

Assessment of the Financial Efficiency of Enterprises in the Agricultural Sector in Bulgaria

Chief Assist. Prof. Damyan Kirechev, PhD
University of Economics - Varna, Varna, Bulgaria
dkirechev@ue-varna.bg

Abstract

The paper analyses the changes in the efficiency and returns to investment in agricultural assets at the sectoral level in Bulgaria after 2007. The methodology incorporates data from the Farm Accounting and Data Network (FADN) at EU level. It assesses key indicators characterizing changes in income, returns and financial position of the agricultural sector in Bulgaria, and analyses the determinants of farm efficiency.

Keywords: agricultural income; gross output; subsidies; financial efficiency; farm efficiency

JEL Code: Q12, Q14

Introduction

Maintaining viable farms is essential for sustainable agricultural and food production in the European Union. The well-being of European farmers is a key objective of the Common Agricultural Policy and has been the subject of extensive research in the economic literature. The agricultural sector is distinguished by its importance for the national economy, generating gross value added, employment for the population and net exports. In this sense, the issues of farm income, financial efficiency and financial health are determinant. Following the general perspective in economics, farm income can be viewed from two sides - as the value added generated by the use of farm inputs and as disposable income for farm households providing a standard of living. Financial efficiency broadly indicates the ability of inputs to provide income. In other words, financial efficiency reflects the productivity and growth of the sector. Financial health is defined as the ratio of disposable income to the financial resources required at a given point in time. Financial stability characterises the ability of farms to generate cash and meet their financial obligations. The assessment of the financial stability is important for the operation of agricultural holdings and is a prerequisite for achieving profitability and financial independence, while at the same time counteracting the negative effects of the financial and credit markets and creating the possibility of self-financing.

1. Thesis statement and literature review

The capacity of farms to generate income and maintain a certain level of efficiency is determined by the diversity of production possibilities, the skills of farmers, the environment, national and regional policies (Hill & Bradley, 2015) (Hill, 2019). The study of income-related policy in European agriculture follows three processes (Finger & El Benni, 2021): increasing complexity of farms as economic entities (incomes are heterogeneous in terms of structure, technology, objectives, etc.); increasing exposure to risk (climatic, market, political); increasing complexity of agricultural policy and policy measures (increasing targeting of policy support, such as sustainable natural resource management policy can affect farm incomes). In the context of these developments, the mechanisms and instruments for income support through the EU Common Agricultural Policy are also changing. Ensuring a 'fair' income implies high data requirements for the need of economic analysis (Coppola, Scardera, & Amato, 2020). At the microeconomic level, the main data sources are accounting surveys and household budgets, while at the macroeconomic level, income data are collected from the EU's Farm Accountancy Data Network (FADN).

Studying the theoretical aspects of economic efficiency on farms (Chavas, J.P. & Aliber, M., 1993), (Kulawik, J., 2010), (Shahraki, A. S. at all., 2018) economic efficiency of agricultural holdings in Bulgaria (Zaimova, D., 2010), (Kopeva, D. at all, 2012), (Koteva, N., 2016), and financial stability

of the agricultural holding in Bulgaria (Koteva, N., 2015), (Ivanov, B. at all., 2020), (Bashev, H. at all, 2022) are the subject of extensive research in foreign and Bulgarian The literature review shows that changes in income and efficiency in agriculture are crucial for achieving financial sustainability, maintaining viability and competitiveness of agricultural holdings. On the one hand, there is a close link between support policy and income generation for farmers, but on the other hand, the support received increases income but does not help to increase the efficiency and profitability of agricultural production.

In this sense, the aim of this paper is to investigate the factors forming net farm income, assess the relationship between income and subsidies, analyse the financial efficiency of farms and their ability to maintain a relatively stable financial position.

2. Materials and methods

The analysis and evaluation of the financial efficiency of the agricultural enterprises in Bulgaria is based on the data of the Farm Accounting Data Network (FADN). For the needs of the analysis comparative methods, analysis of structural variables, factor analysis and dependency analysis are used. Comparisons are made with European Union farm averages.

Data on income formation and financial efficiency are analysed to investigate the factors that determine them and to reflect the impact of subsidies on farm income formation. Since there is no detailed division of income between farm and non-farm income, individual farm income is examined on the basis of 'Annual Work Unit (AWU).

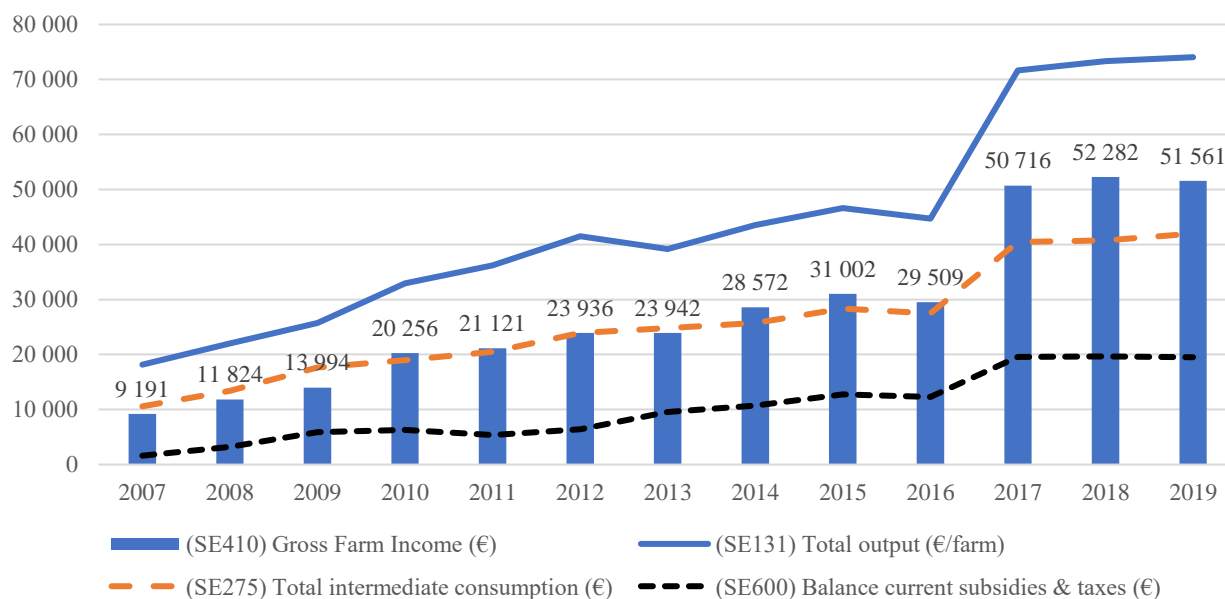
За нуждите на анализа са изследвани следните показатели:

- Gross farm income (€) and Net farm income (€);
- Farm Net Value Added (€/AWU) and Family Farm Income (€/FWU);
- Total fixed assets (€) and Total current assets (€);
- Average farm capital (€) and Gross Investment on fixed assets (€);
- Total output (€) and Total input (€);
- Total external factors (€);
- Indexes of Profitability;
- Farm Net Income (€) - Balance current subsidies and taxes (€);
- Liquidity (ratio), Financial indebtedness(ratio), Financial autonomy (ratio) ets.

The object of analysis in the study is the dynamics of changes in financial and economic indicators. The analysis of the relationship between income and subsidies makes it possible to assess to what extent the viability of farms in Bulgaria is determined by CAP support. According to the FADN, the evaluation on indicators follows the trend of decreasing the number of monitored farms, from 146.7 thousand in 2007 to 61.2 thousand in 2019, while their average size grows.

3. Result and discussion

In the post-2007 period, gross output in the agricultural sector (average per farm) has increased continuously from €18,159 in 2007 to €74,102 in 2019. The rate of increase in gross output is similar to the rate of increase in intermediate consumption and current subsidies and taxes (Figure 1). Intermediate consumption averages about 59.5% of gross output. The share of current taxes and subsidies in gross output increases from 8.8% in 2007 to 26.1% in 2019. Gross farm income grows on average from €9191 to €51427, and its relative share to gross output increases from 50% in 2007 to 69.4%. The relative share of current subsidies and taxes formed on average 34.1% of gross income over the period, increasing from 17.5% in 2007 to 37.6% in 2019. The dynamics of the factors forming gross income on an average farm in Bulgaria is presented in Fig. 1, with a larger increase in the change of indicators observed in 2017, while the values are relatively constant for the period up to 2019.



Source: Farm Accountancy Data Network

Figure 1. Formation of gross income in Bulgaria, average per holding (in euro)

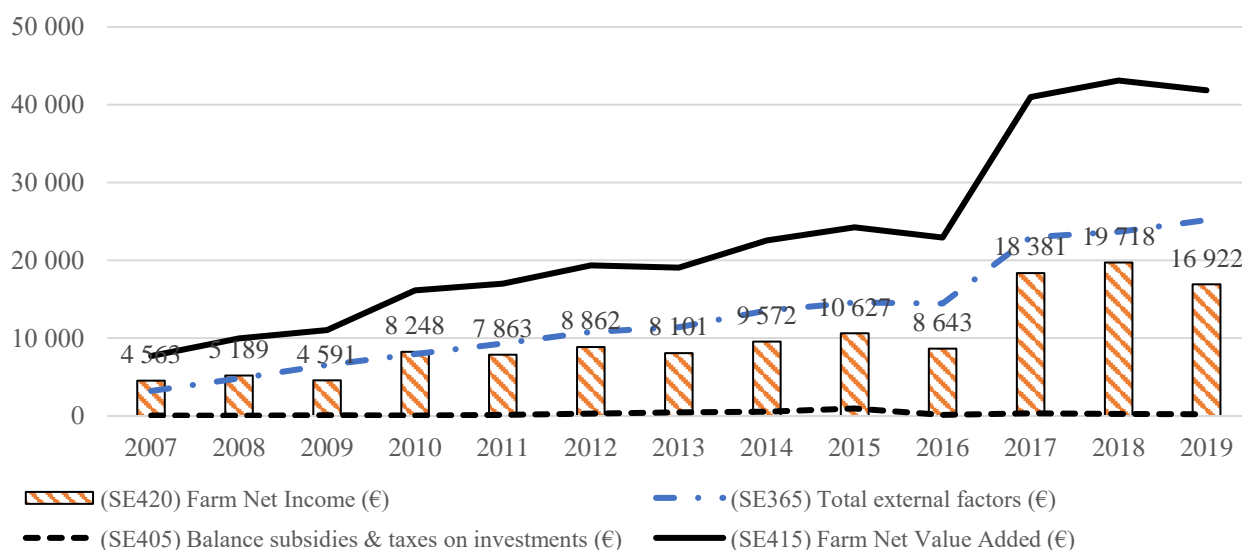
The formation of the gross output of the EU agricultural sector is evolving at a relatively more gradual growth rate, increasing on average per farm from EUR 57067 in 2007 to EUR 92465 in 2019. Intermediate consumption is also changing at a similar rate. On average, intermediate consumption accounts for 61% of gross output in the EU. The share of current taxes and subsidies in gross output averages 15.9%, declining in relative terms from 16.4% in 2007 to 14.8% in 2019. Compared to agriculture in Bulgaria, current subsidies and taxes play a smaller role in gross output. The relative share of current subsidies and taxes. Gross income on average per farm in the EU grows from €34,019 in 2007 to €49,492 in 2019, but as a relative share to gross income it decreases from 59.6% in 2007 to 53.5% in 2019. Over the same period, current subsidies and taxes are on average about 28.9% of gross income in EU farms.

The data allow to conclude that the formation of the gross income of Bulgarian farms is increasingly dependent on current subsidies and taxes, while after 2017 the average farm in Bulgaria forms a larger gross output than the average farm in the EU (the latter is probably a consequence of the decrease in the number of farms, the increase in the average size of farms in Bulgaria and the increased specialization in the cultivation of intensive crops).

Changes in net value added on farms Bulgaria is a consequence of rising gross output and depreciation. Net value added (on average per farm) averages about 80.5 percent of gross income over the period and increases from €7711 in 2007 to €41748 in 2019 (5.4 times). The increased investment activity on farms since 2007 is confirmed by the increase in depreciation by a factor of 6.5, from €1,479 in 2007 to €9,679 in 2019. In contrast, changes in net value added show a much more gradual growth, with a 44% increase in 2019 compared to 2007, from €2,809 on average per farm in the EU to €3,839 in 2019. Net value added in the EU is on average around 76.5% of gross income. At the same time, depreciation and amortisation charges are growing by only 50% - from €7210 in 2007 to €10753 in 2019. Over the period analysed, Bulgarian farms are very quickly reaching the level of net value added of EU farms. If in 2007 the net value added was 28.7% of the EU average level, in 2019 the net value added in the average Bulgarian farm is at the level of 107.7% of that of EU farms.

Net farm income is mainly a function of net value added and factor costs (rents, wages and interest), and the balance of subsidies and taxes have limited influence. Over the period analysed, net farm income in Bulgaria increased by a factor of 3.7, from €4563 to €16877 per farm. Over the period

analysed, the highest value of net income was realised in 2018. In the last three years, there has been a stagnation in net income growth, mainly due to declining net value added and rising input costs. Net income is a consequence of the 5.4-fold increase in net value added over the period and the 7.8-fold increase in factor costs, from €3,215 to €2,095 on average per farm. The balance of subsidies and taxes as a contributor to net income has a positive but small impact, only €67 in 2007 and rising to €224 in 2019 on average per farm. The rapid growth rate of net income is a consequence of increasing gross output and current subsidies and taxes. The level of net income is in the range of 22-26% of gross output and is decreasing, and, relative to net value added, it is decreasing from 59.2% in 2007 to 40.4% in 2019. After 2007, for the entire period analysed, factor costs exceeded the amount of net income generated, indicating the lower efficiency of agricultural production in Bulgaria. The changes in the factors influencing the formation of net income of agricultural holdings in Bulgaria are presented in Figure 2.



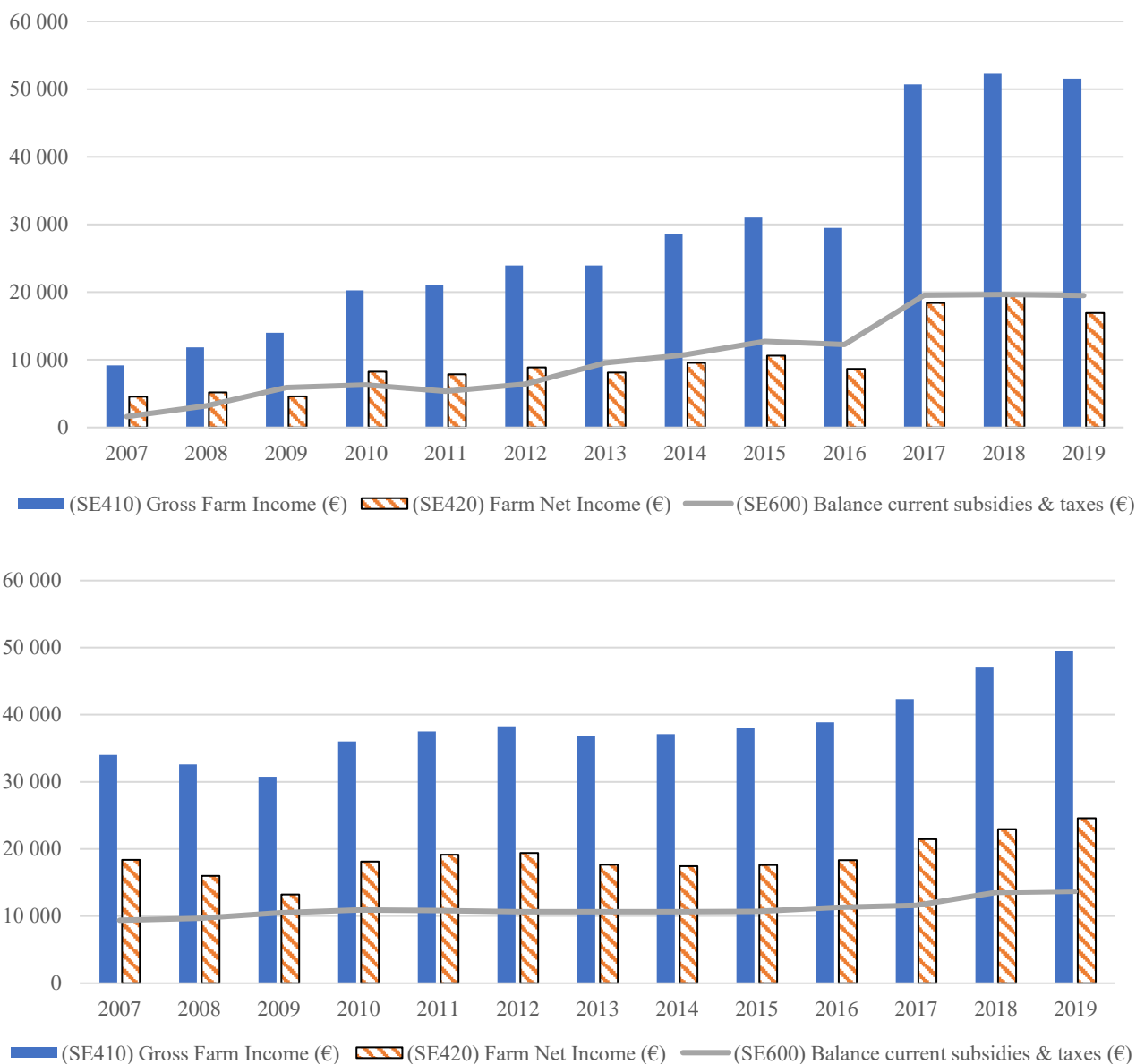
Source: Farm Accountancy Data Network

Figure 2. Formation of net income in Bulgaria, average per holding (in euro)

The net farm income in the EU changed with much less dynamics, increasing by 33% over the analysed period, from 18362 € to 24545 € per farm, mainly due to the 44.5% increase in net value added and the 70.7% increase in factor costs, from 8463 € to 14446 € on average per farm in the EU. The level of net farm income in Bulgaria in 2007 was at 24.8% of net farm income in the EU, but is growing rapidly to reach 85.3-85.5% in 2017-2018 and 68.8% in 2019. The share of net farm income in the EU is at around 26% of gross output (as for Bulgarian farms), but at 64% of net value added (vs. 40% for Bulgaria).

The relationship between gross income, net income and current subsidies in Bulgaria and the EU (Figure 3) shows that Bulgarian farms are highly dependent on the level of subsidies, with the amount of subsidies exceeding the amount of net income after 2012. The level of net income relative to gross income decreases from 49.6% in 2007 to 32.8% in 2019.

A more detailed study of the factors forming net income shows a close correlation with current subsidies and taxes (correlation coefficient - 0.944) and with gross output (correlation coefficient - 0.978). After 2013, average farm subsidies exceed the amount of net income, which determines the strong correlation between income and subsidies. That is, Bulgarian farms would not have achieved net income without subsidies, which determines the importance of subsidies for Bulgarian agricultural production in national terms. As far as these dependencies for the EU are concerned, the lower dependency of net income on subsidies is remarkable.



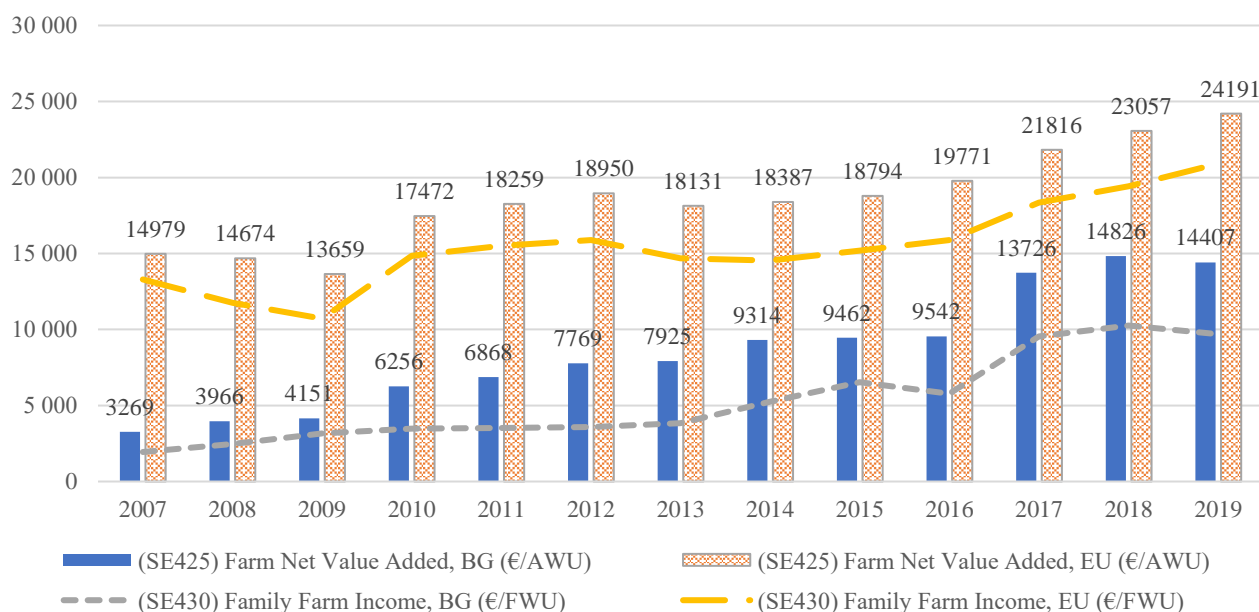
Source: Farm Accountancy Data Network

Figure 3. Relationship between gross income, net income and subsidies in Bulgaria (top) and in the EU (bottom), average per farm (in euros)

Examining the changes in the composition of net value added and net income in Bulgaria and the EU per annual worker unit (AWU) or family worker unit (FWU), there is a steady upward trend in both indicators. Farm net value added/AWU in Bulgaria increased from €3,269 on average per holding in 2007 to €14,407 in 2019 (4.4 times), while net value added/GPE in the EU increased from €14,979 on average per holding in 2007 to €24,191 in 2019. For the same period, the changes in family income/FRE in Bulgaria show an increase from 1943 euro on average per holding in 2007 to 9696 euro in 2019 (5 times), in comparison, in the EU the indicator grows only by 57.3% - from 13290 euro on average per holding in 2007 to 20909 euro in 2019 (Figure 4). The level of the indicator in Bulgaria was at 15% of the EU level in 2007, compared to 53% in 2018 and 46% in 2019.

The study of the asset structure of agricultural holdings implies an analysis of changes in the composition and structure of asset types (fixed and current). Total assets increased from €34307 in 2007 to €157324 on average per holding in 2019. The total increase in assets was more than 4.6 times, with fixed assets growing more than current assets. The change in the composition of assets is a

consequence of the increased investment activity following our country's accession to the EU. Over the same study period, fixed assets grew from €21,242 on average per holding in 2007 to €102,362 on average per holding in 2019 (4.8 times), while current assets grew from €1,065 to €54,963 (4.2 times), respectively (Figure 5). The share of fixed assets in total assets on farms increased from 61.9% to 65.1%, the highest share being 79.9% in 2010. This was accompanied by a decrease in the share of fixed assets from 38.1% in 2007 to 34.9% in 2019. In the structure of fixed assets in 2019, the largest share is occupied by agricultural land (38.4%), followed by machinery and equipment (32.7%), buildings (18.1%) and productive animals (6.5%). There is an upward trend in the share of assets in land, machinery and equipment (as a result of financial support under the Common Agricultural Policy and tax support), at the expense of a decrease in the share of productive livestock (as a result of the growing problems of the livestock sector).



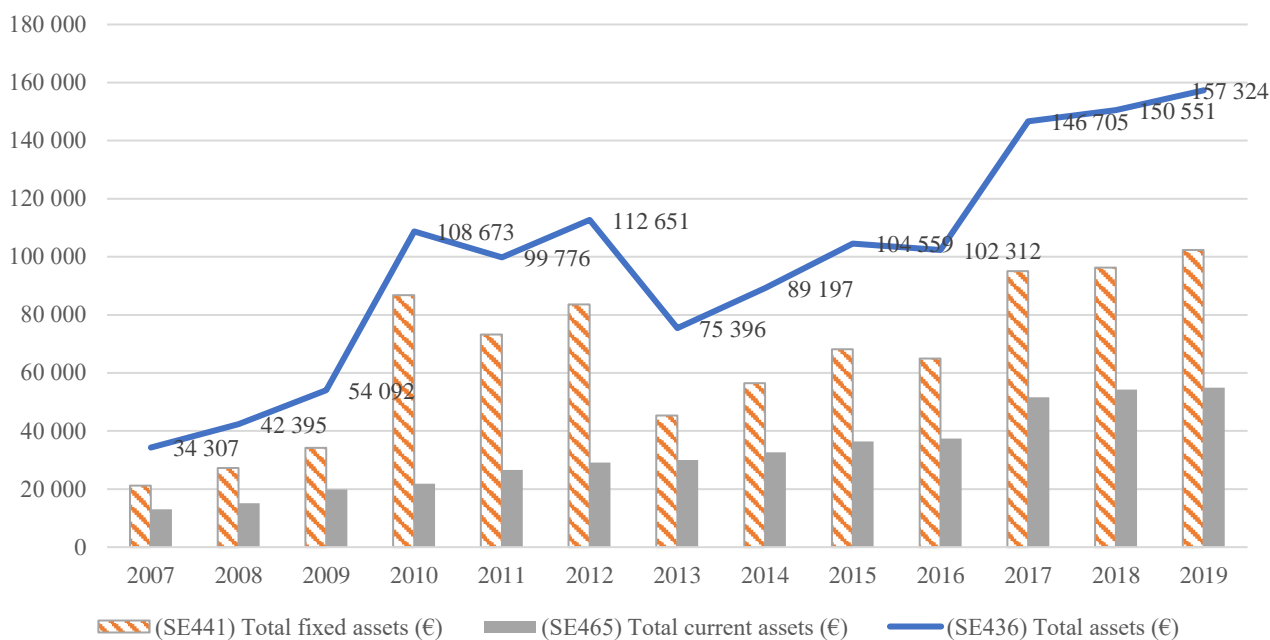
Source: Farm Accountancy Data Network and own calculation

Figure 4. Composition of Farm net value added/AWU and family income/FWU of agricultural holdings, average per holding, in Bulgaria and EU (in euro)

In the structure of current assets in 2019, finished products, receivables and cash accounted for the largest share (68.3%), followed by inventories (26%), and non-breeding livestock (6.6%). The turnover ratio of current assets decreased from 1.39 in 2007 to 1.35 in 2019. The dynamics of all assets show a steady growth rate (Figure 5).

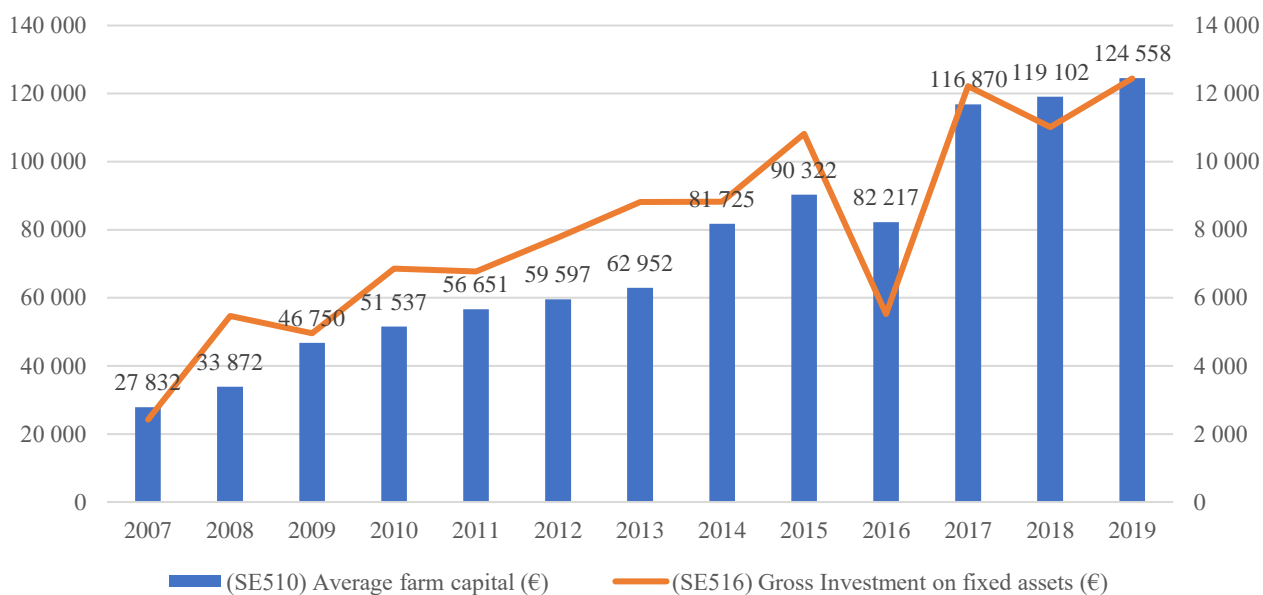
Changes in average farm capital show a steady increase, from €27,822 on average per farm in 2007 to €12,458 in 2019 (4.5 times). This has been accompanied by an increase in gross fixed asset investment from €2422 on average per farm in 2007 to €12444 in 2019. The dynamics of capital changes and gross fixed asset investment over the period 2007-2019 are presented in Figure 6.

Over the period analysed, there is a strong dynamic in the total revenue/total expenditure ratio. Between 2007 and 2012, total revenue exceeded total expenditure (with the exception of 2009), but since 2013 the ratio has been less than 1, indicating that expenditure cannot be covered by gross output. This proves once again that after 2013 Bulgarian farms are highly dependent on current subsidies. Although farms generate a net income, it is highly dependent on gross subsidies and taxes. In practice, the increase in gross and net income hardly compensates for the rising cost of living and factor costs. The evolution of the total income/total expenditure ratio is presented in Figure 7.



Source: Farm Accountancy Data Network

Figure 5. Composition of assets, including fixed and current assets



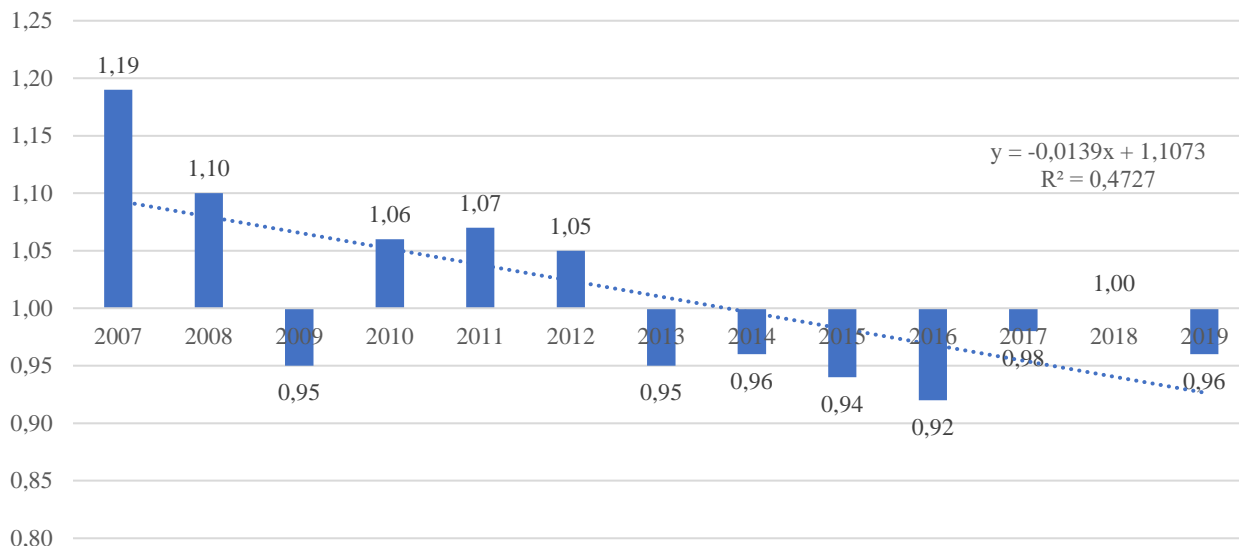
Source: Farm Accountancy Data Network

Figure 6. Farm capital and Gross investment on fixed assets

Analysis of average farm expenditure shows a steady increase from €15,274 in 2007 to €76,843 in 2019 (more than 5 times). This is accompanied by an increase in total domestic consumption from €10579 in 2007 to €41980 in 2019 (4-fold), an increase in depreciation costs from €1779 in 2007 to €9680 in 2019 (6.5-fold) and an increase in factor costs from €3215 in 2007 to €25182 in 2019 (7.8-fold). The dynamics of total and factor costs are presented in Figure 8.

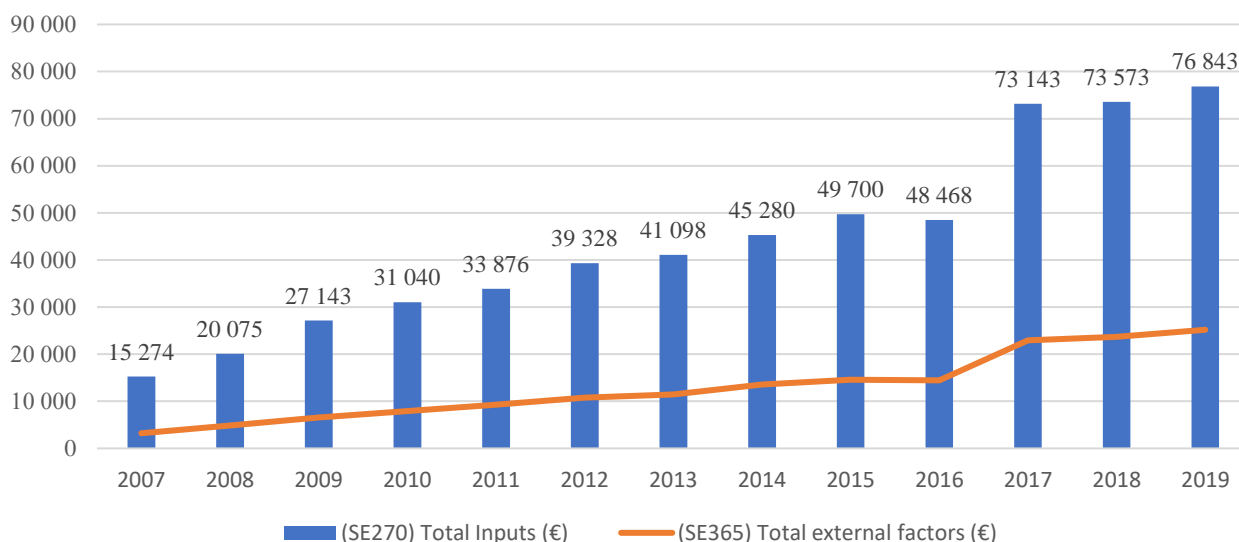
Despite the absolute increase in factor costs, there has been a change in their structure. While in 2007, 59.3% of factor costs were for wages, 32% for land rent and 8.7% for interest, in 2019, rent costs account for 55.9% of total factor costs, while labour costs decline to 39.7% and those for interest payments to 4.3%. Wage costs grow 5.2 times over the 2007-2019 period, and rent costs grow 13.6 times. This is a natural consequence of changes in the land market related to the increase in demand

for land, utilization of uncultivable land and the increase in the level of rents. This is further evidence that, despite rising net income per unit of labour, wage growth rates are lower than those of other factors of production, which demonstrates the sensitivity of agricultural incomes to subsidies and predetermines the need for continued income support policies under the Common Agricultural Policy in the next programming period.



Source: Farm Accountancy Data Network and own calculation

Figure 7. Total output / Total input (ratio)



Source: Farm Accountancy Data Network

Figure 8. Total inputs and Total external factors

The analysis of farm profitability includes the ability of resources to generate net income. For the purposes of the analysis, five profitability proportions are analysed:

1) Average farm profitability on a revenue basis is 22.7%, declining from 25.1% in 2007 to 22.7% in 2019. Revenue profitability was lowest in 2009 at 17.8% and highest in 2018 at 26.9%.

2) Average farm profitability on a cost basis is 23.0%, decreasing from 29.9% in 2007 to 22.0% in 2019. Cost-based profitability was lowest in 2009 at 16.9% and highest in 2007.

3) Average farm profitability on a per capital basis is 15.8%, decreasing from 16.4% in 2007 to 13.6% in 2019. Profitability on a per capital basis is lowest in 2009 at 9.8% and highest in 2018 at 16.8%.

4) The average farm profitability on a fixed asset basis is 10.3%, decreasing from 21.5% in 2007 to 16.5% in 2019. The lowest fixed asset profitability was in 2010 at 9.5% and the highest was in 2007 at 21.5%.

5) Average farm profitability on a total assets basis is 13.8%, decreasing from 13.3% in 2007 to 10.8% in 2019. Profitability on a total assets basis was lowest in 2010 at 7.6% and highest in 2007.

Similar trends are observed in the data for EU countries. Profitability based on total revenue declined from 32.2% in 2007 to 26.7% in 2019. Profitability based on total costs followed a similar trend, declining from 38.2% in 2007 to 30.2% in 2019. Profitability based on capital declined from 14.9% in 2007 to 12.8% in 2019, The data clearly demonstrate the need for continued farm income support.

It can be summarized that declining profitability creates preconditions for hindering the reproduction process in agriculture and increases the dependence of income on subsidies. The dynamics of changes in farm profitability by type over the period 2007-2019 can be seen in Table 1, and the dynamics of absolute differences between net income and current subsidies and taxes are presented in Figure 9.

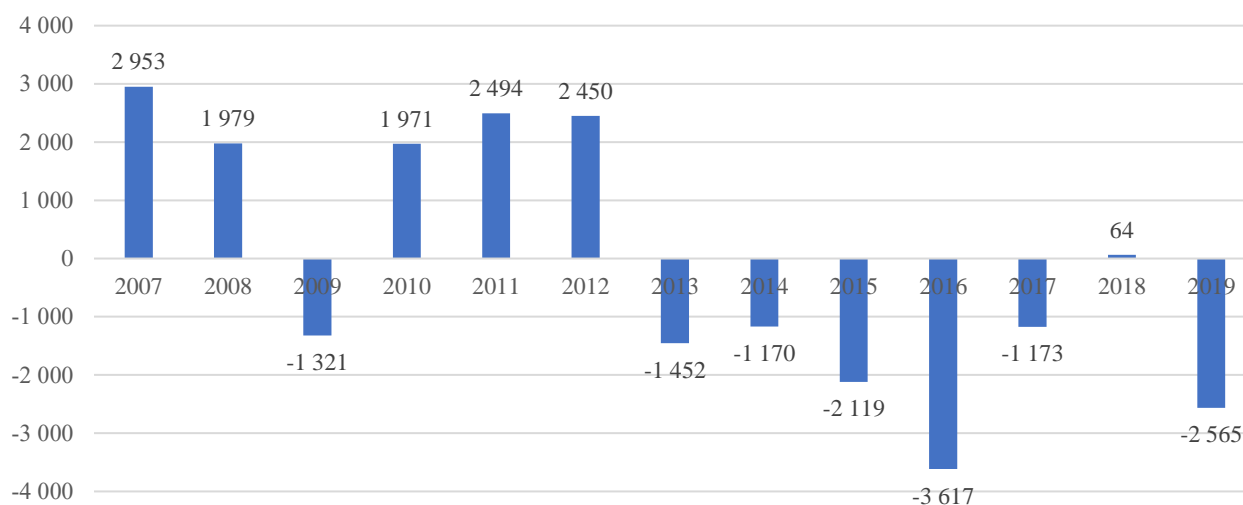
Table 1. Profitability indexes

Year	(SE131) Total output (€/farm)	(SE270) Total Inputs (€)	(SE510) Average farm capital (€)	(SE441) Total fixed assets (€)	(SE436) Total assets (€)
2007	25,1%	29,9%	16,4%	21,5%	13,3%
2008	23,6%	25,8%	15,3%	19,0%	12,2%
2009	17,8%	16,9%	9,8%	13,4%	8,5%
2010	25,0%	26,6%	16,0%	9,5%	7,6%
2011	21,7%	23,2%	13,9%	10,7%	7,9%
2012	21,4%	22,5%	14,9%	10,6%	7,9%
2013	20,7%	19,7%	12,9%	17,9%	10,7%
2014	22,0%	21,1%	11,7%	16,9%	10,7%
2015	22,8%	21,4%	11,8%	15,6%	10,2%
2016	19,3%	17,8%	10,5%	13,3%	8,4%
2017	25,7%	25,1%	15,7%	19,3%	12,5%
2018	26,9%	26,8%	16,6%	20,5%	13,1%
2019	22,9%	22,0%	13,6%	16,5%	10,8%
Average	22,7%	23,0%	15,8%	10,3%	13,8%

The assessment of the financial performance of farms can be extended by examining liquidity, leverage and financial autonomy. The total liquidity ratio reflecting the ratio of current assets to current liabilities declines from 2.5 in 2007 to 1.4 in 2019. In the last few years, the total liquidity ratio has remained around 1.4-1.5, indicating that despite rising costs, the agricultural sector retains a good ability to meet its payments. Over the same period, however, the level of financial indebtedness has been rising, with €0.19 of liabilities per €1 of equity in 2007 and €0.31 of liabilities per €1 of equity in 2019. This can be explained by the excess of total expenditures over total revenues in the years since 2013, the increase in investment activity and the improvement in access to agricultural credit in recent years (Kirechev, 2021). These processes also affect the coefficient for financial autonomy of agricultural holdings, as the indicator marks a decrease from 0.84 in 2007 to 0.76 in 2019. That is, if in 2007 to 1 euro of capital (own plus borrowed) have fallen 0.84 equity, then in 2019 this ratio is already 0.76. Dynamics in the changes in liquidity, financial indebtedness and financial autonomy are presented in Figure 10.

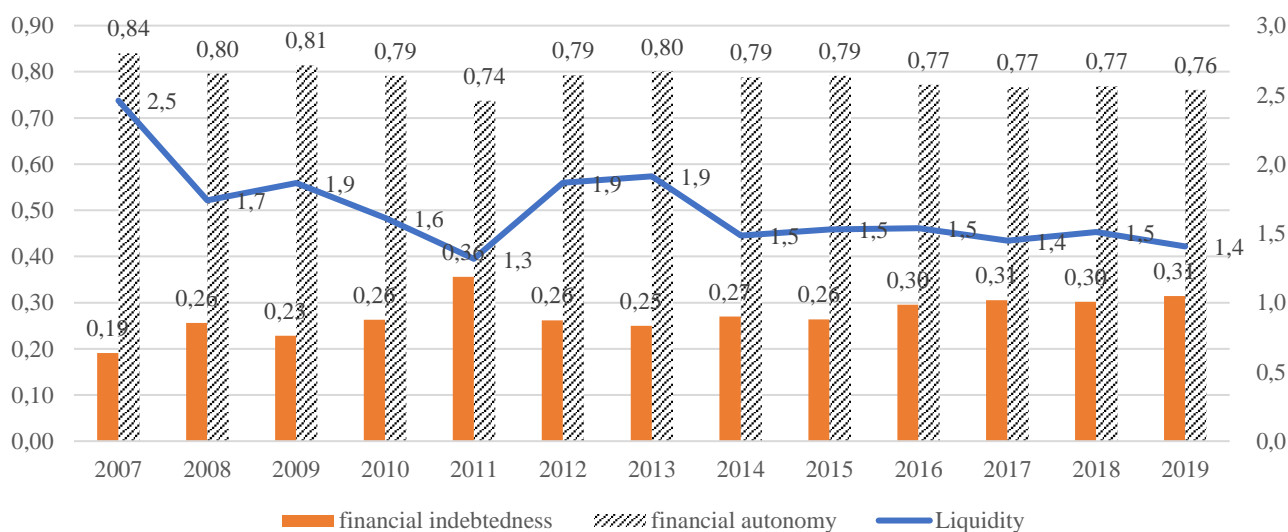
The analysis can be continued in the context of individual sub-sectors and groups of farms in income generation, financial efficiency and financial health. Studies on the subject (Иванов, и др., 2020), (Georgieva, 2020) show large fluctuations in income without subsidies in crop production

(arable crops, permanent crops and vegetables), with a positive difference between net income and subsidies in livestock and mixed farms. The analysis of the impact of subsidies on income and efficiency shows a strong correlation and reinforces the need for public support.



Source: Farm Accountancy Data Network and own calculation

Figure 9. Farm Net Income - Balance current subsidies and taxes



Source: Farm Accountancy Data Network and own calculation

Figure 10. Liquidity, Financial indebtedness, Financial autonomy

Conclusion

As a result of the analysis of the financial efficiency of agricultural holdings in the period after Bulgaria's accession to the European Union, the following conclusions and findings can be drawn:

1) Agriculture in the country is developing positively, with an increase in gross output, gross and net income. Net income is influenced by a number of factors, but is largely influenced by current subsidies and taxes and the cost of factors of production. It can be summarized that current subsidies and taxes are determinants of positive net income formation on farms.

2) Although subsidies are a major factor in supporting income, they do not lead to increased profitability of production. The downward trend in profitability continues, making Bulgarian agriculture even more dependent on support under the Common Agricultural Policy, i.e. financial support must continue to maintain the viability of farms.

3) Despite declining profitability, the financial situation of farms remains stable. Liquidity levels are maintained at a level that allows farms to make their payments. The increase in indebtedness as a result of improved access to borrowed capital and the need to finance increasing asset investments is still at levels that do not reduce the financial autonomy of farms.

Given that support for farmers after 2023 will be more climate and food security focused, coupled with increasing input costs, the challenges for farms to generate income and maintain a sound financial position become greater.

References

1. Bashev, H. Koteva, N., Ivanov, B., Mitova, D., Boevski, I., Terziev, D., Dimova, N., Dimitrova, N., Marinov, P., Tsvyatkov, D., Sarov, A., Kostenarov, K., Yanevska, E. (2022) *Holistichen podhod za definirane, otsenyavane i podobryavane na konkurentosposobnostta na zemedelskite stopanstva v Bulgaria*, Sofia, Institut po agrarna ikonomika, p. 203
2. Chavas, J.-P., & Aliber, M. (1993). An Analysis of Economic Efficiency in Agriculture: A Nonparametric Approach. *Journal of Agricultural and Resource Economics*, 18(1), 1–16.
3. Coppola, A., Scardera, A., & Amato, M. V. (2020). Income Levels and Farm Economic Viability in Italian Farms: An Analysis of FADN Data. *Sustainability*, 12 (4898), 1-18. <http://doi:10.3390/su12124898>
4. Finger, R., & El Benni, N. (2021). Farm income in European agriculture: new perspectives on measurement and implications for policy evaluation. *European Review of Agricultural Economics*, 48(2), 253–265. <http://doi:10.1093/erae/jbab011>
5. Georgieva, T. (2020). Direct Payments as a Risk Management Tool in Bulgarian Agriculture. *Izvestia Journal of the Union of Scientists - Varna. Economic Sciences Series*, 9(2), pp.160-168. DOI: <https://doi.org/10.36997/IJUSV-ESS/2020.9.2.160>
6. Hill, B. (2019). *Farm Incomes, Wealth and Agricultural Policy*. London: Routledge.
7. Hill, B., & Bradley, B. (2015). *Comparison of Farmers' Incomes in the EU Member States*, Policy Department B: Structural and Cohesion Policies. Brussels, Belgium: European Parliament. <http://doi:10.2861/892960>
8. Ivanov, B., Popov, R., Bashev, H., Koteva, N., Malamova, N., Chopeva, M., Mitova, D. (2020). *Analiz na sastoyanieto na selskoto stopanstvo i hranitelno-vkusovata promishlenost. SWOT analiz*. Sofia: Institut po agrarna ikonomika.
9. Kirechev, D. (2021) Improving access to finance for agricultural holdings as a factor for the sustainability of agricultural financing in Bulgaria. *Trakia Journal of Sciences*, Vol. 19, Suppl. 1, pp 197-206, doi:10.15547/tjs.2021.s.01.030
10. Kopeva, D., Madzharova, S., Nikolova, N. (2012) Efektivnost na proizvodstvenite strukturi v zemedeliето. *Nauchni trudove na UNSS*, vol. 2: 84-133
11. Koteva, N. (2015) Ikonomicheskо i finansovo sastoyanie na zemedelskite stopanstva, *Ikonomika i upravlenie na selskoto stopanstvo*, 60 (4): 4-20
12. Koteva, N. (2016). Ikonomicheskа efektivnost i finansova ustoychivost na zemedelskite stopanstva. *Ikonomika 21*, issue 1: 59-82.
13. Kulawik, J. (2010) *Financial Efficiency in Agriculture: the Essence, Measurement and Perspectives, Problems of Agricultural Economics / Zagadnienia Ekonomiki Rolnej 205137*, Institute of Agricultural and Food Economics - National Research Institute (IAFE-NRI).
14. Shahraki, A. S., Ahmadi, N. A., Safdari, M. A (2018) New Approach to Evaluate the Economic Efficiency and Productivity of Agriculture Sector: The Application of Window Data Envelopment Analysis (WDEA). *Environmental Energy and Economic Research 2* (3): 145-160, DOI 10.22097/eeer.2019.159201.1051
15. Zaimova, D. (2011) Metodi za otsenka na ikonomicheskata efektivnost na zemedelskite stopanstva. *Ikonomicheskа misal*, issue 2: 81-94