Economic Sustainability of Quality Wine Districts in the South of Italy. The Case Of Vulture

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Abstract

The paper presents an analysis of economic performance and long-term sustainability of the quality wine production in the Vulture district, in the South of Italy. This case is considered as it is representative of many Italian quality wine districts, that produce a very large variety of high quality wines, and present, in almost all cases, a fragmented structure in small and micro farms. The analysis aims to two objectives. First, assessing current financial profitability of micro grape wine farms. Second, analysing the feasibility and impact of process innovations and structural adjustments.

According to the results of the analysis, a large majority of grape wine farms are currently producing with negative returns on the investment. Financial and economic sustainability could be improved at least for a share of them with the available process innovations, combined with consolidation of the farm structures to reduce land fragmentation. The results are relevant for the design of public policies and private investment strategies.

Keywords: Quality wine districts; economic sustainability; investment analysis, process innovation; South of Italy Viticulture.

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Introduction

In the last 70 years the Italian production of quality wines won international recognition and achieved global market success. Most of the Italian quality wines belong to the system of publicly certified brands of *denominazioni di origine controllate* (certified denominations of origin), DOC, and, and for the top quality the DOCG Brands: *Denominazioni di Origine Controllate e Garantite* (certified and guaranteed denominations of origin). DOC and DOCG brands have been enveloped in the European Union legislation of public brands for agro-food products, the Protected Denominations of Origin (PDO), that extends the certification to all agro-food products of superior quality, mainly based on their geographical origin[1].

411 high quality wines with PDO brands are produced in Italy, among them 341 are DOC wines and 74 are DOCG wines (FEDERDOC, 2018). The counting needs continuous update as new brands are assessed and approved by the national and European Authorities each year. Most of these high quality wines are produced in small quantities, if compared with that of global competitors, and in small districts. Among these 411 wines, only 50 are produced in districts larger than 1000 Ha, and single grape-wine farms have often an average size below 5 Ha.

The size and geographical location of the DOC districts are identified by the same law that establishes the DOC brand. In fact, due to the basic principle of the DOC legislation that connects quality to micro-climate, pedology, even social structures of that particular territory, also in cases of extraordinary market success the enlargement of the district borders was not requested by the producers, with very few exceptions.

The system of DOC brands has allowed the preservation and promotion at global level of an extraordinary variety of Italian and European wines, much beyond what could have been possible with the market strategies and investments of autonomous private brands. On the other hand, the very small scale of the quality wine farms, could became a structural weakness, and a relevant threat for the long term competitivity and sustainability of these wine districts and of the Italian wine sector (Pomarici, 2016).

In order to assess structural constraints, innovation opportunities and the possible strategies for long term sustainability of the Italian SMEs, that represent the largest component of the high quality wine sector, we have carried out an empirical analysis of a DOC and DOCG wine district with structural characteristics well representative of the Italian and especially Southern Italian sector.

The case study chosen is that of the Vulture district, in the Basilicata Region (figure 1). The top product of this area is the "Aglianico del Vulture" wine, one of the most appreciated high-quality red wines of the South of Italy. The Aglianico del Vulture is produced with the top labels of the European system of publicly guaranteed Denominations of Origin for wines: Aglianico del Vulture DOC and Aglianico del Vulture superiore, DOCG. Even if it is based in a small territory, the Aglianico del Vulture wine production has been for centuries, and still is, a pillar of the Vulture district economy and society (Dell'Aglio and Nuzzo, 2015).

The Vulture district is well representative of many quality wine districts Italy. The total surface that could be used to produce the Aglianico wine is close to 1500 Ha, but the vineyards actually certified for the production of DOC and DOCG wine are roughly 600 ha, with some variability per year. With such size the Vulture district is close to the average of Italian DOC districts, and it is among the largest 80.

In the Vulture district vineyards are located in a volcanic, hilly area, most of them with medium slopes and pedological characteristics very well suited for wine productions.

Wine production represents a large share of the agricultural output, but farm fields are strongly dispersed in small lots, and often mixed with other crops, especially olive, fruit orchards, wheat, and other Mediterranean products. The result is beautiful for the landscape, less beneficial for the farm annual balance sheets, that suffer from higher production costs compared to those of competitors with single crops cultivated in larger lots.

Economic sustainability of the wine grape production is critical also for the environmental and social sustainability of the whole district (Littig and Griessler, 2005). In fact, grape production is almost non-substitutable by other crops at similar levels of labor intensity and value productivity per land unit.

In recent years, there have been numerous process innovations for wine grape production which have had substantial impact on production costs, first in the field of mechanical harvesting (Tudisca et al., 2013; Demaldè and Spezia, 2006). Furthermore, organizational innovations like the expansion of markets to rent harvesting machines have facilitated the adoption of these innovations. This has been especially important for wine farms otherwise excluded from such innovations because of structural constraints. Nevertheless, a large share of the smaller farms are still lagging behind in the innovation pace, due to structural and financial constraints. This delay is often leading to negative economic returns for them, and negative estimated financial profitability of new investments, even if planned with the best available technologies.

Structural adjustments, in particular growth of farm size and reduction of fragmentation, is very slow, if not absent in many Italian wine districts. First, this is due to a strong correlation between

vineyard quality and geological and pedological structures of the territory where they are located, which makes the preservation of the product quality while extending the farm base difficult. Second, this is due to rigid land markets in most of the Italian traditional districts of production, where financial, social and cultural factors that reduce supply.

EU policies could also have had a role in limiting structural adjustments, in particular with the interventions that have regulated vine planting rights, even if the opinion on this factor are diverse, and empirical observations are not univocal. (Delord et al, 2015; Galindro et al., 2018)

In the next sections the analysis of the investment in high quality wine-grapes in the Vulture District will be presented. First, the expected profitability of the grape-wine productions will be estimated with an investment analysis. Second, a scenario analysis will be applied to assess the impact of the adoption of technological and organizational innovations, combined to variation of the farm size, in order to assess also the economies of scale that could be exploited with the adoption of the new technologies. Third, a sensitivity analysis will be carried out to test the impact of variation of grape prices in financial results. Lastly, the analysis of potential adoption of process innovation and structural adjustments will be applied at district level, considering the current structure and geographical location of vineyards.

In the quality wine sector, the analysis of production costs, and the relation between structural factors and cost functions is particularly complex. Many methodological proposals and empirical analyses have been presented. (Casini et al., 2014; González-Gómez and Morini, 2006; Latruffe and Piet, 2014; Marone et al.,2017; Sellers-Rubio, 2010; Tudisca et al., 2013).

The long term economic horizon of investments in vineyards, as in olive oil and, fruit orchards, makes the methodologies of investment analysis and financial analysis particularly relevant (Di Napoli and Perretti 2016; Rosselli and De Gennaro, 2011; Seavert and Long 2007; Sojková, and Adamičková, 2011; West et al., 2012).

Empirical analyses at international level and in the Italian case, have proven a significant relation between wineries size and economic efficiency and profitability (Sellers-Rubio, 2010; Sellers and Alampi-Sottini, 2016).

According to other analyses, economies of scale could have a limited impact on productivity in the wine sector, especially where product differentiation and market segmentation can limit the exploitation of cost economies generated by scale growth (Delord et al., 2015; Marone et al., 2017). The small size of wine farms seems to have limited effects on the capacity to compete in the international wine markets, (Köhr et al., 2018). However, farm size has a clearer negative impact on production costs, especially in the stage of grape making, when the small size limits access to efficient technologies (Tudisca et al., 2013; Di Napoli and Perretti, 2016).

Methodology and data

The investment analysis was applied to a wine farm model corresponding to the most frequent wine farm models in the Vulture district. The analysis was carried out in three main steps.

First, profitability of quality wine productions was assessed analyzing financial returns of investments in vineyards. The investment analysis methodology is that commonly applied in agriculture for products with long multiannual production cycles (Rosselli and De Gennaro, 2011; Seavert and Long, 2007; West et al., 2012).

The financial cash flow analysis of the investment was carried out calculating various profitability indexes. The results will be presented here using the Net Present Value: $(NPV) = \sum_{i=1}^{n} \frac{NRi}{(1+r)^i}$ where *n* is the number of years of the time horizon considered, *r* the interest rate, *NR* is the Net Revenue in the year *i*. The time horizon chosen for the financial and economic analysis is that of 30 years.

The discount rate for the calculation of the present values is 3,2%, as an average of the rate currently used in the local financial market for loans to agricultural investments.

Constant prices were applied, assuming inflation neutrality in the period of analysis. Grapes productivity per ha was defined taking in to account the quantitative productivity per ha, which is established in the DOC Aglianico del vulture production code (*Disciplinare di Produzione*) (Decreto Istitutivo, DPR, 1971). The level of productivity per ha, imposed by the production code, is lower than that that might be possible in the local condition, and is considered binding for the awarding of the DOC brand of wine quality. For this reason, the value of yield per ha has been adopted as the most probable average level in the long run.

The revenue does not include subsidies paid by the Common Agricultural Policy (CAP), in order to exclude a factor of profitability that cannot be considered certain and stable in the time horizon of the analysis, that is longer than 30 years. In fact, the CAP is revised, sometime substantially, at least every 7 years.

In the calculation of cash flows, all production inputs, including labor, are priced at market price levels net of VAT (Value Added Taxes). Prices were observed in the relevant markets for each input.

The analysis did not differentiate the prices of inputs between those paid by family farms and those paid by commercial farms. As discussed above, the approach was chosen in order to avoid

binding the economic and financial results to the current demographic and social structure in the district.

In fact, especially in the quality wine production sector, the traditional objective of the family farm, that of maximization of return to family labor (De Benedictis and Cosentino, 1982), appears less relevant in recent times. The main reason is that high quality grape production, often oriented to the export on the international markets, demands highly specialized labor and substantial investments in dedicated machinery. These inputs cannot be easily replaced by non-specialized family labor and labor intensive technologies, as for vineyard design, and planting, pruning, monitoring of vineyard health and planning of treatments for pest controls, harvesting planning and execution for the best grape quality (Di Napoli and Perretti, 2016)

Therefore, even though family farms are still numerous in the Vulture district, entrepreneurial decisions are frequently based on financial profitability, both for family or commercial farms. Also, most of the traditional family farms still active in the area are marginalized in the high quality grape sector. Often, they drop out of the grape production altogether, or, in a few cases, they continue producing low or medium quality wines for their own consumption, or to be sold in local informal markets.

The production technology for high quality grape wines is relatively homogenous in the area, at least for the quantity and quality of inputs used. First, this is because of the strict constraints established by the production code of Aglianico del Vulture DOC wine. Moreover, this is also because the basic characteristics of the Aglianico del Vulture wine cannot be obtained if not using a strongly standardized technology. Minor differences among the single producers exist, in the management of vineyards, the timing and the methodology of same production phases, and other details that do not impact on the basic structure of costs.

The main differences in the production technologies available to most grape producers are those between the labor intensive, and capital intensive, where the capital-intensive technology uses dedicated machines for most of the production operations, and in particular for harvesting. Also, the “labor intensive” technologies need a substantial amount of machinery, but even if the only difference is in the manual harvesting, the quantity of labor is substantially larger than in the case of farms that carry mechanical harvesting.

The financial analysis has been applied not only to different production technologies, but also for different operating organizations, considering both farms that buy and operate all the equipment and the machinery needed, and farms that execute some of the production operations by renting machines from specialized firms (Demaldè and Spezia, 2006; Di Napoli and Perretti, 2016).

The system of renting services from specialized firms for specific production operations, ("*conto terzi*" in Italian), is already very common in most of the Italian agriculture, and is rapidly spreading in new sectors, like grape and wine making. The added value of *conto terzi* is in the very simple and effective service that it provides to small farms, that could not afford the purchase of very expensive machineries to only use them a few days, or even a few hours (Tudisca et al., 2013).

The economies of scale could be thoroughly observed and analyzed. Due to the fixed costs for machinery, and the differences in technologies and use of rented machinery, even if input prices, salaries, and yield/ha are maintained constant, the average total cost is hugely variable with the scale of farms.

In the second step, a scenario and sensitivity analysis were carried out, testing the financial results produced by variations of the farm structure and production technology.

The scenario analysis was carried out on a range of farm sizes, then a sensitivity analysis was carried out to evaluate the impact of variations of the output price.

In the third step, based also on the results of the first two, we carried out an analysis at territorial level. Vineyards of the Vulture district have been identified in a Geographical Information System built using data from the public cadaster (SIAN, 2018).

The single vineyards have been classified as perfectly mechanizable, easily mechanizable or not mechanizable, based on an aggregated index summing the value of structural variables relevant for the introduction of machineries: land slope, vines systems of pruning, vineyard shape, and vineyard area size. The geographical distribution and surface of the three categories were analyzed. To evaluate the potential for structural adjustment, the classification of vineyards was repeated after applying a clustering procedure, based on two indicators representing the potential of consolidation of vineyards in larger units: distance between the neighbor vineyards (<10mt) and size (>5.000 sqm).

1.1 Data sources

Data for the identification of the efficient technologies applicable in the local conditions were obtained from a survey among entrepreneurs and experts in the district, carried out with face to face interviews.

Average grape yields where calculated observing the annual variability and the constraints imposed by the DOC certification rules. The yield per ha is close to that established in the DOC code of production (disciplinare), and it corresponds to the productivity per ha that is expected

to ensure the best quality. Considering the object of the analysis, the farms producing Aglianico DOC wine, the choice appears to be the most realistic, especially for an analysis on the long period.

Data on input prices were obtained from a market analysis carried out to identify the price of each inputs on the relevant markets for the local entrepreneurs. Due to the strong integration of the local markets for DOC grapes, and the almost perfect competition observed, the most realistic assumption, especially in the long period, is that of homogenous prices paid for grapes that qualify for the DOC production.

Therefore, the price of the wine grapes used for the analysis was calculated as an average of the price observed on the local markets, in the last three years until 2017, for grapes sold in the supply chain for Aglianico del Vulture DOC and DOCG production. Data on the structural characteristics of the farms were obtained from official statistics, in particular the National Italian Agricultural Census, the Regional Catasto Vitivinicolo of Regione Basilicata, the official database used for the implementation of the CAP (common agricultural policy), and the national database of the Agricultural sector and Farmers: Sistema Informativo Agricolo Nazionale (SIAN, 2018).

Results and Discussion

1.2 Farm structures in the Vulture District.

The land area used for grape production in Basilicata is approximately 4.900 Ha. The surface of vineyards eligible for the production of high-quality wines is approximately 1.600 Ha. Among these roughly 1.500 Ha are eligible for the production of the Aglianico del Vulture DOC and DOCG wines, according to the data of the last general census of agriculture (ISTAT, 2012).

The structure of Vulture farms is extremely fragmented. According to the last Census, the average arable land per farm is close to 6 ha, and more than 70% of farms are smaller than 10 Ha. This structure is changing very slowly, notwithstanding the intense social, economic and technological dynamics in the last decades.

According to the most recent information, roughly 230 wine farms producing Aglianico del Vulture DOC and DOCG wines have an average size of 2.3 Ha, with just 30% of wine farms larger than 6 ha (Table 1 and 2).

In the last decade, the surface used for the production of quality wine has been always close to 600 Ha, with the average size also stable and close to 2.5 ha. The creation of the DOCG brand, has led to the upgrade of some of the surfaces from the DOC production to the DOCG production, proving that the creation of the new brand has generated just product differentiation within the same district, and not a growth in the production capacity.

The trend over the last years is presented in figure 2, that describes the ha of vineyard that each year are registered in the public register of vineyards producing grapes for DOC and DOCG wines. After the first few years, the average vineyard size for DOCG stabilizes at the same level as that of DOC, while the total surface, apart the annual variability, remains stable.

A number of factors make the land market extremely rigid in Italy and Basilicata (Povellato and Longhitano, 2017), and the adjustment of farm land structure is slow compared to endogenous and exogenous external factors that push for change. In the case of Vulture district, as in the rest of Italy, the structural change of the agricultural sector has produced a steep decline of the number of farms, but this process has not produced an equally intense growth of farm size. This process is described in the Figure 3, where the number of farms, and their average size, measured by their arable land, from 1982 to 2010is shown. The decline in the number of farms, from more than 7000 to little more than 4000, is not accompanied by a significant growth in farm size. Only in the decade following 2000, the farm size grew to 7.5. Most of the land of the farms that are no longer operating is abandoned, and not used for the growth of other farms. In order to provide a measure of this gap in the potential of scale adjustment, a third variable has been built, and is shown in Figure 3, dividing the total arable land in 1982 by the number of farms in the next periods. The arrow on the right provides a measure of the gap between the potential and the actual growth of the farm size.

The same procedure is repeated for the wine sector, including all vineyards, both those producing ordinary wines and those for quality wines, in the district (figure 4). The results are impressive, as the decline in the number of farms is dramatic, more than 4 every 5 wine farms have been closing down in the period, but the land made available is never used by the remaining wine farms. The gap in the structural adjustment is almost equal to the potential.

The result is apparently surprising, because the wine sector in the district has been described as one of the most dynamic in terms of product innovation and market success.

One of the possible explanation is that the investments in product innovation where not accompanied by equally significant investments in structural adjustments, first of all for the increase of farm size, and process innovation at farm level. Therefore, most of the vineyards cultivated in the farms that closed down were simply abandoned. The results in terms of

financial sustainability are distinctly negative and put the very long-term existence of the district at risk.

1.3 Financial profitability of wine grape production.

The basic results are quite concerning. In the current conditions, at least 75% of farms that apply the traditional, labor intensive technology, are producing with a large negative NPV of the investment (Table 3 and Figure 5). The smaller farm size that could ensure positive financial results with traditional technologies is close to 12 ha, far larger than the current average in the Vulture district.

On the basis of this result we can expect that most of the existing farms will risk being forced to wind-up grape-wine production, at least for commercial purposes, as soon as the old vineyards come to an end of their economic life, and will require new investments.

The critical factor that leads to the negative results is labor cost. In the operating years the cost for labor can be estimated in more than 3.000 Euro per ha, close to 60% of operating costs, and 30% of the total return from grapes value (Di Napoli and Perretti, 2016). Even if the annual returns in the full production stage can balance current costs in the same years, there is no chance to recover and remunerate investment costs. Also, as described by Figure 5, the larger farms using labor intensive technology benefit from very limited improvements in their financial results. The economies of scale are limited in the labor intensive farms because fixed costs are relatively small compared to labor cost. This result could also explain the very limited growth of the vineyard size in the last decades, as the push factor of positive economies of scale was almost entirely absent.

Recent developments in process innovations, and especially the launch of capital intensive technologies easily available also to micro farms, could change this future scenario.

Machineries for small scale vineyards and cellars improved potential profitability of small and micro firms. Innovations in the market for production services (conto-terzi) further improved accessibility of these technologies. The new technologies also increased economies of scale accessible to micro and small firms, increasing the incentive for structural adjustment.

1.4 Scenario analysis: Impact of the adoption of process innovation

The adoption of mechanical harvesting impacts the whole production process, starting with the preparation of land, the vineyard agronomic management, and mechanical harvesting.

Two scenarios were considered for the analysis. They were, identical for the technology, but different for the organizational arrangements and the financial consequences. In the first, the

farm purchases and operates the machineries needed for the cultivation of the vineyard and for harvesting. In the second, the farm uses the services of specialized firms, that offer the rent of harvesting machines just for the time needed to the farm (*conto terzi*). Usually the rent price is calculated per Ha, considering the local conditions of accessibility, vineyard structure etc.

Introducing these innovation, the substantial savings in labor costs match the costs of purchasing or renting the harvesting machines and the other arrangements needed.

When feasible, the impact of mechanical harvesting is substantial.

For smaller farms, and up to 6 Ha, the purchasing a mechanical harvester has a negative impact. (Table 3). However, starting from 6 ha of farm size, the innovation produces better results and at 10 ha the results are already significantly positive. The net impact of the introduction of mechanical harvesting becomes even more visible and positive with renting of the harvesting machine. In this case results are better, however still negative, than the traditional systems, starting from the size of 2 Ha. For farms of larger size than 6 Ha the NPV becomes positive and growing (Table 3 and Figure 5).

Smaller farms experience very negative NPV both in the case of manual harvesting and rented harvesting machines, because even renting the harvester, they are forced to own a significant quantity of equipment and machines that generate larger investment costs per Ha (Tudisca et al., 2013).

1.5 Sensitivity analysis for farm size variations.

The sensitivity analysis proves that the level of NPV is very sensitive to variations in farm size. As shown in the Figure 1, the line representing the relation between NPV and farm size is much steeper in the case of mechanical harvesting with owned machines than with the traditional system (Figure 5). The use of higher fixed capital generates larger positive economies of scale. In the case of use of rented machines, the economies of scale are smaller than in the case of purchase, but still larger than in the case of manual harvesting.

A second sensitivity analysis was carried out to assess impact of variations of the output price. The results are presented only for the best technological option, that of mechanical harvesting with rented machines, and for the farm size of 9 ha, which is the smaller farm size with a significant positive NPV (Table 2).

The results prove that the NPV is relatively sensible to price variations. In fact, for negative variations of output prices larger than the 3-4% the NPV becomes negative. This last result proves how, for long term sustainability of high-quality wine production, a stable or even a modest growth of grape prices is critical.

1.6 Structural adjustment and feasibility of process innovation

A geographical analysis was carried out to assess the feasibility of technological innovation in the Vulture territory, in the short and medium period, considering also the structural constraints due to size, location, proximity of vineyards.

The current feasibility of mechanical harvesting for the single vineyards in the district was estimated using data from Regione Basilicata Geographical Information Systems, and data from the Vineyard Register operated by the SIAN (2018). Land slope, vineyard shape, size of single lots where used to classify vineyards in 3 classes, from no mechanizability to perfect mechanizability.

The results are analyzed for the whole Vulture territory and for all vineyards, including also those currently eligible but not registered to produce DOC or DOCG wines. The results are presented in the Table 5 for the whole area.

In the map of Figure 6, a small sample of the territory can be seen in detail. The area, that corresponds to the red spot in the Vulture map in the left corner, is well representative of the typical density and fragmentation of Vulture vineyards.

Then a scenario analysis has been carried out, creating clusters of Vineyards that could be managed as single units, to overcome the fragmentation constraint. For this purpose, all vineyards larger than 5000 square meters, and closer to each other than 10 mt, have been merged in cluster units.

These scenarios are built only considering the structural factors that could allow, or prevent, the creation of larger farm units. Many other factors can and actually influence the process of structural adjustment, including social, financial, and also cultural factors.

At international level some cases of policies promoting structural adjustment of viticulture structures can be mentioned, like the plan Chirac (from the name of the ministry of agriculture at the time) that was implemented in Languedoc (France) in the 70'. It included the objective to promote mergers of farms to achieve a more efficient structure, but the results proved to be mixed (Touzard and Laporte, 1998).

In the Vulture district, the new classification of these vineyard clusters is presented in Table 5 and in the map in Figure 7. The share of vineyards clusters classified as "easily or perfectly mechanizable" can be estimated up to 53% of the total in the district. Therefore, even in this optimistic scenario, a large share of vineyards is excluded from the adoption of innovative technology, and the farms will need a substantial structural adjustment in order to achieve long term economic sustainability.

This last result, combined to those obtained from the investment analysis, leads to forecast a difficult long term sustainability of the quality wine production in the Vulture district.
In fact, a large share, close to 50%, of the current grape-wine producers, could face very poor prospects of long-term survival. Among the other half, many farms could reach financial profitability, and long term sustainability, only through investments in innovative technologies. However, the innovation process will demand intensive investments of financial, technical and entrepreneurial resources.

Conclusions

The article presented the results of an analysis of the economic sustainability of the high quality wines farms in the district of Aglianico del Vulture, which is very representative of the typical Southern Italian quality wine districts.
The analysis had two objectives. Identifying profitability and economic efficiency of the grape-wine farms and assessing financial and structural sustainability of the grape-wine production in the whole Vulture district.
The analysis proved that a large majority of grape wine farms is currently producing with negative returns on investment. The main cause of this result can be identified in high labour costs in a too fragmented farm structure. The result seems applicable to many quality wine districts, especially in the South of Italy. The delay in the structural adjustment seems explained also by the labour intensive technologies, and the scarce potential for economies of scale.
Financial results, and economic sustainability, could be improved with process innovations that are emerging in recent years, in particular for mechanical harvesting. These innovations can be accessible also to micro farms thanks to organizational innovations, in particular those coming from the market for rented mechanical harvesters, that is fast developing in recent years.
At district level, wine production represents a key component of the local rural economy.
Therefore, the structural adjustment of the quality wine sector can have dramatic impact on the whole district. If the current trends continue, just a few large and profitable wine farms could survive, dispersed in a large number of very small non-commercial farms, not integrated with the large ones and not accessing to the external markets.
An alternative scenario could see a process of structural adjustment with the introduction of process innovation and the integration of the micro farms in larger units, capable to exploit the economies of scale created by new capital-intensive technologies. This second scenario could

be more positive for the whole district, especially if the same process takes place for similar high quality Mediterranean products.

The two scenarios depend on many endogenous and exogenous factors. The second, the only one that could lead to the long term sustainability of the district, demands a much larger financial investment, and a more dynamic and efficient land market than the current one. The role of public policies will be critical for such a positive scenario to materialize.

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Notes:

1: A detailed description of EU policies for quality certification can be found at: https://ec.europa.eu/info/food-farming-fisheries/food-safety-and-quality/certification_en

Table 1: Aglianico del Vulture DOC wine farms. Surfaces registered in 2017

Vineyard size in Ha	Farms	total surface	
Ha	Number	Ha	%
0-2	123	114.4	31%
2-4	40	111.7	30%
4-6	11	51.6	14%
6-8	2	13.9	4%
8-10	5	46.5	12%
> 10	3	36.6	10%
total	184	374.7	100%

Source: processed from SIAN Database (2018)

Table 2: Aglianico del Vulture DOCG wine farms, Surfaces registered in 2017

Vineyard size in Ha	Farms	total surface	
Ha	number	Ha	%
0-2	27	27.2	32%
2-4	9	26.2	31%
4-6	3	13.7	16%
6-8	1	7.2	9%
8-10	1	9.8	12%
total	41	84.2	100%

Source: processed from SIAN Database (2018)

Table 3: Financial analysis results

	Net Present Value (Euro) of net revenues over the 30 years		
Farm size ha	manual harvesting	mechanical harvesting	rented mechanical harvesting
2	-54,076	-92,681	-48,011
4	-21,173	-30,176	-13,827
6	-10,204	-9,341	-2,432
8	-4,721	1,076	3,265
10	-1,431	7,327	6,684
12	763	11,494	8,963
14	2,330	14,470	10,590
16	3,505	16,702	11,811
18	4,419	18,439	12,761
20	5,150	19,828	13,520

Table 4: Sensitivity analysis of grape price variations,

NPV with rented mechanical harvesting and farm size of 9 Ha			
Price of Grapes (Euro)	*%*	*(Euro)*	*%*
81	*95%*	*-1,389*	*-127%*
83	*98%*	*1,888*	*37%*
85	*100%*	*5,164*	*100%*
87	*102%*	*8,441*	*163%*
89	*105%*	*11,717*	*227%*

Table 5 Classification of Vulture vineyards per mechanizability quality

vineyards mechanizability	single vineyards		vineyard clusters	
	Ha	**%**	**Ha**	**%**
No mechanizability	865.5	54.7%	756.9	47.9%
Easy mechanizability	441.7	27.9%	406.9	25.7%
Perfect mechanizability	275.0	17.4%	416.6	26.4%
Total	**1,582.1**	100%	**1,580.5**	100%

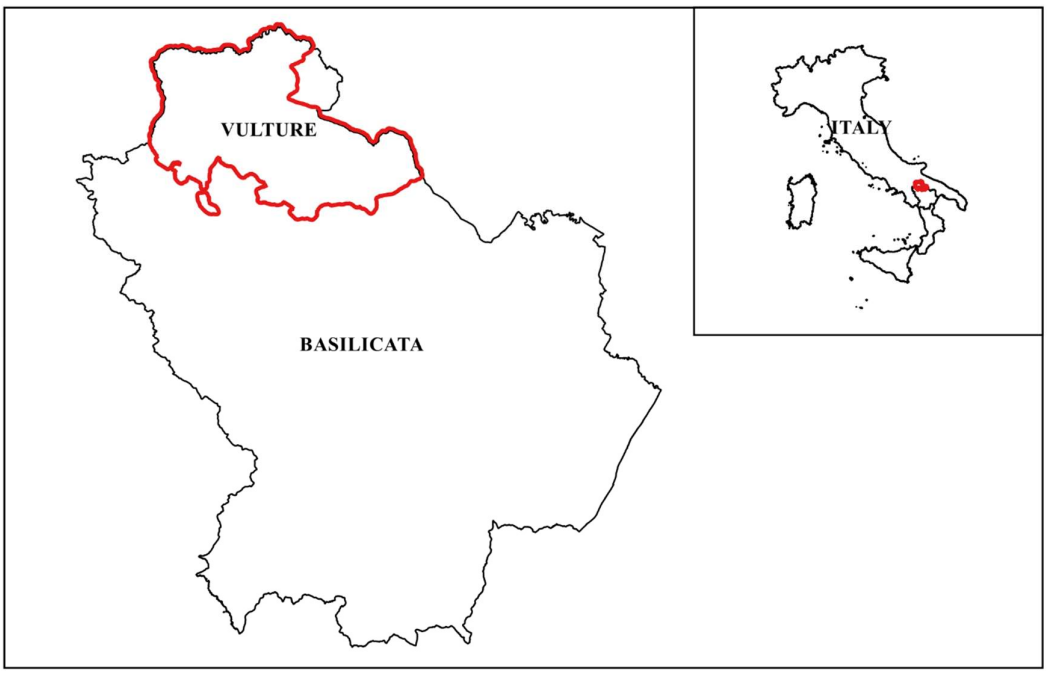

Figure 1 The Vulture district in Basilicata. Italy

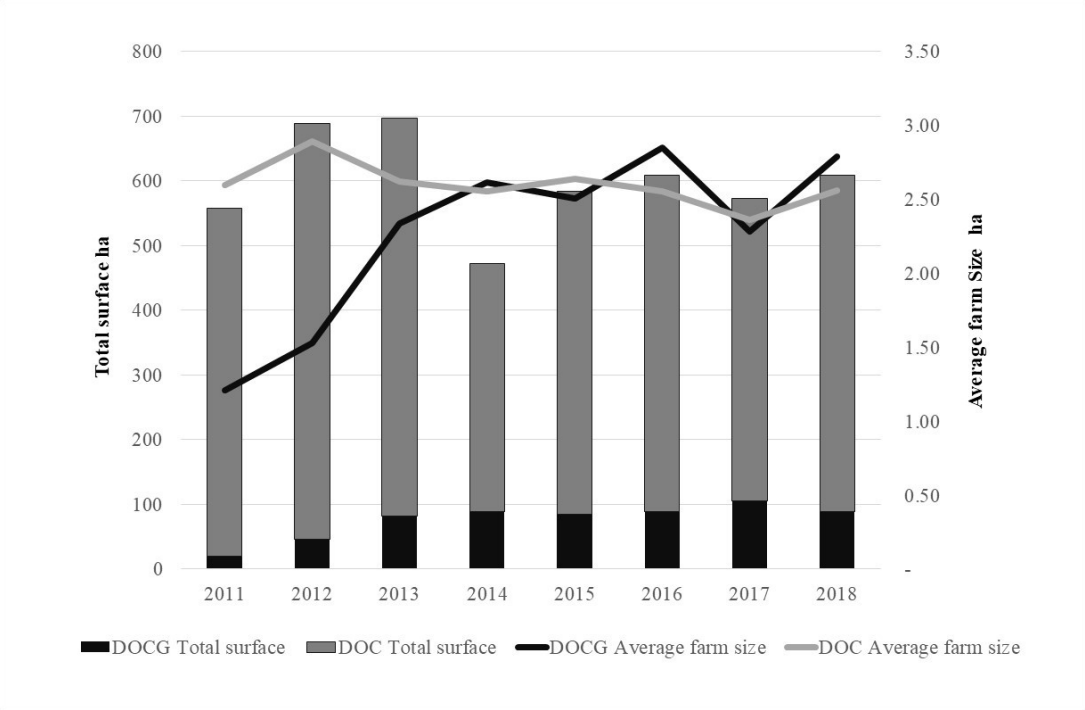

Figure 2 Wine farms dynamic in the Vulture district. Data from the Monitoring system of the Chamber of Commerce Industry and Agriculture Basilicata Region

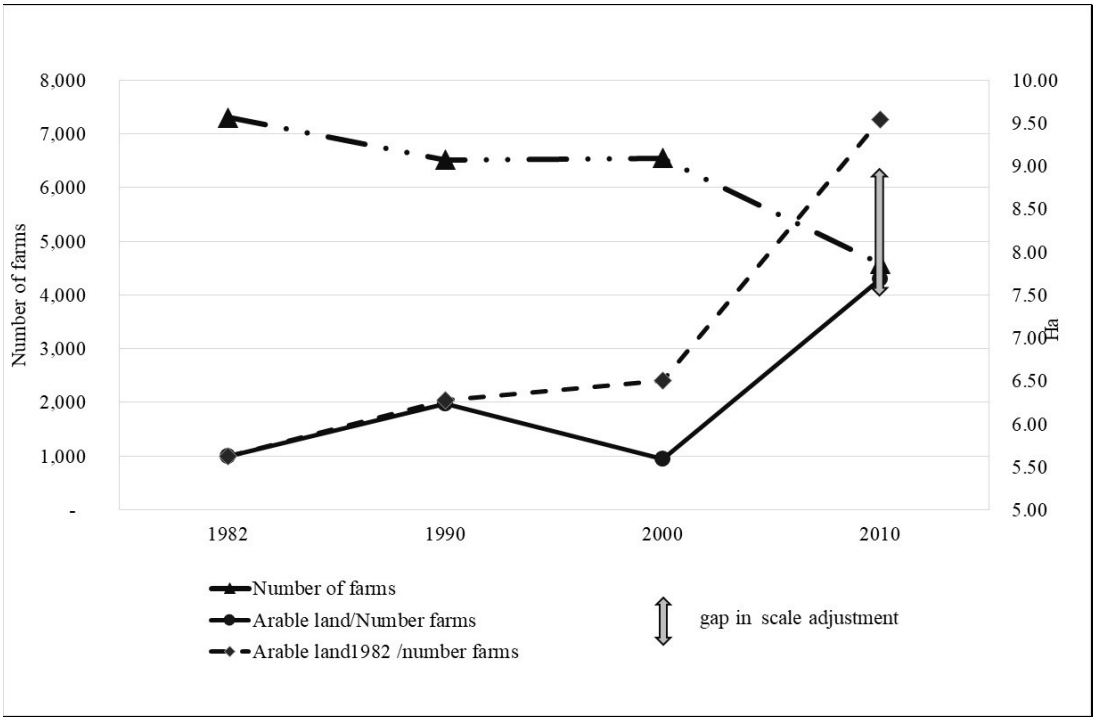

Figure 3 Structural adjustment in Vulture agriculture. Source: ISTAT. Italian Census.

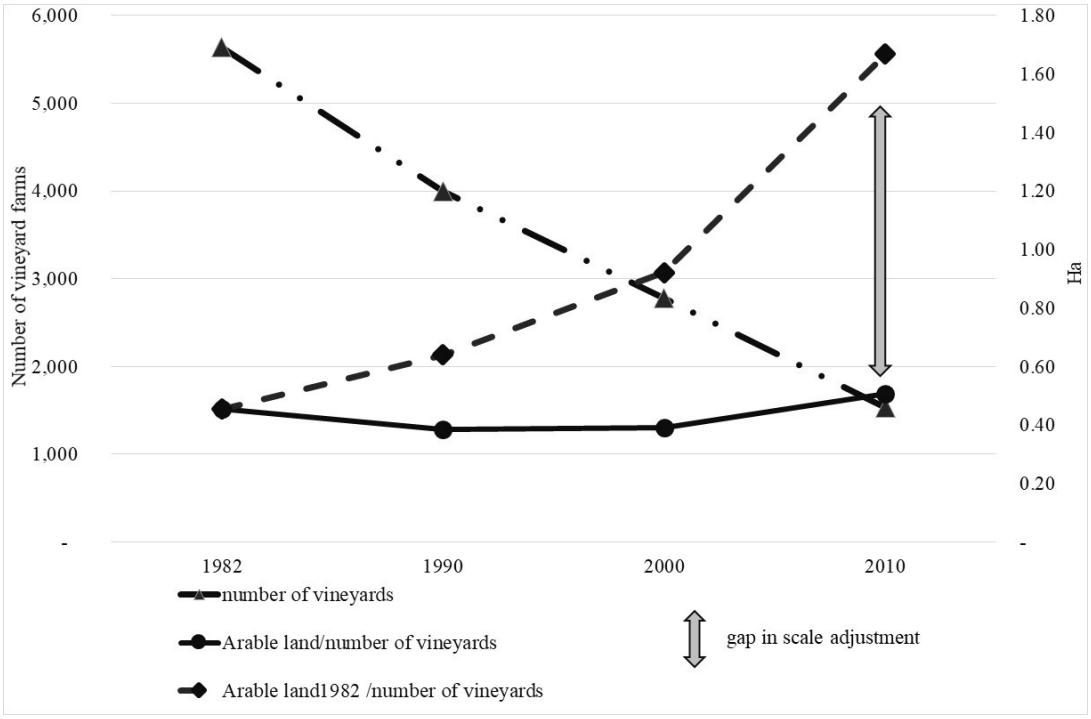

Figure 4 Structural adjustment of wine farms in Vulture. Source: ISTAT Italian Census.

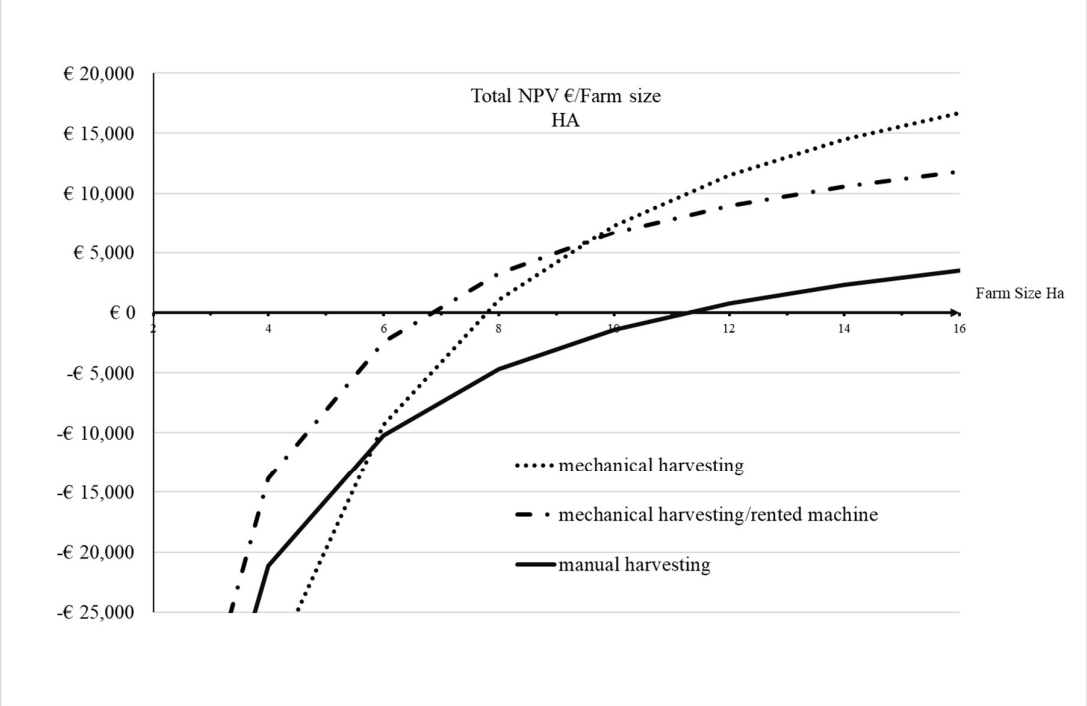

Figure 5: Financial profitability with alternative technologies and farm size, in HA.

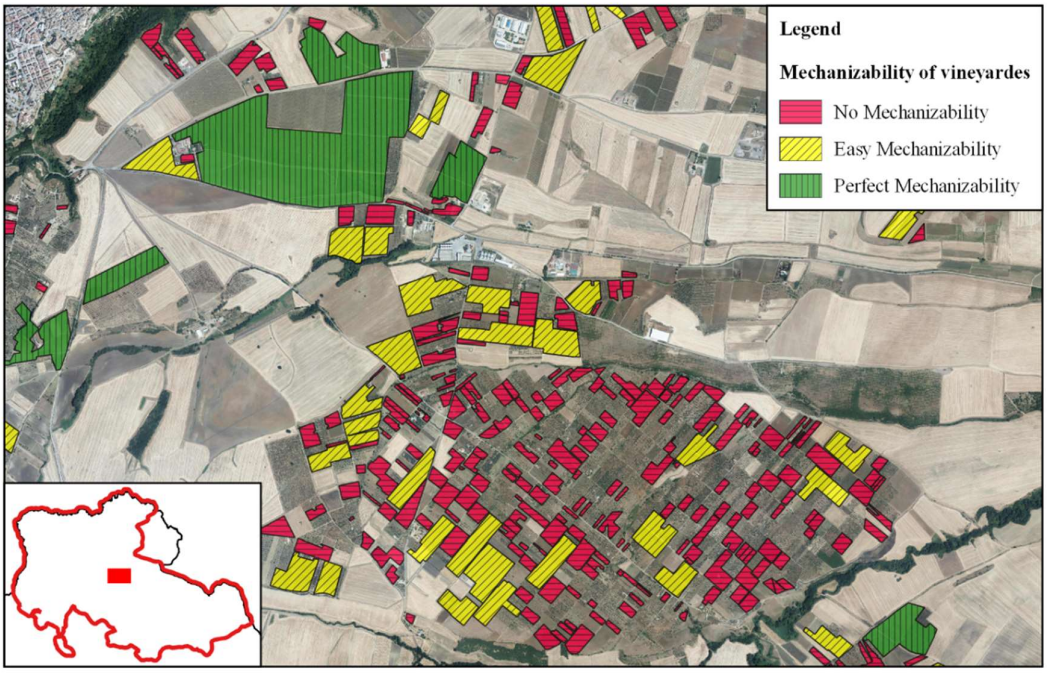

Figure 6 Vineyards per potential access to process innovation

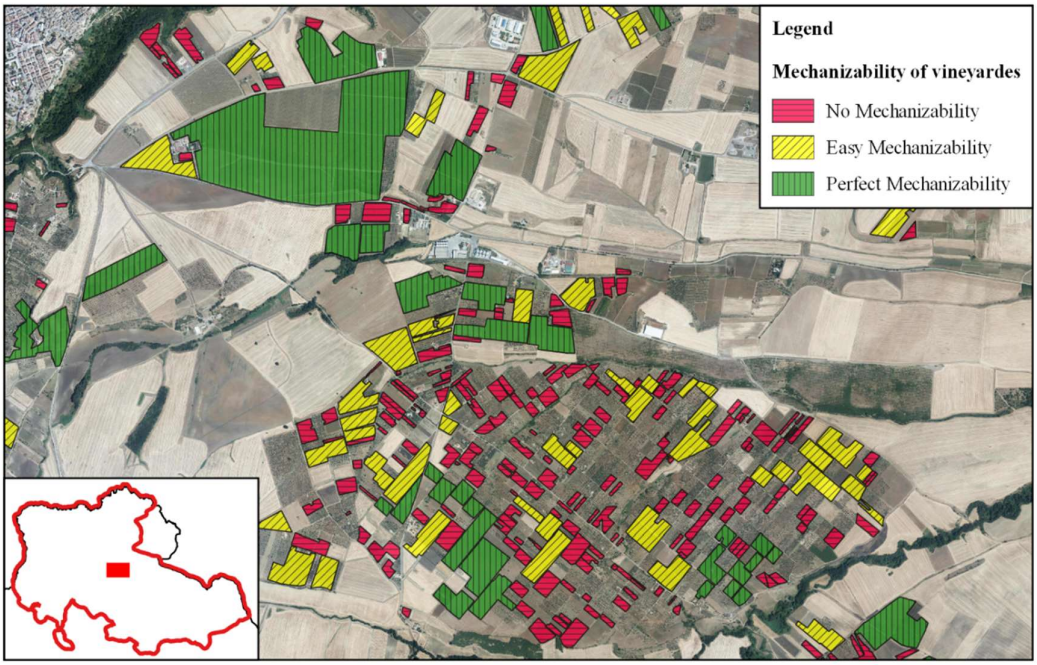

Figure 7 Vineyard clusters per potential access to process innovation