Received: 1 March 2023 | Revised: 10 April 2024 | Accepted: 6 May 2024

DOI: 10.1002/agr.21947

RESEARCH ARTICLE

Agribusiness An International Journal WILEY

Determining the influence of belonging to a wine protected designation of origin on profitability

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Funding information
Patronat de Promoció Econòmica de la Diputació de Lleida

Abstract

To guide consumers, wineries need credible attributes about the quality of their wines and its origin. In Spain, protected designations of origin (PDO) guarantee that the wine has been produced in a certain wine region in accordance with specific and officially regulated quality criteria thus providing elements of guarantee to the consumer. The objective of this work is to determine whether the belonging of a winery to a PDO is positively or negatively related to profitability. This analysis is important because based on its results, managers will have more knowledge to decide whether a winery is interested in joining the regional PDO or not. We performed an empirical study using a random-effects generalized least squares regression analysis, with a sample of 1182 Spanish wineries, in which we determine the relation between belonging to eight of the major Spanish PDOs and winery profitability. The results show that wineries registered in these PDOs tend to have higher levels of profitability than wineries that have opted to remain outside, with these

Abbreviations: CNAE, National Classification of Economic Activities; EBIT, earnings before interest and taxes; GLS, generalized least squares; Ln, natural logarithm; MAPA, Spanish Ministry of Agriculture, Fisheries and Food; PDO, protected designations of origin; PGIs, protected geographical indications; ROAs, return on assets; ROIs, return on investments; ROT, return on turnover; SABI, Iberian Balance Sheet Analysis System; VIF, variance inflation factor.

differences being significant in five of the eight PDOs analyzed. Additionally, the regression model reveals a positive relationship between PDO membership and winery profitability in six of the eight PDOs. Furthermore, the findings suggest that in some of these PDOs small wineries benefit the most from being part of a PDO due to their difficulties in having a recognized brand in the market, while belonging to a PDO seems to be less useful for large wineries that have greater resources to build their own quality brand. On the basis of these findings, the wineries now have more information to decide whether to stay in the PDO, join it, or focus exclusively on developing their own brands [EconLit Citations: L15, L66, Q13].

KEYWORDS
profitability, protected designation of origin, Spanish wineries

1 | INTRODUCTION

The Spanish wine market is organized into territorial divisions known as protected designations of origin (PDO) and protected geographical indications (PGIs). Both use distinctive signs to identify the qualities of a geographical place. However, the PGI category, also known as *Vino de la Tierra*, is at a lower level than the PDO. The requirements for PGIs are less restrictive and more flexible in terms of grape varieties and production methods than for PDOs. This paper focuses on wineries' membership of a PDO (which includes Qualified Designations of Origin, Denominations of Origin, Quality Wines, and Paid Wines) because of the greater protection it offers to the consumer.

PDOs act as collective brands that provide information on themselves to the consumer before they purchase their products (Penagos-Londoño et al., 2023). In the process of selecting a product, the PDO immediately proposes a perception of the quality of the wine to the consumer (Ferreira et al., 2021; López-Bayón et al., 2020), together with data on the geographical area, the climatic zone, or the type of soil (Martínez-Arnaiz et al., 2022). In this way, the region of origin (PDO) can offer a good predictive value of the product, thus increasing consumer expectations (Ferreira et al., 2021). In addition, PDOs are characterized by their producers' commitment to certain levels of quality and quantity in production, and their adherence to strict controls. In exchange, these producers receive a series of benefits that are derived from the collective reputation of their corresponding PDOs (Livat, 2019; Lubinga et al., 2020).

The advantages of a wine market model based on PDOs are very interesting for wineries as they have a collective brand in addition to their own brand. This holds particular importance for smaller wineries who, lacking the necessary resources and economies of scale, find it more difficult to have a recognized brand in the market. The PDO seeks to ratify the quality of products marketed with the legal guarantees and prestige of a specific geographical area (Ferrer et al., 2022). However, some wineries are not in favor of the PDO concept because of the obligations it entails. For some micro wineries, the fee for PDO membership represents a cost and a disincentive, but it is also problematic for all types of wineries to be subject to the discipline of regulations that limit the commercial activity of the winery (Espejel et al., 2011; Martínez-Arnaiz et al., 2022).

The objective of this work is to analyze whether the belonging of a winery to a PDO is significantly related, positively or negatively, to profitability. To this end, we specifically analyzed the relationship between belonging to

the most important Spanish PDOs and profitability. Supposedly, belonging to a PDO boosts profitability because a collective reputation is a sign of quality that can reduce consumer perceptions of risk (Carbone, 2021; Lubinga et al., 2020), but perhaps membership of it does not influence, improve, or hinder the profitability of the winery. Knowing this circumstance is essential for the wineries, who must decide whether to join, continue, or abandon a PDO.

In the literature, there are studies on the influence of PDOs over the marketing of wine in Spain (Areta et al., 2018; De-Magistris et al., 2014; Espejel et al., 2011; García-Gallego et al., 2015). Many works emphasize that PDOs have helped to guide the strategy of Spanish wineries towards higher quality production and international recognition (Esteban & Climent, 2017; García-Gallego et al., 2015; Sellers-Rubio et al., 2021). A number of empirical studies have concluded the positive effects of belonging to a PDO due to the presumed quality attributes (Castriota, 2018; Cei et al., 2018; Sellers & Más, 2013; Spielmann & Williams, 2016). Other works, focused on the analysis of Spanish indications, show not only the solidity of Spanish PDOs, but also their drawbacks, derived from a regulatory framework that identifies them as collective brands (Martínez-Arnaiz et al., 2022). For some producers, recognizable quality limitations are perceived as a brake on the innovative claims of commercial brands, especially those whose focus is on artisanal production (Martínez-Arnaiz et al., 2022).

Considering the positive and negative influences that the fact of belonging to a PDO has on a winery, in this paper, we propose relating belonging to a PDO with the profitability of the winery. As in other studies (Aytac et al., 2020; Bava & Gromis di Trana, 2016; Leal et al., 2022), profitability is the reference value as a performance indicator that guarantees the competitiveness of the wineries, for which we first propose a Dupont analysis to analyze its components, and also a random-effects generalized least squares (GLS) regression analysis, using panel data, and considering the return on assets (ROAs) of each winery as a dependent variable. As independent variables, we considered whether or not the winery belongs to the PDO, if the winery belongs to additional PDOs, and also a set of control variables. Finally, considering that the advantages of the PDO may be greater for smaller wineries given their difficulties in establishing their own brands in the market, we also examine whether the size of the winery could be a moderator of the influence of belonging to a PDO on wineries' profitability.

The results show that, for most of the PDOs analyzed, there is a positive and significant association between PDO membership and winery profitability. Additionally, the results also show that in some cases this positive influence is higher in small wineries, suggesting that this positive effect decreases as the size of the company increases.

The remainder of this paper is structured as follows: Section 2 presents the literature review on the relationship between a PDO and its wineries' profitability. Section 3 focuses on the data sample and methodology. Section 4 presents the empirical results, and Section 5 provides a discussion and concludes the paper.

2 | LITERATURE REVIEW

In Spain, the wine sector is distinguished by a strong territorial character that is derived from economic, social, and cultural interactions within the region in which the wines are produced (Ruiz Pulpón & Cañizares Ruiz, 2022). Some studies have attempted to model the role of certain intangible attributes in the prestige and pricing of quality wines, including environmental conditions, distinctive know-how, vineyard tradition, and culture (Amadieu & Viviani, 2010; Flinzberger et al., 2022). While these are interesting factors, their combination has not permitted researchers to observe the importance and the interdependence of them in the trajectory of the wine sales figures and market prices (Martínez-Arnaiz et al., 2022). Alternatively, simply mentioning the geographical origin can summarize a set of intangible values that characterize the product and help explain the winery's position in the market (Aparicio et al., 2013). In this sense, the image of a wine region influences consumers' perceptions, so it is not surprising that the results of previous studies attribute a significant value to the "region" variable in the final price of the wine (Areta et al., 2018; Fragoso & Vieira, 2022).

Nevertheless, it is agreed that one of the most influential elements in the positioning of a wine in the market is its association with a wine region. Research has suggested that wineries within the same region experience a mutually beneficial innovation that facilitates the enhancement of skills and best practices through the utilization of existing resources and capabilities within the wine industry (Dressler, 2022). It is believed that the most thriving regions in the wine industry will promote the sales of products from wineries situated within their boundaries. Hence, various researchers have explored the connection between wineries' sales and the influence of the PDO on consumer choices. For instance, García-Gallego et al. (2015) concluded in their study that PDOs diminish consumer ambiguity and minimize product search expenses, which provides a benefit to businesses that belong to a PDO. The regional structure of the wine market is an advantage for consumers, who express strong preferences for PDOs (Olmos, 2011; García-Gallego et al., 2015), so much so that Schamel and Anderson (2003) found that consumers are willing to pay more for a differentiated, traditional and regional product.

It seems clear that the quality and characteristics of the wine are essentially due to its geographical origin, with inherent human and cultural factors; it possesses a certain quality, reputation or other specific characteristics attributable to its geographical origin; 100% of the grapes come exclusively from the geographical production area; its production takes place within the geographical area; and finally, the distillation is obtained from grape varieties belonging to *Vitis vinifera* (Aparicio et al., 2013).

Therefore, considering the distinct characteristics of geographical areas in Spain, it can be assumed that wineries' profitability can be explained by their affiliation with a PDO, since collective reputation serves as a quality indicator that diminishes consumer perception of risk (Sellers & Más, 2013). However, in the French market, there is not always a correlation between the geographical indication and the product's quality. Livat et al. (2019) concluded that the semantic distinction of the PDOs included in the large geographical area of Bordeaux is not decisive for the consumer, who prefers to be guided by price or terroir, and that the current PDOs are too numerous and complex to be useful quality signs. In the Piedmont wine region, Bava and Gromis di Trana (2016) discovered a positive and significant relationship between winery profitability and two variables: export intensity and company size. For these Italian authors, belonging to the region is not very relevant, what is important is the size of the wineries; their conclusion is that greater size, obtained through mergers and acquisitions, would allow wineries to expand their business abroad and improve profitability.

We assume the importance of the PDO in the wine sector as a collective brand. We rely on Tirole's reputation theory (Tirole, 1996), which is based on the assumption that collective reputation arises as a set of individual reputations, and there are differences regarding the incentives of individual companies to invest in establishing that collective reputation (Berríos & Saens, 2015). The main difference is that, with a private label, the winery makes investment decisions for each of the brand's products and internalizes the effect of the quality of each individual product on the reputation of the entire brand (Tirole, 1996). By contrast, in a collective brand, individual members are concerned only with the effect of their investment decisions on the value of their own product.

However, it is known that the collective brand, PDO, by itself does not guarantee the success of the winery. In a study on costs and benefits in the world of wine, Caracciolo et al. (2015) reveal that the appellation of origin or PDO does not always ensure adequate profitability for small and medium-sized producers. In fact, the demand for wine from each winery can vary across geographical locations due to the prestige and knowledge of consumers. A study of the effects of differentiation of geographic areas in two specific areas of the Italian market was undertaken by Stasi et al. (2011). They concluded that the PDOs do not guarantee adequate profitability to small producers; in both geographical areas, small wineries were inefficient in size due to the limited availability of capital and the lack of economies of scale.

Specifically, a situation of steady decline in domestic wine consumption and increasing competition in international markets has caused many wineries problems in surviving in the market, winemakers have been forced to use a strategy of collective advertising (Penagos-Londoño et al., 2023). This meant a growth in the competitiveness of the different wine-producing regions worldwide. This phenomenon has also caused the proliferation of collective brands (PDOs) and individual brands of wine that are made in different wineries

(Bernabéu et al., 2016). The growth of brands in the PDOs has not been well received by producers and could be considered as counterproductive. For this reason, although exceptional, there are some cases of abandonment of the PDO by some producers, and even the tendency of other emerging producers to not adhere to it, in an attempt to operate in their own way, taking the lead of the consolidated territorial location, but without being subject to its restrictions (Martínez-Arnaiz et al., 2022).

A paradigmatic case has been the abandonment of 9 prestigious wineries in 2019 from the PDO Cava. These wineries objected to the lack of a clear geographical delimitation of this sparkling wine, and to sharing its collective brand with numerous low-cost wineries or retailer's own brands, which harmed its prestige in national and international markets. The dissident wineries sought to delimit the geographical area and promote the excellence of sparkling wines (Kerr, 2022; Teruel et al., 2023).

Verifying whether membership of a PDO is associated with higher levels of profitability is, therefore, a crucial issue in these times of high competitiveness in the wine market. Our study aims to analyze the relationship between profitability and three characteristics of the wineries: age, size, and whether or not they belong to a PDO. The results will be useful to provide more knowledge to winemakers in crucial decision situations regarding joining, maintaining, or abandoning a PDO or not.

3 | MATERIALS AND METHODS

3.1 | Sample

The sample that was used in this study consists of a total of 1190 Spanish wineries whose data are available in the Iberian Balance Sheet Analysis System (SABI) database, which was prepared by Bureau Van Dijk, and which constitutes the main economic and financial database of Spanish companies.

To identify the wineries that belong to the 101 different Spanish PDOs (Spanish Ministry of Agriculture, Fisheries and Food [MAPA], 2023), we used the lists of registered companies provided by the Regulatory Councils of each of them. These lists were cross-checked with the SABI database. It is important to note that this database exclusively includes companies in corporate form, hence the wineries managed by self-employed individuals are not included in this study.

To analyze the influence of belonging to a PDO on profitability and considering that the influence could be different depending on the PDO, we have specifically analyzed the influence of belonging to eight of the 10 most important Spanish PDOs. Specifically, we have chosen eight of the 10 PDOs with the highest wine sales in hectoliters for the 2019–2020 season based on the data provided by MAPA (2021). These selected PDOs are Rioja, Rueda, Ribera del Duero, Valdepeñas, Valencia, La Mancha, Navarra, and Cariñena. The PDOs Cava and Cataluña, which was also among the 10 PDOs with the highest sales volume, have been excluded from this analysis. This is because in its delimited area, PDOs overlap, and most of the plots have double registration (MAPA, 2023). In the case of PDO Cataluña, it includes a wide range of diverse PDOs, such as Priorat, Empordà, Penedés, Terra Alta, and so forth. This makes it very difficult to accurately identify the influence of belonging to the PDO Cataluña. Regarding PDO Cava, in addition, we do not know whether the wineries outside the PDO produce this type of product (Cava) or not, and therefore we do not know whether they could really be associated with the PDO or not, which is a crucial aspect of our analysis.

Subsequently, to identify in the SABI database the wineries that do not belong to a PDO, we used their economic activity code according to the National Classification of Economic Activities (CNAE-2009). Specifically, we select those companies whose main activity is included in the CNAE code 1102 “Wine production” (a total of 4193 companies). Then we isolated the wineries outside the PDOs from the wineries inside the PDOs that we had previously identified using the lists of the 101 Regulatory Councils. A total of 2267 wineries not affiliated to any DOP were identified. Of these, only those wineries were selected that, due to their geographical location, could

have applied to join one of the eight DOPs, but did not do so. These are wineries that have chosen to remain outside the DOP, even though they had the opportunity to join by being located in one of the municipalities covered by each DOP.

Finally, we have narrowed down the sample by selecting only those companies for which data were available for at least 1 year during the period of 2014–2019. The study has focused on those 6 years to avoid the effects of the economic recession that was experienced in Spain during the previous years, and in order not to include the COVID pandemic that could have significantly affected the results of the wineries. This study, therefore, is framed in a context of moderate economic growth and also of Spanish wine exports, which in this period analyzed has not stopped growing (OeMv, 2018). In addition, we have eliminated from the sample the observations that could be considered atypical, in particular those corresponding to companies with negative equity, to mitigate the impact of extreme values. After applying these filters, the final sample consists of 862 wineries belonging to the selected PDOs, which represent 52% of total wineries in these PDOs,[1] including the most important wineries in each one, and 320 wineries from the same territories that have opted to remain outside from these PDOs. In our opinion it makes the sample very representative and appropriate for this study.

In Table 1, it can be seen how the wineries in the sample are distributed among the PDOs. Rioja is the PDO that contributes a greater number of wineries to the sample (309). After Rioja, the PDOs that most contribute to the sample are Ribera del Duero (259 wineries) and La Mancha (116 wineries). Then Table 1 also provides information on the distribution of wineries not registered in any PDO according to the PDO in which they could be registered according to their location. The municipalities covered by PDOs La Mancha and Rioja are where we found the most wineries not registered in the PDO (109 and 102 wineries, respectively).

3.2 | Dupont analysis

To evaluate the profitability differences between wineries inside and outside the PDO, a Dupont analysis was conducted. The Dupont model is a valuable tool in studying economic and financial performance (Burja & Mărginean, 2014). This model remains a reliable method for evaluating a company's financial performance, principally its profitability (Kim, 2016). To gain a deeper comprehension of a firm's ROA, this analysis splits it into two components: Sales margin and asset turnover. The sales margin calculation is based on earnings before interest and taxes (EBIT) divided by operating income, thus providing data on the profit produced per euro of sales. Asset turnover is determined by dividing operating income by total assets. This metric indicates the efficiency with which businesses use their assets to generate revenue.

This analysis will not only inform us about possible significant differences in ROA, but also about the origin of these differences. Essentially, the DuPont analysis will reveal whether the differences in ROA are due to differences in margin (e.g., as a result of selling at higher prices) or differences in turnover (as a result of higher sales volumes).

3.3 | Regression model

To measure the impact of belonging to a PDO and to each specific PDO on the profitability of the wineries in the sample, we have run the following regression model. Specifically, we have run this model for the whole sample and for each sub-sample.

[1]Actually, the percentage represented by the companies in the sample is higher than indicated because certain wineries are registered in multiple PDOs concurrently. However, this study has only considered them in the primary PDO since it is impossible to differentiate the resources allocated by each of these wineries to the production of wine corresponding to each PDO.

TABLE 1 Distribution of the sampled wineries according to protected designation of origin.

PDO	No. wineries in the sample	No. wineries registered in each PDO[a]	% Wineries registered in each PDO 2018/2019 (%)
Rioja			
Inside the PDO	309	773	40
Outside the PDO	102		
Rueda			
Inside the PDO	49	69	71
Outside the PDO	18		
Ribera del Duero			
Inside the PDO	259	316	82
Outside the PDO	37		
Valdepeñas			
Inside the PDO	8	20	40
Outside the PDO	23		
Valencia			
Inside the PDO	43	103	41.7
Outside the PDO	11		
La Mancha			
Inside the PDO	116	246	47.2
Outside the PDO	109		
Navarra			
Inside the PDO	54	97	55.7
Outside the PDO	7		
Cariñena			
Inside the PDO	24	35	68.6
Outside the PDO	13		
Total			
Inside a PDO	862	1659	52
Outside the PDO	320		

Abbreviation: PDO, protected designations of origin.

[a]No public list of wineries not belonging to each protected designation of origin is available.

– *Dependent variable*

As a dependent variable, we have selected the *economic profitability* using the ROAs ratio, which is calculated as the profit before interest and taxes divided by the total assets. ROA measures how the winery uses its assets to generate profits (Neves et al., 2022) and the growth of the firm (Fuertes-Callén & Cuellar-Fernández, 2019). Therefore, by using ROA, we will know whether the company is more efficient and productive over time and among the industry competitors (Wahlen et al., 2022). Due to the high availability of this variable and its informative

capacity, its use is very common in the literature when analyzing performance in any sector, including the agrifood sector (Gallizo et al., 2019; Grau & Reig, 2015), or specifically the wine sector (Bava & Gromis di Trana, 2016; Neves et al., 2022; Sellers & Alampi-Sottini, 2016; Sellers-Rubio, 2010).

– *Explicative variables*

Protected designation of origin (PDO): To determine the influence of belonging to a wine PDO on profitability, we include a dichotomous variable that takes a value of 1 when the winery belongs to the PDO and 0 if it does not.

Multiple PDO: Some wineries are associated with several collective brands following a differentiation strategy. Research conducted by Sellers and Más (2013) revealed that wineries can enhance their profitability by expanding into numerous collective brands. To determine the influence of belonging to several PDOs on profitability, we include a dichotomous variable that takes a value of 1 when the winery belongs to more than one winery and 0 if not.

– Control variables

In terms of size, we have included the *total assets* of the company. This variable has been taken in the logarithmic form to minimize the asymmetry of the variable, given its large variability. There is no clear consensus in the literature on the impact of firm size on profitability. Some authors suggest that smaller companies can adapt more easily and at lower cost to changes in demand (Olmos, 2011). In this line, Leischnig et al. (2016) found that company size negatively affects sales growth. However, a firm's size can be a source of competitive advantage as larger companies benefit from economies of scale, resulting in greater profitability (Sellers & Alampi-Sottini, 2016). Furthermore, it is worth noting that larger firms have the ability to generate asset gains and borrow debts at more favorable rates compared to smaller firms (Ibhagui & Olokoyo, 2018). Specifically, in the wine sector, previous studies, such as that of Bava and Gromis di Trana (2016), Castriota (2018), or Faria et al. (2020), identified a positive influence of size on profitability. Along the same lines, for the Spanish agrifood sector, studies such as that by Grau and Reig (2015) show that profitability is positively affected by higher levels of asset growth; therefore, we expect a positive relationship with respect to profitability from both variables.

We have also included the variable *age* of the company. The inclusion of age as a control variable is quite common in the literature (Andrés, 2014; Cabrera-Suárez & Martín-Santana, 2015; Neves et al., 2022). The age of a company has been found to be related to its reputation, strategy, and success (Esteve-Pérez et al., 2018). However, the literature has produced disparate results regarding this variable. While some authors, such as Coad et al. (2013) or Georgopoulos and Glaister (2018), found a positive effect of age on sales growth, others, such as Andrés (2014) and Rashid and Naeem (2017), found that a company's age negatively affects its performance. Neves et al. (2022) found that company age has a statistically significant positive correlation with sales growth in the wine sector. This suggests that older companies can obtain high levels of sales by exploiting the synergies and knowledge acquired throughout their lives (Gregopoulos & Glaister, 2018). However, the study also revealed a negative correlation between company age and ROA. In the Portuguese wine sector, Faria et al. (2020) show that the age of the company has a nonlinear relationship with economic performance, and Bava and Gromis di Trana (2016) did not observe any significant relationship between the age of the wineries in the Piedmont region and their return on investments, but there was a negative relationship with their return on turnover. Therefore, based on previous studies, the expected relationship, in this instance, is not clear.

Finally, we have included *leverage*, calculated as the total liability divided by the company's total assets, as a proxy for the capital structure. Previous studies found a positive relationship between debt and profitability (Ahmad & Abdul-Rahim, 2013; Ting & Lean, 2011) based on the trade-off theory (Kraus et al., 1973). However, other studies (Mamaro & Legotlo, 2020; Margaritis & Psillaki, 2010) obtained a significant and negative relationship between debt and profitability, which is in line with the hierarchical order theory. Profitable companies choose to borrow only if their capital structure is such that it allows them to obtain future profits, in accordance with the terms and conditions of their lenders (Nadaraja et al., 2011). For companies in the wine sector, due to the investment needs to modernize and access international markets, or to use winery architecture as one of the strategic leverages for providing the customer with a unique wine experience (Virtuani & Zucchella, 2016), financial debt is the instrument that allows them to increase their

level of competitiveness (Aytac et al., 2020). However, Neves et al. (2022) found that leverage negatively influences sales growth, suggesting that most indebted companies cannot increase their performance.

– Moderating variable:

PDO * LnAssets: Previous studies have shown that larger firms have greater access to external financing and are less financially constrained than smaller firms (Dalci et al., 2019). This is due to the fact that larger organizations have better resources than smaller ones, allowing them to quickly expand their business (Mubeen et al., 2021). As a result, large corporations are more prominent in business activities. Their business operations may reflect significant processes to increase production and sales, leading to greater profitability (Lee et al., 2014). Accordingly, smaller wineries with limited resources have more difficulty in establishing their own brands in the market and may, therefore, benefit more from PDO membership than larger wineries. The inclusion of this interaction term in the model implies the moderating effect of firm size on the relationship between PDO membership and profitability.

In Table 2, we present the explanatory variables employed for each model, along with their descriptions and the expected relationship with the dependent variable, that is, profitability.

Where i corresponds to the respective winery ($i = 1, 2, 3, \ldots$ total number of wineries in each subsample), t represents the period of time ($t = 2014, 2015, \ldots, 2019$); $\beta_1, \beta_2, \ldots, \beta_5$ are the parameters with which to make the estimate, and ε represents the term error.

Taking into account the available data, with a significant number of observations about different wineries over time, the relationship between the independent variables and ROA is addressed through the use of panel data methodology, which has become increasingly common in social science research (Firebaugh et al., 2013). Panel data, by blending the interindividual differences and intraindividual dynamics, have several advantages over cross-sectional or time-series data, for example, more accurate inference of model parameters and controlling the impact of omitted variables (Hsiao, 2007). To choose the most appropriate regression technique, we ran the Breusch–Pagant test for each model estimated in this paper. In all cases, this led to the rejection of the null hypothesis, indicating that the random-effects model is more suitable than Pooled Ordinary Least Squares. The estimation of these models was carried out using the statistical software package Stata 12.

TABLE 2 Explanatory variables of the model.

Variable	Description	Expected relationship
Designation of origin (PDO)	Dichotomous variable that takes the value 1 if the winery belongs to the protected designation of origin and 0 otherwise.	±
Multiple protected designations of origin	Dichotomous variable that takes the value 1 if the winery belongs to more than one protected designation of origin and 0 otherwise.	±
LnAssets	Logarithm of total assets.	+
LnAge	Logarithm of the number of years of the company since its formation.	±
Leverage	Total Liabilities/Total Assets.	±
PDO * LnAssets	PDO *Logarithm of total assets.	–

Note: According to these variables, the model takes the following form:
$ROA_{it} = \alpha + \beta_1 PDO_{it} + \beta_2 MultiplePDO_{it} + \beta_3 LnAssets_{it} + \beta_4 LnAge_{it} + \beta_5 Leverage + \beta_6 PDO{*}LnAssets_{it} + \varepsilon_{it}$.
Abbreviation: PDO, protected designations of origin.

4 | RESULTS

4.1 | Dupont analysis

Table 3 presents the average profitability levels achieved by all wineries in the sample over the entire period, as well as by wineries corresponding to each PDO and those located in the same areas that have chosen to remain outside

TABLE 3 Comparison of means of ROA, margin, and asset turnover.

		ROA		Margin		Asset turnover	
	Observations	Mean	*t*	Mean	*t*	Mean	*t*
All sample							
PDO	4498	0.0289	−10.77***	−0.0314	−5.86***	0.5623	3.04***
No PDO	1336	−0.0159		−0.2548		0.6344	
Rioja							
PDO	1666	0.0296	−4.64***	−0.0220	−1.84*	0.4690	5.19***
No PDO	443	−0.0045		−0.1543		0.5882	
Rueda							
PDO	257	0.0490	−3.34***	0.0155	−1.66*	0.4472	−2.86***
No PDO	69	0.0085		−0.2227		0.3326	
Ribera del Duero							
PDO	1347	0.0309	−2.73***	−0.0332	−1.26	0.3906	1.54
No PDO	144	0.0068		−0.1477		0.4456	
Valdepeñas							
PDO	43	−0.0104	−0.73	−0.3174	−0.93	0.4670	0.59
No PDO	96	−0.0253		−0.6335		0.5231	
Valencia							
PDO	215	0.0353	−1.41	0.0304	−3.43***	1.0874	−1.87*
No PDO	41	0.0098		−0.8261		0.6193	
La Mancha							
PDO	576	0.0266	−5.53***	−0.0309	−3.27***	1.1603	−4.83***
No PDO	462	−0.0310		−0.2748		0.7858	
Navarra							
PDO	265	0.0080	−6.82***	−0.1259	−1.38	0.4886	1.88*
No PDO	25	−0.1502		−0.4245		0.7073	
Cariñena							
PDO	129	0.0154	−0.74	−0.2396	−0.94	0.4643	3.07***
No PDO	56	0.0027		−0.0156		0.7171	

Abbreviations: PDO, protected designations of origin; ROA, return on asset.
Significance levels: 1% (***); 5% (**); 10% (*).

the PDO. The table also shows whether these differences in profitability levels between wineries inside and outside the PDO are significant or not. Additionally, in accordance with the Dupont analysis, the table decomposes these average profitability levels into their respective components. It is margin (calculated as EBIT divided by sales) and asset turnover (calculated as sales divided by total assets). This analysis determines whether the differences in profitability result from margin or turnover differences.

Table 3 shows significant differences in profitability between wineries registered in a PDO (2.89%) and wineries not registered in a PDO (−1.59%). Results also show a wide variability in the profitability of the main PDOs, which highlights the importance of the individual reputation of each of the collective brands in the marketing of the wine produced by the associated wineries. There are PDOs where the profitability of the wineries exceeds 3% and 4% on average, such as Rueda, Valencia, and Ribera del Duero, where the benefits obtained from the sale of wine in relation to their investment exceed other PDOs of international fame in the market, for example, Rioja. For wineries not registered within the PDOs, around 42% of total observations show a negative average return, and here also, the results are very variable, ranging from an average return of almost 1% for wineries outside the PDO Valencia to an average return of −15% for wineries outside the PDO Navarra.

The results show, in all cases, the existence of higher average profitability levels for wineries registered in the corresponding PDOs compared to those wineries that have opted to remain outside the PDOs. These differences are significant (at different levels) in Rioja, La Mancha, Rueda, Navarra, and Ribera del Duero. No significant differences were observed in Valdepeñas, Valencia, and Cariñena.

When the profitability of wineries is decomposed into margin and turnover, there is a certain tendency for wineries registered in the PDOs to operate with better margins than wineries that choose to remain outside the PDO. These differences in margins are statistically significant in Rioja, La Mancha, Valencia, and Rueda. In the rest, although the differences are not significant, it is also observed that the wineries registered in the PDOs operate, on average, with higher margins in almost all of them. These differences in margins suggest that the recognition of the PDO in the market allows their wines to be sold at a higher price.

In terms of asset turnover, the results are mixed, and while in some cases the wineries registered in the PDO also show significantly higher average levels (La Mancha, Rueda, and Valencia), in other cases asset turnover is higher in those wineries that have opted to remain outside the PDO (Rioja, Navarra, and Cariñena), while in other cases the differences are not statistically significant (Ribera del Duero and Valdepeñas).

Therefore, wineries that do not belong to a PDO would not be able to compete with their counterparts in terms of margins, perhaps because their wines are not as recognized by customers who prefer to pay higher prices for PDO wines. However, the lower prices charged by wineries not belonging to a PDO would allow them to compete in terms of turnover and even outperform their counterparts in this ratio in some PDOs.

4.2 | Regression

4.2.1 | Descriptive analysis

Table 4 shows the descriptive statistics corresponding to the variables of the model. It can be seen that the average profitability for the whole sample during the period 2014–2019 was 1.87%. This result confirms the low profitability of the Spanish wine sector during the analyzed period. Table 4 also shows that around 77% of the observations in the sample correspond to wineries that are registered at least in one of the eight PDOs selected for this study, while around 5.53% of the observations corresponds to wineries that are registered in more than one PDO.

We observe that the average total assets of these wineries throughout the period are around 9.46 million euros per year, although there are very important differences between wineries, as indicated by the high deviation.

TABLE 4 Descriptive statistics of the variables of the model.

	Observations	Mean	SD	Minimum	Maximum
ROA	5834	0.0187	0.1348	−2.5164	1.0675
PDO	5834	0.7711	0.4202	0	1
Multiple PDO	5834	0.0553	0.2287	0	1
Assets (th Euros)	5834	9456	33,158	0.2445	922,213
Age (years)	5834	21.67	16.81	1	130
Leverage	5834	0.5751	0.4907	0	10.29

Abbreviations: PDO, protected designations of origin; ROA, return on asset; th, thousands.

TABLE 5 Annual evolution of economic variables (2014–2019).

	2014	2015	2016	2017	2018	2019
Return on assets (ROAs)	0.0155	0.0174	0.0206	0.0240	0.0224	0.0120
Assets (th Euros)	9014	9028	9221	9705	9816	9
Leverage	0.5915	0.5895	0.5793	0.5688	0.5674	0.5558

Abbreviation: ROA, return on asset; th, thousands.

Regarding the longevity of the companies, we observe that this is close to 22 years on average, although the high dispersion shows the existence of a combination of wineries that are still young alongside wineries that already have many years of experience, some of them having over 100 years.

We also observe average levels of debt in the sector that are close to 57% of the total balance sheet. This indicates the important weight that debt has for a large part of the companies in the sector.

More information on the economic variables and the situation of the sector can be obtained from the results in Table 5, which show how the economic variables have evolved throughout the period.

With regard to the mean profitability (ROA), it is observed that the values range from 1.20% to 2.40% over the 6 years under analysis. A positive trend was observed until 2017, after which profitability declined, particularly in 2019. These findings support the obstacles faced by the Spanish wine industry to attain significant returns. In terms of size, the average assets experienced a positive trend from 9 million euros in 2014 to almost 9.9 million in 2019, with a significant increase in 2017 and remaining stable with a slightly increasing trend since then. Finally, regarding leverage, the ratio has steadily decreased from 59% in 2014 to 55.5% in 2019.

To test the multicollinearity of the model variables, Table 6 shows the correlation matrix. As shown, the correlation between the variables is generally low, and in no case would it be significant, as none of them exceed 0.50. To complement the analysis, the table also provides the variance inflation factor (VIF). We can see that the VIF is below 2 in all cases, which means that there are no multicollinearity problems, and therefore, it does not affect the identification of significant effects.

4.2.2 | Results

Table 7 displays the results of the random-effects GLS regression analysis conducted on the whole sample and on the eight PDOs. The model focuses on the economic profitability of each winery as the dependent variable, while considering whether the winery belongs to the specific PDO or not, as well as whether it also belongs to another

TABLE 6 Pairwise correlations and variance inflation factor (VIF).

	(1)	(2)	(3)	(4)	(5)	(6)	VIF
(1) ROA	1						
(2) PDO	0.1397*	1					1.12
(3) Multiple PDO	0.0376*	0.1319*	1				1.08
(4) LnAssets	0.1378*	0.3147*	0.2666*	1			1.58
(5) LnAge	0.0524*	0.1025*	0.1108*	0.4957*	1		1.33
(6) Leverage	−0.2625*	−0.1299*	−0.0476*	−0.2300*	−0.1198*	1	1.06
						Mean VIF	1.24

Abbreviations: PDO, protected designations of origin; ROA, return on asset.

*$p < 0.05$.

PDO, as independent variables. Additionally, the study incorporates total assets and age of the winery as control variables, along with a moderating variable that explores the interaction effect between the winery's size and its belonging to the specific PDO.

The results indicate a positive association between PDO membership and winery profitability for the entire sample. Specifically, this is observed for six of the eight PDOs analyzed in this study. For Rioja, Ribera del Duero, Valencia, and La Mancha, the association is highly significant (1% significance), but also significant (5% significance) for PDO Navarra and to a lesser extent (10% significance) for PDO Cariñena. However, for Rueda and Valdepeñas, we did not find a significant relationship between PDO membership and winery profitability.

The positive effect of PDO membership observed in most of the models is in line with previous studies, which obtained results showing that the different brand values associated with different PDOs are consistent with the importance of the provenance effect in price formation (Pennerstorfer et al., 2019).

Despite the results indicating a positive association between PDO membership and profitability for most of the cases studied, the variable that interacts PDO membership with winery size indicates a negative association between PDO membership and winery profitability as winery size increases for the whole sample and also for some of the PDOs studied. This relationship is statistically significant (at a 1% level of significance) for the whole sample but also particularly in Rioja, Ribera del Duero, Valencia, La Mancha, and to a lesser extent (at 10% significance) for PDO Cariñena. This result, therefore, suggests that for these PDOs, the positive effect of PDO membership is greater for smaller wineries, while membership would be less beneficial for larger wineries. However, in the cases of Rueda, Valdepeñas, and Navarra, winery size is not observed to influence the effect of PDO membership on winery profitability.

As for the winery also belonging to other PDOs, in this case, the results have not shown the existence of significant relationships for any of the estimated models, so it seems that belonging to additional PDOs would not influence the winery's profitability levels in a significant way.

Regarding the predictive capacity of the models, it is important to note that although the adjusted R^2 value is low but acceptable for most of the models (most values fall between 0.1 and 0.25), it is very low for Ribera del Duero (0.074), which indicates that, for this PDO, profitability is even more dependent on variables not included in the model than on belonging to a PDO. Therefore, it is important to exercise caution when interpreting the results of this model, as it may not be entirely reliable, despite indicating similar results to the other PDOs.

An extension of our main objective is to test the influence of control variables on profitability. Our results show that as the size of the company increases, its profitability will be higher in most of the PDOs. Specifically, the results show a statistically significant influence of the size of the wineries on their profitability in 5 PDOs. As such, it can be inferred that in PDOs Rioja, Ribera del Duero, Valencia, and La Mancha, and to a lesser extent Valdepeñas, the level

TABLE 7 Results of random-effects GLS regressions.

	All sample		Rioja		Rueda		Ribera del Duero		Valdepeñas	
ROA	**Coefficient**	***Z***	**Coefficient**	***Z***	**Coefficient**	***Z***	**Coefficient**	***Z***	**Coefficient**	***Z***
Constant	−0.149	−7.19	−0.200	−4.83	0.008	0.16	−0.045	−1.30	−0.352	−3.98
PDO	0.233	9.06***	0.276	5.45***	−0.001	−0.02	0.127	3.13***	0.235	1.26
Multiple PDO	0.009	0.52	0.022	0.57	−0.026	−0.57	0.015	0.77	0.022	0.24
LnAssets	0.032	10.22***	0.039	6.36***	0.004	0.46	0.016	2.84***	0.017	1.65*
LnAge	−0.004	−1.05	0.001	0.13	−0.003	−0.27	0.001	0.10	0.066	3.90***
Leverage	−0.094	−18.87***	−0.110	−13.44***	−0.051	−2.71***	−0.080	−7.89***	−0.032	1.49
PDO * LnAssets	−0.031	−8.57***	−0.039	−5.37***	0.005	0.55	−0.017	−2.80***	−0.043	−1.91
No. observations	5834		2109		323		1491		139	
R^2 adjusted	0.1284		0.1501		0.1979		0.074		0.2011	
χ^2	574.13***		255.38***		15.02**		88.87***		22.41***	

	Valencia		La Mancha		Navarra		Cariñena	
ROA	**Coefficient**	***Z***	**Coefficient**	***Z***	**Coefficient**	***Z***	**Coefficient**	***Z***
Constant	−0.377	−3.00	−0.179	−4.64	−0.352	−2.82	−0.072	−1.25
PDO	0.638	4.54***	0.258	5.11***	0.319	2.35**	0.138	1.87*
Multiple PDO	−0.030	−0.36	0.016	0.35	−0.022	−0.44	0.040	0.91
LnAssets	0.115	6.00***	0.036	6.12***	0.016	1.19	0.005	0.54
LnAge	−0.052	−2.90***	−0.010	−1.20	0.019	1.21	0.001	0.10
Leverage	−0.242	−7.03***	−0.073	−6.53***	0.007	0.48	−0.164	−7.15***
PDO * LnAssets	−0.108	−5.14***	−0.033	−4.76***	−0.019	−1.13	−0.016	−1.65*
No. observations	256		1038		290		185	

TABLE 7 (Continued)

ROA	Valencia		La Mancha		Navarra		Cariñena	
	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z
R^2 adjusted	0.4615		0.1206		0.1323		0.2595	
χ^2	136.44***		109.11***		18.37***		62.61*	

Abbreviations: GLS, generalized least squares; PDO, protected designations of origin; ROA, return on asset.

Significance levels: 1% (***); 5% (**); 10% (*).

of profitability of the wineries increases with the size of the winery. In particular, it appears that the size of the firm explains the individual reputation of the winery, and so larger companies have greater financial resources and can sustain high investments. A larger dimension allows the winery to have facilities for aging wine and investments in R&D, quality, and advertising, to facilitate the introduction of its product into the market (Castriota, 2018). Our results agree with those obtained in the work of Sellers and Alampi-Sottini (2016), where it was found that economies of scale exist in wineries in that as the size of the winery increases, unit production costs decrease.

Regarding leverage, we found a negative and significant association (at a 1% significance level) for both the entire sample and six out of the eight PDOs analyzed individually. Only in Valdepeñas and Navarra did we not observe a significant relationship. This negative association is consistent with the results of Neves et al. (2022), who found that leverage has a negative impact on sales growth in Iberian wineries, such that the most indebted wineries are unable to increase their performance. The authors suggest that the external stakeholders of this type of company recognize that an indebted company has high financial risks, and this can mortgage its performance.

Finally, regarding the influence of the winery's age on profitability, the results do not show a clear consensus. We did not find a significant association between age and profitability for the whole sample. When examining each PDO separately, we found a negative and significant influence (at 1%) in PDO Valencia but also a positive and significant association (at 1%) in PDO Valdepeñas. Therefore, we conclude that the history and experience of the winery do not always help achieve greater profitability in the market.

5 | DISCUSSION AND CONCLUSIONS

This study has been carried out on PDOs and their wineries in the Spanish wine sector, and the results reveal the maturity of a market based on geographical location. The production and sales strategies implemented by the PDOs have been largely effective. Notably, these strategies have established wine references while ensuring consistency of wine quality, thereby preserving their unique territorial identity (Spanish Ministry of Agriculture, Fishing and Food, 2022). However, it is worth noting that PDOs require strict governing bodies with rigid regulatory frameworks that have clashed with the new and growing aspirations of winemakers and consumers (Martínez-Arnaiz et al., 2022). Given this contrast, we wanted to analyze whether there is a relationship between belonging to a PDO and the economic profitability of the winery. How does it impact? The empirical findings indicate that, in the majority of cases, winery profitability is positively associated with PDO membership. The positive effect of belonging to a PDO observed in most of the models is in line with previous studies that obtained results showing that the different brand values associated with different PDOs are consistent with the importance of the origin effect in price formation (Pennerstorfer et al., 2019).

When analyzing the wineries' profitability in terms of margin and turnover, a clear trend emerges showing that wineries registered in the appellations have better margins than wineries not registered in the appellations. This indicates that by maintaining the same cost structure, the recognition of the PDO in the market allows them to sell at higher prices. This result is consistent with Seccia et al. (2017), which identified the geographical indication or PDO as one of the main attributes of wine price variability. However, the same cannot be said for asset turnover, in which case the results are not homogeneous across PDOs. Furthermore, sometimes the differences are not significant, and besides, even wineries outside the PDO achieve better values for this ratio. Thus, belonging or not belonging to a PDO does not seem to be so determinant when we look at the turnover ratio of investments in assets. This means that although the relative sales figure does not significantly increase due to PDO membership, wineries can sell their products at higher margins, resulting in greater economic profitability.

Although the results show a positive association between PDO membership and profitability in the majority of cases studied, the variable that interacts PDO membership with winery size shows a negative association for some PDOs. Small wineries benefit from joining a PDO, as consumers easily recognize the brand. This is the most effective way for small firms to enter the market and leverage their collective reputation (Marchini et al., 2014).

The results of this empirical study can potentially have repercussions of economic and commercial impact since, based on our results, the wineries belonging to a PDO will have to decide whether or not to maintain their permanence in their particular PDO or, on the contrary, aim at developing their own exclusive brands. Likewise, new wineries considering joining a PDO will have to consider the advantages and drawbacks of belonging to a PDO or not. This analysis is also of interest to the regulatory council of each PDO, which, where appropriate, may review the restrictions that are imposed by its internal regulations and which may affect the survival of its associated wineries.

In short, the present study has implications for the wine market that would affect the position of PDOs and the strategy of wineries. These findings are consistent with the conclusions drawn.

Although our results are promising, there are limitations to our study. We were able to examine the production and turnover values of each winery in monetary terms, but we were unable to access data in physical units (liters of wine). Due to the lack of this information, we cannot calculate the unit costs and unit prices of each winery, which would have enabled us to better analyze whether the differences between wineries are based on cost or premium pricing. An additional issue with this study is that, as was mentioned before, the pseudo-R^2 for the estimated models is approximately 10%–25%. Despite this low explanatory power being typical for this type of research, it implies that there are additional omitted variables that are even more important for explaining the economic profitability of these wineries. Further research in this area is needed to identify what other factors influence their profitability and, in this way, contrast the robustness of our results.

ACKNOWLEDGMENTS

This research has received financial support from the Patronat de Promoció Econòmica of the Diputació de Lleida.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data used in this study is derived from public domain resources and the SABI database, and it is available upon request.

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PEER REVIEW

The peer review history for this article is available at https://www.webofscience.com/api/gateway/wos/peer-review/10.1002/agr.21947.

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How to cite this article: Jordi Gené, J., Jordi Puiggené, S., & Gallizo Larraz, J. L. (2024). Determining the influence of belonging to a wine protected designation of origin on profitability. *Agribusiness*, 1. https://doi.org/10.1002/agr.21947