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Key Drivers of European Agriculture: Output, Income, and Stocks in Focus

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Abstract:

Purpose: *The article attempts to analyze stock in relation with output and incomes in agricultural farms in the European Union. We answer the following questions: 1. How important are stocks in farms in relation with balance sum, agricultural area, output and income?; 2. Does the importance of stock depends on the economic size or type of production?; 3. What is the relation between stock output, income and other categories?*
Methodology: *Research is based on the FADN (RICA) database. The scope of the research covers the years 2004-2021. The panel data models are used.*
Findings: *The larger the farm in terms of economic size, the more agricultural area it has, the higher balance sum it manages, and the higher the production and income it generates. Stock of agricultural products increases also with these categories. Taking into account the level of stock, the geographical location of farm is important too but not a type of production. After conducting panel regression, it turns out that the level of stock in farm is influenced by: labour, utilised agricultural area, output, and to a lesser extent: income, liabilities and cash flow.*
Practical Implications: *Farms play an important role as part of agricultural systems in the process of sustainable development. EU policy is focused on agriculture, especially on family farms. When farms generate income, they are able to perform their production functions continuously and efficiently. They become resilient to disruptions and unexpected crises occurring in the economic environment. The appropriate amount of stock helps maintain the continuity of production, it is a part of current assets dedicated for use in case of necessity.*
Originality/Value: *Nowadays issues related to stock management in the context of production and income of the agricultural farms are of interest only to farmers. They are not the subject of discussion among scientists, journalists, politicians, social activists, employees of agricultural advisory centers or banks. Only the methodology for elaborating the life cycle inventory of agricultural products is discussed. Lack of the economic research in this area is a big research gap in the science.*

Keywords: *The European Union, EU policy, FADN, family farm, income, output, stock.*

JEL: *G51, Q10, Q14.*

Paper Type: *Research Paper*

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1. Introduction

The EU policy is focused on agriculture, especially on family farms. This is because family farming is the most common operational farming model in Europe. The majority of the EU's farms are family farms, inherited by next generations, and contributing to the socio-economic and environmental sustainability of rural areas. From economic perspective, family farming is identified with specific entrepreneurial skills, business ownership and management, choice and risk behavior, resilience and individual achievement.

Family farming is often more than just profession because it reflects a lifestyle based on beliefs and traditions. It should be underlined that from a sociological perspective, family farming is associated with family values, such as solidarity, continuity and commitment (EC, 2019). That is why it is so important for them to function and manage them efficiently.

Issues related to stock management in the context of production and income of the agricultural farms are of interest only to farmers. They are not the subject of discussion among scientists, journalists, politicians, social activists, employees of agricultural advisory centers or banks.

This topic is not present in political, economic and social discussions. We can read findings on the methodology for elaborating the life cycle inventory of agricultural products (Mourad *et al.*, 2007; Lovarelli *et al.*, 2016; Tassielli *et al.*, 2019; Sinisterra-Solis *et al.*, 2023; Jeong and Gopinath, 2024; Khan *et al.*, 2024; Cristea *et al.*, 2022). It is more of a technical than economic approach to farming in agriculture. Lack of the economic research is a big research gap in the science.

The appropriate amount of stock helps maintain the continuity of production, it is a part of current assets set aside. Its size indirectly affects the income from the family farm. It should be underlined that farms are unique economic entities. They combine the workplace with the personal life of a farming family. They are a place to earn money and spend money at the same time. They carry out agricultural production in order to ensure an adequate standard of living for members of the farming family.

The uniqueness of their work results from taking up the activity in the food production sector, which is associated with working with living organisms,

seasonality of production and operation in an environment with changeable, and even unpredictable, weather. When farms generate income, they are able to perform their production functions continuously and efficiently. They become resilient to disruptions and unexpected crises occurring in the economic environment.

Family farms are by far the most common type of farm in the European Union (EU), encompassing a wide range of agricultural holdings: from small, semi-subsistence farms with only family workers and farms which have to rely on other gainful activities for a diversified source of income, through to much larger, more productive farms which nevertheless are mostly managed by family members.

There were 9.1 million farms in the EU in 2020, the vast majority of which (an estimated 93%) can be classified as family farms that operate as family-run businesses in which the farm is passed down through the generations. Indeed, family farms dominate the structure of EU agriculture in terms of their numbers, their contribution to agricultural employment and, to a lesser degree, the area of land that they cultivate and the value of the output they generate (Agriculture Statistics, 2024).

The aim of this article is to analyze the amount of stock in agricultural products in relation with the output and incomes in farms from the European Union (EU) in the 2021 year. Also a dynamic analysis of other determinants of stocks is conducted for years 2004-2021 with the use of the panel data models.

2. Background: The Role of Stock in Agricultural Farms

A stock is a considerable part of the current assets in a majority of economic subjects. A stock participates in the production and economic processes and it has an influence on the final result achieved by an economic subject. The stock comes basically from own production, its maintenance costs money, but its availability affects the final farming income.

The stock management is aimed at, on the one hand, assuring the access to stock necessary for normal activity of the economic subject, but on the other hand, maintaining the cost of ordering and storing on the lowest possible level. The stock maintenance is expensive, so the pressure to decrease stock is always present a part of total strategy of the subject operated on cost reduction (Brigham and Houston, 2005). One must remember that capital is multiperiodic inputs of production. It jointly supplies outputs with different time subscripts and it contributes a major part of its services to future rather than to current production (Yotopoulos, 1967).

Focusing on agriculture, production function and factor productivity estimates are of paramount importance, given the role played by this sector in the process of economic development (Donckt *et al.,* 2021).

The appropriate stock management in farms appears to be a huge challenge for their managers. The rational stock management should lead to cost cutting, especially under the circumstances of the growing competitiveness in agricultural markets.

Hence the activity of agricultural farms in the market should be based on the constant search of the possibilities of further rationalization of production. A change and improvement in stock management can support achievement of such target, allowing the increase in effectiveness of production (Wasilewski, 2004).

It is worth emphasizing, that in the agriculture the production relations are composite, because the production depends not only on decisions made by farm's manager about production's factors engaged, but on vegetation conditions as well (Woś, 2004). The consequence of these relations influences individual farm income. Consequently, this amount in current period has an influence on the consumption level and the production increase in the next period. It is worth emphasizing that the rational stock management is a one of costs cutting, so of increasing of production profitability (Ryś-Jurek, 2009).

The last few years have been difficult for most companies, and also for the agriculture (Matei and Anton, 2022; Agusman *et al.*, 2023). Farming is a risky business and prosperity in farming comes and goes in waves that are connected to the up-and-down swings in the general economy (Betanco Gunera, 2023). Despite of fact that the farmland is usually uncorrelated with the equity market (Rasool, 2018).

3. Methodology

Research is based on the data obtained from Farm Accountancy Data Network (FADN, RICA). The FADN data provides a detailed presentation and analysis of the main determinants of the farms' production, economic and financial situations from the EU in the years 2004-2021. The year 2022 is incomplete (it ends as of July 30th, 2024).

This database provides information, among others, about: revenues, costs, production conditions. It should be emphasized that FADN is the only database for which the data are collected according to uniform rules. Farms form this database are creating a statistically representative sample of commercial agricultural holdings operating in the European Union. The number of farms represented in 2021 is presented in Table 1. United Kingdom is excluded in this research.

The research was conducted in three parts. In the first part, the analysis of agricultural area, balance sheet, output, incomes and stock of the average farm from the EU-27 was made, in comparison with the results from those countries in which farms represented account for more than 10% of the EU as a whole. These were: Poland (19.5%), Italy (15.0%), Spain (12.8%) and Romania (10.9%) (Table 1).

Table 1. *Number of farms represented in FADN according to country of EU in 2021*

No	Name of country	Number of farms	No	Name of country	Number of farms
-	**EU-27**	**3 562 962**	14	Lithuania	54 097
1	Poland	693 880	15	Netherlands	43 186
2	Italy	534 547	16	Slovenia	38 927
3	Spain	456 561	17	Belgium	27 720
4	Romania	390 026	18	Sweden	26 852
5	France	268 279	19	Finland	23 095
6	Greece	266 970	20	Latvia	22 216
7	Germany	158 000	21	Denmark	18 173
8	Portugal	115 010	22	Czech Republic	14 212
9	Hungary	102 282	23	Cyprus	11 118
10	Ireland	90 752	24	Estonia	6 944
11	Croatia	67 549	25	Slovakia	4 466
12	Austria	67 354	26	Malta	1 909
13	Bulgaria	57 482	27	Luxembourg	1 355

Source: *Own calculation based on FADN 2024.*

In the second part, the average share of stock of agricultural products in the balance sum was presented according to the economic size and to the type of production along with output and family farm income according and agricultural area to the separated groups. The average results in the EU-27 were presented in the comparison of results from Poland, Italy, Spain and Romania.

In the third part, relations between the stock and output, family farm income and other determinants, are estimated. All available production, economic and financial information from the FADN database were taken into account. In this way, a panel analysis was performed in the years 2004-2021.

The study sought to answer the following questions:

1. How important are stock of farms in relation with balance sum, agricultural area, output and income for farms from the European Union in 2021?
2. Does the importance of stock changes according to the economic size or type of production of farm from the European Union in 2021?
3. What is the relation between stock output, income and other production, economic and financial categories (f. ex.: area, labor, costs, taxes, cash flow, investment)?

In the first and second part of research a descriptive, comparative analysis and basic methods of descriptive statistics was used. In the third part was made a regression. The panel models using the Gretl program are estimated.

The general formulation of a panel data model can be expressed by the equation (Baltagi, 2005):

$$y_{i,t} = \alpha_i + X'_{i,t}\beta + u_{i,t} + \varepsilon_{i,t} \quad (1)$$

Where:

- i (i = 1, ..., N) denoting individuals,
- t (t = 1, ..., T) denoting time periods,
- X'i,t denoting the observation of K explanatory variables in country i and time t,
- αi is parameter which is time invariant and accounts for any individual-specific effect not included in the regression equation.

Two different interpretations may be given to the αi, so two different basic models may be distinguished (Arbia and Piras, 2005):

- Fixed Effect Panel Data Model (FEM)
- Random Effect Panel Data Model (REM).

In order to choose between Random and Fixed Effect Model, the Hausman test is used. The idea is that one uses the random effects estimates unless the Hausman test rejects. In practice, a failure to reject means either that the RE and FE estimates are sufficiently close so that it does not matter which one is used, or the sampling variation is so large in the FE estimates that one cannot conclude practically significant differences are statistically significant (Wooldridge, 2013).

It should be emphasized that other characteristics of the test sample should also have the influence on choice between these models. The estimator in FE model may not be compatible for short panel time series, but the FE model appears to be more appropriate if the analysis objects are not selected randomly and it is important to estimate individual effects for each objects (Dańska-Borsiak, 2011).

The FADN data is not the original data, as it is the aggregated average information calculated on the basis of 15 farms with the obligation of data secrecy applied. Taking all objections into consideration, it was decided to estimate the RE and FE models, on the basis of their statistical significance. This decision was supported by the Hausman test was used and showed.

4. Results

According to the FADN data, the average farm area in the EU in the year 2021 amounted to 40.3 hectares, while in the Poland, Italy and Romania it ranged between 21 and 25 hectares, only in Spain it amounted to 44 hectares (Table 2).

The analysis of the balance sheet according to the FADN data for the year 2021 showsd that the European average farm managed the balance sum equaling to 415 thousands euro. The structure of the European average farm's assets is dominated by

the fixed assets – their average value amounted to more than 75% of balance sum.

The situation was similar in selected countries, although in Spain the fixed assets accounted for only 55% of the balance sheet total (Table 2). It is a result of freezing capital in the fixed assets by farms, because the seasonal leasing of the farm equipment is difficult in the agricultural branch. It happens that in the same time every farm demands agricultural equipment. So the high share of fixed assets makes the farm independent from the leasing firms, but it decreases the farm's flexibility and increases its fixed costs (Poczta and Średzińska, 2007).

It is worth to emphasize that in the structure of fixed assets in chosen four farms (from Poland, Italy, Spain and Romania) and in the average from the EU-27 not occurred the fundamental differences. The exception was Romania with a low results. The value of buildings in the European average farm equaled 49 thousands euro, being about c.a. 15% of fixed assets' value.

The second largest share (about 13.5%) was observed in the case of value of machines and equipment with volume of 42.5 thousands euro. Whereas in the average farm in the EU-27, almost 66% of value of fixed assets in the analysed year was a value of land, permanent crops and production quotas – almost 206 thousands euro (Table 2).

In the analyzed year, a considerable difference occurred in the level and in the structure of current assets in the chosen four farms in comparison with the average farm in the EU-27. The average value of current assets of the European average farm in the year 2021 amounted to 102.5 thousands euro. The highest share in the current assets' structure of average farm from the EU-27 was observed in the case of other circulating assets. The other circulating assets consist of cash and other assets that can be easily converted to cash, short-term assets, amounts owed to the holding, normally arising from business.

The share of other circulating assets in the current assets of the European average farm amounted almost to 80% (with the value of c.a. 80.8 thousands euro). In the structure of current assets of farm from the EU-27, the stock of agricultural products took a considerable place, achieving about 12.5% with the value of 12 thousands euro (Table 2). We can suppose that in the year 2021 European farms conducted production with the support of own agricultural materials. Meanwhile, Polish and Romanian average farm had less cash than the average in the EU, and Spanish and Romanian farms had very low stock.

The European average farm was also characterized by lower inclination to debt. In the analysed year, the share of total liabilities in the balance sum amounted to about 16.6%. Comparing Poland, Italy, Spain and Romania with the EU-27, it can be observed, that the total liabilities of the average chosen farms achieved only (in order of appearance): 5%, 1.3%, 3.5% and 3% of the balance sum (Table 2).

Table 2. *The production and incomes categories in chosen farms from the EU in 2021*

Details	**EU-27**	**Poland**	**Italy**	**Spain**	**Romania**
1. Utilised agricultural area (ha)	40.3	21.4	23.2	44.1	25.0
2. Balance sum (k €)	415.06	207.70	429.17	415.94	73.59
a) Total fixed assets, including (k €):	312.47	181.52	292.26	230.91	55.50
- Land, permanent crops and quotas	205.85	107.47	237.87	180.62	19.87
- Buildings	49.08	38.78	27.68	24.33	16.08
- Machinery	42.48	31.13	19.20	13.60	15.93
- Breeding livestock	13.08	4.03	7.49	12.25	3.53
b) Total current assets, including (k €):	102.58	26.17	136.90	185.02	18.08
- Non-breeding livestock	9.73	5.30	4.90	7.11	1.69
- Stock of agricultural products	12.07	9.00	7.05	1.18	0.77
- Other circulating capital	80.78	11.86	124.95	176.73	15.61
c) Total liabilities, including (k €):	69.48	10.79	5.76	14.37	2.20
- Long and medium-term loans	52.90	8.02	5.54	10.01	0.97
- Short-term loans	16.58	2.77	0.21	4.35	1.23
d) Net worth	345.58	196.90	423.40	401.57	71.38
3. Total output, including (k €):	108.37	45.21	81.11	104.70	34.28
a) total output crops and products	58.93	24.82	53.38	64.75	25.30
b) total output livestock and products	42.66	19.90	22.60	39.09	8.93
c) other output	6.77	0.48	5.12	0.85	0.04
4. Total output calculated on 1 hectare (k €/1 ha)	2.68	2.11	3.50	2.37	1.37
5. Family farm income (k €)	32.17	15.96	40.45	41.13	15.30
6. Family farm income on 1 hectare (k €/1 ha)	0.79	0.74	1.74	0.93	0.61
7. Total subsidies excluding on investments (k €)	15.41	6.59	11.31	11.70	5.71
8. Family farm income without current subsidies (k €)	16.75	9.36	29.14	29.43	9.59
9. Family farm income without current subsidies calculated on 1 hectare (k €/1 ha)	0.41	0.43	1.25	0.66	0.38

Source: *own calculation based on FADN 2024.*

In the year 2021, the total output from the European average farm amounted to 108.4 thousands euro. It is worth emphasizing that the structure of farm's output was as follows (approximately): 54% - crops output, 39% - livestock output and 7% - other output.

The similar structure of output of the average farm occurred in the chosen four countries, but total output from the average farm was two times lower in Poland and Romania than in Italy and Spain (Table 1). While calculating the total output taking into account medium area of farm, the Polish and Spanish results are close to the EU average (2.7 thousands euro), and the Italian is half as high (3.5 thousands euro) and the Romanian is half as low (1.4 thousands euro) (Table 2).

Using the absolute values, in the year 2021 the average family farm income from the EU-27 farm equaled to 32.2 thousands euro, and without the subsidies it was equal only to 16.8 thousands euro. So using the relative values, the European family farm income on 1 hectare equaled ~798 euro but without current subsidies was only to 415 euro (Table 2). In the chosen four countries the situation was different. The higher than medium in the EU-27 results were obtained by Italian and Spanish farm. It is evidence that those farms had a better activity efficiency.

A six classes of average farms were separated in the EU-27 countries according to the economic size in the year 2021 (Table 3). Using the absolute values, the larger the farm in terms of economic size, the more agricultural area it had and the higher balance sheet it managed, and the higher the production and income it generated. Stocks of agricultural products also increased.

Interestingly, in relative terms, with the growth of the economic class, the share of stock in the balance sum also increased from 1.9% for class 1 (2 000 ≤ 8 000 euro) to 4.3% for class 6 (≥ 500 000 euro) in the average farm in the EU-27 in 2021 (Table 3). A similar situation occurred in case of chosen four average farms from Poland, Italy, Spain and Romania.

In absolute and relative terms, the larger the farm according to the economic size, the higher the stock it maintained and the share of stocks in the balance sheet total was higher too. (Table 3). Therefore, it can be concluded that for the level of maintained stock, in addition to the economic size class of the farm, the geographical location is also important.

An eight groups of average farms were separated in the EU-27 countries according to the type of production in the year 2021 (Table 4). Unfortunately, this analysis did not bring a clear-cut conclusions. No outstanding types of production were noticed in terms of maintained inventories – neither in absolute terms nor relative in relation to the balance sum.

The average share of stock in balance sum for the EU-27 countries was between 1.0% and 3.0% for all types, except for vineyards (wine – 16.5%), but later the analysis of the chosen four countries did not confirm any regularity (Table 4). Therefore, it can be concluded that the type of production is irrelevant to the level of stock maintained on the farm.

In order to answer question no. 3, forward stepwise variable selection is introduced. Using the Gretl Program, FE and RE Models are obtained (Table 5). The five RE models and one FE model were created – it should be noted here that their estimates were very close, so the ones indicated by the Hausman test were presented without harming the test results.

Table 3. *The comparison of meaning stock with chosen production and economic categories according to the economic size of farms from the EU in 2021*

Details	Class of economic size					
	1 2 000 ≤ 8 000 € Very Small	**2 8 000 ≤ 25 000 € Small**	**3 25 000 ≤ 50 000 € Medium-Low**	**4 50 000 ≤ 100 000 € Medium-Large**	**5 100 000 ≤ 500 000 € Large**	**6 ≥ 500 000 € Very Large**
1.	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**
EU-27						
1.Utilised agricultural area (ha)	6.0	13.9	27.2	48.1	97.9	252.8
2. Balance sum (k €)	66.10	155.69	296.89	440.72	902.24	3,106.38
3. Stock of agricultural products (k €)	1.26	2.24	5.01	9.43	29.59	132.03
4. Share of stock of agricultural products in balance sum (%)	1.9	1.4	1.7	2.1	3.3	4.3
5. Total output (k €)	8.47	20.73	44.78	85.17	251.09	1,265.07
6. Farm net income (k €)	2.83	10.45	19.78	35.70	77.66	240.93
Poland						
1.Utilised agricultural area (ha)	7.8	13.2	23.7	38.9	79.8	400.8
2. Balance sum (k €)	92.09	140.70	233.84	376.50	715.82	2,767.81
3. Stock of agricultural products (k €)	2.28	5.11	10.97	19.26	37.47	149.13
4. Share of stock of agricultural products in balance sum (%)	2.5	3.6	4.7	5.1	5.2	5.4
5. Total output (k €)	7.55	17.52	38.78	80.23	214.27	1,852.77
6. Farm net income (k €)	2.37	7.78	18.05	37.16	82.98	274.02
Italy						
1. Utilised agricultural area (ha)	-	9.9	17.1	26.6	50.8	98.6
2. Balance sum (k €)	-	183.17	290.54	448.78	884.54	2,612.89
3. Stock of agricultural products (k €)	-	1.96	3.55	5.28	17.68	62.63
4. Share of stock of agricultural products in balance sum (%)	-	1.1	1.2	1.2	2.0	2.4
5. Total output (k €)	-	20.07	38.68	69.75	190.09	804.11
6. Farm net income (k €)	-	11.45	22.05	39.11	94.90	330.66
Spain						
1.Utilised agricultural area (ha)	-	19.2	33.0	54.3	94.8	133.9

1.	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**

2. Balance sum (k €)	-	201.87	288.11	391.78	738.11	2,730.67
3. Stock of agricultural products (k €)	-	0.29	0.62	1.47	2.71	7.24
4. Share of stock of agricultural products in balance sum (%)	-	0.1	0.2	0.4	0.4	0.3
5. Total output (€)	-	26 593.0	44 176.0	79 065.0	197 285.0	1 272 043.0
6. Farm net income (€)	-	15 278.0	22 600.0	38 198.0	70 817.0	387 030.0
Romania						
1.Utilised agricultural area (ha)	4.5	12.4	33.8	77.7	285.3	1 139.5
2. Balance sum (€)	32 920.0	51 824.0	91 144.0	160 141.0	501 353.0	2 755 172.0
3. Stock of agricultural products (€)	123.0	356.0	1 100.0	2 340.0	8 219.0	43 542.0
4. Share of stock of agricultural products in balance sum (%)	0.4	0.7	1.2	1.5	1.6	1.6
5. Total output (€)	8 193.0	20 008.0	50 623.0	100 911.0	326 392.0	1 499 778.0
6. Farm net income (€)	1 850.0	7 520.0	23 092.0	50 833.0	178 715.0	725 065.0

Source: *Own calculation based on FADN 2024.*

In the estimated models all variables are characterized by a level of significance below 0.05. The only exception was constant – in some models it was statistically insignificant.

This procedure requires the presence of a constant in the model, even if it is statistically insignificant. Six variables have a statistically significant influence on the dependent variable – stock of farm, namely: labour, utilized agricultural area, output, family farm income, liabilities and cash flow. The highest positive influence on a stock, observed in all analyzed classes of economic size of farm, is exerted by utilized agricultural area. The second variable with a positive effect on stock and present in all economy size classes is output. Farms' stock is also negatively impacted by variable labour in four on six classes of economic size (Table 5).

Three independent variables affect stock of farm income among the smallest farms (2 000 ≤ 8 000 euro). In this class of farms, the biggest positive impact on stock is exerted by labour, utilized agricultural area and output and a negative impact have liabilities. In the class of small farms (class 2, 8 000 ≤ 25 000 euros), the situation is different. The stock is positively affected by utilized agricultural area, output and family farm income, but the cash flow appears to be a burden.

Table 4. *The comparison of meaning stock with chosen production and economic categories according to the type of production of farms from the EU in 2021*

Details	Type of production							
	Field-crops	Horti-culture	Wine	Other perma-nent crops	Milk	Other grazing live-stock	Grani-vores	Mixed
1.	2.	3.	4.	5.	6.	7.	8.	9.
EU-27								
1. Utilised agricultural area (ha)	52.7	7.3	16.4	13.8	49.7	53.3	43.0	40.7
2. Balance sum (k €)	373.94	452.91	404.97	247.84	737.38	402.12	1,029.56	321.17
3. Stock of agricultural products (k €)	11.11	10.37	66.64	2.74	12.06	4.20	11.87	9.40
4. Share of stock of agricultural products in balance sum (%)	3.0	2.3	16.5	1.1	1.6	1.0	1.2	2.9
5. Total output (k €)	84.27	242.88	104.56	47.84	192.50	66.96	490.31	88.65
6. Farm net income (k €)	30.96	60.60	40.53	22.72	48.69	24.25	70.24	19.47
Poland								
1. Utilised agricultural area (ha)	23.4	5.3	-	7.7	24.8	19.5	31.1	20.9
2. Balance sum (k €)	196.30	118.18	-	137.23	284.68	193.06	538.11	183.69
3. Stock of agricultural products (k €)	9.12	3.22	-	4.83	11.70	6.81	15.21	9.20
4. Share of stock of agricultural products in balance sum (%)	4.6	2.7	-	3.5	4.1	3.5	2.8	5.0
5. Total output (k €)	30.42	51.50	-	22.70	66.68	23.10	352.58	35.57
6. Farm net income (k €)	14.12	15.76	-	9.39	28.20	9.45	64.98	9.83
Italy								
1. Utilised agricultural area (ha)	28.8	4.6	9.4	11.0	42.5	53.4	21.7	28.3

1.	2.	3.	4.	5.	6.	7.	8.	9.
2. Balance sum (k €)	441.17	330.65	381.09	296.99	1,174.33	445.49	910.07	405. 94
3. Stock of agricultural products (k €)	3.17	19.47	18.32	3.45	15.11	4.60	6.07	6.52
4. Share of stock of agricultural products in balance sum (%)	0.7	5.9	4.8	1.2	1.3	1.0	0.7	1.6
5. Total output (k €)	67.67	143.47	70.68	46.27	316.60	72.79	310.36	69.41
6. Farm net income (k €)	35.12	56.03	42.35	25.35	125.31	41.13	119.34	34.42
Spain								
1. Utilised agricultural area (ha)	67.8	7.3	26.5	22.8	38.5	80.3	31.2	99.4
2. Balance sum (k €)	414.04	585.27	292.05	341.35	630.65	351.12	945.67	608.54
3. Stock of agricultural products (k €)	2.27	1.71	1.04	0.19	2.20	1.21	1.30	2.08
4. Share of stock of agricultural products in balance sum (%)	0.5	0.3	0.4	0.1	0.3	0.3	0.1	0.3
5. Total output (k €)	77.71	206.53	58.21	60.85	292.25	84.59	498.53	106.68
6. Farm net income (k €)	36.26	71.02	28.98	30.94	76.16	37.30	117.32	42.50
Romania								
1. Utilised agricultural area (ha)	51.6	1.6	16.6	6.5	11.9	24.6	15.9	8.0
2. Balance sum (k €)	112.52	43.53	179.22	72.77	47.73	69.06	281.59	40.42
3. Stock of agricultural products (k €)	1.08	0.00	2.40	0.00	0.76	1.17	0.21	0.38
4. Share of stock of agricultural products in	1.0	0.0	1.3	0.0	1.6	1.7	0.1	1.0

balance sum (%)								
5. Total output (k €)	54.65	13.00	61.07	24.21	23.74	38.68	159.46	14.51
6. Farm net income (k €)	28.88	4.56	31.24	12.79	8.31	14.94	22.54	4.79

Source: *Own calculation based on FADN 2024.*

The latter phenomenon can be explained by the fact that either the farm spends money on stock or on current cash flow. In class 3 (medium-low farms, 25 000 ≤ 50 000 euro), only 2 variables have a positive impact on the stock: utilized agricultural area and output, and work negatively. Probably the labor costs burden the farm budget so much that there is no cash to buy the more stock. In class 4 (medium-large farms, 50 000 ≤ 100 000 euro), stock increases as utilized agricultural area and output grow, and decreases as labor and family farm income grow.

For large farms (class 5, 100 000 ≤ 500 000 euro), the increase in stocks is stimulated by utilized agricultural area, output and liabilities. This phenomenon can be explained by the fact that farms generally have a low level of debt, so credit has an invigorating effect on them. And in this class, the level of stock is negatively affected by labor. In the very large farm class (class 6, ≥ 500 000 euro), utilized agricultural area and output have a positive impact on stock, and labor with cash flow have a negative impact (Table 5).

Table 5. *Panel models for stock of the European* farms according to the economic size in 2004-2021*

Details	**Class of economic size**					
	1	**2**	**3**	**4**	**5**	**6**
Number of observations	240	375	463	471	471	352
LSDV R^2	-	0.8746	-	-	-	-
within R^2	-	0.1895	-	-	-	-
theta	0.8903	-	0.8607	0.8709	0.8856	0.8515
corr (y, yhat)^2	0.1691	-	0.2154	0.2557	0.4656	0.4850
const	-182.3680 (0.5181)	821.7890 (0.0073)	677.6630 (0.4675)	-167.5350 (0.9175)	- 6 768.1600 (0.0506)	- 21 021.9000 (0.3062)
Labour	359.3220 (0.0184)	-	-1 362.9800 (0.0001)	-3 072.0700 (0.0000)	- 1 558.3500 (0.0003)	-2 551.3500 (0.0000)
Utilised agricultural area	60.0959 (0.0000)	86.9949 (0.0000)	120.0050 (0.0000)	101.5030 (0.0000)	70.8904 (0.0000)	168.6500 (0.0000)
Output	0.0588 (0.0001)	0.0312 (0.0000)	0.0488 (0.0000)	0.1411 (0.0000)	0.1009 (0.0000)	0.1060 (0.0000)
Family farm	-	0.0717	-	-0.0768	-	-

income		(0.0122)		(0.0010)		
Liabilities	-0.0399 (0.0434)	-	-	-	0.0226 (0.0000)	-
Cash flow		-0.0977 (0.0023)	-	-	-	-0.1088 (0.0000)
Hausman Test	$\chi2$ (4) = 3.0299 (0.5528) REM	$\chi2$ (4) = 10.9801 (0.0268) FEM, REM rejected	$\chi2$ (3) = 2.6675 (0.4458) REM	$\chi2$ (4) = 4.1725 (0.3832) REM	$\chi2$ (4) = 1.6058 (0.8078) REM	$\chi2$ (4) = 2.1103 (0.7155) REM

Note: ** Excluding the United Kingdom.*
Source: *Own calculation based on FADN 2024.*

In the estimated models, the set of variables differs slightly with the strength of their influence. Therefore, the results obtained confirm an assumption, according to which determinants affecting stock vary depending on economic size of a farm.

5. Discussion

The results presented in this study indicate that farms increase their stock with the increase in their utilized agricultural area, economic size and production, regardless of the type of production they carry out. The level of stock is negatively affected by the level of labour involved in the farm and the increase in cash flow. A discussion should be held in relation to these results.

Naturally development will result in multi-functional development of farms and skilful incorporation of the new, previously unknown functions fulfilled by the countryside (van der Ploeg and Roep 2003; Prus, 2010; Runowski and Ziętara, 2011; Kalinowski, 2013). This will not be possible without changing farmers' attitudes.

They should realize, regardless of the income generated by their previous work in agriculture, that their farms also have the potential to undertake non-agricultural activities. In this way, they will improve their standard of living (North and Smallbone, 1996; Carter, 1998; Blinova and Vyalshina, 2017). Italy can serve as an example, where over recent years has seen the development of agritourism activity driven by such factors as unfavorable price relations in agriculture (Brelik, 2016).

It is obvious that the majority of farmers were and are familiar with the issue of non-agricultural occupation. Although many of them see the potential to expand their existing agricultural production to encompass new functions. Few are ready to follow this path in the near future. Not surprisingly that farmers seek additional sources of income and the solution seems to be in the increasing of operational diversity.

The most popular types of additional non-farming occupations in the studied group

are different forms of trading, hiring out machinery and tools and providing transportation services. It is accompanied by a lower risk than in the case of farming production. There is also the potential chance to obtain financial support from the funds reserved for the entrepreneurs who start new business ventures (Prus, 2018).

It should be noted here that the decisions on the interest in and co-financing of activities focused on non-agricultural economic activities depended to a large extent on the agrarian structure of the farms (Wojcieszak-Zbierska and Sadowski, 2024). If farms start to develop non-agricultural activities and it becomes important, they raise funds for it, how this affects their farm management? The answer to this question requires further research.

Nowadays there is a growing importance of introduction of the knowledge, innovation and entrepreneurship in countryside (Akinbami *et al.*, 2019; Diaz *et al*., 2019; Cano and Londono-Pineda, 2020, Tabares *et al.*, 2022). These determinants are important for the development of farms and also for agribusinesses, local environments such a countryside, regions and the national economy as a whole.

So the development of appropriate entrepreneurial attitudes of farmers, which will result in actions being taken in different spheres of social and economic life, is currently an important challenge, e.g., for decision-makers and advisory centers (Krzyżanowska and Sikorska-Wolak, 2010; Barber III *et al.*, 2021).

So there is a need for cooperation and active partnership in the transfer of knowledge and innovations between agricultural chambers and agriculture-supporting institutions and farmers.

To ensure the welfare of agricultural producers and agriculture, agricultural chambers should actively participate in the formulation of the national agricultural policy. Agricultural boards should take greater measures to ensure the stability of agricultural income and flow of information and be an important partner for farmers in representing their interests.

Effective representation of the interests of associated members requires changes in the legal regulations concerning agricultural associations (Kasprzyk *et al.*, 2024). So how will these proposed solutions affect the farm and stock management? Will it be the same in all countries? Are there already differences in maintaining stock in farm in the different EU countries? These questions should be the beginning of further research.

6. Conclusion

In the economic literature, too little attention is paid to the issue of farm stock. Securing their appropriate level is necessary to maintain the continuity of production and generate family farm income. These issues are important because farms are the

main recipients of agricultural policy in the EU.

Three questions were asked at the beginning of this study. All of which were answered:

1. How important are stock of farms in relation with balance sum, agricultural area, output and income for farms from the European Union in 2021?
   In the structure of current assets of farm in the EU-27 in 2021, the stock of agricultural products took a considerable place, achieving about 12.5% with the value of 12 thousands euro. But all the balance sum equaled 415 thousands euro from circa 40 hectares, and in the structure of the European average farm's assets fixed assets dominated (~75%). The total output from the European average farm amounted to 108.4 thousands euro, so family farm income amounted to 32.2 thousands euro. But without the subsidies, income equaled only 16.8 thousands euro. The European average farm was also characterized by lower inclination to debt (~16.6% of balance sum).

2. Does the importance of stock is changing according to the economic size or type of production of farm from the European Union in 2021?
   The economic size of farm has an important influence on the level of stock. The larger the farm according to the economic size, the higher the stock it maintained and the share of stocks in the balance sum was higher too. Also the geographical location was important. The analysis showed that the type of production was irrelevant to the level of stock maintained on the farm.

3. What is the relation between stock output, income and other production, economic and financial categories (f. ex.: area, labor, costs, taxes, cash flow, investment)?
   Panel model regression showed that six variables had a statistically significant influence on the stock of farm (dependent variable): labor, utilized agricultural area, output, family farm income, liabilities and cash flow. The positive influence on a stock, observed in all classes of economic size of farms, was exerted by utilized agricultural area and output. In four of six classes of economic size, a loabr negatively impacted farm's stock. In some models, the following variables were also present: family farm income, liabilities and cash flow.

In conclusion, it can be noted that the selection of potential determinants affecting stock of farms depends on the adopted research perspective. This is an opportunity for new research in this field, as well as adopting new research perspectives, and instruments, similarly to the panel models used in this article to analyze farms according to economic size.

It would be worthwhile to pay more attention to the issue of stock on the farm. One may ask to what extent their role will change with the development of other

functions of the countryside.

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