

Drinking Habits and Culturally Conditioned Wine Production in Italy

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1 Abstract

Motivated by increasing interest in cultural goods and their impact on economic output, this case study aims to use regional variation to establish a significant relationship between drinking habits and wine production in 20 regions of Italy. We use yearly wine and grape production, as well as different features of drinking habits for each year since 2013 to document that regions with high proportion of regular consumers of wine have significantly higher wine output, explained exactly by these drinking habits of the population. To account for possible endogeneity of this hypothetical supply-demand chain, we adopt instrumental variable approach where wine reviews on popular sommelier website Vivino serve as our instrument. This instrument differences out endogeneity through the demand side, and through establishing a significant relationship, strengthens our conjecture of culturally conditioned economic output. This instrument captures insightful information about the demand shock of the first and fourth specifications of drinking habits defined in the paper - proportion of people who drink some wine on a daily basis and proportion of people who drink wine rarely. We document a significant relationship of wine culture within the society on the economic portfolio of wine output.

2 Acknowledgements

We thank Professor Eichengreen and Todd Messer for valuable feedback and support throughout the semester. All the errors are our own responsibility.

3 Introduction

Drinking habits and other cultural variables are commonly differenced out in econometric models through fixed effects, because they are viewed to be constant over time. This rough assumption of invariant cultural variables needs further research attention especially in 21st century, when cultural dominance, globalization and standardization absorb or restructure traditions and cultural inclinations of multitude of people. With the same logic, very little, if any, research has been done to estimate the effects of those variables in economic setting. How does the culture interact with economics and how do the cultural shifts disturb economic patterns? This paper has the ultimate goal to pin quantitative approach in answering these questions through a case study in Italian wine industry.

The launch of the Journal of Wine Economics in 2006 ¹ officially marked economists' growing interest in the wine industry and its economic activity. Substantial amount of research has been done to investigate the demand and supply shocks in the wine market such as the effect of climate change on wine industry, the determinants of consumers' changing tastes in wines and how wine production drives wine tourism ². Our research views wine as a "cultural good" and tries to map the causal connection of the nation's drinking habits shaping the economic output of wine.

We investigate and document that expressively high drinking habits lead to wine-oriented production portfolios. Moreover, we use the claim from existing research that wine is a cultural good with its socio-culturally embedded perceptions and distinct traditions of wine experience ³.

The latter statement is bolstered by the fact that traditional touristic visits to Italy became

¹"Journal of Wine Economics." Cambridge Core, www.cambridge.org/core/journals/journal-of-wine-economics

²Gatti, Silvia, et al. Wine in the Old World: New Risks and Opportunities. F. Angeli, 2003.

³POMARICI, Eugenio, Flavio BOCCIA, and Daniela CATAPANO. "The Wine Distribution Systems over the World: an Explorative Survey," 2012. https://newmedit.iamb.it/share/img_new_edit_articoli/46223pomarici.pdf.

more about the experience of tasting vintage wines in social settings, such as WFR (wine and food routes)⁴. Not obvious from the first sight but claiming the responsibility of being the host of the winery also means to serve as an example of how to enjoy wine and drink wine. In fact, the rise of WFRs essentially signals the position of wine as the cultural icon of Italy, attracting millions of tourists each year. But if wine is so important, how does it shape economic behavior? We will test this hypothesis by assuming that wine adherence through traditions and lifestyle significantly impacts economic output of wine with regional and yearly variation, which gives us room for performing econometric analysis.

Thus, the collective adherence to wine through traditionally or culturally supported habits significantly impacts the distribution of economic outputs, in other words – economic output portfolio, favoring production of wine. These differences in wine production levels are evident throughout all the years in our sample. An empirical or simplistic evidence of our yet-to-be-achieved conclusion is further supported by increasing concentration of wineries and WFRs within specific regions that were historically producing more wine than other territories, and according to our hypothesis, had higher “wine-allegiance” or wine-prone cultures⁵.

3.1 Motivation and Existing Literature

Wine is intertwined with the cultures of many big western wine producers such as Italy, France and Portugal. Marks, D. (2011) defines wine to be a “cultural good” explaining that both wine and wine trades are deeply steeped in culture and history. Taking this idea further the author suggests that the new interpretation of this drink may define a market niche not yet served by current producers. We choose Italy as the spot of our case study, because we believe this country has developed a distinctive wine label through time and has heavy weight in the world wine market.

The rising interest towards the cultural goods leaves the space open as if how we define them and what impact they have on the economy. Most of the literature which looks at the wine production and culture from the economic perspective takes some sort of “output-culture” or “output-tradition”

⁴Gatti, Silvia, et al. Wine in the Old World: New Risks and Opportunities. F. Angeli, 2003.

⁵Gatti, Silvia, et al. Wine in the Old World: New Risks and Opportunities. F. Angeli, 2003.

causal relationship as given. No existing paper explicitly tries to define the causal link and measure its impact. One paper⁶ that does not take this relationship for granted is based on a survey of 81 interviews conducted in Piedmont, which covers areas of multifarious engagement with winery. This study, however implementing a strictly qualitative approach, aims to reveal the relationship of wine culture knowledge, frequent consumption of wine with intensive wine production within a specific area. Its conclusion is purely argumentative and supported by qualitative descriptions. Although it adopts an observational study method, instead of answering “how?”, this paper gives only insight into “why?” wine producing areas have high alcohol consumption (and also low alcohol-related risks) via traditional and family-rooted habits from purely a social aspect.

This paper uses data-intensive approach to show that traditions and culture, proxied by different drinking habit features, are notable determinants of the economic output of a certain cultural good, as defined above. Thus, culture remarkably favors development of an economic output.

4 Context

4.1 Supply and Demand of Wine

Wine economics offers multiple insights on how the culture can shape the economic output of a certain territory. It is, in fact, within the flow of rising interest in behavioral economics and game theory that culture and traditions can alter the consumption patterns of a typical “territorial good.” This study aims to give historical background for the wine industry in Italy and possible explanations of its development in the late 20 and 21 century, as well as to lay theoretical background of certain changes in supply levels, demand shocks with a possible establishment of causation between supply and “traditional drinking habits.”

The existence of spatial agglomerations within wine industry leads to more than 30 percent of Italian wine exports being produced only in 3 regions of Italy – Veneto, Puglia and Emilia-

⁶Franca Beccaria Sara Rolando (2016) The more you know, the better you drink: The new drinking culture in Italian wine production areas, *Drugs: Education, Prevention and Policy*, 23:4, 293-301

Romagna as illustrated in our dataset. From game theoretic perspective, Italian wineries have high trust beliefs and networking levels, which is the reason why the wine industry could persist through anti-alcohol measures adopted by the government in 1990s. Adoptions of severe alcohol policies in 1990’s, as well as the launching of National Health Plan and excise taxes on alcoholic beverages⁷, nevertheless negatively impacted wine consumption in all regions. However, the role of structural demand shifts cannot be ignored. In fact, the main instrument of reviews in the main model and the culturally illustrative instruments of family size in the robustness check, find their argumentative justification on demand side.

Although almost all Mediterranean countries have witnessed a drop in their alcohol industries since 1980s⁸, this fact is attributable to the exponentially growing urbanization levels in highly conservative areas, as well as structural changes of the family organization and lifestyle, such as work-life balance, communication and eating habits.

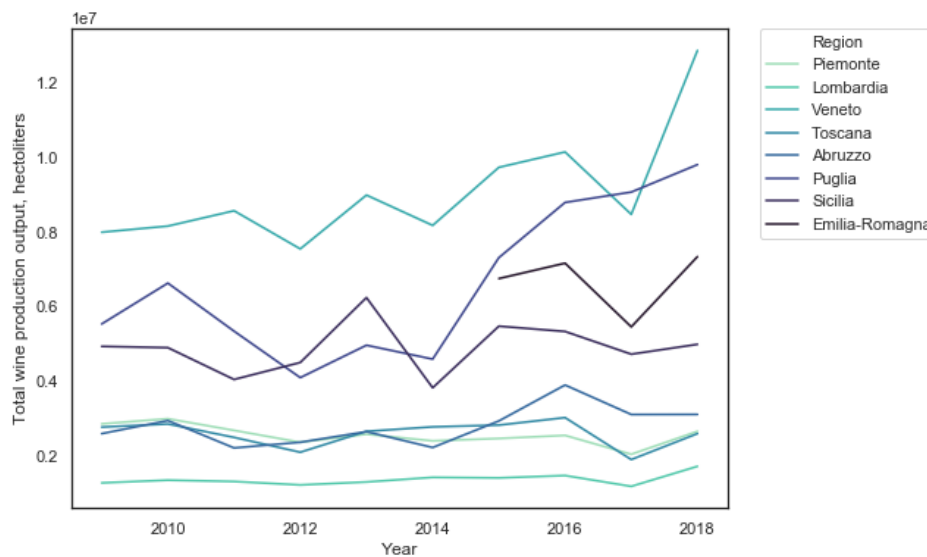


Figure 1: Wine outputs are relatively predetermined with no drastic changes in time

⁷Allamani, Allaman, et al. “Italy Between Drinking Culture and Control Policies for Alcoholic Beverages.” Substance Use amp; Misuse, vol. 49, no. 12, 2014, pp. 1646–1664., doi:10.3109/10826084.2014.913386.

⁸“Less Vino, Please: Italian Drinking Rates Drop.” LiveScience, Purch, www.livescience.com/52834-italian-drinking-rates-drop.html.

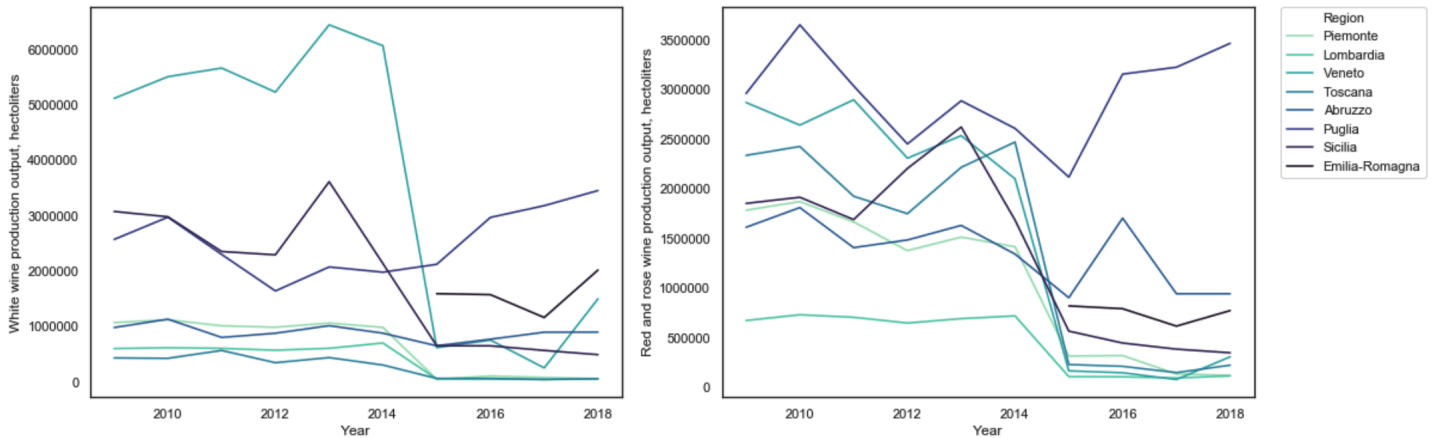


Figure 2: We also notice significant variation in wine portfolios. Specific regions have significantly higher output in white wine production, while the rest - in red and rose wine. As specified later, we will include robustness checks regarding this issue.

Moreover, geographic differences of wine output seem to be invariant in time perspective. This is the main takeaway from our discussion of context. This simple but crucial observation hints that winery concentrations have long-term and deeply rooted credentials to be the hot spots.

Does the existing lifestyle and the increasing casual discussions about wine drive more consumption and hence, more production of wine? Is it the position of wine in the center of family social contexts or family traditions that leads these regions to specialize in the production of this drink? Is it the culture revolving around wine that engraves and predetermines economic portfolio? Our answer is, yes. The hypothesis of this study claims that culture shapes economy: historically fixed habits produce a significant impact on wine output level.

As a side note, we do not notice abrupt takeovers by any region to lead the wine producing tradition since 2006. Thus, some regions are historically or traditionally favored to produce wine, while others not. The existing clustering effect benefits not only sellers and firms, but also buyers. Buyers benefit from decreased search time of appropriate goods, reduced travel costs, efficient transportation and increased trust towards firms.

5 Data

Our sample granularity comprises of 13 years and 20 regions - 260 rows in total for wine production and drinking habits. The time period covers the years starting from 2006 till 2018 for 20 different municipal regions of Italy - Piemonte, Valle d'Aosta, Liguria, Lombardia, Trentino-Alto Adige, Veneto, Friuli-Venezia Giulia, Emilia-Romagna, Toscana, Umbria, Marche, Lazio, Abruzzo, Molise, Campania, Puglia, Basilicata, Calabria, Sicilia, Sardegna. The main (response) variable is the total wine production in hectoliters, while the dependent variable of interest is the drinking habit. The data source is the Italian National Institute of Statistics.

5.1 Drinking Habits Data

This study examines the effect of culture on economic output. In this setting the definition of culture should reflect individual preferences of a cultural good. In order to justify the causality of culture on wine production, the proxy we are going to use for cultural variation should be related to the variation of wine usage. Thus, we implement percentage of wine drinkers as a proxy for drinking habits. Moreover, because the usage of wine can encompass different levels of wine allegiance, signifying different levels of cultural and traditional attachment, we adopt several features of drinking habit proxy: the proportion of people who drink some wine every day, the proportion of people who drink more than half a liter of wine per day, the proportion of people who drink 1 or 2 glasses of wine per day and the proportion of people who drink wine but occasionally. What do we mean by different levels of wine attachment? Comparatively, wine-heavy consumers reflect extensive immersion in wine culture. Clearly, the proportion of wine drinkers with 1 or 2 glasses of daily consumption reflects more information about how wine is planted into the social lifestyle setting (and thus sheds more light into how culturally perceived is this product) than the proportion of wine drinkers with some amount of daily consumption. In fact, we hypothesize no significant relationship between the latter variable and the wine output in our final results, as this proportion reveals nothing about wine culture whatsoever. Although we will run regressions with

all these specifications so as to validate our assumptions, the general proportion of wine drinkers and the proportion of people who drink 1 or 2 glasses of wine daily are the main covariates that represent interesting material for the discussion.

5.2 Wine Production Data

We obtain yearly and regional wine production data in hectares and hectoliters from Italian National Institute of Statistics, as well as total production volumes by type of wine (red, rose and white).

5.3 Population Data

We notice magnitude differentials across regional wine production levels, which leads us to include regional and yearly population values in the dataset.

5.4 Instrumental Variables Data

5.4.1 Where to find them?

Because of a possible simultaneous causality in this hypothetical supply and demand variables, we use instrumental variables to isolate the movements in the demand side that are uncorrelated with error terms. Thus, we need to find a variable that is correlated with the covariate, in this case – drinking habits as specified by proxy variables above, but not with the dependent variable – wine production. Moreover, the instrument should influence the dependent variable only through the means of drinking habits. In order to trace our selection of instruments, let us recall the demand shocks mentioned earlier in the context section of this paper. Hypothesizing that wine is a socio-cultural good we believe that the opinions and the general public discussion about wine can incentivize or disincentivize the consumption of wine and if it has any connection with wine production then the channel through consumption is the only one. Establishing that wine is an inseparable part of people’s lifestyle and daily choices in Italy, we believe that having wine reviews/recommendations as our instrument can give us a strong first-stage. This is our main in-

strument and we use it in the main model to account for recommendation-based exogenous demand shocks. Moreover, most of the wine consumption in Italy is revolved around a family meal or dinner table. Thus, understanding the structural shifts in the organization of family life, lifestyle and eating habits will serve as the desired exogenous shock of the demand side in our model. Family structure is also not correlated with wine output, which makes this variable concept a good candidate for an instrument. To emphasize the cultural aspect of our hypothesis we use the family size as an instrument and perform robustness check on our model in later sections.

6 Wine Reviews: The Crucial Instrument

Our main instrumental variable that uses text analysis is abstracted from a popular wine catalog rating website, Vivino. First, we scrape large dataset from this source with all varieties of wine from all regions and almost all years in our sample (since Vivino launched in 2010). This is the largest existing wine community, which serves as a valuable source to understand what happens with the demand in specific winemaking regions of the world. First, we recognize possible endogenous demand changes explained by price. To control for price elasticity effects on demand, we fix relatively narrow band of 15 – 50 US dollar wines. Moreover, evidence suggests that the demand of wine is largely predetermined by wine quality⁹ and not price. Thus, fixing price is a cautionary technique and does not represent any bias in our methodology.

Next we go on by scraping wine reviews for each region yearly. These reviews are given by Vivino users who can be rated by other users of the platform based on the helpfulness of the review or comment. To sum up, each user in Vivino has her own rating number which reflects how many times other people found this users' reviews valuable or helpful in wine selection process. Thus, it makes sense to give high rating user reviews more weight into our model. Consequently, each review is analyzed for text sentiment which reveals how positive or negative is the feedback. From the perspective of a potential consumer, the sentiment of wine reviews is a good proxy of how likely

⁹HERTZBERG, Anna, and Giulio MALORGIO. Wine Demand in Italy: an Analysis of Consumer Preferences. newmedit.iamb.it/share/img_newmedit_articoli/23840hertzberg.pdf.

is that consumer to demand the wine under review subject. For each review we obtain a sentiment score and use the ratings of their corresponding users to weigh them and get one single average *Vader* score for each region on a yearly basis. To sum up, yearly for each region we calculate:

$$\text{WeightedPolarity}_{t,r} = \frac{1}{N} \sum_{i=1}^N \frac{(VaderSentimentScore_{i,t,r} * \frac{UserRating_{i,t,r}}{\sum_{i=1}^T UserRating_{i,t,r}})}{Length_{i,t,r}}$$

(1)

where N is the number of reviews, i is the index for specific expert user, $UserRating_{i,t,r}$ is the above mentioned rating weight of the i -th user, also referred to as *credibilityoftheuser*. $Length_{i,t,r}$ is the length of the review. We are using an existing “vader” lexicon for determining the polarity of each word. The polarities of the words are negative or positive depending on their meaning. For example, word “amazing” has a very high positive polarity. Aggregating the polarities of individual words we get an estimated polarity for the review, which is the $VaderSentimentScore_{i,t,r}$ in the equation. To illustrate the efficiency of this technique, note the following example review:

'black fruit and spices aromas tannins are present but silky the acidity is medium plus flavors of blackcurrant black cherry oak pepper and blackberries medium plus after taste ali rivera n'

This review is mainly neutral and gives no incentive whatsoever to demand the objective wine in the eyes of a typical consumer. Our measure correctly labels it with 0 score. Another example of highly incentivizing expert review is the following, which logically receives a polarity of 10.5:

n probably the best white wine i had in a long time the nose is good with rose banana and flowers noted the colour is yellowish but very clear lots and lots of tears medium bodied white at 13 alc the palate is smooth with perfect acidity really well balanced biscuit and caramel noted the finish is to die for long long finish with a very good lasting mouthfeel with a pineapple tone fantastic wine well structured and a good balance

Please note that text language processing has a lot of limitations. For example the word *smooth*, which is highly used in sommelier lexicon and represents positive feedback, is scored 0 in vader dictionary. Hence, we also perform human impression-based analysis. Special words were chosen by inspection of reviews (as we became typical users of Vivino), including but not limited to - *perfect aroma, brilliant, smooth, brilliant, very good, never fail*. Thus, we generate special dictionary polarity scores with the following method:

$$SpecialPolarity_{t,r} = \frac{1}{N} \sum_{i=1}^N \frac{SpecialFrequency_{i,t,r}}{Length_{i,t,r}} \quad (2)$$

where $SpecialFrequency_{i,t,r}$ is the cumulative frequency of the specific words in the review i , in year t and region r . N is the number of reviews in 1 year and for 1 region.

We trust our human inspection more than the machine learning polarities by vader; consequently, in the process of designing our final metric we give twice as much weight to our inspection than weighted vader polarity. During our inspection we realized that people who feel very strongly about wine quality, either negative or positive, are keen on writing long comments and paragraphs and because our polarity counting method was to simply add polarities of each word and getting aggregate polarity, so we also standardized the scores by the length. During the research process we became frequent visitors of Vivino’s website, so we realized that when you look at the wine reviews from a specific state, you also have access to previous years. The overall tendency to consume wine is not merely based on this year’s comments but also all the previous ones. For example, from today’s perspective if there are negative reviews in 2018, these can have negative effect on the consumption level in 2019. *Thus, to make the metric more representative of user experience, we took the rolling average of weighted polarities.*

$$RollingWeightedPolarity_{t,r} = \frac{1}{t-2014} \sum_{j=2014}^t WeightedPolarity_{j,r} \quad (3)$$

$$WineReview_{t,r} = RollingWeightedPolarity_{t,r} + 2 * SpecialPolarity_{t,r} \quad (4)$$

6.1 Defending Our Instrument

First Stage: Wine reviews instrument captures a behavioral pattern in consumption through an electronic recommendation source and is undoubtedly correlated with wine demand and drinking habits. If a specific region experiences an increase in its demand score as measured above, it means that people have increasing interest towards wine consumption in that region.

Research by Friberg and Grönqvist ¹⁰ shows that a favorable expert review increases the demand for wine by 6 percent within a week. With this in mind, we believe that wine reviews on the most expansive and diverse wine community website necessarily account for any exogenous demand shifts, which then explain changes in wine supply levels through our covariate, making wine reviews an apt candidate for IV approach. In our analysis the rating represents how “expert” is the reviewer, which makes it intuitive to give higher weight to more expert sommeliers and wine gurus, as people’s demand will respond more aggressively to highly accredited users. Intuitively, understanding how people interact with these reviews discloses wine behavior, which fits into the cultural setting that we constructed in this paper.

Exogeneity Condition: Given that our reviews are very opinion-based and they just reflect people’s individualistic tastes they should be as good as a “randomly” assigned instrument. If there is anything that can make the opinions more deterministic then it is the quality of the wine. Please note that “quality” is a very broad term and can mainly be a demand shock and not a supply shock - the suppliers do not produce more or less solely for the reason of having good or bad quality wine. One channel that can reflect the quality of wine is the price, which potentially affects the supply side. To control for this, our study chooses a very narrow bandwidth of prices, 15 – 50 US dollars and, furthermore, it performs a robustness check where prices are included as a controlled

¹⁰Friberg, Richard, and Erik Grönqvist. “Do Expert Reviews Affect the Demand for Wine?” *American Economic Journal: Applied Economics*, vol. 4, no. 1, 2012, pp. 193–211., doi:10.1257/app.4.1.193.

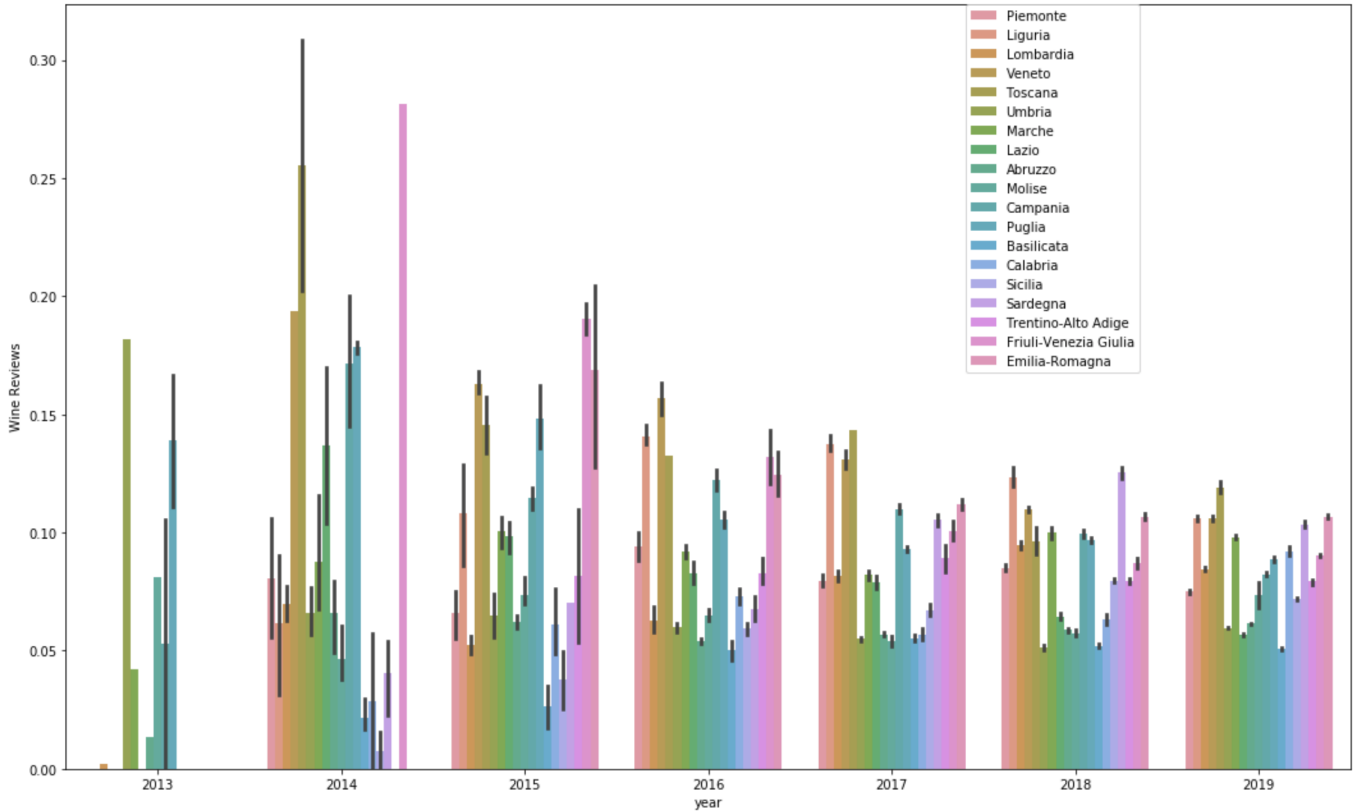


Figure 3: The graph illustrates how the *WineReviews* metric changes over time and regionally. We notice that this metric converges in time, which can mean increased competition between regions, targeting quality winemaking as a branding and touristic tool, as well as spillover effects. Barplot includes standard deviations.

variable. The last concern for the exogeneity condition is to make sure that the outcome variable does not influence our instrumental variable, that is to show that wine production does not make people to write reviews about the wines in any way. One scenario that we considered is where the wine producers pay sommeliers to write reviews about their wines once they were produced. To avoid this possibility our model accounts for a lag between wine production and drinking habits driven by previous year's reviews. It is very unlikely that the wine producers will pay sommeliers to write reviews for the wines that are not produced, yet, with the intentions of increasing the wine production. Moreover, our data pattern showed that the review positivity slowly dropped over time contradicting with the latter concern. As a closing note, we will also point out that Vivino is being used by 35 mln users and even if the wine producers try to negotiate with sommeliers they would

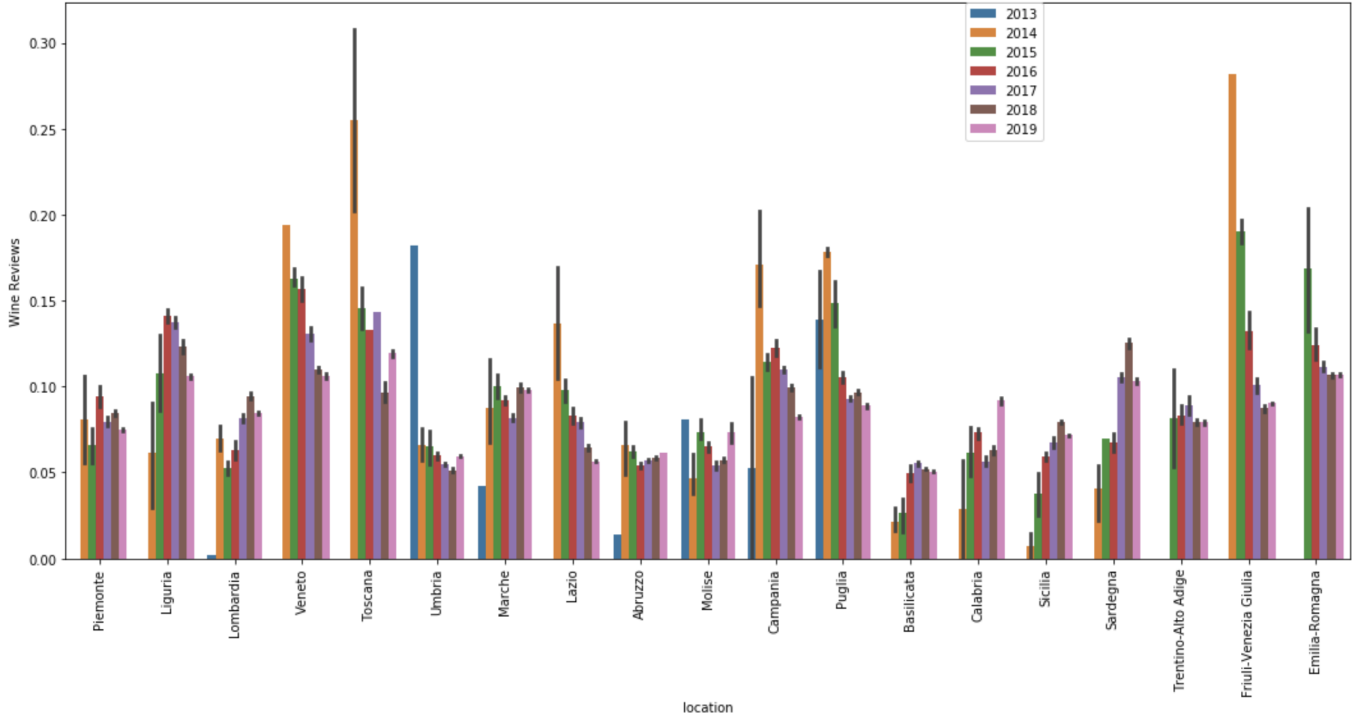


Figure 4: A different visualization of the same pattern as in *Figure 5*. Two things can be inferred from these data: 1. Poorly performing regions see rise in their demand, while wine-established locations experience negative reviews. 2. Overall the trend in reviews is negative, which is explained by rising critique, higher quality wine expectations and decreasing trend of alcohol consumption as mentioned earlier in the paper. Barplot includes standard deviations.

not be able to skew the database of opinions as big as 35 mln.

Exclusion Restriction: Following the discussion from the previous two parts of IV conditions we are left to show that the reviews impact the wine production only through consumption. To illustrate the validity of this assumption let us imagine that the connection of reviews and wine production is not through the wine consumption. The first and the most obvious scenario is thinking of producers who check Vivino to assess the popularity of their wines. Even if the producers intentionally check the website and do not get the consumption signals from the market, the only case they will actually act upon reviews and increase/decrease their production is when they strongly believe that the consumption patterns will be reflected in the reviews, hence, contradicting that the reviews were impacting the production without using the channel of consumption. Finally, being thoroughly a demand-side shock, reviews do not affect the costs of production, the weather conditions for

successful grape harvesting and can only affect the prices through consumption channel - these are the main wine production determinants.

Through such discussions and thought-generating process we conclude that our IV is a reasonable fit for this study.

7 Methodology

The main equation of our hypothesis is:

$$WineProduction_{t,r} = \beta_0 + \beta_1 * DrinkingHabits_{t-1,r} + Population_{t-1,r} + \lambda_r + \gamma_t + \epsilon_{t,r} \quad (5)$$

where $WineProduction_{t,r}$ is the total wine production per capita in hectoliters by region r and in year t ; $DrinkingHabits_{t-1,r}$ is the proportion of people who drink 1 or 2 glasses of wine per day in region r and year $t - 1$, *as specified by the argumentation of our lagged instruments* (3 other specifications also utilized in robustness check section); λ_r , γ_t , $\epsilon_{t,r}$ are regional, time fixed effects and the error term respectively.

This paper uses instrumental variables to eliminate simultaneous causality of wine supply and drinking habits.

2-Stage Least Squares method includes the following regressions:

$$DrinkingHabits_{t-1,r} = \pi_0 + \pi_1 * WineReviews_{t-1,r} + Population_{t-1,r} + \delta_{t-1,r} \quad (6)$$

$$WineProduction_{t,r} = \alpha_0 + \alpha_1 * \hat{DrinkingHabits}_{t-1,r} + Population_{t-1,r} + \lambda_r + \gamma_t + \epsilon_{t,r}$$

(7)

where $\widehat{DrinkingHabits}_{t,r}$ is the estimated dependent variable from (2), and $WineReviews_{t,r}$ is the final weighted sentiment analysis recommendation score of wines in region r and year t .

8 Main Results and Conclusion

The results we got in the table below reject some of our hypotheses conjectured earlier in the paper. First of all, all 4 specifications resulted in significant and positive relationship with wine production. However, *the most important thing to note here and also in further robustness checks*, is that the relationship holds at highest significant level for the proportion of some wine drinkers. The latter variable reflects the general wine culture, whereas more than half and 1 – 2 glass of wine drinkers are the "sticky" or addicted wine users. These people regardless of the wine reviews are going to consume wine, as they are *loyal* customers. Thus, in the beginning we were wrong to think that the variable of interest is 1 – 2 glasses or half liter drinkers. Although these agents are core representatives of wine culture, their proportion in the whole population is relatively small, and thus, changes in these segments will lead to less impact in wine industry. The most insightful place to look for explanations is proportion of some wine drinkers and rare wine consumers, because it is the behavior of these categories that is mostly affected by our instrument and delineates *major* and *large-scale* changes in consumption pattern (as these categories encompass around 60 percent of population). Hence, testing for instrument's relevance, we expect to get strongest instrument specifically for some wine and rare drinkers, as shown in the table below.

	some wine drinkers	half + liter	1-2 glass	rare drinkers
F - statistic	13.1849	2.05531	7.71033	8.20357

Table 1: Note the high values of F-statistic for the first and fourth specifications, with F-statistic for proportion of some wine drinkers being greater than 10.

Variables				
Proportion of some wine drinkers	584,284*** (220,881)			
Proportion of half+ liter drinkers		1.040e+07 (7.645e+06)		
Proportion of 1-2 glass drinkers			1.340e+06** (585,489)	
Proportion of rare drinkers				1.104e+06** (472,921)
Population	0.513*** (0.180)	0.546 (0.355)	0.704*** (0.237)	0.355* (0.204)
Constant	-2.940e+07** (1.156e+07)	-2.336e+07 (1.807e+07)	-2.321e+07** (1.067e+07)	-2.826e+07** (1.262e+07)
Observations	76	76	76	76

Table 2: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$: Standard errors in parentheses

The robust results discussed in the next sections, as well as significant results for all specifications of drinking habits in the main results document an important relationship of wine culture and wine output. This link is always statistically significant for the first specification of drinking habits - proportion of some wine drinkers daily. *This result establishes that an increase in interest of wine culture on major population segment in a region leads to a significantly higher regional wine output produced next year.* Results are also always robust on the fourth specification - proportion of people who rarely drink wine, although on a lesser extent. Hence, we conclude that an increase in wine demand in relatively wine-uninterested circles reveals the progress of wine culture, which thereafter leads to significant increase in wine output within that area.

9 Robustness checks

9.1 Immigration Interaction

As this study explores the cultural effects on economy in general, we propose an interesting extension to our model as a robustness check to test for further cultural implications. We incorporate an

immigration data of all 20 Italian regions with number of foreign citizens by origin of country. Please note that we accessed very granular data with regional and yearly counts of immigrants from 200 different countries. To make our analysis more precise we excluded the countries that are already famous for their existing wine drinking culture. As these immigrants are not part of the traditional Italian wine drinking culture, it will be insightful to look at how demographic changes within a region interacted with the drinking habits variables affect wine output. This accounts for any external drinking habit differences among regions that are attributable to immigrant population. But most importantly this interaction strategy addresses a potential correlation between drinking habits and demographic distribution, especially immigrant population who introduce differential effect on wine culture and output. It can be problematic if a very traditional wine-oriented region that also has significant immigrant population reports lower number of drinking patterns as measured in the data. Thus, introducing interaction terms potentially excludes any exogenous features not representative of intrinsic Italian wine experience.

The following is the correlation table of proportion of immigrants with drinking habits.

Variables	some wine drinkers	half+ liter	1-2 glass	rare	Prop immigrants
some wine drinkers	1				
half+ liter	0.4872	1			
1-2 glass	0.7601	0.6216	1		
rare	0.8283	0.0638	0.3221	1	
Prop immigrants	0.7759	0.3526	0.5681	0.7005	1

Table 3: Correlation table

We observe high correlation of immigrant population percentage and drinking habits, which supports our argument above. The results described in Table 4 reveal significance on some wine drinkers (the general wine attitude). We can potentially assume that Italian immigration policies did a great job to assimilate immigrants into the local culture, as most results are not robust under this variation of the model.

Variables				
Proportion of some wine drinkers	2.974e+06*			
	(1.773e+06)			
Proportion of half+ liter drinkers		-4.705e+07		
		(9.588e+07)		
Proportion of 1-2 glass drinkers			4.540e+06	
			(2.859e+06)	
Proportion of rare drinkers				1.766e+07
				(5.423e+07)
Population	2.638*	-3.413	2.709*	4.577
	(1.361)	(7.907)	(1.478)	(12.88)
Constant	-1.334e+08*	8.845e+07	-6.834e+07	-3.960e+08
	(8.029e+07)	(1.779e+08)	(4.383e+07)	(1.219e+09)
Observations	76	76	76	76
Some wine drinkers - immigrant interacted	-9.261e+06*			
	(5.550e+06)			
Half+ liter wine drinkers - immigrant interacted		2.732e+08		
		(5.579e+08)		
1-2 glass wine drinkers - immigrant interacted			-1.851e+07	
			(1.175e+07)	
Rare wine drinkers - immigrant interacted				-5.935e+07
				(1.825e+08)

Table 4: Immigration robustness check: results are robust under the first specification. This is in line with our conclusion that the general level of wine consumption habits is the most robust covariate. Each regression was run on respective drinking habit specification as an endogenous variable with instrument and an exogenous control interaction term.

9.2 Price Ranges

As mentioned in section 6.1, it is worth to investigate price differences even in the small bandwidth of prices in the sample. We add price as an exogenous control variable in the main model to account for wine quality variations, because we believe that price reflects quality. Note that we are aware that the price is related with the wine output (outcome variable), since it is a determinant of supply. This is why we did not include price as an exogenous variable in our main model.

Variables				
Proportion of some wine drinkers	585,958*** (224,458)			
Proportion of half+ liter drinkers		1.158e+07 (9.467e+06)		
Proportion of 1-2 glass drinkers			1.419e+06** (651,327)	
Proportion of rare drinkers				1.074e+06** (456,989)
Population	0.512*** (0.184)	0.526 (0.393)	0.703*** (0.246)	0.366* (0.206)
Price	976.1 (46,560)	38,693 (110,288)	19,939 (58,329)	-9,304 (50,957)
Constant	-2.951e+07** (1.209e+07)	-2.720e+07 (2.393e+07)	-2.518e+07** (1.252e+07)	-2.721e+07** (1.246e+07)
Observation	76	76	76	76

Table 5: Price exogenous control variable robustness results. Results are all significant and robust except the second specification of drinking habits. Note the high standard errors on the price coefficient, which completely make price as an insignificant variable attributed to the fact that we analyzed a very narrow range of prices.

9.3 Drinking Habits Specifications

Our results are also robust under 3 different specifications of drinking habits, as specified earlier in the data section of this paper. The results can be found in the Main Results Table .

9.4 Wine per capita

We also calculate wine production per capita for each region yearly and use this specification to run the main model (and exclude population term). The results are still robust under this test under some specifications.

Variables				
Proportion of some wine drinkers	0.0979** (0.0479)			
Proportion of half+ liter drinkers		1.743 (1.439)		
Proportion of 1-2 glass drinkers			0.225* (0.123)	
Proportion of rare drinkers				0.185* (0.0953)
Population	-6.59e-09 (3.91e-08)	-9.74e-10 (6.69e-08)	2.55e-08 (5.00e-08)	-3.30e-08 (4.11e-08)
Constant	-4.217* (2.509)	-3.206 (3.401)	-3.180 (2.248)	-4.027 (2.544)
Observations	76	76	76	76

Table 6: Wine per capita instead of total wine output robustness check. Results are all significant and robust except the second specification of drinking habits.

9.5 Different Wine Specifications

We perform main equation regression with 2 other specifications of wine output - white wine, red and rose wine output.

Variables				
Proportion of some wine drinkers	100,728** (51,229)			
Proportion of half+ liter drinkers		1.793e+06 (1.412e+06)		
Proportion of 1-2 glass drinkers			231,035* (122,186)	
Proportion of rare drinkers				190,303* (107,041)
Population	0.0697* (0.0418)	0.0754 (0.0656)	0.103** (0.0495)	0.0425 (0.0461)
Constant	-5.027e+06* (2.682e+06)	-3.987e+06 (3.336e+06)	-3.961e+06* (2.227e+06)	-4.832e+06* (2.857e+06)
Observations	76	76	76	76

Table 7: Regression results when dependent variable is *white wine production*. Results are robust under all specifications of drinking habits except proportion of more than half liter drinkers.

Results for red and rose wine production are insignificant as shown in Table 8. We can interpret the results in the following way: red and rose wine consumption has relatively inelastic demand and

is not captured by our instruments, as it represents the majority of only table wines. The variation in consumption that causes significant changes in supply level is *dictated by white wine*.

Variables				
Proportion of some wine drinkers	57,373 (45,190)			
Proportion of half+ liter drinkers		1.021e+06 (982,174)		
Proportion of 1-2 glass drinkers			131,593 (101,474)	
Proportion of rare drinkers				108,393 (91,333)
Population	0.0447 (0.0369)	0.0480 (0.0457)	0.0635 (0.0411)	0.0293 (0.0394)
Constant	-2.726e+06 (2.366e+06)	-2.134e+06 (2.321e+06)	-2.118e+06 (1.849e+06)	-2.615e+06 (2.438e+06)
Observations	76	76	76	76

Table 8: Regression results when dependent variable is *red and rose wine production*.

9.6 Using Alternative Cultural Instrument

As a variation of our model we want to capture the opposite direction of correlation between instrument and endogenous variable driven again by the wine culture. We choose the proportion of single families. The reason for this choice is that single families¹¹ mostly represent the effect of the so-called urbanization wave discussed earlier in the context section of this paper and reflect the changing lifestyles of the youth, who opt for living separately from their parents. Intuitively, these individuals will participate in significantly less family meals and will engage in less traditional family gatherings or events than their counterparts who live in households with 5 or more individuals. Recalling our previous discussion that most of the wine experience in Italy occurs via family meals and dinners, we infer that the increasing percentage of single families represents declining family gatherings and hence decreasing engagement with wine culture. Thus, this instrument shows how likely is the society to immerse in these traditional meals, during which most of the wine consump-

¹¹Strunin et al. Familial drinking in Italy: Harmful or protective factors? *Addiction Research Theory*, 2010; 18 (3): 344 DOI: 10.3109/16066350902867890

tion occurs. We hypothesize that higher the proportions of single families lead to a decrease of perception of wine as a cultural good and negatively affect wine production through the covariate. Thus, the selection of our instrument designates a measure of a structural change in culture, so that adjusting for the instrument will establish a statistical relationship between drinking habits and the variable of interest, wine output. Because the culture is proxied by the drinking habit features mentioned above, these culture-revealing variables will be highly correlated with the covariates, which is good for the model. In fact it is interesting to observe how this seemingly uninteresting variable is able to exogenously capture a lot of variation in wine demand (wine culture). The next figure illustrates the pattern of family structure and drinking habits, defined per proportion of people who drink 1 or 2 glasses of wine daily.

Figure 6 shows the regional version of Figure 5, further supporting our assumption of declining wine culture simultaneously with the rise of urbanization and weakening family institute.

Results of this robustness check result in negative significant coefficients, as expected by above argument.

Variables				
Proportion of some wine drinkers	-613,781** (294,767)			
Proportion of half+ glass drinkers		-8.284e+06 (5.775e+06)		
Proportion of 1-2 glass drinkers			-2.392e+06 (1.980e+06)	
Proportion of rare drinkers				-1.118e+06* (594,513)
Population	0.347* (0.205)	0.341 (0.299)	-0.0538 (0.531)	0.509** (0.227)
Constant	3.322e+07** (1.543e+07)	2.066e+07 (1.366e+07)	4.461e+07 (3.601e+07)	3.091e+07* (1.586e+07)
Observations	76	76	76	76

Table 9: Negative coefficients signify that the higher the proportion of single families, the lower wine output. Coefficients are significant for the first and the fourth specifications.

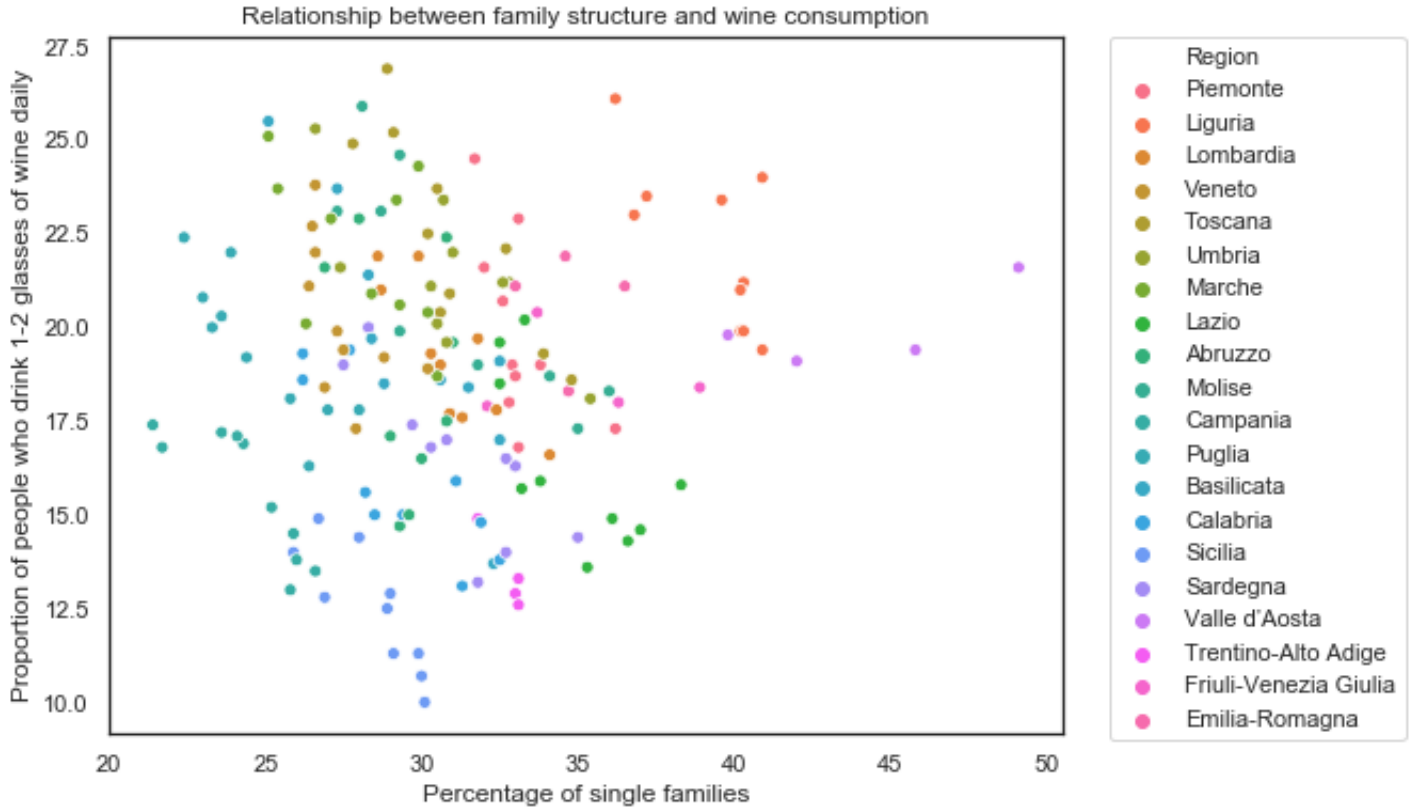


Figure 5: The visualization captures patterns cross-sectionally over 20 regions and 12 years of timespan. What is striking about this pattern is that it is hard to tell the exact direction of the relationship between variables. However, if we look at the different categories of data (for example, per colors) we observe negative correlation. This practical example finds its theoretical justification in Simpson’s paradox. As the colors represent distinct regions, we go on to plot this pattern regionally in the next figure.

The instrument is relatively strong for the general proportion of wine drinkers, as expected, and weak for more than half liter and 1 – 2 glass drinkers. This is explained by the fact that those who regularly and heavily consume wine will not alter their behavior even after starting to live alone, or moving to a multiple-individual household. These agents represent the more ”sticky” part of consumption ladder who do not care about neither wine reviews nor family structure.

	some wine drinkers	half + liter	1-2 glass	rare drinkers
F - statistic	9.06421	2.59905	1.78619	6.21983

Table 10: The following represents the F-statistics of the instrumental variable *Single* on 4 specifications of drinking habits.

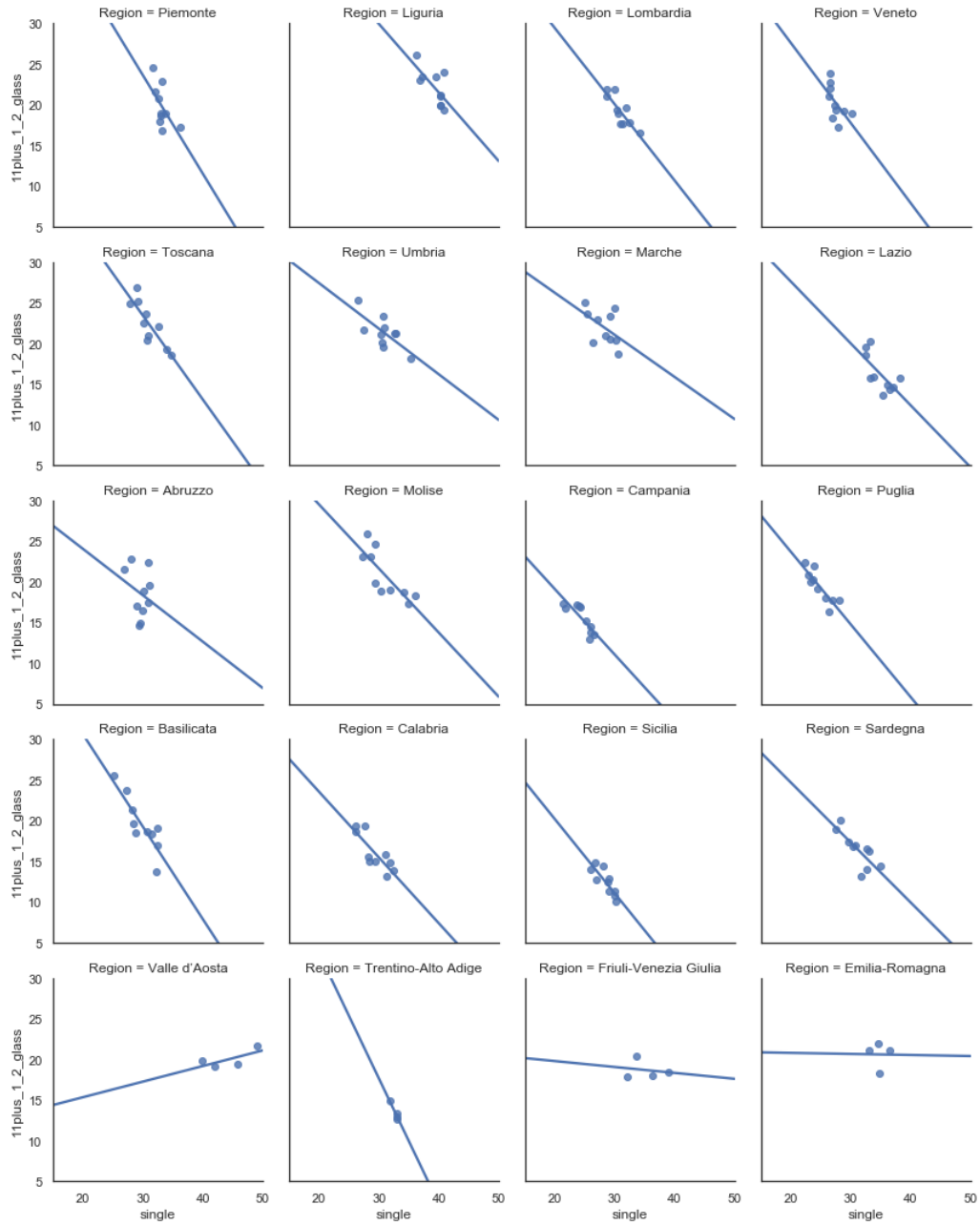


Figure 6: Regional variation of single family - drinking habits pattern.

10 Departing Notes

Conducting this study resulted in the support of a culturally-conditioned wine output. The predominant significance of the first specification of drinking habits explains that wine culture in Italy is all about having wine around and not about drinking it heavily.

11 References

- “Journal of Wine Economics.” Cambridge Core, www.cambridge.org/core/journals/journal-of-wine-economics
- Gatti, Silvia, et al. *Wine in the Old World: New Risks and Opportunities*. F. Angeli, 2003.
- Franca Beccaria & Sara Rolando (2016) The more you know, the better you drink: The new drinking culture in Italian wine production areas, *Drugs: Education, Prevention and Policy*, 23:4, 293-301
- Allamani, Allaman, et al. “Italy Between Drinking Culture and Control Policies for Alcoholic Beverages.” *Substance Use & Misuse*, vol. 49, no. 12, 2014, pp. 1646–1664., doi:10.3109/10826084.2014.913386.
- “Less Vino, Please: Italian Drinking Rates Drop.” LiveScience, Purch, www.livescience.com/52834-italian-drinking-rates-drop.html.
- HERTZBERG, Anna, and Giulio MALORGIO. *Wine Demand in Italy: an Analysis of Consumer Preferences*. newmedit.iamb.it/share/img_new_medit_articoli/23840hertzberg.pdf.

- Strunin et al. Familial drinking in Italy: Harmful or protective factors? *Addiction Research Theory*, 2010; 18 (3): 344 DOI: 10.3109/16066350902867890
- Ashenfelter, O., Jones, G. (2013). The Demand for Expert Opinion: Bordeaux Wine. *Journal of Wine Economics*, 8(3), 285-293. doi:10.1017/jwe.2013.22
- Li, Elton, Johan Bruwer, and Mike Reid(2010). Segmentation of the Australian Wine Market Using a Wine-Related Lifestyle Approach <https://doi.org/10.1080/0957126022000046510>.
- POMARICI, Eugenio, Flavio BOCCIA, and Daniela CATAPANO. (2012) .The Wine Distribution Systems over the World: an Explorative Survey.
https://newmedit.iamb.it/share/img_new_medit_articoli/462_3pomarici.pdf.
- Friberg, Richard, and Erik Grönqvist. “Do Expert Reviews Affect the Demand for Wine?” *American Economic Journal: Applied Economics*, vol. 4, no. 1, 2012, pp. 193–211., doi:10.1257/app.4.1.193.