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Aleksandra Figurek, Alkis Thrassou, Demetris Vrontis

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Economic performance of wine production in EU: a multi-indicator comparative analysis

Aleksandra Figurek*

GNOSIS Mediterranean Institute for Management Science,
School of Business,
University of Nicosia,
46 Makedonitissas Avenue, CY-2417,
P.O. Box 24005, CY-1700, Nicosia, Cyprus, EU
Email: figurek.a@live.unic.ac.cy
*Corresponding author

Alkis Thrassou

GNOSIS Mediterranean Institute for Management Science,
School of Business,
University of Nicosia,
46 Makedonitissas Avenue, CY-2417,
P.O. Box 24005, CY-1700, Nicosia, Cyprus, EU
Fax: +357 22 357481
Email: thrassou.a@unic.ac.cy

Demetris Vrontis

GNOSIS Mediterranean Institute for Management Science,
School of Business,
University of Nicosia,
46 Makedonitissas Avenue, CY-2417,
P.O. Box 24005, CY-1700, Nicosia, Cyprus, EU

and

Department of Management Studies,
Adnan Kassar School of Business,
Lebanese American University, Beirut, Lebanon

and

S P Jain School of Global Management – Dubai Campus,
Dubai, United Arab Emirates
Email: vrontis.d@unic.ac.cy

Abstract: This paper focuses on the specialised EU wine producers participating in the farm accountancy data network (FADN), and employs the FADN approach to perform a multi-indicator comparative examination of the income of European wine production. The research substantively contributes to the development of a more precise approach and suitable indicators that are requisite in measuring the economic performance of EU wine production. Specifically, the indicators of economic performance in wine production are farm net value added (FNVA), FNVA annual working unit (AWU), farm net income (FNI), and family farm income (FFI/FWU). The ratio between total production (total output) and the inputs used in production activities, such as intermediate consumption and particular expenses, is an indication of the overall productivity of an agricultural farm. FADN provides the opportunity to accomplish performance targets including monitoring the development of agricultural income and assessing how European policies affect agricultural firms.

Keywords: FADN; farm accountancy data network; wine; EU; FNVA; farm net value added; FNI; farm net income; family farm income (FFI/FWU); subsidies; CAP; common agriculture policy.

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Biographical notes: Aleksandra Figurek is a graduate of the Faculty of Economics of the University of Banja Luka (Republic of Srpska, B&H). She later obtained a Masters from the same University and a PhD thesis from the University of Novi Sad in Serbia. She was awarded for her achievements by the Government of the Republic of Srpska. She reached the rank of an Associate Professor at the University of the Republic of Srpska. She speaks Serbian, German and English and is currently studying for her second PhD at the School of Business of the University of Nicosia, while also being a researcher for GNOSIS Mediterranean Institute for Management Science.

Alkis Thrassou is a Professor at the Department of Management, University of Nicosia (Cyprus, EU) and holds a PhD from the University of Leeds (UK). He is the Director of Gnosis Mediterranean Institute for Management Science, the Chief Editor of Palgrave Intersections of Business and the Sciences, the Managing Editor of Palgrave Studies in Cross-disciplinary Business Research, an Associate Editor of *EuroMed Journal of Business*, and a Senior Research Fellow of the EuroMed Academy of Business. He has edited and published in numerous internationally esteemed scientific journals and books, and his works have been cited in thousands of scientific publications.

Demetris Vrontis is the Vice Rector for Faculty and Research and a Professor of Strategic Marketing Management at the University of Nicosia, Cyprus. He is the Founder and Editor in Chief of the *EuroMed Journal of Business*, an Associate Editor of the International Marketing Review, an Associate Editor of the *Journal of Business Research* and a Consulting Editor of the *Journal of International Management*. He is also the President of the EuroMed Academy of Business, which serves as an important and influential regional academy in the area of Business and Management. He has widely published in about 300 refereed journal papers, 45 books and 60 chapters in books, and has presented papers to over 80 conferences.

1 Introduction – research context and aims

Due to advancements in technology and procedures, agri-food industry is held to higher standards for the accuracy and coordination of its production planning and management (Thrassou et al., 2021; Figurek and Thrassou, 2023). A ratio that considers the farms' output and management techniques serves as the foundation for profitability.

The scientific literature claims that farm accountancy data network (FADN) data can give appropriate support for sustainability evaluation and monitoring results among farms, which is a vital data source for evaluating the efficacy of the CAP policies (Briamonte et al., 2021). For instance, FADN makes it feasible to closely monitor the financial performance of wine farmers, who frequently engage in the end market but are not necessarily directly connected to it. FADN data were utilised to conduct a small-scale profitability study on production of food that emphasises how the final product's pricing is what determines if an investment is feasible (Mennella et al., 2020). The most relevant metrics are net income per hectare and per family labour unit, both of which may be obtained from FADN (Andrei et al., 2020).

Agricultural intervention and the usage of FADN as a framework for performance monitoring demonstrate the efficacy of the FADN (Kelly et al., 2018). The annual time frame, regular data gathering techniques, and historical records are its primary benefits. Additionally, FADN may provide data on a sizable sample of individual holdings that are considered to be significant policy actors, crucial land management decision-makers, as well as the legal companies that receive CAP payments and are thus regulated. The quantity of data enables the attainment of novel goals such as tracking agricultural revenue growth or analysing the outcomes of local or European farm policy. Only the FADN database offers adequate, financial, societal, and environment data on agrarian holdings that spans the whole EU.

2 Literature review

The world's greatest level of wine production is recorded in the European Union. From 2016 and 2020, the production volume per year was on average 165 million hectolitres. It made up 45% of the wine-growing regions of the globe (Eurostat, 15 December 2022). The largest agri-food sector in the EU is wine, which, in exports, accounts for 7.6% of the value of agricultural goods delivered in 2020. Farmers in Europe need to manage a variety of risks, such as pricing sensitivity (Hardaker et al., 2015), drought awareness (Parsons et al., 2019), and climate change, in order to deal with dynamism and uncertainty (Reidsma et al., 2007). Climatic change may degrade grape content and lower yields in warmer regions (Santos et al., 2020; Galletto et al., 2014), but it may also increase the quality of some wines produced in colder regions.

Slijper et al. (2022) investigated broad patterns that depict how farms manage risk, and unpredictability; compared farm adaptability throughout different farming types and European countries; and assessed how certain aspects of holdings have an impact on resilience, adjustment, and transformation. A farm's capacity for adapting its production methods is represented by adaptation, while a big improvement in the business's emphasis is represented by transformation (Darnhofer, 2014). Analysing holding well-being (Barrett and Constas, 2014) or yield through time (Chavas, 2019) allows the capture of dynamics of resilience in agriculture (Knippenberg et al., 2019). This strategy

broadens previously conducted research at a European level, which solely addressed adaptation (Vanschoenwinkel et al., 2019; Reidsma et al., 2015).

Considering that globalisation may be competitive at times, it is not remarkable that wine production competitors who were able to use effective strategies were successful and even overtook the owners, the conventional producers. Wines that are organic and biodynamic have been increasingly popular worldwide, especially in nations that traditionally consume wine (Schäufele and Hamm, 2017). Due to the stratified local social capital, the majority of Italian local production systems that specialise in grape and wine possess revenue-positive attributes due to the presence of multiple networks, some of which are official and others informal (Pomarici et al., 2021). In order to raise consumer knowledge and comprehension of the various sustainable production techniques, wineries interested in commercialising sustainable wines creates tailored marketing campaigns. This is certainly relevant for biodynamic and natural wines, which are not as common and can cause customer concern (Vecchio et al., 2023).

In addition to providing physical sustenance, food is increasingly seen by consumers as an important part of intangible cultural tradition across the world (Dixit, 2020). Being a family business plays a significant role in the digital communications process, connecting wine family enterprises rather than just creating connections among players in the wine production. Tradition is the main pillar of cultural heritage in the wine business (Iaia et al., 2019). Geographical indications (GI) are associated with product differentiation tactics that enable pricing premiums (Van Haeck et al., 2019). In addition to environmental concerns, other challenges include the sustainable economy, land abandonment, decreased service delivery, and ageing agricultural populations (Recanati et al., 2019).

In order to improve the management decision-making that leads organisations into alliances, Lamba et al. (2022) attempted to expand understanding of how and why certain strategic incentives impact one another. Dinesh and Suhil (2022), who concentrated on strategic innovation in new businesses, emphasised the conceptual connections between entrepreneurial orientation, organisational innovation, technology innovation, and product innovation. Results from the management standpoint provide decision makers and wine producers with insight and concepts for differentiating their offer and can support them in addressing the growing customer demand for more responsible production techniques in opposition to the negative effects of traditional agriculture practices (Thrassou, 2016). Given the significance of consuming natural wines, consumers' knowledge of this fact is expanding, and the wine industry is being urged to create efficient marketing techniques that will aid customers in recognising and differentiating between the natural wines available on the market. (Migliore et al., 2020). Geographical trademarks identify a distinctive feature of the product that is connected to its homeland. Product differentiation may result in higher pricing for consumers (López-Bayón et al., 2020). In comparison, Monier-Dilhan et al. (2020) investigate a number of factors in their study of GI impacts on pricing.

According to Donati et al. (2020), PGI production has a significant beneficial impact on the local economy. According to an investigation into the research by Mattas et al. (2020), PDO goods have particularly positive spill-over effects on rural development. Additionally, they significantly assist other agricultural businesses and traditional environment protection (Bacsi et al., 2022). The sustainability and resilience of farms in underdeveloped and distant locations are predicted to increase as a result of geographic indications (GIs), which are intended to promote rural development (Poetschki et al.,

2021). According to Carbone et al. (2021), the degree of complexity of the countries of destination gives essential information about the type of competition that products will face in the target market. Assessments based on more general metrics, including value contributed and profitability, are required (Cei et al., 2018). The EU's Mediterranean member states have the highest prevalence of GIs (Jantyik and Torok, 2020).

Considering relevant data for the year 2016, Pawlak et al. (2021) evaluated the farmlands of the EU and the USA and discovered which groups of countries produce economic viability in this industry. They also investigated the key factors that influence success in the farming sector. Employing resulted Eurostat data that showed distinct trends of common agricultural policy (CAP) subsidies in three groups of various trends, Magrini (2022) examined the sustainability and output aspects of agriculture (ground, workforce, capital, and entrepreneurship) in a research conducted 26 EU countries from 2004 to 2018. Sustainability is a problem for the wine industry because of its implications on changing climate, soil degradation, water consumption, and power consumption. It is also a competitive component and a catalyst for innovation (Capitello and Sirieix, 2020). Wine production will need to significantly change its production procedures in order to fulfil the growing societal and institutional demand for environmental sustainability (Pomarici and Vecchio, 2019).

One of the most common methods for agricultural sustainability research is used based on sustainability indicators (Sauvenier et al., 2005; Van Passel and Meul, 2012; Dantsis et al., 2010). Interest in conceptualising sustainable development and methodological difficulties surrounding its evaluation has grown over the past 40 years (Dabkienė, 2016). Coca et al. (2020) explored more complicated issues associated with environmental achievements, food production and sustainability (Andrejovská and Glova, 2022), and global food security guidelines because farm achievement cannot be outlined without guidance to the broader context. Given the complex nature of agricultural policies (Finger and El Benni, 2021), several research studies examine the CAP, which is the foundation of the primary support measures used in agriculture (Erjavec et al., 2021; Guth and Smedzik-Ambrozy, 2019; Volkov et al., 2019).

Several variables and specific elements that have been identified in conditioning, synergistic, or competing interactions among them all affect how well agriculture performs (Coca et al., 2023). The paper's goal is to analyse the efficiency of winemaking while taking into account the connections and interactions that have been made between important components. The methodology for determining profitability in agriculture is still being developed (Ma et al., 2021), with policy instruments like subsidies having an ever-increasing impact as strategic tools (Martinho, 2019; Alaoui et al., 2022), economic development via productivity and profitability, increasing revenue for agricultural businesses and producers' well-being, and diversifying EU farming in terms of investment and interactions across production aspects (Zakrzewska and Nowak, 2022). Since the majority of organisations in the business community are SMEs, they exhibit limited long-term resilience to economic shocks (Olorogun, 2021).

Quality information on all important business parameters should be available from the agricultural holding's accounting information system. It is the connection between making decisions, carrying out company operations, controlling, analysing, and taking remedial action. An accounting data network drawn from a representative sample of agricultural properties makes up the macro system.

This is a substantial amount of quite different information that is constantly and actively transmitted between farms and a variety of other users (the Ministry of

Agriculture and other state bodies in charge of agriculture at various levels – republic, province, area, municipality; advisory service; chambers and other professional or interest associations of agricultural producers; banks, funds, and possible agricultural investors; faculties and other academic and scientific-research institutes and organisations, etc.).

Ratios that reflect the farms' output and management techniques are the cornerstone of profitability and efficacy (Chiravuri, 2018). According to Palash and Bauer (2017), the amount of land allocated to different forms of production may have an impact on a farm's profitability and sustainability (Matakanye, 2021). Zsarnóczai and Zéman (2019) investigate the relationships between the businesses of the EU-12 countries by contrasting several farm key indicators (such as output value of the agriculture sector, input effectiveness, subsidies, labour, and farm profit per annually working unit (AWU)).

Using a unique agriculture economics' conceptual approach known as the model of multiplicative competitive interaction, Neuenfeldt et al. (2019) examined the factors that influence modification to farms in the EU-27. For evaluating models of regional farm shares, MCI offers a more advantageous description rather than a Markov approach. Farm group-specific equations are made possible by the MCI framework and are used to take into account factors that are unique to certain farm groups. Farm group shares according to the farm structure survey (FSS) at the regional level are explained by the MCI framework utilising variables from Farm Accountancy. The agri-food sector is now consistent with the law standards for the accuracy and cohesion of its production management and design due to the advancements in its processes and technology (Thrassou et al., 2021).

The performance (conduct of production activities) of farms as resource users is the focus of analysis of agricultural farm operation efficiency. It's also critical to consider the farm's relative productivity given its particular size and ownership of production components. The performance (implementation of production activities) of farms as consumers of resources is prioritised when measuring the efficiency of operations on an agricultural farm. The relative effectiveness of the farm within the confines of its particular size and ownership of production components is also crucial to consider.

The scientific literature implies that FADN data (Filipiak and Maciejczak, 2018) can give appropriate support for sustainability evaluation and monitoring outcomes among farms, which is an important background information for assessing the effectiveness of CAP initiatives (Briamonte et al., 2021). FADN enables attention to be focused on the financial performance of wine farmers who are primarily participants in, but frequently not directly connected to, the end market. The net income per hectare and per family work unit, which are available from FADN, are the most appropriate metrics (Pomarici and Sardone, 2020; Andrei et al., 2020). The designers of agrarian policy must coordinate the stated objectives and come to an agreement on the extent of their accomplishment. This is required, among other reasons, since the economic systems of some nations have a variety of limitations. When it comes to the agriculture sector's declared objectives, three sorts of constraints may have lesser consequences. First of all, the cost of doing business is directly impacted by the dependence of agricultural output on production technology and the availability of inputs. The architects of agrarian policy must compromise on the degree of its realisation while maintaining alignment with the stated objectives. This is essential because of a variety of limitations in some nations' economic systems, among other things. Three types of constraints have lower influence on the achievement of specified objectives pertaining to the agriculture industry. The

availability of inputs and production methods, which have a direct impact on company expenses, are first and foremost a factor in agricultural output.

Agricultural intervention and use of FADN as a foundation for performance monitoring highlight the effectiveness of the FADN database (Kelly et al., 2018). The standardised data gathering procedures, the annual time period, and the historical records are the its key strengths. Moreover, FADN may offer information on a significant sample of individual holdings that are thought to be important policy players, key decision-makers for land management, as well as the legal entities that receive CAP payments and are thus subject to regulation. The abundance of data enables the achievement of fresh objectives, such as tracking the growth of agricultural revenue or evaluating the results of local or European agriculture policy. The FADN repository is the uniform resource of institutional, financial, socioeconomic, and environmental information on agricultural property that covers the whole EU and permits cross-national comparison.

The primary function of the FADN is to provide information to assist agricultural producers in making decisions regarding:

a planning for a more effective allocation of material and financial resources

b the way to carry out specific activities

c the control process, which involves comparing expected and actual results.

The FADN offers insights into the causal links between specific system segments, at both the micro and macro levels. And facilitates planning of long-term investments in agricultural production, the degree of agricultural production subsidisation, and the detailed analysis of the obtained data to determine how well the kind and volume of output match market demands. The EU's agricultural policy makers may consequently better understand how specific agricultural production types are represented and evolving throughout all of its member states. Crises are additionally and frequently an occasion for change, whether it is in the social, economic, or technical spheres (Thrassou et al., 2022), and the growth of agriculture in each member state, and the EU as a whole, may be better managed through the development of high-quality CAP policies in all contexts and circumstances.

The paper reflects on the economic performance of wine production in European states using the FADN methodology. The paper is arranged as follows: in Section 1, we outline the FADN methodology and key economic performance indicators for wine production. The outcomes and data used are explained. The key conclusions, discussions, and major consequences resulting from the research are summarised in the last section.

3 Research gaps

It is clear that the FADN system has a lot of data from the examination of theory and practice in how this system functions in EU member states. There are still some variations even though the collection of data that must be gathered for the FADN system's requirements at the national and EU levels has been substantially agreed upon and standardised. For example, FADN data related to input and output categories (input production factors and output-final agricultural products) tend to be more aggregated at the EU level than at the Member State level. In addition, individual FADN databases

established at the level of EU member states include more information for certain types of production.

Understanding what is happening with the advantages of agricultural output does not lessen the need of knowing how farm households are doing financially. The indicators of the benefits from agricultural output, although appearing to be more universally acknowledged among statisticians in EU Member States than those relevant to farming families, are really based on concepts that are far from evident. The following are essential among them: In both the overall Economic Accounts for Agriculture and the macroeconomic FADN, the basic unit is not the full farm. It excludes any other beneficial endeavours that the farm could engage in and, with a few minor exceptions, only applies to the agricultural activities that takes place on farms. It may be challenging to allocate the costs of such activities to the right sources when inputs are utilised including both farming and non-farm purposes (such as the use of electricity).

Although it is occasionally referred to as income, the main metric at both levels (Net Value Added per Annual Work Unit) is significantly distinct from both corporate profit and individual or family income. It serves as a substitute for the payment for all of the "fixed" components of production, such as all of the land, all of the capital, whether or not the farm operator owns it, and all of the labour, whether hired or supplied by the farmer's family. There is some logic in the practice of dividing the factor reward by the size of the factor base when examining changes over time, but accounting for changes in only one fixed factor (labour) can be questionable on both theoretical (such as attributing any productivity gains to labour when increases in capital may also be a factor) and practical reasons (at least in certain countries statisticians have concerns about the quality of the information on labour input where most of the changes are noticed over time).

In order to meet the demanding environmental and societal objectives that go hand in hand with the goal of a successful agriculture sector, a transformation approach for the EU's common agricultural policy (CAP), which also includes the wine program, is part of ongoing process. The wine sector is involved in the CAP reform process as well because of its significance to EU agriculture. In that context, it's critical to emphasise that the CAP has always contained a wine industry-specific policy. This strategy is characterised by the selection of specific sectoral objectives that are only loosely related to those proposed for other sectoral initiatives.

4 Framework, graphic representation and proposed model

A unified classification of holdings in the European Union is provided by the typology of agricultural holdings. The categorisation is based on a set of economic coefficients computed as regional averages, on the standard output coefficients (SOC), and on structural data gathered under the integrated farm statistics (IFS) and in the FADN.

FADN offers comprehensive financial, economic, structural, and production data on more than 80,000 farms around Europe, including sales, farm usage, farm consumption, and changes in inventories. Each year, the information is systematically gathered. The three stratification parameters that FADN uses to ensure that particular groupings of farms are appropriately represented in the sample are area, income levels, and type of cultivation (European Commission, 2016). More than 1000 different variables are present in the data gathered for each sample farm. FADN includes standardised farm-level data for all of Europe; these data components must be reported to the European Commission,

and all nations use the same accounting principles (such as depreciation). Around 5 million farms make up the EU's FADN, which accounts for 90% of the total land used for agriculture (UAA) and produces 90% of the total agricultural production. The information needed to determine the standard output coefficient (SOC) includes production data over a 12-month period.

The holdings are categorised according to their economic size (ES) and farming type (TF), which are assessed using the SO of several agricultural production categories. Farms considered to be commercial belong within the FADN field of observation. A commercial farm is one that is large enough to serve as the farmer's primary source of work and generate enough income to sustain the farmer's family. The farm must be larger than a certain economic scale to be categorised as commercial. Each Member State's threshold is varied due to the various farm structures present throughout the European Union. FADN offers the possibility for lengthy management of investment in farming systems, the level of agricultural production subsidisation, and the synchronisation of the sort and amount of output to market needs based on a systematic analysis of the data (Figurek and Vasković, 2017).

Figure 1 Total inputs (see online version for colours)

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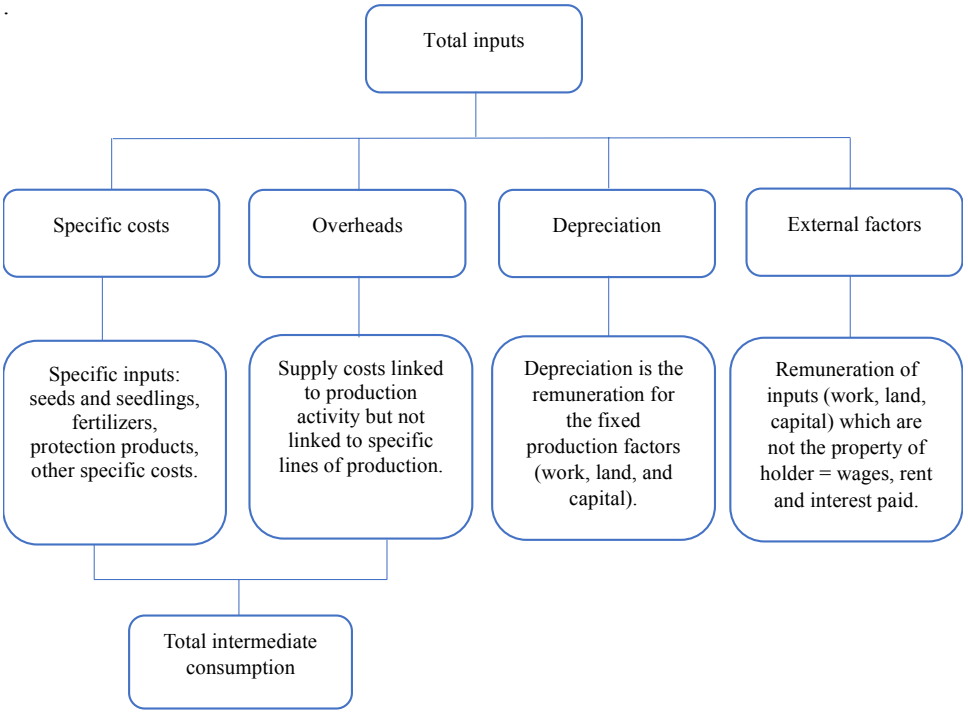
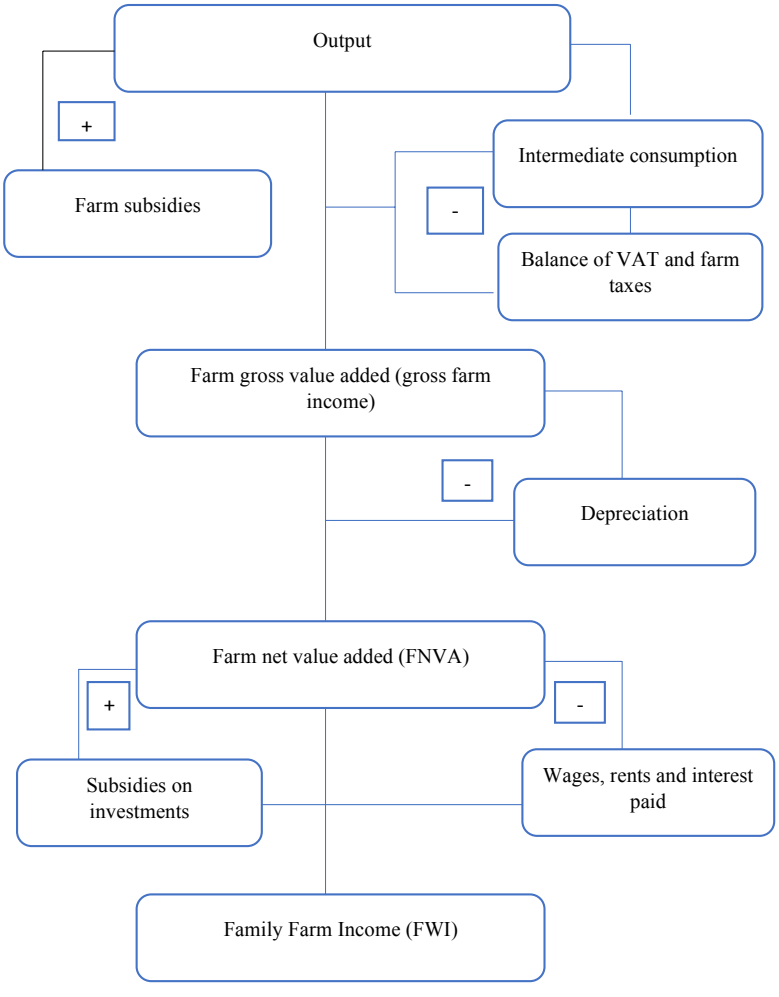


With the creation of the FADN system, indicators were developed with which EU member nations may track the performance of business operations and the advancement of production procedures within the sector. These indicators refer to both inputs and outputs in the production process. Total inputs are made up of individual expenses as well as overhead, depreciation, and outside influences. Inputs are related to the agricultural activity of the holding and linked to the output throughout the financial year.

Sums for agricultural inputs produced on the land, such as seeds, plants, and food for grazing cattle and granivores, but not manure, are included. Agricultural taxes and some other fees are included in the balance of 'subsidies and taxes' on contemporary and non-current activities rather than in the total cost when computing FADN standard results. The FADN accounts should not include the holder's personal taxes (European Commission, 2023).

Total particular expenses (including inputs generated on the farm) and production-related expenses are included in total consumption expenditure (Figure 1). Agricultural overheads involve supply costs related to business activities excluding production lines. Permanent agricultural plantings, fixed farm structures and forest plantings, machinery, equipment, and land upgrades are all subject to depreciation. The replacement value serves as the basis for calculation. Depreciation is the term used to describe the payment made for the fixed costs of production (work, land, and capital), whether they come from outside sources or family members.

Figure 2 Farm income in the framework of the FADN based on FADN methodology (see online version for colours)



Total intermediate consumption only includes those particular expenditures and farming overheads that arise from output during the accounting year (Figure 2). Specific expenses involve certain inputs (expenditures related to certain crops' plants, fertilisers, crop protection tools, and other expenses). Persistent crop plantations (considered biological resources), agricultural infrastructure and fixed equipment, land upgrades, machinery and equipment, and forest plants are among the capital assets that incur depreciation throughout the accounting year. Capital in circulation and real estate do not depreciate.

5 Theory

In order to look into the variables influencing farm structural change in the EU-27, Neuenfeldt et al. (2019) used the multiplicative competitive interaction (MCI) model, a distinctive analytical framework in agricultural economics. According to Reiff et al. (2016), the CAP reforms and the EU's growth altered how well the farming industry performed for its member nations. Farms' economic performance is impacted by organisational, operational, and behavioural elements (Sauer and Moreddu, 2020). A few studies have focused on the European Union's single agricultural policy in action, particularly with regard to the financial effects on farmers, marketplaces, and the environment. Economic performance is also a strategic aim of common agricultural policy and for the wine sector (European Commission, 2020).

Farm net value added (FNVA) is calculated by subtracting depreciation expenditures from total farm revenue (FNVA). It is used to compensate for the permanent factors of production, whether they be external or family (labour, land, and capital). Thus, it is possible to compare agricultural holdings regardless of whether family or non-family output characteristics were taken into account. Production + yearly Pillar II payments, Pillar I payments, any national subsidies, agriculture taxes (income taxes are excluded), depreciation, and intermediate consumption and VAT balance are used to compute FNVA. To account for differences in farm size and provide a more true view of agricultural labour productivity, the score is obtained per yearly work unit (AWU). farm net income (FNI) is the total of family labour earnings, land rentals, and capital gains. It is calculated by removing the FNVA from the external forces of production and adding the residual amounts of investment-related supports and tax.

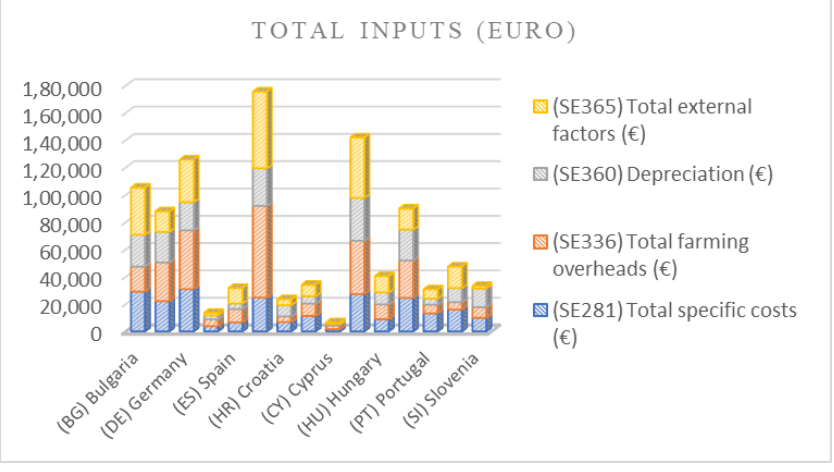
6 Results

Total inputs comprise the sum of all specific expenses, agricultural overheads, depreciation, and external variables, according to the FADN approach. The costs associated with the holder's farming activity and the outputs of the current accounting year are used to calculate them. Additionally, they include amounts pertaining to the utilisation of the holding's results as inputs for the agricultural production. On the other hand, agricultural taxes and other fees are not taken into account when calculating the balance between supports and taxes on current and non-current operations. Total external factors, which include salary, rent, and interest payments, can be viewed as compensation for inputs that belong to someone other than the holder.

The greatest inputs are in France, Luxembourg, and Germany, according to an analysis of the input components used in wine production in the EU (Figure 3). The

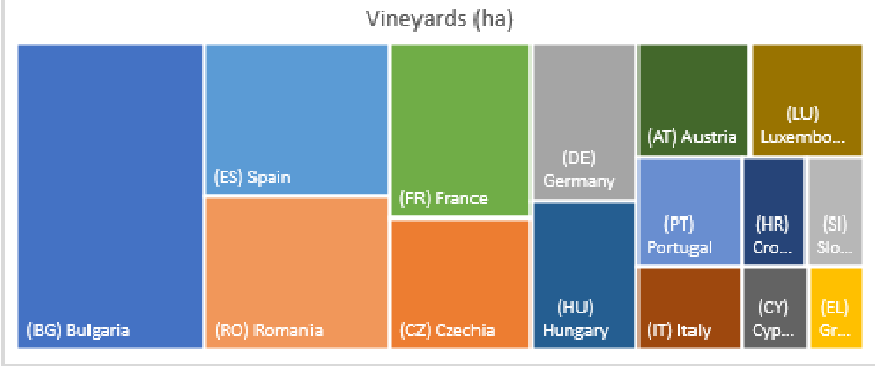
structure of the overall input varies throughout the European Union's member states in 2020. Total farming overheads predominate in the production of German and French wine, averaging €42,920 and €67,179 per farm, respectively. Total external elements dominate the entire structure of inputs used to produce wine in Bulgaria, Spain, and Luxembourg, where the average cost per farm is €34,556, €11,436, and €44,267, respectively. In Slovenia and Croatia, depreciation accounts for most of the overall input structure and, on average, per farm, calculates €8330 and €13,654, respectively.

Figure 3 Total inputs (Euro), according to the FADN database (see online version for colours)



In considering the area in hectares covered by vineyards (including young plantations), it is evident that according to data from 2020, Bulgaria has a significant average area of 34.6 ha per farm. Spain and Romania have the same average area under vineyards (17 ha) per farm (Figure 4). The average area under vineyards in Austria, Luxembourg and Portugal is around 7 ha, while the smallest average area under vineyards per farm is found in Greece (2.7), Cyprus (3.4) and Slovenia (3.7).

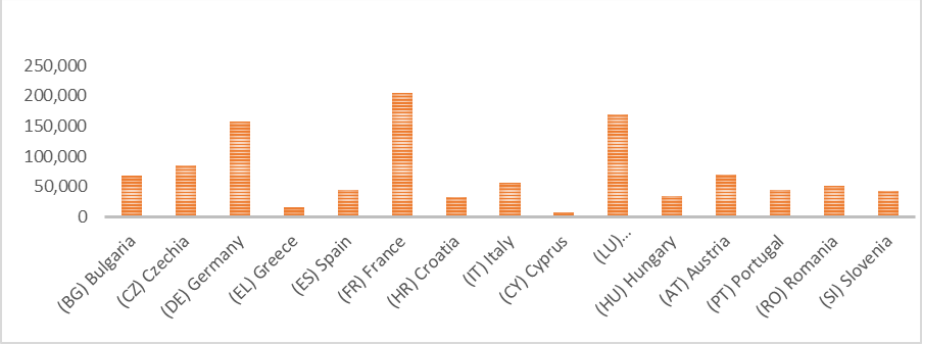
Figure 4 Vineyards (ha) in EU countries, FADN database (see online version for colours)



Analysing the production value of wine (in euros per farm) in 2020, it was determined that France, Luxembourg, and Germany achieved the highest average value per farm and

exceed the average amount of €204,114/farm, €169,481/farm, and €157,456/farm, respectively (Figure 5). They are followed by the Czech Republic (€85,671/farm), Austria (€70,228/farm), Bulgaria (€67,405/farm), Italy (€56,113euro/farm). The lowest average value per farm was achieved by Greece (€15,376/farm) and Cyprus (€6840/farm).

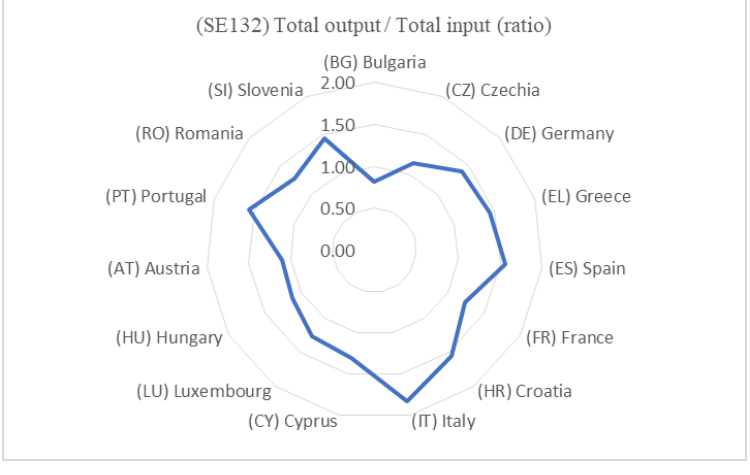
Figure 5 Wine (euros per farm), FADN database (see online version for colours)



It is obvious that the nations with the biggest average area for wine production did not produce the highest output value when comparing the two datasets. Due to the aforementioned considerations, it is required to include other indicators that will give a more comprehensive assessment of the circumstances and broaden the study of economic performance of wine production in the EU member states.

Total output divided by total input equals total output plus [specific expenses, overhead, depreciation, and outside influences]. The costs associated with the holding's agricultural activities included those for inputs generated on the property (farm usage) such as seeds, seedlings, and feed for grazing cattle and granivores, but not for manure. Farm taxes and other fees are considered in the balance of 'Subsidies and taxes' (subsidies-taxes) on current and non-current operations rather than being added to the cost total when computing FADN standard results.

Figure 6 Total output/total input ratio, FADN database (see online version for colours)



On the farms, the greatest output/input ratio (Figure 6) was seen in Italy 1.84, Portugal (1.57), Spain (1.56), and Croatia (1.56). Slovenia comes next, with an output-to-input ratio of 1.46, followed by Greece, 1.44, Germany, 1.40, Cyprus, 1.31, Romania, 1.28, Luxembourg, and France 1.24, Bulgaria has the lowest ratio observed (0.82). Analysis of the basic structure of this indicator showed that few developed countries have a lower ratio, considering the significant share of total costs (inputs) invested in wine production.

7 Discussion

Farm net value added is determined by subtracting depreciation costs from total agricultural income. It is utilised to make up for fixed production inputs like labour, land, and capital, whether they come from the outside or the inside. So, regardless of whether family or non-family sources of production were used, agricultural holdings may be compared.

For better assessing the productivity of the agricultural labour, the FNVA/AWU is determined per annual work unit (AWU), which takes into consideration the various scales of farms. The usage of net added value is a key indication for examining the income structure, beginning with the type and size of agricultural holdings. This gives information about the share of the value in connection to factors like farm size, type of output represented by a particular farm, etc. For the overall examination of this indicator, keeping track of the variations in FNVA realised values according to EU member states is insufficient. Additionally, it's important to pinpoint the constraints that have an impact on the accuracy of the analysis of the revenue created by an agricultural farm. The structure is diverse depending on the country and the types and sizes of agricultural holdings that predominate in some countries, i.e., the proportion of borrowed capital, rented land, and paid labour, which impact the outcome achieved when calculating FNVA.

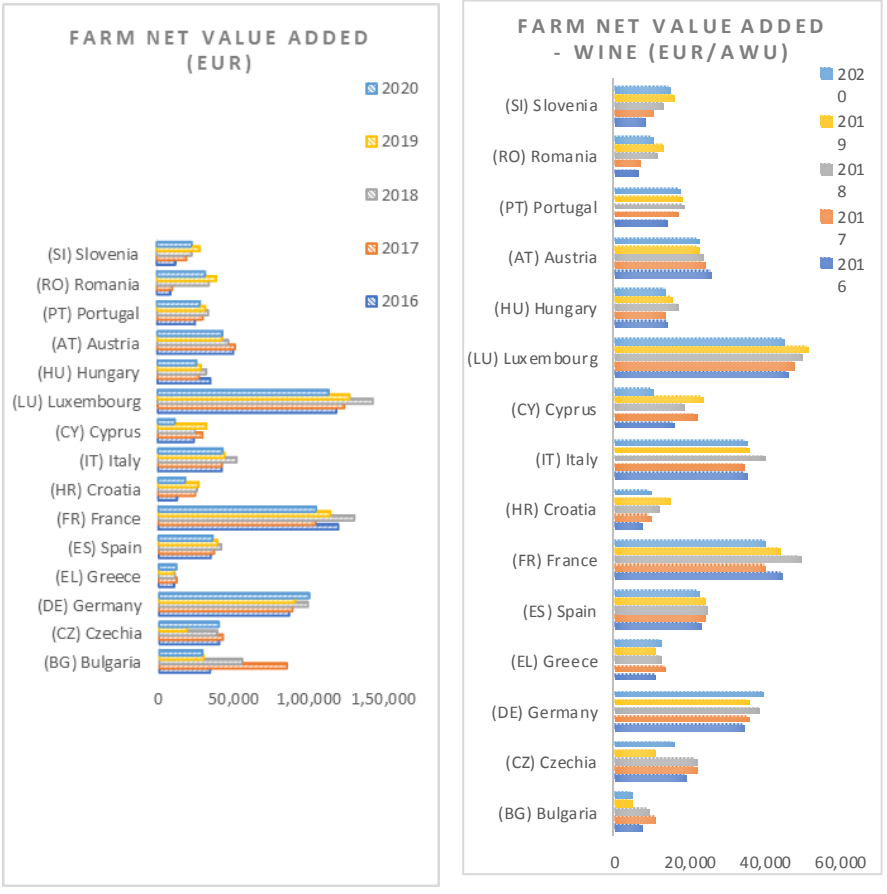
When FNVA is stated according to the AWU, the disparities in the labour force are treated as compensation for each holding. A mean score is determined by summing the sample farm incomes by the sample farm weights and the sample farm AWU by the sample farm weights.

The FNVA realised values indicate significant disparities between member countries. According to data from 2020, the highest average values of FNVA per farm in wine production were achieved in Luxembourg €111,933, France €103,809, and Germany €99,629, while the lowest average values were Cyprus €11,178, Greece €11,704 and Croatia €17,690. Since the average areas of farms specialising in wine production in EU countries differ significantly, the authors continued with the analysis of FNVA/AWU. Eurostat uses AWU when calculating the time spent on production activities on the agricultural holding. It is equivalent to permanent employment and represents the work of one person who is permanently employed on the farm during a period of 12 months. The number of working hours of one employee on an annual basis is 1800 (8 hours of labour each day times 225 working days). This information is used if the employment legislation of the EU member states does not prescribe any other norm.

Analysing FNVA/AWU, the wine producers that achieve the highest productivity per unit of work are the same countries that achieved the highest average values of FNVA,

while the countries with the lowest average value of FNVA per farm are Bulgaria and Croatia, which achieved a value of €4360 and €9248, respectively (Figure 7). Another indicator that is used when looking at and analysing the income generated on the farm is family farm income, or FFI. An indicator of income per annual labour unit of household members engaged in agricultural production is represented by FFI/FWU (family work unit).

Figure 7 Farm net value added (FNVA) in euros, farm net value added per AWU (euro/AWU) (see online version for colours)



Authors' calculation according to the FADN database.

Farm net income (FNI) is the sum of the wages paid to family members, the value of their land, and their capital (FNI = FNVA – total external variables plus the balance of investment subsidies and taxes). It is computed by subtracting the external factors of production from the FNVA and combining the balance of investment subsidies and taxes. This measure of income accounts for differences in the amount of family workers to be paid per holding. The value is calculated as FNI per family work unit (FWU). Only farms that use unpaid labour (which in most cases means family members) are included in the calculation. Family members who work in the agricultural industry make up most of the

workforce; they are not paid a wage but must be compensated from farm income. Compensation for family labour is another method of assessing income because the FNVA is necessary to finance not just family labour but all fixed production components. Compensation for family labour is calculated as follows: FNVA + the balance of investment-related subsidies and taxes – total external production factors – opportunity costs associated with owning land and capital. Alternatively, starting with the prior indication, FNI – opportunity cost of one's own capital – opportunity cost of one's own land.

The countries where the FNI decreased in 2020 (compared to the previous year) in wine production are Spain with an average FNI per farm of €24,019, Croatia (€13,382), Cyprus (€9,955), Hungary (€13,190), Portugal (€21,836), Romania (€15,558). Farms that achieved an average FNI (per farm) of more than €30,000 in 2020 are Luxembourg (€70,562), Germany (€65,592), France (€49,817), Italy (€34,418), and Czechia (€30,253). Greece, Germany, and the Czech Republic succeeded in raising the average FNI per farm in 2020 in comparison to 2019. Only Bulgaria had a negative average FNI value, which had increased from 2016 to 2018, but then started to decline in 2019 and continued to decline in 2020 (Figure 8).

If we do an examination of FFI/FWU, we find that the movement trend and ranking are identical to those of FNI. In 2020, farms in Luxembourg attained the highest FFI (€58,271/FWU), Germany (€40,909/FWU), France (€39,409/FWU) and Italy (€37,654/FWU). Compared to 2019, the countries that achieved increased FFI/FWU values in 2020 are Czech Republic (€19,530), Greece (€12,320), Hungary (€17,996), and Austria (€16,520).

Figure 8 Family net income (FNI) in euros, family farm income (FFI/FWU) euro/FWU (see online version for colours)

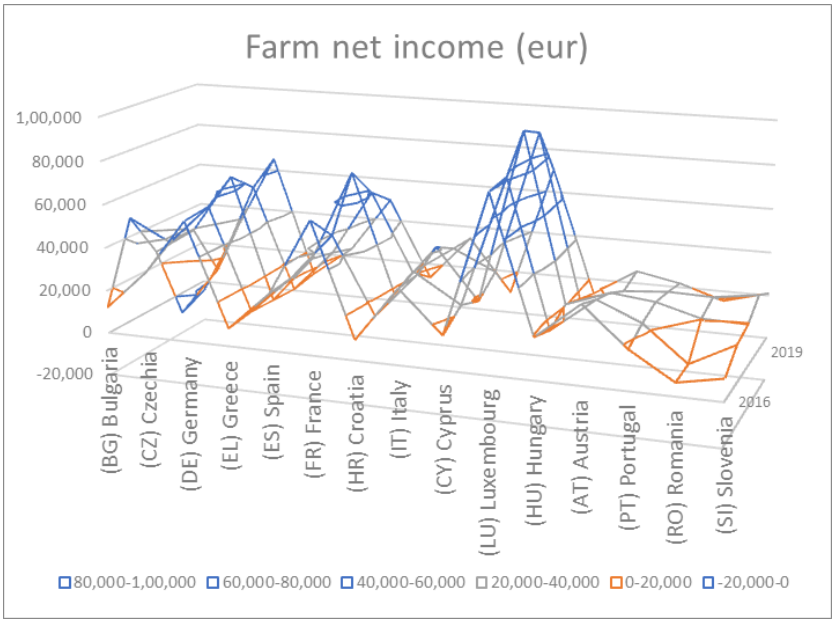
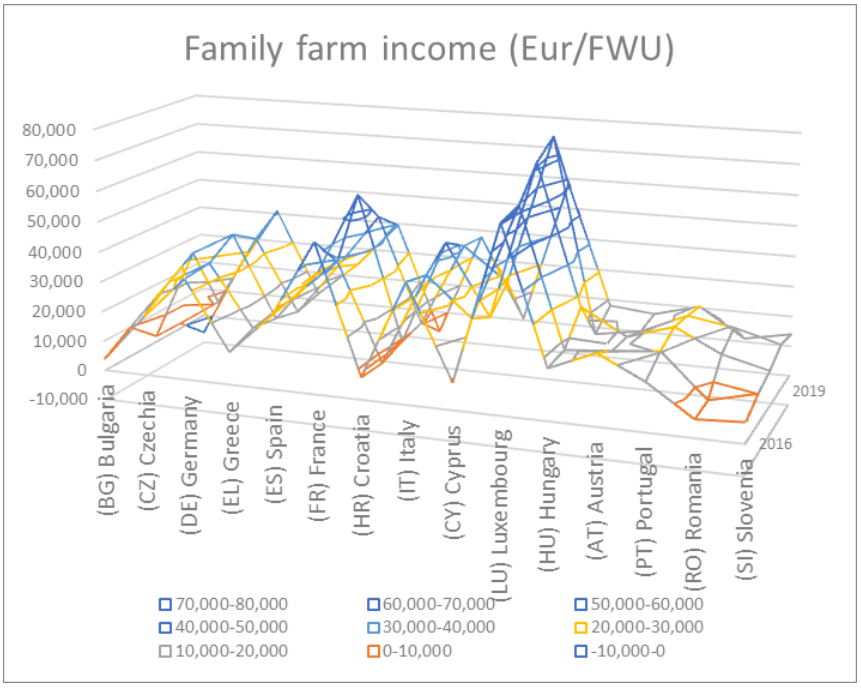


Figure 8 Family net income (FNI) in euros, family farm income (FFI/FWU) euro/FWU (see online version for colours) (continued)



Authors' calculation according to the FADN database.

A reform process for common agriculture policy of the EU (CAP), which also includes the EU wine strategy, was initiated in 2018 to satisfy the ambitious environmental and social goals that go hand in hand to ensure that the agriculture industry is competitive. The wine sector is also participating in the CAP amendment process as it represents a significant portion of EU agriculture. Regarding that, it must be emphasised that a policy oriented towards the wine business has been a component of the CAP from the start and is distinguished by the determination of specific sectoral objectives that are only partially the same as those indicated for other sectoral interventions.

Even though the extensive regulation of wine production in the EU is complex, it cannot be considered an isolated instance. In fact, due to goals relating to fiscal difficulties, product integrity, and consumer protection, the rise of the wine business has also occurred in non-European nations under suitable regulation (Georgopoulos, 2014).

The highest average value of the subsidies (excluding subsidies on investments) per farm in wine production was achieved by Luxembourg (€21,671), Austria (€14,897), the Czech Republic (€13,236), and Bulgaria (€12,480). The lowest average values of the subsidies per farms are in Romania (€3581) and Portugal (€3770). The countries in which a rise in the average farm-level subsidy value in 2020 was recorded are Slovenia (which achieved the value of €6235 on average per farm), followed by Hungary (€8632),

France (€7724), Greece (€3762). The greatest average value per wine-producing farm is identified in Luxembourg, the Czech Republic, France, and Bulgaria, according to an analysis of investment subsidies (Figure 9).

The EU wine strategy is an excellent example of how vertical initiatives, which cover the whole wine supplier base, may be integrated with horizontal measures, which are relevant to all agricultural sectors. The announced affirms the array of techniques already in use in the industry and makes some intriguing improvements to it (Goncharuk and Figurek, 2017), but it also suggests preparing the integration of the resources available for all goods in a centralised framework indicated by national CAP development direction using an assessment process (Pomarici and Sardone, 2020).

The common agricultural policy (CAP) reform process got under way with the intention of defining a new policy framework for European agriculture (Cardillo et al., 2023). The Multiannual Financial Framework (MFF) management regulations will change at the same time as the CAP reform process. The MFF amendment seems to be a substantial one in terms of both the funding options for next common budgets and the EU-supported expenditure goals.

Figure 9 Total subsidies and subsidies on investment in euros (average per farm) (see online version for colours)

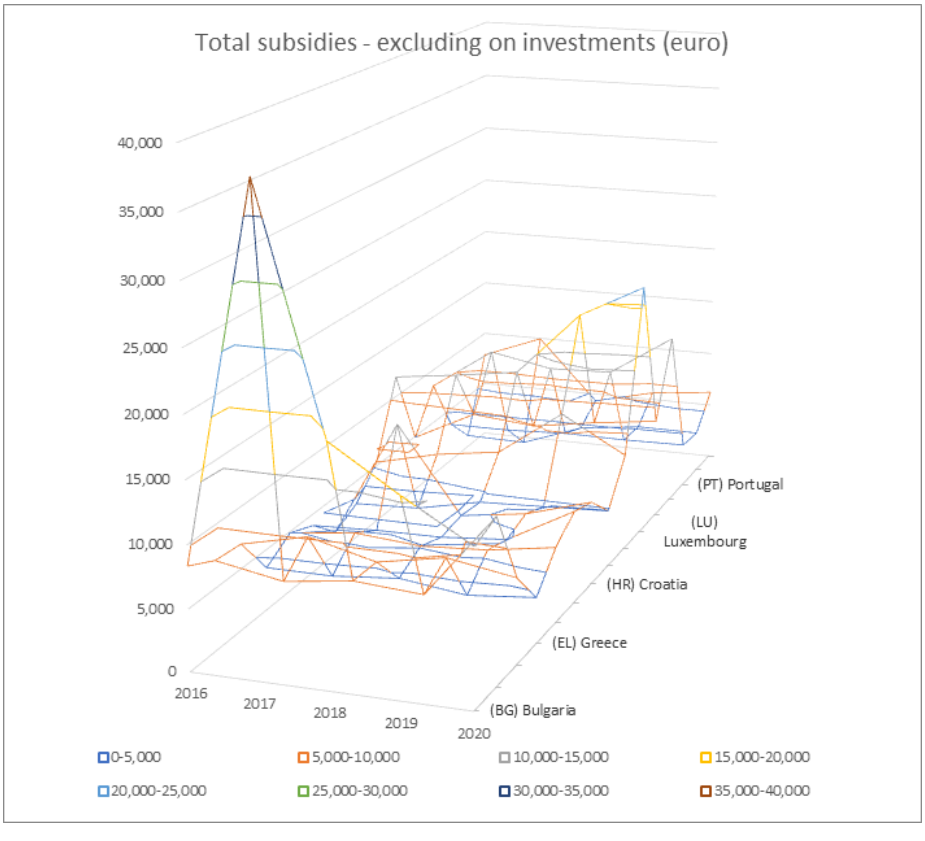
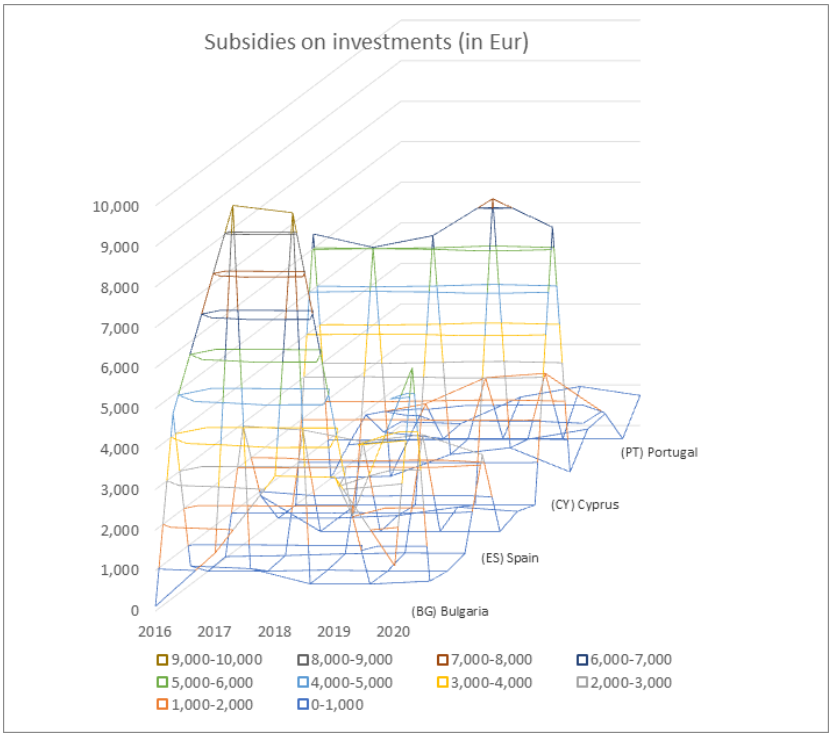


Figure 9 Total subsidies and subsidies on investment in euros (average per farm) (see online version for colours) (continued)



Authors' calculations according to the FADN database.

8 Conclusion and managerial implications

The economic indicators of European wine production vary according to the member state's location. Each wine region has its own distinctive qualities, including the size of the vineyard as well as the holding specialisation. The concept of economic income measurement has been applied to a variety of agricultural economic assessments, and its evaluation has made it possible to assess the economic performance of farms from several different perspectives.

This paper's focus was on assessing the economic performance in wine production in different EU wine-producing countries. The FADN methodology was used to analyse the financial position of farms in the EU. In order to determine the agricultural holdings that performed the best, wine income was evaluated and reported as farm net value added, FNVA per AWU, and FNI and FFI per FWU. The disparities that are evident in the realisation of income on agricultural farms are wide, and their causes are complex. They are the result of the combined or opposing effects of many factors, which are characteristic of the agricultural sector: economic potential, type of agricultural production, etc. Likewise, they represent the result of the action of external factors.

FADN equips producers with the right information they need to decide upon the best production structure, and to increase the efficiency of both individual productions and of

their farm as a whole. Farmers may increase their market involvement and flexibility by managing their production operations effectively. The micro-level data are compiled and categorised by region, farm size, and farm type. The ability to develop reliable agro-economic indicators, analyse them properly, and use the results to adopt appropriate measures from a variety of areas concerning the agricultural sector (agrarian, customs, credit, monetary policy, etc.) is made possible at the macro level by information pertaining to the operations of agricultural holdings with wine production. In these situations, quantifiable indicators on the conditions and outcomes of agricultural farm operations are available to agricultural policy makers. An acceptable strategy for the development of the wine sector is the timely use of such information in the formulation of agrarian policy and the associated programs, control, i.e., monitoring and their assessment.

The new CAP, which includes the years 2023–2027, binds farmers to organising and managing their farms to meet ambitious environmental standards. The new paradigm of agricultural growth now faces new obstacles, which this European agricultural strategy has been modified to address. It aims to strengthen agriculture's contribution to the EU's ecological and technological goals while providing smaller farmers with more specialised help to improve their farms' competitiveness.

In light of the discussion around the conversion to a Farm Sustainability Data Network, future study may consider expanding the data collection now conducted on EU farms to include information on their environmental and social practices. Based on FSDN, it is possible to monitor the performance of agricultural farms, determine the crucial factors that affect their profitability, and assess the results of the agricultural policy measures implemented at the time while taking into account environmental and social concerns. The aforementioned integrated approach makes it possible for producers to use inputs more precisely and to distribute financial resources that are made available through the sale of both individual and aggregate output, in an appropriate manner, by considering information from both the micro and macro levels.

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Appendix

Table A1 Farm net value added (euro)

Farm net value added (Euro)					
Country	*2016*	*2017*	*2018*	*2019*	*2020*
(BG) Bulgaria	33,557	84,741	55,112	29,418	28,556
(CZ) Czechia	39,851	42,354	38,442	18,431	39,650
(DE) Germany	86,158	88,242	98,559	90,138	99,629
(EL) Greece	9988	11,775	10,634	9910	11,704
(ES) Spain	34,301	36,517	41,257	38,767	35,581
(FR) France	118,596	103,459	129,131	113,265	103,809
(HR) Croatia	12,288	24,265	25,420	26,466	17,690
(IT) Italy	41,787	41,952	51,491	43,766	42,404
(CY) Cyprus	23,434	29,246	24,222	31,761	11,178
(LU) Luxembourg	117,050	122,077	140,773	125,519	111,933
(HU) Hungary	34,408	26,945	31,796	28,375	25,439
(AT) Austria	49,477	50,695	46,264	42,338	42,354
(PT) Portugal	24,558	29,572	33,207	31,330	27,799
(RO) Romania	8,670	9,851	33,743	38,484	31,330
(SI) Slovenia	12,018	19,100	22,569	27,949	22,713

Table A2 Farm net value added (euro)

Farm net value added (Euro/AWU)					
Country	*2016*	*2017*	*2018*	*2019*	*2020*
(BG) Bulgaria	6985	10,898	8668	4443	4360
(CZ) Czechia	18,524	21,392	21,565	10,907	15,759
(DE) Germany	34,240	35,173	38,670	35,115	39,550
(EL) Greece	10,871	13,210	12,246	10,484	12,057
(ES) Spain	22,543	23,382	24,880	23,885	22,029
(FR) France	44,397	40,054	49,363	44,110	39,957
(HR) Croatia	7047	9216	11,766	14,345	9248
(IT) Italy	34,927	34,046	40,289	35,230	34,649
(CY) Cyprus	15,364	21,189	18,117	23,137	9597
(LU) Luxembourg	45,865	47,593	49,866	51,589	44,815
(HU) Hungary	13,858	13,270	16,474	14,931	13,332
(AT) Austria	25,914	23,300	22,842	21,860	22,076
(PT) Portugal	14,045	16,552	17,979	17,700	17,110
(RO) Romania	5760	6553	11,284	12,667	9543
(SI) Slovenia	7505	10,306	12,955	15,535	14,380

Table A3 Farm net income (euro)

Farm net income (Euro)					
Country	*2016*	*2017*	*2018*	*2019*	*2020*
(BG) Bulgaria	12,272	48,591	26,795	–9846	–4883
(CZ) Czechia	30,384	38,772	39,059	13,905	30,253
(DE) Germany	55,780	57,192	66,200	56,345	65,592
(EL) Greece	8315	9701	8789	7904	9608
(ES) Spain	26,301	27,489	30,655	27,765	24,019
(FR) France	61,209	48,965	72,631	58,425	49,817
(HR) Croatia	9,389	13,733	17,784	21,982	13,382
(IT) Italy	34,538	34,703	41,446	35,114	34,418
(CY) Cyprus	15,613	22,746	18,162	25,812	9955
(LU) Luxembourg	79,902	81,371	97,148	92,075	70,562
(HU) Hungary	19,112	15,360	20,665	16,808	13,190
(AT) Austria	35,541	31,161	27,902	22,455	25,703
(PT) Portugal	18,199	22,743	25,702	24,065	21,836
(RO) Romania	6063	6821	20,234	23,545	15,558
(SI) Slovenia	10,088	17,508	19,711	26,460	20,977

Table A4 Family farm income (euro/FWU)

Family farm income (Euro/FWU)					
Country	*2016*	*2017*	*2018*	*2019*	*2020*
(BG) Bulgaria	3928	9898	1971	1821	–6295
(CZ) Czechia	19,698	26,872	32,668	11,035	19,530
(DE) Germany	33,657	34,638	40,322	34,888	40,909
(EL) Greece	10,909	14,055	12,698	10,414	12,320
(ES) Spain	24,381	26,289	29,181	27,703	24,272
(FR) France	49,518	39,084	57,239	46,119	39,409
(HR) Croatia	7350	6933	9341	10,801	3094
(IT) Italy	39,457	37,331	43,749	38,665	37,654
(CY) Cyprus	8,926	24,688	20,391	27,628	10,565
(LU) Luxembourg	60,382	61,990	71,933	77,154	58,271
(HU) Hungary	16,744	17,488	26,673	12,939	17,996
(AT) Austria	23,092	18,735	18,374	15,410	16,520
(PT) Portugal	15,786	20,223	23,158	22,061	20,515
(RO) Romania	5869	6314	15,772	19,604	11,109
(SI) Slovenia	6,731	10,066	12,052	15,516	14,051

Table A5 Total subsidies – excluding on investments (euro)

Total subsidies – excluding on investments (euro)					
Country	*2016*	*2017*	*2018*	*2019*	*2020*
(BG) Bulgaria	8346	37,959	19,115	15,658	12,480
(CZ) Czechia	7216	6228	6943	6559	13,236
(DE) Germany	6996	8231	6857	7868	6950
(EL) Greece	3494	3470	3958	3255	3762
(ES) Spain	4888	5515	5064	5393	6251
(FR) France	4010	4228	4284	4740	7724
(HR) Croatia	1930	11,933	4646	5423	7044
(IT) Italy	2991	3204	4357	4579	4821
(CY) Cyprus	5315	6607	7388	11,316	8259
(LU) Luxembourg	11,778	12,460	13,247	18,795	21,671
(HU) Hungary	4897	7614	7081	7939	8632
(AT) Austria	8492	12,186	11,151	11,326	14,897
(PT) Portugal	3497	3495	3742	3689	3770
(RO) Romania	1074	965	2929	3624	3581
(SI) Slovenia	7867	9950	4334	5645	6235

Table A6 Subsidies on investments (euro)

Subsidies on investments (euro)					
Country	*2016*	*2017*	*2018*	*2019*	*2020*
(BG) Bulgaria	117	1437	3330	3301	1117
(CZ) Czechia	4550	9681	9501	2017	5681
(DE) Germany	455	391	15	10	83
(EL) Greece	2	4	29	2	0
(ES) Spain	34	60	103	124	115
(FR) France	2927	2830	2544	2717	2221
(HR) Croatia	884	0	0	0	0
(IT) Italy	0	5	66	275	169
(CY) Cyprus	0	0	0	0	0
(LU) Luxembourg	6361	6031	6320	7229	6531
(HU) Hungary	15	56	591	757	161
(AT) Austria	508	623	640	638	889
(PT) Portugal	914	1188	1833	1940	943
(RO) Romania	166	0	0	0	0
(SI) Slovenia	91	45	701	961	740