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# The Impact of Investment Activity on Economic Growth in Agricultural Holdings in Bulgaria by Specialisation

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**Abstract.** *Since Bulgaria joined the European Union (EU), the country's farms have undergone significant changes: the number of farms is decreasing, their size is increasing, and the level of public support is also increasing. Total production by the agricultural sector is changing in different proportions. As a result of public support, investment activity on farms increases significantly, which is a crucial factor in the economic growth of farms. However, the dynamics of investment activity vary from farm to farm, depending on their specialisation. This paper aims to analyse how changes in farm investment activity by specialisation affect the generation of total output growth and farm economic size. The analysis is based on data from the 2007-2022 Farm Accounting Data Network across eight farm types by specialisation. The methodology involves measuring the composition, structure, and dynamics of farm assets, as well as the dynamics of gross investment, and assessing the impact of investment on total farm output and net income generation. Statistical methods, structural analysis, and dependency analysis are used to analyse the dynamics of the indicators. The main results show differences in the changes of indicators across sub-sectors. On average, Bulgarian farms saw a 8-fold increase in gross investment, compared to a 3.3-fold increase in the EU average. In the asset structure, fixed assets predominate in the Wine, Permanent crops, Horticulture, Dairy, and Other grazing livestock sectors. A higher correlation exists between gross fixed asset investment and gross output in the livestock subsectors, while a lower correlation is observed in the crop subsectors. The analysis can target farm investment activity by specialisation and improve public support for fixed asset investment by the agricultural subsector. In the transition toward greater farm sustainability, investment direction will be crucial to enhancing farm sustainability and competitiveness.*

**Keywords:** agricultural investment, agricultural output, farm size, fixed assets, return of fixed assets, FADN analysis.

## Introduction

Bulgaria's membership in the European Union (EU) has provided Bulgarian farms access to significant financial resources through the Common Agricultural Policy, more modern technologies, and new market opportunities. However, agriculture's production efficiency is challenged by the ongoing restructuring of farms. Investment activity can play an important role in increasing farms' productivity and competitive position and supporting their transition towards sustainability. Assessing farm investment activity is complex and requires considerable information because it can be analysed from different perspectives: the intensity and volume of investment, the structure of investment, the financing of investment, access to finance, the impact of investment on efficiency, etc.

Investing in fixed assets is critical to improving the productivity of the agricultural sector insofar as fixed assets are the active capital for producing output. Investment not only supports the replacement of resources but can also be seen as an important factor in the overall economic growth of farms. Hence, the author's objective is to assess the investment activity of agricultural holdings for their economic growth. Considering the variety of farm types by size, specialisation, region, etc., the importance of this problem increases. In this sense, the aim of the present study is to

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investigate and evaluate how investment affects the creation of farm growth by specialisation - in terms of total output and farm size. Fulfilling this objective involves several research tasks: estimating total output and economic growth by farm type; assessing the condition and structure of assets; evaluating the direction of investment by analysing the change in fixed asset structure; and estimating the dependence of total output and economic size of farms on changes in investment (gross and net) and changes in fixed assets.



## Literature review

In the literature, there is a range of evidence that Bulgaria's accession as a full member of the European Union has led to significant transformations in the agricultural sector - agricultural production has increased (Ivanov, et al., 2020), gross investment increased (Turlakova, Slavova, Ivanova, & Genov, 2015), the average size of agricultural farms has increased (MZH, 2021), the level of subsidies through the Common Agricultural Policy has become an important driver for maintaining the competitiveness of farming structures (Bachev, 2023) and the efficiency of the sector as a whole (Ivanov, 2021; Bachev, 2021). In a previous study by the author, financial instruments were evaluated as a source of financing for agricultural holdings in Bulgaria, with a specialisation focus (Kirechev, 2023), which raises the challenge of investigating how investment activity stimulates the economic growth of farm holdings in Bulgaria. An earlier study assessed the relationship between non-farm income and agricultural investment in Bulgarian family farms (Hertz, 2009). Other studies investigating investment activity on European farms have examined the impact of investment on the efficiency of production factors (Czubak & Pawłowski, 2024), an assessment is made of factors influencing the level of investment activity of farmers (Szymańska, Dziwulski, & Kruszyński, 2021). No independent study has been found in the Bulgarian literature on how the dynamics of investment in agrarian holdings by specialisation in Bulgaria affect farm productivity and economic size.

## Methodology

The study's methodology aims to assess the importance of farm investments in Bulgaria for achieving economic growth. It is argued that investment in fixed assets is an important factor in creating total farm output and increasing economic growth.

Estimates of the economic growth of farms are analysed in terms of changes in total output, which changes their economic size. Total output reflects the output produced for domestic consumption and the market generated by crop production, livestock farming and associated activities. The economic size indicates the potential of farms to produce and helps to compare farms with different specialisations. For the evaluation, the following are analysed:

- Changes in total output and changes in farm economic growth.
- Changes in total fixed assets on farms.
- Changes in the structure of fixed assets on farms.
- Changes in the structure of fixed assets on farms by type of fixed asset provide information on farm investment guidelines.
- The trends in gross fixed asset investment and net fixed asset investment.
- The dependence of total farm output and economic growth on changes in fixed assets, gross fixed asset investment and net fixed asset investment.
- Changes in return on fixed assets (ROA) - through the ability of fixed assets to generate farm net income.

The analysis is complemented by comparing the average Bulgarian farm with the average EU farm to develop the average Bulgarian farm among the EU farms. The analysis of the impact of investments on the economic growth of Bulgarian farms includes eight types of farms according to their specialisation: fieldcrops farm, horticulture farm, wine farm, other permanent crops farm, milk farm, other grazing livestock farm, granivores farm, and mixed farm.

For the evaluation, time series analysis, structural analysis, and correlation dependence analysis methods are used. The analysis period is 2007-2022 (after Bulgaria acceded to the EU, covering two programme periods). The data source is the Farm Accountancy Data Network (last updated 10 December 2024). Data processing is done using MS Excel.



## Results and discussions

With Bulgaria's accession to the European Union, agriculture as part of the country's economic development has shown significant improvement. Although the share of the agricultural sector in GDP is declining, according to the Bulgarian Ministry of Agriculture and Food (MZH, 2008-2023), the gross value added almost doubled between 2007 and 2022. Farm restructuring processes have led to a reduction in the number of farms, an increase in their average size and an increase in the value of their output. (MZH, 2021). According to FADN data (used for this analysis), the number of farms is decreasing from 146.7 thousand (2007) to 56.9 thousand (2022) - by -61% and -6.1% annual average. Over the same period, the economic size of farms increased 4.6 times (10.7% average annual), and total output in value increased 7.0 times (13.9% average annual). The average Bulgarian farm is growing more dynamically than the average EU farm, which outpacing the average EU farm in 2017 (See Figure 1).

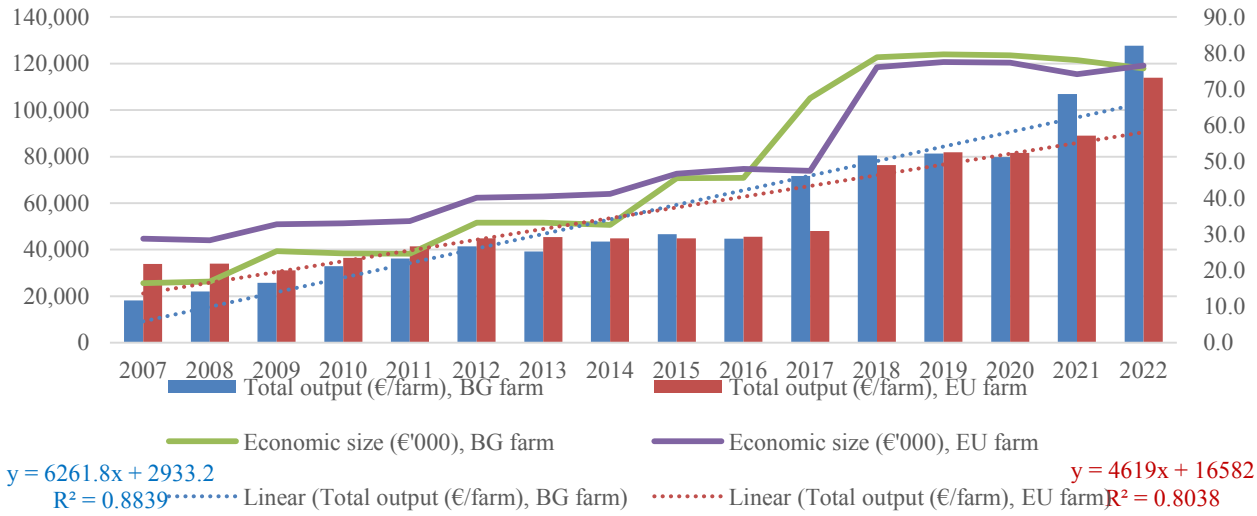


**Figure 1. Changes in Total output and Economic size of the average farm in Bulgaria and the EU, 2007-2022**

Source: FADN.

The restructuring of Bulgarian farms by specialisation is dynamic and follows various trends. The Granivores farm, Mixed Farms, Fieldcrops Farms and Milk Farms are the sectors with the fastest growth rates in total production. The change in economic growth is also strongly influenced by the dynamics in the number of farms by specialisation - the number of Fieldcrops farms for the period analysed increased 1.5 times (2.7% annual average); Other permanent crop

farms increased their economic size 1.3 times (1.7% annual average). For all other farms by specialisation, the number of farms decreased, with the most significant (almost 10 times) decreases in Granivores farms (with -14.1% average annual) and Mixed farms (14.4% average annual). Despite the reduction in the number of farms (in most agricultural sectors), total output is growing faster than changes in economic growth, which means that output is changing not only due to the number of farms but also as a result of productivity. Table 1 in the Appendix presents changes in total output and economic size of farms overall by specialisation.

Changes in farm productivity are a consequence of several factors (Ivanov, et al., 2020), but this study assesses the impact of changes in the level of fixed assets on growth creation. The analysis of changes in fixed assets shows that the average Bulgarian farm is experiencing significant changes - the size increases from €21.2 thousand (2007) to €113.2 thousand (2022) - 6.3 times (13.0% annual average). Over the same period, the average farm in the EU has increased fixed assets from €102.6 thousand (2007) to €267.7 thousand (2022) - 2.6 times (6.6% annual average). Notably, on average, Bulgarian farms have a significantly lower level of fixed asset endowment than EU farms (See Table 1), which determines the lower capital intensity of the average Bulgarian farm and the need to expand investment in fixed assets. The highest growth in the level of fixed assets was observed in Granivores farms (14.4 times, 19.5% annual average), followed by Mixed farms (12.2 times, 18.1% annual average) and Milk Farms (5.5 times, 12.0% on average per year). Although with lower growth than the national average, fixed assets increased in Fieldcrops farms (4.2 times, 10.0% on average per year) and Wine farms (See Table 1).

**Table 1. Changes in the composition of fixed assets total for all farms and by farm type, 2007-2022**

| Farms type | 2007 (€/farm) | 2022 (€/farm) | Aver. Ann. growth, % | Stand. Dev., € | Average, € | Change rate (index) |
|---|---|---|---|---|---|---|
| BG-farms | 21 242 | 133 252 | 13,0% | 33 869 | 77 865 | 6,3 |
| EU-farms | 102 616 | 267 714 | 6,6% | 60 937 | 178 667 | 2,6 |
| Fieldcrops | 45 629 | 189 919 | 10,0% | 40 054 | 114 656 | 4,2 |
| Horticulture | 29 315 | 79 618 | 6,9% | 131 447 | 115 268 | 2,7 |
| Wine | 176 216 | 312 372 | 3,9% | 75 212 | 256 913 | 1,8 |
| Permanent crops | 38 773 | 63 793 | 3,4% | 12 185 | 50 604 | 1,6 |
| Milk | 14 136 | 77 810 | 12,0% | 20 406 | 40 954 | 5,5 |
| Other grazing | 13 635 | 48 468 | 8,8% | 13 399 | 28 683 | 3,6 |
| Granivores | 38 260 | 552 547 | 19,5% | 234 381 | 287 997 | 14,4 |
| Mixed | 10 177 | 123 774 | 18,1% | 40 730 | 42 791 | 12,2 |

Source: FADN and author's calculation.

Analysis of fixed asset returns (as measured by their ability to generate farm net income) shows significant fluctuations from 2007 to 2022. However, it is noteworthy that the average Bulgarian farm generates a higher farm net income per unit fixed asset investment (See Figure 2, left) than the average EU farm, where the fixed asset level is more significant. A similar result is observed when assessing the ability of fixed assets to generate total output (See Figure 2, right). The return on fixed assets to create income, by farm specialisation, is highest (2022) in the Other grazing livestock farms, Milk farms, Granivores farms, and Other permanent crop farms (See Appendix, Figure 1). In the remaining farms by specialisation, the indicator is increasing. The ability of fixed assets to create total output increases on Granivores farms, Milk farms, Mixed farms and Wine farms, and decreases on other farm types. The most remarkable ability to create total

output from €1 invested in fixed assets in 2022 is in Granivores farms (1.68), followed by Fieldcrops farms (1.06), Milk farms (0.94) and Mixed Farms (0.81), and the lowest value of the indicator is measured in Other permanent crops farms (0.34) and Wine farms (0.31) (See Appendix, Figure 2).



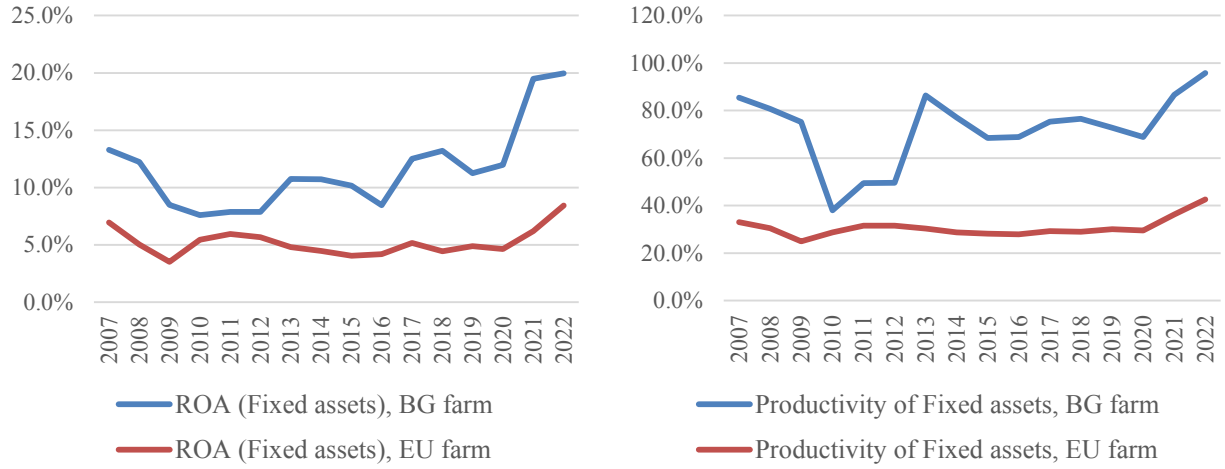


**Figure 2. Changes in Returns of fixed assets to create farm net income (left) and the ability of fixed assets to produce total output (right), 2007-2022**

Source: FADN and author's calculation.

However, the growth in available fixed assets is accompanied by a change in the asset structure. On the average Bulgarian farm, the share of fixed assets in total assets declines from 61.9% (2007) to 58.6% (2022) by -0.37% points annual average. Although fixed assets account for a larger share of the average EU farm, it also decreases from 79.2% (2007) to 75.1% (2022) by -0.35% points annual average. The decrease in the structure of fixed assets in the overall structure mainly accounts for the decrease in the crop sectors (only the Wine sector shows growth), while the share of fixed assets is increasing in the livestock sectors. Crop production has a more significant impact on total output formation - about 2/3 of the output created in Bulgarian agriculture. The sectors with the highest share of fixed assets in 2022 are Permanent crop sectors, followed by ruminant livestock sectors, Horticulture and Mixed farms. In the farms of the most dynamic sector, Fieldcrops, the share of fixed assets reaches 54.9% (2022).

In order to reveal the trends of investment activity in agricultural holdings in Bulgaria, it is worth assessing the changes in the structure of fixed assets by type. The average Bulgarian farm is dominated by assets in land and permanent crops - increasing from 30.6% (2007) to 38.9% (2022), as well as assets in machinery and equipment - which increased from 27.8% (2007) to 32.6% (2022). Given the declining production and number of farms in the livestock sectors, the share of assets in breeding animals and buildings is declining. This is confirmed in other studies on farm financing in Bulgaria (fi-compass, 2020; fi-compass, 2023). Another trend is the increasing share of assets for other gainful activities (OGA) and improving the use of land and resources, the share of which reaches 4.3%. In previous studies involving the author, it was found that the output of other gainful activities is significant for sectors diversifying their output with non-agricultural activities - production of vegetables, fruits, fieldcrops, grazing animals (Stanimirova & Kirechev, 2024). On the average EU farm, the leading share of fixed assets in the total asset structure is represented by land and permanent crops, with their share increasing from 52.6% (2007) to 59.2%

(2022). The share of all other fixed assets is decreasing (See Appendix, Table 2). Changes in the structure of fixed assets on individual farms by specialisation show the following:

– The share in fixed assets of land, which is the leading resource for production, increased 5.7 times (12.3% annual average) in the Fieldcrops sector. The amount of machinery and equipment as assets increased 3.1 times (7.8% per annum on average), but their share in the total asset structure decreased. Similarly, the building stock grew 3.3 times (8.4% on average per year), but their share decreased.



– The share of buildings (in the form of greenhouses and warehouses), machinery, and equipment increased significantly in the Horticulture sector. The share of other fixed assets also increased significantly, reaching 7.9% in 2022.

– In the Wine sector, almost two-thirds of the share of fixed assets are land and permanent crops, which increased 1.8 times (3.9% average annually) but did not change the overall fixed asset structure. Growth is also observed in the amount of machinery and equipment - 2.1 times (4.9% average annual).

– In the Other permanent crops sector, land and permanent crops have the largest share in the fixed asset structure, but their share in total fixed assets declined from 74.5 % (2007) to 60.8 % (2022). Assets in buildings increase more significantly, by 2.9 times (7.4% annual average), and assets in machinery and equipment by 1.6 times (3.0% annual average). On these farms, other assets that support operations and improve the land increased significantly.

– In the Milk sector, the share of breeding livestock in the fixed asset structure is increasing, accounting for 35.4% of total fixed assets (2022) and growing 5.7 times (12.3% annual average). Assets in machinery and equipment increase significantly by 7.2 times (14.1% annual average), assets in buildings by 4.3 times (10.2% annual average) and land by 4.7 times (10.9% annual average). There was a more significant increase in other assets.

– In the Other grazing livestock sector, breeding animals and land as assets increased their share in the total fixed asset structure. Breeding livestock as an asset increased 3.8 times (9.4% annual average), and machinery and equipment increased 7.0 times (13.9% annual average). Buildings as assets increased in size by 2.2 times (5.3% annual average).

– In the Granivores sector, machinery and equipment has the most significant increase in asset structure, increasing its share to 41.2% (2022), while assets in buildings account for just under ½ of total fixed assets. The increase in farm concentration determines the higher growth rates of the asset structure, with machinery and equipment increasing 18.2 times (21.3% annual average), buildings increasing 12.4 times (18.3% annual average), and breeding animals increasing 14.9 times (19.7% annual average). Although the amount of land used on farms is increasing, its share in the total asset structure is decreasing.

– The structure of machinery, equipment, and breeding animals is increasing in the Mixed farms sector. Machinery and equipment increased by 16.9 times (20.7% annual average), breeding animals increased by 12.6 times (18.4% annual average), land and permanent crops increased by 9.5 times (16.2% annual average), and buildings increased by 9.4 times (16.1% annual average). Mixed farms maintain a diversified asset structure given that they diversify their production into crop and livestock production (in recent years, the share of crop production exceeds that of livestock production).

Changes in the amount of fixed assets on farms are also a consequence of changes in fixed asset investment. Over the period analysed, on the average Bulgarian farm, gross investment grows 8.0 times (14.8% annual average), and net investment (measured as gross investment less depreciation) grows at the same rate. The rate of change of gross investment in the average EU

farm is considerably lower - gross investment grew only 3.3 times (8.3% average annual), and net investment was negative and growing at the beginning of the period analysed. For the whole period, except for 2007 and 2016, gross investment in the average Bulgarian farm is significantly higher than in the average EU farm. The trend is similar for net investment (except for 2016 and 2020) (See Figure 3). The data presented in Figure 3 show a continuous increase in gross investment and net investment, which can be explained by the restructuring of farms to improve their competitiveness and by the improvement of the fixed asset structure.



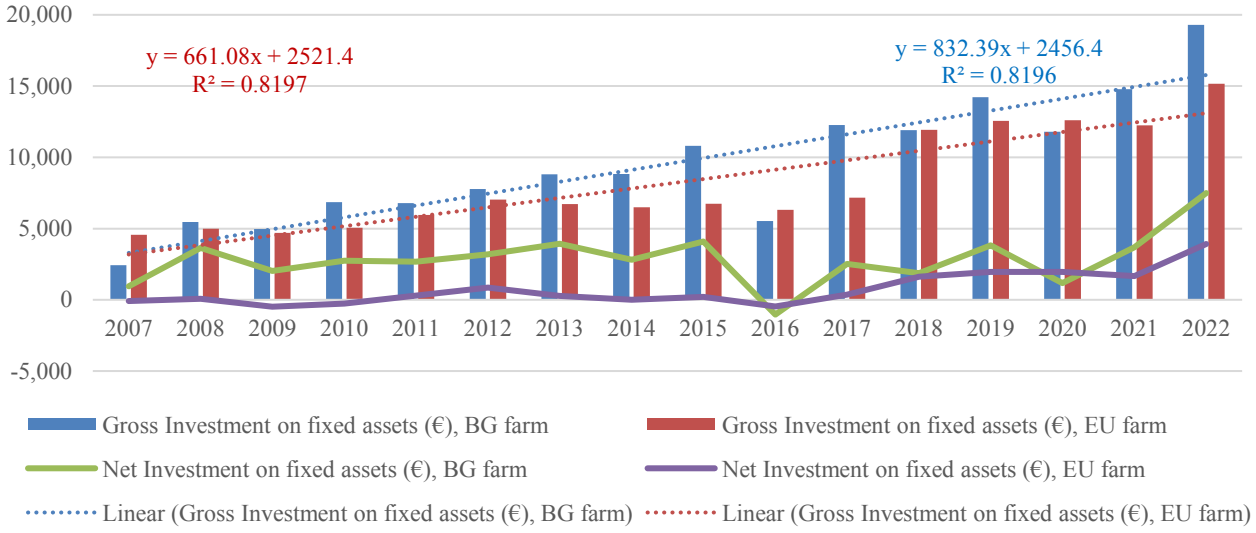


**Figure 3. Changes in gross and net investment in the average farm in Bulgaria and the EU, 2007-2022**

Source: FADN.

A more detailed analysis of gross and net farm investments by specialisation over the period analysed is presented in Appendix 3 and shows different trends. The growth rate of gross investment is higher on livestock farms, but on crop farms, investment per unit area is higher - especially with permanent crop farms and arable farms increasing their land purchases. Mixed farms (51.7 times) and Granivores farms (10.7 times) have the highest growth rates in gross investment. Wine farms make the most significant gross investments to restore vineyard areas, which require significant financial resources per hectare.

The assessment of the relationship between farm economic growth and investment includes an analysis of the correlations between the level of physical fixed assets, gross investment and net investment on total output and farm economic size. The values of the correlation coefficients R are interpreted as follows: $0 < R < 0.3$ - weak dependence; $0.3 < R < 0.5$ - moderate dependence; $0.5 < R < 0.7$ - significant dependence; $0.7 < R < 0.9$ - strong dependence; $0.9 < R < 1$ - very strong dependence.

Analysis of the average Bulgarian farm data shows a very strong correlation between total output from gross investment and the economic size of farms. The correlation between the fixed asset level, total output, and economic growth is interpreted similarly. Both relationships have a high coefficient of determination, confirming the result's significance; as for the impact of net investment, its correlation with total output is moderate, and farm economic size is weak. That is due to depreciation, which reduces the value of assets. The correlations between the indicators for the average EU farm follow a similar trend (See Table 2). Gross investment maintains fixed asset

levels, which are important factors for increasing the value of total production and for increasing the economic size of farms.

**Table 2. Correlation of total output and economic size of farms with the level of fixed assets, gross investment and net investment for all farms and by specialisation, 2007-2022**

| Farms type | Indicator R, $R^2$ | Fixed Assets (FA) | | Gross Investment on FA | | Net Investment on FA | |
|---|---|---|---|---|---|---|---|
| | | Total Output | Economic Size | Total Output | Economic Size | Total Output | Economic Size |
| BG-total | Correlation | 0,90 | 0,87 | 0,95 | 0,86 | 0,48 | 0,21 |
| | R-square | 0,82 | 0,76 | 0,91 | 0,75 | 0,23 | 0,04 |
| EU-total | Correlation | 0,94 | 0,99 | 0,91 | 0,85 | 0,48 | 0,25 |
| | R-square | 0,88 | 0,99 | 0,82 | 0,73 | 0,23 | 0,06 |
| Fieldcrops | Correlation | 0,87 | 0,91 | 0,92 | 0,86 | 0,65 | 0,21 |
| | R-square | 0,75 | 0,82 | 0,85 | 0,73 | 0,42 | 0,04 |
| Horticulture | Correlation | -0,38 | -0,33 | 0,88 | 0,78 | 0,44 | 0,20 |
| | R-square | 0,14 | 0,11 | 0,77 | 0,60 | 0,20 | 0,04 |
| Wine | Correlation | 0,87 | 0,49 | 0,39 | 0,78 | 0,20 | 0,16 |
| | R-square | 0,77 | 0,24 | 0,15 | 0,61 | 0,04 | 0,03 |
| Permanent crops | Correlation | 0,87 | 0,68 | 0,68 | 0,48 | 0,41 | 0,15 |
| | R-square | 0,76 | 0,46 | 0,47 | 0,23 | 0,17 | 0,02 |
| Milk | Correlation | 0,98 | 0,98 | 0,94 | 0,88 | 0,46 | 0,27 |
| | R-square | 0,95 | 0,96 | 0,88 | 0,77 | 0,21 | 0,07 |
| Other grazing | Correlation | 0,95 | 0,93 | 0,87 | 0,80 | 0,36 | 0,14 |
| | R-square | 0,91 | 0,86 | 0,75 | 0,64 | 0,13 | 0,02 |
| Granivores | Correlation | 0,97 | 0,99 | 0,91 | 0,87 | 0,36 | 0,27 |
| | R-square | 0,95 | 0,98 | 0,82 | 0,75 | 0,13 | 0,07 |
| Mixed | Correlation | 0,99 | 0,99 | 0,88 | 0,84 | 0,49 | 0,33 |
| | R-square | 0,98 | 0,97 | 0,78 | 0,70 | 0,24 | 0,11 |

Source: FADN and author's calculation.



As regards the assessment of the above-mentioned dependencies by farm specialisation, the following is observed:

– There is a very strong correlation between the level of gross investment and total production on Fieldcrops farms, Milk farms, and Granivore farms. There is also a strong correlation for Horticulture Farms, Other grazing livestock Farms, and Mixed Farms. The correlation is weaker for perennial crop farms, with a significant correlation for Other permanent crop farms and a moderate correlation for Wine farms.

– Changes in economic growth are strongly dependent on gross investment for all speciality farms except Other permanent crop farms.

– Total output is very strongly dependent on the level of fixed assets in the livestock and crop sectors (with the exception of Horticulture farms, which is due to the significant level of fixed assets recorded for 2010, 2011, and 2012—this determines the very low level of determination).

– Farm economic size has a very strong correlation with the level of fixed assets for crop farms and animal farms. The correlation between fruit and vineyard farms is lower - moderate for Wine Farms and significant for Other permanent crop farms. That can be explained by the high establishment cost of perennial crops and the longer reproduction period of assets.

– Regarding net investment, the most significant impact is on the total production of Fieldcrops farms, Milk farms and Horticulture farms. In the remaining sectors, the level of the coefficient of determination does not allow for a statistically significant relationship. Concerning the impact of net investment on the economic size of farms, the coefficient of determination between the indicators is very low. It does not warrant a statistically significant relationship - for all sectors, the correlation is weak.



The discussion of the analysis results shows different proportions in the development of investment activity on farms, in general, and by specialisation. The analysis of the farms shows that the average Bulgarian farm is developing dynamically in terms of production creation and economic growth. The average Bulgarian farm is outpacing the average EU farm in terms of total output created and economic size, which can be explained mainly by the increase in farm size and the decrease in the number of farms. Regarding farm specialisation, the most intensive farms are Fieldcrops farms, Granivores farms, Mixed farms and Milk farms. On permanent crop farms, the level of perennial crops is high, but establishing these crops requires significant investment per unit area, and the return on investment is more extended. Field crops farms have a greater need for land and investment in land improvements (irrigation, etc.) to respond to declining rent costs, which, according to FADN, are increasing significantly. In livestock farms with a more extended reproduction period (dairy farms and other grazing livestock), investment activity is focused on the acquisition of breeding animals, which occupy a large part of the herds. In Granivores farms (pig and poultry), due to the faster reproduction of animals from the main herds, investments are directed towards the modernisation of buildings, machinery and equipment - not only to increase production but also to meet the high safety requirements (due to the easier spread of epidemics and diseases that cause significant damage).

The analysis provides sufficient reason to summarise that investment activity is an important factor in sustaining the growth of total output and economic size of farms but is influenced by features such as - asset specificity, nature of the production and reproduction process, public support, etc. Although the analysis is not aimed at assessing the role of public support in increasing investment, there is considerable evidence that supports through the Common Agricultural Policy has an important role to play in restructuring (Ivanov, et al., 2020) and increasing competitiveness (Ivanov, 2021) (Bachev, 2023) and maintaining the income and financial performance of Bulgarian farms (Kirechev, 2022).

## Conclusion

In summary of the analysis of the dependence of the economic growth of Bulgarian farms on the level of investment, the following conclusions and generalisations can be drawn:

– Bulgaria's accession to the EU created favourable conditions for expanding agricultural production in the country. Bulgarian farms are developing dynamically and outpacing the EU average.

– The average Bulgarian farm's fixed assets are increasing in value, but their relative share in the total asset structure is decreasing. The average Bulgarian farm's assets' ability to create value is higher than that of the average EU farm, with the potential of fixed assets to create net income and total output increasing.

– The restructuring of the agricultural production sectors has predetermined changes in the direction of fixed asset investment. The crop production sectors are dominated by investments in land, land improvements, and permanent crops, as well as in physical assets to support productivity gains, efficiency, and sustainability of production. In livestock sectors with more extended

reproductive periods, investments are directed towards increasing the number of breeding animals, while in sectors with faster animal reproduction, investments are directed towards physical assets.

– Gross and net investments in the average Bulgarian farm outstrip those in the average EU farm.

– There is a strong correlation between total output and the economic size of farms' gross investment and fixed asset endowment, with certain specificities across farms by specialisation.



– The Common Agricultural Policy will continue to be an important factor in supporting investment activity. Although not explored independently in this study, public support for investment activity is actively helping to restructure agricultural sectors and increase investment opportunities.

– In the context of the transition to sustainability, Bulgarian farms will increase demand for investments in implementing agroecological techniques, climate change mitigation practices, and environmental protection.

– Improving competitiveness will generate demand for opportunities to diversify farm economic activities, broadening the investment base.

In conclusion, the analysis can help guide investment activity in farms by specialisation and improve public support for fixed asset investment by agricultural subsector. The impact of investment on total output and economic size of farms can be analysed in depth by farm size or regionally, which are favourable directions for future research.

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## Appendix

**Table 1. Changes in total output and farm size for all farms and by specialisation, 2007-2022**

| Farms type | Indicator | 2007 | 2022 | Aver. Ann. Growth, % | Stand. Dev., € | Average, € | Change rate (index) |
|---|---|---|---|---|---|---|---|
| BG-total | Total output (€/farm) | 18 159 | 127 731 | 13,9% | 30 702 | 56 158 | 7,0 |
| | Economic size (€'000) | 16,5 | 75,8 | 10,7% | 24,0 | 47,4 | 4,6 |
| EU-total | Total output (€/farm) | 33 921 | 113 878 | 8,4% | 23 750 | 55 844 | 3,4 |
| | Economic size (€'000) | 28,8 | 76,6 | 6,7% | 18,6 | 50,1 | 2,7 |
| Fieldcrops | Total output (€/farm) | 53 872 | 201 514 | 9,2% | 36 489 | 103 533 | 3,7 |
| | Economic size (€'000) | 47,8 | 110,7 | 5,8% | 26,0 | 84,3 | 2,3 |
| Horticulture | Total output (€/farm) | 21 916 | 50 506 | 5,7% | 9 373 | 29 606 | 2,3 |
| | Economic size (€'000) | 19,2 | 34,9 | 4,1% | 7,5 | 25,0 | 1,8 |
| Wine | Total output (€/farm) | 46 238 | 99 673 | 4,5% | 26 111 | 67 722 | 1,9 |
| | Economic size (€'000) | 29,0 | 56,4 | 5,3% | 15,5 | 37,9 | 2,2 |
| Permanent crops | Total output (€/farm) | 13 548 | 21 793 | 3,2% | 3 806 | 15 528 | 1,6 |
| | Economic size (€'000) | 13,9 | 15,8 | 0,9% | 4,4 | 13,4 | 1,1 |
| Milk | Total output (€/farm) | 11 089 | 73 195 | 13,4% | 18 305 | 31 852 | 6,6 |
| | Economic size (€'000) | 11,7 | 56,4 | 11,1% | 17,6 | 31,3 | 4,8 |
| Other grazing | Total output (€/farm) | 8 299 | 26 522 | 8,1% | 6 092 | 15 220 | 3,2 |
| | Economic size (€'000) | 8,0 | 19,5 | 6,1% | 6,1 | 13,3 | 2,4 |
| Granivores | Total output (€/farm) | 60 047 | 929 992 | 20,0% | 292 131 | 367 913 | 15,5 |
| | Economic size (€'000) | 43,5 | 597,3 | 19,1% | 215,2 | 301,2 | 13,7 |
| Mixed | Total output (€/farm) | 6 699 | 100 510 | 19,8% | 29 281 | 30 997 | 15,0 |
| | Economic size (€'000) | 7,8 | 69,5 | 15,7% | 25,6 | 28,4 | 8,9 |

Source: FADN and author's calculation.

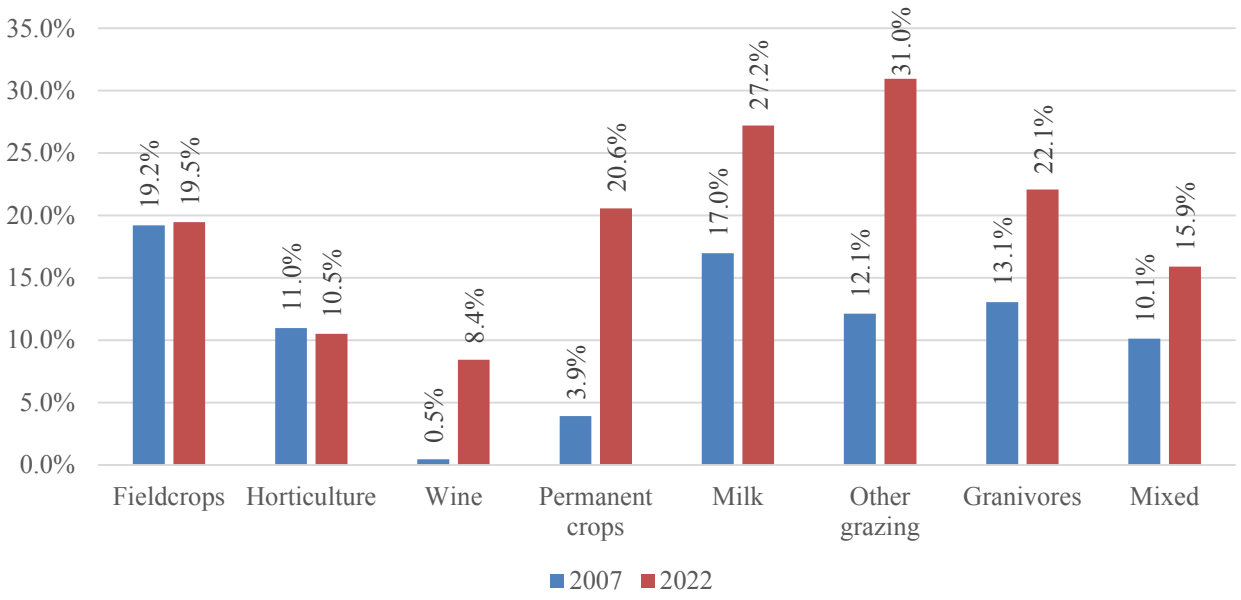


**Figure 1. Changes in Returns of fixed assets to create farm net income by specialisation farms, 2007-2022**

Source: FADN and author's calculation.

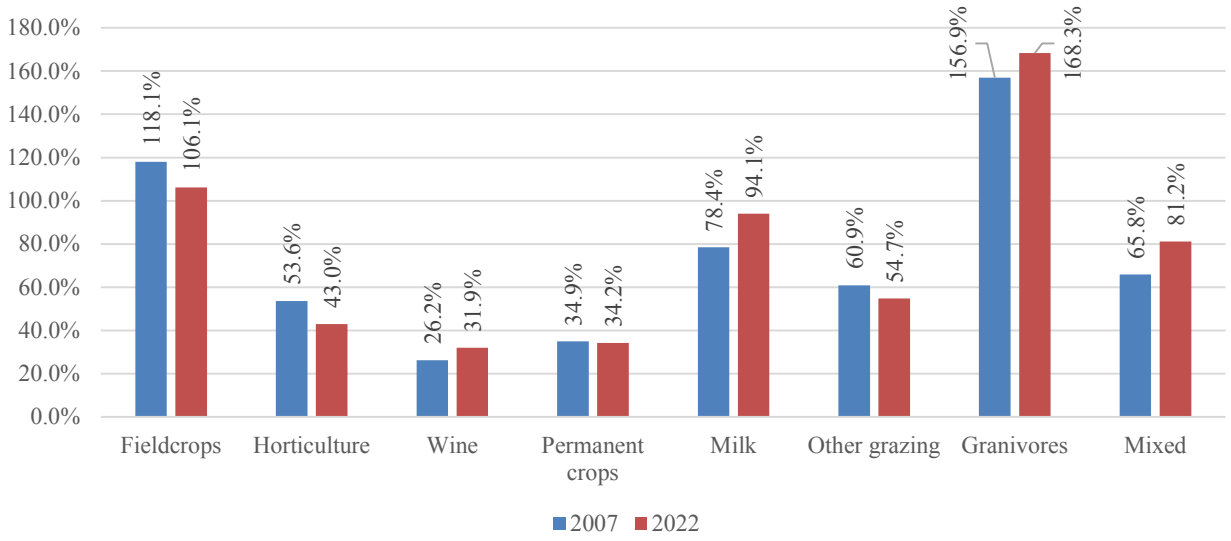


**Figure 2. Changes in the ability of fixed assets to produce total output by specialisation farms, 2007-2022**

Source: FADN and author's calculation.

**Table 2. Changes in the structure of fixed assets by type of fixed assets, all farms and specialisation, 2007-2022**

| Farms type | Year | Land, permanent crops & quotas (%) | Buildings (%) | Machinery and equipment (%) | Breeding livestock (%) | Other fixed assets (%) |
|---|---|---|---|---|---|---|
| BG-total | 2007 | 30,6% | 28,4% | 27,8% | 13,2% | 0,0% |
| | 2022 | 38,9% | 17,7% | 32,6% | 6,5% | 4,3% |
| EU-total | 2007 | 52,6% | 25,3% | 16,3% | 5,8% | 0,0% |
| | 2022 | 59,2% | 18,5% | 15,9% | 5,4% | 1,0% |
| Fieldcrops | 2007 | 34,3% | 16,8% | 48,0% | 1,0% | 0,0% |
| | 2022 | 47,0% | 13,5% | 35,6% | 0,3% | 3,6% |
| Horticulture | 2007 | 23,0% | 43,6% | 33,3% | 0,0% | 0,0% |
| | 2022 | 15,5% | 41,2% | 35,4% | 0,0% | 7,9% |
| Wine | 2007 | 63,3% | 18,1% | 18,6% | 0,0% | 0,0% |
| | 2022 | 63,9% | 12,2% | 21,5% | 0,1% | 2,4% |
| Permanent crops | 2007 | 74,5% | 6,9% | 18,6% | 0,0% | 0,0% |
| | 2022 | 60,8% | 12,3% | 17,6% | 0,0% | 9,2% |
| Milk | 2007 | 19,7% | 31,9% | 14,4% | 34,0% | 0,0% |
| | 2022 | 16,8% | 24,8% | 18,8% | 35,4% | 4,1% |
| Other grazing | 2007 | 21,4% | 30,6% | 11,4% | 36,6% | 0,0% |
| | 2022 | 12,4% | 18,6% | 22,6% | 39,4% | 7,0% |
| Granivores | 2007 | 11,7% | 50,5% | 32,7% | 5,0% | 0,0% |
| | 2022 | 6,2% | 43,2% | 41,2% | 5,2% | 4,1% |
| Mixed | 2007 | 41,0% | 22,6% | 24,7% | 11,7% | 0,0% |
| | 2022 | 32,1% | 17,4% | 34,3% | 12,1% | 4,1% |

Source: FADN and author's calculation.

**Table 3. Changes in in gross and net investment, for all farms and by specialisation, 2007-2022, 2007-2022**

| Farms type | Indicator | 2007 | 2022 | Aver. Ann. growth, % | Stand. Dev., € | Average, € | Growth rate (times) |
|---|---|---|---|---|---|---|---|
| BG-total | Gross investment. (€) | 2 422 | 19 284 | 14,8% | 4 238 | 9 532 | 8,0 |
| | Net investment (€) | 942 | 7 492 | 14,8% | 1 769 | 2 848 | 8,0 |
| EU-total | Gross investment. (€) | 4 562 | 15 172 | 8,3% | 3 366 | 8 141 | 3,3 |
| | Net investment (€) | -77 | 3 917 | 29,9% | 1 149 | 744 | 50,8 |
| Fieldcrops | Gross investment. (€) | 7 992 | 31 704 | 9,6% | 6 905 | 20 817 | 4,0 |
| | Net investment (€) | 3 170 | 13 340 | 10,1% | 6 686 | 7 714 | 4,2 |
| Horticulture | Gross investment. (€) | 3 944 | 5 631 | 2,40% | 5 144 | 6 157 | 1,4 |
| | Net investment (€) | 1 793 | -2 689 | -2,3% | 5 271 | 2 036 | -1,5 |
| Wine | Gross investment. (€) | 54 973 | 83 697 | 2,8% | 21 373 | 27 734 | 1,5 |
| | Net investment (€) | 43 507 | 66 756 | 2,9% | 20 789 | 10 744 | 1,5 |
| Permanent crops | Gross investment. (€) | 4 419 | 5 793 | 1,8% | 2 157 | 4 772 | 1,3 |
| | Net investment (€) | 1 538 | 621 | -5,9% | 2 329 | 215 | 0,4 |
| Milk | Gross investment. (€) | 861 | 5 580 | 13,3% | 1 802 | 3 074 | 6,5 |
| | Net investment (€) | 325 | -166 | -19,5% | 1 557 | 145 | -0,5 |
| Other grazing | Gross investment. (€) | 383 | 2 864 | 14,4% | 1 385 | 1 966 | 7,5 |
| | Net investment (€) | -104 | 680 | 13,3% | 803 | 598 | 6,5 |
| Granivores | Gross investment. (€) | 4 080 | 43 681 | 17,1% | 27 027 | 35 048 | 10,7 |
| | Net investment (€) | 449 | -13 411 | -25,4% | 12 790 | 7 842 | -29,8 |
| Mixed | Gross investment. (€) | 382 | 19 747 | 30,1% | 6 120 | 5 330 | 51,7 |
| | Net investment (€) | -213 | 10 005 | -29,3% | 3 480 | 1 719 | 46,9 |

Source: FADN and author's calculation.