) and Cyprus (167, 5 euros/100kg).

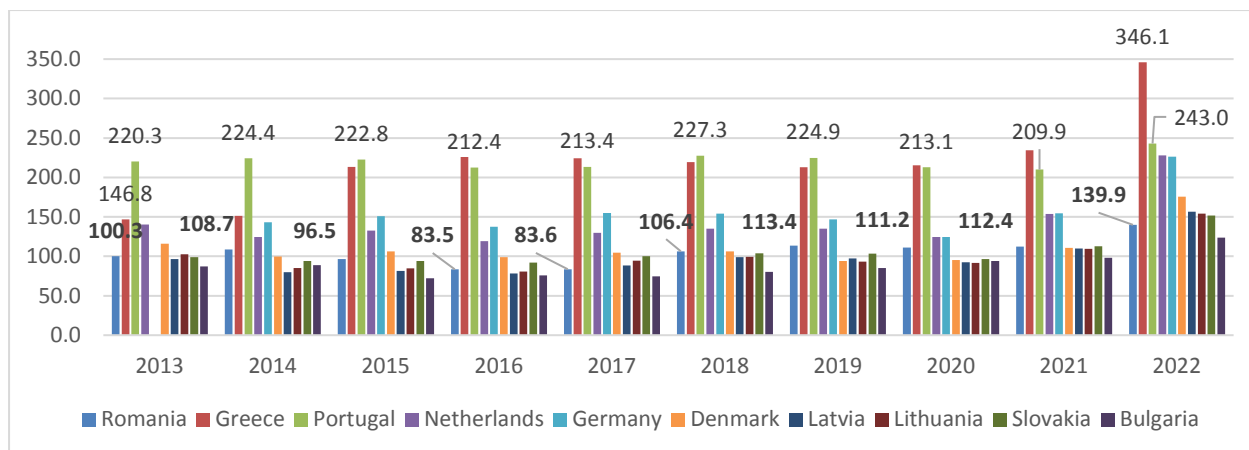


Figure 3. Cows prices (euro/100 kg live weight)

Source: Eurostat (2022)

https://ec.europa.eu/eurostat/databrowser/view/APRI_AP_ANOUTA__custom_7538151/default/table?lang=en

The live weight beef price in Romania was among the lowest among the EU 27 countries, starting from 100.2 euros/100 kg in 2013, it fell to 83.2 euros/100 kg in 2017, as then to rise steadily to around 140 euros/100kg in 2022 (an increase of 40%). However, throughout the analyzed period and in 2022, only Bulgaria (123.9 euros/100kg) registered a lower price than Romania. Like the two countries, low prices were also reported by the Czech Republic (161.6 euros/100kg), Latvia (156.4 euros/100kg), Latvia (154.3 euros/100kg) and Slovakia (151.7 euros/100kg). At the top of the hierarchy of EU 27 countries were Greece (346.1 euros/100kg), Portugal (243 euros/100kg), Germany (226.3 euros/100kg) and the Netherlands (227.9 euros/100kg).

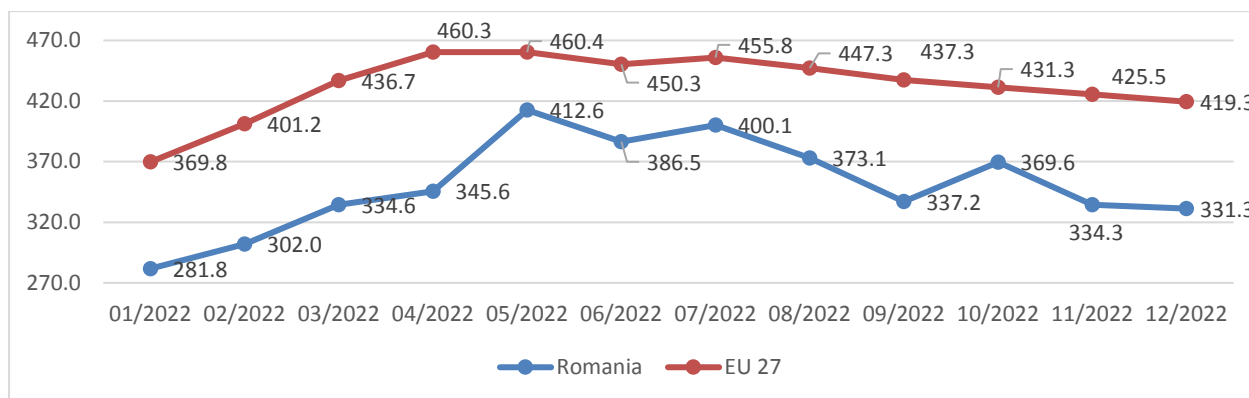


Figure 4. Beef carcass prices (euro/100 kg)

Source: AgriData (2022), <https://agridata.ec.europa.eu/extensions/DashboardBeef/BeefPricesExt.html>

In order to highlight price fluctuations over the course of a year and the existing gaps between prices in Romania and the EU27 average, we presented in Figure 4 the evolution of the price of beef - carcass in the months of 2022. It can be seen that, in Romania, the price starts from 281 euros/100 kg, increases in the first months of the year, until April (by 7.2%, 10.8%, 3.3% and 19.4% compared to the previous month), then successive decreases and increases (-6.3%, 3.5%, -6.7%, -9.6%, 9.6%, -9.6%, and -0.9% compared to the previous month).

There is also variation in the EU27 average price, but the variation registers much smaller negative values, while the positive values are comparable (8.5%, 8.9%, 5.4%, 0.0%, -2, 2%, 1.2%, -1.9%, -2.2%, -1.4%, -1.3%, -1.4% compared to the previous month). There were significant gaps between beef prices in Romania compared to the EU27 average, thus, in the first 4 months of the year prices were 23-25% lower than the average European price, in the next 4 months by 10-17 % lower, and in the last 4 months by 17-23% lower. At the level of 2022, the average price of beef was 19% lower in Romania compared to the EU27 average.

Swine

The price of grade I carcass pork had an oscillating evolution with an upward trend, so that from 207 euros/100 kg in 2013, it fell to 189.1 euros/100 kg in 2015, then increased to approx. 209 euros/100kg in 2020, and in 2022 it was 240.3 euros/100kg (a 16% increase in 2022 compared to 2013). What is important to note is that, of all the EU27 countries that reported complete data to Eurostat, Romania records the most appreciated sales prices. Similar developments and significant prices were also recorded in Sweden with a 13% increase from 2013 to 2022 (from 194 euros/100 kg to 219 euros/100 kg), Germany a 20% increase (from 170 euros/100 kg to 205 euros/100 kg), Portugal an increase of 6% (from 190 euros/100 kg to 202 euros/100 kg), Finland a 13% increase (from 178 euros/100 kg to 201 euros/100 kg).

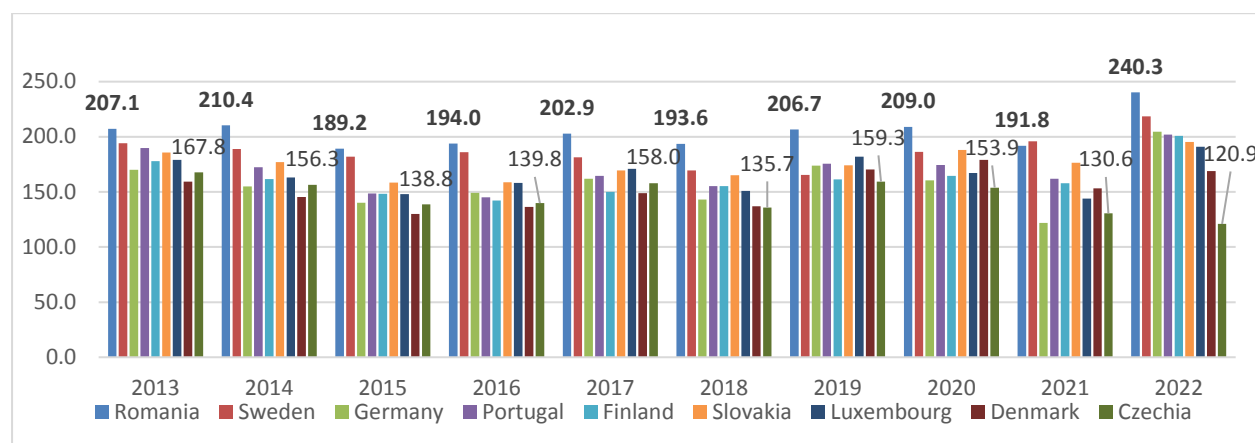


Figure 5. Pig carcasses grade I prices (euro/100 kg live weight)

Source: Eurostat (2022)

https://ec.europa.eu/eurostat/databrowser/view/APRI_AP_ANOUTA__custom_7538151/default/table?lang=en.

Denmark had the lowest prices (from 160 euros/100 kg in 2013 to 169 euros/100 kg in 2022), and the Czech Republic the lowest price throughout the analyzed period, with significant reduction trends (in 2022 by 28% lower than in 2013).

The price of grade II carcass pork in Romania was low compared to the other EU 27 countries and showed a downward trend in the analyzed period, starting from 172 euros/100 kg in 2013, it dropped to 145 euros/100 kg in 2016, then to increase significantly, reaching 175 euros/100 kg in 2022, approximately at the level recorded in 2013 (an increase of 1.9%).

The same downward evolution of prices with a slight increase at the end of the period, i.e. in 2022, was recorded in the case of all EU 27 countries for which there is data provided by Eurostat.

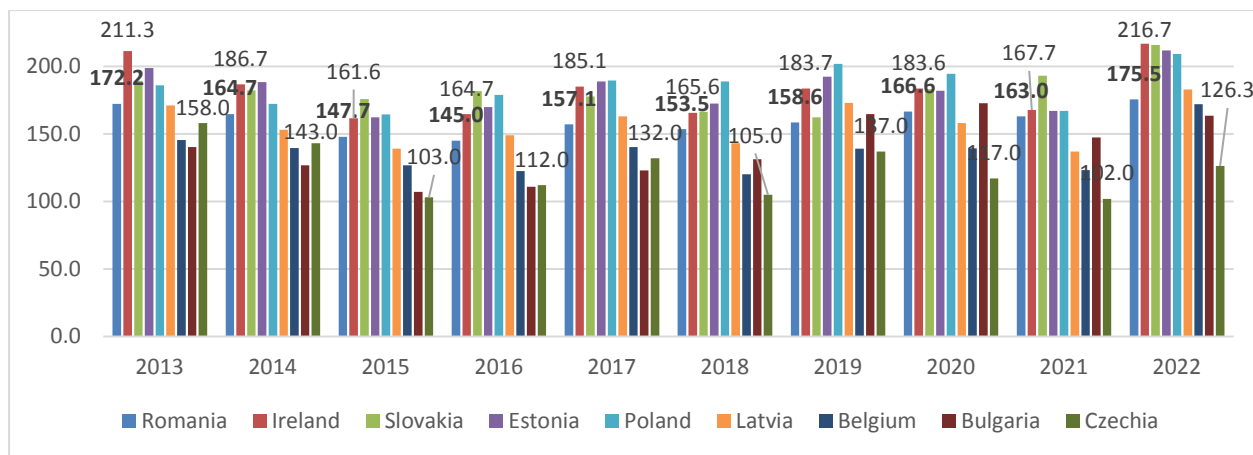


Figure 6. Pig carcasses grade II prices (euro/100 kg live weight)

Source: Eurostat (2022)

https://ec.europa.eu/eurostat/databrowser/view/APRI_AP_ANOUTA__custom_7538151/default/table?lang=en.

Thus, Ireland records in 2022 the highest price of 216.7 euros/100 kg (an increase of only 2.6% compared to 2013), Slovakia 215.8 euros/100 kg (a 14% increase compared to 2013), Austria 209.1 euros/100 kg (a significant increase of 22% compared to 2013). The last places in the hierarchy were occupied by Bulgaria with a price of 163.4 euros/100 kg (an increase of 16.5% compared to 2013), the Netherlands 161.6 euros/100 kg (a significant increase of 33% compared to 2013) and the Czech Republic 126.3 euros/100 kg, the lowest price recorded in 2022 (down 20% compared to 2013).

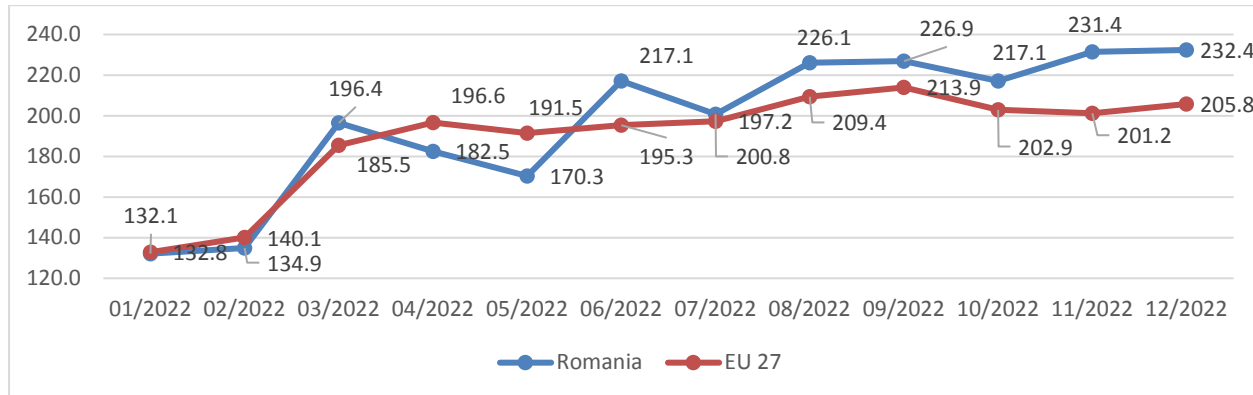


Figure 7. Pig meat average prices carcass grade I+II (euro/100 kg)

Source: AgriData (2022), <https://agridata.ec.europa.eu/extensions/DashboardPigmeat/PigmeatPricesCarcases.html>.

Fluctuations in the price of pork carcass during 2022 are significant, it starts from 134.9 euros/100 kg, it registers increases and decreases until July (+2.1%, +45.6%, -7.1%, -6.7% and +27.5%, -7.5% compared to the previous month), then, except for October, successive increases (+12.6%, +0.4%), -4.3%, 6.6% and 0.4% compared to the previous month). The EU 27 average price has a similar evolution to Romania, but the reductions and increases are more moderate from one month to the next (+5.4%, +32.4%, +6.0%, -2.6%, +2.0%, +1.0%, +6.1%, +2.2%, -5.2%, -0.8%, +2.3%).

Poultry

The price of poultry meat in live weight started from 113.4 euros/100kg in 2013, decreased every year, reaching 83 euros/100kg in 2019 (reduction by 27%), and then, in 2022, reaching approximately current level recorded at the beginning of the analysis period, respectively 113.9 euros/100kg.

Italy, Latvia, Greece, Spain, Germany, Lithuania and Belgium recorded significant high prices on the EU27 market, although with oscillating developments with a downward trend in the period 2014-2020.

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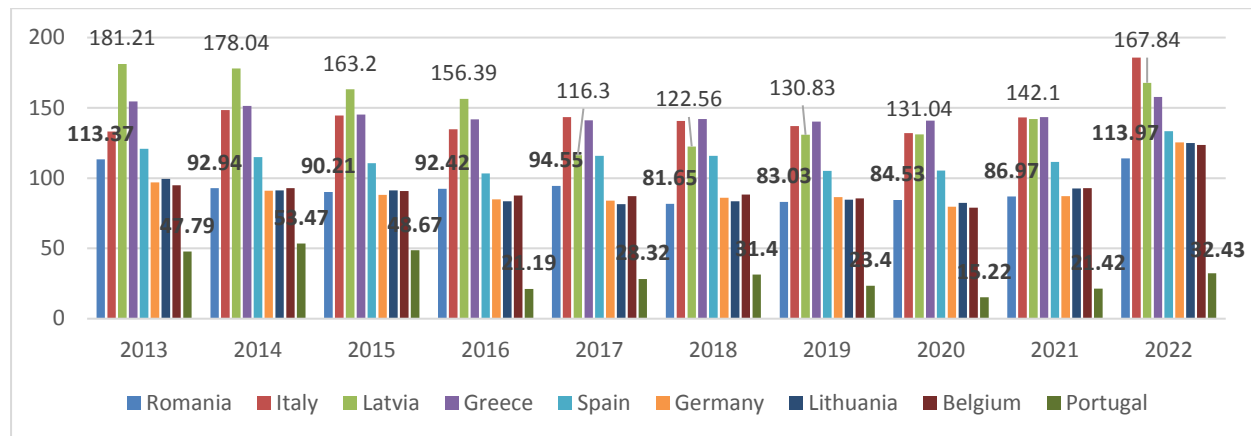


Figure 8. Poultry meat prices (euro/100 kg live weight)

Source: Eurostat (2022)

https://ec.europa.eu/eurostat/databrowser/view/APRI_AP_ANOUTA__custom_7538151/default/table?lang=en

Similar developments and price levels for poultry meat in Romania, in the period 2013-2022, were also recorded by other countries, especially Central and Eastern Europe, such as Bulgaria (decrease of 0.2%, in 2022; 116.6 euros/100kg), Slovakia (increase of 0.2%, in 2022; 116.6 euros/100kg), Slovenia (decrease of 2.6%, in 2022; 116.6 euro/100kg), the Czech Republic (increase of 16.7% in 2022; 111 euro/100kg), Hungary (increase of 13.3% in 2022; 111 euro/100kg) and the Netherlands (increase of 25%, in 2022; 115 euros/100kg).

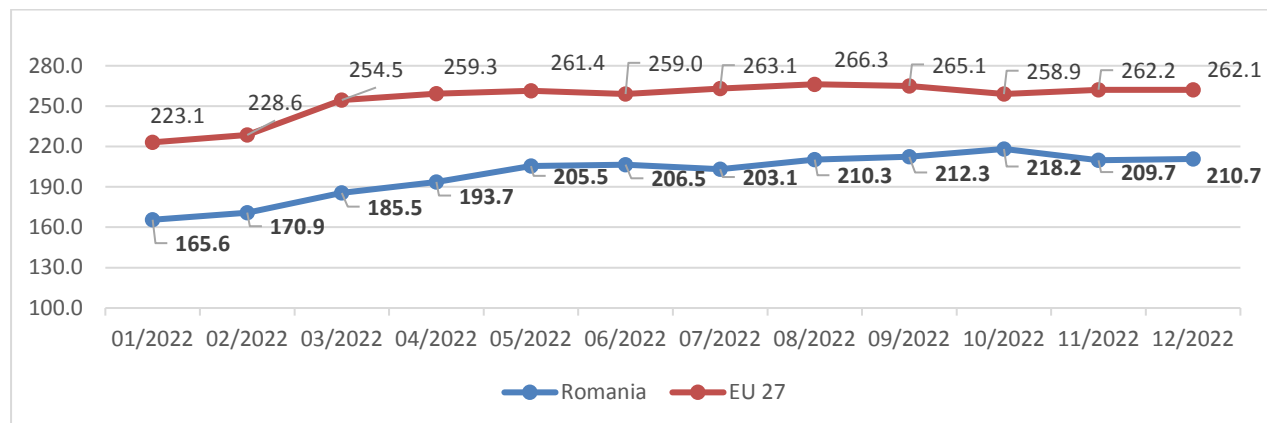


Figure 9. Poultry meat (broiler) prices in 2022 (euro/100kg)

Source: AgriData (2022), <https://agridata.ec.europa.eu/extensions/DashboardPoultry/PoultryPrices.html>

In all months of 2022, the price of broiler chicken meat in Romania was 15% to 27% lower than the EU27 average. In January, the lowest price of 165.6 euros/100kg was recorded, which increased up to 218.2 euros/100kg in September, before falling to 210.7 euros/100kg in December. However, at the end of 2022 there was a 27% increase in the price of broiler chicken meat.

Milk

The price of cow's milk in Romania recorded among the lowest values compared to EU member countries. In 2013, only Latvia (27.9 euros/100kg) and Lithuania (27.5 euros/100kg) recorded lower values than Romania (28.1 euros/100kg), and in 2022 Romania's position in the EU27 hierarchy was similar, with an average milk price of 40.6 euros/100kg, while only Belgium (36.9 euros/100kg) and Luxembourg (28.7 euros/100kg). The average price of cow's milk in Romania recorded an oscillating evolution with a downward trend from 2013 to 2019, the most significant price drops were recorded in 2015 (27.4 euros/100kg) and 2016 (27.2 euros /100kg). Throughout the rest of the period, it was kept at a low level compared to the EU 27 average, and then from 2020 it increased (30.4 euros/100kg), reaching a maximum of the analyzed period, in 2022 (40.6 euros/100kg).

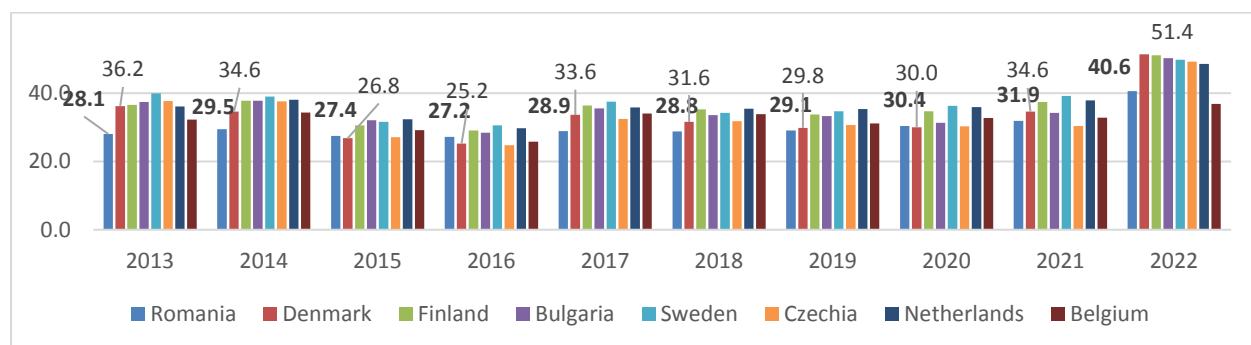


Figure 10. Cow milk prices (euro/100 kg)

Source: Eurostat (2022)

https://ec.europa.eu/eurostat/databrowser/view/APRI_AP_ANOUTA__custom_7538151/default/table?lang=en.

An important and successive decline in the price of milk is also noticeable in the case of the other European milk-producing countries, in the period 2013-2020, namely Denmark, Finland, the Netherlands, Germany, Bulgaria, Sweden, the Czech Republic.

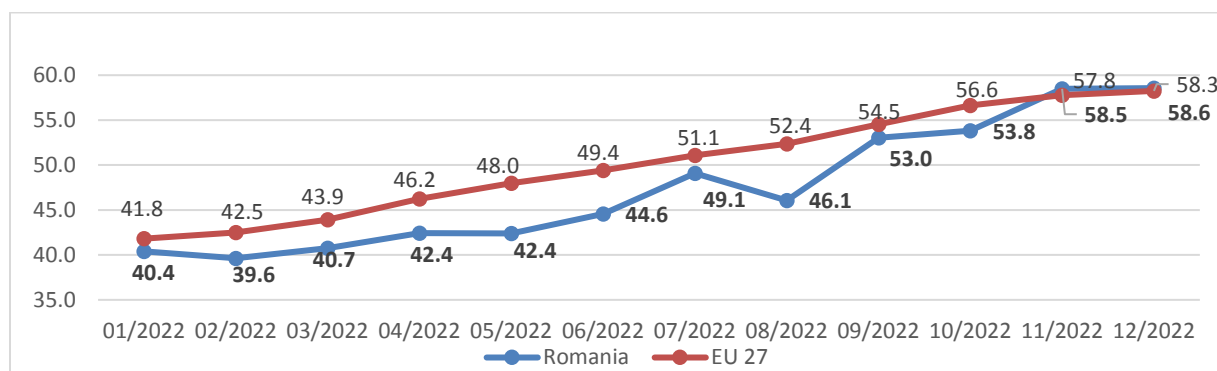


Figure 11. Cow milk prices in 2022 (euro/100 kg)

Source: AgriData (2022), <https://agridata.ec.europa.eu/extensions/DashboardRawMilk/RawMilkPrices.html>.

Fluctuations and variation in prices during 2022, per month, as well as the existing gaps between milk prices in Romania and the EU27 average, are highlighted in Figure 11. It can be seen that, in Romania, the price starts from 40.4 euros/100 kg in January, then a decrease of 2% in February, increases in the following 2 months (of 2.8% and 4.1% compared to the previous month), then a significant decrease of -0.02% in May, followed by increases in the following 2 months (of 5.1% and 10.1% compared to the previous month), in August again there is a decrease compared to the previous month of -6.2%, and by the end of 2022 it will significant increases were recorded (15.1%, 1.5%, 8.7% and 0.1% compared to the previous month).

The EU 27 average price of milk is on the rise month-on-month, with increases of 1.7%, 3.3%, 5.3%, 3.8%, 2.9%, 3.4%, 2.5%, 4.1%, 3.9%, 2.0%, 0.8%.

The large number of small dairy cow farms existing in Romania, the low level of investments in automation and sustainable technologies, the inconsistency of agricultural policies in the field of supporting cow farms, especially small ones, the faulty milk collection system and the unstable economic environment of recent years is reflected very well in the low and fluctuating production of milk, as well as in the low level of prices. On the other hand, at the EU 27 level, the increase in milk production followed by a decrease in demand for this product and derived products was the main cause of the market imbalance manifested by significant price drops.

Economic instability can lead to significant market fluctuations, including fluctuations in agricultural prices, exchange rates or interest rates. This increases uncertainty and financial risk for private investors, as it can be difficult to forecast and manage risks in an unstable economic environment. (Moschini, & Hennessy, 2001)

During periods of economic instability with significant market fluctuations, banks and financial institutions may become more reluctant to provide loans or finance for PPPs or agricultural projects.

Economic instability can also influence the demand for agricultural products, reducing consumption or affecting consumer preferences. This can lead to significant variations in income and profitability for agricultural projects. To mitigate or eliminate these effects, during periods of economic instability, governments may take unforeseen measures, such as changing regulations or tax policies, changes that can have a significant impact on project operating costs and profitability (Barry & Robison, 2001).

To manage these risks and ensure the functionality of PPPs in the livestock sector, it is important to explore viable financing options such as: government subsidies, guarantees for loans, innovative financing structures, agricultural insurance (Kloeppinger-Todd & Sharma, 2010).

Thus, careful planning and risk management and close collaboration between public and private partners are essential to ensure the success of PPPs projects in this specific sector of livestock husbandry.

Conclusion

From the analysis carried out, corroborated with the results from the specialized literature, it can be stated that the functionality of PPPs in agriculture is influenced by a number of factors, among which we note the fluctuations of supply, demand and prices for livestock products. However, these factors can exert both positive and negative influences. As for the positive influences, they manifest themselves in periods of increased demand and rising prices, through a transmission mechanism that gives PPPs the opportunity to invest in more efficient livestock processing technologies.

Regarding the negative influence on PPPs in agriculture, however, sudden price fluctuations can make planning and management of PPP projects difficult.

Thus, farmers may be affected by fluctuations in prices and demand for animal products, given that price reductions lead to lower receipts, while an increase in prices may be followed by a corresponding increase in input prices.

Given these considerations, it is appreciated that PPPs in the agricultural sector require the implementation of a series of risk management strategies and tools to deal with price and demand fluctuations. These may include flexible contracts, agricultural insurance or strategic stocks of livestock products to manage variability.

Furthermore, by adopting coherent policies and measures, the functionality of PPPs can be greatly improved. A first step could be for public authorities to implement awareness and education programs for farmers, guiding them to understand the benefits of PPP. A second measure is represented by the involvement of the private sector in decisions at the government level in order to develop policies that are more coherent and closer to the needs of farmers.

A third measure could be to provide tax incentives to private companies involved in PPPs in the livestock sector that include tax breaks or other incentives for investment in infrastructure, technology or services that support increased production and improve efficiency. Finally, a last step could be to establish clear and predictable regulatory frameworks that provide legal certainty for all parties involved.

In conclusion, fluctuations in supply, demand and prices for livestock products can influence the functionality of PPPs in agriculture both positively and negatively. It is important that PPP projects are designed and managed with these variables in mind to maximize benefits for all involved, including farmers, investors and consumers.

However, the study also has a number of limitations. Thus, the main limitation of the study is that it is based on the available data provided by Eurostat, AgriData and Faostat, data that may include the lack of detailed information, as well as possible errors or discrepancies in data collection or interpretation. Also, the analysis covers the period 2014-2022, which may not give a complete picture of the evolution of the market over time. Extending the period of analysis could, of course, provide a more comprehensive perspective on trends and influencing factors.

Finally, the last limitation of the study is that it uses more of a qualitative analysis of risk factors, based on the interpretation of data and observed trends. In future research, more rigorous quantitative analyzes will be used, which could provide a deeper and more objective understanding of the situation.

Acknowledgement

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