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# FARMING ECONOMY IN FUNCTION OF THE LAND AREA: THE CASE OF DOURO WINEGROWING SYSTEMS

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#### ABSTRACT

Companies use a set of production factors that they combine and transform into a final product. This process gives rise to a set of costs and revenues, respectively, which are at the root of the farms' profitability. Several factors influence and conditionate the quantities and types of the used production factors. The area of the land cultivated is an important factor that has been highlighted in the literature. This work aims to analyse the productive systems that characterise grape production in the Portuguese Douro region, at the level of their inputs and outputs and associated economic values, as well as to identify whether the dimensions of production units influence the obtained values. To achieve this purpose, a face-to-face survey was used to collect specific input-output information from a sample of 110 wine-growing farms. The findings show that the quantities of production factors and corresponding costs as well as its yields change according to the size of the farm. In general, farms with an average size of 10 to 20 hectares of vineyard area stand out as those which present a better balance between the yields and costs, and better compensate the remuneration of the entrepreneurial factor and the capital involved in the company.

Keywords: Inputs, production system, profitability, outputs, winegrowing system

#### **1. INTRODUCTION**

Production units use a set of production factors to obtain their final product, which vary as a whole depending on the final output quantities. However, the used production systems may enhance the combined use of factors and the economy of others, allowing more profitable situations, with reflexes on environmental externalities. In this context, and in the agricultural sector, the used area of production conditionates the used production system and may influence the economic performance, which can be a competitive advantage. This is a subject that has appeared in literature with some controversy, namely in the works of Delord et al. (2015), Diewert and Fox (2010), Galindro et al. (2018), Gleyses (2007), Hooper et al. (2002), Sellers and Alampi-Sottini (2016), Sheng et al. (2015) and Towsend et al. (1998).

Smaller farms use smaller quantities of inputs as a whole, but per unit of area (conventionally the hectare) there may be an excessive use of inputs in order to improve the system, which may be greater than the system's capacity and reduce its profitability. However, it is also in the smallest farms that the use of own resources, such as labour of family origin, can give rise to conditions conducive to its profitability. There are about 570 million farms in the world, most of them smallholdings or family-operated with less than two hectares (Lowder et al., 2014), which makes it relevant to assess whether the management of the system practiced is correctly developed. Sellers and Alampi-Sottini (2016) analysed the influence of firm size on the economic performance of Italian wineries, and their results showed that the size of the firm is positively correlated with all indicators of performance. They found that the company may achieve the optimum size and higher efficiency with increasing returns to scale when the unitary costs are minimized, which confirms the previously results obtained by Diewert and Fox (2010) and Sheng et al. (2015).

Hooper et al. (2002) attribute a fundamental role in this context to the technological progress and access to improvements can also explain why big farms have more productivity. They often have more capital available and easier access to finance than small farms to invest in new technologies that allow reaching higher productivity levels. Nevertheless, the positive relationship between the size and performance or productivity of a company is not always confirmed. Berry and Cline (1979) detected an inverse correlation between farm size and productivity, mainly concerning developing countries. Such situations are also identified in Portuguese viticulture from Douro, declared the oldest demarcated and regulated region in the world, whose production systems have been adapted to the mountainous terrain that hinder productive activity, but allow the production of an excellent quality product - Port wine - known worldwide. Galindro et al. (2018) reveal that medium-sized farmers' vineyards display higher marginal increment for a subregion from Douro and, more recently, Santos et al. (2020) found that the efficiency scores increases with farmers' vineyards size up to 10 to 20 and farmers' vineyards with more than 20 hectares appear to be the least efficient. The aim of this work is to know the viticultural production system used in the Douro region, namely its production factors, products obtained, yields and costs struture, and to analyse the existing relationships according to the obtained production area. The knowledge of the economic impacts of the options taken by the managers of the agricultural production units, may contribute to identify their main potentialities and weaknesses, in order to better adjust them to the used production area.

### 2. METHODOLOGY

### 2.1. Used Model

In this paper we start from the definitions of costs, income and results adopted for the agricultural farms by Avillez et al. (2004). Costs represent the consumption of production factors and income are the benefits obtained directly by the farming system and indirectly by the monetary aid received annually in the form of subsidies. The results are the difference between the incomes and some categories of costs and three types were considered in this work, which represent, respectively, the entrepreneur factor remuneration (Equation 1), the labour factor remuneration (Equation 2) and the capital factor remuneration (Equation 3).

Entrepreneur and family income (EFI) = Gross Production - Real charges + subsidies to current activity (1)

Labour income (LI) = Gross Production - Purchase of goods and services abroad - Taxes and insurance on land and non land assets - Depreciation - Allocated interest + subsidies to current activity (2)

Company's capital income (CCI) = Gross Production - Purchase of goods and services abroad - Taxes and insurance on land and non land assets - Depreciation - Rents - Wages and social charges paid and allocated + subsidies to current activity (3)

# 2.2. Data

The data used for this work was gathered from a sample of 110 Douro grape producers by a structured face-to-face survey (Table 1). The main criteria for selecting the universe surveyed were the geographical distribution and the size of the farm, which is relevant to the subject under study, in order to ensure the diversity and heterogeneity of production systems present in the farms of Douro. The sample consisted of 31, 32, 30 and 17 farms, belonging respectively to area classes one to five, five to ten, ten to twenty and more hectares, distributed proportionately among the three sub-regions of the Douro. The selected farms with an area equal to or greater than 20 ha were fewer in number due to their lower representation in the Douro region.

The farms of the study were generally contacted in advance by their farmers' associations or cooperative wineries. The data were collected through face-to-face surveys of winegrowers and/or entrepreneurs on the farms, on the farms themselves or on the facilities of their farmers' associations and wineries cooperatives. The agricultural season of inquiry was 2017. The gathered data was then validated by a formal meeting with the respondents and their representative associations through the use of the World Café model realized at 2019.

# **3. RESULTS**

Figure 1 illustrates the representative winegrowing production system of the Douro region. Table 1 shows the results obtained by category of costs, yields and their respective results by groups composed by similar sized farms. The ranges of used area correspond to those used for the collection of information and are coincident with those observed in various statistical sources in the sector.



Figure 1: Winegrowing production system (Source: Own elaboration)

The observation of the exposed elements makes it possible to identify labour as one of the most important production factors in Douro winegrowing systems, whose costs, including social charges, reach, in larger farms, almost 70% of their total real costs. Smaller farms, despite having less spending on labour due to the use of family labour, when quantifying the corresponding opportunity cost, reach values of total cost very close to those evidenced in larger production units. The costs of fertilisers and other chemical products as well as depreciation and amortisation are lower on larger farms as the total value is diluted by a larger number of hectares. In general, the costs with the remaining factors shown in Table 1, as well as the total volume of costs, including or not the attributed costs, are lower for the area size between 10 and 20 hectares. In terms of income, although farms of up to 5 hectares have the highest volume of production and the highest volume of subsidies, they also have the highest expenditure, so they do not stand out as the most profitable farms. Farms with an average size of between 10 and 20 hectares have a volume of production just behind smaller farms. The fact that a large part of their volume is intended for the production of port wine and, therefore, more highly valued on the market allows them to stand out as those with the highest total economic yield obtained per unit area.

Farms area (ha)	[1, 5]	[5, 10]	[10, 20]	[20, ∞[
Costs				
Labour costs purchased and social costs (€/ha)	1177,4	1559,3	1849,4	2403,2
Total labour costs (€/ha)	2358,4	2197,7	2079,7	2403,2
Costs with fertilizers and chemical products (€/ha)	614,4	493,7	486,3	351,8
Costs with energy (€/ha)	27,3	39,7	24,2	67
Amortization/Depreciation costs (€/ha)	805 <i>,</i> 6	699,1	527,8	434,9
Insurance, rentals, associations fees, land taxes (€/ha)	199,5	171,9	121,3	161,6
Real total costs (€/ha)	3707,5	<mark>3389,</mark> 4	<b>3189,</b> 3	3635,4
Total costs (€/ha)	5317,7	4680,3	3864	4074,4
Incomes				
Grapes production in volume (kg/ha)	6050,9	5772	5861,1	5182,4
Grapes production for Port wine (kg/ha)	2005,3	2271,9	2734,2	2620
Grapes production in value (€/ha)	4409,1	4081,1	<b>4593,6</b>	4094,7
Annual subsidities (€/ha)	687,8	498,5	252,8	207,7
Total benefits (€/ha)	5096,9	4579,6	4846,4	4302,4
Results	-		-	_
EFI - Entrepreneur and family income (€/ha)	1389,4	1109,1	<b>16</b> 56,9	667,1
LI - Labour income (€/ha)	712,6	1214	<b>242</b> 0,9	2460,6
CCI - Company's capital income (€/ha)	957,9	1182,2	2095,7	1200,3

 Table 1: Costs, incomes and economic results with Winegrowing production system of Douro

 (Source: Own elaboration)

The economic results reflect the observations made previously, highlighting once more the farms with an average size between 10 and 20 hectares at the level of remuneration of the entrepreneur (EFI) and the capital (CCI) factors. These results are in line with those obtained by Berry and Cline (1979), Galindro et al. (2018) and Santos et al. (2020). Large farms above 20 hectares, despite being the group with the highest burden by labour factor, are also the ones standing out the most in terms of remuneration for this factor of production (CCI), regardless of the type of work and its form of remuneration. These situations confirm the analysis from Diewert and Fox (2010), Sellers and Alampi-Sottini (2016) and Sheng et al. (2015).

#### **4. CONCLUSION**

This work has made possible to identify the set of production factors that intervene directly in the Douro winegrowing system and enable the gathering of excellent quality grapes, which are responsible for making wines worldwide recognised. In terms of production costs, labour, depreciation of fixed capital and fertilisers and chemical products stand out in order of importance, as the main contributors to the high volume of costs achieved in the region. Being a mountain wine-growing region, the need for this production factor is very high, with a strong weight in the production cost structure, namely in farms without the use of family labour. In general, farms with a vineyard area of 10 to 20 hectares have the most beneficial indicators for the economy of the farm. This is due to the lower volume and value of costs, but also due to the better economic returns provided, in particular, by the higher selling price of grapes intended for Port wine. In conclusion, the production system used in this area dimension (10 to 20 hectares) provides better economic results and, when not dependending on structural factors, can be an example to be reproduced in other dimensions.

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