Firm characteristics and export performance in Portuguese wine firms

Firm
characteristics
and export
performance

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Abstract

Purpose – The purpose of this paper is to contribute to the determinants of export performance literature. The authors investigate the effect of firm characteristics on the Douro region wine firms export performance. The authors consider the Douro region, as it has the Portugal highest wine classification, the appellation d'origine contrôlée and undertakes the first position in the Portuguese wine production and export.

Design/methodology/approach – The authors apply a pooling cross-sectional data set that includes 427 observations. The authors pooled two cross sections consisting of 214 and 213 firms for the years 2014 and 2015, respectively. The firm export intensity and propensity are the dependent variables. Moreover, the firm size, age and productive efficiency are accounted as the firm characteristics. The authors use the ordinary least squares regression and the tobit and probit models for estimations.

Findings – First, size is an influential factor to improve the export performance, and the importance of size is higher for younger firms. Second, there is a positive response from export intensity to age and this response is higher for smaller firms. However, there is a negative response from the export propensity to age and this negative response is higher for bigger firms. Third, there is weak evidence to support a relationship between efficiency and export performance.

Research limitations/implications – This research and the presented results are undoubtedly under some limitations. The main limitation is about the data availability for all characteristics of a firm. For example, it will enrich the result if the authors add some other important variables such as production cost, research and development expenditure and the quality of produced wine by each firm to our analysis.

Originality/value – This research reveals that the influence of firm characteristics on the export performance of Portuguese wine firms is missing in the literature. The results provide a basis to Portuguese wineries to improve their export performance by applying the relevant strategies.

Keywords Export performance, Portugal, Size, Efficiency, Age, Firm characteristics, Wine firms

Paper type Research paper

JEL classification – F14, D22, L66

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1. Introduction

This paper examines the association between export performance and firm characteristics among the Port and Douro wine firms in the Douro region of Portugal. This region is a demarcated wine region since 1756 and is one of the oldest wine regions of the world.

In recent years, the European Union (EU) is given a primary position to the wine industry. This was illustrated by the extensive package of financial support, both at the production and marketing levels. This happened in the context of the wine common market organization reforms in 2008 and 2013 (Regulation EC No 1308/2013 of the European Parliament). According to the EU regulations, the support provided to the promotion of wines on third country markets deserves special attention, as it increases their international competitiveness. The same as the other wine producing countries, Portugal has also adopted strategies to strengthen its position in the world wine market, which may significantly benefit the Portuguese wine firms.

In 2015, Portugal occupied the 4th and the 5th places in the EU in terms of the area of planted vineyards and production, respectively, and the 11th position for production among the world wine producers[1]. Over the period from 2000 to 2009, Portugal has shown very positive annual rates of changes in performance indices, namely, export market penetration and export value proposition; however, it has shown a negative value on the productivity index (Fleming *et al.*, 2014). Although Portugal is an important player in the European and the world wine markets, there is a very limited survey regarding the determinants of Portuguese wine export. The new challenges faced by the wine firms necessitates more research for a better understanding of export behavior and to adopt the opportunities that arise from a better knowledge. These are the reasons behind adopting this research, which examines the main firm characteristics that determine the Portuguese wine firms export performance.

Export plays an important role in the economy. It influences employment, economic growth and balance of payments. However, the process of promoting export depends on several factors, such as firm characteristics, trade regulations and global and domestic macroeconomic conditions. In this context, studies that are focused on the association between firm characteristics and export performance have a long tradition in the literature concerning exporting (D'Angelo *et al.*, 2013; Boly *et al.*, 2014; Agnihotri and Bhattacharya, 2015; Kim and Hemmert, 2016). The general consensus supports the existence of a strong association between them.

The goal of this paper is to investigate the effect of firm characteristics on the Portuguese wine firms export performance. We consider the Douro region wine firms, as this region has the Portugal highest wine classification, the *appellation d'origine contrôlée* (AOC). Moreover, this region undertakes the first position in the Portuguese wine production and export (OIV). We apply the firm-level data with focus on export intensity and propensity as the dependent variables. The explanatory variables are firm size, age and the interaction term between size and age, and finally, productive efficiency, which are the measurements of the firm characteristics. To examine this relationship, we apply the ordinary least squares (OLS) regression and the tobit and probit models to estimate a pooled cross-sectional database, which consists of 427 observations for the years 2014 and 2015.

In summary, we find that first, among the Douro region wine firms, firm size is an influential factor to improve export performance, and the importance of size in developing export is higher for younger firms. Second, there is a positive response from export intensity to age and this response is higher for smaller firms. However, there is a negative response from the export propensity to age, and this negative response is higher for bigger firms.

Third, there is a weak evidence to support a positive relationship between efficiency and the wine firms export performance.

2. Literature review

In Section 2.1, we review the literature of firm characteristics and export performance association. In Section 2.2, we review the literature of wine export determinants, and we define the main research questions of this paper.

2.1. Firm characteristics and export performance

2.1.1 Firm size and export performance. Size is an important characteristic of a firm, as it is an indicator in shaping firm internationalization ability. The size of a firm can make known market power, capability and scale economies (Park and Jang, 2010). One dominant argument about the size-based explanation of a firm growth is that a larger firms have more specialized managerial resources and can benefit from scale economies (Samiee and Walters, 1991). Another explanation states that firm size is beneficial as access to foreign markets needs a certain level of knowledge, resources and credibility that normally only larger firms can afford to obtain (Reuber and Fischer, 1997). Moreover, it is most likely that firms first undertake growth in the domestic market, and they enter to international markets only after a certain level of age and size achievements in their own country (Bonaccorsi, 1992). Previous studies that investigated the impact of firm size on export performance generally find a positive association (Boly *et al.*, 2014; Agnihotri and Bhattacharya, 2015; Kim and Hemmert, 2016).

2.1.2 Firm age and export performance. Age is another important element to extend the firms access to foreign markets. This importance can be explained via different perspectives. For instance, age increases the experience-based capabilities, refined routines, ability to adopt, market credibility and reliability of firms (Baum and Shipilov, 2006). Older firms are more flexible to accept the changes and to adopt with new markets (Kelly and Amburgey, 1991). Furthermore, older and larger firms are more on the routines, bureaucratized and expert, which enable them to change a standard process (Haveman, 1993). Some literature also states that younger firms show more interest in foreign markets than older ones (Kaynak and Kothari, 1984), as the firm age can be associated to rigid thinking, inflexibility and failure to change strategy (Love *et al.*, 2016). The results from previous empirical studies that investigate the effect of firm age on export performance are inconclusive. Some papers find a positive effect from age to export performance (Agnihotri and Bhattacharya, 2015; Kim and Hemmert, 2016); however, some studies achieve a different conclusion showing that age negatively affects export performance (Kirpalani and Macintosh, 1980), while there is also a findings that reveals no the effect (Ganotakis and Love, 2011; D'Angelo *et al.*, 2013).

2.1.3 Firm efficiency and export performance. There are additional costs for selling products in foreign markets, such as transportation, marketing and production costs in modifying current domestic products for foreign consumption, personnel with skill to manage foreign networks, and gathering information and dealing with the different legal and economic environment in the foreign country (Wagner, 2007). These costs constitute entry barriers that is less productive firms are not able to afford. In this regard, Clerides *et al.* (1998) and Melitz (2003) develop models to explain that only more efficient firms afford the fixed entry costs in the export market. The firm productivity and efficiency relationship with export is examined by a number of studies (Melitz, 2003; Crino and Epifani, 2009). The general conclusion shows a positive association between them.

2.2. Determinants of wine export

The case studies that examine the determinants of wine firms export are very limited. For instance, with a focus on the USA wine firms, [Silverman et al. \(2004\)](#) find a positive effect from resource commitment and size and a negative impact from export barriers. [Karelakis et al. \(2008\)](#) investigate the Greek wine firms export problems. They find that the main factors that affect wine export are firm export competence, knowledge related to export channels, environmental factors and the conditions necessary for the development of an export channel. Moreover, the findings reveal that export problems are more likely to occur in firms that are more passive in terms of export activity. [Maurel \(2009\)](#) investigates the firm characteristics factors that are important for the French wine small- and medium-sized firms. The author finds that in the French wine industry, business partnerships, innovation, a greater size and an effective export commitment are associated to higher levels of export performance.

Although Portugal is an important player in the European and the world wine markets, few studies have been conducted regarding the determinants of Portuguese wine export. [Vivas and Sousa \(2012\)](#) identify the firms internationalization strategies among the Portuguese wine industry. The authors argue that the lack of production units' size, poor investment in the commercial area, and the limited options to export to a wide range of countries originate insufficient ability to compete with larger, more experienced firms in international markets. [Mourão and Martinho \(2016\)](#) identify the most important determinants of the Portuguese wine exports and the efficiency levels for each destination country. Results reveal that the value of Portuguese wine export has a positive relationship with the government influence on the economic activity of the country. [Gouveia, et al. \(2018\)](#) examine the macroeconomic determinants of Port wine exports, taking into account the diversity and different levels of Port wine qualities. The results show that the quantity and value of total Port wine exports are positively associated with overall GDP per capita and the presence of Portuguese immigrant communities, while they are negatively influenced by landlockedness.

To the best of our knowledge, there is no previous study that investigates the relationship between the Portuguese wine firms characteristics and wine export performance. This is critical to design an effective strategy that encourages firms to participate in international markets. Therefore, it is relevant to test the relationship between firms' characteristics, (such as size, age, efficiency, etc.) and the export performance of Portuguese wine firms. In this paper, we aim to answer the following research questions:

- RQ1.* Does the wine firm size affect the wine firm export performance in Douro region?
- RQ2.* Does the wine firm age affect the wine firm export performance in Douro region?
- RQ3.* Does the wine firm efficiency affect the wine firm export performance in Douro region?

3. Data, model and methodology

3.1. Data description

We use a pooled cross-sectional data set with 427 observations. We pooled two cross-sections consisting of 214 firms for the year 2014 and 213 firms for the year 2015. The applied sample is constituted by the Port and Douro wine firms included in the 11021 NACE-2009 code (production of still and liquors wine). The database is obtained from the Financial and Economic Entrepreneurial Data Base, which is provided by Informa Dun and Bradstreet (D&B)[2]. We use the database of commercial agents that are registered in Instituto dos Vinhos do Douro e Porto (IDVP) as *appellation AOC*.

3.1.1 Dependent variables. The dependent variable is export performance measured by export intensity and export propensity. Export intensity is the share of export to the total sales of firm, and export propensity is a binary variable that takes the value one if the firm is an exporter and zero otherwise. In Table I, we report the firms statistics based on the number and the percentage of firms that export their products. It shows that in 2014, around 54 per cent and in 2015, around 58 per cent of the Douro region wine firms have been active in international markets and export their wine.

3.1.2 Explanatory variables. The main explanatory variables are size, age, productive efficiency and the interaction term between size and age. Firm *size* represents the number of employees in the firm, *age* is the number of years that each firm has been active in this business. The interaction term, *sizeage* is calculated by multiplying the size by age, to find if there is any interaction effect between the firms *size* and *age*. We would like to find if the effect of firm size on export performance depends on the magnitude of firm age, and vice versa. Finally, productive efficiency, that we name it *efficiency*, is calculated by using the method of data envelopment analysis. This is a non-parametric approach that is initially proposed by Charnes *et al.* (1978, 1981). This approach does not need to assume a functional form to the production (cost or profit) function, being the frontier surface constructed through linear programming. A firm is efficient if no other firm is able to produce a higher level of output from the same input (output-oriented) or if it produces the same output from less input (input-oriented). Following Sellers and Alampi-Sottini (2016), we apply an input-oriented model, as the inputs are more under firms control than the output. In this study, three controllable inputs of firm characteristics (cost of raw materials, number of employees and value of debts) are chosen. The output data on annual turnover has been considered. We assume $j = 1, \dots, N$ firms and each firm uses vector of m inputs, $X_j = (x_{1j}, x_{2j}, \dots, x_{mj})$ to produce a vector of s outputs, $Y_j = (y_{1j}, y_{2j}, \dots, y_{sj})$ and linear variable returns to scale. The programming model developed by Banker *et al.* (1984) is given by:

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

subject to:

$$\sum_{j=1}^n x_{ij} \lambda_j + s_i^- = x_{r0} \quad \sum_{j=1}^n y_{rj} \lambda_j - s_i^+ = \theta y_{i0}$$

$$\sum_{j=1}^n \lambda_j = 1 \quad \lambda_j, s_r^+, s_i^- \geq 0$$

$$j = 1, \dots, n, r = 1, [\dots] s; i = 1, [\dots], m \quad (1)$$

	Year	
	2014	2015
Total number of firms	214	213
Number of exporters	117	124
Percent of exporters	54.67	58.22

Note: The information reported in this table belongs to the sample that we used in this study. Our sample contains 60% of the total wine producing firms in Douro region

Table I.
Statistics of firms

Table II.
Criteria to identify
firms size

Size	Criteria
Micro	<10 employees; and < €2m turnover
Small	10 ≤ employees < 50; and 2 ≤ turnover < €50m
Medium	50 ≤ employees < 250; and 50 ≤ turnover < €250m
Big	Employees ≥ 250; and turnover ≥ €250m
Source: The source of firm size classification is the Official Journal of the European Union, 2003	

Table III.
Average values of
data based on firms
size

Variable	Sample (427)	Micro (305)	Small (100)	Medium (17)	Big (5)
<i>Intensity</i>	0.193	0.115	0.323	0.652	0.760
<i>Employment</i>	16	3	20	99	436
<i>Age</i>	20.50	13.50	31.50	68.00	65.00
<i>Efficiency</i>	0.451	0.432	0.464	0.630	0.712
Note: The values in parentheses are the number of firms					

Table IV.
Summary statistics

Variable	Obs	Mean	SD	Min	Max
<i>Intensity</i>	427	0.193	0.264	0	0.924
<i>Propensity</i>	427	0.564	0.496	0	1
<i>Age</i>	427	20.50	20.468	2	116
<i>Size</i>	427	16.00	52.751	1	593
<i>Efficiency</i>	427	0.451	0.250	0	1
Notes: Based on information from the Port and Douro Wines Institute (IVDP), the total number of wine firms in Douro region is 1,151. This includes firms that only sell wine with no transformation and firms that produce and sell wine. This study is focused only on the wine firms included in the second category for the reason of technological homogeneity. Our sample covers 60% of the wine producing firms in Douro region					

	Intensity	Propensity	Age	Size	Efficiency	Firm characteristics and export performance
Intensity	1.000					
Propensity	0.639 (0.000 < 0.01)*	1.000				
Age	0.338 (0.000 < 0.01)*	0.183 (0.000 < 0.01)*	1.000			
Size	0.401 (0.000 < 0.01)*	0.196 (0.000 < 0.01)*	0.426 (0.000 < 0.01)*	1.000		
Efficiency	0.180 (0.000 < 0.01)*	0.148 (0.002 < 0.01)*	0.104 (0.030 < 0.05)**	0.180 (0.000 < 0.01)*	1.000	

Notes: * and ** represent statistical significance at the 1 and 5% levels, respectively. The values in parentheses are *p*-values

Table V.
Correlation coefficients

All the correlation coefficients within the explanatory variables are statistically significant. The highest correlation coefficients are between size and age (0.426) while another coefficient among the explanatory variables are all less than 0.20. Therefore, although there is a degree of correlation between the explanatory variables but it is not as high to cause multicollinearity problem.

3.1.3 Control variables. As the control variables, we account for the type of produced wines. In the Demarcated Douro Region, both Port and Douro wines are produced. The firms produce one or both types of wines. Thus, the wine firms can be categorized into three groups, namely, only produces Port wine, only produces Douro wine and produces both Port and Douro wines. Therefore, we include two dummy variables, a dummy that takes the value one if the firm produces only Port wine and zero otherwise (*Port*), and a dummy that takes the value one if the firm produces only Douro wine and zero otherwise (*Douro*). The firms that produce both Port and Douro wines are considered as the base group.

3.2. Model and methodology

According to our research questions, the following equations are formulated:

$$\text{intensity} = \alpha_0 + \alpha_1 X + \alpha_2 \text{Port} + \alpha_3 \text{Douro} + \varepsilon_1 \quad (2)$$

$$\text{propensity} = \beta_0 + \beta_1 X + \beta_2 \text{Port} + \beta_3 \text{Douro} + \varepsilon_2 \quad (3)$$

Export performance are measured by two indices, namely, export intensity and export propensity. *X* is the vector of explanatory variables representing firm characteristics. In fact, under each equations (2)-(3) six models will be examined. In Model 1, *X* is firm size, in Model 2 is firm age, in Model 3 is productive efficiency, in Model 4 is size, age and productive efficiency, in Model 5 is size, age and the interaction term between size and age, and in Model 6 is size, age, the interaction term between size and age and productive efficiency. All models include *Port* and *Douro* dummy variables.

Referring to the Wooldridge (2016), we chose whether to include an explanatory variable in a regression by analyzing the possible tradeoff between bias and variance. In this study, the incentive to estimate both simple and multiple regression models is the presence of some degree of correlation between the explanatory variables. This can affect the variances of estimators, and consequently, the estimation results inferences. Therefore, first, we examine a set of univariate models that are free of any possible multicollinearity. However, simple

regression models suffer from endogeneity and the omitted variable bias, which makes the estimated parameters inaccurate. Therefore, in the second step, we estimate a set of multivariate regressions. This reduces the biasedness; however, there is a risk of generating the coefficients that are not statistically significant, as the independent variables have a degree of correlation. This is hardly preventable in econometrics analyses.

To estimate equations (2)-(3), we need to apply two methodologies proper for each dependent variable. We start with equation (2), in which export intensity is the dependent variable. As the value of export intensity is a proportion bounded between zero and one, using conventional linear regression methods might fail to account for the qualitative difference between limit (zero) and non-limit (continuous) observations (Greene, 2003). To solve this, we adopt the censored regression tobit model. The tobit model is a type of non-linear regression model that was initially proposed by Tobin (1958). In this method, the regression is achieved by making the mean in the preceding correspond to a classical regression model (Greene, 2003). When the error term is normally distributed, the formulation of the tobit model is:

$$y_i^* = x_i' \alpha + \varepsilon_i,$$

$$y_i = \begin{cases} 0 & \text{if } y_i^* < 0 \\ y_i^* & \text{if } y_i^* \geq 0 \end{cases} \quad (4)$$

where $i = 1, \dots, 427$. In this model, all negative values of y_i^* are coded as 0, so these data are left censored at 0 and the parameter α is estimated using a maximum likelihood function. In tobit models, the estimated coefficients do not have a direct interpretation. Therefore, the average marginal effect of the associated regressors will be estimated, which is the effect of a unit of change in the explanatory variable on the dependent variable.

Second, we examine the models under equation (3). In this model, the export propensity is a binary dependent variable that takes the value one if a firm exports and zero otherwise. Thus, a conventional linear regression method is not appropriate, as among other reasons, the fitted value of the dependent variable will not be restricted to lie between zero and one. To solve this, we can use the probit and logit models as the limited dependent variable models. Theoretically, if the error term has a standard normal distribution, the probit model is preferred, and if the error term has logistic distribution, the logit model is preferred. However, economists tend to favor the normality assumption for the error term, and this is the reason that the probit model is more popular than the logit model in econometrics (Wooldridge, 2016). In practice, the difference in their results are typically very small and it does not usually matter, which one we use, especially, if we present the marginal effects. In this study, we favor the normality assumption and we present the probit model results. Bellow, we show the general formulation of this model:

$$y_i^* = x_i' \beta + \varepsilon_{it},$$

$$y_i = \begin{cases} 0 & \text{if } y_i^* \leq 0 \\ 1 & \text{if } y_i^* > 0 \end{cases} \quad (5)$$

where $i = 1, \dots, 427$. In this method, the observed dependent variable is determined by whether it exceeds a threshold value. The parameter β is estimated using a maximum likelihood function. In the probit model, the estimated coefficients do not quantify the influence of the explanatory variables on the probability of success, as the coefficients are parameters of the latent model. Therefore, the average marginal effect will be estimated, which is the effect of a unit of change in the explanatory variable on the probability of success.

4. Results

The results are reported in [Tables VI-IX](#). The OLS regression results are reported as the benchmark in [Tables VI](#) and [VII](#). In [Table VI](#), the export intensity and in [Table VII](#), the export propensity are, respectively, the dependent variables.

The tobit and probit models results are reported in [Tables VIII](#) and [IX](#), respectively. For the tobit model estimations, the coefficients measure the average marginal effect of one unit of change in firm characteristics on export intensity. In the probit model estimations, the coefficients measure the average marginal effect of one unit of change in firm characteristics on the probability that the export propensity changes from zero to one or the probability that a firm becomes an exporter.

As we reported the scaled-up probit and tobit estimates by means of the average marginal effects, it is very normal to have coefficients close to the OLS[4]. To shorthand, we mainly focus on the results from the tobit and probit models.

4.1 Size

First, we focus on the tobit model estimations reported in [Table VIII](#). There is a direct univariate relationship between size and export intensity (Model 1). This result stays robust when we apply a multivariate model, controlling for age and efficiency (Model 4). Next, we control for the interaction term between size and age, sizeage under two models. One model includes size, age and sizeage (Model 5) and one model includes size, age, efficiency and sizeage (Model 6). In both models, the positive effect of size stays robust.

In Models 5 and 6, the results reveal that, the effect of size on export intensity is statistically significant at the 1 per cent level, examined by the joint significance F -test between size and sizeage. The sign of sizeage is negative and significant. This shows that the marginal effect of size on export intensity depends on the years that a firm has been active in this business. The positive effect of size together with the negative effect of sizeage reveal that an additional unit of size yields a higher increase in export intensity for younger firms compared to the older ones. It is predicted that holding other factors fixed, if the number of employees increases by 100, the export intensity of a newly established firm will increase by 0.6 unit, while the export intensity of a 20 years old firm will increase by 0.4 unit.

Focusing on the probit model estimations reported in [Table IX](#), we again find a direct univariate relationship between size and export propensity (Model 1). The result stays robust when we apply a multivariate model, after controlling for age and efficiency (Model 4); age and sizeage (Model 5); and age, efficiency and sizeage (Model 6). The results obtained by Models 5 and 6 indicate that the effect of size on propensity is statistically significant at the 1 per cent level. This is examined by the joint significance F -test between size and sizeage. The positive effect of size together with the negative effect of sizeage reveal that an additional unit of size yields a higher increase in probability to export for younger firms. It is predicted that holding other factors fixed, if the number of employees in a newly established firm increases by 100, the probability of export will increase by 2.3 units; however, in a 20 years old firm this will increase the probability of export by two units.

Table VI.
OLS estimations

Export intensity	Size	Age	Efficiency	Sizeage
Model 1	0.001 (4.55)* [0.000]			
Model 2		0.001 (2.68)* [0.000]		
Model 3			0.097 (2.35)** [0.041]	
Model 4	0.001 (3.97)* [0.000]	0.0007 (1.00) [0.000]	0.062 (1.63) [0.038]	
Model 5	0.005 (8.72)* [0.000]	0.001 (2.28)** [0.000]		-0.0001 (-7.13)* [0.000]
Joint significance <i>F</i> tests				
size and sizeage	57.36 (0.000)*			
age and sizeage		25.48 (0.000)*		
Model 6	0.005 (8.47)* [0.000]	0.001 (2.33)** [0.000]	0.051 (1.41) [0.036]	-0.0001 (-6.97)* [0.000]
Joint significance <i>F</i> tests				
size and sizeage	52.78 (0.000)*			
age and sizeage		24.36 (0.000)*		

Notes: *, ** and *** represent statistical significance at the 1, 5 and 10% levels, respectively. The values in parentheses are the *t*-statistics. The values in brackets are the robust standard errors. For *F*-test, the values in parentheses are the *p*-values. *sizeage* represents the interaction term between size and age

(continued)

Export intensity	Port	Douro	F-stat	R ²
Model 1	0.288 (4.55)* [0.086]	-0.191 (-3.33)* [0.028]	46.08 (0.000)*	0.289
Model 2	0.223 (2.47)** [0.090]	-0.210 (-7.25)* [0.029]	39.44 (0.000)*	0.236
Model 3	0.306 (4.42)* [0.069]	-0.233 (-8.22)* [0.028]	47.51 (0.000)*	0.227
Model 4	0.239 (2.57)** [0.093]	-0.179 (-6.43)* [0.027]	28.19 (0.000)*	0.294
Model 5	0.349 (5.33)* [0.065]	-0.148 (-5.44)* [0.027]	94.05 (0.000)*	0.332
<i>Joint significance F tests</i>				
size and sizage				
age and sizage				
Model 6	0.336 (5.16)* [0.065]	-0.145 (-5.32)* [0.027]	80.73 (0.000)*	0.334
<i>Joint significance F tests</i>				
size and sizage				
age and sizage				

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Table VI.

Table VII.
OLS estimations

Export propensity	Size	Age	Efficiency	Sizeage	Port
Model 1	0.0008 (3.36)* [0.000]				0.311 (5.01)* [0.062]
Model 2		0.0007 (0.62) [0.001]			0.328 (5.04)* [0.065]
Model 3			0.175 (1.78)*** [0.098]		0.328 (5.85)* [0.056]
Model 4	0.0007 (2.52)** [0.000]	0.0000 (0.02) [0.001]	0.156 (1.57) [0.099]		0.346 (4.94)* [0.070]
Model 5	0.004 (3.21)* [0.001]	0.0008 (0.64) [0.001]		-0.0001 (-2.81)* [0.000]	0.372 (6.67)* [0.049]
<i>Joint significance F tests</i>					
size and sizeage	7.20 (0.000)*				
age and sizeage		4.06 (0.018)**			
Model 6	0.003 (2.97)* [0.001]	0.0009 (0.65) [0.001]	0.147 (1.49) [0.099]	-0.0001 (-2.65)* [0.000]	0.334 (6.81)* [0.049]
<i>Joint significance F tests</i>					
size and sizeage	5.62 (0.003)*				
age and sizeage		3.59 (0.028)**			

Notes: *, ** and *** represent statistical significance at the 1, 5 and 10% levels, respectively. The values in parentheses are the *t*-statistics. The values in brackets are the robust standard errors. For *F*-test, the values in parentheses are the *p*-values. *sizeage* represents the interaction term between size and age

(continued)

Export propensity	Douro	F-stat	R ²
Model 1	-0.339 (-7.01)* [0.048]	36.59 (0.000)*	0.123
Model 2	-0.356 (-7.07)* [0.050]	23.33 (0.000)*	0.117
Model 3	-0.353 (-7.63)* [0.046]	25.22 (0.000)*	0.124
Model 4	-0.329 (-6.34)* [0.051]	22.71 (0.000)*	0.129
Model 5	-0.309 (-6.70)* [0.054]	25.25 (0.000)*	0.131
<i>Joint significance F tests</i>			
size and sizage			
age and sizage			
Model 6	-0.300 (-5.48)* [0.054]	22.21 (0.000)*	0.137
<i>Joint significance F tests</i>			
size and sizage			
age and sizage			

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Table VII.

Table VIII.
Tobit models

Export intensity	Size	Age	Efficiency	Sizeage
Model 1	0.001 (4.43)* [0.000]			
Model 2		0.002 (2.37)** [0.000]		
Model 3			0.181 (2.36)** [0.076]	
Model 4	0.001 (3.68)* [0.000]	0.0008 (0.87) [0.001]	0.131 (1.79)*** [0.073]	
Model 5	0.006 (7.13)* [0.000]	0.002 (2.04)** [0.000]		−0.0001 (−5.99)* [0.000]
<i>Joint significance F tests</i>				
size and sizeage	37.55 (0.000)*			
age and sizeage		17.95 (0.000)*		
Model 6	0.006 (6.79)* [0.000]	0.002 (2.13)** [0.001]	0.116 (1.64) [0.071]	−0.0001 (−5.77)* [0.000]
<i>Joint significance F tests</i>				
size and sizeage	32.38 (0.000)*			
age and sizeage		16.62 (0.000)*		

Notes: *, **, and *** represent statistical significance at the 1, 5 and 10% levels, respectively. The values in parentheses are the *t*-statistics. The values in brackets are the robust standard errors. For *F*-test, the values in parentheses are the *p*-values. *sizeage* represents the interaction term between size and age
(continued)

Export intensity	Port	Douro	F stat	Pseudo R^2
Model 1	0.317 (3.53)* [0.089]	-0.307 (-8.04)* [0.038]	36.59 (0.000)*	0.215
Model 2	0.236 (2.34)** [0.100]	-0.332 (-8.29)* [0.040]	50.36 (0.000)*	0.184
Model 3	0.322 (4.60)* [0.069]	-0.356 (-9.33)* [0.038]	64.38 (0.000)*	0.184
Model 4	0.254 (2.39)** [0.102]	-0.289 (-7.37)* [0.039]	35.09 (0.000)*	0.222
Model 5	0.384 (5.09)* [0.065]	-0.249 (-6.40)* [0.027]	80.76 (0.000)*	0.245
<i>Joint significance F tests</i>				
size and sizage				
age and sizage				
Model 6	0.354 (4.68)* [0.075]	-0.242 (-6.18)* [0.039]	72.53 (0.000)*	0.249
<i>Joint significance F tests</i>				
size and sizage				
age and sizage				

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Table VIII.

Table IX.
Probit models

Export propensity	Size	Age	Efficiency	Sizeage	Port
Model 1	0.010 (2.99)* [0.003]				0.239 (0.19)* [0.026]
Model 2		0.0008 (0.65) [0.001]			0.333 (14.47)* [0.023]
Model 3			0.171 (1.83)*** [0.093]		0.322 (5.19)* [0.062]
Model 4	0.012 (3.06)* [0.004]	-0.003 (-1.94)*** [0.001]	0.134 (1.50) [0.089]		0.352 (13.03)* [0.027]
Model 5	0.023 (4.52)* [0.005]	-0.001 (-1.02) [0.001]		-0.0001 (-3.32)* [0.000]	0.170 (9.44)* [0.018]
<i>Joint significance X² tests</i>					
size and sizeage	18.28 (0.000)*				
age and sizeage		13.60 (0.000)*			
Model 6	0.023 (4.35)* [0.005]	-0.001 (-0.96) [0.001]	0.125 (1.45) [0.087]	-0.0001 (-3.25)* [0.000]	0.199 (9.95)* [0.020]
<i>Joint significance X² tests</i>					
size and sizeage	16.96 (0.000)*				
age and sizeage		12.75 (0.001)*			

Notes: *, ** and *** represent statistical significance at the 1, 5 and 10% levels, respectively. The values in parentheses are the *t*-statistics. The values in brackets are the robust standard errors. For Wald X^2 , the values in parentheses are the *p*-values. *sizeage* represents the interaction term between size and age.

(continued)

Export propensity	Douro	Wald χ^2	Pseudo R^2	Iterations
Model 1	-0.255 (-4.57)* [0.055]	50.89 (0.000)*	0.126	5
Model 2	-0.355 (-7.12)* [0.049]	49.74 (0.000)*	0.092	3
Model 3	-0.354 (-7.89)* [0.152]	52.87 (0.000)*	0.097	3
Model 4	-0.267 (-4.84)* [0.055]	51.86 (0.000)*	0.138	5
Model 5	-0.243 (-4.41)* [0.055]	54.03 (0.000)*	0.150	6
<i>Joint significance χ^2 tests</i>				
size and sizage				
age and sizage				
Model 6	-0.236 (-4.24)* [0.055]	54.47 (0.000)*	0.154	6
<i>Joint significance χ^2 tests</i>				
size and sizage				
age and sizage				

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Table IX.

This is an interesting outcome, as we find that first, among the Douro region wine firms, the firm size is an influential factor to improve the export performance. Second, the importance of size is higher for the younger firms compared to the older ones. This result is in line with [Silverman *et al.* \(2004\)](#) and [Maurel \(2009\)](#), who find that greater size is an advantage for developing the wine firms export performance.

4.2 Age

First, we focus on the tobit model estimations reported in [Table VIII](#). There is a direct univariate relationship between age and export intensity (Model 2). We find that after controlling for size and efficiency (Model 4), the significant effect of age disappears. However, in Model 5 that includes size and sizage, and Model 6 that controls for size, efficiency and sizage, the positive effect of age stays robust.

The results obtained from Models 5 and 6 indicate that the effect of age on export intensity is statistically significant at the 1 per cent level. This is examined by the joint significance *F*-test between age and sizage. The positive effect of age together with the negative effect of sizage reveal that an additional year of age yields a higher increase in export intensity for smaller firms. It is predicted that holding other factors fixed, 10 years additional age in the smallest firm (one employee) will increase the export intensity by almost 0.02 unit; however, the same additional age in a firm with 16 employees (the average firm size in the sample) will increase the export intensity by 0.004 unit. Therefore, we find that there is a positive response from the Douro region wine firms export intensity to the years of activity in the market; however, this response is higher for the smaller firms compared to the bigger ones.

The whole story is much different when we consider the export propensity. Focusing on the probit model estimations that are reported in [Table IX](#), we find that, there is no marginal effect from age to export propensity within a univariate framework (Model 2). However, when we control for size and efficiency (Model 4), we find an inverse and statistically significant marginal effect from age to export propensity. Next, we go further and we investigate the age effect within the models that account for the interaction term between size and age, sizage. In both Models 5 and 6, the signs of age and sizage are negative and their joint significance *F*-test is statistically significant at the 1 per cent level.

The results from Models 5 and 6 show that there is a negative marginal effect from age; however, this effect depends on the magnitude of size. In summary, it is predicted that holding other factors fixed, 10 years additional age in a firm with one employee will decrease the probability to export by almost 0.01 unit. However, the same additional age in a firm with 16 employees will decrease the probability to export by 0.02 unit. Therefore, we find that among the Douro region wine firms, there is a negative response from probability of export to the firm age, and this negative response is higher for the bigger firms compared to the smaller ones.

In summary, a positive relationship between age and export performance of firms is supported only for export intensity. This result is partially in line with the previous studies that underline the age as an advantage for developing export performance ([Agnihotri and Bhattacharya, 2015](#); [Kim and Hemmert, 2016](#)). We conclude that among the Port and Douro wine firms if a firm is an exporter, higher age increases its share of export; however, if it is not an exporter, then increasing age will reduce the probability to become an exporter. This can be due to the reason that the firm age can be associated to rigid thinking, inflexibility and failure to change strategy or behavior ([Love *et al.*, 2016](#)).

4.3 Efficiency

First, we focus on the tobit model estimations that are reported in [Table VIII](#). There is a direct univariate relationship between efficiency and export intensity (Model 3). At the 5 per cent level of significance, it is predicted that one unit increase in efficiency will increase the export intensity by 0.18 unit. When we control for size and age (Model 4), efficiency still has a positive effect; however, the significance level reduces to the 10 per cent. Nevertheless, when we control for size, age and sizeage (Model 6), the significant effect of efficiency disappears. Focusing on the probit model estimations that are shown in [Table IX](#), only the univariate model reveals a positive effect from efficiency to export propensity, at the 10 per cent level of significance. However, when we control for other factors (Models 5 and 6) the efficiency effect is not significant.

In summary, only the univariate estimations support the effect from the firm productive efficiency to the export performance. This is not strongly consistent with the studies that define a positive influence from efficiency to export performance ([Bigsten *et al.*, 2000](#); [Granér and Isaksson, 2007](#)).

4.4 Control variables

We find that the firms that only produce Port wine have on average higher export performance and the firms that only produce Douro wine have on average lower export performance, compared to the firms that produce both Port and Douro wines (the base group). These results are due to the greater weight of Port wine exports on total sales than Douro wine. Port wine has a long export tradition for more than two hundred years, with 85 per cent share of export to total sales, which makes the Port wine a typical case of globalization. In opposite, Douro wine is a new entrant in the international markets, with 40 per cent share of export to total sales.

5. Conclusions, implications, limitations and future research

The goal of this paper is contributing to determinants of export performance literature and providing an empirical evidence on this issue. To achieve this goal, we investigated the effect of firm characteristics on the export performance of the Portuguese wine firms. We consider Douro region, as this region has the highest wine classification in Portugal and undertakes the first position in the Portuguese wine production and export.

In this paper, we use two measurements for export performance, namely, export intensity and export propensity of the Portugal Douro region wine firms. Export intensity is the share of export to total sales of firm, and export propensity is a binary variable that takes the value one if the firm is an exporter and zero otherwise. The explanatory variables that represent firm characteristics are the size, age and productive efficiency of the Portugal Douro region wine firms. Moreover, we included two dummy variables, a dummy that takes the value one if the firm produces only Port wine and zero otherwise, and a dummy that takes the value one if the firm produces Douro wine and zero otherwise. The firms that produce both Port and Douro wines are considered as the base group. A pooling cross-sectional data set is applied, which includes 427 observations for the years 2014 and 2015. We applied the OLS regression, and the tobit and probit models for estimations.

We find that among the Douro region wine firms, first, the firm size is an influential factor to improve the export performance and the importance of size is higher for the younger firms. Second, there is a positive response from their export intensity to the firm age, and this response is higher for the smaller firms. However, there is a negative response from the probability of export to the firm age, and this negative response is higher for the bigger firms. Therefore, in Douro region, if a wine firm is an exporter, aging increases its

share of export; nonetheless, if it is not an exporter, then by growing old the probability to become an exporter diminishes. Third, only the univariate estimations support the effect from firm productive efficiency to the export performance while the effect disappears when the other factors are controlled. Moreover, the dummy variables show that the highest export performance belongs to the firms that only produce Port wine and the lowest performance belongs to the firms that only produce Douro wine.

The Portuguese Douro region wine firms to adopt the relevant strategies can use these results. Among the Douro region, wine firms, the younger ones have higher incentive to enter to international markets compared to the older ones. In addition, the younger firms export performance is more responsive to their number of employees. Therefore, new investments in the younger Douro region wine firms with the goal to increase their size would help them to enter to international markets. As a result, this will be beneficial for the Douro region local economy; it will develop the local businesses and will create new jobs.

This research and the presented results are undoubtedly under some limitations. The main limitation is about the data availability for all characteristics of the firms. There is a hesitation that in the current version some important factors that can be influential on export performance are not accounted for. In this regard, if the factors that we did not account for are correlated with both the explanatory variables and the export performance measurements, then this will lead to the endogeneity issue and biased estimations. For instance, the R&D expenditure in a firm or the quality of produced wine can have a direct correlation with the firm size/age and with the export performance, and ignoring them in the model can cause an upward bias in the estimated coefficients. However, unless we account for these factors and obtain an empirical evidence, we are not able to comment on unbiasedness of our results with certainty.

Therefore, in future analyses, indeed, it will enrich the results if we obtain the data for more factors and include them into our analyses. Moreover, in future research, it will be interesting to perform the analysis for other Portugal regions that produce wine, such as Vinho Verde, Beira Interior, Alentejo, Encostas d'Aire and many others. Finally, another interesting future research is to examine the macroeconomic-export performance relationship between the Portuguese wine firms.

Notes

1. This information is obtained from the International Organization of Vine and Wine (OIV), Elements De Conjonture Mondiale. April 2018.
2. Informa Dun & Bradstreet requested all the wine firms in Douro region to fill the financial report form; however, 60 per cent of the firms filled the forms.
3. The source of firm size classification is the Official Journal of the European Union, 2003.
4. For further discussion about this issue see [J.M., Wooldridge \(2016\)](#), 6th edition, pages 533-534.

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