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ARTICLE

Export propensity and export intensity of wine producers in Piedmont (Italy)

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Abstract
While a large body of literature explores how international wine trade correlates with country, market and national industry characteristics, research at firm level on the choice to export (export propensity) and on the importance of exports on production or sales (export intensity) remains scarce. More importantly, a review of the literature reveals inconsistent results across the different studies regarding the variables correlated with export choices. No such analysis was conducted in Italy. Based on a survey of 180 wine firms in Piedmont (Italy), we estimate the variables correlated to export propensity and intensity. Our findings indicate that the most relevant factors include belonging to a wine producer cluster, wine quality and the firm's legal status. Other variables are analyzed, confirming the divergent findings in the literature. We conclude that local and individual characteristics play an important role in these decisions.

Keywords: wine exports; export propensity; export intensity; cluster; Piedmont

JEL codes: Q12; D22; L25

I. Introduction

The wine sector is largely globalized, and in the early 21st century over 35% of global wine production was exported (Anderson and Pinilla, 2018). This trend accelerated dramatically during the last few decades of the 20th century, driven by both traditional wine-producing countries (the Old World) and newer entrants into the market. However, in the Old World the change was particularly dramatic, due to a strong decline in domestic consumption offset by a surge in exports. For instance, in Italy the share of exports over total wine production grew from less than 5% in the early 1950s to around 50% in the 2000s (Corsi et al., 2018). While exports represent a substantial proportion of national production, there is significant variability at the individual winery level. For instance, in our sample of wine firms, 23% of wineries export more than 70% of their volume, but 14% export less than 15%, and 11% do not export at all.

This variability raises the question of why individual producers behave differently. More precisely, our research question asks whether there are systematic factors correlated with the wine firms' exporting behavior. In particular, we focus on the variables associated to two dimensions: export propensity—the decision to export any quantity, and export intensity—the share of exports over total production or sales. Based on a review of the literature, we identify several potentially relevant variables, including structural characteristics of the firms, product quality, firm's innovativeness and broad strategies, firm's environment and participation in wine producer clusters, and management characteristics.

Our analysis is based on a direct survey of 180 wine producers in Piedmont, located in the northwest of Italy, a region renowned for wine production. Using econometric methods to address the limitations of previous studies, we analyze the impact of these variables on export propensity and intensity. We compare our findings with those from the literature and conclude that there is considerable variation in the correlates of export behavior across wine-producing regions.

II. Literature review

Extensive literature examines export performances and their correlates for the general economy. While economic studies generally focus on macroeconomic determinants of trade, management research explores individual firm performance. The most common measure of performance is export intensity, or the share of exports in total output (Katsikeas et al., 2000). The determinants of export intensity (for a review, see Chen et al., 2016; Reis and Forte, 2016) have been variously attributed to firm and management characteristics; to industry characteristics; to the institutional setting in both exporting and importing countries; to exporting skills that can be acquired. Among firms' internal characteristics, firm size and age are frequently analyzed as determinants of export intensity. Larger firms are generally assumed to benefit from economies of scale, allowing them to venture into foreign markets more easily, although reverse causality is possible, with exporting contributing to firm growth. Firm age is often taken as a proxy for experience, which should have a positive effect on export intensity, but might also indicate sclerotic thinking or inertia, resulting in a negative result.

The results of the empirical investigations are largely inconsistent across different studies. Firm size was found to have positive, negative, or no significant relationship with export intensity, while the impact of firm age is similarly mixed.

In the more specific field of wine export, research has primarily focused on macroeconomic determinants of wine trade (e.g., Anderson and Pinilla, 2018; Cardebat and Figuet, 2019; Macedo et al., 2019, 2020; Lessoua et al., 2020; Puga et al., 2022, among many others). Nonetheless, some studies examine wine firms' engagement in exports. Some papers deal with producers' views on obstacles and favorable factors for exporting. For instance, Karelakis et al. (2008) report the factors of success in exports according to the opinions of a sample of Greek wine producers. These include export competitive advantage, environmental factors (such as hostility and price competition), and channel relationship antecedents. Bianchi and Wickramasekera (2013) highlight firm factors enhancing and inhibiting export activity according to Chilean

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producers. Köhr et al. (2018) investigate the effects of strategic factors (share of intra-EU destination of exports) and structural factors (quality of exported wine, managers' age, and firm size) on perceived difficulties in the internationalization process among Italian wine small- and medium-sized enterprises (SMEs).

Several other studies use econometric methods to analyze the factors associated with export performance. Maurel (2009) analyzes the factors affecting export intensity and net export turnover of small-medium-sized French wine firms, finding that business partnerships, innovation, firm size, and export commitment positively influence export performance, and that cooperatives behave differently from the other firms. Fernández-Olmos (2011) studies 177 Rioja wine firms, finding that human capital, product innovations, advertising expenditures, and firm size positively influence export propensity, while firm age has a negative effect. Crozet et al. (2012) find that among Champagne producers, higher quality (proxied by producer ratings) is associated with a higher probability of exporting, higher export prices and higher export value, though no firm characteristics other than reputation are considered.

Amadieu et al. (2013) analyze, on a sample of French wine firms (101 cooperatives and 95 corporations), the effect on export intensity of expenditure for tangibles and intangibles, firm size and age, education of managers, output quality, capital intensity, and productivity. Firm size (number of employees) negatively correlates with export intensity for corporations and positively for cooperatives, while age is never significant. Serrano et al. (2016) in a sample of Spanish wine firms estimate the effect on export propensity and export sales of participation to wine producer clusters of different degrees of collaboration and internationalization, and of firm characteristics (size, age, financial status, innovations). The results show that along with wine producer cluster characteristics, age is positively related to export sales but not to export propensity, and size positively to both.

Bashiri Behmiri et al. (2019), examine export propensity and export intensity in a sample of Portuguese wine firms, and find that size is positively related to export performances (particularly for younger firms), like firm age (particularly for smaller firms). Ferrer et al. (2021) analyze a sample of Spanish wineries, finding that firm size has a significant and positive relationship with both export propensity and intensity, while firm age relationship is negative with export propensity and positive one with export intensity. Participation in horizontal networks (Protected Designation of Origin [PDO]) positively influences export intensity but not export propensity.

Finally, Depetris Chauvin et al. (2023) explore the direct and indirect effects of organic production on export intensity (both volume and value) in a sample of Spanish wineries, through the impact of managers' personality, wineries' characteristics, and strategies. Managers' openness, quality strategy, and activity diversification are positively related to exports, while firm age and size have a negative effect.

The final paper aligns with a broader stream of literature that examines the impact of economic operators' personality traits on economic activities. Personality traits are defined by the American Psychological Association (2023) as "the enduring characteristics and behaviour that comprise a person's unique adjustment to life, including major traits, interests, drives, values, self-concept, abilities, and emotional patterns." This literature most frequently identifies five clusters of personality traits, called the "Big Five": extraversion, openness to new experiences, agreeableness (altruistic and

cooperative attitude), neuroticism (emotional stability), and conscientiousness (Costa and McCrae, 1992).

To sum up, the correlates of export propensity and intensity as analyzed in the literature are

- Firms' structural characteristics: size, legal nature (cooperative, corporation, etc.), and experience (age)
- Product characteristics: type, quality, and diversification
- Firm's innovativeness and broad strategies
- Firm's environment and participation to wine producer clusters
- Management characteristics

The literature review highlights significant variability in the sign, significance, and effect of the variables, depending on the specific study and context. Additionally, it is noteworthy that the analysis of export intensity in nearly all the reviewed studies has relied on models such as linear regression, two-stage Heckman analysis, or Tobit models censored from below. However, these methods fail to account for the fact that the dependent variable (export intensity) is bounded between 0 and 1, which violates the distributional assumptions of these models.

In the following sections, we present the data we used for our analysis, detail the operationalization of the variables mentioned above, and outline the econometric strategy employed.

III. Data

a. Area of investigation, sample characteristics, and structure of the questionnaire

The questionnaire for this survey was developed as part of an international research project coordinated by the Haute École de Gestion of Geneva, launched in 2019–2020. Its objective was to evaluate the technologies adopted by wineries, their marketing strategies, their innovations, and their structural characteristics, focusing on firms in different countries. Our study concentrated on two areas in Piedmont, a major wine-producing region in northwest Italy. Piedmont is known both for its extensive vineyard areas, which cover about 6% of Italy's total in 2022 (I.Stat, 2023), and for its production of high-quality wines. In 2022, Piedmont produced more than 2.4 million liters of wine (4.5% of Italy's total output), 94% of which were PDO wines (9.2% of Italy's total PDO production).

The questionnaire was distributed in two key wine-producing areas in Piedmont: Langhe and Roero (Cuneo province) and Monferrato (Asti and Alessandria provinces). These areas are home to over 9,000 wine farms, covering about 41,000 ha, which represents more than 90% and 96% of Piedmont's wine farms and total vineyard area, respectively (Table 1). In 2022, Langhe and Monferrato accounted for approximately 97% of the region's PDO wine production, which in turn represented almost 9% of the national PDO production. The wines produced in these areas range from early-consumption reds, dry whites, and rosés to the great, long-aging red wines of Barolo and Barbaresco.

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Table 1. Vineyards and wine production in Italy, piedmont and in the survey areas. 2020–2022 averages

Vine area	ha	%
Italy	654,027	100.00
Piedmont	41,430	6.34
Langhe-Roero and Monferrato	39,319	6.01
Wine production	hl	%
Overall wine production in Italy	52,268,548	100.00
PDO wine production in Italy	23,374,465	44.71
Overall wine production in Piedmont	2,496,739	4.78
PDO wine production in Piedmont	2,344,369	4.49
PDO wine production in Langhe-Roero and Monferrato	2,273,700	4.35

Source: ISTAT, 2023. Available at http://dati.istat.it/Index.aspx?QueryId=33,654

The Consortia for the Protection of Barolo, Barbaresco, Alba, Langhe, Dogliani, Barbera d'Asti e vini del Monferrato, Ovada DOCG, and Gavi provided member lists.[1] The main role of the Consortia is to foster the Protected Designations of Origin existing in their areas, to control and to verify the wine quality. The wineries were initially contacted by phone to present the project and gauge their willingness to complete the questionnaire. A total of 666 farms were contacted—322 in Langhe-Roero and 344 in Monferrato- of which 36 (35 and 1, respectively) declined (5.4%). Letters were then sent to the remaining 630 wineries with a request to complete the questionnaire online. The survey process allowed respondents to pause and resume the questionnaire at their convenience.

In total, 180 completed questionnaires were returned (102 from Langhe-Roero and 78 from Monferrato), representing a response rate of 28.6%. The sample is not representative in strict statistical terms, not being the result of a random sample. However, despite the questionnaire being long and detailed, the sample covers approximately 23% of the total vineyard surface area, and 23% of the wine farms in these two areas (computing cooperative members). Moreover, when calculated again computing cooperative members, the average vineyard size in the sample was 4.62 ha, close to the regional average of 4.75 ha, providing confidence in the sample's representativeness. The survey was conducted in the spring of 2020, with questions divided into five sections covering general information about the firm, technical production organization, production capacity, export markets, and the firm's approach to innovation.

b. Variables

The dependent variables in our analysis are the share of exports over total sales and over total production, measured in volume. These data were asked in two separate sections

[1]Though the Consortia are largely representative of the wineries in the survey area, not all wineries are Consortia members. The main reason is that the services rendered to members entail an annual membership fee which not all farms (especially the smaller ones) are willing to pay. Unfortunately, the share of Consortia members over total wineries is not available.

of the questionnaire. In one section, respondents were asked to provide the percentage of their sales and production volume sold domestically, from which the export share was calculated. In another section, respondents provided the share of exports over total sales and volume within specific percentage brackets, in addition to those with zero exports. These brackets were: less than 5%, 5–15%, 15–30%, 30–50%, 50–70%, and more than 70%. However, the responses were not always consistent, as some percentages provided did not match the relevant share brackets. Though stating the share brackets requires a lower psychic effort than indicating a precise percentage, for our analysis we primarily used the precise export share, which allowed us to apply appropriate econometric models. Nevertheless, we also conducted a robustness check using the bracketed data.

For the *firm's structural characteristics*, we included size, legal nature, and age, following Maurel (2009), Fernández-Olmos (2011), Amadieu et al. (2013), Serrano et al. (2016), Bashiri Behmiri et al. (2019), and Depetris Chauvin et al. (2023). Firm size was measured by both total production volume (*Production*) and vineyard area (*Area*). Age was calculated as the number of years since the firm's foundation (*Age*: 2020—year of foundation). We also considered the firm's legal status, distinguishing between *Corporations* (including limited liability companies [LLCs]), *Cooperatives*, and sole proprietorships (including partnerships, individual farms, etc.).

Product characteristics included diversification, measured by the number of grape varieties, wine labels, and other activities (such as local food production, agro-tourism, or event organization). Given the correlation between them, these variables were summed into a diversification variable (*Diversification*). We also included the share of other activities in total sales[2] (*Sales other activities*). Additionally, dummy variables were used to indicate whether the firm produced organic or biodynamic wine (*Organic*), or used Integrated Pest Management (*IPM*).

To approximate *wine quality*, we developed indicators based on the composition of wine output by price segment. Segments included Value (up to €6.00/bottle), Commercial Premium (€6.10–€10.00), Premium (€10.10–€15.00), Super Premium (€15.10–€25.00), Ultra Premium (€25.10–€40.00), Luxury (€40.10–€100.00), and Icon (over €100.00). A domestic price indicator (*Domestic price*) was calculated as the mean of the segment midpoints (and the open upper class fixed at 130 euros), weighted by the share of total volume sold domestically. For export prices, we used the unweighted average of the midpoint of the price segments for exported wines (*Export price*), since we only had the information on which segments they exported. Finally, we developed an average price indicator (*Average price*) equal to the average of the domestic and export prices, weighted by the share of exports in total volume. This average price was used as a proxy for wine quality in our econometric models.

We also considered *firms' innovativeness and broad strategies*, which have been linked to export performance in the literature. Innovativeness was measured by counting the number of new techniques introduced over the past 10 years

[2]As the share was recorded in percentage brackets, we took as values the central values of the brackets.

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in areas such as cultivation (*N. innovations vineyard*), winemaking (*N. innovations cellar*), marketing (*Innovations marketing*—dummy variable), distribution (*Innovations distribution*—dummy variable), and packaging (*N. innovations packaging*).

In addition, we analyzed *firms' strategic orientations* using a principal component analysis (PCA) of responses to a battery of statements regarding competitiveness. The PCA identified *four broad firm strategies*: "Marketing and innovation in the top segment," "Price and cost competition in the value segment," "Quality and innovation," and "Product and market diversification." The methodology and results of the PCA can be found in Annex 1, and the factor loadings were included as explanatory variables in the econometric models.

We also examined *firms' environment and participation to wine producer clusters*, as previous research has shown that cluster membership can impact export performance (Amadieu et al., 2013; Serrano et al., 2016). Specifically, we considered whether firms were located in the Langhe-Roero area (*Langhe*—dummy variable), which has a strong tradition of high-quality wine production and export, and a rich network of institutions supporting the wine industry, all of which is less developed in Monferrato.

Finally, we included *management characteristics* in the analysis. To identify the psychological profiles of managers, we conducted a PCA based on responses to a series of self-assessment questions[3] on personality traits as defined by the American Psychological Association (American Psychological Association, 2023). This allowed us to capture four personality dimensions: *Introversion & Disagreeableness, Conscientiousness, Openness* (to new experiences), and *Neuroticism* (emotional stability). The factor loadings from the PCA were included in the econometric models as proxies for managerial personality traits (Annex 2).

Our dataset did not include institutional variables such as legislation in the exporting or importing country, as these factors were homogeneous across all firms in the sample.

Table 2 presents the distribution of firms by class of export intensity, and Table 3 provides descriptive statistics for the variables. About 57% of the sampled firms are located in Langhe-Roero. The average production size is 320,000 L, though there is significant variation, mainly due to the cooperatives. The average production for cooperatives is 2,175,000 L, compared to 211,000 L for other firms. The average vineyard area is approximately 43 ha, but this figure is skewed by the large areas owned by cooperatives. Excluding cooperatives, the average vineyard area is 25.4 ha. When dividing the cooperatives' vineyard area by the number of members (a figure directly obtained from the cooperatives), the result is 2.27 ha per member, indicating significant variation in vineyard size.

[3]The assessment was based on answers on a 5-points Likert scale to a battery of questions about the respondent's self-definition ("I am a person…"). The questions were answered by the persons responding to the questionnaire. They were mainly (79.4%) the owners, that generally also fulfilled one or several other functions (Winemaker, Enologist, Agronomist, Cellar master, Vineyard manager, Operations Director, Sales manager, Marketing Manager, PR Manager). The non-owners too generally fulfilled more functions, as only

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Table 2. Distribution of firms by export intensity

	Share of exports over total sales (SETS)		Share of exports over total volume (SETV)	
Export shares	Freq.	Percent	Freq.	Percent
0%	19	10.56	19	10.56
< 5%	11	6.11	13	7.22
5 – 15%	13	7.22	13	7.22
15 – 30%	14	7.78	16	8.89
30 – 50%	33	18.33	29	16.11
50 – 70%	51	28.33	48	26.67
>70%	39	21.67	42	23.33
Total	180	100	180	100
Mean		49.98		49.11

The age of the firms ranges from 5 to 215 years, with an average of 54 years. Most of the firms are sole proprietorships, since corporations and LLCs are only 17 (9.4%), and 10 (5.6%) are cooperatives.

The predominant cultivation method is Integrated Pest Management, used by half of the firms, while organic farming is employed by 24% of firms (29% in Langhe-Roero and 18% in Monferrato). On average, 5.7 different grape varieties are cultivated, and 14.1 different wine labels are sold. The average number of non-wine-related activities is low, at 0.8 per firm. Thus, the overall diversification indicator has a mean of 20.6.

The average number of innovations introduced over the past 10 years is relatively low, generally less than one per firm, except for cellar innovations, where the average is 1.09 and the maximum number of innovations is 12. Nevertheless, 28% of firms have introduced some form of marketing innovation, and 13% have implemented innovations in distribution. The average number of innovations is consistently higher in Monferrato, though the data do not clarify whether this reflects later adoption or a greater propensity for new developments.

The weighted average quality price indicator is approximately 17 euros, placing the firms in the Super-premium segment. This figure results from a lower domestic price (about 11 euros) and a higher export price (29 euros). Prices are consistently higher in the Langhe-Roero area compared to Monferrato.

Finally, the firm strategy and personality trait variables derived from the PCA have a mean of zero and a standard deviation of 1 for the full sample, as per the construction.

IV. Analysis strategy and results

The choice to export or not, and the extent of export activity, can be understood as the decision-maker's choice that maximize monetary benefits and personal satisfaction. To

10.6% of these respondents fulfilled a single function. We assumed the respondent was the person making the management decisions, which is obviously true for the owners, but not necessarily so for the other functions.

Table 3. Descriptive statistics of the variables

	OVERALL		LANGHE-ROERO		MONFERRATO	
Variable	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Langhe-Roero area (yes = 1)	0.567	0.497				
Production (000 l.)	320.5	999.9	289.2	1094.7	361.5	865.7
Area (ha)	42.85	99.01	34.31	69.03	54.01	127.72
Firm's age (years)	53.8	43.7	57.2	41.8	49.4	46.0
Corporation (yes = 1)	0.094	0.293	0.108	0.312	0.077	0.268
Cooperative (yes = 1)	0.056	0.230	0.029	0.170	0.090	0.288
Organic (yes = 1)	0.244	0.431	0.294	0.458	0.179	0.386
IPM (yes = 1)	0.500	0.501	0.539	0.501	0.449	0.501
Diversification: n.varieties + labels + other activities	20.6	38.0	22.6	49.1	18.0	13.9
Sales other activities/total (%)	7.0	14.5	5.4	9.7	9.2	18.9
N. innovations vineyard	0.97	1.28	0.90	1.14	1.05	1.45
N. innovations cellar	1.09	2.02	0.92	1.68	1.32	2.39
Innovations marketing (yes = 1)	0.28	0.50	0.22	0.44	0.37	0.56
Innovations distribution (yes = 1)	0.13	0.34	0.11	0.31	0.17	0.38
N. innovations packaging	0.81	1.50	0.49	0.96	1.23	1.92
Average price indicator (€)	16.93	13.46	21.86	12.84	11.78	12.17
Domestic price indicator (€)	10.65	9.49	14.77	11.39	7.85	6.66
Export price indicator (€)	29.02	17.25	29.57	17.16	27.64	17.58

(*Continued*)

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Table 3. (*Continued.*)

	OVERALL		LANGHE-ROERO		MONFERRATO	
Variable	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Firm strategies						
'Marketing and innovation in top segment'	0.000	1.000	0.084	0.948	−0.109	1.061
'Price and cost competition in the value segment'	0.000	1.000	−0.166	0.934	0.217	1.047
'Quality & innovation'	0.000	1.000	0.172	0.926	−0.225	1.053
'Product and market diversification and wide scope'	0.000	1.000	−0.234	1.002	0.306	0.917
Manager's personality traits						
Introversion & Disagreeableness	0.000	1.000	0.032	0.959	−0.042	1.056
Conscientiousness	0.000	1.000	0.028	0.927	−0.036	1.093
Openness	0.000	1.000	−0.046	0.959	0.060	1.054
Neuroticism	0.000	1.000	0.008	0.986	−0.011	1.024
N. observations	180		102		78	

Note: prices are weighted averages.

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analyze its correlates, we proceeded with different steps.[4] The first step was analyzing the dichotomous choice of exporting or not, i.e., the propensity to export, through a probit model. The probit model estimates the effect of the independent variables on the probability of exporting, regardless of the amount exported. In practical terms, it assumes that the decision-maker first decides whether to export, and only if the answer is positive does the decision of how much to export follow.

The probit model's estimated parameters (Table 4) provide information on the significance and sign of the variables' effects, but not on their magnitude. To obtain a better understanding of the quantitative effects, the marginal effects can be calculated, which measure the change in the likelihood of exporting for changes in the independent variables. However, if unobserved heteroskedasticity is present, marginal effect estimates may be inconsistent.[5] To cope with this, we used a linear probability model (LPM) with robust standard errors to estimate the effects, and the results are also presented in Table 4.

Only a few variables significantly affect the probability of exporting. Firms located in the Langhe district exhibit an average 19% higher probability of exporting compared to those in the other area. The firm's age also has a significant positive but modest effect, with an increase of 0.1% for each additional year in operation. Firms organized as cooperatives show a 33% lower probability of exporting compared to sole proprietorships.[6] Other variables related to product characteristics, such as organic or IPM production and product diversification, were not found to be significant. Surprisingly, cellar innovations appear to reduce the likelihood of exporting, decreasing it by 4% for each additional innovation. While marketing innovations also have a negative effect, it is only weakly significant, and the estimated marginal effect is not significantly different from zero in the LPM. Finally, among the personality traits, "Consciousness," (possibly related to risk aversion), is negatively related to the probability. No significant effect can be found for the firm strategies identified by the PCA.

Next, we analyzed the factors associated with export intensity, or the share of exports in total sales and volume. Since these dependent variables are bounded between 0 and 1, we applied a fractional regression model (Papke and Wooldridge, 1996; Wooldridge, 2010), which accounts for this constraint and allows for observations at the zero value. This approach departs from the ones used in the literature that almost invariably fail to consider the range restriction. The results for the share of exports in total sales (SETS) and total volume (SETV) are shown in Table 5, and average marginal effects are reported in Table 6.

[4]Preliminarily, we checked for the presence of multicollinearity between the explanatory variables. We found no evidence of concern for multicollinearity. The mean VIF was 1.61, and the highest individual VIF was 3.25, all values well below the value of 10 commonly considered as a threshold for concern. Also, the Condition number was 7.84, again well below the value of 15 commonly considered as a threshold for concern.

[5]We are grateful to a referee for pointing to this issue.

[6]All corporate firms export to some extent; hence the relevant dummy variable was excluded from the estimated model.

Table 4. Probit and linear probability models of the choice to export

	Probit model		Linear probability model	
	Coefficient	Standard Error	Coefficient	Robust Standard Error
Langhe	2.106***	0.7698	0.1859***	0.0503
Production	−0.0010	0.0008	0.0000	0.0000
Area	0.0234**	0.0175	0.0010***	0.0003
Age	0.0163**	0.0083	0.0010**	0.0005
Cooperative	−3.582*	1.8354	−0.3325**	0.1542
Organic	0.3034	0.8926	0.0359	0.0482
IPM	−0.2204	0.5008	0.0124	0.0510
Diversification	0.0253	0.0376	−0.0003	0.0003
Sales other activities	0.0067	0.0129	0.0007	0.0020
N. innovations vineyard	0.3266	0.2568	0.0225	0.0185
N. innovations cellar	−0.3029**	0.1232	−0.0404**	0.0170
Innovations marketing	−0.7736*	0.4419	−0.0800	0.0755
Innovations distribution	0.5285	0.7234	0.1434	0.0910
N. innovations packaging	0.0441	0.1590	−0.0030	0.0225
Average price	−0.0306	0.0324	−0.0023	0.0014
Firm strategies				
“Marketing and innovation in top segment”	0.3747	0.2679	0.0259	0.0243
“Price and cost competition in the value segment”	−0.2154	0.2828	−0.0028	0.0206
“Quality & innovation”	0.2705	0.2288	0.0153	0.0227
“Product and market diversification and wide scope”	−0.3271	0.2713	−0.0219	0.0231

(*Continued*)

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Table 4. (*Continued.*)

	Probit model		Linear probability model	
	Coefficient	Standard Error	Coefficient	Robust Standard Error
Manager's personality traits				
Introversion & Disagreeableness	−0.3841	0.2389	−0.0255	0.0224
Conscientiousness	−0.6734**	0.2762	−0.0689***	0.0232
Openness	0.1189	0.2523	−0.0004	0.0230
Neuroticism	−0.2307	0.2209	−0.0297	0.0220
Constant	0.4867	0.7957	0.7682***	0.0693
N. Obs	180		N. Obs	180
Log likelihood	−29.151		F(23, 156)	161
Chi squared [23]	63.061***		Prob > F	0.048
McFadden R-sq.	0.520		R-sq.	0.295

***, **, * = = > Significance at 1%, 5%, 10% level.
Note: The corporation dummy variable was excluded (all corporation export).

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Table 5. Fractional regression - share of exports on total sales (SETS) and on total volume (SETV)

	SETS			SETV		
	Coefficient	STD. err.	P > z	Coefficient	Std. err.	P > z
Langhe	0.725***	0.119	0.000	0.6957***	0.1217	0.0000
Production	−0.0001***	0.0000	0.005	−0.0001***	0.0000	0.0000
Area	0.001	0.001	0.508	0.0004	0.0009	0.6360
Age	0.001	0.001	0.485	0.0001	0.0011	0.9560
Corporation	0.004	0.179	0.980	0.1230	0.1582	0.4370
Cooperative	−1.026***	0.400	0.010	−0.9976***	0.3715	0.0070
Organic	−0.058	0.131	0.657	−0.0119	0.1241	0.9240
IPM	−0.076	0.116	0.511	−0.0348	0.1072	0.7450
Diversification	0.002***	0.001	0.008	0.0020**	0.0009	0.0240
Sales other activities	0.001	0.003	0.729	−0.0003	0.0036	0.9380
N. innovations vineyard	0.019	0.044	0.657	0.0495	0.0453	0.2750
N. innovations cellar	−0.091***	0.030	0.002	−0.0964***	0.0304	0.0010
Innovations marketing	−0.089	0.144	0.534	−0.1042	0.1443	0.4700
Innovations distribution	0.150	0.157	0.341	0.1081	0.1692	0.5230
N. innovations packaging	0.091*	0.052	0.084	0.0984*	0.0519	0.0580
Average price	0.009**	0.004	0.035	0.0094**	0.0042	0.0240

(*Continued*)

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Table 5. (*Continued.*)

	SETS			SETV		
Firm strategies						
'Marketing and innovation in top segment'	0.055	0.050	0.272	0.0778	0.0520	0.1350
'Price and cost competition in the value segment'	−0.014	0.049	0.775	−0.0152	0.0501	0.7620
'Quality & innovation'	0.048	0.056	0.392	0.0340	0.0557	0.5420
'Product and market diversification and wide scope'	−0.122**	0.054	0.024	−0.1296**	0.0558	0.0200
Manager's personality traits						
Introversion & Disagreeableness	0.001	0.058	0.991	−0.0613	0.0538	0.2540
Conscientiousness	−0.020	0.059	0.728	−0.0029	0.0610	0.9620
Openness	0.049	0.056	0.386	0.0482	0.0563	0.3910
Neuroticism	−0.029	0.054	0.588	−0.0624	0.0565	0.2690
Constant	−0.562***	0.144	0.000	−0.5751***	0.1412	0.0000
N. observations	180			180		
Wald chi2(24)	229.94***			239.3***		
Log pseudolikelihood	−107.915			−107.073		
Pseudo R^2	0.135			0.1416		

***, **, * = = > Significance at 1%, 5%, 10% level.

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Table 6. Average marginal effects from the fractional regressions

	SETS			SETV		
	Marg. Eff.	Std. err.	P > z	Marg. Eff.	Std. err.	P > z
Langhe	0.2474***	0.0375	0.0000	0.2355***	0.0383	0.0000
Production	−0.00003***	0.0000	0.0050	−0.00004	0.0000	0.0000
Area	0.0002	0.0003	0.5070	0.0001	0.0003	0.6360
Age	0.0003	0.0004	0.4850	0.0000	0.0004	0.9560
Corporation	0.0015	0.0611	0.9800	0.0416	0.0534	0.4360
Cooperative	−0.3502***	0.1356	0.0100	−0.3377***	0.1251	0.0070
Organic	−0.0198	0.0447	0.6580	−0.0040	0.0420	0.9240
IPM	−0.0260	0.0395	0.5110	−0.0118	0.0363	0.7450
Diversification	0.0008***	0.0003	0.0080	0.0007**	0.0003	0.0250
Sales other activities	0.0004	0.0012	0.7290	−0.0001	0.0012	0.9380
N. innovations vineyard	0.0066	0.0149	0.6570	0.0168	0.0153	0.2740
N. innovations cellar	−0.0312***	0.0100	0.0020	−0.0326***	0.0101	0.0010
Innovations marketing	−0.0305	0.0488	0.5320	−0.0353	0.0486	0.4690
Innovations distribution	0.0511	0.0536	0.3400	0.0366	0.0572	0.5220
N. innovations packaging	0.0309*	0.0177	0.0820	0.0333*	0.0174	0.0550
Average price	0.0030**	0.0014	0.0350	0.0032**	0.0014	0.0230

(*Continued*)

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Table 6. (*Continued.*)

	SETS			SETV		
Firm strategies						
'Marketing and innovation in top segment'	0.0189	0.0171	0.2700	0.0263	0.0175	0.1320
'Price and cost competition in the value segment'	−0.0047	0.0166	0.7750	−0.0051	0.0170	0.7620
'Quality & innovation'	0.0163	0.0190	0.3930	0.0115	0.0189	0.5420
'Product and market diversification and wide scope'	−0.0416**	0.0183	0.0230	−0.0439**	0.0186	0.0180
Manager's personality traits						
Introversion & Disagreeableness	−0.0002	0.0197	0.9910	0.0208	0.0183	0.2560
Conscientiousness	−0.0069	0.0200	0.7280	−0.0010	0.0207	0.9620
Openness	0.0166	0.0191	0.3870	0.0163	0.0191	0.3920
Neuroticism	−0.0101	0.0186	0.5880	−0.0211	0.0192	0.2710

***, **, * = = > Significance at 1%, 5%, 10% level.

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The models are highly significant overall, but only a few individual variables are significant. The Langhe dummy parameter is significant and suggests that firms in the Langhe district show an increase of around 25 percentage points (pp) for SETS, and around 24 pp for SETV compared to the other district.

In contrast, the effect of firm production size is negative, but practically negligible. A one-million-litres increase in production is associated with only a 0.03–0.04 pp reduction in the share of exports (remember that the mean is 320,500 L). The size of vineyard area does not significantly affect export intensity, nor does the firm's age. Cooperatives, however, show a strong negative association with export intensity, with decreases of 35 pp in SETS and 34 pp in SETV compared to sole proprietorships. The corporation legal status does not show a significant effect.

Among product characteristics, organic and integrated pest management have no significant effect. Diversification has a limited positive effect: one additional item in the diversification index increases export intensity by 0.08–0.07 pp. However, the share of other activities over total sales does not have a significant impact (and has opposite signs for SETS and SETV).

Cellar innovations show a significant negative effect on export intensity, decreasing SETS by 3.1 pp and SETV by 3.3 pp for each additional innovation. Innovations in packaging, on the other hand, positively affect both SETS and SETV, increasing them by around 3 pp, though the parameters are only weakly significant. Innovations in the other fields (vineyard, marketing, distribution) are not significant.

Quality, as measured by the price indicator, matters, with a 0.3 pp increase in both SETS and SETV for each additional euro increase in the quality price indicator.

Finally, while most of the firm's broad strategies were not significant, the strategy "Product and market diversification and wide scope" had a weak but negative effect on export intensity, potentially reflecting a focus on internal markets. No significant effects were found for the personality traits of managers.[7]

V. Discussion

Our results reveal that the strongest and most consistent predictor of export behavior is the firm's location within the Langhe area. In all of our models, firms located in the Langhe district are more likely to export and export a larger share of their production compared to firms in Monferrato. Specifically, firms in Langhe export, on average, 24–25 pp more in terms of total sales and volume than those in other

[7]To complete the analysis, we run a beta regression. Beta regression accommodates dependent variables greater than 0 and less than 1, but is not appropriate when in some observations the dependent fractional variable is zero or one (Ferrari and Cribari-Neto, 2004; Smithson and Verkuilen, 2006). Therefore, we estimated the beta regression on the subsample of the exporting firms (161 over 180). The results are almost completely consistent with the fractional regression ones. They are not presented here for brevity but are available from the authors upon request. As further robustness checks, we also run alternative models, namely an OLS regression, an ordered probit and an interval regression on the SETS and SETV brackets. Although these models are not strictly appropriate in statistical terms, the relevant results are again largely consistent with the results of the fractional regression. They too are available upon request.

areas, according to the fractional regression.[8] The Langhe area perfectly fits into the characteristics of Marshallian industrial districts (Marshall, 1920), where localized industries create a special *atmosphere* giving several advantages through a combination of competition and cooperation. An industrial district creates economies external to the individual enterprises but internal to the local system, the community shares common values, the industry is specialized, the necessity to sell the production creates a trade network (Becattini, 1989). In Langhe, several institutions (Piedmont Region, Consortia, Schools and Universities, Associations, etc.) promote wine production and innovation, also enhancing the links within the producer cluster (Bell and Giuliani, 2007). These institutions, along with PDOs and quality control mechanisms, generate economies of scale and scope, and reduce transaction costs for producers (Belletti et al., 2017). A long tradition of prestigious wines, the initiatives to promote them abroad, even changing the technology (Negro et al., 2011), as well as institutions devoted to safeguarding and promoting wine quality, explain well the effect of this cluster. By contrast, Monferrato, while also a major wine-producing region, lacks such a rich network of institutions connected with wine production and export. The effect of the wine producer cluster is consistent with the finding of Maurel (2009), Serrano et al. (2016), and Ferrer et al. (2021).

The second robust finding is the negative effect of cooperative status on export intensity. Cooperatives export less than sole proprietorships and corporations. The choice of whether to export at all is more variable, with the parameter being only weakly significant, but the relationship with export intensity is highly consistent. This result is consistent with previous studies, such as Amadieu et al. (2013), who found that cooperatives in France also tend to export less. Several reasons could explain this: cooperatives may lack the management skills required for effective export strategies, or their collective nature may make them more risk-averse. Furthermore, the quality of wine produced by cooperatives may be lower, which can impact their ability to compete in international markets. In our sample, the price-quality indicator for cooperative wines is 9.4 euros, significantly lower than the 18.3 euros for non-cooperative firms. The behaviour of corporations and LLCs does not significantly differentiate from the one of sole proprietorships, which somewhat differs from the results of Fernández-Olmos and Malorgio (2020), who found that family business negatively impacted the speed of the wine industry internationalization. In our Piedmont sample, sole proprietorships perform better than cooperatives in exporting, but not differently from corporations.

Since the average size is much larger for corporations than for sole proprietorships, this questions the association of firm size with exports. While the parameter for production size is significant and negative, its effect is almost negligible in practical terms (3–4 pp less for one-million-liter increase). In our sample, economies of scale linked to larger size do not seem to orient firms to foreign markets, contrary to what found by

[8] According to the beta regression estimated among the exporting firms only (not reported here), belonging to the Langhe area is associated to 16–17 pp of the export shares. This suggests that the association between belonging to this cluster and the decision to export is stronger than the association with the export quantity, i.e., is stronger with export propensity than with export intensity.

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Maurel (2009) in France and by Fernández-Olmos (2011) and Depetris Chauvin et al. (2023) in Spain. Foreign markets are willing to pay higher prices for high-quality wines, so that the competition is on quality rather than on costs, and economies of scale have a minor role in the capacity to export. The literature on export performances typically argues that a larger size implies greater financial and managerial resources, thus reducing the risks of venturing into foreign markets (Wagner, 1995). In the case of Piedmont, these advantages of firm size are apparently overcome by those of quality, that is not necessarily linked to firm size.

Wine quality, as measured by the price indicator, is not statistically related to the choice to export, according to the probit model. Though, it is positively associated with export intensity, as per the fractional regression model. This suggests that the best wines are generally destined for the foreign markets. This finding is consistent with Crozet et al. (2012), who found that higher-quality Champagne producers are more likely to export and sell their wines at higher prices abroad.

The evidence for several other firm characteristics is mixed and, in some cases, absent at all. Firm age has a significant positive relationship with export propensity, but no significant relationship with export intensity. In the literature on firms' export performances, firm age is seen alternatively as a facilitator of exports because of accumulation of experience or, on the opposite, as an impediment, because of sclerotic thinking or inertia. Our findings contrast with the findings of Serrano et al. (2016) (who observed a negative relationship between age and export propensity but a positive one with export intensity), and with those of Fernández-Olmos (2011) (who found a negative effect of age on firms' degree of internationalization), both estimated on a Spanish sample. For Amadieu et al. (2013) the age parameter, estimated on a French sample, was not significant. Our results for Piedmont suggest that firm age is associated with the choice to experiment foreign markets (at least, because it trivially increases the time in which exports can be experimented), but it does not necessarily lead to a strong export orientation.

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Organic and IPM production methods do not significantly impact export behavior in our sample, contrary to the significant positive effects of organic production found by Depetris Chauvin et al. (2023).

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The diversification indicator (admittedly a rough one: sum of the number of grape varieties, the number of different wine labels and the number of other activities) is significant, but the marginal effect is almost negligible (0.07–0.08 pp). Therefore, the evidence is not strong enough to conclude that a larger production scope strongly favors export or that exports require a larger product variety, also considering that the other indicator of diversification (the share of other activities over total sales) is never significant. This contrasts with the positive, although only weakly significant, relationship with export performances of a similar indicator found by Depetris Chauvin et al. (2023), who consider diversification as a risk-reducing and additional income-generating strategy. In our Piedmont sample, such a strategy is apparently secondary.

According to the literature, process innovations can enhance efficiency, thus creating competitive advantages, and product innovations can differentiate product characteristics, thus giving the firm another competitive advantage among customers (Rodriguez and Rodriguez, 2005). We found that cellar innovations (process innovations) have a negative relationship with export intensity, contrary to the findings of Maurel (2009) and Fernández-Olmos (2011). This may reflect the fact that cellar innovations are aimed at cost reduction for lower-quality wines intended for domestic markets, while exports in Piedmont are oriented to traditional wines, especially in the Langhe area. Other process innovations (in the vineyard, in marketing, in distribution) are not significant neither for export intensity nor (except for innovations in marketing) export propensity. By contrast, packaging innovations, (product innovations) are positively related to export intensity, probably because of the reputation-enhancing effect of innovative labels and lighter bottles, or because they are required for exporting.

Only the strategy "Product and market diversification and wide scope" is significant (and negative) in one model, perhaps indicating a focus on specific markets and products. Finally, one manager personality trait seems to have a significant effect on the choice to export, but not on export intensity. The lack of significance of the other personality traits on export propensity and of all personality traits on export intensity suggest that the personality variable is not particularly relevant. For both personality traits and strategies, either the PCA variables are not appropriate to proxy for the effective real correlates, or a strong variation precludes clearly systematic effects or, finally, some respondents were not the actual decision-makers.

VI. Conclusions

In this paper, we reviewed the literature on the correlates of export propensity and export intensity of the wine industry, and tested the relevant variables using a sample of wine producers in Piedmont, Italy. Our findings show that belonging to an area cluster, particularly the Langhe district, is the most significant factor connected with export activity. Firms located in the Langhe region are more likely to export and export a higher share of their production, likely due to the strong institutional support and reputation for high-quality wines in the region.

Table 7. Signs of the explanatory variables

	Our results		Literature
	Export propensity	Export intensity	
Area cluster	+	+	+
Firm size	n.s.	-	+ - n.s.
Age	+	n.s.	- +
Legal status cooperative	-	-	-
Quality (price)	n.s.	+	+
Organic	n.s.	n.s.	+
Diversification	n.s.	+, n.s.	+
N. innovations	- +	- +	+
Firm strategies	n.s.	-	+ -
Managers' personality	-	n.s.	+ -

Note: For Literature, see Section "Literature review".
n.s. = not significant.

We also found that wine quality plays an important role in determining export intensity, with higher wine quality associated with a higher share of exports. By contrast, a firm legal status as a cooperative is strongly and negatively associated with the choice of exporting and its intensity.

So far, the results are consistent with the findings in the literature. Not so for the other variables. In Table 7, we present a comparison between our results and the finding in the literature on wine export correlates. We found no significant connection of firm's production size with export propensity, and a weak negative connection with export intensity, contrary to other studies. Firm age, a proxy for experience, correlates positively with export propensity but not with export intensity, while the literature reports conflicting effects. The connection between diversification in terms of number of products and the share of exports is weak. Diversification in terms of other activities has no systematic effects, contrary to the literature. Process innovations in the cellar are not positively correlated to exports, and packaging innovations are, while the literature generally concludes for a positive effect.

Our results therefore contradict several findings in the literature, that on their part were already often inconsistent, as shown in the literature review. The diversity in the operationalization of the correlates might in principle partly explain the inconsistency of the results. Nevertheless, this does not apply to many variables (e.g., firm age, firm size). Regardless, the diversity in the measurement of the variables could explain the differences in the intensity of the relationships, not the diversity of signs.

The unavoidable conclusion is that there are hardly systematic correlates of export propensity and intensity. One might therefore wonder why the results are so inconsistent. In our view, the explanation is to be found in the diversity of local situations, as to natural conditions, economic environment and, importantly, traditional orientations in wine making and marketing. There is probably much path dependency in export orientation, since finding the right export channels and creating a network is crucial,

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and having the path already opened by someone else is a great help for a firm considering this possibility. Causation, therefore, can go both ways. This also holds for the different variables found in the literature, and in our results as well, since no analysis is specifically designed to detect the direction of causation. For example, wine quality can be viewed as a determinant of export, if a high quality preceded the choice of exporting, but high wine quality can also be the result of the demand of foreign markets. In addition, at the same time there is apparently much individual variation in the choices, depending on particular characteristics of the individual product (which are variable even at small distances), and on managers' attitudes, including propensity or aversion to risk.

Overall, our study confirms that there is no one-size-fits-all approach to encouraging wine exports. Instead, policymakers and practitioners should consider the specific characteristics of the region, the firms, and the products when designing strategies to enhance export performance in the wine sector, and should encourage local inter-company and inter-sectoral relationships that foster the creation of wine districts and networks.

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Competing interests. The authors declare none.

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Annex 1

Principal Component Analysis (PCA) Methodology of firms' strategies.

To identify the firms' strategies, we utilised the responses, on a 1 to 5 scale, to a question asking 'State how much importance your firm gave to the following competitivity items', on 21 items listed in the table below. Factor analysis with Kaiser normalization and Varimax rotation was employed. The determination of the suitable number of components was based on selecting those with an eigenvalue exceeding 1. An absolute minimum threshold of 0.4 was utilized for interpreting the factor matrix. Assessment of the model's goodness was conducted through the utilization of the Kaiser-Meyer-Olkin (KMO) test and Bartlett's test.

The table below illustrates the four identified components, each of which has been named based on the strategy it represents, aligned with the original variables describing the component.

Firm strategies PCA results

	Components			
	Marketing and innovation in top segment	Price and cost competition in the value segment	Quality & innovation	Product and market diversification and wide scope
New product development	0.738			
Building brand identification	0.696			
Concerted effort to build reputation within industry	0.662			
Innovation in production process	0.642			
Strong influence over distribution channels	0.624			
Innovation in marketing techniques and methods	0.572			
Products in higher priced market segments	0.503			
Products in lower priced market segments		0.749		
Promotion advertising expenditures above the industry average		0.689		

(*Continued*)

(*Continued.*)

	Components			
	Marketing and innovation in top segment	Price and cost competition in the value segment	Quality & innovation	Product and market diversification and wide scope
Emphasis on the manufacturing of specialty products		0.598		
Pricing below competitors		0.590		
Major effort to insure availability of inputs		0.572		
Only serve specific geographic markets		0.535		−0.432
Maintaining high inventory		0.458		
Overriding concern for lowest unit cost		0.454		
Strict product quality control procedures			0.790	
Efforts to insure highly trained personnel			0.774	
Major expenditure on production process-oriented R&D			0.590	
Limited range of products				−0.723
New product development				0.620
Broad product range				0.615
Explained variance [%]	29.923	11.213	7.551	5.818
Test KMO	0.820			
Bartlett's test of sphericity				
Chi square (210 df)	1422.915			
Sig.	0.000			

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Annex 2

Principal Component Analysis (PCA) Methodology of personality traits

To identify the managers' personality traits, we utilised the responses, on a 1 to 5 scale, to a question asking 'Here follows a list of personal characteristics. Please evaluate how much each of them is fit to describe yourself' on 20 items listed in the table below. The same methodology was used for factorial reduction (PCA) as already described in Annex 1.

Manager's personality traits PCA results.

	Components			
	1 Extroversion (-) Agreeableness (-)	2 Conscientiousness (+)	3 Openness (+)	4 Neuroticism (+)
Quiet	0.699			
Likeable	−0.683			
Talkative	−0.626			
Shy	0.610			
Extroverted	−0.570			
Unlikable	0.546			
Friendly	−0.524	0.458		
Unfriendly	0.489			
Conscientious		0.744		
Responsible		0.655		
Emotionally stable		0.627		
Conventional		0.478		
Curious			0.660	
Open to new experiences			0.649	
Who does not like change			−0.591	
Calm				
Undisciplined				0.701
Moody				0.680
Anxious			−0.495	0.598
Disorganized		−0.410		0.521
Explained variance [%]	20.484	13.406	10.167	6.564
Test KMO	0.706			
Bartlett's test of sphericity				
Chi square (190 df)	1058.781			
Sig.	0.000			

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