The EU vine planting scheme in Italy: do market forces prevail over regulatory design?

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Abstract

Quotas have been extensively used in the past to stabilise and control the EU agricultural production systems. Over the decades, markets have, however, been liberalised, and quota schemes have remained in force for only a few sectors. The wine sector is one of them, with a quota regime shaping the distribution of vineyards across territories and the competitiveness of the sector.

By examining the Italian case, the paper provides a preliminary analysis of the dynamics of the vineyards' inter-regional allocation after the new scheme's establishment in 2016.

The analysis is conducted at the regional level over the 2008-2022 period and exploits dynamic two-way FE with bias correction (LSDVC) models. Findings show that there was vineyard reallocation from less to more remunerative regions, which are also the regions that produce the highest-quality wines, according to the Geographical Indication scheme, and those wines that are more in demand by consumers. By linking policy design with broader economic and structural changes, the paper contributes to the debate on how governance instruments can support wine sector competitiveness, while reflecting on new lines of interventions in the light of the 2028 planned revision of the EU scheme.

Keywords: quotas, production specialisation, Italy, wine sector, vineyards evolution

1. Introduction

Quota-based strategies, as a production control mechanism, have been widely adopted at both the national and international levels to support the competitiveness and resilience of the agrifood sector [1]. Quotas were introduced as policy levers to support prices (e.g., sugar and milk markets), promote healthier food systems (e.g., organic land targets), manage natural resources and shape land use change.[1] Even if nowadays most of the quota regimes have been cancelled following policy liberalisation aims [9], the EU wine sector is still controlled through an authorisation scheme that regulates planting evolution and vineyards' regional distribution, in the wake of the bane of new vineyards introduced in the late 1970s [10] (Reg. n. 1308/2013). [2]

In 2007, a liberalisation was planned, but the decision was reversed in 2013. The decision was supported by the statements that liberalisation would be in favour of bigger producers who would have delocalized vineyards to higher-yield territories, increasing production and decreasing prices and quality. Since

[1] Among others, [2-8].

[2] In this paper, we use the term quota (or quotas) to denote a maximum limit on planting authorisations, and not a limitation on production volumes. The word vineyards refer to vineyards for wine production. Vineyards for table grapes are not included in the quota regime and are out of the scope of this paper.
The wine sector is regulated through a sort of quota-based mechanism also in extra-EU countries, such as the USA (acreage controls) [11].

2016, the historical regime, based on marketable planting rights, has been replaced by the current quota mechanism based on administrative authorisations for planting vineyards (i.e., land control).[3] The scheme will be in force until 2045, with two mid-term reviews in 2028 and 2040 [13]. The recent Vision for Agriculture and Food by 2040, and beyond, restated the effectiveness of such an approach, stating that "*the Commission closely monitors all markets and rapidly acts when market situation deteriorates"* [12] and reported that "*[…] the wine sector required such a response*" to address the escalating pressure of external shocks (e.g., climate change, trade policies) and of changes in consumers' preferences.

Existing literature is mainly limited to only one contribution that discusses the role of this scheme from a theoretical perspective, developing a theoretical model of planting rights [14], but leaving the literature without empirical evidence of post-2016 dynamics. Such scarcity of empirical studies can be attributed to the difficulty of separating the policy effect from the massive market trends occurring simultaneously and, methodologically, to the lack of a control group, given that all the EU regions of the principal producing countries are treated. This makes econometric evaluation extremely difficult.

This paper attempts to investigate what happened after the establishment of the new quota-based system in 2016 by looking at the inter-regional allocation dynamics of vineyards across Italian regions. The analysis is conducted at the regional level over the 2008-2022 period and adopts a Generalised Method of Moments (GMM) panel approach to exploit heterogeneous post-2016 changes across regions.

The study focuses on Italy as a good quasi-laboratory case for the following two main reasons.
Firstly, in Italy, the wine sector is a key asset for regional economies: all the Italian regions and provinces produce wine. Italy is the Old-World wine country accounting for the largest vineyard area, the largest wine production in the EU [15] and a constant significant increase in terms of hectares (+0.8%) [16].[4] Italy is also the country with the highest number of wines certified as Geographical Indications (GI) (Reg. EU, 2024/1143): 528 GIs (1,620 wines in the EU) [17].[5] According to the EU regulations on wine and food quality, the presence of GIs can be considered as a good indicator of wine quality production across territories. All Italian regions are acknowledged within the wine GI scheme.

Second, from the scheme perspective, Italy decided not to add any of the possible additional limitations available in the framework of the EU scheme, leaving unaltered the EU policy design.

Findings reveal that, over time, there was vineyard reallocation from less to more remunerative regions, which are also the regions that produce the highest-quality wines, according to the GI scheme, and those

[3] COM (2025) 75 final: COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS. A Vision for Agriculture and Food Shaping together an attractive farming and agri-food sector for future generations.
[4] In 2024, Italy was the only EU Old World wine producer that experienced an increased in terms of hectares. Spain accounted 930 thousand (-15.0%), France 783 thousand (-0.7%) and Italy 728 thousand (+0.8).
[5] Among them, 409 Protected Designation of Origin and 119 Protected Geographical Indication [17].

wines that are more requested by consumers. The analysis provides evidence of a specialisation quality-driven concentration process in viticulture within regional agricultural systems, suggesting that the authorisation scheme did not prevent market forces from concentrating production. According to the 2012 regulation, in fact, market reallocation should not be possible given that the vineyards' evolution and distribution are controlled by public authorities. However, after 10 years of the establishment of the quota-based system, regional vineyards' allocation seems to be, at least partially, influenced by market dynamics.

The discussion is informed by the EU wine regulatory context and existing wine economics literature. The descriptive evidence on interregional reallocation of authorisation, particularly from Southern regions toward the North-East, is compelling and policy relevant. Evidence suggests that market dynamics could drive vineyard allocation towards market efficiency, responding to national and international demand, and generating territorial and type of wine concentration [18].

Recalling the economic literature on the benefits of spatial agglomeration (*Milieu Innovateur*) [19], such territorial proximity can be considered as an effective strategy to create competitive advantages, especially in the short to medium term, and enhance the socio-economic development of the territories involved. Through collective learning and cross-fertilisation among local actors, positive externalities can be maximised [20,21]. Through this lens, the paper's results would be good news, as Italian producers found a way around potentially inefficient planned territorial allocation and to respond to the market. However, some relevant caveats remain on vineyards' allocation driven by market efficiency as it could also generate negative economic, social and environmental implications for different stakeholders.

Such dynamics may incentivise the abandonment of vineyards in less remunerative regions and be at the expense of small producers, contrasting with the policy objective of maintaining vineyards also in less attractive regions and preserving native grape varieties.

At the same time, an excessive degree of geographical concentration may hint at the capacity of the wine system to react to structural and localised changes (e.g., climate change and consumers' preferences), potentially affecting the long -term competitiveness of the sector and the socio-economic development of territories. This paper invites policymakers involved in European and national strategies for the wine sector to reflect on future objectives and actions.

The rest of the paper is organised as follows. Section two summarises the contextual and policy frameworks, while Section three presents the research design. Results are debated in Section Four. The paper concludes with policy recommendations and final remarks in the Conclusions.

2. Contextual framework

2.1 The vineyards quota-based policy

Since the 1960s, when the Common Market Organisation (CMO) for the wine sector was established, several regulations have been introduced to control the extension of vineyards and the quantity and quality of wines produced in the EU countries [22]. The overall objective of public policies has been to guarantee domestic and international market stability by avoiding imbalances between supply and demand and price decline [23,24]. In this context, the geographical vineyards' distribution has always been managed by regulatory measures [13,14]. The current system is based on planting authorisations, which are free of charge, allocated every year and non-transferable across owners and regions (for a summary of the scheme see [10], p. 402). Such an approach was proposed not only as a mechanism to control market dynamics (supply and demand), but also the geographical distribution of vineyards [25].

Under the authorisation scheme, every year, in each EU producing country, the total amount of new vineyards can increase by a maximum of 1% (artt. 63-65 Reg. n. 1308/2013), which is divided across regions based on national criteria. If the regional requests are lower than the available number of hectares, the national authority can distribute them across vine growers; otherwise, a reduction is necessary to not exceed the annual regional 1% limit (amending Reg. (EU) No 1308/2013).[6]

Planting authorisations (new and old) cannot be inter-regionally reallocated by producers, except for some exemptions: M&A of existing vineyards (the new entity assumes all rights and authorisations linked to the pre-existing vineyards), business sales (rights and authorisations remain linked to the business unit that is sold) and vineyards within the same wine holding.[7]

In addition to the EU regulation and requirements, member States have the possibility to select some additional criteria to make the allocation across territories more stringent [26]. These additional restrictions are not mandatory, while each EU MS can decide to implement them and which ones.
Italy, for example, did not introduce any additional criteria. For instance, in comparison with other EU countries, in Italy, adequate occupational skills and competence are not required for applicants (Spain, yes); additional criteria for PDO vineyards have not been included (France and Spain, yes), and all regions can expand their vineyards' plantation (France and Spain, no) [26].

[6] Italian rules of implementation establish a linear reduction of exceeding requests, on regional basis (Ministerial decree 19 December 2022 n. 649010). Since the 2016, the national reserve of planting rights has been abolished. This reserve included planting rights that had been waived, which were then reallocated upon payment or free of charge through public calls to specific categories of vine-growers, such as young farmers or producers in remote areas.
[7] EUROPEAN COMMISSION, Information on Planting Authorisations requested and granted and Planted Vine Areas 2021, DIRECTORATE-GENERAL FOR AGRICULTURE AND RURAL DEVELOPMENT - Directorate E. Markets E.2. Wine, spirits and horticultural products, Brussels, 3 February 2022.

Replanting authorisations are, instead, automatically released upon request for an area equivalent to the previous one and can be used in the same holding where the grubbing-up took place (art. 66 Reg. n. 1308/2013). However, if the agricultural activity is carried out also in other areas, where the applicant is the tenant, replanting authorisations can also be used there, being, in principle, part of the same agricultural holding (art. 45 of Law No. 203 of 1982). The only restriction is that the original vineyard area must be replanted with a different agricultural production (e.g., fruit).

Planting and replanting authorisations are valid for 3 years from the date on which they were granted. However, some exceptions also exist in this case (article 62 of Reg. (EU) 1308/2013). For example, in 2023, the EU extended by one year the validity of planting and replanting authorisations expiring in 2024 in those regions that have been affected by extreme climatic events to plant vines in 2025 (especially in France, Italy and Spain).

In this context, an open question remains: *is it possible to reallocate vineyards across regions?* The answer is yes, even if we cannot bring direct evidence of strategic holdings' behaviours. Actors seeking to start or expand production in a specific region, but who are unable to obtain all the desired new authorisations there due to excess demand (over 1% annually), may acquire or lease an agricultural holding in another region that already possesses vineyards and, thereby, planting authorisations. These authorisations can be transferred to the desired region, either by renting or purchasing land there, or by converting existing production on land already owned into vineyards. Another option is to ask for new authorisations in less requested regions, where it is more probable to obtain the authorisation for a huge number of hectares, and, after a minimum period of five years, move planting rights to other regions with their authorisations.

This mechanism may result in a market-driven geographical reallocation of vineyards toward more attractive regions (i.e., areas from where more requested wines come from). In the medium-long run, such dynamics may generate an increase in geographical concentration and production specialisation economies of the wine system, land use changes in historical wine regions, and a general increase in the price of vineyards (i.e., land). The price of land will increase, in fact, not only in the most renewable wine territories, but also in less attractive ones, because buying existing vineyards to be grubbed up permits to overcome the obstacles in obtaining new planting authorisations to be used in more promising areas.

2.2 Vineyards quotas and regional allocation: a theoretical framework

Regional vineyards' allocation is managed in theory through the quota scheme and, therefore, it can be framed within the economic literature that examines the theoretical foundations of the relationship between quotas, territorial agglomeration and regional economic systems. Existing literature suggests

that quotas should not be expected to passively distribute activity across territories, but rather actively interact with market behaviours.

First, from a regional development perspective, a quota-based system that allows vineyard reallocation may amplify agglomeration forces at the territorial level. Without additional limitations, it can indirectly lead to allocations in favour of pivotal influential regions. Wine systems will tend to cluster due to increasing returns (i.e., more requested wines), knowledge spillovers, and shared reputation [27,28]. In the long run, such dynamics could become self-reinforcing, and regions benefiting from market dynamics gain additional economic power, further strengthening their bargaining position in future allocation requests and generating path dependence. Market mechanisms will tend to reallocate planting authorisations toward high-productivity clusters, even if in principle these specific quotas are non-transferable.

In this sense, planting authorisations may function more as catalysts for reallocation across regions than as a redistributive tool, unless explicitly designed to prevent regional asymmetries. In recipient regions, those attracting vineyard relocation, local economies will become specialised, with a growing concentration of economic value. In the short term, this process may act as a lever for socio-economic development, fostering a shift toward higher value-added activities, such as increased employment, higher incomes, exports and new business opportunities [29,30]. However, in the long run, excessive specialisation may weaken regional resilience, reducing the capacity to respond to external shocks (e.g., extreme climatic events) or to develop new growth paths (e.g., changes in consumer preferences) [31,32]. For instance, *how would the Italian wine system and Veneto's regional economy be affected if consumers stopped drinking Prosecco?* [33].

As Boschma [32] stated, regional resilience should be conceptualised, in fact, not just as the ability of a region to accommodate shocks, as is common in the literature, but as the ability of regions to reconfigure their socio-economic and institutional structures to develop new growth paths.

On the other hand, in donor regions, those from which vineyards are being displaced, regional economic systems may undergo an opposite transformation, moving away from historically rooted wine production toward alternative economic activities. The main risk associated with this trajectory is the erosion of historical grape varieties, traditional production practices and local cultural identities, particularly those linked to large-scale viticulture. While some small-scale or niche productions (e.g., Marsala wine) may persist, they are unlikely to be sufficient to preserve the economic relevance of the wine sector in these regions [34]. This trend may affect the economic vitality of rural areas, which are often exposed to the risk of abandonment.

Second, the rent-seeking perspective suggests that quotas create artificial scarcity while generating rents associated with access to vineyards [35]. When allocation rules are uniform across regions, as in the case

of the EU planting authorisation scheme in Italy, heterogeneous actors might respond by reallocating effort toward regions where expected rents are the highest [36]. This mechanism implies that quotas on planting rights can reinforce regional disparities: regions of origin of the most required wines are better positioned to engage in rent-seeking activities, capture a larger fraction of vineyards, and crowd out weaker regions. Another possible consequence, for which we cannot provide direct evidence, is to crowd out small vine makers, while big players may benefit from such territorial concentration. The possibility of buying vineyards and, with the conditions addressed in the paper, of moving the planting authorisations to a more remunerative region, where land is only rented, may discourage those producers that are in less demanded regions from maintaining the holding, rather than selling it.

Lastly, from the sustainability perspective, if unanticipated by the policy, the additional pressure may lead to an overexploitation of natural resources (e.g., soil, water) and compromise the environmental sustainability of the regional systems [37].

3. Research design

3.1 The Italian wine sector in a nutshell

A high level of complexity characterises the Italian wine sector with different pedoclimatic environments, types of grapes, cultivation methods and production processes [38,39] from which originate a wide variety of wines, whose uniqueness is intrinsically linked to their terroir [40-42]. Over the last years, the sector has experienced an increase in the production of white and rosé wines [15,38], while a decrease in red ones, even if the economic relevance of the highest-quality red wines remains stable (e.g., Super Tuscan). This trend has been accompanied by a geographical concentration of vineyards in those territories acknowledged by the most well-known white and sparkling wines, such as the North-Eastern Italian territories [43,44].

The structure of the Italian wine sector is also fragmented, with many economic actors involved [44] and wine-related economic activities proposed, such as enotourism [45,46]. Today, small winegrowers and makers still account for a huge part of the Italian wine industry, often organised in wine cooperatives, even if a concentration process has started with mergers and Acquisitions (M&A) investments and the increasing role of bigger actors [33,47].

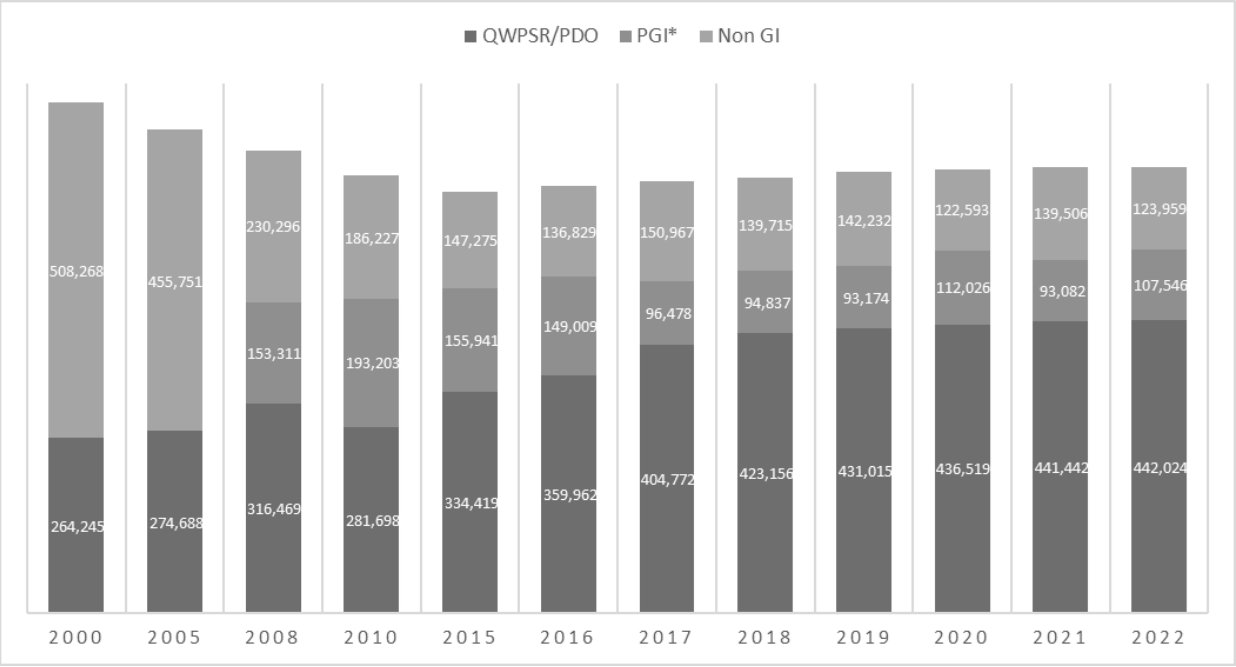
From the international trade perspective, wine exports represent 12% of the total Italian agri-food exports, accounting for 69 billion EUR and a 5.8% yearly increase [47]. Changes in foreign consumers' preferences and trade policies are affecting the composition of the Italian wine exports, mainly in favour of sparkling wines [48]. The presence of GI wines seems, in fact, to positively affect the internationalisation of Italian wine regions [49].

3.2 Data

To study inter-regional vineyards allocation dynamics, the paper relies on an original dataset on the geography of Italian vineyards and their evolution over the 2008-2022 period.[8] Data on regional vineyards come from the Agency for Agricultural Payments (AGEA), which, in Italy, is responsible for collecting information on the extension and composition of vineyards.

Over the period under analysis, Italian vineyards have experienced an overall U-shaped trend (Figure 1), with heterogeneity across regions (see Figure A1 in the Appendix for geographical distribution).

Figure 1. Area of vineyards for wine by type in Italy, 2000-2022 (hectares)



Note: Net of the vineyards already included in the PDOs.

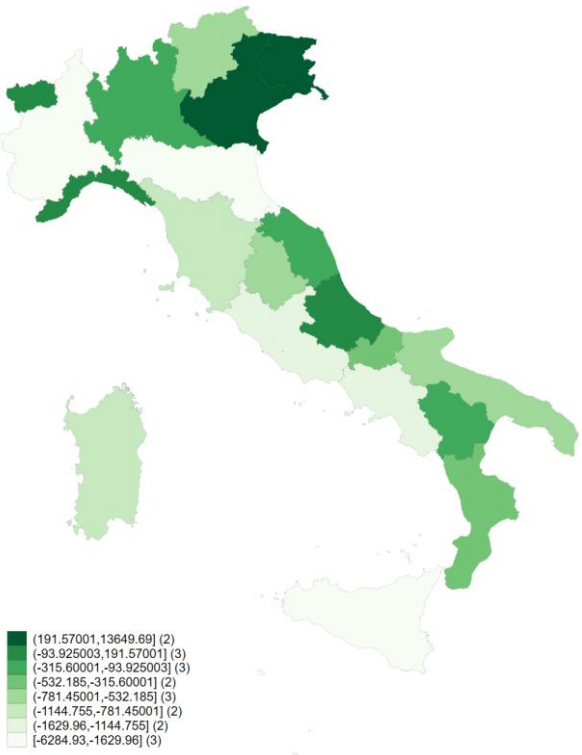
Source: Authors' elaboration on the AGEA dataset.

Between the beginning of 2016 and the end of 2021, 5,000 authorisations, corresponding to 9,000 hectares of vineyards, were transferred across regions (Table 1), following a concentration pathway

[8] The time span is the longest available because before 2008, data on vineyards did not distinguish between PDO and PGI wine, while some data after 2021 are not available. Data on new authorisations and vineyard distribution between Regions available only upon request to national authorities. 20 Regions are included in the original dataset.

(Figure 2): Sicily accounted for 56% of the hectares lost, while Veneto and Friuli-Venezia Giulia together represented more than 90% of the of hectares obtained (5,700 hectares in Veneto and 2,800 hectares in Friuli-Venezia Giulia).[9] As a result, some regions have expanded their vineyards much more than the corresponding 1% extension rate for new planting, equal across all Italian regions.

Figure 2. New authorisations *vs* vineyards utilised agricultural area



Note: The map depicts the difference between the hectares of vineyards authorised by new planting rights and the utilised agricultural area dedicated to vineyards for wine over the 2016-2021 period in hectares. Darker colours indicate higher values. *Source:* Authors' elaboration on the AGEA dataset.

[9] ¾ of the authorisations come from only 4 regions: Sicily (56%), Lazio (9%), Umbria (6%) and Apulia (6%).

Table 1: Hectares reallocation across regions (2016-2021)

	Authorizations (Number)	Area (Hectares)	Authorizations (%)	Area (%)
		Outgoing		
Italy	**4.957**	**9.443,3**	**100,0**	**100,0**
Umbria	*217*	*594,8*	*4,4*	*6,3*
Latium	*390*	*866,5*	*7,9*	*9,2*
Apulia	*311*	*551,4*	*6,3*	*5,8*
Sicily	*2.219*	*5.256,9*	*44,8*	*55,7*
		Incoming		
Italy	**5.124**	**9.431,1**	**100,0**	**100,0**
Veneto	*3.460*	*5.761,3*	*67,5*	*61,1*
Friuli Venezia Giulia	*1.240*	*2.785,5*	*24,2*	*29,5*

Note: Comparison of outgoing and incoming shows limited misalignments, such that it does not change the result on regional flow crossings.

Source: Authors' elaboration on the AGEA dataset.

Data on vineyards are complemented with a comprehensive set of demographics, agricultural territorial characteristics and socio-economic information at the regional level (sources: ISTAT and Farm Accountancy Data Network). Whilst ISTAT provides harmonised data on regional characteristics and wine export, the FADN offers harmonised information on the structure of the agricultural sector.

3.3 Methodology

Methodologically, we estimate the following dynamic two-way fixed effects model with bias correction (LSDVC) [50]:[10]

$$Vineyards_{i,t} = \alpha + \beta_1 Vineyards_{i,t-1} + \beta_2 \sum_{r=1}^{R} \beta_r D_r + \sum_{r=1}^{R} \beta_r (D_r \; x \; POLICY_t) + \beta_3 Controls_{i,t-1} + \beta_4 Spatial\ lags_{i,t-1} + \gamma_i + \lambda_t + \varepsilon_{i,t} \quad (1)$$

Where *i* is the region, and *t* is the year.

[10] Estimating a dynamic panel model by standard within-group (LSDV) fixed effects generates inconsistent estimates because the lagged dependent variable is mechanically correlated with the demeaned error term [51]. LSDVC estimator analytically corrects the Nickell bias through a higher-order asymptotic expansion.
The bias correction is initiated using the Arellano–Bond estimator [52] (bias order 3) [50]. Variance-covariance estimation is based on 1000 bootstrap replications.
The dynamic specification of the model is justified by the significance of the Wooldridge test [53].

Vineyards denotes the following dependent variables for region i and time t: (i) vineyard extensions (hectares), (ii) agricultural specialisation (share of agricultural land), (iii) regional specialisation (share of regional surface) and (iv) production. These variables allow us to depict the spatial distribution and potential concentration of vineyards across regions.

$Vineyards_{i,t-1}$ is the one-period lagged value of the dependent variable, accounting for the persistent nature of the outcome.

Dr are NUTS2 region dummies, while $Policy_t$ is a binary variable equal to 1 in the post-policy period.

$\sum_{r=1}^{R} \beta_r (D_r \; x \; POLICY_t)$ captures heterogeneous policy effects across NUTS2 regions: the coefficients measure differential policy effects of each NUTS2 region relative to the reference region, while the overall average effect of the policy is absorbed by the $POLICY_t$ variable. *Controls* are a vector of time-varying controls, including wine export shares (unit value); agritourism density, the amount of CAP funds for innovation programmes, population density, employment rate, export unit values, the share of food and beverage industry value added, the share of agricultural value added, rate of tertiary education, utilised agricultural area, temperature and precipitation averages.

Spatial Lags denote time-varying spatially lagged PDO vineyards, PGI vineyards and non-GI vineyards. Because contiguity weights may generate isolated units (i.e., islands), we define the spatial weights matrix using inverse-distance weights based on regional centroids and row-standardise it so that spatial lags represent weighted averages of geographically closer regions. Spatially lagged variables capture spillover effects from neighbouring regions, reflecting the extent to which changes in vineyard area (or related variables) in geographically proximate regions are associated with local dynamics.

All the *Controls* and *Spatial Lags* have been included with a one-year time lag. See Table 2 for the description and source of all the variables and Table A1 for the descriptive statistics.

Lastly, γ_i captures region-specific fixed effects, λ_t captures year fixed effects, while $\varepsilon_{i,t}$ is the idiosyncratic error term.

This specification identifies, therefore, heterogeneous post-2016 changes across regions, while absorbing all time-invariant regional heterogeneity and common macroeconomic shocks and aggregate trends affecting all regions simultaneously.

We clarify that this approach does not identify an average causal effect of the policy in the absence of an untreated control group, but rather differential impacts consistent with region-specific exposure.

Table 2: Definition and source of variables

Variable	Definition	Source
	Control variables	

Population density	Absolute value of the average population per square kilometre	Authors' elaboration from data of the Italian National Institute of Statistics, ISTAT
Employment rate	Share of residents of working age 15 years or over	Italian National Institute of Statistics, ISTAT
Higher education rate	Share of secondary and tertiary education	Italian National Institute of Statistics, ISTAT
Exports	Value of exports – mln EUR	Italian National Institute of Statistics, ISTAT
Share of food and beverage industry value added	Share of Gross Value Added of the food and beverage sector	Italian National Institute of Statistics, ISTAT
Share of agricultural value added.	Share of Gross Value Added of the agricultural sector	Italian National Institute of Statistics, ISTAT
Utilised agricultural area	Total area taken up by arable land, permanent grassland, permanent crops and kitchen gardens used by the holding, regardless of the type of tenure or of whether it is used as a part of common land	Farm Accountancy Data Network (FADN)
Amount of CAP funds for innovation programmes	Value of CAP funds received for innovation activities through the Second Pillar (EUR)	Farm Accountancy Data Network (FADN)
Agritourism density	Number of farms that offer agritourism activities per square kilometre (regional)	Authors' elaboration from data of Italian National Institute of Statistics, ISTAT
Unit value of GI wine exports	Unit value of GI exports (EUR/Kg)	Authors' elaboration from data of Italian National Institute of Statistics, ISTAT
Unit value of non-GI wine exports	Unit value of non-GI exports (EUR/Kg)	Authors' elaboration from data of Italian National Institute of Statistics, ISTAT
PDO vineyards - spatial lags of neighbouring regions	PDO vineyard area in neighbouring municipalities in the previous year (ha)	Agency for Agricultural Payments (AGEA)
PGI vineyards - spatial lags of neighbouring regions	PGI Vineyard area in neighbouring municipalities in the previous year (ha)	Agency for Agricultural Payments (AGEA)
Non-GI vineyards - spatial lags of neighbouring regions	Non-GI vineyard area in neighbouring municipalities in the previous year (ha)	Agency for Agricultural Payments (AGEA)
Time lags of outcome variables	Outcome variables in the previous year t-1	Authors' elaboration from data of the Agency for Agricultural Payments (AGEA)
Temperature	Average regional temperature (Celsius)	Italian National Institute of Statistics, ISTAT
Precipitation	Average regional precipitation (millimetres)	Italian National Institute of Statistics, ISTAT
	Outcome variables	
Vineyard extensions	Land dedicated to vineyards (th ha) – total, PDO, PGI and non-GI	Agency for Agricultural Payments (AGEA)
Vineyard specialisation	Share of vineyard in the regional utilised agricultural area	Authors' elaboration from data of the Agency for Agricultural Payments (AGEA)
Wine production	Quantity of wine – (th hectolitres)	

Note: Control variables are included with a one-year time lag.

3.4 Limitations

We acknowledge that inference remains subject to the constraints of a small-N setting. Coefficient estimates and standard errors should be interpreted with appropriate caution to avoid over-interpreting results that are only marginally statistically significant.

Separating the policy effect from simultaneous market trends and, therefore, in identifying a causal policy effect, is a key limitation of the study. The policy structure, in fact, does not permit us to adopt policy evaluation approaches based on the comparison between treated and untreated units. The fact that all the Italian regions are treated at the same point in time limits the possibility of using a Propensity Score methodology, as we do not have untreated units. In addition, the fact that the scheme has been implemented at the EU level makes a Synthetic Control approach infeasible, as we do not have countries that have not been treated and that can be used as a donor pool. All the EU regions should, in fact, discharge form the list of the donor pool. Lastly, a Difference-in-Differences approach, both static and staggered, cannot be implemented as Italian regions have been treated at the same point in time. In addition, verifying the linkages explored in this study at a more disaggregated level of analysis is limited by the availability of data. Data on vineyard distribution differentiated by type of grapes (i.e., GI or wine grape) at a more disaggregated level of analysis (i.e., provinces and municipalities) are not available.

Another limitation regards the fact that we cannot capture intra-regional shifts (e.g., from hills to plains within the same region). Data are, in fact, not provided at sub-regional levels.

The extension of the analysis to other EU countries is also strongly conditioned by data provision. The methodology we employed necessitates not only data on socio-economic regional characteristics and agricultural sector features, but also a set of information on the type of vineyard distribution. Unfortunately, harmonised data about vineyard distribution across regions and GI types (i.e., PDO/PGI/non-GI) are not provided by the EU. Each country can decide if, and in which manner, to make them available and for whom. For instance, in the case of Italy, AGEA authorises only national agricultural research institutes to officially ask for this data. Nevertheless, our paper provides a detailed step-by-step guide of the research design that makes the replicability for other EU countries technically feasible.

In this paper, we rely on the GI scheme as our reference measure of quality. The analysis could benefit from using alternative indicators for wine quality, but they face important limitations in terms of data availability and interpretation. For example, data on consumer liking and expert liking are, firstly, difficult to reconstruct consistently over time and, secondly, they cover only a selected list of wines. In addition, at present, there is no official available database collecting wine rankings from different guides

(e.g., Robert Parker, Gambero Rosso) or from consumer surveys, although such a resource would be extremely valuable for researchers in wine economics.

4. Results

Table 3 shows post-2016 changes across regions in vineyard extension in absolute values. To discuss regional differential impacts, we select Veneto as the baseline region given its relevance for the Italian wine sector: it is the first Italian region for vineyards (104 hectares), wine production (27%) and Italian wine GI economic value (40%) [47].[11] Estimation coefficients show, therefore, how the dynamics in each region differ relative to Veneto.

All regions show negative and statistically significant coefficients for all regions, indicating that the increase of the absolute amount of vineyard area is consistently smaller than in Veneto (*Column 1).* Considering the 1% yearly extension as a common condition across regions, such differences highlight that some regions have the capacity and the possibility of attracting more planting authorisations than the established ones. In this sense, estimations confirm that Veneto has extended vineyards more than the rest of the country [22,47].

Heterogeneous patterns emerge when distinguishing by quality GI segments, signalling a regional comparative advantage in GI vineyard extensions.

The expansion of PDO vineyards is, in fact, significantly weaker outside Veneto (*Column 2*), while PGI vineyards expanded more strongly in other regions (*Column 3*). On the one hand, this dynamic is consistent with the importance of high-value Veneto PDO wines in Veneto [47] and, more in general, confirms that, under successful conditions, the GI scheme works as an attractive market force for the wine sector. GIs' territories are, in fact, attractive not only for their *terroir*, but also for the community-specific set of production assets [54,55] and the economic benefits generated by this quality scheme [45,56], such as prosperous economic conditions [30,57], innovation dynamics [58,59], and internationalisation [60,61]. [12] Literature demonstrated that GIs can be assumed as a proxy of cooperative territories capturing the tangible and intangible assets (e.g., informal networks) [30,63] that are assumed

[11] Piedmont is the first region for the number of GI wines (60) accounting for 1.180 mln EUR, while Tuscany is the second one (58) accounting for 1.139 mln EUR.

[12] For example, looking at PDO wines, in 2023, one hectare in the Barolo area (Langhe, Piedmont) has a minimum land value of 250 thousand EUR and a maximum of 2 million; one hectare in the Prosecco DOCG area (Veneto) has a minimum land value of 300 thousand EUR and a maximum of 600 thousand EUR; one hectare in the Etna area (Sicily) has a minimum land value of 45 thousand EUR and a maximum of 95 million. Conversely, one hectare for table wine ranges from 265 to 150 in Veneto, while from 20 to 40 in Sicily (source: *Indagine sul mercato fondiario*[62]).

to be crucial in supporting economic development [64]. Drawing on these arguments, vine makers may benefit from locating their vineyards in successful GI territories [54].[13]

On the other hand, however, taken together with the general increase of vineyards (i.e., in absolute terms), the result highlights a potential concentration pattern in favour of those regions already involved in successful PDO productions, which may also benefit from attracting additional vineyards. In other words, in the long run we could imagine a process of increasing regional divergence, where regions with a strong PDO orientation continue to strengthen their position and capture higher value production, while other regions may increasingly specialise in lower-quality or less strictly certified segments of the wine market. Abruzzo and Marche are examples of this potential trend.

Non-GI vineyard patterns are more stable, with several non-significant effects (*Column 4*). Such dynamics can be mainly explained by the fact that these wines have lost their attractiveness in national and international markets over the years, shaping a reorientation towards more profitable market segments. The reason is dual. On the one hand, consumers drink less and prefer wines with higher quality than table wines [38,66]. There was a "*decrease in consumption in traditional wine-producing Member States*" (Recital 54 of Reg. n. 1308/2013), such as Italy, indeed. On the other hand, the production of these wines was historically managed by large collective bodies that, since the 80s, have lost their market power in favour of individual holdings [67]. However, in some cases, non-GI wines still represent a higher presence in the vineyard's scenario.

Taken together, findings seem to suggest that, over the years, the regional specialisation patterns within the Italian wine sector have been strengthened, with more attractive regions consolidating their position as leading territories specialised in high-quality certified productions. This trend is consistent with a quality-driven concentration process, where leading regions consolidate high-value production, while others adjust through alternative quality segments.

Table 3: Vineyards – absolute values

	Vineyards – total (1)	Vineyards – PDO (2)	Vineyards – PGI (3)	Vineyards – non-GI (4)
NUTS2#Policy				
Abruzzo	-3.75***	-15.5***	10.5***	3.65
	(0.74)	(2.86)	(3.86)	(3.48)
Basilicata	-3.85***	-15.7***	8.91**	3.35

[13] It is important to highlight that this dynamic should not be taken for granted, as producers could prefer to plant vineyards in non-GI areas to avoid the strongest restrictions imposed by GI Product Specifications (PS) in terms of yield and quality requirements. Existing theoretical studies on the consequences of the GI scheme did not address then authorisation scheme mechanism and, typically, focus on a single region, rather than on a country (e.g. [65]).

	(0.82)	(3.18)	(4.30)	(3.87)
Calabria	-3.88***	-16.9***	13.0***	1.19
	(0.81)	(3.00)	(4.05)	(3.72)
Campania	-4.34***	-13.2***	9.88**	0.29
	(0.80)	(2.99)	(4.10)	(3.64)
Emilia-Romagna	-4.04***	-16.8***	6.12	3.84
	(0.86)	(2.85)	(4.04)	(3.64)
Friuli-Venezia Giulia	-4.46***	-19.0***	8.87*	7.14
	(0.91)	(3.49)	(4.95)	(4.52)
Latium	-3.44***	-16.5***	12.4***	-2.26
	(0.97)	(3.28)	(4.38)	(4.03)
Liguria	-4.96***	-16.5***	8.28*	4.41
	(0.87)	(3.30)	(4.52)	(4.11)
Lombardia	-3.61***	-17.9***	10.2**	4.17
	(0.87)	(3.19)	(4.31)	(3.88)
Marche	-4.29***	-16.6***	6.34	5.90
	(0.81)	(2.96)	(4.04)	(3.64)
Molise	-3.99***	-15.4***	10.0**	1.65
	(0.80)	(3.03)	(4.00)	(3.62)
Piedmont	-4.70***	-17.1***	9.02**	3.30
	(0.80)	(2.83)	(3.82)	(3.44)
Apulia	-2.54***	-14.4***	9.94**	1.61
	(0.80)	(3.03)	(4.19)	(3.61)
Sardinia	-4.20***	-17.4***	11.5***	1.96
	(0.80)	(2.97)	(4.00)	(3.58)
Sicily	-4.42***	-4.13	-8.07*	3.37
	(0.96)	(2.87)	(4.23)	(3.77)
Toscana	-3.30***	-16.6***	7.43*	2.17
	(0.86)	(2.93)	(4.20)	(3.79)
Trentino-Alto Adige	-4.97***	-19.4***	7.44	7.29
	(0.93)	(3.51)	(4.89)	(4.45)
Umbria	-4.25***	-18.0***	11.0***	1.39
	(0.85)	(3.04)	(4.19)	(3.81)
Valle d'Aosta	-4.73***	-17.2***	9.08**	4.23
	(0.78)	(2.98)	(4.05)	(3.66)
Controls and spatial lags	✓	✓	✓	✓
Pre-trend	✓	✓	✓	✓
Regional FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Observations	280	280	280	280
Groups	20	20	20	20

Note: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Reported coefficients are region-specific POLICY effects estimated via NUTS2×POLICY interaction. Initial estimator: Arellano-Bond (AB). Bias correction: bias(3). Bootstrapped (1000) standard errors in parentheses.

Vineyards are expressed in thousands of hectares.

To better investigate the regional specialisation toward the wine sector, we look at the share of vineyards on the regional Utilised Agricultural Area (UAA) (Table 4). Table 4 provides evidence of a trend of geographical concentration of vineyards given that most of the coefficients are negative and statistically

significant, indicating that the increase in the share of regional agricultural land devoted to vineyards is consistently stronger in Veneto than in the rest of Italy (*Column 1*), especially in the case of PDO vineyards. This indicates that most of the regions show a smaller increase in the share of vineyards over the total surface and, in addition, over the regional agricultural area. Evidence reflects, therefore, a national trend of regional agricultural specialisation toward viticulture in regions with comparative market-driven advantages in attracting vineyards (e.g., production of white and sparkling wines that are the most requested) [47]. Conversely, other regions are experiencing a decline in vineyards' relevance in comparison with other crops, such as the case of Sicilian tropical fruits [68].

Table 4: Share of vineyards on regional Utilised Agricultural Area surface

	Share of vineyards – regional UAA (1)	Share of PDO vineyards – regional UAA (2)	Share of PGI vineyards – regional UAA (3)	Share of non-GI vineyards – regional UAA (4)
NUTS2#Policy				
Abruzzo	-0.88**	-1.03***	0.51**	-0.10
	(0.35)	(0.31)	(0.24)	(0.26)
Basilicata	-0.36	-0.88***	0.45*	0.30
	(0.37)	(0.32)	(0.27)	(0.28)
Calabria	-0.74**	-1.09***	0.96***	-0.38
	(0.36)	(0.32)	(0.25)	(0.27)
Campania	-0.76**	-0.77**	0.42	-0.16
	(0.36)	(0.32)	(0.26)	(0.27)
Emilia-Romagna	-0.75**	-1.13***	0.22	0.38
	(0.37)	(0.31)	(0.25)	(0.27)
Friuli-Venezia Giulia	-0.32	-1.08***	0.41	0.47
	(0.42)	(0.37)	(0.31)	(0.33)
Latium	-0.74*	-1.04***	0.52*	-0.057
	(0.40)	(0.35)	(0.27)	(0.29)
Liguria	-0.74*	-0.92***	0.29	0.11
	(0.40)	(0.35)	(0.28)	(0.30)
Lombardy	-0.62	-1.12***	0.44	0.30
	(0.39)	(0.34)	(0.27)	(0.28)
Marche	-0.66*	-0.99***	0.24	0.26
	(0.36)	(0.31)	(0.25)	(0.26)
Molise	-0.56	-0.88***	0.55**	0.0072
	(0.36)	(0.31)	(0.25)	(0.27)
Piedmont	-0.62*	-0.93***	0.33	0.20
	(0.34)	(0.31)	(0.24)	(0.25)
Apulia	-0.63*	-0.80**	0.32	0.016
	(0.37)	(0.33)	(0.26)	(0.27)
Sardinia	-0.68*	-1.01***	0.58**	-0.022
	(0.36)	(0.31)	(0.25)	(0.26)
Sicily	-0.65*	-0.38	-0.28	0.21
	(0.37)	(0.32)	(0.26)	(0.28)
Toscana	-0.44	-0.91***	0.36	0.19

	(0.37)	(0.32)	(0.26)	(0.28)
Trentino-Alto Adige	-0.89**	-1.37***	0.18	0.56*
	(0.43)	(0.37)	(0.30)	(0.32)
Umbria	-0.71*	-1.04***	0.52**	-0.030
	(0.37)	(0.32)	(0.26)	(0.28)
Valle d'Aosta	-0.66*	-0.93***	0.32	0.19
	(0.36)	(0.31)	(0.25)	(0.27)
Controls and spatial lags	✓	✓	✓	✓
Pre-trend	✓	✓	✓	✓
Regional FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Observations	280	280	280	280
Groups	20	20	20	20

Note: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Reported coefficients are region-specific POLICY effects estimated via NUTS2×POLICY interaction. Initial estimator: Arellano-Bond (AB). Bias correction: bias(3). Bootstrapped (1000) standard errors in parentheses.

Vineyards are expressed in thousands of hectares.

Looking at vineyard composition (i.e., the share of vineyards across GI and non-GI categories), several coefficients are negative and statistically significant in the case of PDO vineyards (*Column 1*), while positive in the case of PGIs (*Column 2*), highlighting a shift of regions that are less competitive in PDO production toward PGI segments (e.g., Calabria and Latium). These findings validate the quality-driven allocation process highlighted in the case of absolute values, where leading regions consolidate high-value production, while others adjust through alternative quality segments.

Table 5: Share of GI and non-GI vineyards on regional vineyards

	Share of vineyards – PDO (1)	Share of vineyards – PGI (2)	Share of vineyards – non-GI (3)
NUTS2#Policy			
Abruzzo	-0.19*	0.26**	-0.0013
	(0.10)	(0.10)	(0.12)
Basilicata	-0.16	0.046	0.24*
	(0.11)	(0.12)	(0.14)
Calabria	-0.23**	0.62***	-0.22*
	(0.11)	(0.11)	(0.13)
Campania	-0.041	0.22**	-0.12
	(0.11)	(0.11)	(0.13)
Emilia-Romagna	-0.13	0.042	0.11
	(0.11)	(0.11)	(0.13)
Friuli-Venezia Giulia	-0.24*	0.10	0.16
	(0.13)	(0.14)	(0.16)
Latium	-0.21*	0.30**	-0.096
	(0.12)	(0.12)	(0.14)
Liguria	-0.051	0.13	-0.011

	(0.12)	(0.12)	(0.15)
Lombardy	-0.24**	0.20*	0.092
	(0.12)	(0.12)	(0.14)
Marche	-0.13	0.044	0.13
	(0.11)	(0.11)	(0.13)
Molise	-0.16	0.18*	0.11
	(0.11)	(0.11)	(0.13)
Piedmont	-0.13	0.14	0.056
	(0.10)	(0.10)	(0.12)
Apulia	-0.17	0.27**	-0.0044
	(0.11)	(0.11)	(0.13)
Sardinia	-0.20*	0.30***	-0.035
	(0.11)	(0.11)	(0.13)
Sicily	-0.016	0.030	0.0085
	(0.11)	(0.12)	(0.14)
Toscana	-0.16	0.15	0.038
	(0.11)	(0.12)	(0.14)
Trentino-Alto Adige	-0.22*	0.095	0.19
	(0.13)	(0.14)	(0.16)
Umbria	-0.26**	0.36***	-0.062
	(0.11)	(0.11)	(0.14)
Valle d'Aosta	-0.18*	0.16	0.10
	(0.11)	(0.11)	(0.13)
Controls and spatial lags	✓	✓	✓
Pre-trend	✓	✓	✓
Regional FE	✓	✓	✓
Year FE	✓	✓	✓
Observations	280	280	280
Groups	20	20	20

Note: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Reported coefficients are region-specific POLICY effects estimated via NUTS2×POLICY interaction. Initial estimator: Arellano-Bond (AB). Bias correction: bias(3). Bootstrapped (1000) standard errors in parentheses.

Vineyards are expressed in thousands of hectares.

Regarding Veneto, PDO wines can be considered as a key driver of the inter-reallocation of vineyards in favour of this region. However, even if there are 14 PDO wines in Veneto, the economic value of the wine sector is driven by the Prosecco DOP system, which is a kind of "unicorn" of the Italian wine sector, accounting for 30% of the economic value of the regional wine sector and registering a constantly impressive increase in production and demand [47]. From the economic perspective, such success has generated economic benefits and value creation through proximity spillovers at the local level [69]. At the same time, however, the Prosecco miracle has demanded expansion and conversion of land use [70], generating some socio-economic and environmental conflicts [71]. Studies have, in fact, demonstrated that vineyard expansion replaced traditional cropland, grassland and woodland, generating soil erosion and biodiversity degradation. At the same time, the expansion and the concentration of vineyards may

increase environmental pollution, consequently generating social exclusion and an increased depopulation of hills [70,72].

The Prosecco production has sharply increased over the last decades [73], following a boom in consumer demand that is still not well understood in marketing circles or by economists. Unfortunately, we do not have specific data on national or international demand to test the inter-regional reallocation of vineyards towards regions that are characterised by the most demanded products. Nevertheless, we can only look at wine production. The negative and statistically significant coefficients for almost all regions indicate that most regions experienced a smaller increase or a larger decline in total wine production after 2016. Veneto benefited from a considerably stronger production dynamic compared with other regions. On the one hand, this result confirms the regional specialisation patterns; on the other hand highlights production dynamics (*Table 6*), which were less evident from vineyard estimations. For example, while PDO wine production was significantly stronger in Veneto (*Column 2*), PGI production increased more strongly outside Veneto (*Column 3*).

Leaving the discussion about the reasons for the reputation of Prosecco wine outside of this paper, and taking all the results together, the findings are compatible with the hypothesis that the policy quota system does not fully constrain market-driven concentration. This reinforces existing structural differences within the Italian wine sector, with Veneto, for example, consolidating its position as a leading region in PDO-based wine production.

487 **Table 6**: Wine production

	Wine production (1)	PDO wine production (2)	PGI wine production (3)	Non-GI wine production (4)
NUTS2#Policy				
Abruzzo	-1,71***	-1,07***	678***	644***
	(395)	(279)	(217)	(224)
Basilicata	-2,41***	-1,12***	637***	129
	(441)	(288)	(234)	(247)
Calabria	-2,22***	-991***	683***	224
	(430)	(290)	(231)	(240)
Campania	-2,65***	-1,16***	588***	82.7
	(423)	(290)	(223)	(234)
Emilia-Romagna	-1,95***	-826***	581***	407*
	(417)	(292)	(220)	(235)
Friuli-Venezia Giulia	-1,19**	-514	894***	337
	(513)	(340)	(277)	(294)
Latium	-2,24***	-963***	765***	158
	(471)	(320)	(249)	(259)
Liguria	-2,13***	-975***	623**	186
	(468)	(320)	(251)	(264)
Lombardy	-2,03***	-944***	771***	253
	(447)	(316)	(244)	(250)
Marche	-2,20***	-988***	618***	175
	(416)	(288)	(225)	(234)
Molise	-2,02***	-880***	756***	362
	(420)	(295)	(221)	(230)
Piedmont	-2,39***	-900***	724***	59.4
	(398)	(281)	(210)	(218)
Apulia	1,71***	-1,10***	885***	2,65***
	(405)	(292)	(233)	(271)
Sardinia	-2,14***	-965***	694***	178
	(415)	(289)	(222)	(230)
Sicily	-1,93***	-679**	436*	-342
	(432)	(279)	(232)	(244)
Toscana	-2,22***	-840***	684***	140
	(442)	(302)	(234)	(246)
Trentino-Alto Adige	-1,63***	-572*	798***	189
	(515)	(341)	(271)	(293)
Umbria	-2,17***	-833***	642***	113
	(440)	(298)	(233)	(245)
Valle d'Aosta	-2,32***	-1,07***	681***	190
	(420)	(297)	(221)	(234)
Controls and spatial lags	✓	✓	✓	✓
Pre-trend	✓	✓	✓	✓
Regional FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Observations	280	280	280	280
Groups	20	20	20	20

Note: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Reported coefficients are region-specific POLICY effects estimated via NUTS2×POLICY interaction. Initial estimator: Arellano-Bond (AB). Bias correction: bias(3). Bootstrapped (50) standard errors in parentheses.

Wine production is expressed in thousands of hectolitres.

4.1 Robustness checks

To assess the stability of our baseline LSDVC estimates, we conduct a series of robustness checks.

First, we vary the order of bias correction from one to three [50]. Second, we compare LSDVC estimates with those obtained via the Driscoll–Kraay fixed-effects estimator [74], which produces standard errors robust to cross-sectional dependence, heteroskedasticity, and serial correlation of unknown form.

Lastly, we replicate the analysis by simulating an anticipated timing of the policy from 2008 to 2016. Coefficients show opposite signs in comparison with main results across most specifications, which is broadly consistent with the main results, although the placebo exercise should be interpreted with caution given the observational nature of the data and the small number of cross-sectional units (Table A2 and Table A3).

5. Policy recommendations and conclusions

This paper investigated the dynamics of inter-regional allocation of vineyards in Italy after the introduction of the 2016 authorisation scheme, offering very preliminary evidence to reflect on the dynamics of the wine sector and future policies, even if we cannot conclude for policy-caused effects.

The analysis suggests that, within the current quota-based regulatory framework, the territorial distribution of vineyards is shaped by market dynamics. This evidence opens the debate about whether the current quota-based system should be modified in the light of the trade-off between territorial balance and market competitiveness.

From the territorial perspective, in fact, vineyards are following a geographical concentration pattern, which, in the long run, might shape regional economies.

On the one hand, the economic systems of regions attracting vineyards could become highly specialised, with increasing economic benefits in the short and medium run, while potential risks in the long run. An excessive degree of specialisation could, in fact, increase environmental (e.g., pathogenic grapevine diseases, agrobiodiversity) and socio-economic vulnerability (e.g., market turbulences for specific products). Concentration trends may, therefore, anticipate a reflection on the need to take "*into account environmental concerns […] maintenance of biodiversity and the upkeep of the countryside*" (Recital 38 of Reg. n. 1308/2013).

On the other hand, the abandonment of historical production in some regions may undermine the local economic competitiveness of the wine sector, the presence of historical grape varieties and the cultural identity of areas with a traditional wine vocation.

To prevent market-driven concentration, policymakers should consider adopting stricter allocation requirements. For example, they could limit the reallocation of authorisations across PDO areas or tie authorisations to regions rather than individual holdings. At the same time, care must be taken to avoid excessively constraining market dynamics. Such top-down, one-size-fits-all intervention is, in fact, not always suggested by the economic literature, as excessive planning could ultimately reduce the sector's ability to adapt to unexpected shocks and changing market trends.

Conceptually, additional quota allocation criteria could help to ensure a more balanced distribution of vineyards across territories, but it could block the concentration driven by market efficiency as additional policy restrictions might reduce the wine sector's competitiveness. At the same time, market dynamics could penalise vulnerable areas and stakeholders, such as small and medium-sized producers and family farmers.

The possibility of moving the planting authorisations to more remunerative regions, with the conditions addressed in the paper, may discourage those producers that are in less demanded regions to maintain the holding, rather than to sell it, especially in less remunerative and less productive regions (such as the South of Italy). At the same time, a geographical concentration and scale relevant for a global brand (e.g., Prosecco) may generate a mismatch in business models among small and big players despite geographical proximity [29].

To be less exposed to market-driven allocation mechanisms, small producers could be incentivised to cooperate and implement shared forms of business. Wine cooperatives, which are still a major player in the Italian wine sector [44,47], are a concrete example. Where cooperatives are well established, affiliated producers can, in fact, sell their grapes at a fair price within the cooperative framework and rely on strong local networks [45,75,76]. These conditions may provide stable income opportunities and reduce farmers' reliance on market-led land reallocation, mitigating viticultural decline.

The liberalisation of the vineyard market is clearly not on the next EU agenda, and surplus prevention is once again considered essential to maintain the competitiveness of the wine sector. The High-Level Group of EU Commission on Wine Policy has just underlined the necessity to put more in coherence the overall set of wine policy measures for the management of the production potential to control production levels and prevent price turbulences.[14] The new EU GI Law increased the role of producers in this sense, by leaving GI *Consortia* the possibility of setting a "*production plan*" aiming at having enough

[14] High-Level Group on Wine Policy, Policy Recommendations for the Future of the EU Wine Sector, December 2024.

production to respond to consumers' demand, without reducing prices (Reg. (EU) 1143/2024). Based on the new regulation, Consortia, as recognised producer groups, can request binding rules for the regulation of supply of products designated by a GI (art.33). The objective of the regulation is, in fact, to increase the Consortia's governance function of supply chains. In the sector under analysis, this reform introduces a different approach for which the real volume control happens at the GI level and not (at least not only) at the planting authorisation level. Territories involved in the GI scheme will be, therefore, affected by two different control mechanisms, the former designed at the EU level by governments, while the latter at the local level by producers. On the one hand, this strategy can help to achieve market efficiency, avoiding price decline and excessive wine reserves. Production plans are, in fact, more flexible than the authorisation scheme, and they can be yearly updated to respond on time at market dynamics. On the other hand, it will generate a multilevel governance of the wine sector that could be capable of applying in tandem private agreements (production plan) and public regulations. A high level of coordination among public institutions (EU, national and regional) and producers become essential.

From this perspective, it is crucial, in the short term, to carefully take into consideration the limits of the current allocation mechanism and to open the debate about the potential need for different strategies to succeed in taking together sectoral private interests and territorial balances. An anticipatory government system approach [77] based on territorial and individual characteristics, such as those proposed by Caravaggio et al. [78] for rural development funds allocation, can offer benefits for policy design. Policymakers and practitioners may, in fact, benefit from ex-ante allocation tools to better advance towards policy's objectives (e.g., high-quality, market equilibrium) and efficiently distribute benefits across producers and territories.

Community-led and territorial-based interventions could help in this direction. They might contribute to optimising the authorisation distribution not only from the market perspective, for which top-down management could be more efficient, but also from the social and cultural one [78]. Place-based interventions should help regional economic systems to address specific local challenges (e.g., heatwaves in the Mediterranean areas), while local producers should be more conscious of new business opportunities for the wine sector in the medium and long run (e.g., bilateral trade agreements) [79].

At the same time, sectoral characteristics (e.g., type of grapes, holding's structure, cooperative participation) should also be considered in policy design. For instance, monoculture and intensive production, maybe more economically profitable but with less landscape value, may, for instance, reduce the attractiveness of territories for citizens and tourists [80], affecting the income diversification of local actors.

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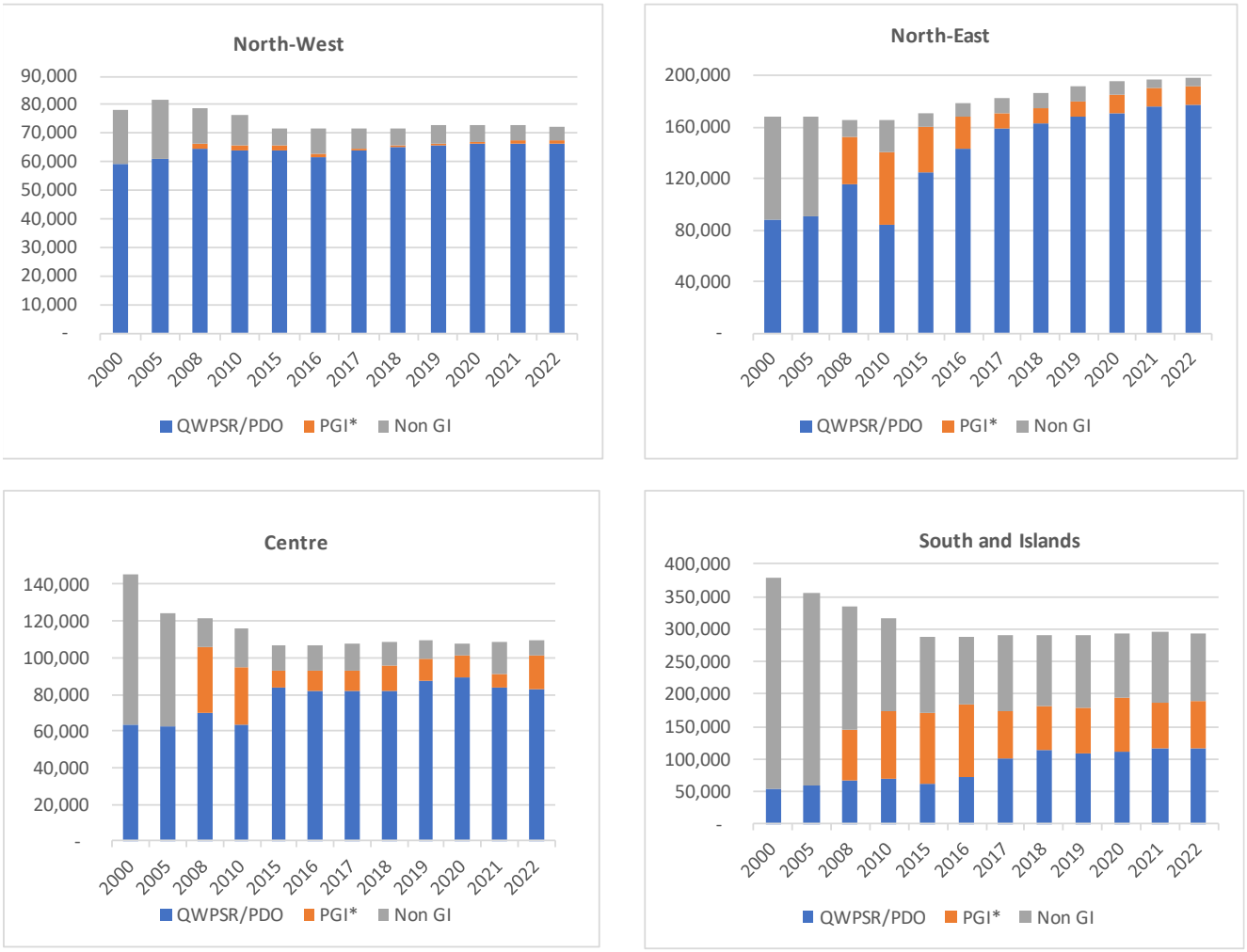
761

Appendix

Figure A1: Area of vineyards for wine by quality type and geographical area, 2000-2022 (hectares)



* Net of the vineyards already included in the PDOs. Values are in ha.

Source: Authors' elaborations on the AGEA dataset.

767 **Table A1**: Descriptive statistics

Variable	Mean	Sd	Min	Max
Control variables				
Population density	194.09	111.29	6.74	426.27
Employment rate	44.02	6.93	30.34	55.59
Higher education rate	0.12	0.02	0.08	0.21
Exports	20068.04	27105.20	324.98	136513.20
Share of food and beverage industry value added	0.02	0.02	0.001	0.19
Share of agricultural value added	0.03	0.01	0.01	0.06
Utilised agricultural area	18307.10	9755.46	1317.54	50296.45
Amount of CAP funds for innovation programmes	4213.18	25318.35	0	292553
Agritourism density	0.10	0.12	0.002	0.46
Unit value of GI wine exports	3.84	1.54	1.29	10.03
Unit value of non-GI wine exports	3.59	3.75	0.35	24.75
PDO vineyards - spatial lags of neighbouring regions	18.47	5.38	9.52	33.8
PGI vineyards - spatial lags of neighbouring regions	6.12	2.40	2.28	13.68
Non-GI vineyards - spatial lags of neighbouring regions	7.41	3.33	3.02	25.80
Temperature	15.83	1.92	1.64	19.84
Precipitation	778.05	274.68	0	2102.6
Outcome variables				
Vineyard extensions - total	33.15	30.01	0.29	122.29
Vineyard extensions - PDO	18.18	19.80	0.06	97.97
Vineyard extensions - PGI	6.92	12.43	0	68
Vineyard extensions – non-GI	8.04	12.28	0	82.04
Vineyard specialisation - total	1.83	1.48	0.02	7.25
Vineyard specialisation - PDO	0.95	0.94	0.02	5.44
Vineyard specialisation - PGI	0.38	0.64	0	4.15
Vineyard specialisation – non-GI	0.49	0.77	0	6.01
Wine production - total	2390.93	2694.41	9.75	12865.55
Wine production - PDO	984.05	1359.16	8.25	9173.33
Wine production - PGI	679.77	999.69	0	4846.35
Wine production – non-GI	727.09	1205.28	0	6925.49

768 Note: Vineyards are expressed in thousands of hectares. Wine is expressed in thousands of hectolitres.

769

Table A2: Placebo test, fake treatment time (2008-2016) – Absolute values

	Vineyards – total (1)	Vineyards – PDO (2)	Vineyards – PGI (3)	Vineyards – non-GI (4)
NUTS2#Policy				
Abruzzo	3.74***	15.4***	-10.4***	-3.51
	(0.75)	(2.86)	(3.90)	(3.50)
Basilicata	3.82***	15.8***	-9.05**	-3.38
	(0.83)	(3.17)	(4.32)	(3.89)
Calabria	3.91***	16.9***	-13.0***	-1.34
	(0.82)	(3.01)	(4.08)	(3.74)
Campania	4.32***	13.2***	-9.95**	-0.067
	(0.81)	(2.97)	(4.11)	(3.66)
Emilia-Romagna	4.06***	16.7***	-6.09	-3.89
	(0.87)	(2.85)	(4.08)	(3.66)
Friuli-Venezia Giulia	4.45***	19.2***	-8.95*	-7.30
	(0.92)	(3.49)	(4.98)	(4.53)
Latium	3.46***	16.5***	-12.2***	2.28
	(0.99)	(3.30)	(4.40)	(4.04)
Liguria	4.95***	16.6***	-8.41*	-4.64
	(0.88)	(3.31)	(4.55)	(4.13)
Lombardia	3.64***	17.9***	-10.2**	-4.27
	(0.88)	(3.20)	(4.35)	(3.91)
Marche	4.28***	16.7***	-6.40	-5.87
	(0.82)	(2.97)	(4.07)	(3.65)
Molise	3.96***	15.5***	-10.2**	-1.82
	(0.82)	(3.03)	(4.03)	(3.64)
Piedmont	4.70***	17.1***	-9.21**	-3.27
	(0.81)	(2.83)	(3.84)	(3.46)
Apulia	2.55***	14.4***	-9.91**	-1.69
	(0.81)	(3.03)	(4.21)	(3.65)
Sardinia	4.22***	17.4***	-11.4***	-2.02
	(0.82)	(2.98)	(4.03)	(3.60)
Sicily	4.44***	4.23	8.20*	-3.31
	(0.98)	(2.86)	(4.28)	(3.80)
Toscana	3.32***	16.6***	-7.52*	-2.21
	(0.88)	(2.94)	(4.23)	(3.81)
Trentino-Alto Adige	4.96***	19.4***	-7.63	-7.34
	(0.95)	(3.50)	(4.91)	(4.47)
Umbria	4.25***	18.1***	-11.0***	-1.78
	(0.86)	(3.06)	(4.23)	(3.83)
Valle d'Aosta	4.71***	17.3***	-9.24**	-4.43
	(0.80)	(3.00)	(4.09)	(3.67)
Controls and spatial lags	✓	✓	✓	✓
Pre-trend	✓	✓	✓	✓
Regional FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Observations	280	280	280	280
Groups	20	20	20	20

Note: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Reported coefficients are region-specific POLICY effects estimated via NUTS2×POLICY interaction. Initial estimator: Arellano-Bond (AB). Bias correction: bias(3). Bootstrapped (1000) standard errors in parentheses.

Vineyards are expressed in thousands of hectares.

Table A3: Placebo test, fake treatment time (2008-2016) – Share of regional UAA

	Share of vineyards – regional surface (1)	Share of PDO vineyards – regional surface (2)	Share of PGI vineyards – regional surface (3)	Share of non-GI vineyards – regional surface (4)
NUTS2#Policy				
Abruzzo	0.86**	1.03***	-0.52**	0.11
	(0.36)	(0.31)	(0.25)	(0.26)
Basilicata	0.32	0.86***	-0.47*	-0.31
	(0.38)	(0.32)	(0.27)	(0.28)
Calabria	0.73**	1.09***	-0.96***	0.36
	(0.37)	(0.32)	(0.26)	(0.27)
Campania	0.74**	0.76**	-0.44*	0.17
	(0.37)	(0.32)	(0.26)	(0.27)
Emilia-Romagna	0.75**	1.12***	-0.23	-0.38
	(0.38)	(0.31)	(0.26)	(0.27)
Friuli-Venezia Giulia	0.29	1.07***	-0.42	-0.47
	(0.44)	(0.37)	(0.31)	(0.32)
Latium	0.73*	1.04***	-0.51*	0.047
	(0.42)	(0.35)	(0.28)	(0.29)
Liguria	0.70*	0.92***	-0.29	-0.11
	(0.41)	(0.35)	(0.29)	(0.30)
Lombardy	0.60	1.12***	-0.44	-0.31
	(0.40)	(0.34)	(0.27)	(0.28)
Marche	0.63*	0.99***	-0.25	-0.26
	(0.37)	(0.31)	(0.26)	(0.26)
Molise	0.52	0.87***	-0.56**	-0.013
	(0.37)	(0.31)	(0.25)	(0.26)
Piedmont	0.58*	0.92***	-0.35	-0.20
	(0.35)	(0.30)	(0.24)	(0.25)
Apulia	0.64*	0.79**	-0.32	-0.022
	(0.38)	(0.33)	(0.26)	(0.27)
Sardinia	0.64*	1.02***	-0.57**	0.014
	(0.37)	(0.31)	(0.25)	(0.26)
Sicily	0.64*	0.38	0.29	-0.21
	(0.39)	(0.31)	(0.27)	(0.28)
Toscana	0.44	0.90***	-0.37	-0.19
	(0.38)	(0.31)	(0.27)	(0.28)
Trentino-Alto Adige	0.88**	1.37***	-0.20	-0.56*
	(0.44)	(0.37)	(0.31)	(0.32)
Umbria	0.67*	1.05***	-0.51*	-0.00028
	(0.38)	(0.32)	(0.27)	(0.28)
Valle d'Aosta	0.61	0.93***	-0.33	-0.20
	(0.37)	(0.31)	(0.26)	(0.27)

Controls and spatial lags	✓	✓	✓	✓
Pre-trend	✓	✓	✓	✓
Regional FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Observations	280	280	280	280
Groups	20	20	20	20

Note: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Reported coefficients are region-specific POLICY effects estimated via NUTS2×POLICY interaction. Initial estimator: Arellano-Bond (AB). Bias correction: bias(3). Bootstrapped (1000) standard errors in parentheses.

Vineyards are expressed in thousands of hectares.

Table A4: Regression with Driscoll-Kraay standard errors – Absolute values

	Vineyards – total (1)	Vineyards – PDO (2)	Vineyards – PGI (3)	Vineyards – non-GI (4)
NUTS2#Policy				
Abruzzo	-4.48***	-18.3**	11.2***	2.87
	(0.46)	(6.16)	(3.07)	(2.14)
Basilicata	-4.63***	-19.4***	9.90**	3.96*
	(0.67)	(5.53)	(3.43)	(2.00)
Calabria	-4.68***	-20.3***	14.1***	1.03
	(0.72)	(5.85)	(3.43)	(3.60)
Campania	-5.11***	-16.8***	10.9***	-0.23
	(0.51)	(5.33)	(3.38)	(2.14)
Emilia-Romagna	-5.00***	-19.0***	6.19	3.80
	(0.54)	(5.44)	(3.56)	(2.50)
Friuli-Venezia Giulia	-4.97***	-20.7**	8.22*	7.99
	(0.84)	(7.14)	(3.93)	(4.56)
Latium	-4.47***	-19.6***	13.6***	-2.44
	(1.01)	(4.98)	(3.80)	(2.51)
Liguria	-5.71***	-19.5***	8.84**	5.02
	(0.55)	(5.99)	(4.01)	(3.83)
Lombardy	-4.45***	-21.0***	10.9***	4.39*
	(0.64)	(5.96)	(3.48)	(2.34)
Marche	-5.05***	-20.1***	7.42*	6.53**
	(0.56)	(4.78)	(3.54)	(2.89)
Molise	-4.78***	-19.2***	10.8***	2.06
	(0.56)	(5.09)	(2.64)	(1.66)
Piedmont	-5.59***	-20.5***	10.0**	3.16
	(0.77)	(5.38)	(3.50)	(2.26)
Apulia	-3.40***	-17.3***	11.3***	0.53
	(0.72)	(5.13)	(3.74)	(2.88)
Sardinia	-4.96***	-20.5***	11.6***	2.16
	(0.82)	(5.18)	(3.77)	(2.23)
Sicily	-5.55***	-5.00	-11.5*	3.08
	(1.09)	(3.46)	(6.37)	(5.11)
Toscana	-4.23***	-18.7***	8.69***	1.23
	(0.70)	(4.44)	(2.54)	(2.38)
Trentino-Alto Adige	-5.62***	-21.8**	7.88*	7.24

	(0.71)	(7.41)	(3.93)	(4.26)
Umbria	-5.10***	-20.5***	11.9***	1.72
	(0.54)	(5.67)	(3.64)	(2.25)
Valle d'Aosta	-5.42***	-20.6***	9.98**	4.98*
	(0.54)	(5.68)	(3.69)	(2.57)
Controls and spatial lags	✓	✓	✓	✓
Pre-trend	✓	✓	✓	✓
Regional FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Observations	280	280	280	280
Groups	20	20	20	20
R2	0.96	0.88	0.72	0.36

Note: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Vineyards are expressed in thousands of hectares.
Cross-section dependence in panel time-series data has been tested with the Pesaran [81] CD test.
Standard errors are estimated following Driscoll and Kraay [74] with a lag truncation parameter of 1. Results are robust to alternative lag truncation parameters in the Driscoll-Kraay estimator, with standard errors computed under lag(1), lag(2), and lag(3) yielding consistent significance levels across all specifications.

Table A5: Regression with Driscoll-Kraay standard errors – Share of regional UAA

	Share of vineyards – regional UAA (1)	Share of PDO vineyards – regional UAA (2)	Share of PGI vineyards – regional UAA (3)	Share of non-GI vineyards – regional UAA (4)
NUTS2#Policy				
Abruzzo	-0.82	-1.16*	0.53***	-0.084
	(0.47)	(0.56)	(0.12)	(0.12)
Basilicata	-0.46	-1.13**	0.44***	0.31*
	(0.43)	(0.50)	(0.11)	(0.15)
Calabria	-0.82**	-1.26**	1.01***	-0.45
	(0.37)	(0.51)	(0.24)	(0.34)
Campania	-0.82**	-0.95*	0.45***	-0.26*
	(0.37)	(0.45)	(0.13)	(0.13)
Emilia-Romagna	-0.89*	-1.39**	0.21	0.32**
	(0.43)	(0.50)	(0.14)	(0.14)
Friuli-Venezia Giulia	-0.37	-1.13*	0.30	0.54*
	(0.40)	(0.57)	(0.18)	(0.29)
Latium	-0.82**	-1.21***	0.54***	-0.11
	(0.37)	(0.39)	(0.17)	(0.15)
Liguria	-0.78**	-1.11**	0.30	0.13
	(0.34)	(0.51)	(0.18)	(0.21)
Lombardy	-0.65*	-1.29**	0.45**	0.27*
	(0.35)	(0.48)	(0.16)	(0.15)

Marche	-0.71*	-1.22**	0.27*	0.32*
	(0.36)	(0.41)	(0.13)	(0.17)
Molise	-0.61	-1.12**	0.54***	0.043
	(0.45)	(0.47)	(0.11)	(0.12)
Piedmont	-0.64	-1.12**	0.37**	0.21
	(0.37)	(0.45)	(0.14)	(0.13)
Apulia	-0.87**	-1.02**	0.33	-0.11
	(0.31)	(0.42)	(0.28)	(0.26)
Sardinia	-0.69*	-1.19***	0.52***	0.064
	(0.35)	(0.38)	(0.13)	(0.14)
Sicily	-0.73*	-0.45	-0.50	0.21
	(0.38)	(0.33)	(0.35)	(0.25)
Toscana	-0.66*	-1.14***	0.37**	0.11
	(0.31)	(0.33)	(0.14)	(0.12)
Trentino-Alto Adige	-0.91	-1.53*	0.18	0.51*
	(0.53)	(0.72)	(0.18)	(0.28)
Umbria	-0.73**	-1.21**	0.54***	0.024
	(0.33)	(0.44)	(0.16)	(0.12)
Valle d'Aosta	-0.69**	-1.14**	0.33*	0.22
	(0.30)	(0.44)	(0.16)	(0.17)
Controls and spatial lags	✓	✓	✓	✓
Pre-trend	✓	✓	✓	✓
Regional FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Observations	280	280	280	280
Groups	20	20	20	20
R2	0.67	0.81	0.64	0.53

Note: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Vineyards are expressed in thousands of hectares.

Cross-section dependence in panel time-series data has been tested with the Pesaran [81] CD test.

Standard errors are estimated following Driscoll and Kraay [74] with a lag truncation parameter of 1. Results are robust to alternative lag truncation parameters in the Driscoll-Kraay estimator, with standard errors computed under lag(1), lag(2), and lag(3) yielding consistent significance levels across all specifications.