Chapter 14

Wine Firm's Size and Economic Performance: Evidence from Traditional Portuguese Wine Regions

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Abstract

The wine market is an excellent example of monopolistic competition, demonstrating both vertical and horizontal product differentiation. The propensity toward monopolistic competition and the asymmetric preferences of wine consumption can justify the coexistence of different sized wineries. The main goal of this chapter is to analyze the economic performance of wineries, using indicators widely employed in economic and business literature, and to assess the potential influence of size on firm's performance. To achieve this goal, different statistical tests are applied to firms´ data collected from two representative Portuguese demarcated wine regions (Douro and Vinho Verde). The results confirm that the wine firm's performance is a multidimensional construct, exhibiting similarities and differences, according to the index used. The size of firms increases their export performance but exhibits a nonstatistical effect on the financial performance. The indices of productivity and productive efficiency show that there is no standard behavior. The results of this study can be useful both for managers and public decision-makers, given the importance of controlling economic performance in order to guarantee the industry's competitiveness in an increasingly globalized wine business.

Keywords: competitiveness, demarcated wine regions, economic performance, size, wine industry, monopolistic competition

1. Introduction

Over recent decades, the wine industry has been under an intense process of globalization, with an impressive increase in competition as a consequence of the new suppliers entering the market: new world wine producing countries (such as Australia, New Zealand, South Africa,

Argentina, Chile, and more recently China), and at the same time, the decreasing consumption of the old world traditional wine-producing countries (namely, Italy, France, Spain, and Portugal). The opening up and globalization of the wine markets raise both challenges and opportunities to the wine regions and consequently to the respective wine firms, which must adopt strategies that address the consumer's demand in an economic and sustainable way.

The wine market reveals itself to be an excellent example of monopolistic competition, wherein the market is determined by significant variety, differentiated by growing regions, and consumer preference/demand for taste, price, and advertising. There is not only one market for wine, but many different ones depending on price, tastes, and brands, with consumers selecting within red or white wines, or even within grape varieties. This is why "wine" is a bundle of monopolistic and competitive markets and not a single competitive or monopoly undifferentiated market.

Following Church and Ware [1], the assumption of symmetry and consumers´ taste for variety supports the essential feature of monopolistic competition, wherein every brand is in competition with each other. Consequently, the focus of the models of monopolistic competition is not typically on strategic decisions regarding to product specification or design, since the products are assumed to be equally differentiated. Instead, the model focuses on the issue of the extent of variety: the number of products available in the market. Two conditions must be satisfied to achieve equilibrium: profit maximization and free-entry condition. In the process of profit maximization, it is expected that the group of larger firms has a behavior referred to as true or perfect monopolistic competition and the group of small firms as oligopolistic, in which the equilibrium is attained whether the firms compete over price or quantity. The free-entry condition implies that the profit must be an incentive to enter or exit. The profit of an additional entrant must be nonpositive and the profit of a firm in the industry non-negative. Ignoring the integer constraint, these two considerations imply that the profit of firms in the industry must be zero, at equilibrium. Moreover, in this market structure, the number of firms depends on product elasticity substitution and on the extent of scale economies. As elasticity substitution increases, products become less differentiated, and as result, the demand becomes more elastic, reducing the market power of the firm and the equilibrium prices tend toward a state of perfect competition. This squeezes price-cost margins, reducing profitability. The opposite occurs if the elasticity substitution decreases. Otherwise, the greater the extent of economies of scale, the smaller the number of firms that will be in the industry and hence varieties, leading to an increase in prices and in the market share at which firm's breakeven. Conversely, reduction in the extent of scale economies reduces the minimum price markup and the market share for a firm to break even, resulting in an increase in the number of firms where equilibrium occurs and in the variety of products.

Theoretically, the model of monopolistic competition justifies the coexistence of wineries of different sizes and production technologies, charging different prices for distinct wines, according to the consumer's willingness to pay. In this scenario, the profitability could be independent of the firm's size.

Portugal seems to be a good example of a traditional wine producing country, with a strong presence in the international market and a market structure of monopolistic competition.

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In 2015, there were 39,727 farms of grape vine cultivation that represented a planted area of 201,445 ha [2], the fourth largest in European Union (EU). The total production of 2015 was 6,205,756 hl [2] (fifth in the EU, after France, Italy, Spain, and Germany and 11th in the world wine production). From the total wine production (77.76% protected Designation of Origin), 70.5% is red wine, 29.5% white wine, 13.2% fortified wine, namely Port wine. The domestic consumption reached 4.94 million hectoliters (79.6% of production), and 2.8 million hectoliters were exported (45.11% of production), meaning that Portugal is both an importer and exporter [2]. The average price of exporting was 2.63 Euro/Liter, against the 0.55 Euro/Liter for importing, meaning that Portugal exports wine with a higher added value [2].

Due to the soil, climatic, social, and economic factors, Portugal is a heterogeneous wine country, with very specific conditions as testified by one of the currently most recognized Portuguese winemakers (Dirk Nieeport in [3]): *Portugal has one thing that only few countries nowadays have - traditions, history, old vines, old and diversified varieties, and personalized methods of vinification*. Due to its diversity, the country has long since been divided into various wine regions, there currently being fourteen demarcated wine regions, each one with the own *terroir* characteristics. The Douro and Vinho Verde demarcated regions are representatives of the Portuguese wine *terroir* model, located in the Northeast and Northwest of Portugal, respectively. In 2015, the Douro region had an area of 43,659 ha (21.7% of the Portugal area) and produced 1,407,006 hl (22.7% of the total Portuguese production), shared by Port wine (almost 50%) and still wines. The Vinho Verde region extends along an area of 15,821 ha (7.9% of the Portuguese area) with a production of 693,026 hl (6.38% of the Portuguese production), only still wines [2].

In a microeconomic level, the Portuguese wine supply is characterized by the presence of a diversified typology of economic agents [2]: warehouse, distiller, bottler, exporter/importer, producer of vinegar and wine, merchant without establishment, preparer, producer, wine-maker, and winemaker bottler. Considering the classification of economic activities in the EU (NACE) in the code 11021, production of still and liquors wines, in 2015, there were 1246 active firms, according to the database *racius* [4].

Similarly to other traditional wine countries [5], it is known that Portuguese wine firms, including the ones located in the Douro and Vinho Verde regions, embrace different marketing strategies that range from the low cost or mass market types to those based on product differentiation or a market niche. In general, the first strategy is adopted by the largest firms, which prefer to offer standardized wines and to cater to large distribution channels. On the other hand, small firms prefer to satisfy the needs of narrow markets, emphasizing the importance of differentiation based on the *terroir*, *appellation,* and geographic identity in order to enhance perceived wine quality, which endorses the monopolistic competition model. Given this multifaceted market structure, the importance of monitoring and controlling economic performance becomes clear, as such entrepreneurial strategies may guarantee survival in the long term. The assessment of a wine firm's performance is a critical managerial issue [6], despite its measure is a multidimensional construct, whose indicators to be used depend on the stakeholder perspective and on the outcomes to be achieved.

Researchers in economics and management strategy showed a long interest in understanding the main determinants of the firm performance in different market structures. Two theoretical

alternatives approaches have been used [7] to analyze the importance of the industry and the business unit factors in the firm performance: the paradigm structure-conduct-performance (SCP) of the industrial organization [8, 9], suggesting that the industry structure is the main determinant of performance differences across firms, and the business strategy [10, 11], assuming that the resources and capabilities are the main determinants of differences of profitability across firms.

Some studies on the agrifood sector conclude that there is a direct relation between firm size and financial performance in the food industry [e.g., 7, 12]. The findings suggest a positive relationship between firm size with return on assets (ROA) [7, 12], return on equity (ROE), and return on investment (ROI) [12] and based in arguments like greater resources and market opportunities of large firms, which enables to be more efficient in the use of inputs, to benefit from economies of scale and to a stronger market power. However, other studies [13] reported a negative relation, showing that smaller firms can obtain a better financial performance. Thus, the empirical evidence is inconclusive on the effect of firm size on the financial performance of agrifood firms, suggesting the need of additional empirical research, that takes into account both the market structure and different indexes of firm performance.

Based on information collected from the Douro and Vinho Verde wine regions, the main goal of this chapter is to analyze the economic performance of wineries, using indicators widely employed in economic and management literature and to assess the potential influence of size on economic performance. To achieve this goal, different nonparametric and parametric tests are applied to indices related to export performance, profitability, productivity, productive efficiency, and solvency.

2. Methodology and sampling

2.1. Methodology

In line with the aims of the chapter in the first step, based on information included in firm's annual financial reports, indices are computed related to export performance, profitability, solvency ratios, labor productivity, and economic efficiency.

The index of export performance (EP), measured by the ratio between firm exports and turnover, reflects the firm's ability to be competitive in international markets. Size is an important factor in shaping the firm's potential for internationalization. In free markets, the size of a firm can reveal its potential market power, capability, and scale economies: all essential elements in gaining an international market. Vivas and Sousa [14] identify internationalization strategies of firms in the wine industry in Portugal, as well as the option to export to a wide range of countries, pointing out a lack of size of the production units, coupled with poor investment in the commercial area. This framework constraints the ability to compete with larger producers, more experienced in international markets and holding a more consistent commercial attitude. Therefore, it is expected that EP will be positively correlated with size.

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Profitability indices measure the extent to which a business generates a profit from the resources applied to the business. Traditionally, to compute profitability, indices such as ROA (ratio between total earnings before interests and taxes and total assets), ROE (ratio between net income and total equity), and ROI (ratio between total earnings before interests and taxes and the sum of plants, equipment, and stocks) are used. In a market structure, such as monopolistic competition, where firms of different sizes coexist and survive, it is expected that there should be no strong statistical relationships between profitability and size, namely on the ROE.

Complementary to the profitability indices, the solvency ratios gauge the firms´ ability to pay all financial obligations if all assets are sold or to continue operations after financial adversity. Two ratios can be used: the leverage or debt to equity ratio (Lev) and financial autonomy or equity to asset ratio (FA). Since microfirms have difficulties in accessing market capital and/or to bank loans, it is expected that these ratios change according to size.

To estimate productivity, two measures specifically relating to labor are used: turnover per employee (T/E) and added value per Employee (AV/E). In the profit maximization strategy, it is expected that managers try to optimize the use of labor, independently of size. Consequently, the indices of productivity may or may not be related to size.

The indices of economic (productive) efficiency allow us to get information about the relative performance of a firm in comparison with the optimum (frontier) that it is possible to achieve. Based on the firms included in a technologically homogeneous sample, the frontier and, consequently, productive efficiency can be computed through parametric or nonparametric approaches. In our case, productive efficiency is computed using the data envelopment analysis (DEA), a nonparametric approach initially proposed by several authors [15, 16]. This approach has the advantage of not needing to assume a functional form to the production (cost or profit) function, since the frontier surface is constructed through linear programming. The main disadvantage is that any deviation between observed and estimated value is considered as (in)efficiency, or even as a consequence of random factors. A firm is efficient if no other firm is able to produce a higher level of output from the same input (output oriented), or a firm is efficient if it produces the same output from less input (input oriented). Following the methodology described by Sellers and Alampi-Sottini [6], we apply an input-oriented model, since the inputs are under the control of firms more than the output. Three controllable inputs (cost of raw materials, number of employees, and value of debts[1]) have been chosen. Moreover, the output data on annual turnover have been considered. Assuming $j = 1, \ldots, n$ firms, each one using vector of m inputs, $X_j = (x_{1j}, x_{2j}, \ldots, x_{mj})$, to produce vector of outputs, $Y_j = (y_{1j}, y_{2j}, \ldots, y_{sj})$ and linear variable returns to scale (VRS). The programming model is given by Eq. (1):

$$\text{Max } z_0 = \theta + \varepsilon \sum_{r=1}^{s} s_r^+ + \varepsilon \sum_{i=1}^{m} s_i^- \tag{1}$$

subject to:

[1]This variable is included because access to loans and the correspondent cost is a crucial issue in the firm performance.

$$\sum_{j=1}^{n} x_{ij}\lambda_j + s_i^- = x_{r0}$$

$$\sum_{j=1}^{n} y_{rj}\lambda_j - s_r^+ = \theta y_{i0}$$

$$\sum_{j=1}^{n} \lambda_j = 1$$

$$\lambda_j, s_r^+, s_i^- \geq 0$$

$$j = 1, \ldots, n, r = 1, \ldots s; i = 1, \ldots, m. \quad (1)$$

where θ is the measure of efficiency for each unit. A firm is efficient if θ^*=1 and all the slacks are equal to zero, and $\varepsilon > 0$ is a non-Archimedean element that is defined to be smaller than any positive real number. Since the indices of productive efficiency summarize the relative management performance in the inputs allocation, they may or not be related to size, although a positive relation stands out.

In the second step, the data are analyzed using descriptive statistics and both nonparametric and parametric tests, in order to test if there is an association between indices and size. More specifically, since we have different groups of observations for each variable, the Kruskal-Wallis equality-of-population rank test is used. To test if there are differences between means of groups in the same variable, the Hotelling's T2 is used. Furthermore, to check the robustness of the nonparametric tests, ordinary least squares (OLS) regression models are estimated, where the dependent variables are the indices and the explanatory variables are dummies according to size.

2.2. Sampling

In accordance with the aim of the study, as well as to assure the technological homogeneity of the sample, two demarcated wine regions are considered: the Douro region and the Vinho Verde region, both in the North of Portugal. The Douro is one of the oldest world wine regions, fitting well the *terroir* model [17]. It is characterized by the production of two different products: the fortified Port wine and still wines. The Vinho Verde region only produces still wines. In both regions, there are a very large number of wine brands that are sold in different markets at different prices.

Given the economic and technological differences between the two regions, it is recommended that each one of them is analyzed as a separate sample. Therefore, in order to define the respective sample of each region, we start by selecting the firms that are registered as a winery in the regulator of Port and/or still Douro wines (Port and Douro Wines Institute: www.ivdp.pt) and in the regulator of Vinho Verde (Commission of Viticulture from Vinhos Verdes region: www.vinhoverde.pt). Moreover, to overcome any possible effects of seasonality, we decided to collect economic and financial data that are available for the last 2 years, 2014 and 2015.

This means that this study is carried out with a pooled sample data of firms and years, and the databases are obtained from the Financial and Economic Entrepreneurial Data Base provided by Informa Dun & Bradstreet (D&B) and reporting wine firms included in the 11,021 NACE-2009 code (production of still and liquors wines). Considering that not all the financial reports include the information required for this research, we eventually got a sample database that includes: for the Douro region, 434 pooled observations, 218 for 2014 and 216 for 2015[2], with 204 wine firms observed for both years and 26 for only 1 year, and for the Vinho Verde region, the sample includes a pool of 299 observations, 154 of 2014 and 145 of 2015, in a total of 162 wine firms, 137 observed for both years and 25 for only 1 year.

Table 1 shows the main descriptive statistics of the variables used, for both wine regions. The range between the minimum and the maximum, together with the comparison between the standard deviation (SD) and mean, allows us to conclude that each sample reflects a heterogeneous market structure, typical of monopolistic competition. According to the value of the mean of the variables, the firms of the Douro region are bigger than those of the Vinho Verde region (**Table 1**).

In order to build a detailed basis of information about the market structure of each wine region, we have classified firms according their size, adopting the European Commission recommendation [18][3]. This recommendation is used to obtain criteria to define the size of the firm, the number of employees, the turnover, or total assets on the balance sheet (**Table 2**). Consequently, these criteria should be used to analyze any industry, including in the wine business. These criteria also suggest the use of financial and productive indicators to assess the performance of the industry.

3. Results

In this section, performance indices (export performance, profitability, solvency, productivity, and efficiency) are presented, both for the Douro and Vinho Verde regions (**Table 3**). As can been seen, the statistical descriptive measures show a highly heterogeneous industry in and for both wine regions.

For the Douro region, the average of the index of EP is 18%. The profitability ratios are ROA = 0.9%, ROE = 20.5%, and ROI = 68.1%. Regarding solvency, the mean of leverage (Lev) is 2.25 and the equity/asset (AF) ratio is 28%. The productivity indices show that on average, the amount sold per employee (T/E) is 121.5 thousand Euro and the added value per employee (AV/E) is 31.5 thousand Euro. Comparing the standard deviation (SD) with the mean, we conclude that there is a high relative dispersion between observations, which is confirmed through the values of the weighted means of the indices: EP = 58%, ROA = 3.9%, ROE = 4.4%,

[2]Considering that the total national number of firms active in 2015 is 1246, the sample of Douro represents 17.33% and Vinho Verde 11.64%.

[3]The classification of firms by the EU, according their size, aims to improve the consistency and effectiveness of policies targeting small and medium enterprises and would, to this end, homogenize the definition of the size of the firm between member states, to limit the risk of distortion of competition resulting from different levels of public support.

Variables	Minimum	Maximum	Mean	SD
Douro region				
Assets (10^3 euro)	3.000	257,010.000	7,886.000	29,006.000
Equity (10^3 euro)	−2060.000	184,547.000	4249.000	18,806.000
Investments (10^3 euro)	0.100	220,150.000	6231.000	23,708.000
Turnover (10^3 euro)	0.100	132,503.000	2881.000	12,199.000
Added value (10^3 euro)	−1,012.000	46,618.000	735.000	3299.000
Employees (#)	1	593	16.000	53.000
Vinhos verdes region				
Assets (10^3 euro)	6.900	50,727.000	2137.000	5167.000
Equity (10^3 euro)	−1,277.000	31,492.000	966.000	2898.000
Investments (10^3 euro)	0.100	41,583.000	1594.000	3973.000
Turnover (10^3 euro)	0.400	31,999.000	996.000	3130.000
Added value (10^3 euro)	−660.000	13,401.000	265.000	1112.000
Employees (#)	1	148	7.000	14.000

Legend: SD – Standard Deviation.

Table 1. Descriptive statistics of the variables used for Douro (434 observations) and Vinhos Verdes (299 observations) regions (years 2014 and 2015).

Size	Criteria
Micro	Employment: < 10 workers; and turnover or assets: < 2 million Euro
Small	10 ≤ workers < 50; and 2 ≤ turnover or assets < 50 million Euro
Medium	50 ≤ workers < 250; and or 50 ≤ turnover or assets < 250 million Euro
Big	Workers ≥ 250; and or turnover or assets ≥ 250 million Euro

Table 2. Criteria to identify size of the firms using European Commission recommendation [18].

ROI = 4.94%, Lev = 0.85, FA = 0.54, T/E = 181.8 thousand Euro, AV/E = 46.4 thousand Euro, a picture that is different of that one given by the arithmetic mean and calls for a group analysis. The average of economic efficiency (EF) is 0.454 meaning that the Douro wine industry could use 55.6% fewer inputs to obtain the same level of output, if all the firms adopted the observed best productive practice. The averages of technical efficiency (TE) and scale efficiency (SE) are 0.692 and 0.692, respectively, suggesting that the deviation from the production frontier is due to a similar extent to the inefficient use of inputs (technical efficiency) and to firms not operating at an optimum size (scale efficiency).

Regarding the Vinho Verde region, the arithmetic means of the sample are: EP = 11.8%, ROA = −0.5%, ROE = −8.2%, ROI = −0.07%, Lev = 7.52, FA = 0.25, T/E = 101.3 thousand Euro, AV/E = 24.3 thousand Euro. However, as with the Douro region, the simple means compares

Indices	Minimum	Maximum	Mean	SD
Douro region				
EP	0.000	0.930	0.180	0.250
Profitability				
ROA	−8.415	1.060	0.009	0.430
ROE	−34.850	41.170	0.205	3.180
ROI	−10.020	165.840	0.681	8.920
Solvency				
Lev	−258.000	204.720	2.250	20.890
FA	−14.490	0.970	0.280	0.940
Productivity				
T/E (10^3 Euro)	80.000	2799.500	121.500	227,917.000
AV/E (10^3 Euro)	−120.706	305.200	31.500	37,534.000
Efficiency				
EF	0.000	1.000	0.454	0.250
TE	0.083	1.000	0.692	0.282
SE	0.000	1.000	0.693	0.267
Vinhos Verdes region				
EP	0.000	0.993	0.118	0.203
Profitability				
ROA	−1.116	0.899	−0.005	0.163
ROE	−21.665	8.634	−0.082	1.800
ROI	−10.295	4.511	−0.073	0.904
Solvency				
Lev	−18.731	897.680	7.517	57.255
FA	−5.165	0.998	0.252	0.706
Productivity				
T/E (10^3 Euro)	0.398	3053.000	101.337	263.676
AV/E (10^3 Euro)	−83.004	410.333	24.287	38.608
Efficiency				
EF	0.008	1.000	0.417	0.227
TE	0.084	1.000	0.678	0.285
SE	0.008	1.000	0.675	0.283

Legend: SD – Standard Deviation; EP - Export Performance; ROA - Return on Assets; ROE - Return On Equity; ROI - Return on Investment; Lev - Leverage; FA - Financial Autonomy; T/E - Turnover per Employee; AV/E - Added Value per Employee; EF - Economic Efficiency; TE - Technical Efficiency; SE - Scale Efficiency.

Table 3. Indices of performance of Douro (434 observations) and Vinho Verde regions (years 2014 and 2015).

poorly with the weighted means, which have the following values: EP = 30.7%, ROA = 4.4%, ROE = 5.3%, ROI = 5.9%, Lev = 1.21, FA =0.45, T/E = 134.4 thousand Euro, and AV/E = 35.7 thousand Euro. The average of EF is 0.417, meaning that Vinho Verde firms could use 59.3% fewer inputs if all of them were on the production frontier. The averages of TE and SE are 0.678

	EP	ROA	ROE	ROI	Lev	FA	T/E	AV/E	EF	TE	SE
EP	1										
ROA	0.036	1									
ROE	−0.052	0.085***	1								
ROI	−0.051	0.134*	0.022	1							
Lev	0.022	0.029	−0.009	−0.007	1						
FA	0.143*	0.549*	−0.022	−0.044	0.004	1					
T/E	0.057	0.058	0.039	−0.015	−0.003	−0.052	1				
AV/E	0.244*	0.303*	0.111*	0.026	0.019	0.004	0.632*	1			
EF	0.177*	0.199*	0.086***	0.045	0.017	0.235*	0.538*	0.619*	1		
TE	0.038	−0.015	0.057	0.078	−0.065	0.026	0.258*	0.238*	0.499*	1	
SE	0.164*	0.200*	0.016	−0.021	0.092**	0.254*	0.319*	0.412*	0.601*	−0.346*	1

*, **, *** statistically significant at 1%, 5% and 10%, respectively.
Legend: EP - Export Performance; ROA - Return on Assets; ROE - Return On Equity; ROI - Return on Investment; Lev - Leverage; FA - Financial Autonomy; T/E - Turnover per Employee; AV/E - Added Value per Employee; EF - Economic Efficiency; TE - Technical Efficiency; SE - Scale Efficiency.

Table 4. Pearson correlation coefficients of indices of performance of Douro region (434 observations, years 2014 and 2015).

and 0.675, respectively, indicating that the causes of productive inefficiency are due to a similar extent to the inefficient use of inputs and to firms not operating at an optimum size.

In order to analyze the linear relation between the indices of performance, coefficients of Person correlation are computed for both regions (**Tables 4** and **5**) and special attention is given to the signal and statistical significance of these coefficients. For the Douro region (**Table 4**), the EP shows a highly positive correlated with FA, AV/E, EF, and SE. The ROA is positively correlated with ROE, ROI, FA, AV/E, EF, and SE. The ROE is positively correlated only with ROA, AV/E, and EF. The ROI is only positively related to ROA. The Lev is only positively related to SE. The FA is positively related to EP, ROA, EF, and SE. The T/E is positively correlated with ROA, AV/E, EF, TE, and SE. The AV/E is positively correlated with EP, ROA, ROI, T/E, and with the three indices of efficiency. The EF is positively correlated with the other indices of efficiency, and with EP, ROA, ROE, ROE, FA, T/E, and AV/E. The TE is positively correlated with T/E, AV/E, EF, and negatively with SE. The SE is positively correlated with EP, ROA, Lev, FA, T/E, FA, and negatively with TE. This last result means that firms being close to the optimum size do not mean they are efficient in the use of inputs. From the 55 linear correlation coefficients computed, 43.6% are statistically significant and only the correlation between TE and SE is negative. ROI and Lev are the indexes that present more linear independence to the other indices.

Regarding to the Vinho Verde region (**Table 5**), the EP is positively correlated with ROA, FA, AV/E, EF, and SE; the ROA is positively correlated ROI, FA, T/E AV/E, EF; the ROE is negatively correlated with ROI and Lev; the ROI is positively correlated with ROA, AV/E, EF, and SE and negatively correlated with ROE; the Lev is negatively correlated with ROE, EF, and

	EP	ROA	ROE	ROI	Lev	FA	T/E	AV/E	EF	TE	SE
EP	1										
ROA	0.165*	1									
ROE	0.018	0.006	1								
ROI	0.083	0.602*	−0.108***	1							
Lev	−0.045	0.002	−0.779*	0.019	1						
FA	0.127**	0.437*	0.003	0.378*	−0.029	1					
T/E	0.063	0.135**	0.032	0.078	−0.029	0.055	1				
AV/E	0.179*	0.358*	0.055	0.170*	−0.042	0.213	0.474*	1			
EF	0.177*	0.374*	0.079	0.116**	−0.127**	0.312*	0.404*	0.534*	1		
TE	0.006	0.265*	0.090	0.039	0.046*	0.017	0.182*	0.236*	0.401*	1	
SE	0.182*	0.158*	0.017	0.108***	−0.172*	0.314*	0.186*	0.258*	0.544*	−0.502*	1

*, **, *** statistically significant at 1%, 5% and 10%, respectively.
Legend: EP - Export Performance; ROA - Return on Assets; ROE - Return On Equity; ROI - Return on Investment; Lev - Leverage; FA - Financial Autonomy; T/E - Turnover per Employee; AV/E - Added Value per Employee; EF - Economic Efficiency; TE - Technical Eficiency; SE - Scale Efficiency.

Table 5. Pearson correlation coefficients of indices of performance Vinho Verde (299 observations, years 2014 and 2015).

SE; the FA is positively correlated with EP, ROA, ROI, EF, and SE; the T/E is positively correlated with ROA, AV/E, EF, TE, and SE; the AV/E is positively correlated with EP, ROA, ROI, T/E, and with the indices of efficiency; the EF is positively correlated with EP, ROA, ROI, FA, T/E, AV/E, TE, and SE and negatively with leverage; the TE is positively correlated with ROA, Lev, TE/E, AV/EEF, and negatively with SE; and the SE is positively correlated with EP, ROA, ROI, FA, T/E, AV/E, and EF and negatively with Lev and TE. For this region, from the 55 linear correlation coefficients computed, 45.5% are statistically significant, with 5 of them being negative (ROE-ROI, ROE-Lev, Lev-EF, Lev-SE, and SE-TE). For instance, the negative correlation Lev and EF implies that the more indebted the firm is, the less efficient it is, both in terms of technical efficiency and scale efficiency. Moreover, the negative signal of the correlation coefficient between SE and TE shows that the firms´ optimum size does not lead to the better use of inputs, as has also been demonstrated to be the case in Douro region.

Summarizing, the statistical significance of the Pearson correlation coefficients confirms the assumption that the performance of the company should not be assessed on one index, highlighting the importance computing, and analyzing alternative performance indices, in order to reinforce the results. Moreover, both in terms of signals and statistical significance, there are differences between the correlation coefficients of the Douro and Vinho Verde regions, giving yet another clear reason to analyze them as separate samples.

Therefore, in order to ascertain whether there are differences in the performance of the wine firms, according to their size, each sample was divided into different groups according to the referred criteria of **Table 2**, which are the number of employees, total turnover, and total assets. Since the results are very similar, we only report the results ordered according to the number of employees.

	EP	ROA	ROE	ROI	Lev	FA	T/E (10^3 €)	AV/E (10^3 €)	EF	TE	SE
Micro (n = 312)											
Mean	0.107	0.002	0.278	0.930	2.363	0.223	99.247	27.298	0.437	0.709	0.666
SD	0.189	0.506	3.734	10.515	24.462	1.099	144.965	35.737	0.260	0.296	0.299
Small (n = 100)											
Mean	0.306	0.024	0.014	0.038	2.223	0.399	171.342	37.889	0.465	0.610	0.759
SD	0.281	0.063	0.600	0.096	5.454	0.208	386.509	37.780	0.213	0.239	0.144
Medium (n = 17)											
Mean	0.636	0.051	0.055	0.059	0.758	0.608	214.696	68.480	0.631	0.808	0.779
SD	0.163	0.024	0.037	0.031	0.472	0.160	189.556	46.094	0.158	0.150	0.109
Big (n = 5)											
Medium	0.750	0.044	0.044	0.052	0.592	0.592	193.381	39.880	0.714	0.866	0.808
SD	0.134	0.019	0.029	0.022	0.024	0.024	63.845	32.928	0.197	0.155	0.098
Statistical F	48.870	2.680	0.700	0.670	1.500	6.040	239.800	2.750	49.200	10.520	3.050
(Sig.)	0.020	0.283	0.633	0.647	0.423	0.145	0.004	0.278	0.020	0.088	0.257
KW	92.610	4.720	3.280	2.280	9.490	19.210	33.050	31.480	19.080	15.310	1.160
(Sig.)	0.000	0.192	0.350	0.517	0.023	0.000	0.000	0.000	0.000	0.002	0.763
OLS regressions											
Constant	0.750	0.043	0.044	0.052	0.689	0.592	193.381	39.880	0.712	0.866	0.808
(Sig.)	(0.000)	(0.620)	(0.750)	(0.560)	(0.000)	(0.000)	(0.000)	(0.160)	(0.000)	(0.000)	(0.000)
Micro	−0.643	−0.041	0.232	0.878	1.673	−0.369	−94.113	−12.581	−0.275	−0.156	−0.142
(Sig.)	(0.000)	(0.640)	(0.360)	(0.090)	(0.180)	(0.000)	(0.060)	(0.660)	(0.000)	(0.000)	(0.000)
Small	−0.443	−0.019	−0.031	−0.013	1.533	−0.193	−22.039	1.990	−0.247	−0.266	−0.049
(Sig)	(0.000)	(0.830)	(0.840)	(0.890)	(0.120)	(0.000)	(0.690)	(0.940)	(0.000)	(0.000)	(0.160)
Medium	−0.115	0.007	0.010	0.009	0.067	0.016	21.315	28.600	−0.008	−0.058	−0.029
(Sig)	(0.190)	(0.930)	(0.940)	(0.930)	(0.890)	(0.900)	(0.810)	(0.380)	(0.340)	(0.290)	(0.550)
Statistical F	97.030	0.420	0.520	1.040	1.380	12.560	3.750	4.320	10.590	17.850	7.940
(Sig.)	(0.000)	(0.740)	(0.670)	(0.370)	(0.250)	(0.000)	(0.010)	(0.010)	(0.000)	(0.000)	(0.000)

Legend: EP - Export Performance; ROA - Return on Assets; ROE - Return On Equity; ROI - Return on Investment; Lev - Leverage; FA - Financial Autonomy; T/E - Turnover per Employee; AV/E - Added Value per Employee; EF - Economic Efficiency; TE - Technical Efficiency; SE - Scale Efficiency; SD – Standard Deviation; Sig - significance; KW - Kruskal-Wallis test; OLS - Ordinary Least Squares.

Table 6. Indices of performance of Douro region (434 observations, years 2014 and 2015) ordered according to the number of employees.

Table 6 includes the results of the Douro region. Taking into account the number of observations for each size, we observe that almost 72% of the firms are micro, 23% are small, 3.9% are medium, and only 1.1% are big, confirming the hypothesis of a heterogeneous market structure that underlies the monopolistic competition approach. Assuming the value and significance of the Kruskal-Wallis test, since the null hypothesis of equality of population rank test is rejected, the results indicate a positive relationship between size and the indices of EP, Lev, FA, T/E, AV/E, EF, and TE. This is not the case for the profitability indicators (ROA, ROE, and ROI) and SE. However, the Hotelling statistical F is applied to examine that the means of the four sizes are the same. The results only reject this hypothesis for the EP, T/E, and EF (at a 5% level of significance) and TE (at 10% of level of significance).

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In order to check the robustness of these results, the OLS regressions, whose dependent variable is the respective index of performance, are estimated. The explanatory variables are dummy variables of the size, with "big" being omitted. The results of these models for the Douro region are also included in **Table 6**. The signal of the coefficients and, namely, the global significance (values of F) confirm that there are differences in the performance of firms dependent on their respective size. Specifically, it is noted that export performance, financial autonomy, productivity, and efficiency are lower in micro and small wine enterprises. However, this difference seems not to have consequences on the profitability and leverage indices, since the respective regressions are not statistically significant.

Concerning the Vinho Verde region (**Table 7**), according to the number of employees, there are no big wine firms, with 77.6% being micro, 21.4% small, and 1% medium, confirming the dominance of very small companies. The Kruskal-Wallis test allows us to infer that there is only a positive relationship between size and the indices of EP, T/E, AV/E, and TE and that there are no statistically significant relationships with the other indices. The Hotelling F test

	EP	ROA	ROE	ROI	Lev	FA	T/E (10^3 €)	AV/E (10^3 €)	EF	TE	SE
Micro (n = 232)											
Mean	0.102	−0.011	−0.096	−0.100	8.875	0.226	93.541	22.251	0.414	0.702	0.650
SD	0.202	0.179	2.033	1.022	64.888	0.764	292.740	40.684	0.239	0.283	0.310
Small (n = 64)											
Mean	0.157	0.010	−0.043	0.015	2.973	0.349	126.066	29.720	0.427	0.587	0.765
SD	0.183	0.083	0.424	0.139	6.121	0.439	114.987	28.139	0.178	0.273	0.134
Medium (n = 3)											
Mean	0.533	0.130	0.155	0.160	1.359	0.483	216.533	69.279	0.551	0.880	0.623
SD	0.193	0.113	0.159	0.139	1.139	0.185	26.386	43.879	0.131	0.183	0.029
Statistical F	44.230	0.710	0.620	0.700	0.620	3.880	65.340	10.420	28.260	55.230	639.950
(Sig.)	(0.110)	(0.640)	(0.670)	(0.650)	(0.670)	(0.340)	(0.090)	(0.210)	(0.130)	(0.090)	(0.030)
KW	20.970	3.890	0.920	2.950	2.710	0.990	23.650	15.570	3.240	10.770	2.270
(Sig.)	(0.000)	(0.140)	(0.630)	(0.230)	(0.260)	(0.620)	(0.000)	(0.000)	(0.190)	(0.000)	(0.320)
OLS regressions											
Constant	0.533	0.128	0.155	0.159	1.359	0.483	216.533	69.279	0.551	0.880	0.623
(Sig.)	(0.000)	(0.470)	(0.800)	(0.670)	(0.680)	(0.060)	(0.000)	(0.230)	(0.000)	(0.000)	(0.000)
Micro	−0.432	−0.139	−0.251	−0.260	7.516	−0.256	122.992	47.027	−0.137	−0.178	0.027
(Sig.)	(0.010)	(0.440)	(0.690)	(0.490)	(0.140)	(0.330)	(0.010)	(0.419)	(0.180)	(0.090)	(0.370)
Small	−0.376	−0.119	−0.193	−0.147	1.521	−0.147	−92.933	39.720	−0.129	−0.300	0.144
(Sig)	(0.020)	(0.500)	(0.760)	(0.690)	(0.680)	(0.579)	(0.130)	(0.490)	(0.210)	(0.010)	(0.000)
Statistical F	5.080	0.890	0.120	1.470	1.240	1.260	3.260	1.020	0.920	8.430	25.540
(Sig.)	(0.010)	(0.410)	(0.880)	(0.230)	(0.290)	(0.280)	(0.040)	(0.360)	(0.400)	(0.000)	(0.000)

Legend: EP - Export Performance; ROA - Return on Assets; ROE - Return On Equity; ROI - Return on Investment; Lev - Leverage; FA - Financial Autonomy; T/E - Turnover per Employee; AV/E - Added Value per Employee; EF - Economic Efficiency; TE - Technical Efficiency; SE - Scale Efficiency; SD – Standard Deviation; Sig - significance; KW - Kruskal-Wallis test; OLS - Ordinary Least Squares.

Table 7. Indices of performance of Vinho Verde (299 observations, years 2014 and 2015) ordered according the number of employees.

only permits the rejection of the null hypothesis of equality means of the three groups, for the variables T/E, TE (both at 10%), and SE (at 5%). The results of the OLS regressions show that the indices EP, T/E, and TE increase positively with the size, but negatively with SE. This last result implies that the larger firms tend to deviate from the optimal size, although they are more technical efficient in the use of inputs.

Generally speaking, we can summarize that Douro wine firms are more heterogeneous than their Vinho Verde counterparts, which can be explained by comparing the technologies and market structures of the two markets. In both cases, the relationship between size and performance depends on the index of performance used, and it becomes clear that organizational performance is a multidimensional construct that should take into account the different dimensions of economic performance and even the respective regions[4] (spatial differentiation) in which they are located.

4. Conclusions

The wine industry neatly illustrates the market structure of monopolistic competition, exhibiting as it does varying degrees of product differentiation and free entry into the industry, with competition between groups of firm's size. Some of them search for market niches acting as oligopolies and others for mass markets acting as in perfect competition. In this context of horizontal product differentiation, notwithstanding the globalization of the wine market, a better understanding of the performance of the wine industry requires a microeconomic analysis based on measures at both the level of the firm and that of the wine region.

Based on data for the Douro and Vinho Verde regions, two representative Portuguese wine regions that fit well into the *terroir* model, and where horizontal product differentiation is clearly present, the main goal of this research has been to estimate the economic performance of wineries using different approaches and to assess the influence of the respective sizes of firms on performance indices, including ratios of traditional profitability, solvency, labor productivity and export performance, and productive efficiency. The results show that the wine firm's performance is a multidimensional construct and there are expected differences between wine regions, which are well predicted by the monopolistic competition model specifically regarding horizontal product differentiation.

Nonetheless, in both regions, export performance increases with size, which can be explained by the fact that big firms have at their disposal greater marketing resources and the ability to make substantial investment in the search for new international markets. Relative to the profitability indices, in both regions, there is no statistically significant relationship to size, and there coexist different typologies of firms in the market, according to the monopolistic

[4]In our case (results not reported in the chapter but provided by the authors) in order to test if there are differences between the two wine regions, the estimation of OLS regression, where the only explanatory dummy variable is the region, indicates that EP, ROI, AV/T, and EF are higher for the Douro region and not statistically different for the other variables.

competition model. The indicators of productivity show that there is no standard result as these differ by region, demonstrating that the productivity of labor is higher in the bigger firms of the Douro region, but not in the Vinho Verde region where the turnover per employee is higher for microfirms, there being no statistical differences between groups.

The indices of productive efficiency of Douro firms show that the bigger firms are empowered to adopt management strategies that improve the use of economic resources. This is a consequence of a better use of inputs and the adoption of an appropriate size. In opposite, the firms of the Vinho Verde region show a different result, in which the economic efficiency is independent of the firms' size. This could be a consequence of the better use of inputs by bigger wineries to be annulled by the deviation from the optimal size.

Summing up, the results do not show in a clear way that bigger wine firms outperform small ones, depending on the conclusions drawn from the indices that are used. The results also highlight the diversity among wine firms and the need to understand why they are different. Consequently, future research will be directed toward understanding which specific resources constitute a source of competitive advantage, expressed in variables that are not considered in this study and that are only available through the use of firm's enquires.

Regarding policy implications, mainly in the areas of public support and regulation, this research shows that micro and small wineries are the most common types in the Portuguese wine industry and that, in the short run, this situation will not change. Moreover, assuming that globalization and international competition continue to increase in the wine industry, the search for new international markets should be aware of the importance of scale economies. This is an aim that can be achieved through organic growth or strategic alliances, either along the whole production and distribution chain or exclusively in the area of marketing.

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