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MACROECONOMIC DETERMINANTS OF WINE PRODUCTION IN THE EUROPEAN UNION¹

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Abstract

This paper focuses on the determinants of wine production in the European wine industry. In the last two decades, the European wine industry has undergone many changes due to the entry of new countries into the world wine market. Although increasing competitiveness became the priority of the European Common Agricultural Policy, wine production and consumption in the EU have decreased in the last two decades, and therefore the aim of this research is to analyse and identify the macroeconomic determinants of wine production, i.e. what factors besides the price influence wine production in selected EU countries and in how they can be controlled. Empirical research was conducted using data

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for EU member states traditionally engaged in wine production. Panel data on wine production, wine consumption, average wine price, wine imports, wine exports and EU support to the wine sector were collected from secondary sources for 15 wine-producing EU countries and for the period 2009-2018. We estimated the econometric model using pooled OLS, as diagnostic tests indicated that this estimator was the best fit for our data. Our results suggest that domestic demand and domestic (EU) subsidies are the main drivers of wine production. To keep up with New World wine producers, even more emphasis should be placed on promoting the wine drinking culture.

Keywords: *EU wine industry, wine production, wine consumption, wine import, wine export*

1. INTRODUCTION

During the last two decades, the global wine market has witnessed many changes brought about by the emergence of New World Countries (NWC), Australia, South Africa, New Zealand, Chile, Argentina, the United States, Canada and Uruguay, in the world wine market. The key competitive advantages of wine producers from New World countries compared to EU countries include larger average plantation size, larger wineries, and lower labour costs, which in turn leads to lower average production costs and lower final product prices. In addition, the EU wine industry is highly fragmented on the production side of the market, due to the long tradition of wine production and thus the presence of numerous wine producers who have engaged in the production of quality wines. The entry of new countries into the world wine market has led to the need for an analysis of the drivers of EU wine production.

Considering the fact that New World countries have intensified wine competition in the world wine scene, the idea of conducting this research arose from the need to understand the importance of the market structure of the EU wine industry in creating a competitive market. The paper focuses on wine production in selected EU countries and presents macroeconomic data relevant to understanding the changes in EU wine production and EU policies regarding wine production. The importance of this research lies in its aim to understand the drivers of wine production in the EU, with wine production and the wine industry in general being one of the pillars of the EU economy, as it is mainly composed of small and medium-sized enterprises located in rural areas, which play a key role in the sustainability of EU regions. Our research findings can be used to adapt the policies needed to support the wine industry and thus indirectly support the sustainable economic growth of EU regions.

The paper focuses on wine production in selected EU countries and uses country-level macroeconomic data relevant for understanding changes in EU wine production and the impact of EU policies on wine production. The objective of this paper is to analyze and identify the macroeconomic determinants of wine

production, i.e. what factors besides price influence wine production in selected EU countries. The paper is structured as follows. After a brief literature review (second section), the data and methodology (third section) used in this paper are presented. The estimation results and discussion are presented in the fourth section, while the fifth section draws a conclusion.

2. LITERATURE OVERVIEW

As the focus of this thesis is on the EU market and the wine industry as a whole, rather than on individual companies, the Structure Conduct Performance (SCP) paradigm, although primarily descriptive and therefore criticized, is applicable. Within industrial organization, the SCP paradigm was developed by Edward Mason in the 1930s, whose teachings were continued within Harvard School by Joe Bain (1959) and his definitions of market structure, firm behaviour, and market performance. Within Bain's linear SCP paradigm, corporate behaviour is seen as the bridge between market structure and market performance, market structure as the cause and market performance as the consequence (Bain, 1956). Bain also studied barriers to entry, which is one of the key elements of market structure. In his view, entry barriers make it difficult for new firms to enter the market while allowing firms already in the market to raise prices above competitive levels and thus earn above average profits. The linear SCP paradigm was valorised and the relationships between market structure, behaviour and performance were defined as complex and interactive (Martin, 1988). The SCP paradigm has been used as a theoretical model for the analysis of the wine industry and other related industries in many academic works (Stasi, Seccia, & Nardone, 2010; Outreville, 2015; Rebelo., Gouveia, Lourenco-Gomes & Marta-Costa, 2018; Bobenič & Bruothova, 2019).

Market structure can be measured by many factors, such as the number of competitors, heterogeneity of products, etc. In the wine industry, competition is high while products are heterogeneous, which leads to strong competition and the need to strengthen competitive advantages at the state level. According to Taylor (2001), Australian success in the wine market is a result of competitive advantage (dynamic, created) rather than comparative (static, natural) advantage. One of the leading researchers in the field of industrial organization, Martin (2012), studied the relationship between market structure and market performance in selected industries. The results of his research were consistent with the mainstream view that a more competitive market structure and firm lead to higher market performance. But what are the factors that influence the achievement of competitive advantage of a firm is the question that is the focus of scholars' research. According to Porter & Millar (1985), the impact of information technology on cost i.e. its reduction and product differentiation gives the firm a competitive advantage. Product differentiation, along with tradition and innovation, became a key to success for European wine producers. Kastelan Mrak , Sokolic & Vretenar (2016) have pointed out that competitive advantage can be

seen as the result of a bundle of activities and resources, i.e. a vertical and the horizontal spread of technological and/or market activities. Lorenzo et al. (2018) confirmed a positive relationship between technology and business performance. Investing in technology is very important for gaining a competitive advantage in the wine sector. Atkin, Gilinsky & Newton (2012) build on Porter's research in 1985 and attempt to demonstrate the link between the presence of an environmental strategy and competitive advantage in the wine industry, while others state that it is the degree of innovation that leads to competitive advantage (Conto, Antuners Junior, Vaccaro, 2016; Anning-Dorson, 2018). In their paper, Behmiri, Correia, & Gouveia (2019) focused on the drivers of wine production in the EU from a macroeconomic perspective with emphasis on monetary indicators by testing the impact of labour, investment, export, import, interest rate, and exchange rate on wine production. Against this background, identifying the factors that lead to the strengthening of the competitive advantage is the key to the success of the wine industry of each country. In our paper, we therefore practically estimate the wine production function, our approach being similar to that of Vlachos (2017), with the main difference being the scope of the analysis, as Vlachos estimates the production function only for Greece.

The wine sector, as an important segment of EU agriculture, is under Common Agricultural Policy (CAP). European Union (EU) is the world leader in wine production with an average annual production of about 167 million hectolitres (between 2014 and 2018), representing about 65% of world wine production, 60% of global consumption and 70% of exports (ec.europa.eu). CAP was created in 1962 and is the most integrated of all EU policies, established with the aim of strengthening competitiveness and stimulating quality production of the agricultural sector. CAP has undergone several adjustments (reforms) since its creation. In the past, the EU wine policy experienced a lot of criticism regarding its complex structure and the high proportion of expenditure on numerous interventions, but today wine policy is completely different from the past and is still subject to further adjustments in terms of its complexity (Pomarici & Sardone, 2020). Over the decades, the traditional objectives of CAP have been upgraded so that, according to Massot (2018), the new objectives include environmental protection, promotion of sustainable development, animal welfare, food quality and safety, consumer and employment protection, public health, and economic, social and territorial cohesion. Although the latest reform of Common Market Organization (CMO) aimed to strengthen the competitiveness of the wine sector, there are conflicting opinions among scholars on this issue. Balogh & Jambor (2017) concluded in their paper that the reform has weakened the competitiveness of European Union winemakers. According to them, the European Union did not respond well to new global challenges, such as climate changes and the emergence of new countries in the world wine market. Papadopoulos (2015) concluded in his paper that the CAP has not found a solution to reduce social inequalities in rural areas. According to his conclusions, CAP has not addressed all the challenges of EU agriculture despite several reforms. One of the problems of the EU agricultural sector is the uneven

development in the old and new EU member states, as the old EU member states are considered a better developed sector. According to Papadopoulos (2015), Mediterranean and Eastern European countries have a higher proportion of small farms, while Northern and Western European countries have a higher proportion of large farms. Also, according to Eurostat statistics, the major difference between the old and new EU member states is the economic size, technology/innovation level of EU farms and connected rural areas. Considering the differences between all EU member states, it is a big challenge to find a way to meet the needs of all member states through a common policy.

The 2014-2020 reform focused on increasing competitiveness, improving sustainability and increasing effectiveness with the long-term goal of improving the competitiveness and sustainability of the agricultural sector. The increase in competitiveness was intended to be achieved directly through changes in market mechanisms by removing production constraints (Katunar, Vretenar & Kastelan Mrak, 2020). The proposed CAP revision for the period 2021-2027 does not significantly change the structure of wine policy.

The EU supports and protects its wine producers (as well as traders and consumers) through the following policies, legislation and short-, medium- and long-term trade measures: Promotion in non-EU countries, responsible consumption and distillation of by-products as short-term measures; green harvesting and harvest insurance as medium-term measures; and restructuring and conversion of vineyards, including replanting for health and phytosanitary reasons, investment in equipment and innovation aimed at developing new products, processes and technologies as long-term measures. A combination of these measures promotes the production of high quality/price wines made with less phytosanitary inputs while maintaining farmers' income levels (ec.europa.eu).

Wine production in the EU is characterized by a long tradition and high quality of wines. The globalization of the wine market has led EU policy to focus on producers rather than the product (Katunar et al., 2020), which allows them to produce a product that is slightly different from that of their competitors and to compete in the market and attract customers through factors other than price. To understand the impact of the policy of CAP on strengthening the competitiveness of the wine sector, it is important to understand the market structure. For Rebelo et al. (2018), the wine industry is a perfect example of monopolistic competition due to the large number of producers, sellers and buyers present in the same market, the coexistence of wineries of different sizes, technologies used, differentiated products, both vertically and horizontally, and free exit and entry into the industry in the long run. Within the wine industry, consumers perceive the products of different producers as different and wine producers have some control over price, which has been reinforced in the European wine industry by the 2014-2020 CAP reform. Notwithstanding these measures, wine production stagnated or even declined in some EU countries. According to the 2018 report, Evaluation of CAP measures for the wine sector, between 2000 and 2012, wine production and consumption, as well as the area under cultivation, decreased in

the EU, while New World countries (mainly Argentina and Chile), China and the USA increased their areas under cultivation and production volumes, and this trend is still present. Mora (2007) examined the reasons for the success of the New World countries, citing price competitiveness and brand power as explanations.

There are a large number of buyers in the European wine industry. On the supply side, many changes have occurred due to the globalization of the wine industry, the appearance of New World suppliers and the global economic crisis. While on one hand wine imports showed a constant growth (appsso.eurostat.ec.europa.eu), indicating a strong activity of wine producers from non-EU countries, wine consumption showed a constant decline in the period between 2005 and 2017 (International Organization of Vine and Wine, OIV, available at: [oiv.int](https://www.oiv.int)), partly due to the global economic crisis and partly due to the changing trends in consumer preferences (Brunner & Siegrist, 2011). The globalization of the wine market and changes in consumer preferences, both in the EU and in emerging markets (Camillo, 2012), have led to the need for the EU wine strategy to build on tradition and quality as its recognized advantages, resulting in an increased share of quality and premium wines in EU production. In 2015, quality wines accounted for 83 percent of total wine production (Eurostat, ec.europa.eu), with a trend of constant increase.

The European Union is the largest exporter of wine in the world. According to the latest available data from International Organization of Vine and Wine ([oiv.int](https://www.oiv.int)) for 2016, the EU accounted for more than 69% of world exports, of which more than 91% were exported to 15 EU countries that are the focus of this article. Spain is the largest exporter in terms of volume (21.8% of world export in 2016), while according to State of the vitiviculture world market in 2018 ([oiv.int](https://www.oiv.int)), France is the largest exporter in terms of value. In 2018, 51% of EU exports went to countries outside the EU, while 49% went to trade within the EU, and the EU exported 60% more than it imported. In the period from 2009 to 2018, Spain, France and Italy increased the volume, value and share of exports outside the European Union. Although imports and exports in the EU28 showed a constant increase in the 10 years observed, exports (outside and inside the EU) increased by 69% in the period observed between 2009 and 2018, while imports (outside and inside the EU) increased by 34% (ec.europa.eu). While imports outside the EU have remained almost the same over the last 10 years and all the increase relates to imports within the EU28, exports outside the EU28 increased by 114% and within the EU28 by 30%.

In the 15 observed countries whose wine production in volume represents more than 92% of the EU28 wine production and more than 60% of the world wine production ([oiv.int](https://www.oiv.int)), imports increased by 43% and exports by 66% over the period 2009 - 2018. It is important to note that exports to non-EU countries increased by 109%. Moreover, production was constant (fluctuations were caused by weather conditions) during the observed period (2009 - 2018), while the average price of still wine increased from 20% to 40%.

The significant reduction of trade barriers, due to the development of a common EU market, led to the increase in intra-EU trade. Although the share of EU exports on the world market is decreasing, the absolute value of exports (both in volume and value) is growing every year. This is a consequence of the emergence of new markets (especially in Asia), the increase in purchasing power and an evolving wine culture, which in turn leads to greater demand for high quality wines. During the observed period, the European Union increased the share of expensive and high quality wines in production and also in exports, while cheaper wines were imported to meet domestic demand.

To understand the motives of EU wine producers for exporting surplus wine products, it is necessary to understand today's global wine market. As mentioned earlier in this paper, exports and imports increased in the observed countries and over the observed period, while production remained constant (it even decreased slightly), as did consumption, which may seem surprising. Indeed, demand and consumption of predominantly cheaper wines was met by imports. The EU also saw an increase in areas under vines with a fall in yield per unit area (as a result of the green harvest and restructuring) and an increase in yield per unit area due to an increase in

3. DATA AND METHODOLOGY

This empirical study was conducted using data for EU member states traditionally involved in wine production. We constructed our database from publicly available data from Eurostat. Our panel data consists of available data on wine production from secondary sources over the period 2009-2018 for 15 EU member states: Austria, Bulgaria, Croatia, Cyprus, the Czech Republic, France, Germany, Greece, Hungary, Italy, Portugal, Romania, Slovakia, Slovenia and Spain. In Tables 1 to 3 we present descriptive statistics for all countries and two subsamples (as simple averages across panel units/years). The description of each variable is the same as the description of the variables for equation [1], with the only difference that for the purposes of descriptive statistics we have calculated the individual statistics (mean, standard deviation, minimum and maximum) using the original, untransformed variables.

Table 1

Descriptive statistics for the database

VARIABLES	N	mean	sd	min	max
support	150	0.000333	0.000109	0.000124	0.000653
avgprice	140	5.507	2.858	1.700	12.11
consumption	150	30.79	12.71	0.800	59.10
exports	150	2,685	3,176	57.54	10,526
imports	150	3,178	6,035	77.28	25,349
production	150	0.0388	0.0236	0.00938	0.176

Source: Authors' calculations

Comparing the results of the descriptive statistics from Table 1 with those shown in Tables 2 and 3, we can see that the three top producers (Spain, France and Italy) are on average more productive and more oriented towards exports compared to the rest of the countries in the sample, while domestic consumption is mostly satisfied with domestic wine. This can be said for all wine producing countries in general, as wine consumption is mostly satisfied with locally/regionally produced wine, but the statistical data (comparison of imports in euro across all three tables) show that this home bias is larger than average for these three countries. The results of the descriptive statistics show that it is necessary to control for the top three producers as they excel in wine production compared to the other 12 EU wine producing countries and not doing so would lead to biased results.

Table 2

Descriptive statistics for top 3 wine producers in EU

VARIABLES	N	mean	sd	min	max
support	30	0.000345	9.90e-05	0.000200	0.000492
avgprice	30	5.983	1.998	3.300	9.830
consumption	30	40.50	12.24	22.20	59.10
exports	30	6,338	3,152	1,764	10,526
imports	30	475.7	301.2	117.9	1,112
production	30	0.0565	0.0122	0.0353	0.0766

Source: Authors' calculations

Table 3

Descriptive statistics for the rest of the sample

VARIABLES	N	mean	sd	min	max
support	120	0.000330	0.000112	0.000124	0.000653
avgprice	110	5.377	3.045	1.700	12.11
consumption	120	28.37	11.67	0.800	55.20
exports	120	1,772	2,450	57.54	9,981
imports	120	3,853	6,579	77.28	25,349
production	120	0.0343	0.0237	0.00938	0.176

Source: Authors' calculations

Based on the theory presented in the literature review, we develop the following empirical model:

$$\ln(\text{avgproduction}_{it}) = \beta_0 + \beta_1 \ln(\text{consumption}_{it}) + \beta_2 \ln(\text{avgprice}_{it}) + \beta_3 \ln(\text{support}_{it}) + \beta_4 \ln(\text{exports}_{it}) + \beta_5 \ln(\text{imports}_{it}) + \lambda_t + u_{it} \quad [1]$$

Equation [1], which is our main econometric model, $\text{avgproduction}_{it}$ stands for the average production per hectare of the total vineyard area in country i in time t , consumption_{it} is the per capita consumption of wine in litres, avgprice_{it} is the average price of wine per litre, support_{it} is the financial support from EU funds per hectare, exports_{it} is the exports of wine in euros per hectare, while imports_{it} is the imports of wine in euros. λ_t represents time fixed effects and u_{it} is the error term.

All variables in the model are transformed, using logarithmic transformation to ease the interpretation since the model variables are in different units. We estimate Equation [1] using the standard linear panel data estimator, namely pooled OLS (POLS). Using POLS can be justified in cases when both panel and time dimensions are low, which is the case in our research, with the number of panel units being 15 and time series spanning through 11 years. Moreover, as is shown in the next section, diagnostic test confirmed that the POLS is suitable given our data.

4. RESULTS AND DISCUSSION

We estimate four versions of equation [1], which we refer to as models 1-4, and present the results in Table 4. Model 1 does not include the international trade variables (exports and imports of wine), model 2 is a full model (as shown in equation [1]), while model 3 adds a dummy variable to model 2, with the dummy variable having a value of 1 if the country is either Spain, Italy, or France, or 0 if not. These three countries were chosen because they are by far the largest wine producers in our database. By including this dummy variable, we wanted to control for the large difference in production volumes between the top 3 producers and the rest of the countries in our database. With the same aim, we expressed the variables on production, EU subsidies and exports in terms of quantities per hectare, i.e. we divided the original values of the variables by the area cultivated in a given country.

Table 4

Results of the estimation of model [1]

	Model 1	Model 2	Model 3	Model 4
<i>consumption</i>	0.360 ^{***}	0.299 ^{***}	0.302 ^{***}	0.293 ^{***}
	(0.0858)	(0.0722)	(0.0647)	(0.0717)
<i>avgprice</i>	0.329 ^{***}	0.0716	0.0860	0.0837
	(0.0598)	(0.0555)	(0.0583)	(0.0604)
<i>support</i>	0.479 ^{***}	0.438 ^{***}	0.441 ^{***}	0.484 ^{***}
	(0.142)	(0.113)	(0.109)	(0.105)
<i>exports</i>		0.194 ^{***}	0.127 ^{**}	0.123 ^{**}
		(0.0260)	(0.0426)	(0.0431)
<i>imports</i>		0.0402	0.0815 [*]	0.0835 [*]
		(0.0253)	(0.0322)	(0.0329)
<i>top3</i>			0.263 [*]	0.0698
			(0.110)	(0.144)
Time FE	Yes	Yes	Yes	Yes
Time-top3 interaction	No	No	No	Yes
Constant	-0.921	-2.303 [*]	-2.159 [*]	-1.708
	(1.334)	(1.058)	(0.988)	(0.975)
<i>N</i>	140	140	140	140
<i>R</i> ²	0.485	0.677	0.693	0.711

Robust standard errors in parentheses
^{*} $p < 0.05$, ^{**} $p < 0.01$, ^{***} $p < 0.001$

Source: Author's calculations based on data taken from Eurostat

We tested the normality of the residuals of each of the presented models using a modified Jarque-Bera test, suitable for panel data, according to Alejo, Galvao, Montes-Rojas & Sosa-Escudero, (2015). The results showed that H_0 of normality of the residuals could not be rejected. We also performed a robustness check by estimating equation 1 with two standard estimators used in panel data analysis, the fixed effects estimators (FE) and the random effects estimators (RE). We performed the Hausman test, which is typically used to decide between the suitability of FE or RE for the data at hand. The null hypothesis of the Hausman test could not be rejected (Chi2 value of 7.93 with 14 degrees of freedom and p-value of 0.89), i.e. the test indicated that we should use the RE -estimator and that we should compare the RE -coefficients and their significance with our results obtained with the POLS estimator. The difference in magnitude of the coefficient between RE and POLS for model 4 was negligible only in the cases of EU support (subsidies) and exports; both coefficients were statistically significant, i.e. both coefficients passed the robustness check. From the results presented in Table 4, it can be seen that all coefficients have the expected signs and are mostly significant, except for the coefficient of the variable average price of wine, which is not significant at the 5% level of significance.

5. CONCLUSION

In this paper, we carried out research of the determinants of wine production in selected wine-producing EU member states. By applying a panel data analysis for 15 countries and 11 years and estimating econometric models, we succeeded in extracting the main drivers of wine production in EU countries.

Our results show that the main determinant of production is domestic demand, represented in our case by the consumption variable. In general, per capita consumption can also serve as a proxy for the wine tradition in a given country. We also checked the correlation between per capita consumption and production, which is positive, as expected. Moreover, our results show that EU support is a strong driver of production, with a 0.44% increase in production for a 1% increase in support, suggesting that EU policies related to the wine industry have a positive impact on domestic (EU) production. Since 2006, the EU has been trying to strengthen the competitiveness of domestic wine producers and increase their market value share. And as our results show, EU financial instruments have fulfilled their role in increasing the competitiveness of EU wine producers, as our results indicate that there is a robust positive relationship between subsidies and wine production per hectare.

The limitations of our research lie in the use of aggregate country-level data. The use of producer-level data would provide more insights into the production function of wine across EU countries and how the production functions differ across countries. The problem is that this type of data is very limited (only available for some regions, not at country level) as well as the fact that it is cross-sectional, which would limit possible research questions.

Moreover, we focus only on EU countries. Including all wine producing countries in the world could expand the list of research questions and allow a comparative analysis of wine production determinants between different groups of countries, such as New World and Old World wine producing countries.

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MAKROEKONOMSKE DETERMINANTE PROIZVODNJE VINA U EUROPSKOJ UNIJI

Sažetak

Fokus ovog rada su faktori koji utječu na proizvodnju vina u vinskoj industriji zemalja članica Europske unije. U posljednja dva desetljeća europska vinska industrija je prošla kroz brojne promjene uzrokovane ulaskom novih zemalja na svjetsko tržište vina. Iako je povećanje konkurentnosti postalo prioritet Europske zajedničke poljoprivredne politike, proizvodnja i potrošnja vina se smanjila, stoga je cilj ovog rada identificirati i analizirati makroekonomske determinante proizvodnje vina, odnosno faktore, osim cijene vina, koji utječu na proizvodnju vina u EU. Empirijsko istraživanje provedeno je na podacima država članica Europske unije koje se tradicionalno bave proizvodnjom vina. Podatci o proizvodnji vina, potrošnji vina, prosječnoj cijeni vina, uvozu vina, izvozu vina i potporama iz EU fondova za vinski sektor, prikupljeni su iz sekundarnih izvora za razdoblje od 2009. do 2018. godine. Razvili smo i procijenili ekonometrijski model koristeći POLS, koji se pokazao najprikladnijim za procjenu nakon provedbe dijagnostičkih testova. Rezultati procjene ukazuju da su domaća potražnja i EU potpore glavne determinante proizvodnje vina. Osim toga, vidljivo je da postoji još prostora za povećanje značaja domaće potrošnje te da bi EU poljoprivredna politika, između ostalog, trebala promicati kulturu pijenja vina.

Ključne riječi: vinska industrija, proizvodnja vina, potrošnja vina, uvoz vina, izvoz vina.

JEL klasifikacija: L66, Q11, Q17.