

## ***In vino veritas: competitive factors in wine-producing industrial districts***

María Jesús Ruiz Fuensanta \*, Francesc Hernández Sancho \*\*,  
Vicent Soler i Marco \*\*\*

**ABSTRACT:** The wine sector holds a prominent place within the whole Spanish food and agriculture industry. The importance given to this activity has also been transferred to the international market where Spain holds a position of leadership, both in terms of production as in overseas sales. A large number of the wine-producing firms in our country are located in industrial districts, which is to say in geographical areas characterised by a high concentration of small and medium-sized companies whose productive organisation corresponds to a model based on flexible specialisation. In previous papers, it has been possible to verify how wine-producing industries located in industrial areas show greater efficiency in relation to rivals located in other types of environments. The aim of this article is to further research on the specific features of industrial districts which could explain their firms' increase in efficiency. For the identification and quantification of these determining factors affecting productive efficiency, a methodology based on parametric adjustments models is to be used. An empirical application is to be carried out on a sample of Spanish wine producers for the years 2000 and 2010, extracted from the SABI database.

**JEL Classification:** D20; L66; R10

**Keywords:** Industrial districts; Productive efficiency; wine sector.

---

\* Department of International and Spanish Economy, Econometrics and History and Economic Institutions. Faculty of Law and Social Sciences. University of Castilla La Mancha. Ronda de Toledo, s/n. 13071 Ciudad Real. Tel: +34 926295300 Ext. 3585. Fax: +34 926295407. Email: [MariaJesus.Ruiz@uclm.es](mailto:MariaJesus.Ruiz@uclm.es).

\*\* Department of Applied Economics II. Faculty of Economics. University of Valencia. Campus dels Tarongers. Av. Tarongers, s/n. 46022. Valencia. Tel: +34 963828349. Fax: +34 963828354. Email: [Francesc.Hernandez@uv.es](mailto:Francesc.Hernandez@uv.es).

\*\*\* Department of Applied Economics II. Faculty of Economics. University of Valencia. Campus dels Tarongers. Av. Tarongers, s/n. 46022. Valencia. Tel: +34 963828349. Fax: +34 963828354. Email: [Vicent.Soler@uv.es](mailto:Vicent.Soler@uv.es).

*Received: 02 july 2015 / Accepted: 10 august 2015.*

## ***In vino veritas: factores competitivos en distritos industriales productores de vino***

**RESUMEN:** El sector vitivinícola ocupa una destacada posición en el conjunto de la industria agroalimentaria española. La importancia demostrada por esta actividad se traslada también al mercado internacional donde España ostenta una posición de liderazgo tanto en términos de producción, como de ventas al exterior. Buena parte de las empresas elaboradoras de vino de nuestro país se ubican en distritos industriales, o lo que es lo mismo, en entornos geográficos caracterizados por la elevada concentración de pequeñas y medianas empresas cuya organización productiva responde a un esquema basado en la especialización flexible. En anteriores trabajos, se ha podido constatar cómo las empresas elaboradoras de vino ubicadas en este tipo de enclaves industriales presentan una mayor eficiencia respecto de competidores localizados en otro tipo de entornos. El objetivo de este artículo es profundizar en la investigación de los rasgos específicos de los distritos industriales que podrían explicar este plus de eficiencia de sus empresas. Para la identificación y cuantificación de estos factores determinantes de la eficiencia productiva se utiliza una metodología basada en modelos de ajuste paramétrico. Se lleva a cabo una aplicación empírica sobre una muestra de empresas españolas productoras de vino para los años 2000 y 2010, extraída de la base de datos SABI.

**Clasificación JEL:** D20; L66; R10.

**Palabras clave:** distritos industriales; eficiencia productiva; sector del vino.

### **1. Introduction**

The food and agriculture industry has always formed, and still forms today, a prominent part of the Spanish production structure. Within this, one of the most relevant activities is wine-making. This is not without reason, according to data from the International Organisation of Vine and Wine (OIV), Spain is the country with the greatest expanse of vineyards in the world, with 945,727 hectares allocated to vine cultivation in 2013, despite having experienced a progressive decrease in the cultivated area since 2004. This area is distributed throughout the seventeen autonomous communities, although this is not uniform. The region of Castilla-La Mancha stands out in particular, as it accumulates 49% of the total national area, and has thus become the geographical area with the largest area allocated to this type of cultivation in the world.

In line with the above, Spain is also ranked among the top positions in international wine production. Specifically, according to data published by the Spanish Agricultural Guarantee Fund (Fondo Español de Garantía Agraria, FEGA) our country became the first wine producer in the world for the first time in 2013, with a combined production of wine and must of 52.6 million hectolitres, representing an increase of 53.7% in relation to that obtained during the 2012/2103 season, compared with Italy's 44.9 million and France's 42.3 million. Moreover, the majority

of national production is set aside for export, making this sector a valuable positive contribution to the balance of our balance of trade. In fact, according to information provided by the Institute of Foreign Trade (Instituto de Comercio Exterior, ICEX) Spain was the second country in terms of the number of litres of wine exported during 2013. However, when considering the value of exports, Spain was relegated to third position behind France and Italy. This figure indicates the low average selling price of Spanish wine, despite the fact that in that year there was a simultaneous decrease in the volume of wine exported and an increase in the value of exports, showing the increase in the price per litre of wine sold on the international market. It is not for nothing, the sales of wine with protected designations of origin that year experienced an increase in exports, both in volume and value.

The production of wine in our country is elaborated in the 4600 wineries (according to data from the Spanish Institute for Foreign Trade (Instituto Español de Comercio Exterior, ICEX) which are distributed throughout the national territory. It is a sector in which there is generally a predominance of small, family-owned companies and where a strong presence of the phenomenon of cooperativism can also be detected.

Due to all the above, the wine industry is not only important in terms of GVA and national employment, but it also plays a strategic role in local development. It is a manufacturing activity that is rooted in the tradition and culture of many territories, where it sometimes constitutes the local community's main source of income, in a direct way through the cultivation of the vine and its transformation into wine, and indirectly through the emergence of auxiliary industries and complementary services, such as the growing rise of Enotourism.

This paper aims to investigate the factors that influence the productive efficiency of Spanish firms dedicated to the production of wine related products. To do this, we will start with technical efficiency indexes taken from a previous paper (Hernández *et al.*, 2013) by means of the application of nonparametric methods on a sample of Spanish wineries. In that paper, the carrying out of a series of preliminary tests on the indices calculated indicated the existence of differences in efficiency based on whether or not the winery was located in an industrial district. For this reason, the aim of the present paper is to further the study of such divergences, trying to identify the specific aspects that could explain the differences in efficient performance between firms, and whether this identification allows the influence of the «district-effect» (Hernandez and Soler, 2003).

In the following section, we will precisely explore the determinants of business efficiency in greater depth, placing special emphasis on the influence of territorial externalities and their connection with the efficient performance of wine firms. In the third section, the model used for the empirical analysis is presented, while in the fourth part a description of the variables and the sample used in the estimation is given. The empirical approach and the results of the estimation are described in the fifth and sixth sections respectively. Finally, some brief conclusions are presented.

## 2. Territorial externalities in the wine sector

Closely related to agriculture, the origin of the wine industry goes so far back in time that today it is deeply rooted in the territory in which it is developed, in a way that a great part of the socioeconomic life of that territory revolves around it. In those days, it was often the vine growers themselves who started to carry out the first transformation of grapes taken from their crops and, sometimes, also from other neighbouring farmers. However, there were also those who only worked in the elaboration process, buying the raw material from farmers in the area. There were even certain villages in which the inhabitants produced the wine together, later sharing the wine obtained according to the volume of grapes brought by each person (Pan-Montojo, 2001). In this custom, the origin of two of the features of the current wine industry can be seen with a clear influence on the efficiency of firms in the sector: the emergence of horizontal organisation for production activity, and cooperation for carrying out certain activities.

In connection with the first of these features, it should be mentioned that the progressive development of the wine industry in a specific territory generally leads to the proliferation of companies belonging to auxiliary industries and production services, resulting in the formation of authentic agro-industrial districts.

According to the classical definition, the Marshallian industrial district is a «socio-territorial entity which is characterised by the active presence of both a community of people and a population of firms in one naturally and historically bounded area» (Becattini, 1990). The express mention made in this definition of the social community that lives in the district precisely underlines the fact that the Marshallian industrial district is something more than a simple business cluster based on the existence of locational advantages. The Marshallian industrial district enjoys the mark that is left by the historical development of a manufacturing activity which has become the centre of the local productive environment, and, by extension, is also the epicentre of the area's social progression. Specifically, the industrial district is characterised by gathering a significant number of small and medium-sized companies within its territorial limits which specialise in one or several of the phases into which the productive process of the activity which makes up the district's main industry can be separated (Dei Ottati, 2003; Sforzi, 2003).

By extension, according to Iacoponi (1990), the agro-industrial district would be that in which the production activity developed in the local environment contains all the phases of agribusiness; therefore including the suppliers of agriculture companies, the companies themselves and also the companies engaged in the transformation and distribution of products from agriculture.

This particular way of organising the production activity and the cooperative and competitive relationships which are initiated between the economic agents residing in the district are the origin of some competitive advantages that can only be enjoyed by companies located within the district and which logically have become superior performers in relation to companies located outside of it. In particular, the socio-ter-

ritorial support of the population of local companies allows solid bonds of trust to be generated, which favour the formal and informal diffusion of knowledge (Sengenberger and Pyke, 1992; Bellandi, 1996; Hernandez *et al.*, 2012).

In addition to the historical development itself, over the last few years, the management derived from the Designations of Origin has contributed to strengthening wine firms' connection to the territory, due to the obligation to use raw materials of a given origin and carry out certain phases of the production process in the specific geographical area (Sánchez, 2003).

Due to this strong link between the territory and wine firms, it is foreseeable that the characteristics and circumstances of the local environment in which these firms develop their activity have a significant influence on the performance of the firm and, in particular, on its productive efficiency (Hernández and Soler, 2003, 2008; Vidal *et al.*, 2013; Aparicio *et al.*, 2015). Other authors, (Capello, 2009; Fusco and Vidoli, 2013) points out that the territories are a source of economic advantages or disadvantages, which range from the mere availability of productive factors to the existence of raw materials and whether the area can be more or less easily accessed. Of equal importance, especially in the case of industrial districts, are the externalities of knowledge and opportunities for learning which may arise in the local productive environment as a result of the formal and informal relationships that are initiated between the agents that live and work within it (Sorensen, 2002). Tacit knowledge derived from the specific nature of each geographical environment and local practices is especially relevant for the performance of modern wine production (Turner, 2010; Outreville, 2015).

All these territorial characteristics join the features of the firms to determine their productive efficiency. In this sense, it is important to note that the wine sector has not stayed on the sidelines of the process of innovation and technological modernisation that Spanish industry has experienced during the last few decades. In this way, they have incorporated process and product improvements, such as the use of remote sensing in the regulation of soil characteristics or the use of yeasts selected, and on occasions genetically improved, during the fermentation process of the wine. These advances undoubtedly contribute to improving the efficiency of wineries, although incorporating them into their production processes is inevitably determined by the availability of financial and human resources. Ultimately, physical capital intensity can be considered to be an approximation of the specific knowledge of the activity developed by the firm, which is found to be incorporated into the machinery and equipment used in the production process (Wu *et al.*, 2007).

Furthermore, innovation in the wine sector is transferred not only to the manufacturing process and variety of products, but also to the way of organising and managing the activity (Cusmano *et al.*, 2010; Castillo-Valero *et al.*, 2013; Simon-Elorz *et al.*, 2015).

In this paper, we aim to precisely analyse the influence that a selection of factors from the firm and environment have on Spanish wineries. The description of the model used for this is made in the following section.

### 3. Description of the model

Among the strategic objectives of any firm, is clearly the one which concerns the progressive improvement of the firm's productive efficiency until it is able to position itself, at a given time, on the line establishing the production boundary. Nevertheless, there are factors such as technological rigidities, inertia, resource constraints and institutional regulations and controls that will make it difficult for the firm to immediately reach its full efficiency (Gujarati, 1995). Therefore, change in the real value of a firm's technical efficiency in a certain period will not be total, but rather partially adjusted to the desired value. For this reason, the suggested equation takes the form of a partial adjustment model:

$$TE_{i,t} - TE_{i,t-1} = \delta_i (TE_{i,t}^* - TE_{i,t-1}) \quad (1)$$

in which  $TE_{it}$  is the observed value of technical efficiency<sup>1</sup> for firm  $i$  in the period  $t$ ,  $TE_{i,t-1}$  is the value for the previous period,  $TE_{it}^*$  is the desired value (target) for efficiency and  $\delta_i$  is the speed of adjustment. This last value represents the rate of convergence of the firm's real efficiency to its desired value and its value should fall between 0 and 1. The extreme case in which the speed of adjustment is zero means that real efficiency in the period  $t$  is equal to the efficiency obtained in the previous period ( $t-1$ ). The opposite extreme in which the speed of adjustment is equal to one means that real efficiency in the period  $t$  has completely met the desired value. Consequently, if it is observed that  $\delta_i < 1$  then there is a partial adjustment between the degree of technical efficiency from the period  $t - 1$  to the period  $t$ . However, if  $\delta_i > 1$  then there is an over-adjustment in the target value of technical efficiency. This over-adjustment can be a reflection of unforeseen changes in the economic conditions (Löf, 2004).

Equation (1) can be reformulated in the following way:

$$TE_{i,t} = \delta_i TE_{i,t}^* + (1 - \delta) TE_{i,t-1} \quad (2)$$

---

<sup>1</sup> From a productive point of view, the term efficiency is associated with a rational use of available resources. It is used to describe production processes that employ all production factors optimally in accordance with the existing technology. Farrell (1957) became a pioneer in the study of the frontier functions used as referents to obtain measures of efficiency for each unit of production. This method of analysis represents the origin of what is known in the economic literature as Data Envelopment Analysis (DEA) models. According that, a frontier of best practices is made up of the most efficient firms in the sample and obtained by using linear programming techniques. Consequently, when a firm obtains the maximum output from a given vector of inputs, or uses minimum inputs to produce a given output, it will be located on the so-called production frontier. The technical efficiency of a firm can be measured by calculating the maximum proportional reduction possible in the use of factors that is compatible with maintaining its level of output. An efficient behaviour would mean that it is impossible to reduce these inputs, while inefficiency would mean opportunities to minimise inputs. If the efficiency index is equal to 1, the firm is considered technically efficient, while if it is less than 1, then the firm is inefficient —meaning that other firms may be able to produce the same output with fewer inputs.

Given that the target value of technical efficiency  $TE_{it}^*$  will be dependent on a certain combination of factors, the previous equation can be expressed as:

$$TE_{i,t} = \delta_i f(X_{i,t}; \beta_i) + (1 - \delta) TE_{i,t-1} \quad (3)$$

where  $X_{it}$  is a set of variables capable of determining the development of the technical efficiency of wine firms, among which are the firm's internal characteristics and the features of the local environment in which the wineries develop their activity.

#### 4. Variables and sample

The variables proposed to be included in the model as firm-specific variables capable of influencing the firm are: size (*Size*), age (*Age*), endowment of physical capital (*StockK/L*), level of debt (*Leverage*) and legal form represented through two fictitious variables, one which indicates whether the winery is a joint stock company and another which represents wine cooperatives.

On the other hand, those that are included as features of the environment in which the winery develops its activity are, firstly, the level of human capital, whose influence on the efficiency of the firm is collected through two variables, *KHext* and *KHint*, representative of the quantity and quality and the human capital respectively. Together with these, two variables are also incorporated which measure the intensity of the presence of agricultural and industrial establishments in the territory (*Densagr* and *Densind*). The greater the density of the network of establishments dedicated to each of these activities, the greater the potential for the creation of networks that facilitate the diffusion relevant information and knowledge. For its part, the variable *Reemp* represents the existing relationship between the number of older employees in relation to the young people who have been incorporated into the labour market. Therefore, this variable makes it possible to approximate the local environment's internal capacity to generate a workforce which is capable of replacing the current population of employees in the medium term, and with this, to maintain the tacit knowledge produced in the heart of the municipality. Finally, the variable *Habitat* symbolises the living conditions in the local environment. The specific definitions of the variables included in the model are compiled in Table 1.

The data used in the analysis has been taken from the Iberian Balance Sheet Analysis System (Sistema de Análisis de Balances Ibéricos, SABI). This is a database that contains information from the Business Register, relating to the balance sheets and profit and loss accounts of more than 1.2 million Spanish firms and 400,000 Portuguese firms. Concretely, the selection of the firms for the sample has been carried out by basically combining two essential criteria, as well as that which relates to location in Spain. Firstly, the main activity of the firm should correspond to *Code 1593 (Wine elaboration)* in accordance with CNAE-93. Moreover, the firm should have complete information for 2000 to 2010, the years that are referred to in the analysis carried out. After eliminating cases that presented anomalies or incongruences, the combination

of the two criteria resulted in obtaining a sample made up of 731 wineries. The data relating to the conditions of the local environment in which the wineries develop their activity have essentially been taken from the 2001 Population Census produced by the National Institute of Statistics (Instituto Nacional de Estadística, INE).

**Table 1.** Description of variables

<i>Variable</i>	<i>Description</i>	<i>Source</i>
$TE_1$	Technical efficiency for 2010	(Hernández <i>et al.</i> , 2013)
$TE_0$	Technical efficiency for 2000	(Hernández <i>et al.</i> , 2013)
$DIM$	Fictitious variable which takes the value of 1 if the LLMA has the features of an industrial district.	(Boix and Galletto, 2006)
<i>Size</i>	Size of the firm	SABI
<i>Age</i>	Age of the firm	SABI
<i>Coop</i>	Fictitious variable which takes the value of 1 if the firm is a cooperative	SABI
<i>SA</i>	Fictitious variable which takes the value of 1 if the firm is a joint stock company	SABI
<i>Leverage</i>	Level of debt	SABI
<i>StockK/L</i>	Ratio of physical capital to employee	SABI
<i>KHint</i>	Level of education index (Pob 30-39)	Censo de Población, 2001. INE.
<i>KHext</i>	% of the population taking post-compulsory studies	Censo de Población, 2001. INE.
<i>Densind</i>	No. of industrial firms per 1000 inhabitants	Censo de Población, 2001. INE.
<i>Densagr</i>	No. of agricultural firms per 1000 inhabitants	Censo de Población, 2001. INE.
<i>Reemp</i>	Ratio of the population between the ages of 55 and 59 to that between the ages of 20 and 24 resident in the municipality	Censo de Población, 2001. INE.
<i>Habit</i>	Habitability index for the municipality	Censo de Población, 2001. INE.
$Region_j$	Fictitious variable that takes the value of 1 if the firm is located in the autonomous community (reference region, Catalonia)	

## 5. Empirical approach

As was pointed out in the introduction to this paper, one of the aims of our research is to try to explain the existence of differences in the efficient performance of firms in the wine sector, taking into account whether or not they are located in a territory with the characteristics of an industrial district, according to the Marshall-Becattini definition of the concept. To do this, it is necessary to carry out or previously have obtained a geographical delimitation of these districts. In this study, the map of industrial

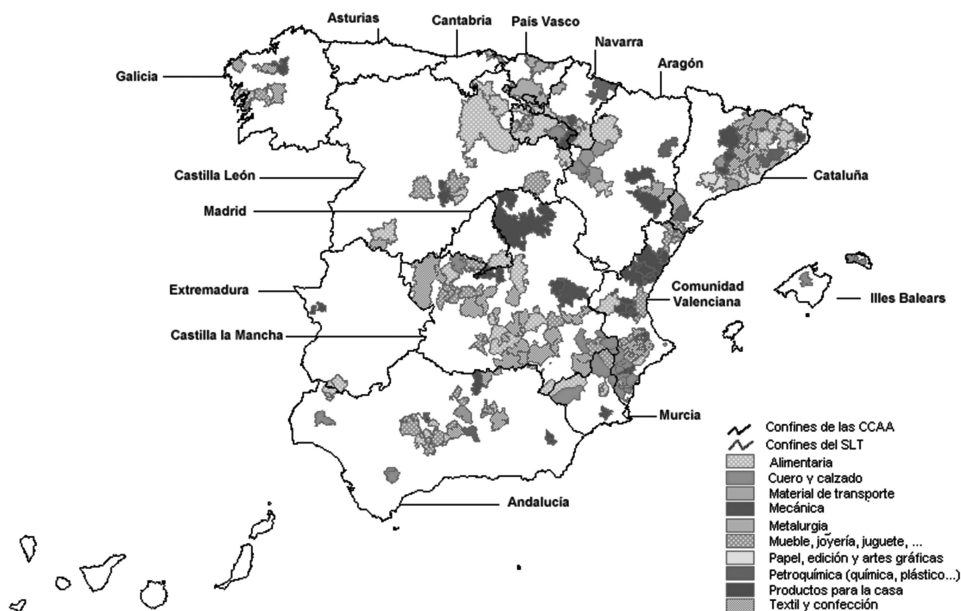


districts in Spain, developed by Boix and Galletto (2004, 2006) and Boix and Trullén (2011), following the methodology used by the Italian National Institute of Statistics (Istituto Nazionale di Statistica: ISTAT, 1997; 2005) will be taken as a reference.

This is made up of two stages: firstly, they proceed to identify the local labour market areas (LLMAs) which will be used as reference points of geographical units. Once this has been done, the identification of potential industrial districts is carried out through a procedure consisting in the calculation of a series of nested indicators of concentration. Thus, first of all, the LLMAs that are specialized in the manufacturing industry are identified. From these, those characterised by a predominance of small and medium-sized firms are selected. Next, the main industry in each SME manufacturing LLMA are determined and, finally, whether or not the majority of work corresponding to the industrial district is concentrated in small and medium companies is verified.

Due to the application of this methodological framework, and using data from the Census and from the Central Business Register (Directorio Central de Empresas - DIRCE) developed by the INE, Boix and Galletto (2004) identify 237 industrial districts (Figure 1) which are reduced to 205 in the second version of the map (Boix and Galletto 2006; Boix and Trullén 2011). The autonomous regions with the greatest number of districts are Valencia (54 districts), Castilla-La-Mancha (44 districts) and Catalonia (35 districts).

**Figure 1.** Map of the Spanish Industrial Districts. 2001



Source: Boix and Galletto (2004).

Given that the location of the municipality logically appears in the data provided by SABI, it has been possible to assign each firm in the sample to a specific LLMA, and by extension, identify which firms in our sample are located in LLMA that meet the basic preconditions to be considered industrial districts.

Some of these industrial districts coincide precisely with geographical environments with a long tradition in the wine industry in our country and whose production enjoys the protection and guarantee that a Designation of Origin (D.O.) provides. This is the case of the Haro and Logroño districts, which are made up of territories from the autonomous communities of La Rioja and the Basque Country, the Villafranca del Penedés and Sant Sadurni d'Anoia districts in Catalonia and the industrial districts of Manzanares, Tomelloso and Villarrobledo in Castilla-La Mancha, which fit within the D.O. Wines of La Mancha, and that of Valdepeñas, which is assigned to the D.O. of the same name. However, we also find LLMA specialised in the wine industry that, nonetheless, present a form of industrial organisation that is different from that of the district, such as the LLMA of Aranda de Duero and Toro in Castilla-León, and that of Jerez de la Frontera in Andalucía, all of which are also protected by a D.O.

This leads us to wonder if wine companies located in industrial districts exhibit a superior performance as compared to those located in other production environments. For our sample, we find that the 376 firms located in industrial districts have an average technical efficiency higher than the value corresponding to wine firms located in other LLMA (Table 2). This encourages us to investigate the existence of a district effect also for the wine industry. The results obtained are presented in the next section.

**Table 2.** Average technical efficiency by type of LLMA

	$TE_0$	$TE_1$
District average (376 firms)	0.4038	0.4260
Non-district average (355 firms)	0.3765	0.4031
Total sample	0.3905	0.4148

## 6. Results

In order to investigate the factors that can influence the efficiency of wineries we estimated the following model described in Section 3:

$$\begin{aligned}
 TE_i^1 = & \alpha_0 + \lambda TE_i^0 + \beta_1 DIM_i + \beta_2 Size_i + \beta_3 Age_i + \beta_4 Coop_i + \beta_5 SA_i + \beta_6 Leverage_i \\
 & + \beta_7 StockKIL_i + \beta_8 KHint_j + \beta_9 KHext_j + \beta_{10} Densind_j \\
 & + \beta_{11} Densagr_j + \beta_{12} Reemp_j + \beta_{13} Habit_j + \sum_{n=1}^{n=16} \beta_n region_{nj} + \varepsilon_i
 \end{aligned}
 \tag{4}$$

In equation (4), the subscripts  $i$  and  $j$  precisely indicate whether the variable is from a firm or territory. The dependent variable ( $TE_{it}$ ) represents the technical efficiency of the winery in the year 2010, while  $TE_{it-1}$  quantifies the corresponding efficiency for the year 2000. As indicated above, these indices were calculated in a previous paper from the use of mathematical programming techniques and represent the differences that separate each firm from the boundary of the best practice established by the most efficient wineries in the sample (Hernández *et al.*, 2013).

The correlation among the variables, and the scale means and standard deviations for each of the measured variables in the model are displayed in Table 3. Due to the presence of the delay of the dependent variable in the set of explanatory variables, the model has been estimated through maximum likelihood methods (Wallis, 1972). The results obtained are shown in Table 4. We have not detected any heteroscedasticity problems in the data. In addition, the normality of the variables was investigated by calculating the skewness and kurtosis coefficients, so that the variables which did not follow a normal distribution were transformed to avoid problems in the maximum likelihood estimation. Furthermore, the average variance inflation factor of the variables analysed is 1.48 which indicates that the analysis is not affected by multicollinearity problems.

The first comment refers to the fact that level of technical efficiency reached by the wine firm in the past does not determine its future efficiency, or better expressed, it is not a factor that guarantees that the firm will maintain its previous position in the efficiency ranking of the firms that make up the sample analysed.

Nevertheless, what can be observed is that wineries located in industrial districts seem to exhibit a superior level of efficiency in relation to those located in other types of LLMAs, thus again confirming the district-effect which is usually referred to in literature regarding industrial districts, although the magnitude the influence is not excessively high.

With regard to the potential effect of the characteristics of the winery on the level of efficiency, the first to be seen is the significant positive influence of the size of the firm. In this case, the size of the firm can act as a proxy measure of the availability of financial and human resources. In contrast, the age of the firm is a factor that displays a negative effect on efficiency. From this, it can be deduced that in today's wine sector, the knowledge obtained through experience acquired over time is not a significant enough value to guarantee efficient management of the productive process. On the contrary, this experience can turn into inertia which is detrimental to adaptation to changes in the economic environment and the incorporation of innovation.

On the other hand, as in Pestana and Gomes (2007), our results point to the legal form as a factor that conditions the efficiency of wineries. In particular, wine cooperatives can be seen to have an improved performance in relation to other legal forms such as private limited companies and limited liability companies. However, neither the firm's level of debt nor its level of capitalisation seem to be factors that determine its technical efficiency.

**Table 3.** Pairwise correlations, unstandardized means and standard deviations

	TE1	TE0	Size	Age	Coop	SA	Leverage	StockK/L	KHint	KHext	Densind	Densagr	Reemp	Habit
TE <sub>1</sub>	1													
TE <sub>0</sub>	-0.002	1												
Size	0.017	0.118	1											
Age	-0.002	0.067	0.373	1										
Coop	0.065	-0.019	0.038	0.319	1									
SA	0.016	0.054	0.331	0.408	-0.170	1								
Leverage	0.004	0.022	-0.089	-0.112	-0.033	-0.131	1							
StockK/L	0.048	-0.003	0.071	0.067	0.050	0.171	-0.007	1						
KHint	0.007	-0.029	0.082	-0.038	-0.150	0.116	-0.069	0.057	1					
KHext	0.009	-0.060	0.072	-0.016	-0.073	0.110	-0.046	-0.001	0.623	1				
Densind	0.061	0.015	-0.118	-0.091	-0.045	-0.002	-0.016	0.093	0.088	0.079	1			
Densagr	0.003	-0.036	-0.026	-0.038	0.028	-0.033	0.026	0.008	0.007	0.053	-0.031	1		
Reemp	-0.040	-0.016	-0.134	-0.153	-0.023	-0.086	-0.033	0.004	0.241	0.090	-0.047	0.097	1	
Habit	-0.029	0.027	0.111	0.093	-0.048	0.152	-0.034	0.017	0.237	0.193	-0.047	-0.081	-0.137	1
MEAN	0.415	0.390	18.56	24.75	—	—	95.79	508.0	2.74	36.73	10.04	4.33	0.812	61.26
SD	0.171	0.184	46.02	15.34	—	—	167.8	457.5	0.21	8.81	22.08	32.09	0.307	6.62

**Table 4.** Results of the estimation. Standardised coefficients.

<i>Variables</i>	<i>Coefficient</i>	<i>Std. Err.</i>	<i>z</i>	<i>P&gt; z </i>
<i>TE<sub>0</sub></i>	-0.020	0.0371	-0.5	0.616
<i>DIM</i>	0.089	0.0173	1.77	0.077
<i>Size</i>	0.074	0.0065	1.64	0.100
<i>Age</i>	-0.091	0.0173	-1.76	0.078
<i>Coop</i>	0.073	0.0417	1.56	0.118
<i>SA</i>	0.028	0.0165	0.57	0.566
<i>Leverage</i>	0.005	0.0000	0.13	0.895
<i>StockK/L</i>	0.027	0.0086	0.64	0.520
<i>KHint</i>	0.114	0.0517	1.76	0.078
<i>KHext</i>	-0.04	0.0010	-0.76	0.446
<i>Densind</i>	0.081	0.0004	1.66	0.098
<i>Densagr</i>	0.017	0.0002	0.42	0.673
<i>Reemp</i>	-0.043	0.0249	-0.94	0.348
<i>Habit</i>	-0.039	0.0012	-0.84	0.399
$\alpha_0$	0.2927	0.1588	1.84	0.065
<i>Log likelihood</i>	245.39838			

With regard to the variables relating to the immediate environment in which the firm develops its activity, it can firstly be observed that the proportion of the population that continue their studies after compulsory education is not as important as the level of education they achieve. In other words, this means that, more than the quantity of available human capital, what is really relevant is its quality. Apart from this, the only territorial variable that exhibits a significant influence on the firm's technical efficiency is the density of the networks of industrial establishments located in the area. This result is likely to indicate the existence of beneficial effects for business performance derived from synergies between firms located in the same territory and, in short, the emergence of knowledge spillovers in the wine industry.

## 7. Conclusions

The aim of this paper is to further research on the explanatory factors of the differences in the efficient performance of wine firms taking into account the possible influence of territorial externalities. In previous research, the study of the so-called district-effect has been addressed through a methodology based on non-radial mea-

asures of technical efficiency. In these, the presence of a differentiating performance was noted in terms of the efficiency between firms located within a hypothetical industrial district in relation to those outside of it.

On the basis of a sample of 731 Spanish wineries with information for the period 2000 to 2010, a methodology based on parametric adjustment models has been applied, obtaining the following results: first of all, it can be observed that the wine firms located in industrial districts have a higher level of efficiency in relation to those outside of it; thus confirming the influence of so-called territorial externalities. Regarding the internal characteristics of the winery, it should be noted that there is a direct relationship between the size of the firm and efficient performance. At the same time, cooperatives show a higher level of efficiency in relation to other legal forms. The favourable influence of the quality of human capital on the total efficiency of the firm is also significant. However, the age of the winery is not shown to be relevant when explaining the levels of efficiency reached.

The results achieved mean a considerable advance in relation to previous studies and have made it possible to confirm the great possibilities that the methodologies used offer the analysis of the sector. At the same time, this encourages us to continue to further the study of the internal functioning of wine firms and the changes that they have undergone in the last few years, as well as to continue to research the role that the territory plays in the differential in efficiency seen between wineries.

In the same way, these results can encourage policy makers to pursue policies which implement the «social atmosphere» of industrial districts and give incentives to societal cooperatives, not only for social reasons. The best practices in efficiency in these business scenarios mean that competitiveness in the sector will also benefit, as will, therefore, the general interests of the economy and society.

## References

- Aparicio, J., Borrás, F., Pastor, J. T., and Vidal, F. (2015): «Accounting for slacks to measure and decompose revenue efficiency in the Spanish Designation of Origin wines with DEA», *European Journal of Operational Research*, vol. 231, Issue 2, pp. 443-451.
- Becattini, G. (1990): «The Marshallian industrial district as a socio-economic notion», in Pyke, F., Becattini, G., and Sengenberger, W. (eds.), *Industrial districts and inter-firm cooperation in Italy*, Geneva, International Institute for Labour Studies, pp. 37-51.
- Bellandi, M. (1996): «Innovation and change in the Marshallian industrial district», *European Planning Studies*, vol. 4, n° 3, pp. 357-368.
- Boix, R., and Galletto, V. (2004): *Identificación de Sistemas Locales de Trabajo y Distritos Industriales en España*. MITYC, Secretaría General de Industria, Dirección General de Política para la Pequeña y Mediana Empresa (mimeo) (in Spanish).
- Boix, R., and Galletto, V. (2006): «El mapa de los distritos industriales de España», *Economía Industrial*, n° 359, pp. 95-112 (in Spanish).
- Boix, R., and Trullén, J. (2011): «La relevancia empírica de los distritos industriales marshallianos y los sistemas productivos locales manufactureros de gran empresa en España», *Investigaciones Regionales*, n° 19, pp. 75-96.

- Capello, R. (2009): «Space, growth and development», in Capello, R., and Nijkamp, P. (eds.), *Handbook of Regional Growth and Development Theories*, Cheltenham, Edward Elgar, pp. 33-52.
- Castillo-Valero, J. S., and García Cortijo, M. C. (2013): «Analysis of explanatory factors of profitability for wine firms in Castilla-La Mancha», *Revista de la Facultad de Ciencias Agrarias*, vol. 45, Issue 2, pp. 141-154.
- Cusmano, L., Morrison, A., and Rabelloti, R. (2010): «Catching up Trajectories in the Wine Sector: A Comparative Study of Chile, Italy, and South Africa», *World Development*, vol. 38, Issue 11, pp. 1588-1602.
- Dei Ottati, G. (2003): «The governance of transactions in the industrial district: the “community market”», in Becattini, G., Bellandi, M., Dei Ottati, G., and Sforzi, F. (eds.), *From industrial districts to local development: an itinerary of research*, Cheltenham, Edward Elgar, pp. 73-94.
- Farrell, M. (1957): «The Measurement of Productive Efficiency», *Journal of the Royal Statistic Society*, serie A, 120 (3), pp. 253-290.
- Fusco, E., and Vidoli, F. (2013): «Spatial stochastic frontier models: controlling spatial global and local heterogeneity», *International Review of Applied Economics*, vol. 27, Issue 5, pp. 679-694.
- Gujarati, D. N. (1995): *Basic Econometrics*, McGraw-Hill, New York.
- Hernández, F., and Soler, V. (2003): «Cuantificación del “efecto distrito” a través de medidas no radiales de eficiencia técnica», *Investigaciones Regionales*, 3, pp. 25-39.
- (2008): «Medición del efecto distrito: una aproximación no paramétrica», en Soler, V. (ed.) (2008): *Los distritos industriales (DI)*, Monográfico de Mediterráneo Económico, 13, Almería, Cajamar, pp. 83-96 (in Spanish).
- Hernández, F., Ruiz-Fuentsanta, M. J., and Soler, V. (2013): «Eficiencia productiva y efecto distrito en el sector vitivinícola español: un análisis empírico», paper presented in the XXXVIII Reunión de Estudios Regionales, Bilbao (in Spanish).
- Hernández, F., Soler, V., Sala, R., and Almenar, V. (2012): «Productive Efficiency and Territorial Externalities in Small and Medium-Sized Industrial Firms: A Dynamic Analysis of the District Effect», *Growth and Change*, vol. 43, Issue 2, pp. 179-197.
- Iacoponi L. (1990): «Distretto industriale marshalliano e forma di organizzazione delle imprese in agricoltura», *Rivista di Economia Agraria*, n° 4, pp. 711-744.
- ISTAT (1997): *I sistemi locali del lavoro 1991*, edited by Sforzi, F. Roma, Istituto Poligrafico e Zecca dello Stato (in Italian).
- ISTAT (2005): *I Sistemi Locali del Lavoro. Censimento 2001*, edited by Orasi, A., and Sforzi, F. (in Italian).
- Lööf, H. (2004): «Dynamic optimal capital structure and technical change», *Structural Change and Economic Dynamics*, vol. 15, pp. 449-468.
- Outreville, J. F. (2015): «The market structure-performance relationship applied to the Canadian wine industry», *Applied Economics Letters*, in press, 7 p.
- Pan-Montojo, J. L. (2001): «Industrialización y viticultura en España, 1760-1900: una visión de conjunto», paper presented in the Congress of the Economic History Association, september 2001 (in Spanish).
- Pestana, C., and Gomes, J. C. (2007): «Comparing the productive efficiency of cooperatives and private Enterprises: the Portuguese wine industry as a case study», *Journal of Rural Cooperation*, vol. 35, n° 2, pp. 109-122.
- Sánchez, J. L. (2003): «Capital exógeno y procesos de innovación en la industria vinícola de la Denominación de Origen “Toro”», *Boletín de la Asociación de Geógrafos Españoles*, n° 36, pp. 61-79 (in Spanish).
- Sengenberger, W., and Pyke, F. (1992): «Industrial district and local economic regeneration: research and policy issues», in Pyke, F., and Sengenberger, W. (eds.), *Industrial districts*

- and local economic regeneration*, Geneva, International Institute for Labour Studies, pp. 3-29.
- Sforzi, F. (2003): «Local development in the experience of Italian industrial districts», in Beccattini, G., Bellandi, M., Dei Ottati, G., and Sforzi, F. (eds.), *From industrial districts to local development: an itinerary of research*, Cheltenham, Edward Elgar, pp. 157-183.
- Simon-Elorz, K., Castillo-Valero, J. S., and Garcia-Cortijo, M. C. (2015): «Economic Performance and the Crisis: Strategies Adopted by the Wineries of Castilla-La Mancha (Spain)», *Agribusiness*, vol. 31, Issue 1, pp. 107-131.
- Sorensen, J. (2002): «The strength of corporate culture and the reliability of firm performance», *Administrative Science Quarterly*, n° 47, pp. 70-91.
- Turner, S. (2010): «Networks of learning within the English wine industry», *Journal of Economic Geography*, vol. 10, n° 5, pp. 685-715.
- Vidal, F., Pastor, J. T., Borrás, F., and Pastor, D. (2013): «Efficiency analysis of the designations of origin in the Spanish wine sector», *Spanish Journal of Agricultural Research*, vol. 11, Issue 2, pp. 294-304.
- Wu, Z. B., Yeung, G., Mok, V., and Han, Z. (2007): «Firm-specific knowledge and technical efficiency of watch and clock manufacturing firms in China», *International Journal of Production Economics*, vol. 107 n° 2, pp. 317-332.