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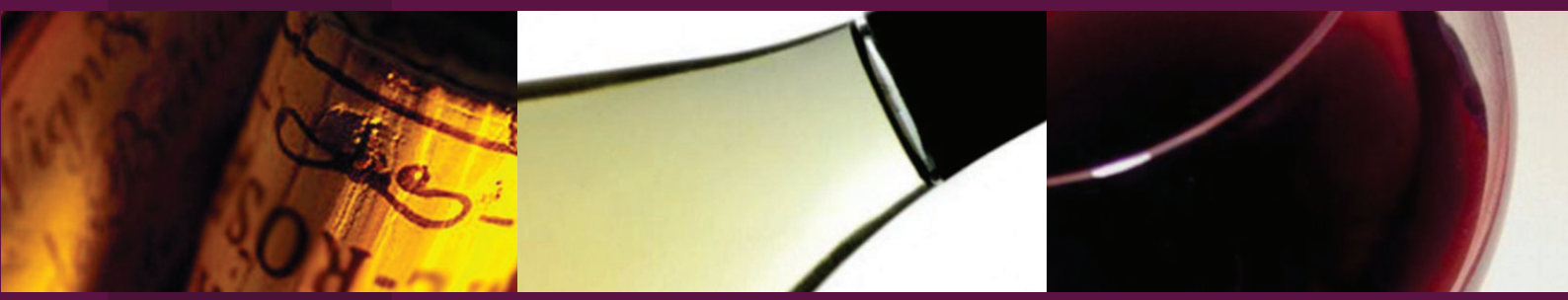

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FIRENZE UNIVERSITY PRESS

Volume 12 Issue 1 june 2023 ISSN 2213-3968

Wine Economics and Policy

Volume 12, Issue 1 – 2023

Firenze University Press

Wine Economics and Policy is an international, peer reviewed and open access journal published by UniCeSV – Centre for the Strategic Development of the Wine Sector, University of Florence.
The mission of the journal is to provide an environment for academic researchers and business professionals around the world to work together in the fields of wine economics and policy in order to deal with the current and future issues of the wine sector.

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Published by
Firenze University Press – University of Florence, Italy
Via Cittadella, 7 – 50144 Florence – Italy
http://www.fupress.com/wep

Wine Economics and Policy

Firenze University Press
www.fupress.com/wep

Citation: Rafael Del Rey, Simone Loose (2023). State of the International Wine Market in 2022: New market trends for wines require new strategies. *Wine Economics and Policy* 12(1): 3-18. doi: 10.36253/wep-14758

Data Availability Statement: All relevant data are within the paper and its Supporting Information files.

Competing Interests: The Author(s) declare(s) no conflict of interest.

State of the International Wine Market in 2022: New market trends for wines require new strategies

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Abstract. The objective of this discussion paper is to provide an overview of the state of the global wine sector in 2022 and discuss the effects of recent events on the wine trade's development. First, long-term trends in the global consumption and production of wine and the development of the international wine trade are discussed. The growth trend of global wine consumption ceased in 2008, but the last decade in the global wine trade has been characterised by stagnant volumes but increasing values driven by premiumisation. Several recent events have affected the volume or composition of the global wine trade: the recovery of the wine trade after Covid-19, global cost increases and inflation, the shift of Chinese wine consumption and the effect of the Russian invasion of Ukraine on Russian wine imports. The paper closes with an outlook on how underlying long-term trends might affect the strategies that successful wine business can employ in the future and suggests future areas of research in the wine business and economics.

Keywords: global wine trade, wine consumption trends, inflation, industry strategies.

1. SCOPE AND OBJECTIVE OF THE DISCUSSION PAPER

This discussion paper combines insights from two data sources unique to the wine sector. The Spanish Observatory of Wine Markets (OeMv) collects a singular record of long-term data of the global wine trade. Most of the data series from OeMv presented here was updated only for this paper and has not been published before. On behalf of ProWein, the University of Geisenheim regularly surveys international experts along the wine supply chain about their perceptions and insights and publishes the annual ProWein Business survey.

Current insights from comprehensive trade data and survey opinions are combined to explore the state of the global wine sector at the end of 2022. The paper is limited to descriptive analysis to provide a basis for later hypothesis testing. Long- and short-term developments are described and the effects of current events on the wine trade are discussed. By combining past

developments with current events, the authors draw conclusions about the potential future development of the wine sector and propose recommendations for successful industry strategies. The nature of a discussion paper makes those conclusions rather speculative and not based on hypothesis testing.

The paper is organised as follows. Section two presents the long-term development of wine consumption, wine production and the volume and value of the global wine trade. It also briefly outlines the current status of key markets and main producer countries. The third section examines how the current events of the pandemic and inflation have affected the wine sector and how wine imports to China and Russia have changed. The paper closes with suggestions of potential future trends.

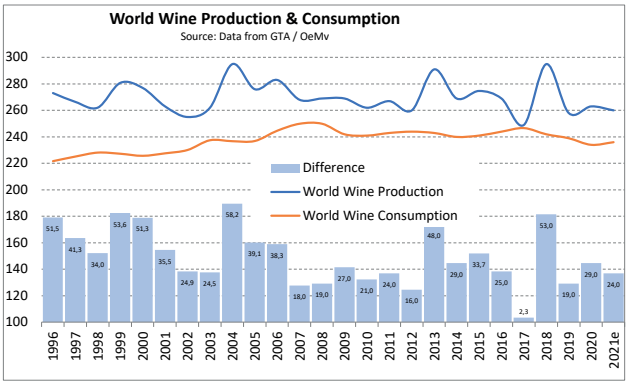

Figure 1. World wine trade by volume in million hectolitres (OeMv, 2023 [1], based on data from GTH /IHS).

2. LONG-TERM DEVELOPMENT OF PRODUCTION, CONSUMPTION AND TRADE OF WINE

The international wine trade and international wine consumption have not been growing much since 2011 in terms of volume. This steady state was not fundamentally altered by the pandemic, nor the effect of inflation and cost increases, nor the Russian war in Ukraine. Thus far, the international wine trade does not seem to be directly affected by the increasing deglobalisation of the world economy. The relative stability of global wine consumption, around 240 million hectolitres, has been maintained since 2009, which represents a trend lasting for more than 13 years.

2.1 Development of production and consumption

Owing to varying meteorological conditions during the different stages of the production cycle, but also influenced by economic incentives, there are strong annual variations in wine production (Figure 1). Climate change and the end of European Union (EU) subsidies for wine distillation in 2011 seem to have increased the amplitude of variations in recent years with a record low of 246 million litres in 2017 and a record high of 295 million litres in 2018.

On the contrary, global wine consumption is much more stable. After a long and steady increase up to 2007, global wine consumption remained fairly stable until 2017, when it started to decline slightly in line with the reduction of wine imports to China (see section 3.4) and was temporarily affected by reduced wine consumption during the pandemic.

Considering that a certain amount of wine production goes into industrial products, such as vermouth or vinegar, and that some gets lost in the elaboration process of wine production, an average amount of approximately 30 million litres per year is produced in excess of world consumption. Low harvests lead to scarcity and an increase in bulk wine prices, whereas a series of high harvests reduce prices. The declining trend in wine consumption tends to increase the pressure on wine prices in price sensitive market segments and certain product specifications (see section 4). Generally, production must follow consumption patterns. Otherwise, an increasing oversupply and wine stock will further increase the pressure on wine prices. Managing the economic sector in these conditions is therefore challenging.

2.2 Wine trade by volume has become steady

The first decade of the century was characterised by growth in global wine consumption (Figure 2) and a shift to non-wine-producing countries. After a halt to these two trends, global wine trade is now almost flat in volume terms. Since 2011, the global wine trade has moved between 100 million and 110 million hectolitres annually and grown at a very limited compound annual rate of 0.4%. This is a very low rate compared to 4.3% annual growth in the first 11 years of the century. In absolute numbers, between 2011 and 2022, world trade increased by 400 million hectolitres, while during the previous 11 years, between 2000 and 2011, it had grown by 3.3 billion hectolitres. Future trade volumes will depend on future global wine consumption trends (section 4).

2.3 Wine trade by value and average price increases – premiumisation

While the wine trade in volume terms is constant, it is sharply growing in value terms. Figure 2 shows the

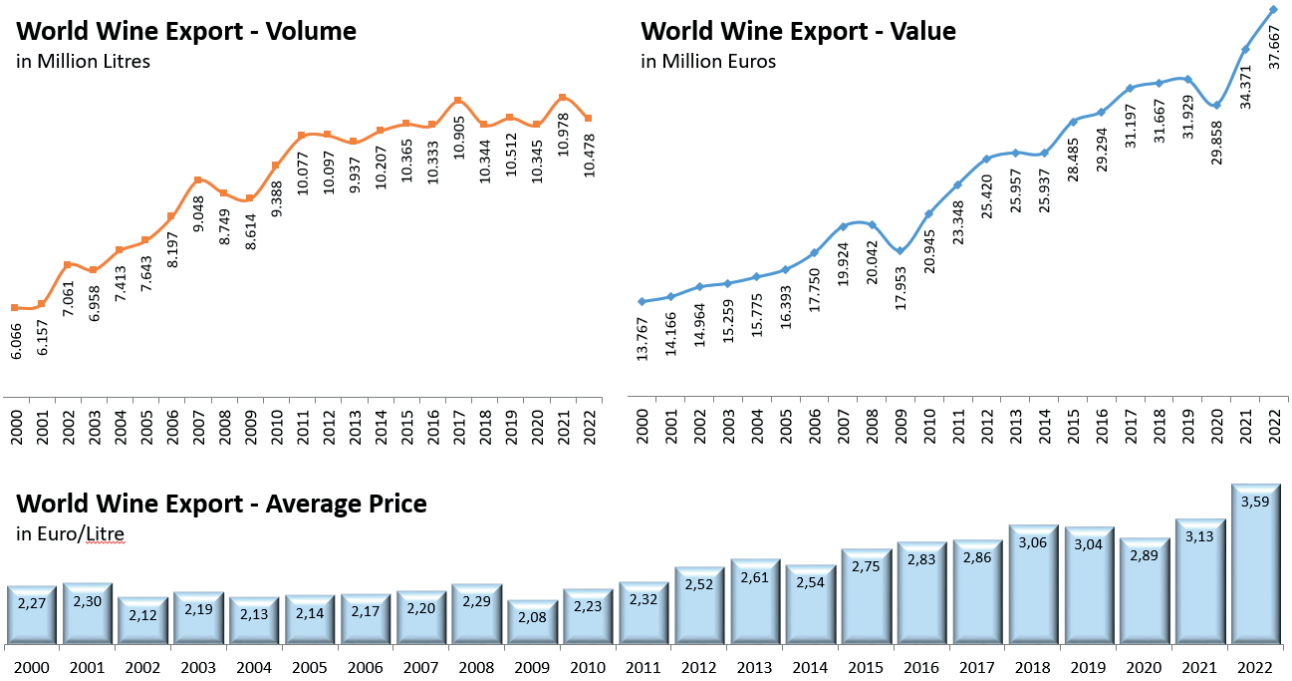

Figure 2. World wine trade by volume, value, and average price (OeMv 2023 [2], based on data from GTH/IHS)

consistent increase in world trade in euros since 2000 with the two exceptions of the financial crisis in 2009 and the Covid-19 crisis in 2020. Both crisis years also saw a decline in average prices. In 22 years, the wine trade has grown from €14 billion to more than €37 billion. Between 2000 and 2010, the growth in value was mainly driven by an increase in volume (Figure 2), while average prices largely remained constant. The average annual price change over that period was −0.2%.

When volume growth stopped, rising average prices drove value growth. Average prices increased from €2.32/litre in 2011 to €3.59/litre in 2022 at an annual growth rate of 4.1%. This increase in the value of traded bottles or litres of wine was due to premiumisation. The long-term growth of trade value was almost even with an average annual rate of 4.3% during the first volume-driven decade of the century and 4.4% since 2011. In absolute terms, world exports increased by €7 billion between 2000 and 2010 and doubled (€14.3 billion) between 2011 and 2022.

The global wine trade reduced sharply during the two crisis years 2009 and 2020. Nevertheless, the recovery after the Covid-19 crisis in 2020 more than compensated for this loss, as was also the case after the 2009 financial crisis. Even in 2022, despite uncertainties caused by the Russian invasion of Ukraine, increasing deglobalisation and generalised inflation, the overall value of world trade increased by 9.3% while the volume

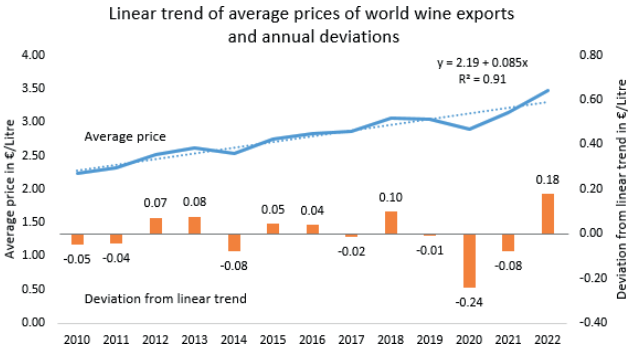

Figure 3. Deviation of average price from linear price trend (2010–2022), based on data in Figure 2.

decreased by −4.5%. As we will see in sections 2.5 and 4, import values did not increase equally across all countries and regions.

The 14.4% increase in average prices in 2022 is exceptionally high and at least partially related to inflation as some producers managed to carry over their higher costs for energy and glass by increasing the wine prices (see section 3.3). The linear trend line across global average wine prices from 2010 to 2022 shows a very good fit to the data (Figure 3). Compared to the trend line, Covid-19 resulted in negative price deviations for 2020 and 2021, while a positive deviation of €0.18/litre in 2022 is likely linked to inflation.

2.4 World trade by type of wine

The overall tendency of steady volume and increasing value does not equally apply to all product categories (Figure 4). Sparkling wines have led the growth in the world wine trade, while bottled non-sparkling wine reflects the general trend of increasing value without growth in volume. Sparkling wine has been increasing at a compound annual growth rate of 7.5% for value (5.6% volume) for the last 12 years. The largest category of bottled wine, on average, increased annually by 3.8% in value (0% in volume) and bulk wine slightly declined in volume (−0.2%) and increased in value annually by 3%. These diverging trends also apply to the development during 2022 (see Figure 9). The rise of sparkling wines, led by Italian Prosecco but also followed by Champagne and Cava, goes hand in hand with the increase in sales of white wines relative to red wines and relates to a positive trend in consumer preferences for fresher wines; see section 4.1 for a detailed discussion.

2.5 Development of key producing countries

Wine exports are strongly concentrated in a few countries, traditionally positioned along the 40th latitude of both hemispheres. France alone represents one third of the total export value (Figure 5). Together with Italy and Spain, they represent 61.6% of value and 54.5% of volume for 2022. The top 11 global exporters of wine account for 86.3% of total value and 87% of volume.

For decades, France, Italy and Spain have remained the three largest world wine exporters. However, their evolution has been quite different. Overall, massive international trade in wine is a very recent phenomenon. Up to the 1970s, less than 15% of total wine consumption was traded among different countries. With few exceptions (e.g. England), wine was a product to be consumed domestically and close to the place of production. It was only in the 1970s that Italy and then France started to export increasing amounts of wine. Spain came much later because of its late entry to the EU in 1986.

More recently, since 2000 and particularly up to 2012, Spain grew faster by volume than France and Italy and took the lead in global wine trade volume from 2014 to 2021. Spain's exports fluctuate strongly around 21 million hectolitres depending on the size of its crops. Italy also grew strongly between 2003 and 2011, but since then, it has shown less strong fluctuations than Spain. Over the last 20 years, France's exports have been relatively steady at a volume of around 14 million hectolitres with a slightly decreasing tendency.

Consistent with the overall trend, the value of exports has grown strongly for the top three exporting countries, though they have differed in slopes and impacts of the financial crisis in 2009 and the Covid-19 pandemic in 2020. France's export value seems to be most sensitive to economic conditions, showing strong depressions during both crises and steep recoveries thereafter. It grew from less than €6 billion to almost €10 billion in the 10-year period since 2009. Fuelled by inflation, recovery after Covid-19 has been even steeper, increasing from €8.7 billion to more than €12 billion in two years. Italy shows a more stable value increase with weaker sensitivity to economic crises. Spain shows the lowest slope and values have almost remained constant over the last five years. Therefore, France and Italy especially managed to benefit from premiumisation. An interesting research question is what strategies the French and Italian wine businesses used to achieve this success.

Figure 6 shows the absolute export volumes and percentage change for 2022. Italy overtook Spain and took the number one position by a small margin. As expected

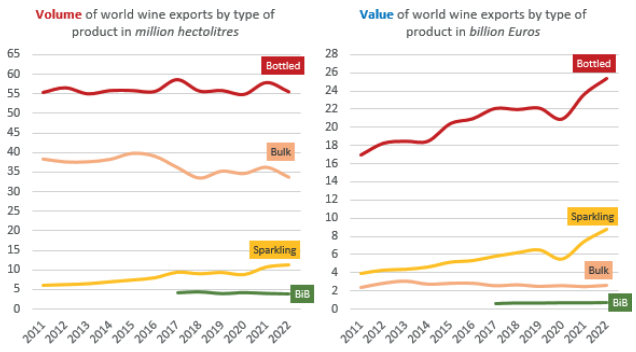

Figure 4. Volume and value of exports by type of product (graphic based on data from OeMv, obtained from GTA/IHS), BiB = Bag in Box.

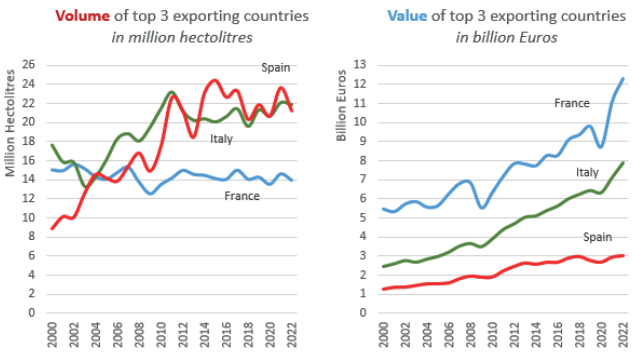

Figure 5. Top three exporting countries by volume and value (graphic based on data from OeMv, obtained from GTA/IHS).

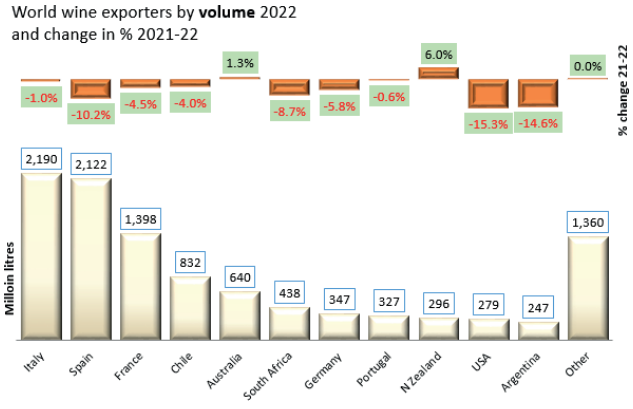

Figure 6. Top wine exporters' change in volume, 2021–2022 (graphic based on data from OeMv 2023 [1], obtained from GTA/IHS).

from the overall trend, most countries lost volume. Out of 11 countries, only two were able to increase export volumes: New Zealand and Australia. After a small harvest in 2021, New Zealand took advantage of the sufficient supply and premiumisation trend. As a relatively small wine producer, exporting slightly less than three million hectolitres, particularly of fresh Sauvignon Blanc, New Zealand exports at a high average price of €4.56 per litre – third after France and the United States (USA). Australia recovered slowly after the harmful trade restrictions imposed by China by diversifying exports to other markets.

On the opposite side, the USA, Argentina and Spain lost more than 10% export volume compared to 2021. The USA was particularly affected by lower imports by the United Kingdom (UK). Wine sales from Argentina fell mostly in the UK, Canada, China and Paraguay and were affected by the market contraction in Germany. Spain suffered from two consecutive small harvests, which were partially related to extreme heat, lower demand for bulk wine and high price sensitivity of the bulk wine market. South Africa reduced shipments particularly to Germany and the USA.

Such changes among the top wine producers and exporters can also be analysed in terms of who has been better able to adapt to recent trends in world wine consumption. France, particularly with its premium wines and Champagne, Italy, with the strong growth of Prosecco and some non-sparkling (often white) Protected Geographical Indication (PGI) premium wines, and New Zealand, with its crisp high-quality white wine, may be considered the three countries leading the market in recent years. As will be discussed in section 4, exporters well placed in both ends of the market – the top high-quality, expensive and famous wines on the higher end and the fresh, competitive and very well distributed wines on the lower end – seem to be performing better than other producers. There is a need for researchers to substantiate this suggestion.

2.6 Recent trends in key import markets

Wine imports are much more diversified than exports. The top three exporters sell their wines to about 190 markets, which also have developed very differently. By value, the UK was traditionally the largest world importer until the USA took the lead in 2012 with an import value of €3.9 billion (Figure 7). Subsequently, the USA climbed to €7 billion, at an annual average growth rate of 5.9%, while the UK only reached €4.8 billion in 2022, growing at a lower rate of 2.1% per year. Covid-19 had a strong negative impact on the USA's import values but the years before and after show strong growth. Germany remained quite stable during the recent 22-year period, reaching €2.7 billion in 2022. Canada grew faster to become the fourth largest wine importer, spending €2.2 billion last year. Japan, the Netherlands, China, Belgium, Switzerland and Russia complete the top 10 ranking of the world's largest wine importers, which account for two thirds of the total import volume.

On a very different scale, Figure 8 shows six other large wine importers with import values in 2022 above €1 billion. China had impressive development until 2018, but then this started to decrease, long before Covid-19 affected wine consumption (see section 3.4). The Netherlands shows steady growth in wine imports, which, similar to Germany, may also have been partially re-exported to other neighbouring markets. Belgium, Switzerland and France have grown particularly well after the pandemic. Exports to Russia increased to €1.3 billion in 2022 and will be analysed in more detail in section 3.5.

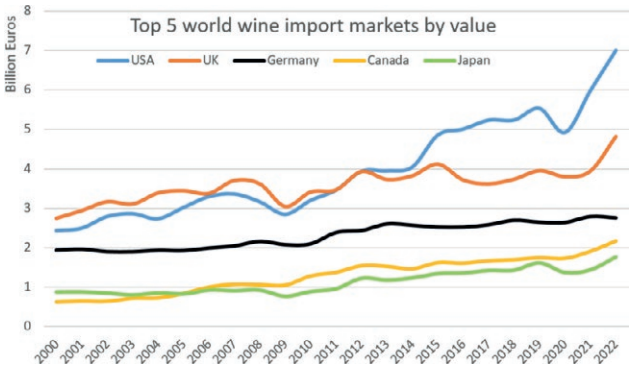

Figure 7. Top 5 world import wine markets by import value in billion euros (graphic based on data from OeMv, obtained from GTA/IHS).

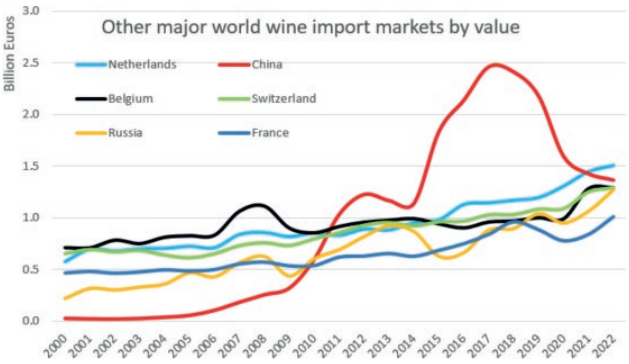

Figure 8. Other major world wine importers by value in billion euros (graphic based on data from OeMv, obtained from GTA/HIS)

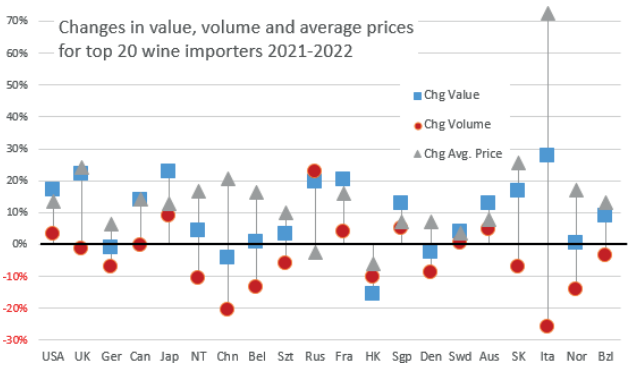

Figure 9. Changes in value, volume and average prices for top 20 wine importers in 2022 (graphic based on data from OeMv, obtained from GTA/IHS).

For 2022, the majority of world import markets show a similar dichotomy between (a) an increase in import values due to higher average prices and (b) a decrease in import volumes (Figure 9). Out of the largest 20 wine import markets, 13 decreased their import volumes. Except for Hong Kong, all markets increased import values. Average prices increased in all countries with the exception of Russia and Hong Kong. Italy stands out with erratic wine imports of cheap bulk wine, mostly from Spain, when their domestic harvest falls short.

3. CURRENT CHALLENGES FOR THE INTERNATIONAL WINE TRADE

This section presents industry expert opinions about current challenges the wine industry is facing. It examines four recent events affecting wine consumption and trade. During Covid-19, the value and volume of the global wine trade decreased suddenly and recovered quickly in 2021. Cost increases and inflation affected both the supply and demand sides, leading to disparate reactions of price and volume for the different price segments of wine. The dynamics of the change in wine imports into China continue to affect the global wine trade. Preliminary data are presented to depict how the volumes and routes of wine trade with Russia changed after the Russian invasion of the Ukraine.

3.1 Producer and trade perceptions

Since 2017, an international survey has been conducted on behalf of ProWein to explore the perceptions of experts along the complete supply chain for wine. The respondents include producers and exporters, importers, trade and horeca businesses (Loose, 2023[3]). The resulting ProWein Business Report provides an indicator of the development of producer sentiment about the economic situation and perceptions of the threats and challenges to the industry (Figure 10).

The global economic upturn after Covid-19 already led to a greater demand for energy and rising energy prices in 2021. With the war in Ukraine and sudden collapse in energy supplies in 2022, prices in many parts of Europe therefore often more than doubled compared to

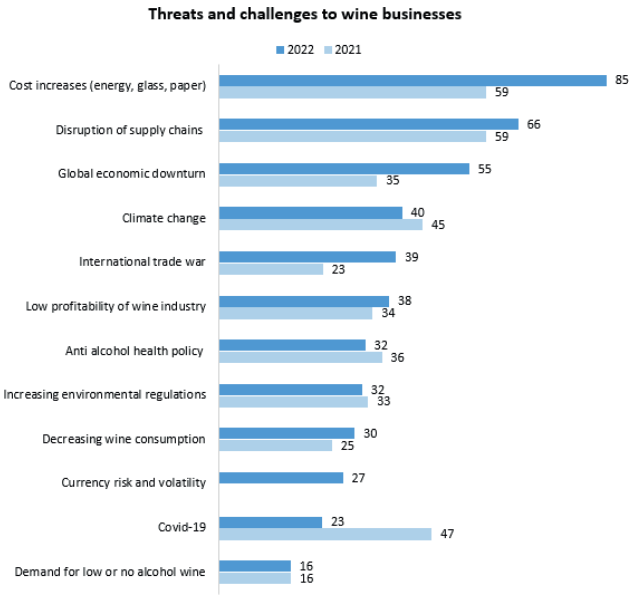

Figure 10. Threats and challenges to wine businesses. Share of respondents who see strong or very strong effects (4 and 5 on a 5-point scale) based on Loose (2022[4], 2023[3]) with n = 2,880 and n = 2,455 respondents, respectively, sorted in descending order by 2022 results.

2020. For 2021 and 2022, rising costs and disruptions to supply chains ranked at the top of the list. However, the degree to which the industry was affected clearly increased in 2022. According to 85% of those polled, the rising costs of energy, glass and paper pose a great or very great threat to their companies. In 2022, almost all producers were affected by transportation issues and supply chain disruptions, which seem to have eased over the first months of 2023.

For 2023, international economic experts at the OECD and World Bank anticipate a further downturn in the global economy, which might cause a reluctance amongst consumers to buy wine. General inflation and particularly high price increases for energy and food have reduced consumers' real incomes. Experts in the wine sector viewed the impact of an economic slowdown as the third largest challenge for the wine industry. Compared to the previous year, the proportion of respondents sharing this view was up from 35% to 55%. The effects of inflation on wine supply and demand are detailed in section 3.3.

The consequences of international trade wars, particularly the intervention on exports to Russia, were perceived as a clear threat to wine producers (39%), particularly in the highly export-oriented countries Portugal (59%) and Spain (57%). From the industry's perspective, the impact of Covid-19 has subsided. Covid-19 is still relevant to the hotel (44%) and food service/hospitality industries (42%). Section 3.2 details the strong recovery after Covid-19. Climate change has been pushed even further into the background by the economic crisis. Compared to 2021 [5], its importance dropped in 2022 from 45% to 40%, with regional variations.

The industry entered 2022 with positive expectations. Producers and traders hoped for a recovery from the negative impact of Covid-19. These hopes were not or were only partially fulfilled. In general, therefore, the industry is looking to the future with caution.

3.2 Covid-19

In the long-term perspective illustrated in Figure 2, Covid-19 was only a small "dent". Zooming in with a higher resolution, the effects of Covid-19 have been more accentuated. Global wine exports had already fallen by six million hectolitres in 2019 and then fell by a further two million hectolitres in 2020, the first year of the pandemic. More importantly than the relatively small drop in volume, Covid-19 resulted in a sharp decline in the value of the global wine trade in early 2020. Over the complete year 2020, wine trade lost a total of €1.9 billion or 5.8% of its value and faced strong uncertainty about its future development, like most other industries did during the pandemic.

In 2021, both the volume and value of the global wine trade showed a steep recovery, and by mid-2021, reached pre-Covid values that were soon strongly exceeded. From today's perspective, the decline in

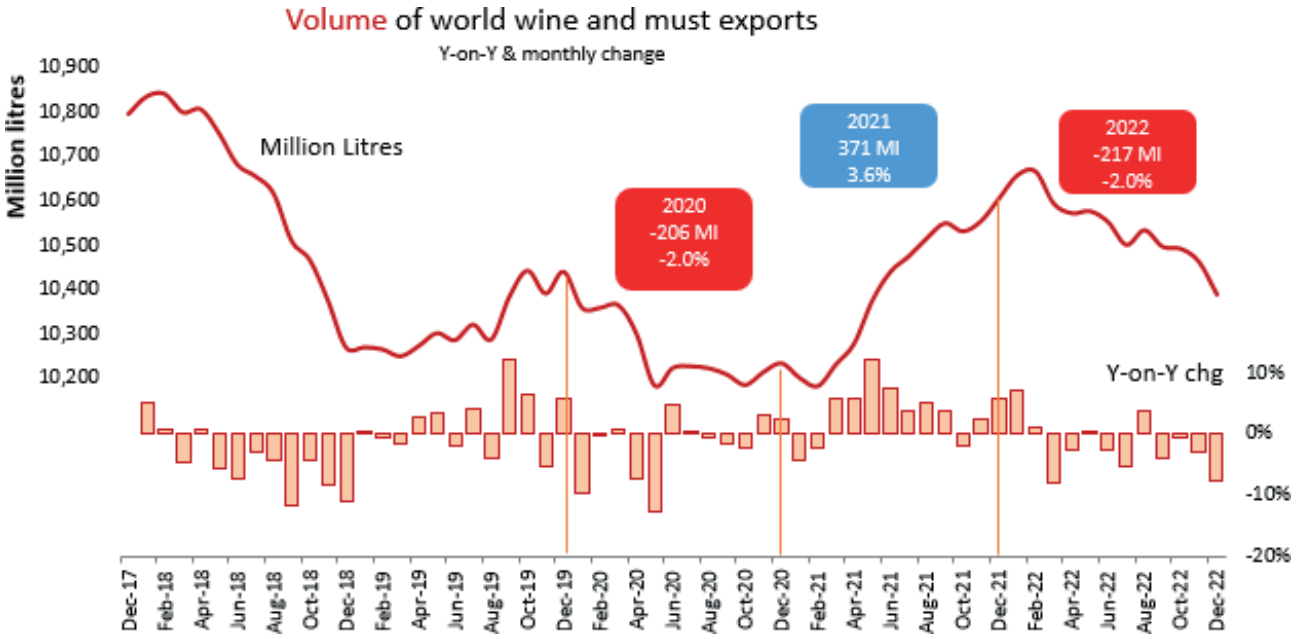

Figure 11. World wine exports, volume (graphic based on data from OeMv, obtained from GTA/IHS).

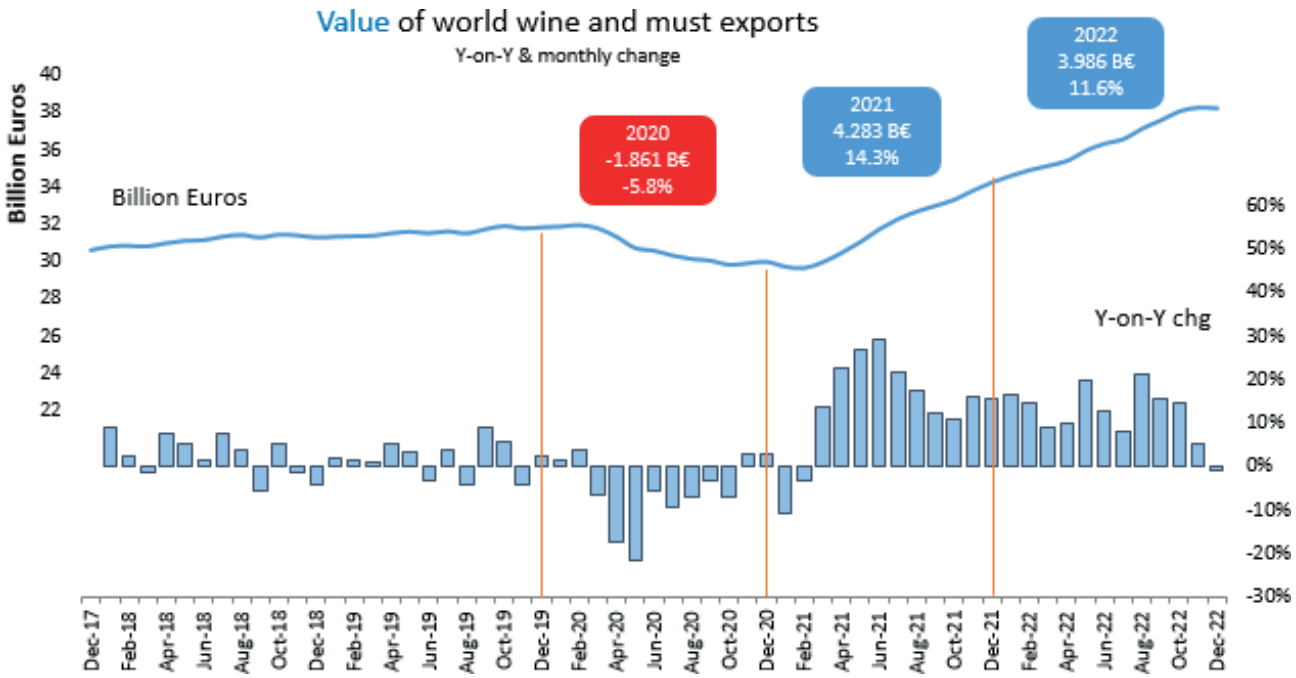

Figure 12. World wine exports, value (graphic based on data from OeMv, obtained from GTA/IHS).

the wine trade during the pandemic can partially be explained by reduced orders and stocks keeping the intermediaries as well as horeca businesses in a period of high uncertainty. Once vaccinations became available in 2021, trade picked up again, and part of the strong recovery relates to the refilling of declined inventories.

The volume of the global wine trade started to decline in early 2022 because of the effects of inflation (section 3.3), while the value continued to increase, although at a declining rate. For the first time since the outbreak of Covid-19, in December 2022, the value started to drop, and the future development for 2023 and beyond is of high interest to the wine sector. It cannot be ruled that over the long term, generalised inflation might also negatively impact the value of the wine trade.

3.3 Cost increases, inflation and economic slowdown

Fuelled by the synchronous economic recovery, costs started to rise in 2021 with increasing freight rates and higher costs for energy and dry goods, such as glass, closures and cartons. Russia's invasion of Ukraine led to a severe energy crisis, and the costs of gas and electricity more than doubled in many European countries. This led to a further increase in prices for energy-intensive products, such as glass and aluminium. Wine producers reported cost increases of approximately 30%. In economic terms, the cost shock led to an upwards shift in the supply curve (Figure 13).

For consumers, the increase in energy prices led to a steep increase in inflation. Compared to 2021, inflation tripled in Europe up to 9.2% in 2022, leading to a significant decline in consumers' real incomes [6]. The global inflation rate of 8.8% was similarly high [7]. Lower income households were particularly affected by roughly 20% increases in food prices and gas and electricity prices increasing by 50–100% in many countries [8]. This led to a downward shift of the demand curve for wine. Consequently, the flat price-sensitive section was more strongly affected than the steep slope section of inelastic demand for premium wine by affluent households (Figure 13).

The combined effect of the supply and demand shocks led to a new market equilibrium with a reduction in quantity and an increase in price. The degree of those changes significantly differs for elastic and inelastic demand. For elastic demand, consumers strongly reduce their wine purchases and trade down to lower prices. This effect was particularly visible in Germany, where according to Nielsen Home Scan Data [9], retail wine sales declined by -6.5%, particularly affecting German wine (–8.1%), while imports to Germany for low-priced Spanish wine and European blends increased. For the inelastic demand for premium wine, the price effect considerably outweighs the loss in quantity as the value of wine sales increases. This is particularly the case in the

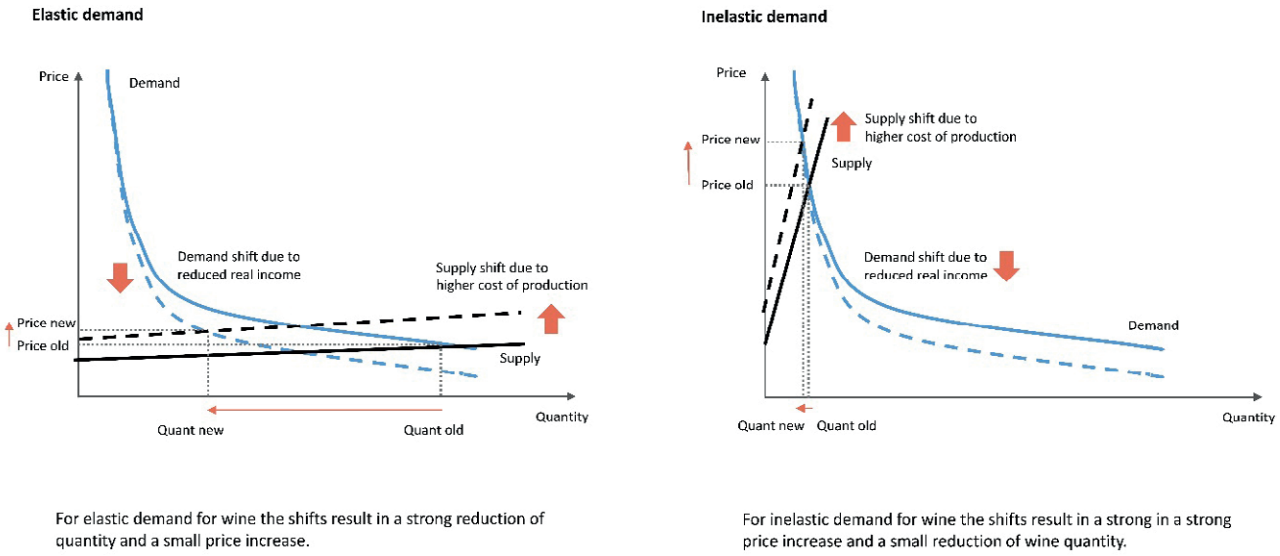

Figure 13. Effects of cost increases and inflation on wine supply and demand for elastic and inelastic market segments.

USA (section 2.5). In addition, for direct-to-consumer sales in Germany for 2022, we could observe higher revenues and only slightly reduced quantity [10].

The overall income and price sensitivities for wine vary by region and state, and so far, there is limited research available on this. The global effect on wine consumption and trade is an aggregate of those regional effects. In this context, wine consumption behaviours at the country level are quite heterogeneous across geographical regions (section 2.6). By the end of 2022, the global wine trade was dominated by imports from countries with low price insensitivity and good economic conditions, most importantly the USA. This agrees with expert opinions in the ProWein Business export [3], where 63% expected minor drops in sales in the premium and luxury segment. Increasingly, therefore, producers and traders are focusing on the high-price segment; this is also because the absolute margin in this segment is significantly higher than in the entry-level wine segment.

Of course, the increasing value of wine sales does not mean increasing profitability, since margins would depend on what grows faster: costs or selling prices. Future developments in costs, economic conditions and price sensitivity will determine how many wine producers can carry over their cost increases to consumers. This will have crucial implications for the economic sustainability of wine producers [11].

3.4 China

The globalisation of wine consumption has for many years compensated the decline in wine consumption in the most important three wine producer countries, France, Italy and Spain. In particular, China began promoting wine consumption as a healthy alternative to spirits, and wine imports grew strongly until their peak in 2018 (Figure 14). After a change to the rules for gift giving and public spending, Chinese imports started to decrease by about one million hectolitres per year. This negative trend left clearly visible marks in the data on global wine consumption. Covid-19 then accelerated the falling trend slightly, with the steepest decline between January and July 2020.

In 2022, wine imports further decreased (–20.6%), while the decline in the value of imports slowed down to –4.3%. It is hard to predict the future development of wine consumption and imports to China. Current accounts from IWSR (2023 [12]) indicate increased sales of imported spirits with the reopening of on-premise consumption. As wine consumption in China has been closely tied to a positive attitude towards a Western lifestyle, it is uncertain what effects the shift in geopolitics, deglobalisation, the development of domestic production and aging of the Chinese population will have on future wine imports to China.

3.5 Russia

After Russia invaded Ukraine in February 2022, many countries imposed trade restrictions with Russia. According to OIV (2023 [13]), with 5% of global wine consumption, Russia is the sixth most important country by consumption. For the last decade Russia as

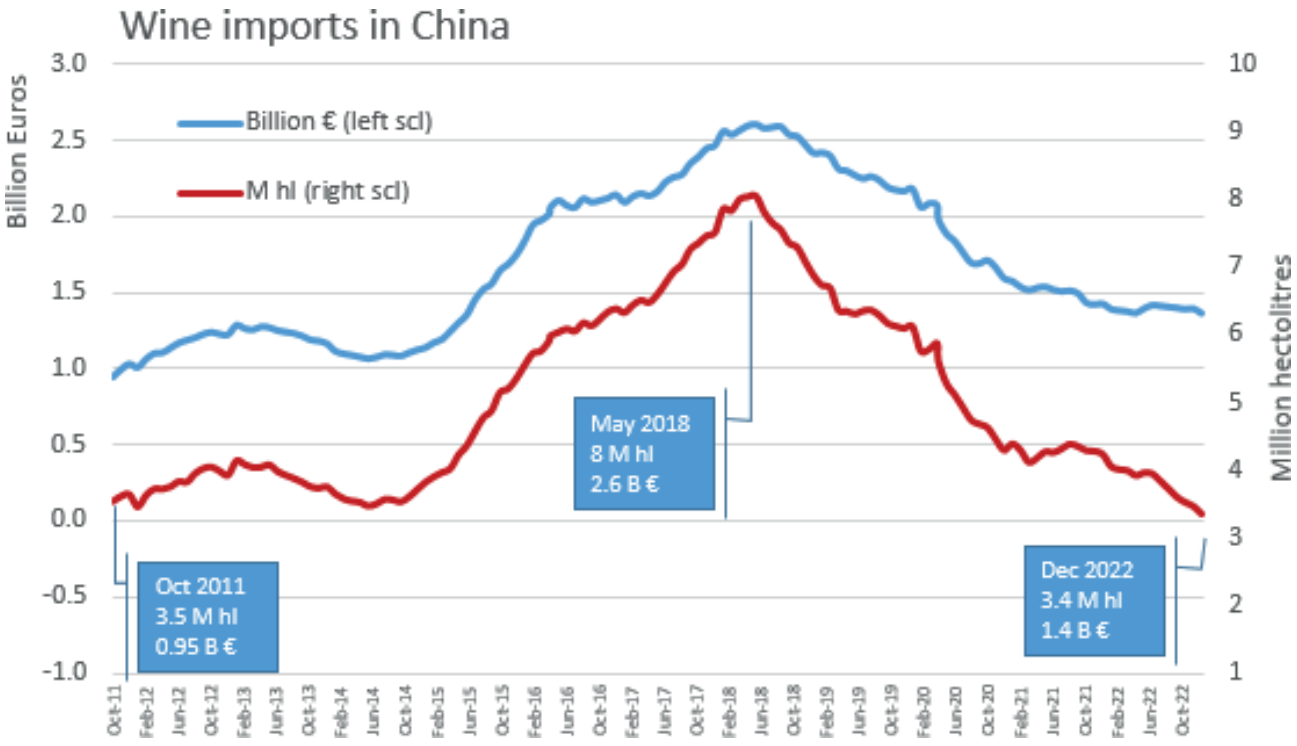

Figure 14. Value and volume of wine Imports in China (graphic based on data from OeMv, obtained from GTA/IHS).

seen as one of the top emerging wine markets [14]. It is therefore of interest to see what effects the war has had on wine imports to Russia. Generally, two sources of data are available. Imports are recorded by Russia and exports to Russia are reported by the exporting countries. Historically, those two data sources largely run parallel with a small gap (Figure 15 and Figure 16). Russia stopped official reports of wine imports in February 2022. Therefore, current data completely rely on export data.

What happened after the start of the war? The dashed lines in and Figure 15 and Figure 16 show that import volume and value, respectively, sharply dropped and rapidly rose again thereafter. Preliminary data thus suggest that the war did not significantly reduce wine consumption in Russia. On the contrary, according to exporters' data, wine sales to Russia strongly increased in 2022. The means of importing and origins of wine imports did change, however, to some extend becoming more indirect through re-exporting countries.

The majority of wine exports to Russia are organised as indirect exports through two Baltic states, Latvia and Lithuania (Figure 17 and Figure 18). Customs data analysed by OeMv [1] suggest that 82% (69%) of imports into Latvia (Lithuania) are re-directed to Russia. Moreover, wine exports from Poland can be considered re-exports of wine from other origins, although on a much smaller volume basis. Conversely, Georgia has its own strong production and very limited wine imports. In 2022, particularly exports of Georgian wine to Russia increased strongly (50% in volume and 40% in value). Wine through Latvia increased in value (38%) but less so in volume (16%). Re-exports through Lithuania were hardly affected by the war, and re-exports through Poland declined strongly. The data also show that direct exports from producing countries increased

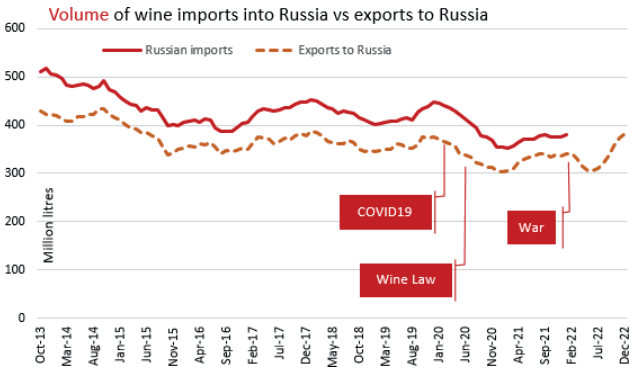

Figure 15. Imports and exports to Russia, volume (graphic based on data from OeMv 2023, obtained from GTA/IHS).

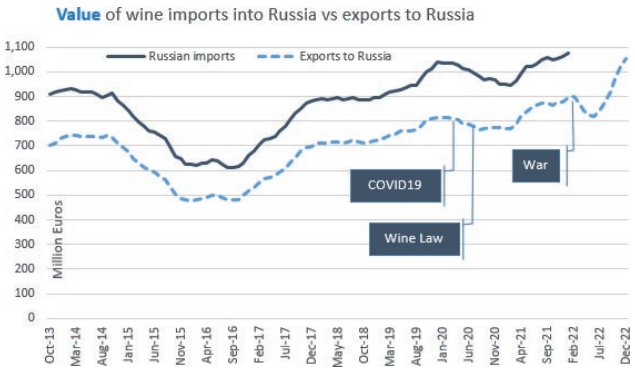

Figure 16. Imports and exports to Russia, value (graphic based on data from OeMv, obtained from GTA/IHS).

Figure 17. Wine exports to Russia 2022, volume (graphic based on data from OeMv, obtained from GTA/IHS).

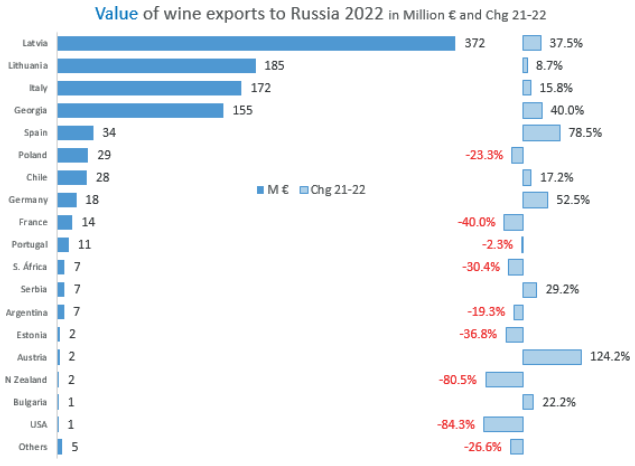

Figure 18. Wine exports to Russia 2022, value (graphic based on data from OeMv 2023, obtained from GTA/IHS).

strongly by volume (Germany 79%, of which some can be re-exports, Spain +49%, France +43%) and by value (Spain 79%, Germany 53%). Exports from New Zealand, South Africa and Argentina declined strongly. Average prices decreased overall (Figure 9). It will be of interest to see how the composition by origin, volume and value of the wine trade with Russia will be affected in the future, particularly after financial restrictions for bank payments may become stricter.

4. POTENTIAL LONG-TERM TRENDS

We close the paper by discussing three major current market trends and contemplate how they might affect future strategies that companies can apply to stay in business successfully. We outline questions for researchers of the wine business and economics to address in the future.

4.1 Shift towards lighter and fresher wines

For a long time, "real wine" had to be red. To be highly rated, for instance, by Robert Parker's Wine Advocate, only a few years ago, red wine had to be heavy, strong, bold and jammy. Now, we see a major shift globally towards lighter and refreshing wines. In particular, there is rising consumer demand globally for sparkling wines (section 2.4 and Figure 19).

This trend is reflected in many strong market signals. Red wine, particularly red wine targeted to lower segments of the market, is in a surplus globally. Regarding Bordeaux, the classical example of red wine, there was an announcement that vines would be pulled on 10,000 hectares because of structural oversupply. Ciatti bulk wine reports have been indicating falling prices for red wine for the last two years, while white wine has been experiencing strong demand and increasing prices. The formerly successful fruity and strong Australian red grape varieties seem to have been hit the hardest by falling demand for red wines with prices dropping as low as USD 0.33 to 0.47 per litre [15].

The trade success of sparkling and white wines agrees with the expectations for the global wine trade's future well-performing wine styles for 2023 (Figure 20). Some industry experts see climate change and hotter summers as a driver of consumers preferring lighter and fresher wines [16]. At the same time, climate change makes it harder for wine growers to produce light and fresh wines, which require a change in viticultural procedures and/or grape varieties.

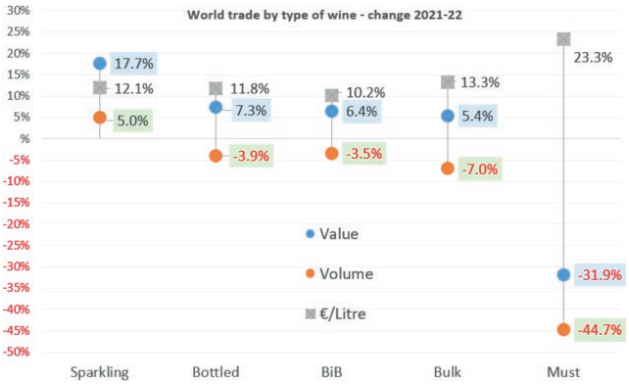

Figure 19. World trade by type of wine change of volume, value and average prices 2021–2022 (graphic based on data from OeMv, obtained from GTA/IHS).

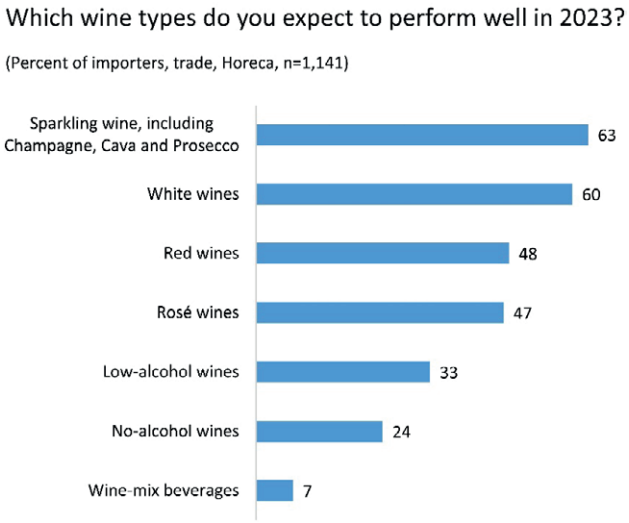

Figure 20. Global wine trade perceptions of well-performing wines for 2023 [17].

The trade perceptions in Figure 20 indicate the trend for no/low- alcohol wines. While the OIV has released a definition of dealcoholized wines (the permitted oenological practices are still in discussion [18]). Low-alcohol wines are not as clearly legally defined yet and cannot be legally called "wines" in many regions. Often, their classification depends on the national rules for wine taxes, if they depend on the level of alcohol, such as in the UK or Scandinavia.

Many traditional wine-producing countries face a trend of particularly younger consumers cutting down on alcohol. No-low products are seen as one way to provide an alternative [17]. One of the big questions will be whether a grape-based alcohol-free beverage has to be produced through dealcoholisation. Successful products, such as the Kylie no alcohol sparkling rosé, provide examples of the potential of technological innovations in the sector that do not necessarily require the two steps of fermentation and subsequent dealcoholisation. For wine producers, the changes in consumer demand pose challenges. Ideally, those changes can be anticipated to include adapting vine plantations that are normally used for 30 to 40 years.

Currently, there is a research gap concerning how long-term cycles in wine demand develop and shift over time. Understanding the underlying drivers of consumer preferences and the consumption context would be helpful for the industry to anticipate changes ahead.

4.2 Shift to new wine consumption regions

Consumption in wine-producing countries has been decreasing for decades, but such decreases have been more than compensated with parallel growth in wine consumption in non-producing countries. Wine was becoming fashionable in societies that had previously shown a preference for beer or other international beverages while it was losing popularity in traditional wine-producing regions. Such differences in wine consumption explained the increase in trade: wine had to be shipped from producing to non-producing countries. Actually, the ratio of total world wine consumption and traded wine has been consistently growing in recent decades, up to around 46% in 2022 [1]. That is, almost every second bottle of wine is consumed in a country other than the one in which it was produced.

However, it seems that these changes in wine consumption in different areas of the world no longer imply increasing trade volumes in more recent years. Positive trends in increasingly consuming countries do not offset negative ones in traditional producers as clearly as they used to. Nevertheless, in areas where wine is not a traditional beverage, like most countries in Latin America or Africa, the value of wine imports continues to grow faster than in more traditional wine regions, such as Europe (Figure 21). Latin America and Africa jointly still represent less than 5% of the value of global wine imports but have the potential to evolve. This dynamic shift in the regional development of wine consumption and trade is likely to continue into the future. This might affect what type of wine is demanded (see section 4.1) and how it is packaged [19].

If wine is increasingly marketed to consumers in non-producing countries, it may very well be that new consumers will approach wine in a different way and may prefer easy-to-drink wines – that is, fresher, probably sweeter and with some bubbles – rather than tra-

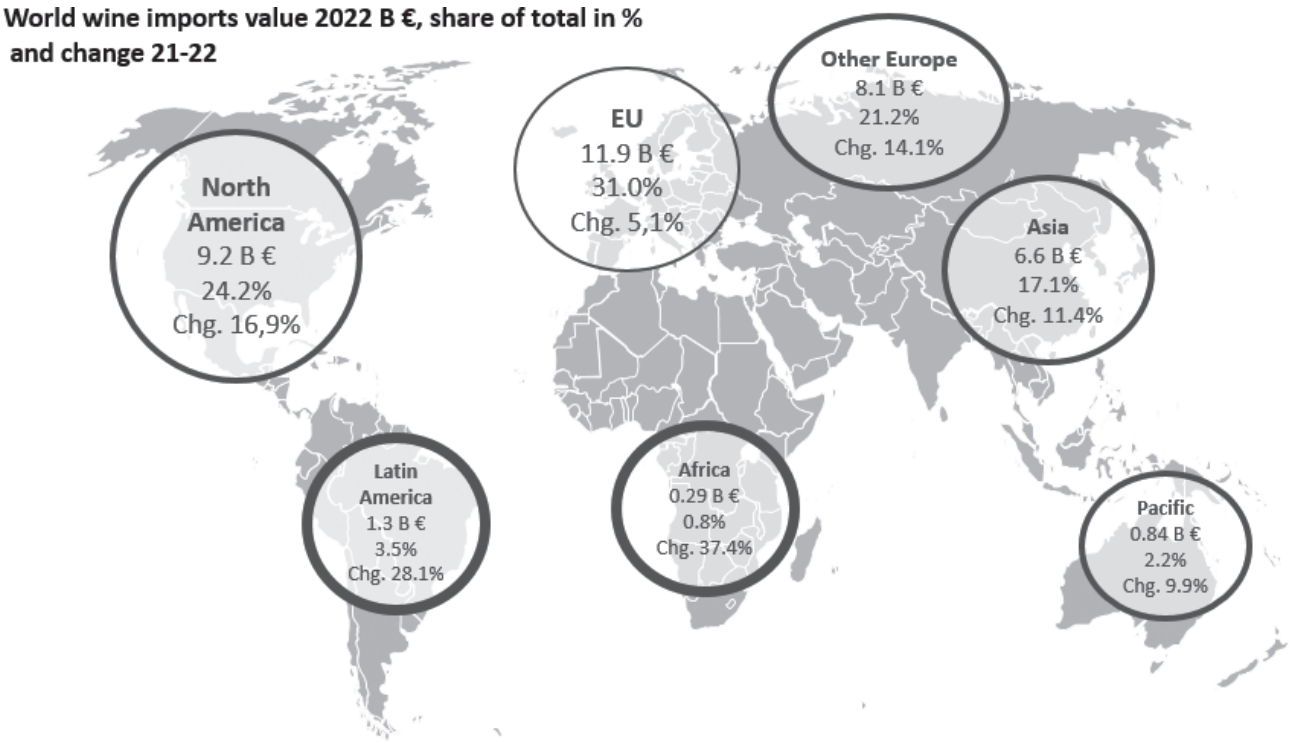

Figure 21. Wine imports by region: value of 2022 and change 2021–2022 (OeMv [2]); border strength indicates growth rate.

ditional reds. The same trend seems to apply to new consumers entering the alcoholic beverage category in traditional markets. Indeed, such a hypothesis does not contradict the remaining and even increasing consumption of traditional and high-quality wines, preferably aged reds, mostly by older, experienced consumers with higher incomes. The relative composition of both preference groups varies by country and will likely change over time, when older age cohorts leave the market and younger consumers enter it.

Following from these two opposing trends, it can be hypothesised that we will enter a period of increasing polarisation between (a) premium and super-premium wines for connoisseurs and more traditional drinkers and (b) easy drinkers increasingly looking at wine as a sort of elegant refreshment. Important implications would follow for wine policy and company strategies if the hypothesised trend is confirmed.

4.3 Diverging segments require different strategies

The different price segments of wine have been impacted quite differently by cost increases and inflation (section 3.3). As suggested in the previous section, a stronger polarisation might be expected in the future. Different evolutions of different price segments require different strategies from companies.

The small niche of premium and super-premium wines represents a limited wine volume (of possibly 10–15%) but of high value. The small producing estates and companies focusing on high quality, reputation and storytelling have so far been minimally affected by the crisis. They were able to increase their prices because of a price-inelastic demand by their consumers. For some wines, even a positive price elasticity was observed. Potentially owing to the exclusivity of the products, sales volume increased when prices went up.

Yet there is a large segment of highly price-sensitive consumers who favour more popular and easy-to-drink wines (lighter, fresher, sweeter, white, rosé, sparkling, etc.) at very competitive prices. Some of these consumers have reduced their wine consumption and traded down to lower price points, increasing the price competition for producers in this large segment.

In the future, these two different segments will require different strategies. The strategy for the high-quality segment is based on objective and subjective wine quality. It is based on ownership or close relations with high-quality vineyards and regions. The necessary product characteristics must be matched by subjective reputation indicators, such as awards, storytelling and

good distribution in the upper segment of the market. Prices will likely increase further in this segment. It is highly uncertain whether the volume of this high-quality segment will increase significantly in the near future or even decline, making it harder for new entrants.

Cost and price competition are the main drivers of the second segment. Efficiency is the key to production at a low cost. This includes serving food retail with cost-efficient, own-label products. This will increase the pressure on grape producers, and declining volumes will push those stuck in the middle – those with costs too high for price competition but a profile too low for premium – out of the market.

Large companies with a portfolio of well-known brands that are very well distributed will be successful in this segment. For most consumers in this segment, taste is more important than objective quality indicators, such as EU protected designations of origin (PDOs) regulations. This might explain why EU PGIs (Protected Geographical Indications, former table wines with geographical indication) products and wines that are based on grape varieties, which can more flexibly react to changes in taste preferences, are less affected by the current crisis than traditional and strongly regulated PDOs, such as Bordeaux or Rioja.

The dichotomy between premium and value wine segments would explain why premium and super-premium wines from some segments of the supply of famous traditional and strongly regulated European PDOs, such as Bordeaux or Rioja, evolved very well in recent times, even increasing sales after a two-digit increase in prices. At the same time, traditional wines from the same PDOs but targeting a more popular segment of consumption suffer from strong oversupply and are requesting crisis distillation from the European and national authorities. They can hardly compete with wines produced in cheaper producing regions, particularly in a segment of the market for which the region of origin may not be so important and may no longer justify a higher price. For companies as well as regions, being caught in the middle may be a problem. Imposing and selling high-cost wines in the lower price segments no longer seems to work, particularly not if it also requires different tastes. This argument also provides the basis for many companies to enlarge their portfolios, including forming different categories to better fit different and changing segments of the market.

This also has important implications for wine politics and the strategies for PDOs and IGPs. If the segment of high-quality PDO wines is limited and not growing further, it might not be a desirable goal for each wine region to establish PDOs. Instead, cost efficiency, economic sustainability and flexibility in the adaptation of product specifications to consumer preferences are key elements of sustainable wine politics. To date, considerable research has focused on quality. More research is required on the cost efficiency of wine production and different taste preferences.

5. CONCLUSION AND DIRECTION FOR FUTURE RESEARCH

We see five main areas of future business and economics research related to the wine trade that are of high importance for the future of the wine sector.

5.1 What strategies permit premiumisation?

Over the last 20 years, the global wine trade has undergone substantial shifts. It changed from volume-driven growth to growth of value due to premiumisation, of which not all wine-producing origins could benefit to the same extent. For the wine sector, it would be important to understand the success strategies of producers, such as France, Italy and New Zealand, which strongly increased sales and the average prices of their products, while others did not succeed to the same degree.

5.2 Understand the drivers of preference shifts and anticipate future shifts

Besides premiumisation, successful growth seems to be driven by a substantial shift in some consumers' preferences. Sales of lighter and fresher wines, including sparkling wine, have increased, while an oversupply of commercial red wines has kept prices low and required supply management. It is important for the future of the wine sector to understand the underlying drivers of this preference shift and, ideally, to be able to anticipate how preferences will change in the future for the industry to react.

5.3 Understand growing wine markets and their product preferences

The US market appears to be the main growth motor for the global wine trade, while prior hopes for a further increase in wine consumption in China have not materialised. Considering the shift in wine consumption of younger generations in the USA, it is uncertain to what degree the value of wine exports to the USA can be sustained into the future. How other growing mar-

kets, such as Canada, South Korea, Australia and Russia, will evolve in the future is of interest. In addition, regions that are new to wine are growing strongly in wine imports, although from a small absolute base. New markets and new consumers might require new product styles and packaging, to which existing producers will have to adapt to be successful in the future. It is important for the wine sector to understand regional and generational differences in wine preferences and how they might evolve in the future. Will young consumers and consumers in new markets evolve and change their preferences towards premium wines or will the current trend of light and fresh wines increase and persist? Or will both evolve in parallel, increasing the current polarisation of the market? New consumers and/or new markets may very well mean new consumption trends. In fact, new trends in the world wine trade may be responsible for the consistent leading role of sparkling and white wines.

5.4 Corporate strategies for a polarised wine demand

In the current major wine markets, we see contrary developments of the small but valuable premium wine segment, where prices increase strongly, and the large but cost-aggressive popular wine segment, where volume declines and prices only increase marginally. In a situation of oversupply and changing wine preferences, this puts wine producers under stronger competitive pressure. Companies must adapt to this suggested polarisation of wine demand that requires either high-quality products or cost-efficient commercial products. While specialisation can be one adaptation approach, particularly for small and medium-sized family businesses, having a portfolio of products targeted to different segments may be an alternative strategy for large international companies.

5.5 Optimal regulation and cost efficiency

The suggested polarisation has major implications for wine politics and the framework this sets for quality versus cost efficiency as well as the flexibility with which producers can react to changes in consumer preferences and climate change. Future research is required on how producers can remain economically sustainable while producing at competitive costs. This includes long-term strategies for regulating oversupply and quality differentiation adapted to consumer preferences.

The medium- and longer-term effects of inflation and a potential longer-term cooling or recovery of the global economy are difficult to foresee currently. What the analysis of recent data clearly shows is that the world of wine is changing. New consumers in new countries and new trends are forcing companies to adapt their structures and follow new strategies to be economically sustainable in the long run. Closely following up on such trends and consumers' preferences will be a key element to succeed.

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Wine Economics and Policy

Firenze University Press
www.fupress.com/wep

Citation: Riccardo Vecchio (2023). Does anyone read my papers? The gap between academic consumer research and the real (wine) world. *Wine Economics and Policy* 12(1): 19-22. doi: 10.36253/wep-14724

Data Availability Statement: All relevant data are within the paper and its Supporting Information files.

Competing Interests: The Author(s) declare(s) no conflict of interest.

Does anyone read my papers? The gap between academic consumer research and the real (wine) world

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Abstract. The goal of this discussion paper is to foster the debate among scholars on some of the key issues that are currently challenging the impact of academic wine consumer studies and encourage younger researchers towards alternative paths. Based on my personal experience, I will focus on some scholars' practices that (in my view) could be revised to increase the reconnection of researchers to the practical world, namely: topic relevance Vs. trendiness, methodological approaches and data utility, sample issues and the replication crisis.

Keywords: relevance, practicioners, scholars.

1. INTRODUCTION

As a wine consumer scholar from the beginning of my academic career I was clearly aware that I would never uncover the role of oncogene activation in human thyroid carcinomas or discover a real-time strategy to control prosthetic hands. Nevertheless, I always thought that my research outputs could be of (some) interest for practitioners and policy makers. The sad reality is (in my case) that the outcome papers are only read by academic colleagues. The most frustrating consideration stems from the fact that nowadays research funds are deeply bounded by practical objectives and deliverables. Nonetheless, my wine consumer studies (I can state with a great degree of confidence) have rarely whispered in the ears of princes [1] – informed policy makers – and never advised wineries' managers in their strategic planning. As a partial consolation, I quote Lockshin and Corsi [2] (p.493, 2020) which stated: "This behaviour has often led to the accusation, particularly from industry, that our research does not provide answers to the questions that really matter". The researcher-practitioner divide is indeed an enduring issue among many disciplines and especially in applied academic fields (see, among others, [3]). Notwithstanding the merits of knowledge diffusion among the academic community, I do believe that as applied scholars we should profoundly aim to reach a wider audience of possible ben-

eficiaries of our research. Similarly, we must encourage young scholars to develop studies that have an impact also (or foremost) on the real-world. However, this pattern is not without potential pitfalls, recalling the caveats of too closely following practitioners' agendas [4]. In my personal view, academic studies have strongly been pressured towards novelty of findings and the application of innovative methodological approaches, which are surely important features of research but do not represent (necessarily) a quality mark. Additionally, the increasing competitiveness and complexity of the scientific publication process has encouraged scholars to engage in research that have greater publication appeal (the so-called indicator game). Moreover, academic research timing (from hypothesis formulation to data gathering and article publication) is clearly divergent from practitioners' need to collect and analyse market information. Nevertheless, a sharp shift towards relevant research that addresses substantive problems could be necessary, urged by the increasing amount of external funding which is progressively more outcome based. The goal of this discussion paper is to foster the debate among scholars on some of the key issues that are currently challenging the impact of academic wine consumer studies and encourage younger researchers towards alternative paths. In my view not everything is directly attributable to the scholars' community, as some pushbacks are also due to the industry and to policy makers. Hereafter, due to my personal experience, I will focus only on some scholars' practices that (in my view) could be revised to increase the reconnection of researchers to the practical world: topic relevance Vs. trendiness, methodological approaches and data utility, sample issues and the replication crisis. But first some words of warning. Whilst I am aware of the importance of the relevance versus rigour debate [5] and the differences existing among Universities and business schools' research, for sake of conciseness I will not dwell into these issues. Additionally, I do not question the basic principles of academic freedom [6], which is in my opinion one of the most remarkable benefits of our profession. Finally, I transparently admit that in many papers I have deviated from several recommendations provided in this discussion and (as later highlighted) I am aware of the incentives of digressing.

2. RELEVANCE VS. TRENDINESS (AND THE INDICATOR GAME)

Scientists consider an article to be relevant if it addresses an issue that has an impact on collective and/or individual well-being in the short or long term. While undoubtedly it is hard to perform wine consumer research that actively benefits the broader collective, we should encourage studies that provide useful insights for multiple stakeholders. However, an unwritten, but quite well-known, fast-track to publication is to perform research on a "hot topic"; in other words, investigate an issue that is popular in the international or national media due to some (recent) trend or phenomenon. Nevertheless, most often when a topic is popular among the general press, the wine industry has already exploited its market opportunities. Similarly, articles dealing with such hot topics have higher probabilities to be cited by colleagues and thus contribute to the indicator game [7].

3. METHODOLOGICAL APPROACHES AND DATA UTILITY

The general rule in science is that empirical research is rigorous if the methods and techniques warrant the conclusions drawn. Whilst scholars generally acknowledge that all methodologies investigating consumer and other stakeholders' attitudes and behaviours (from field experiments to stated preferences techniques) hold specific limitations and strengths (see, among others, [8]), there seems to be a periodic popularity upsurge of one, specific method of data gathering. Guiding to over-criticism towards other methodologies and to a proliferation of studies more concerned of showcasing the complexity and grandeur of the underlining design rather than focusing on the potential utility of outcomes. Relatedly, a worrying issue is also the use of validated scales in our research, which is certainly due to seek high methodological rigour, nonetheless it can lead scholars to diverge from real-world measurements. Whilst information on psychological processes in the consumer journey and possible moderating or mediating influences are key for wine industry stakeholder, often the outcome of these scales depict individual psychometric characteristics that do not offer practical insights to wineries or policy makers interested in identifying market segments or interventions' effectiveness. Studies should be designed building on the unique make-up of that market [2] and carefully considering their final, empirical contribution [9].

4. UNDER-POWERED SAMPLES AND THE REPLICATION CRISIS

Causal inferences to be informative relies on externally valid samples [10]. However, empirical evidence suggests that non-representative convenience samples

can provide insights that closely resemble those found using representative samples [11]. Indeed, many wine consumer studies rely on limited samples, most often non representative of any specific target population [12, 13]. While acknowledging the difficulties in achieving successful academic collaborations, an alternative to perform studies with narrow, convenience samples could be to crowdfund larger datasets collecting quota-based sub-samples from different affiliations. The immediate advantages of such practice would be to reduce individual scholars' efforts of data collection (as each participant could provide a limited number of respondents) and more closely reach a larger population, (probably) located in different geographical areas. Strictly related to the issue of low external validity of many wine consumer studies is the huge issue of the publication bias attached to replication studies. Most scholars are convinced (and I fear appropriately) that journals will never publish research that loyally replicates an investigation performed by other authors [14]. Whilst the advancements provided by this work for the academic community could indeed be limited, the outcomes would be of great benefit for the practitioners. As findings could offer an important update on stakeholders' attitudes or/and behaviours and, even more importantly present, a validation of previous insights.

5. CONCLUDING REMARKS

I hope that this discussion paper, examining a non-exhaustive list of core topics that limit academic studies' usefulness to solve practitioners and policy makers problems, will provide some impetus to wine consumer researchers to further debate (and potentially increase) our contribution to the real-world. Among the possible options, we should try to engage practitioners in the design of our studies and further exploit the opportunities offered by traditional and social media to share outcomes through popular science outputs (as indeed many younger scholars are increasingly doing). Overall, I sincerely believe that enhancing the impact of our wine consumer research is a win-win solution.

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Wine Economics and Policy

Firenze University Press
www.fupress.com/wep

OPEN ACCESS

Citation: Eva Parga Dans, Riccardo Vecchio, Azzurra Annunziata, Pablo Alonso González, Raimundo Otero Enríquez (2023). A certification for natural wine? A comparative analysis of consumer drivers in Italy and Spain. *Wine Economics and Policy* 12(1): 23-35. doi: 10.36253/wep-12890

Data Availability Statement: All relevant data are within the paper and its Supporting Information files.

Competing Interests: The Author(s) declare(s) no conflict of interest.

A certification for natural wine? A comparative analysis of consumer drivers in Italy and Spain

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Abstract. The 2020 certification of natural wine (NW) in France has unleashed a heated debate in Europe. However, knowledge about NW consumer profiles and preferences in a comparative perspective remains scarce in the academic literature. This study aims to define the perceptions, preferences and profiles of wine consumers who support a NW label. For this purpose, we employed analysis of variance, aprioristic factor analysis and multiple regression analysis to examine data from a direct survey performed in Italy and Spain in 2020. Findings reveal that NW consumers in both countries deem it necessary to establish a certification for NW. However, we found significant differences regarding consumers' profiles, as well as purchasing preferences. In Spain, demand for NW certification is linked to eco-healthy and proximity-craft attributes of wine, and is considered more important by non-professional consumers and those with lower educational level. In Italy, information on the label and the purchase experience are the most important factors to aid in recognizing NW, while women show a significant interest in the NW certification. These findings may help policymakers to establish homogeneous parameters to differentiate and certify NW.

Keywords: natural wine, food labeling, consumer preferences, food certification, ecolabels.

1. INTRODUCTION

1.1 Research context

On March 25, 2020, natural wine (NW) obtained legal recognition for the first time in France under the designation *Vin Méthode Nature*, opening the way for similar initiatives worldwide. This recognition results from a long struggle led by the *Syndicat de Défense des Vins Naturels* before the French Government. The European Commission (EC) decided not to allow the use of the term NW because there is no definition of the term "natural" in the EU regulations associated with wine. Therefore, the combination of the two words can be misleading for the consumer, and damaging to the image of other wines [1]. Debate on the approval of the certification *Vin Méthode Nature* is ongoing at the European level. Disagreements emerge among EU states about the possibility of allowing it at their national level. The French authorities thus decided to create a new appellation associated with the method of production of these wines, based on fulfilling a series of requirements that include certification of organic viticulture, use of indigenous yeasts, prohibition of stabilization or filtration, and absence of any additives except low sulfite doses (up to 30 mg/liter). This opens up both a new horizon for a whole sector that can now certify wine with the recently approved French label and a legislative path for other countries to follow suit.

Until now, NW was considered a social movement involving consumers, producers and other actors in the wine value chain, who advocated naturalness and minimal intervention in wine rather than a regulated or defined form of winemaking [2, 3]. This movement spread throughout the 20th century from France to the whole of Europe as a reaction to modern viticulture and enological techniques. This includes intervention in the vineyard with synthetic chemicals and in the cellar with the more than 50 additives and processing aids that can be added to wine without a labeling requirement [4]. Several associations have emerged in Europe in defense of NW, such *as L'Association des Vins Naturels* or *Sans Aucun Intrant ni Sulfite* in France, *Triple AAA, Viniveri, Vinnatur* or *VAN* in Italy, and the *Asociación de Productores de Vino Natural* in Spain. This has added to the proliferation of different national standards [5, 6]. Although there is no agreed definition for NW, these associations advocate a winemaking process under parameters of minimum intervention and the greatest respect for nature.

Wine is a canonical example of credence and experience goods because its quality is difficult to assess from its labeling [7]. Unlike any other food product, wine carries no information about its nutritional values, ingredients or expiration date, despite the fact that it can contain dozens of additives, generating confusion for consumers [8]. The European Commission intends to address this issue and revise the labeling requirements of alcoholic drinks. It has even published a roadmap to update the regulation on the provision of food information to consumers (EU 1169/2011 FIC). Since 2017, the EC has launched a series of reports and forced the wine industry to present a self-regulatory proposal in 2018. Specifically, the proposal of the *Comité Européen des Enterprises Vins* (CEEV), as the representative institution of wine industries in Europe, is to offer some nutritional and ingredient information through a *quick response* (QR) code but not labeling the information on the bottle. However, through its Beating Cancer plan, the EC proposes a mandatory nutritional declaration and list of ingredients in alcohol labeling and is currently preparing an impact assessment that will culminate in a legislative proposal in 2022 [9]. Controversy between countries is also on the rise, given the emergence of new alcohol regulations such as the Irish Public Health Act from 2018, requiring alcoholic beverages to provide health warning claims on their labels similar to the ones displayed on tobacco [10].

These initiatives can be interpreted as a reaction to the current situation of the wine sector. In the light of this debate, this manuscript sets out to answer two key research questions. First, is there a specific consumer profile that demands the differentiation of NW in the market? Second, what are the preferences and perceptions of wine consumers who consider a certification to identify NW important? Answering these questions is a prerequisite for the development of a EU-wide certification and to better address both producers and consumers' needs and expectations, thus helping NW producers to create new marketing communication strategies or adapt their existing ones to new and emerging market niches.

1.2 Information asymmetries in the wine market

Wine constitutes a seminal example of information asymmetries in the market [11]. In this context, producers know about the elaboration process whereas consumers cannot, or it is difficult and time-consuming for them to obtain such information. These asymmetries make wine a complex product, about which specific knowledge is needed to make rational purchasing choices [12]. Consumers lack incentives to optimize their purchasing decisions and producers lack mechanisms to differentiate themselves in the market. This creates a poten-

tial adverse selection problem. Since it is not possible to differentiate the quality of the product, there are no incentives to compete and produce above average quality, eventually threatening its survival in the market [13].

In the case of NW, consumers still do not have a clear notion of what it is, how it differs from other wines, and where to buy it [6, 14]. In fact, the lack of NW certifications and the uncertainty associated with its attributes have generated a very unstable market for this product in traditionally wine-producing countries such as Spain, where consumer research about NW is scarce [15, 16]. Recent research has shown growing consumer interest in products with environmental attributes, such as organic, healthy, sustainable, responsible and "proximity" wines [17, 18]. It is accompanied by a surge in new certifications that aim to convey trust and inform about wine's intrinsic and extrinsic qualities [19]. Previous research has shown that consumers are willing to pay a premium for organic wines in the belief that they are healthier, tastier, and of higher quality [3, 20]. However, the differences between organic, biodynamic, or sulfite-free wines remain confusing for many in the face of the proliferation of information associated with the naturalness of these wines [21-24]. Fewer studies have been conducted about NW specifically, although the literature on the topic is rapidly growing. Such coverage focuses on the different productive models in the natural wine field [15, 25, 26] and on the policy controversies arising from the recent French certification of natural wine "*vin mèthode nature*" [27]. Studies focusing on consumer interest in NW show that a predisposition to pay more for NW by Italian consumers was associated with drinking frequency and occasion, organic production, sulphite content, income, and attitudes towards healthy eating and the environment [28, 29]. Other studies have explored consumer perception of NW in the Italian wine industry [14], the construction of taste in the NW market [30], and marketing strategies in the NW sector [2, 25]. There is a research gap regarding comparative studies between countries, in that we must better understand consumer behavior and specific socioeconomic profiles, given the current dominant focus on Italy in the literature. This study therefore enriches the growing literature on sustainable food consumption attitudes. A further research gap lies in the lack of studies on consumer interest in NW certification, a timely issue with normative implications because the certification developed by the French government has changed the field of play. Owing to these present academic gaps in knowledge, this manuscript sets out to answer two key research questions. First, is there a specific consumer profile that demands the differentiation of NW in the market? Second, what are the preferences and perceptions of wine consumers who deem a certification to identify NW important? Answering these questions is a prerequisite for the development of a EU-wide certification and to better address both producers and consumers' needs and expectations, and help NW producers to create new marketing communication strategies. Owing to the present academic gap in knowledge to date, this paper deals with consumer profiles in relation to NW label interest and their preferences regarding a NW certification. For this purpose, data were collected through a direct survey delivered in Italy and Spain. Both are traditional producing and consuming wine countries leading in terms of vineyard surface area, production volume and export value rankings worldwide, only after France [31]. Ultimately, the paper offers an original contribution to a rather unexplored but emerging topic.

2. MATERIALS AND METHODS

2.1 Data collection

Data were collected using a questionnaire survey aimed at a convenience sample of Spanish and Italian wine consumers aged between 18 and 70 . The questionnaire was administered by online survey management software, with a filling time of approximately 11 minutes. The survey consisted of a total of 30 questions structured from multiple-choice answer possibilities based on previous research into NW consumption [5, 6, 14], divided into four interrelated sections: (1) wine consumption habits and occasions; (2) wine labeling information and eco-label perceptions; (3) NW consumption habits, perceptions and occasions; (4) socio-demographic factors. Before beginning the survey, all participants provided informed consent. This included the purpose of the research, the voluntary nature of participation, number of questions, approximate response time, and the possibility of leaving the survey at any time. Both survey procedure and questionnaire were favorably evaluated by the Ethics Committee of the Spanish National Research Council (CSIC, approval number 136/2020).

As mentioned, a convenience sampling procedure was applied in the absence of a regular wine consumer population census. Eligibility was based on the definition of regular wine drinkers by Wine Intelligence [32], i.e., individuals consuming wine at least once a month. This description has been previously used in similar wine consumer studies [33-35], The questionnaire was launched through specialized sector agents in both Spain and Italy. Producers' associations, distributors, wine critics, sommeliers, wine observatories, etc., publi-

cized the initiative through their websites. They requested the participation of their users, clients and followers, to improve the response rate among wine consumers in both countries. Through this system, a total of 527 fully completed surveys by wine consumers were collected in Spain and 501 in Italy during the two months from mid-September to mid-November 2020.

2.2. Data analysis

Data analysis consisted of two phases in order to understand the drivers influencing demand for NW labeling. Consumer demand for a NW label was our dependent variable and was assessed by asking "*To what extent do you consider labeling important to identify NW?*". Respondents answered this question using a five-point scale (from 1 "not at all" to 5 "a lot"). The first phase of the analysis responds to our research question regarding profiles of consumers that expressed a need for NW certification. It consisted of a sample description and an analysis of variance (ANOVA) aimed at distinguishing which socio-demographic and consumer profiles most accurately describe wine drinkers likely to support certification of NW in the two countries. Based on the F value and the associated significance level ($p<0.01$), a relationship of statistical dependence or independence was established between the factors and the DV, in line with recent research related to NW consumer preferences [5, 36].

The assumption of normality is used especially when any of the factor categories has less than 50 cases. It was tested through Kolmogorov-Smirnov or Shapiro-Wilk statistics and was not fulfilled in several ANOVAs. Therefore, rejection of the hypothesis of equality of means was replicated by default through a Kruskal-Wallis test. For the case of the independent dichotomous variables (gender and NW consumption), means were compared by evaluating the level of significance associated with the F value [37].

The purpose of the second phase was to answer our second research question, about the preferences and perceptions of wine consumers who consider labels important as a means to identify NW. First, it included r Pearson correlations ($p<0.01$), in order to discriminate between independent and quantitative variables (IV) in wine labeling information, and on purchasing occasions that best correlated with the DV for each country [38]. It also established a ranking order and a comparison between the two. All the 85 IV in the questionnaire were used to prepare this ranking. The aim of this bivariate exploratory statistical analysis is to identify the best IVs that explain the DV in Spain and Italy. This also sheds light on the differences between the two countries. The exploratory bivariate analysis was followed by an aprioristic factor analysis to group the best IVs from each country under common latent dimensions. This strategy permits such exploratory factor analysis and makes it more efficient, thanks to avoiding the *rubbish in, rubbish out* phenomenon described by [38], which can result from factoring in an indiscriminate number of variables.

The factor extraction method is based on principal component analysis using a Varimax rotation. In all cases, Bartlett's test of sphericity rejected the null hypothesis that the observed correlation matrix is an identity matrix ($p<0.01$), which legitimizes aprioristic factorizations [38]. The eigenvalues obtained for each of the factors created are always greater than the unit. The scores obtained in differential format for each factor are calculated using the regression estimation method. Finally, the factors are used as IVs in a multiple regression model aimed at explaining the largest percentage of variance in the DV and establishing an explanatory or predictive model for each context. Use of the factors in the explanatory model was supported by a corresponding significant F value ($p<0.01$) [39]. In the multiple regression models, we checked the assumptions of normality and homoscedasticity of the residuals, as well as the linearity of the IVs with respect to the DV. It was also verified that the Durbin-Watson statistic was between 1.5 and 2.5 in the models, so the residuals were mutually independent.

3. RESULTS

3.1 Socio-demographic profiles & NW certification

This section responds to our question about whether there is a specific consumer profile correlated with demand for the differentiation of NW in the market. Table 1 shows the sample description from both countries. The Spanish sample was composed of 527 wine consumers, 69% men and 31% women, with a mean age of 45 years. More than 50% of the Spanish respondents had a net monthly income of between 1,001 and 2,000 € and university or master studies (79.4%). In addition, 36.2% of the population surveyed considered themselves to be wine professionals. Regarding wine consumption habits, 44.2% of respondents drank wine several times a week, 78.0% consumed NW (33.3% at least once a month), and considered that a certification for NW is necessary (3.95 out of 5).

The Italian sample was made up of 501 wine consumers, 55% of whom were men and 45% women, with an average age of 38. Almost 50% of the Italian respondents had a net monthly income between 1,001 and 2,000 € and university or master studies (55.5%). Finally, 19.6%

Table 1. Socio-demographics and wine habits of the surveyed population.

		Spain (n=527)	Italy (n=501)
Gender (%)	Female	30.9	45.3
	Male	69.1	54.6
Age	Mean (S.D.)	44.90 (10.27)	37.50 (14.49)
Income (%)	Less than €1,000	9.1	25.4
	€1,001 – €2,000	50.6	48.7
	€2,001 – €3,000	25.8	15.4
	More than €3,000	14.9	10.5
Level of education (%)	No studies	0.6	0.0
	Secondary	2.5	5.5
	Vocational training	17.6	38.9
	University/master	79.4	55.5
NW consumption (%)	Yes	78.0	68.7
	No	22.0	31.3
Wine consumption frequency (%)	At least once a month	6.1	15.2
	Several times a month	9.3	13.6
	Once a week	17.5	21.8
	Several times a week	44.2	36.7
	Everyday	23.0	12.8
NW consumption frequency (%)	At least once a year	35.2	21.5
	At least once a month	33.3	32.3
	At least once a week	14.8	22.7
	2-3 times a week	11.2	15.7
	Daily	5.6	7.8
I am a… (%)	Wine professional	36.2	19.6
	Wine consumer	63.8	80.4
NW label importance	Mean (S.D.) in a scale from 1 to 5	3.95 (1.33)	3.90 (1.10)

of respondents defined themselves as wine professionals. Regarding wine consumption habits, 36.7% drank wine several times a week, 68.7% consumed natural wine (32.3% at least once a month) and considered a NW certification necessary (3.90 on average out of 5).

The significant sociodemographic profiles or IV associated with the desire for a NW label in each country are detailed in Table 2. Results show that in both countries NW consumers are more likely to ask for a certification, to be able to identify it in the market. However, ANOVA shows significant differences between consumer profiles from Spain and Italy.

In Spain it was the non-professional consumers and those without university or higher education who most expressed a need for NW certification. In Italy, on the other hand, (female) gender was the variable that discriminated the importance of such certification. All these variables showed significant differences (Sig. $F<0.05$), but there were also descriptive differences to consider in both samples. For example, Spanish consumers with lower purchasing power most valued the need to certify NW. This difference in means would be significant by the F test, not by KW. In Italy, younger consumers thought it more important to certify NW, whereas in Spain the over-50s showed the greatest interest in this, although not with statistical significance.

3.2 Wine purchasing preferences, perceptions & NW certification

This section responds to our question about the preferences and perceptions of wine consumers who deem a NW certification desirable. In order to understand the underlying data structure, Table 3 shows the r Pearson correlations ($p<0.01$) that best explain the DV for the cases of Spain and Italy, establishing a comparative ranking between them.

In the Spanish case, ranking results show that considering NW healthier than other wines was the main motivation for its consumption among those who would prefer it had a certification. Secondly, the fact that NW wines are organic and sustainable is the next motivation

Table 2. ANOVA – Kruskal-Wallis test / DV ("Do you consider labeling important to identify NW?") * IV.

IV- NW consumption (VI)		No	Yes	F	Sig.			
SPAIN	n	116	412	8.144	.004			
	Mean	3.65	4.04					
ITALY	n	157	344	8.272	.004			
	Mean	3.69	4.00					
IV- I am a…		Wine Professional	Wine Consumer	F	Sig.			
SPAIN	n	191	337	5.884	.016			
	Mean	3.77	4.06					
ITALY	n	98	403	.122	.727			
	Mean	3.87	3.91					
IV- Wine consumption frequency		At least once a month	Several times a month	Once a week	Several times a week	Every day	F	Sig.
SPAIN	n	32	50	92	233	121	.528	.715
	Mean	4.16	4.12	3.99	3.90	3.92		
ITALY	n	76	68	109	184	64	1.581	.178
	Mean	3.93	4.13	3.72	3.88	3.98		
IV- NW consumption frequency		At least once a year	At least once a month	At least once a week	2-3 times a week	Daily	F	Sig.
SPAIN	n	145	137	61	46	23	1.020	.397
	Mean	4.01	4.08	4.23	3.76	4.04		
ITALY	n	74	111	78	54	27	.471	.757
	Mean	3.96	4.02	3.91	4.15	3.96		
IV- Income		Less than €1000	€1001-2000	€2001-3000	More than €3000	F	Sig.	
SPAIN	n	48	267	136	77	2.782	.040(**)	
	Mean	4.02	4.06	3.94	3.57			
ITALY	n	94	180	57	39	.525	.666	
	Mean	3.98	3.83	3.77	3.92			
IV- Education Level		Primary School	Secondary School	University or Master	F	Sig.		
SPAIN	n	13	93	419	7.672	.000		
	Mean	4.54	4.38	3.84				
ITALY	n	27	191	272	2.237	.108		
	Mean	3.48	3.91	3.95				
IV- Age in large groups		18-34	35-49	+50	F	Sig.		
SPAIN	n	78	280	169	.444	.642		
	Mean	3.97	3.90	4.02				
ITALY	n	270	108	122	2.516	.082		
	Mean	4.00	3.79	3.78				
IV- Gender		Woman	Man	F	Sig.			
SPAIN	n	162	362	.947	.331			
	Mean	4.03	3.91					
ITALY	n	227	274	6.971	.009			
	Mean	4.04	3.78					

** Kruskal-Wallis test (Sig.>.05).

Table 3. Comparison of Pearson correlations (r) / DV ("To what extent do you consider labeling important to identify NW?") * IV.

Highest r for Spain			Highest r for Italy		
	SPAIN			ITALY	
	Ranking	r		Ranking	r
Healthy (Motivation NW consumption)	1	.377**	Tasting (NW identification)	1	.344**
Sustainable and organic (Motivation NW consumption)	2	.357**	Wine shop (Place NW purchase)	2	.311**
Winery (Place NW purchase)	3	.323**	Books, guides and/or specialized magazines (NW identification)	3	.297**
Brand (Importance label information)	4	.318**	Biodynamic certification (Importance label information)	4	.288**
Artisanal (Motivation NW consumption)	5	.309**	Internet and/or social networks (NW identification)	5	.277**
Region and/or country (Importance label information)	6	.290**	Brand (Importance label information)	6	.274**
Wine shop (Place NW purchase)	7	.289**	Organic certification (Importance label information)	7	.270**

** Sig.<.01.

for their consumption. Third, wineries are the preferred place for NW purchase. Subsequently, the winery name or brand when choosing a bottle of wine appears fourth in the ranking. Following this in fifth place, the fact that NW is handmade is a motivation for its consumption and demand for certification. Finally, the region and country of origin is in sixth position, while wine shops as the preferred place of NW purchase follow this as seventh. This means that for Spaniards who consider a NW certification necessary, it is important to characterize attributes such as healthy, sustainable, ecological and artisanal, which are the main motivations for its consumption. In comparison, these attributes rank 20th, 13th and 30th in Italy).

In the Italian case, those wishing for a NW certification prioritize the place of purchase over the specific attributes of NW. In other words, in first place they prefer to go to tastings to identify and buy it. In second place, Italians prefer to go to wine shops (seventh in Spain) and, in third place, they rely on books, guides or specialized magazines to identify NW. Biodynamic certification (e.g., Demeter) is important for Italians, appearing fourth in the ranking. It is noteworthy that for Italians who would prefer NW certification, the internet and social networks are important spaces for identifying NW, with fifth position in the ranking. The information present on the label and the organic certification occupy positions number six and seven, respectively. Thus, in addition to purchase (tastings, wine shops, book or guides), aspects related to labeling (biodynamic and organic certifications or brand) are also relevant factors among those requesting NW certification. These results are in stark contrast with the Spanish case, where purchase places occupy the 43rd, 7th and 19th positions in ranking and labeling considerations appear in 46th, 17th and 9th positions.

These variables were subsequently organized through an aprioristic factor analysis to identify clusters of explanatory variables of the DV. These factors have a higher Pearson's r than the IV variables that comprise them (see Table 4), so their predictive capacity will be greater for the DV.

In the Spanish case, the first explanatory factor associated with demand for a NW certificate clusters the variables expressing NW attributes that characterize it as healthier, more sustainable and ecological than other wines. This factor was defined as *eco-healthy* (F1). A second explanatory factor emerges for the Spanish context that combines the perception of NW as artisanal and the preference to buy directly from the winery. We named this factor *proximity-craft* (F2). A third factor combines the importance of the brand or product name with the region and country of origin when a person supporting NW certification chooses a wine. We called this factor *origin-brand* (F3). In the Italian case, a factor identified as *wine experience* (F4) groups together tasting and wine shops as means to identify and buy NW. Another factor defined as *on-label-info* (F5) groups the importance of organic and biodynamic certifications with brand information, in order to recognize NW. Finally, we defined a sixth factor *extra-label-info* (F6) as the importance of information widely retrieved in the media to recognize

Table 4. Pearson correlations (r) / DV ("To what extent do you consider labeling important to identify NW?)" * Factors.

SPAIN	r
F1_ECO-HEALTHY (IV- Healthy + IV- Sustainable and organic)	.406**
F2_PROXIMITY CRAFT (IV- Winery + IV- Artisanal)	.374**
F3_ORIGIN-BRAND (IV- Brand + IV- Region and/or country)	.337**
ITALY	r
F4_WINE EXPERIENCE (IV- Tasting + IV-Winery)	.405**
F5_ ON-LABEL-INFO (IV- Biodynamic certification + IV-Brand + IV- Organic certification)	.351**
F6 _EXTRA-LABEL-INFO (IV- Books, guides and/or specialized magazines + IV- Internet and/or social networks	.312**

**Sig.<.01.

NW, including books, social networks, specialized magazines and similar outlets.

Finally, these factors were used as IV in a multiple regression analysis in order to establish an explanatory or predictor model for each country. Table 5 shows the factors that explain a higher percentage of variance for both cases in a combined rather than independent form. This provides robustness to these combinations when explaining the DV (see Table 5 and estimated coefficients in Table A1).

In the case of Spain, the combination of F1 and F2 in the same model explains a significant percentage (18.9%) of the variance (Sig. F change<0.01), that is, the perception that NW is both eco-healthy and proximity-craft. In contrast, the factor associated with origin-brand (F3) was left out of the model as it does not contribute a significant percentage of variance to explanation of the DV (Sig. F change<0.05). This defines a model for the demand for a NW certificate in Spain that could be taken into account when developing legislation and labeling policies. In the case of Italy, both factors (F4 and F5) entered into the explanatory regression model of the DV, i.e. the combination of experience (F4) and on-label-info (F5) explains the need for a NW certificate. The factor associated with extra-label-info (F6) was left out of the final model because it does not contribute a significant percentage of variance to the explanation of the DV (Sig. F change>0.05).

4. DISCUSSION

Our results in Spain and Italy show that NW consumers are more likely to demand a certification that identifies NW in the market. However, there are differences between the socio-demographic profiles of consumers and the drivers of NW consumption between countries. In Spain, the socio-demographic profile of consumers who support NW certification includes non-professional consumers and people with no university or higher education, whereas in Italy, as a group women do. These results converge with recent research by [40], which found that women pay more attention to wine labeling and are more likely to pay for NW in the Italian market. In the Spanish case, there is no previous research on consumer profiles and NW, so further work is required in this area.

Table 5. Regression model summaries.

Model	r	r^2	Adjusted r^2	Std. error of estimate	Change Statistics					Durbin-Watson
					r^2 change	F change	df1	df2	Sig. F change	
SPAIN										
1	.409[a]	.167	.166	1.208	.167	104.202	1	518	.000	1.933
2	.438[b]	.192	.189	1.191	.025	15.782	1	517	.000	
a. Predictors: (Constant). F1_ECO-HEALTHY										
b. Predictors: (Constant). F1_ECO-HEALTHY. F2_PROXIMITY CRAFT										
c. DV- "To what extent do you consider labeling important to identify NW?"										
ITALY										
1	.405[a]	.164	.162	.924	.164	73.170	1	373	.000	1.912
2	.441[b]	.194	.190	.908	.030	13.916	1	372	.000	
a. Predictors: (Constant). F4_WINE EXPERIENCE										
b. Predictors: (Constant). F4_WINE EXPERIENCE. F5_ ON-LABEL-INFO										
c. DV- "To what extent do you consider labeling important to identify NW?"										

Several studies have noted the relationship of the symbolic prestige of wine consumption with the purchasing power and high education levels of certain social classes [41], even suggesting that wine is a food that establishes hierarchies [42]. Already Bourdieu's studies [43] analyzed the taste for wine as an element of bourgeois social distinction, which allows classifying the social and educational origin of the individual. However, our results show that in Spain the need felt to certify NW is associated with wine consumption among social strata with lower purchasing power and educational qualifications. These results are in line with other research showing that the lower classes can challenge the *bourgeoisie* regarding food and wine enjoyment, making a statement of sociability and generosity that contrasts with the formality and rigidity of the middle and upper classes [44].

Traditionally, in many mostly southern parts of Europe, wine was an everyday food staple [45]. However, with the globalization of wine and the proliferation of brands and quality labels, the choice to purchase wine has made the debate about which consumers choose which wine more complex. Thus, our results for the Italian sample differ profoundly from the Spanish context, where women and young people are more likely to be interested in a NW label. In short, the socio-demographic characterization of wine consumers remains a complex scientific debate and therefore deserves special attention, especially in relation to emerging consumer trends such as NW. In fact, it remains unclear why certain sociodemographic factors are associated with greater interest in NW as a function of each specific society or culture.

The factors resulting from this study are in line with recent research on NW. Concerning the eco-healthy factor or F1, previous studies have shown that the perception of a wine's naturalness through labeling information associated with health consciousness, sustainability and ecological winemaking are becoming determinant drivers of purchasing choices [22, 46]. They are positively associated with a higher willingness to pay [47]. Moreover, these studies show that not only the perception but also the labeling of these attributes has become important, in line with F5, the on-label-info factor, for the Italian consumer sample. For both the Spanish and Italian samples eco-healthy (F1) attributes are important. However, Italian consumers prefer to obtain this information on-label (F5), through organic and biodynamic certifications. This shows the complexity of the current wine certification system, the multiple associated seals and the confusion it entails for the consumer, which ultimately emphasizes the absence of ingredient labeling of this product. In fact, organic certification has undergone a significant market breakthrough and has managed to build trust among consumers [48]. Current confusion about the differences between organic, biodynamic and NW for consumers, who tend to think that they are all similar, has contributed to this loss of confidence in labels [3, 20, 21]. Certainly, organic, biodynamic and NW are all based on organic agriculture, but they have different ways of working in the vineyard and winery [6]. Seufert et al. [49] show that the perception of organic agriculture as chemical-free is the result of a limited and partial approach to organic certifications, engendering a huge confusion between environmental, sustainable or health-related principles. This would explain why in the Italian sample the need to certify NW is associated with the importance of seeking extra-label information (F6) to identify it. Thus, our results suggest that in the absence of more information, a certification system combining eco-healthy (F1) and on-label-info (F5) could satisfy different NW consumer profiles in various countries.

What these results ultimately show is that the quality conventions associated with origin, brand or reputation of wine have changed radically, in turn transforming traditional systems of marketing and labeling [50]. Our results regarding F3, the origin-brand factor, indeed suggest this, since its attributes are important for those desiring NW certification in Spain, whereas in Italy it is also relevant but in combination with organic and biodynamic certification (F5 on-label-info). It would appear that the certification based on protected designations of origin (PDO) played a very important role during the 1990s, when the globalized wine market developed [51]. In this scenario, traditional producer or Old World countries competed with New World countries by relying on a system based on PDO, brand names and prizes from international competitions that generated positive attitudes among consumers [30, 52]. However, in the contemporary globalized market, varied certifications associated with eco-friendly, sustainable or health characteristics have emerged, generating alternatives to conventional wines [53, 54]. Our results suggest that traditional aspects of the wine quality certification system are still important when certifying NW. Therefore, a certification system for NW should respect traditional quality conventions in the wine labeling system and combine it with other emerging aspects valued by the contemporary consumer such as F1 (eco-healthy), F2 (proximity craft) or F5 (on-label-info).

Furthermore, aspects related to proximity-craft (F2) are important for Spaniards supporting a NW certificate. Previous research highlights the association con-

sumers make between the perception of craft, traditional, small-scale or proximity winemaking with sustainable, organic and natural winemaking [5, 55, 56]; in other words, wines that deviate from standard and industrial production methods [57]. Not surprisingly, the French certification body *Vin Méthode Nature* is currently debating whether to charge wine companies producing over 25,000 bottles per year more, to prevent appropriation of the label by industry. Therefore, aspects related to proximity-craft should also be taken into account when certifying NW.

Finally, there is the experiential factor (F4) among those wanting a NW certification in Italy. In general terms, wine has been considered as a unique product and different from any other food whose singularity makes it an experiential product [58]. Wine is ceasing to be a traditional food in rural societies and is becoming more and more a product associated with hedonic or luxury consumption, especially in non-wine producing regions [36]. The recent review on consumer behavior by Deroover et al. [59] highlights that wine is perceived as an expression of traditions and culture. These attributes have greater influence on purchasing and consumption choices than for any other food or beverage [60]. Our results show that the lived-experience of identifying and buying a NW in specialized wine shops and wine tastings is also part of this consumption pattern. Therefore, a NW certificate should incorporate aspects that differentiate these wines with regard to the unique experience that can take place through NW consumption.

5. CONCLUSION

This study has furthered demographic and sociocultural knowledge of the consumer profiles and drivers of demand for a NW certification, distinguishing as an example between Spanish and Italian wine drinkers. To answer the initial research question as to whether there is a specific consumer profile that considers a NW label necessary, results show that those who already consume NW are the most likely to demand a certificate to differentiate NW in the market, both in Italy and Spain. However, there are significant differences between these profiles. In Spain, non-professional consumers and those with lower educational levels support a NW certificate to a greater extent, while in Italy it is women who show a greater interest.

Concerning our second research question about the preferences and perceptions of wine consumers who consider NW certification important, results show four main explanatory factors in the final multiple regression models, two for each country. The eco-healthy and proximity-craft factors explain the demand for a NW certificate in Spain to a greater extent, while in Italy it is the on-label-info and experiential factors. Both samples converge in showing a predisposition among those who consume NW to prefer a distinctive label and that the explanatory factors for such a certificate are not mutually exclusive. Therefore, these results suggest that the stakeholders could indeed set homogeneous standards to reduce uncertainty and information asymmetries concerning NW. This constitutes an important contribution to the debate on the need to establish a common regulatory framework leading to a consensual EU-wide creation of a distinctive NW label. This would help assuage the polemics among countries, as reflected in complaints by several Members of the European Parliament against the French certification initiative *Vin Méthode Nature*. It could also satisfy NW producers who demand some sort of differentiation in the wine market given the lack of ingredient labeling in wine. In parallel, it could also respond to consumer interests in more transparent and sustainable food products, given that the new regulations for labeling alcoholic beverages are still being debated, with no clear outcome [9]. Certainly, a rise in the minimum standard requirements for ingredient labeling in the wine sector would make NW producers less interested in having their own certification [61], but this scenario is still unclear. Given that the promotion and growth of NW would be positive in terms of environmental sustainability and a cleaner food chain in Europe and beyond, a NW certification is in line with new EU-wide strategies such as *From Farm to Fork* and the *European Green Deal*. A pro-labeling policy for NW would be therefore fundamental to reconcile sustainability aims with consumer and producer interests alike, thus reducing the currently prevailing information asymmetry in the wine market.

We are aware that the lack of a probabilistic sample is a core shortcoming of this study, which limits the potential to extrapolate the results to the whole wine consumer population in Spain and Italy at large. Furthermore, the explained variance in the regression models is low, which implies that there may be more drivers influencing demand for a NW certificate. Future research should explore the perspectives of other actors in the wine sector on NW labeling, such as winemakers or traders, to further optimize NW communication and marketing. Similarly, more cross-national and comparative studies are needed to better delve into the profile of the NW consumers and the perceptions associated with them, in order to more effectively deliver a Europe-wide certification.

ACKNOWLEDGEMENTS

This study was supported by the Spanish Innovation, Technical and Scientific Research Plan 2017–2020 – Ramón & Cajal Ref. RYC2018-024025-I and PID2021-126272OA-100. The text was edited by Guido Jones, funded by the Cabildo de Tenerife, under the TFinnova Programme supported by MEDI and FDCAN funds. Dissemination of the survey in Spain was provided by the Observatorio Español del Mercado del Vino (OEMV), Viti vin, Spanish Wine Lover, Gourmet Hunters, Bodegas.bio, Indie Spanish Wines, Vinos Utópicos, Junguitu ¿hablamos de vino?, El Sumiller and Vinófilos.

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APPENDIX

Table A1. Coefficients.

Model[a]	Unstandardized coefficients		Standardized coefficients	t	Sig.
	B	Std. error	Beta		
SPAIN					
Constant	3.955	.052	_	75.719	.000
F1_ECO-HEALTHY	.372	.067	.283	5.581	.000
F2_PROXIMITY CRAFT	.266	.067	.201	3.973	.000
ITALY					
Constant	3.974	.047	_	84.256	.000
F4_WINE EXPERIENCE	.322	.052	.319	6.150	.000
F5_ ON-LABEL-INFO	.196	.053	.194	3.730	.000

a. DV- "Do you consider labeling important to identify NW?"

Wine Economics and Policy

Firenze University Press
www.fupress.com/wep

OPEN ACCESS

Citation: Kamila Vesela, David Křížek, Lucie Severova (2023). Structure and development of the Czech wine market and foreign wine trade. *Wine Economics and Policy* 12(1): 37-49. doi: 10.36253/wep-11522

Data Availability Statement: All relevant data are within the paper and its Supporting Information files.

Competing Interests: The Author(s) declare(s) no conflict of interest.

Structure and development of the Czech wine market and foreign wine trade

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Abstract. The aim of the presented text is to evaluate the structure and development of the Czech wine market, foreign wine trade and to analyse the factors shaping domestic demand for wine. The text presents the results of the analysis of primary and secondary data. Time series on the development and direction of the foreign wine trade are analysed and the results are then compared with the findings of a questionnaire survey of 946 respondents which provides information about the current consumer preferences of the Czech population in drinking wine. Wine consumption has shown stable growth over the last 20 years, as demonstrated by primary research. The research has proven that wine consumption in the Czech Republic shows a faster growth rate than domestic production, which is also reflected in import demand. From the point of view of factors influencing domestic demand for wine, it is mainly the age, education, income and size of the consumer's residence. The research provides an up-to-date view of the structure of wine demand in the Czech Republic and identifies the factors influencing wine demand. The research also makes it possible to predict the future direction of the Czech wine trade.

Keywords: export, import, production, consumption, wine.

1. INTRODUCTION

The Czech Republic is a country with long-term wine production, but also consumption. From 1995 to 2016, wine production increased from 459 (in 1000 hl) to 631 (1000 hl). This production grew at an average annual rate of 4.57% per year. In contrast, wine consumption in the Czech Republic increased from 1995, when its value was 63.7 (1000 hl) to 192 (1000 hl). It is an increase of more than 300%. The average consumption per person in 1995 was 7.6 l of wine, in 2016 it was already 21.3 l/person. The average growth rate of wine consumption was 6.57% per year. For a clear overview, see figure 1.

A similar trend can be observed in Asia, where the share of consumer spending in total household spending is also growing. The largest consumption of wine is currently in France, followed by Italy and Austria. Bentzen and Smith [1] dealt with the situation and problems of wine production in

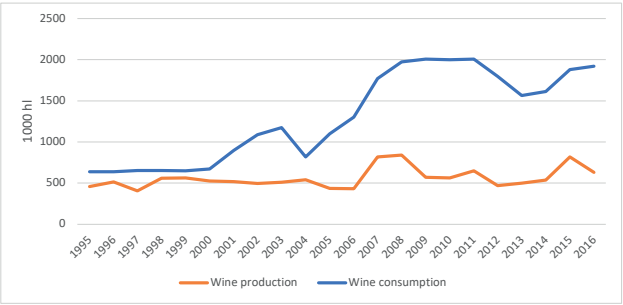

Figure 1. The development of wine production and consumption in the Czech Republic over the period 1995-2016 (Source: own processing based on MZCR data).

countries with low wine production, especially in Denmark, whereas Marquart and Hanf [2] focused on Armenia. Wine production in the Czech Republic is more focused on white wine. The share of white grape varieties in young vineyards in the Czech Republic in 2015–2018 was 92% of the total area of vineyards. Veltlínské zelené, Pálava and Ryzlink rýnský [3] have the largest share in the Czech Republic. The unequivocal market leader is the Bohemia sekt group [4]. Chládková [5] adds sufficient investment in the development and expansion of market share as a key element for maintaining the company's competitive position in the wine market. It should also be noted that the Czech Republic's accession to the European Union significantly affected the wine market in the Czech Republic, which was reflected, among other things, in a slight decline in the market shares of most companies [6]. For example, Butkus et al. [7] dealt with the issue of the impact of the Czech Republic's accession to the European Union on the Czech Republic's foreign trade. They used an econometric model to try to determine the direct effect of the Czech Republic's accession to the EU on the size of foreign trade. However, the analyses carried out provided mixed results regarding EU membership and export growth.

With the accession of the Czech Republic to the European Union, there have been a number of changes in Czech viticulture, the market for Czech consumers now offers a number of foreign wines in various price categories and quality levels. The integration of domestic and foreign wine markets can be expected, which will be reflected in the gradual convergence of wine prices at the global level. Most Czech producers are convinced that their wines will continue to be sufficiently competitive [8]. The development of the wine industry contributes to the overall competitiveness of individual regions of the Czech Republic, as well as the competitiveness of the Czech Republic on global markets [9]. Specific problems of this sector including the development of wine consumption per capita were analysed, for example, by Chládková [10]. Verner [11] analysed the relationship between economic growth, production growth in the sector and quality of life. To understand the functioning of a particular market, in addition to knowledge of secondary data on overall market variables (such as production, consumption, profitability, or foreign trade), it is important to know the factors influencing the behaviour of individual market players. The importance of studies of agricultural commodities in the Czech Republic was emphasized e.g. by Svatoš and Smutka [12].

Wine is one of the commodities with a long history of production and consumption in the Czech Republic. The aim of this text is to evaluate the structure and development of the Czech wine market, foreign trade in wine and to analyse the factors shaping domestic demand for wine. The research provides an up-to-date view of the structure of wine demand in the Czech Republic and identifies the factors influencing wine demand. The research also allows predicting the future direction of the Czech wine trade. This is important for regional development planning, as wine production is significantly more widespread in certain regions than in others (due to climatic conditions).

The aim of the presented text is a comprehensive evaluation of the Czech wine market in terms of wine production, consumption and foreign trade. The following sub-objectives have been set, the fulfilment of which will lead to the fulfilment of the main objective: 1) to evaluate the development and predict production, consumption and foreign trade (exports and imports) in wine in the Czech Republic; 2) to analyse the factors of wine demand among the population of the Czech Republic.

2. MATERIAL AND METHODS

The key source of data for this research are 1) secondary data coming from the official website of the Czech Statistical Office (hereinafter referred to as the CSU) and the Ministry of Agriculture of the Czech Republic (hereinafter referred to as the MZCR); 2) primary data obtained by a questionnaire survey. The data base of secondary data consists mainly of annual data on the development of wine production and consumption in litres, as well as wine exports and imports in litres and average wine consumption per person (in litres/year). In the research of secondary data, both absolute and relative indicators are analysed. Secondary data for analysis are available in a comprehensive version for the

period 1995–2016 (unfortunately, newer data are not yet available).

For the basic evaluation of time series, basic statistical descriptive characteristics were used, which were utilized to describe the year-on-year rates and the absolute deviation and their development between wine production and consumption and wine exports and imports. Methods of trend analysis and regression statistics were used for analysis and prediction. The selection of a suitable trend function was made by using and evaluating interpolation criteria. The function chosen is that which has the smallest possible value of the MSE criterion, meets the conditions of the F-test and has a sufficiently high value of reliability R. The value of MSE is determined using function (1):

$$MSE = \frac{\sum_{t=1}^{T}(-\hat{y}_t)^2}{T} \quad (1)$$

where T is the number of observations, y_t are measured values and $\hat{y}_t$ are expected values. Linear and quadratic curves were used as basic with respect to the development of time series. The following null hypotheses were established:

- *H01: The wine production/consumption in the Czech Republic has no trend (is stationary);*
- *H02: The development of the wine export/import ratio in the Czech Republic has no trend. (is stationary).*

The results of the analysis of time series are further confronted with the results of the questionnaire survey, which was conducted in 2020 and was focused on the evaluation of consumer preferences of the population of the Czech Republic regarding wine consumption. In order to obtain up-to-date consumer information, primary research was carried out to determine the extent, size and structure of the demand for wine. The aim was in particular to identify the factors influencing the size and formation of demand for wine. Quantitative research using a questionnaire technique of data collection was used to obtain primary data. The research was carried out in 2020 in September and October. A total of 946 respondents took part in the questionnaire survey, which represented an 84% return after the elimination of empty or incomplete questionnaires. The gender composition of the respondents was 420 (44.4%) men and 526 (55.6%) women. The age structure of the respondents was divided into groups of 0–20 years, 21–25 years, 26–30 years, 31–40 years, 41–50 years, 51–60 years and 61 and more years. The dominant groups are 0–20 years and 21–25 years, which together make up 86% of all respondents. The structure of respondents' demand was further examined according to the highest level of education attained and the amount of income. Of the total number of respondents, 81.1% of respondents indicated that they would indulge in wine at least occasionally. Absolute and relative frequencies were used in the descriptive statistics and contingency tables and the $\chi 2$ test was used to analyse the obtained data. The contingency table contains the observed frequencies from the questionnaire survey of individual combinations of characters. From the differences (residues) of the observed frequencies and the frequencies obtained from the assumption of the null hypothesis, the total normalized residue is calculated. If its value is less than the critical value of the distribution $\chi 2$ at the significance level of 0.95 for the appropriate degree of freedom, the null hypothesis cannot be rejected at the 95% significance level. Significant variables (according to Chi-square test) were further tested using multinomial and ordinal logistic regression, depending on the type of dependent variable. Logistic regression models were constructed and their quality was evaluated based on Nagelkerke's R squared value. Furthermore, the significance of the regressors was tested using Omnibus Likelihood Ratio Tests. The questionnaire survey focused on the following questions: How often do you drink wine? What wine do you prefer? Where do you most often buy wine? In what price range do you most often buy wine? The answers to these questions were then analysed according to gender, age, education attained, income and size of residence of the respondents. For these purposes, null hypotheses were established and tested.

3. RESULTS

The first phase of the research is focused on evaluating the state of the Czech wine market and the possibilities of predicting further market direction. For these purposes, time series on the production and consumption of wine in the Czech Republic and the values of exports and imports of wine from or to the Czech Republic are analysed. In the next phase, the results of this research are compared with the results of the analysis of primary data from the questionnaire survey.

The following graph (Figure 2) maps the development of wine production and consumption in the Czech Republic for the period 1995–2016.

Wine production shows growth in the period observed, but it also shows relatively high variations. This phenomenon must be attributed to the fact that wine production is conditioned by a number of factors. First of all, it is the area of vineyards, then especially

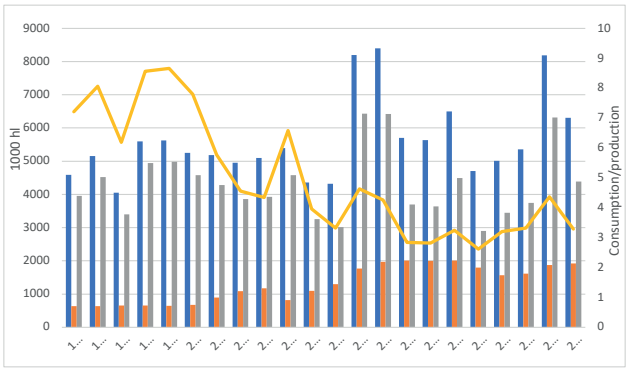

Figure 2. The development of wine production and consumption in the Czech Republic over the period 1995-2016. Blue columns indicate wine production. Orange shows wine consumption. The grey column is wine production minus consumption. The yellow curve shows the ratio of production to consumption (Source: own processing based on MZCR data).

the quality and extent of the harvest in individual years, which is conditioned by the quality of climatic conditions, the number of pests and other factors. In the whole period observed, wine production exceeds consumption, however, the absolute difference between production and consumption decreases over time. This is due to the faster growth rate of wine consumption over production. This effect is clearly evident from the indicator of wine production/consumption where, as the graph above shows, this indicator has been declining for a long time. It is this indicator of the ratio of the amount of production and consumption of wine that expresses the direction of the Czech wine market and was the subject of analysis and prediction. For these purposes, a null hypothesis was established:

- *H01: The ratio of the amount of production and consumption of wine in the Czech Republic has no trend.*

The relationship between wine production and consumption was expressed using a ratio indicator found as the ratio of total wine production in the Czech Republic/ total wine consumption in the Czech Republic. As the graph above shows, this indicator has a declining trend, indicating a faster increase in wine consumption compared to production. Subsequently, a regression analysis was performed in order to reveal and describe the function characterizing the development of the share of wine production and consumption. Using the quadratic trend function, it was possible to explain 74.34% of the variability of the dependent variable; the value of the F test, or the P value shows a value of 0.000002, i.e. it satisfies the condition of a result with less than 5% level of significance. The individual parameters of the function are described in the following table (Table 1).

The functional relationship is described by equation (2):

$$y_t = 9{,}1473\text{-}0{,}5587t + 0{,}0131t^2 \quad (2)$$

where y_t is the ratio of wine production and consumption in the Czech Republic in individual years. Using this function, the values for the expected development of production and consumption for the next 4 periods are then simulated. These are shown in the following graph (Figure 3).

The research has shown a relationship between wine production and consumption, which can be described by this function. The development showed a faster growing rate of wine consumption than production, which reduces the difference between production and consumption, and thus also decreases the analysed ratio indicator of wine production/consumption. This is followed by research into whether and how this growing consumption is reflected in the foreign trade of the Czech Republic. For these purposes, time series on the export and import of wines from and to the Czech Republic are analysed. Data in this case are available until 2019. The development of the foreign wine trade is analysed in summary and according to the division into vermouth, sparkling wine and grape wine (still). For these purposes, a null hypothesis was established:

- *H02: The development of the wine export/import ratio in the Czech Republic has no trend.*

The relationship between wine exports and imports was expressed using a ratio indicator found as the ratio of wine exports from the Czech Republic/wine imports to the Czech Republic. The following graph (Figure 4) describes the development of the foreign wine trade.

Table 1. Parameters of the function of the ratio of production and consumption of wine in the Czech Republic.

Reliability value R	SS residues	MSE	F test ("P")	parameter a	parameter b	parameter c
0.74343514	21.93117	0.996871	0.000002	9.147321	-0.55866	0.013096

Source: own processing.

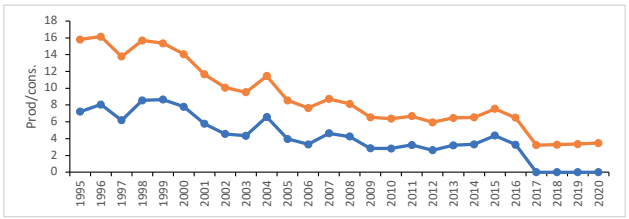

Figure 3. Prediction of the development of wine production/consumption in the Czech Republic. The orange curve shows an estimate. The blue curve represents production and consumption (Source: own processing).

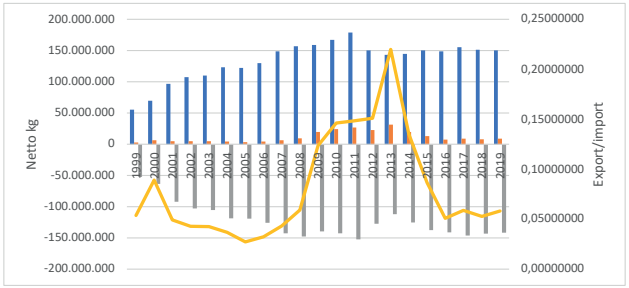

Figure 4. The Czech Republic's foreign wine trade. The blue column indicates import. Orange indicates export. Gray shows net exports. The yellow curve represents the export/import (Source: own processing based on CSU data).

Figure 4 shows the growth of wine imports, which corresponds to the growing demand, or wine consumption. The import of wine in 2019 increased almost threefold compared to 1999, i.e. approximately the same as the consumption of wine in the Czech Republic. Tomšík [13, 14] adds that the largest volumes of wine are imported from Italy and Hungary. The export of wine then goes mainly to Slovakia and Poland. In the case of Slovakia, the export of wine from the Slovak Republic is directed, among other destinations, to the Czech Republic [15].

Subsequently, a regression analysis was performed in order to reveal and describe the function characterizing the development of the share of wine exports and imports. In the case of total exports and imports, it is not possible to describe the development of the share of exports and imports of wine using a suitable function

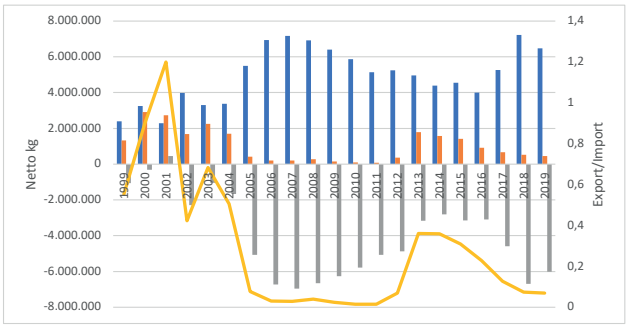

Figure 5. The Czech Republic's foreign trade in vermouth. The blue column indicates import. Orange indicates export. Gray shows net exports The yellow curve shows exports/imports (Source: own processing based on CSU data).

and it must be stated that there is no statistically significant relationship describing the development of exports and imports of wine. A more detailed analysis according to the type of wine has already been able to describe a statistically significant relationship, broken down into foreign trade in vermouth, sparkling wine and grape wine (still). The development of foreign trade in vermouth is shown in the following graph (Figure 5). During the period observed, imports of vermouth increased by 2.7 times the value of 1999, while exports fell to about one third.

Using the quadratic trend function, it was possible to explain 55.90% of the variability of the dependent variable of the ratio of exports and imports, yet the model shows statistical significance; the value of the F test, or the P value shows a value of 0.0006, thus satisfying the condition of a result with less than a 5% level of significance. The individual parameters of the function are described in the following table (Table 2).

The functional relationship is described by equation (3):

$$y_t = 1{,}0097 - 0{,}1294t + 0{,}0045t^2 \quad (3)$$

where y_t is the ratio of vermouth export and import over time. Using this function, the values for the expected development of foreign trade in vermouth for the following period are then simulated. These are shown in the following graph (Figure 6).

Table 2. Parameters of the function of the ratio of export and import with vermouth.

Reliability value R	SS residues	MSE	F test ("P")	parameter a	parameter b	parameter c
0.559041	0.943614	0.044934	0.00063	1.009714	-0.12944609	0.00446645

Source: own processing.

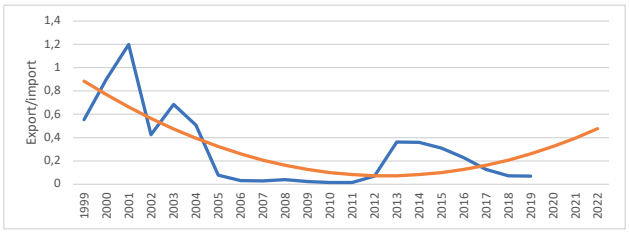

Figure 6. Predicting the development of foreign trade in vermouth. The blue curve indicates export/import and the orange estimate (Source: own processing).

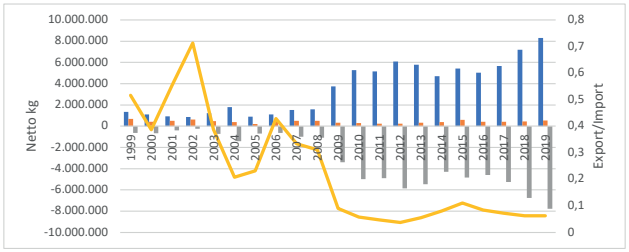

Figure 7. The Czech Republic's foreign trade in sparkling wine. The blue column indicates import. Orange indicates export. Gray shows net exports. The yellow curve represents the export/import (Source: own processing based on CSU data).

In the case of sparkling wine, there was an even greater increase in imports. Compared to 1999, the import of sparkling wine increased more than 6-fold by 2019, while exports, similarly to vermouth, decreased in the period observed (Figure 7).

Using the quadratic trend function, it was possible to explain 73.88% of the variability of the dependent variable of the ratio of exports and imports, yet the model shows statistical significance; the value of the F test, or the P value shows a value of 0.00001, thus satisfying the condition of a result with less than a 5% level of significance. The individual parameters of the function are described in the following table (Table 3).

The functional relationship is described by equation (4):

$$y_t = 0{,}6465 - 0{,}0584t + 0{,}0014t^2 \quad (4)$$

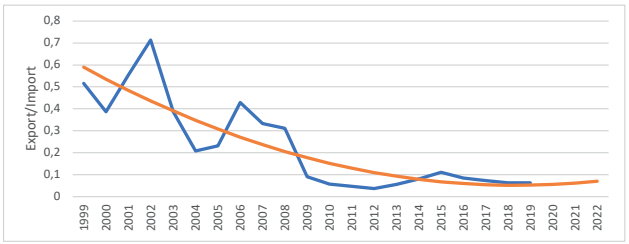

Figure 8. Predicting the development of foreign trade in sparkling wine. The orange curve shows an estimate. The blue curve represents production and consumption (Source: own processing).

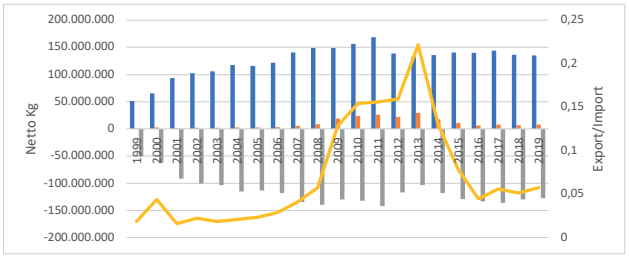

Figure 9. The Czech Republic's foreign trade in grape wine – still. The blue column indicates import. Orange indicates export. Gray shows net exports. The yellow curve represents the export/import (Source: own processing based on CSU data).

where y_t is the ratio of export to import of sparkling wine over time. Using this function, the values for the expected development of foreign trade in sparkling wine for the following period are simulated. These are shown in the following graph (Figure 8).

Unlike vermouth and sparkling wine, still grape wine showed significant growth on the export side during the period observed. Compared to 1999, wine exports in 2019 reached more than 8 times the value in 1999. At the same time, imports in this case increased "only" 2.7 times over the period observed (Figure 9).

The development of the foreign trade relationship, or the mutual ratio of exports and imports is more complicated in this case. The quadratic trend function was able to explain 42.33% of the variability of the dependent variable, yet the model shows statistical significance. The individual parameters of the function are described in the following table (Table 4).

Table 3. Parameters of the function of the ratio of export and import with vermouth.

Reliability value R	SS residues	MSE	F test ("P")	parameter a	parameter b	parameter c
0.738835	0.213037	0.010145	0.00001	0.646529	-0.05843594	0.00143415

Source: own processing.

Table 4. Parameters of the function of the ratio of export and import with still wine from grapes.

Reliability value R	SS residues	MSE	F test ("P")	parameter a	parameter b	parameter c
0.423322	0.041582	0.00198	0.007053	-0.04624	0.02292227	-0.0008445

Source: own processing.

The functional relationship is described by equation (5):

$$y_t = -0{,}0462 + 0{,}0229t - 0{,}0008^{*}t^2 \quad (5)$$

where y_t is the ratio of export to import of still wine over time. Using this function, the values for the expected development of foreign trade in still wine for the following period are simulated. These are shown in the following graph (Figure 10).

The conclusions from the first phase of the research are as follows: Although the volume of wine production in the Czech Republic outweighs its consumption, in the long run and in the whole period observed there is a faster growth rate of wine consumption than production. Thus, the ratio indicator of production/consumption decreases; this phenomenon proved to be statistically significant. The growing consumption of wine was also evidenced by the growing demand for wine imports, which also showed a total of about 3-fold growth between 1999 and 2019 (i.e., approximately the same growth as the growth of total wine consumption in the Czech Republic in the given period). Imports of sparkling wine are growing the fastest (6 times the imports between 1999 and 2019), vermouth and still wine from grapes show an increase of 2.7 times over the period observed from 1999. In terms of volume, however, the largest item is the import of still wine. In the case of still wine from grapes, it was the only item mentioned for which exports increased, particularly by 8 times compared to 1999. The trends observed in exports and imports for individual wines proved to be statistically significant in all cases.

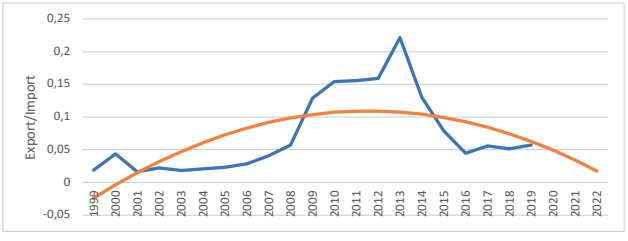

Figure 10. Predicting the development of foreign trade in still wine. The orange curve shows an estimate. The blue curve represents production and consumption (Source: own processing).

The second part of the research is based on the evaluation of primary data obtained from a questionnaire survey. The aim of this research was mainly to test the results of previous research resulting from the analysis of secondary data. Given the findings of growing wine consumption, respondents were first asked if they drank wine and how often. Respondents chose from the answers: daily, every other day, once a week, once a month and exceptionally. The highest frequency was recorded in the answer "exceptionally" (383 answers) and "once a week" (263 answers), the lowest frequency, on the other hand, was recorded in the answer "daily" (10 answers). Furthermore, factors that may affect the intensity of wine drinking were analysed, namely gender, age, education, income and size of residence of the respondents. In this context, the following null hypothesis was established:

- *H03: The gender, age, education, income and size of residence do not significantly predict the frequency of wine drinking.*

Multinomial and ordinal logistic regression were used to evaluate the statistical hypothesis. First, initial preparation for the use of logistic regressions was performed. A separate table of results is created for each dependent variable to determine the relationship between the dependent and independent variables. The dependencies were examined using Chi-square test. The significant variables were then entered into an ordinal logistic regression model.

The results of the first hypothesis testing by the chi-square test are shown in the following Table 5.

Table 5. The results of Chi-square test of the question "How often do you drink wine?".

Criterion	χ2	Critical value	Result
gender	32.6112	9.487729	rejected
age	16.38039	15.50731	rejected
education	25.39251	9.487729	rejected
income	19.84832	21.02607	not rejected
size of residence	23.76653	26.29623	not rejected

Source: own processing.

The research has shown that there is a relationship between gender and the frequency of wine drinking.

Based on the results of the Chi-square test, an Ordinal Logistic Regression model was created. The reference category was the last and most numerous category "exceptionally". Only variables that were statistically significant according to the Chi-square test were included in the model.

The results of the ordinal logistic regression are shown in the following Table 6.

Based on the result of the Likelihood Ratio test, we accept the alternative hypothesis, i.e. at least one predictor is statistically significant at the 5 % significance level. Nagelkerk's pseudo R^2 of 0.02 indicates a very small effect of the predictors on the explanatory variable.

Table 7 summarizes the impact of each predictor. It is clear from the table that at the standard 5 % significance level, the variables education and gender are influential in the model.

The answers are in line with the findings of Chládková et al. [16], who showed in her research based on direct questioning of 1,000 respondents from all over the Czech Republic that 11.3% of respondents drink wine several times a week, 29.8% of respondents drink wine at least once a week and 23.32% of respondents drink wine several times a month. She also noted that only 2.7% of respondents do not drink wine at all. Kelley et al. [17] also concluded that wine is drunk more by women, but argues that the frequency of consumption is higher in men than in women. An interesting feature of his research is also the research on the importance of the relationship between information about the pairing of food and wine on the labels of bottles and demand, or consumption of wine. As a result, consumers who buy wine at least once a week were positively affected by this information, and this effect decreased with the frequency of purchase.

The second research question was: "What wine do you prefer? White, rosé or red?" White wine had the highest frequency of responses (664 responses), rosé had the lowest frequency of responses (187). Subsequently, null hypothesis was established:

- *H04: The gender, age, education, income and size of residence do not significantly predict the wine type preference (White, rosé or red).*

The results of the chi-square test are shown in the following Table 8.

The research has shown that there is a relationship between wine type selection and gender, age, education and income. The relationship between the size of residence and wine type selection was not confirmed.

Based on the Chi-square test results, a Multinomial Logistic Regression model was created. The reference category was the most numerous category – white wine and only variables that have a significant effect on the dependent variable according to the Chi-square test were included in the model.

The results of the multinomial logistic regression are shown in the following table Table 9.

Based on the result of the Likelihood Ratio test, we accept the alternative hypothesis, i.e. at least one predictor is statistically significant at the 5 % significance level.

Table 6. The results of the Ordinal logistic Regression of the question "How often do you drink wine?".

Model	R^2_N	χ^2	df	p
1	0.02	47.33	8	<.0001

Source: own processing.

Table 7. Omnibus Likelihood Ratio Tests of the question "How often do you drink wine?".

Predictor	χ^2	df	p
gender	15.05	1	0.0001
age	8.72	6	0.1897
education	11.09	1	0.0009

Source: own processing.

Table 8. The results of the chi-square test of the question "Which wine do you prefer?".

Criterion	χ2	Critical value	Result
gender	15.35246	5.991465	rejected
age	29.48014	18.30704	rejected
education	6.094705	5.991465	rejected
income	20.56061	15.50731	rejected
size of residence	14.64243	15.50731	not rejected

Source: own processing.

Table 9. The results of the multinomial Logistic Regression of the question "Which wine do you prefer?".

Model	R^2_N	χ^2	df	p
2	0.05	62.57	24	<.0001

Source: own processing.

Nagelkerk's pseudo R^2 of 0.05 indicates a small effect on the explanatory variable.

Table 10 summarizes the effect of each predictor on different categories of the dependent variable. It is clear from the table that at the standard 5 % significance level, only the variables age and gender have a significant effect in the model. For the other variables we see statistically inconclusive effects.

In connection with wine type selection, respondents were also asked about the preference for dry, sweet or semi-sweet wine. Most respondents indicated a preference for semi-sweet wine (452 responses), the least respondents indicated dry wine (293 responses).

Tested null hypothesis:

- H05: The gender, age, education, income and size of residence do not significantly predict the wine type preference (Dry, semi-sweet and sweet).

The results of the chi-square test are shown in the following table (Table 11).

The research showed the existence of a relationship between the preference of the wine type and the education and income of the respondents.

Based on the results of the Chi-square test, a Multinomial Logistic Regression model was again created. The reference category was the most numerous category – semi-sweet wine and only the variables education and income, which are statistically significant according to the Chi-square test, were included in the model.

The results of the multinomial logistic regression are shown in the following Table 12.

Based on the result of the Likelihood Ratio test, we accept the alternative hypothesis, i.e. at least one predictor is statistically significant at the 5 % significance level. Nagelkerk's pseudo R^2 of 0.04 indicates a very small effect of the predictors on the explanatory variable.

Table 13 summarizes the impact of each predictor on different categories of the dependent variable. The table shows that at the standard 5 % significance level, both variables have a significant effect in the model.

The next research question tested was where people buy wine most often. In this question, respondents chose a supermarket, a wine shop, directly from a wine-maker or from fair-trade stores. As expected, the most frequent answer was a supermarket, followed by a wine shop. The lowest frequency of responses was for fair-trade stores. Subsequently, null hypothesis was established:

- H06: The gender, age, education, income and size of residence do not significantly predict the place of purchase of wine.

The results of the chi-square test are shown in the following table (Table 14).

The research has shown a relationship between the place of purchase of wine and age and the size of residence. In her research, Chládková et al. [16] also showed the highest proportion of supermarkets as places of sale of wine (45.2% of respondents buy wine in supermarkets and 23.8% in wine shops).

Based on the results of the Chi-square test, a Multinomial Logistic Regression model was again created. The

Table 10. Omnibus Likelihood Ratio Tests of the question "Which wine do you prefer?"

Predictor	χ^2	df	p
age	23.15	12	0.0265
education	2.55	2	0.2801
gender	11.76	2	0.0028
Income	14.82	8	0.0628

Source: own processing.

Table 11. The results of the chi-square test of the question "Which wine do you prefer?".

Criterion	$\chi 2$	Critical value	Result
gender	0.808905	5.991465	not rejected
age	6.010452	9.487729	not rejected
education	20.22551	5.991465	rejected
income	27.54793	15.50731	rejected
size of residence	5.039119	15.50731	not rejected

Source: own processing.

Table 12. The results of the multinomial Logistic Regression of the question "Which wine do you prefer?"

Model	R^2_N	χ^2	df	p
3	0.03	41.67	10	< .0001

Source: own processing.

Table 13. Omnibus Likelihood Ratio Tests of the question "Which wine do you prefer?"

Predictor	χ^2	df	p
education	12.57	2	0.0019
income	21.28	8	0.0064

Source: own processing.

reference category was the largest category – supermarket shopping and only the variables age and size of the municipality, which are statistically significant according to the Chi-square test, were included in the model.

The results of the multinomial logistic regression are presented in the following Table 15.

Based on the result of the Likelihood Ratio test, we accept the alternative hypothesis, i.e. at least one predictor is statistically significant at the 5 % significance level. However, it should be noted that this significance level is very marginal. A Nagelkerk pseudo R^2 of 0.02 indicates a very small effect of the predictors on the explanatory variable.

Table 16 summarizes the impact of each predictor on different categories of the dependent variable. It is clear from the table that at the standard 5 % significance level, only municipality size has an effect on the dependent variable.

The last question tested is the price range of purchased wines. Respondents chose from the following price categories: up to CZK 70, CZK 70–100, CZK 100–150 and over CZK 150. From the point of view of absolute frequencies, people buy wine the most in the price category CZK 100–150, the least in the category up to CZK 70. Tested hypothesis:

- H07: The gender, age, education, income and size of residence do not significantly predict the choice of price category when buying wine.

The results of the chi-square test are shown in the following table (Table 17).

The research has shown the existence of a relationship between the price range of wine and gender, age, income and size of residence.

Based on the Chi-square test results, an Ordinal Logistic Regression model was created. The reference category was the last category – over CZK 150. All explanatory variables were included in the model except education, which is statistically insignificant according to the Chi-square test.

The results of the ordinal logistic regression are shown in the following Table 18.

Table 14. The results of the chi-square test of the question "Where do you buy wine most often?".

Criterion	χ2	Critical value	Result
gender	0.990744	5.991465	not rejected
age	21.45865	18.30704	rejected
education	0.612048	5.991465	not rejected
income	7.424061	9.487729	not rejected
size of residence	16.73919	15.50731	rejected

Source: own processing.

Table 15. The results of the multinomial Logistic Regression of the question "Where do you buy wine most often?".

Model	R^2_N	χ^2	df	p
4	0.02	31.79	20	0.0456

Source: own processing.

Table 16. Omnibus Likelihood Ratio Tests of the question "Which wine do you prefer?"

Predictor	χ^2	df	p
size of residence	17.66	8	0.0239
age	13.00	12	0.3689

Source: own processing.

Table 17. The results of the chi-square test of the question "In what price range do you most often buy wine?".

Criterion	χ2	Critical value	Result
gender	17.41022	7.814728	rejected
age	67.97642	12.59159	rejected
education	3.231538	7.814728	not rejected
income	36.23751	15.50731	rejected
size of residence	137.8922	21.02607	rejected

Source: own processing.

Table 18. The results of the ordinal logistic regression of the question "In what price range do you most often buy wine?".

Model	R^2_N	χ^2	df	p
5	0.02	36.69	15	0.0014

Source: own processing.

Table 19. Omnibus Likelihood Ratio Tests of the question "In what price range do you most often buy wine?".

Predictor	χ^2	df	p
Age	9.9	6	0.1288
Size of residence	3.63	4	0.4588
Gender	0.2	1	0.6566
Income	25.21	4	<.0001

Source: own processing.

Based on the result of the Likelihood Ratio test, we accept the alternative hypothesis, i.e. at least one predictor is statistically significant at the 5 % significance level. Nagelkerk's pseudo R^2 of 0.02 indicates a very small effect of the predictors on the explanatory variable.

Table 19 summarises the impact of the individual predictors. The table shows that at the standard 5% significance level, only income has an effect on the dependent variable.

4. DISCUSSION

Wine is one of the most frequently consumed alcoholic beverages in the Czech Republic. There can be several motivations for wine consumption; Anchor and Lacinova [18] points out that one of the strong motives for wine consumption is social respect, which occurs especially in the young generation. However, it is possible to go even further, and Oyinsey's et al. [19] article, for example, is suggestive, as it takes into account a multidimensional experiential framework that seeks to uncover the dimensions that shape the experience of wine consumption. Over the last 20 years, the Czech Republic has shown significant and sustained growth in consumption, which is faster than growth in wine production. However, domestic production still exceeds wine consumption. The growing consumption of wine is also reflected in the growing demand for wine imports. However, this is not just a matter for the Czech Republic, but as Bonn [20] shows, as awareness grows, so too does demand, globally [21]. The growing consumption of wine is also reflected in the growing demand for wine imports. From the point of view of the structure of the foreign wine trade, imports of sparkling wine are growing the fastest, but the largest item of foreign trade is the import of still wine. Straková [22] adds that with the growing frequency of wine drinking, the consumption of Moravian and Czech wines prevails over foreign ones.

Knowledge of the consumption and purchase motives of citizens of the Czech Republic, especially the young generation, is especially important for understanding the Czech wine market, as these people are the current and future consumers of wine [23]. The research has shown the following conclusions: the frequency of wine drinking depends on gender, age and education. Here it can be further noted that gender not only affects consumption, but also preferences and customer satisfaction, for example Mitchell and Walsh [24], Atkin et al. [25]. The same is also true in the case of age- in addition to consumption, it has an impact on both of the above, for example Thach and Olsen [26] or Olsen et al. [27]. There is a relatively higher frequency of wine drinking among women than men, wine consumption increases with age and there is higher wine consumption among people with lower education. In the case of testing wine type preferences, dependence on gender, age, education and income was confirmed. Consumption is clearly dominated by the consumption of white wine. White wine is clearly preferred more by women, it also dominates across all age categories. Consumption of white wine also increases with increasing education and decreases with increasing age. On the fact that age can play an important role in preferences, for example, the article by Hammond et al. [28] which states age is important in wine consumption, but also in wine preferences, on consumption behavior. Consumption of semi-sweet wines clearly dominates in the decision-making on wine consumption in relation to the sugar content in wine. The dependence of the consumption of individual types of wine on education and income was proven. With increasing education, the consumption of sweet wines decreases and consumer preferences are shifting in favour of dry wines. Consumption of dry wines also increases with income, whereas consumption of sweet wines decreases with increasing income. In terms of the place of purchase of wines, supermarkets clearly dominate. The research has shown a relationship between the choice of place to buy wines and age and the size of residence. With age, the amount of purchases from the wine-maker increases and the number of purchases in supermarkets decreases. Němcová and Stankova [29] confirms that the most common places of purchase for generation Y are supermarkets and wine shops. From the point of view of the price category of wines, the consumption of wines in the price range of CZK 100–150 dominates the most. The results confirm, among other things, the research of Chládková et al. [3], who identified the most important factors influencing wine consumption in the form of consumer disposable income, product price and the existence of available substitutes (she considered beer in particular). Here, however, is the limit of this article, as it does not distinguish between the price a consumer would prefer when buying wine for themselves and when buying wine as a gift. As Cholette and Castaldi [30] point out, the price when buying wine as a gift tends to be higher. As Yu et al. [31] finds, this difference can be as much as ten times greater.

If we compare the results of the presented research with the findings of the research carried out in Italy, we observe certain differences. Consumer preferences when buying wine in Italy using the "best-worst" scaling method have shown that direct, especially sensory experiences of consumers are key when choosing wine

in retail stores. The local statistical analysis showed that the age of consumers plays a role in the selection of wine in retail stores, the geographical location has not been proven [32]. Gil and Sánchez [33] analysed the factors shaping demand in Spain, especially between two different regions, Aragon and Navarre, using a weighted least squares approach. The research focused on three attributes, namely the price, origin and vintage of the grapes. Surprisingly, the presented results (at least in comparison with the results of research from the Czech Republic) showed that the most important attribute of wine purchase is its origin, followed by the vintage.

5. CONCLUSIONS

Although the Czech Republic is described as a beer country, the popularity of wine and its consumption shows clear and long-term stable growth. We also observed a positive development in the production of vines, which has a long tradition in the Czech Republic. The question of the future direction of the Czech wine market is promising and further development of the market in terms of production of domestic wine-makers as well as overall consumption and growth of competition can be expected. Related to this is the need for wine producers to submit more to the wishes of demand (customer orientation) and thus the need to know the demand, its structure, preferences, expectations and factors that affect it becomes more important.

ACKNOWLEDGMENT

This work was supported by the Faculty of Economics and Management, Czech University of Life Sciences in Prague under Grant "The impact of climate change on the economic performance of the viticulture and wine-making sector in the Czech Republic" number 2020B0002."

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Wine Economics and Policy

Firenze University Press
www.fupress.com/wep

OPEN ACCESS

Citation: Stefano Massaglia, Tibor Verduna, Vincenzo Varchetta, Filippo Brun, Simone Blanc (2023). The impact of alternative packaging on the life cycle of wine on tap. *Wine Economics and Policy* 12(1): 51-62. doi: 10.36253/wep-13016

Data Availability Statement: All relevant data are within the paper and its Supporting Information files.

Competing Interests: The Author(s) declare(s) no conflict of interest.

The impact of alternative packaging on the life cycle of wine on tap

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Abstract. Sustainability is a key objective of development policies within international organizations, and it is also progressively gaining importance in the wine industry as a whole and, more specifically, in the draught wine market. The competitive conditions of the wine sector and the evolution of consumption styles have led to an increasing need for more accurate management strategies and analysis activities to determine the performance of wineries. This study aims to analyse both the environmental and the economic concerns of a commercial development strategy implemented by an Italian winery that uses three packaging formats (glass bottle, one-way PET keg, and reusable steel keg) in the sale of Falanghina PGI wine on three different markets (domestic, Italy; regional, Germany; and international, USA). By assessing the environmental and economic impact of the different formats on the three scenarios through LCA and LCC analysis, it is revealed that the economic and environmental sustainability of packaging types can vary significantly depending on the market destinations. In any case, the results show that PET, and especially reusable materials such as steel, can lead to a marked reduction in impacts on the market for tapped wine.

Keywords: Life Cycle Assessment (LCA), Life Cycle Costing (LCC), wine, packaging.

1. INTRODUCTION

Sustainability is undoubtedly a key objective of development policies within international organizations. The European Union (EU), through its *Europe 2020 Strategy*, aims to promote smart, sustainable, and inclusive growth. Sustainability has also gained importance in the wine sector and has led to companies and consumers being more aware of this issue within the wine supply chain [1,2].

Consumer awareness in particular plays a central role in encouraging wine producers to pay close attention not only to economic aspects but also to the environmental impact of wine at different stages of its life cycle [3].

About 258 million hl of wine were produced during the 2019 campaign, according to the International Organisation of Vine and Wine (http://www.oiv.int). Moreover, competitive landscapes in the wine sector and high fragmentation of consumer behaviour have led to the need for management planning and tighter monitoring of costs. The precise estimation of the production cost of a litre of wine is an essential basis for setting up the different processing steps and for developing appropriate marketing strategies [4–6].

The consumption of wine at entertainment venues such as restaurants and bars highlights the need to find a compromise between environmental and economic costs, in order to ensure the consumer has a pleasant, reasonably-priced and sustainably-valued consumption experience. To this end, the choice of wine packaging can impact significantly on limiting environmental impacts and reducing costs. In recent years, several alternative packaging options have been adopted in the beverage sector. In addition to traditional glass bottles, wine is marketed to on-premise markets in large bag-in-box containers, PET (polyethylene terephthalate) kegs, and steel kegs [7].

Two distinct and contrasting aspects arise in the choice of packaging: on the one hand, retailers prefer large-volume packaging due to its convenience; on the other, consumers prefer glass-bottled wine due to environmental concerns about plastic pollution [8]. Another important aspect, as indicated by several authors [9,10] is that consumers' purchasing decisions are influenced by the end-of-life of the product rather than the environmental impacts in the production and transport phases.

With regard to on-premises markets, PET and steel kegs appear to be the most promising competitors to glass. Both contain more volume for the same weight, and steel can be used multiple times, theoretically with endless use. In addition, the distribution phase is more critical for glass, due to the fragility of the material, which also has a major impact on secondary and tertiary packaging and on the type of materials used (pallets, films, and carton boxes) [11].

In recent years, the use of steel kegs for serving wine on tap has increased dramatically, especially in the United States, Australia, and New Zealand [12]. In Europe, the use of bottles is widespread, but innovative alternative packaging seems to be appreciated both by retailers, who want to reduce the costs generated by waste by enhancing the efficiency of resource management and distribution, and by consumers who are more and more interested in sustainable wine consumption [13].

Two methodologies deemed by academics as most suitable for assessing the environmental impacts and the economic aspects of agri-food products during their life cycle are the Life Cycle Assessment (LCA) and the Life Cycle Costing (LCC).

Recent studies have investigated the environmental impacts of wine grape production [14], grape cultivation and wine making [15,16]. Other works have considered the life cycle of a wine bottle [17] and the environmental impacts of consumption [18]. Cultivation [19–21] and the wine-making process [22,23] have also been studied from an economic point of view.

In recent literature, studies can be found that relate PET and steel kegs for beer consumption [24,25], but only one paper assesses the environmental impact of PET keg adoption in the wine industry [26].

In light of the above, the research question is related to the environmental and economic competitiveness of different materials commonly used for packaging wine sold on local and international markets.

The objective of this study is to evaluate the environmental impacts and life cycle cost of three packaging systems (glass vs. PET vs. steel) of Campania's Falanghina PGI wine on tap, in three market scenarios, i.e. local, Italy vs. regional, Germany vs. international, USA. Alternative scenarios are defined considering the variation of the three packaging systems and the distance of distribution on the market in order to identify the aspects that most influence the environmental and economic performances of wine on tap.

The case study is an Italian winery (located in the Campania region), which processes 7,300 hl of wine, mostly marketed in 20 l stainless steel keg containers, in 0.75 l glass bottles and in 20 l disposable PET keg recipients.

The wine portfolio consists of 22 references, two of which are light sparkling wines that account for more than 30% of all wines in terms of volume. Among still wines, Campania Falanghina PGI (obtained by an autochthonous/local cultivar) represents the largest in terms of volume share and annual growth rate.

The hypothesis is that large packaging that can be reused several times is less impactful from an environmental and economic viewpoint than packaging used only once.

2. METHODOLOGY

2.1. Functional Unit and system boundaries

The volume of the beverage is typically chosen as the functional unit (FU) for LCA and LCC analyses and, in particular, other studies that have focused on wine have defined their FU as 0.75 l or 1 l of wine [27,28]. When analysing the consumption of wine on the premises, we

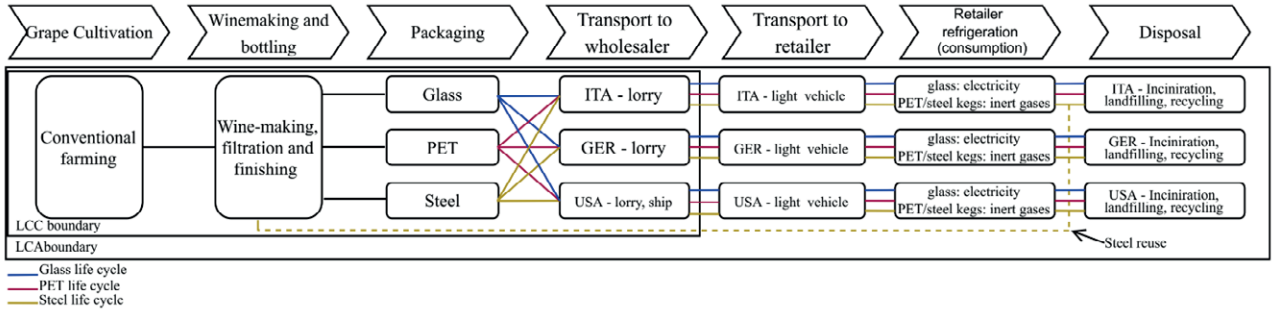

Figure 1. System boundaries.

chose a 125 ml glass as FU, because that allowed us to compare Falanghina PGI wine marketed in different volume packages.

We considered the on-trade markets to carry out a cradle-to-grave environmental analysis, while the economic analysis was conducted from cradle to wholesale. Cultivation of grapevine, winemaking, packaging, transport, refrigeration and waste management were considered and the allocation method by mass was used, considering that the wine yield of a unit mass of grapes is about 70%.

The decision to adopt two systems lies in the fact that there are limitations when estimating both the transport costs from the wholesaler to the retailer and the product handling phase at the point of sale: the wine storage and service phase by the retailer could not be calculated because of the high variability due to the intrinsic characteristics of the shops, which results in very different costs (Figure 1).

2.2. LCA methodology

2.2.1. Inventory analysis and impact assessment

The software tool SimaPro 8.5 (PRE Consultants, Amersfoort, The Netherlands) was used to perform the LCA.

For vine growing, winemaking, packaging and transport, we obtained primary data from the winery; for refrigeration and disposal, we used background data from the Ecoinvent v.3.7 database.

The environmental impacts of the three packaging techniques and the three markets were calculated by adopting the IMPACT 2002+ method.

2.2.2. Grape cultivation

Grape cultivation was analysed from cradle to farm gate. We assumed that Falanghina PGI grapes are grown with a conventional farming model. All input was provided by the farmers, and we processed it considering the production cycle in the following phases: fertilisation, fungicide treatments, pesticide treatments, pruning, inter-row management, irrigation, and harvesting.

It was assumed that the vineyard is in full production, and vineyard establishment and end-of-life were excluded from the assessment as these stages represent minor impacts due to the long (and uncertain) lifespan of the vineyard.

Table 1 shows data for agricultural operations.

2.2.3. Winemaking

The vinification phase considers two steps:

Step 1 – Winemaking with all related operations (Table 2)

Step 2 – Filtration and finishing with addition of pre-packaging products (Table 3)

Table 1. Inventory data for vineyard (amount per 125 ml of wine).

	Unit	Amount
Input from nature		
Water	m^3	1.49E-02
Input from the technosphere		
Diesel	kg	4.06E-03
Lubricating oil	kg	8.78E-05
Urea, as N	kg	5.00E-04
Ammonia	kg	3.33E-04
Phosphate fertiliser	kg	4.17E-04
Potassium fertiliser	kg	4.17E-04
Sulphur trioxide	kg	6.25E-04
Dithiocarbamate-compound	kg	9.52E-05
Copper oxide	kg	1.49E-04
Sulphur	kg	2.34E-04
Poles, softwood, PCP treated	m^3	1.98E-04
Aluminium around bimetallic steel wire	m	8.93E-03

Table 2. Amount of all input in the first wine-making step (per 125 ml of wine).

Input	Unit	Destemming and crushing	Fermentation	Racking	Clarification	Cleaning	Cooling
Energy	kWh	3.50E-04		2.50E-05			1.33E-02
Yeasts	G		2.50E-02				
Potassium metabisulphite	g		6.25E-03				
Fermentation activator	g		5.00E-02				
Enzymes	g		1.25E-03				
Bentonite	g				6.25E-02		
Detergents	g					7.00E-02	

Table 3. Amount of all input in the second wine-making step (per 125 ml of wine).

Inputs	Unit	Amount
Water	g l^{-1}	2.70E-03
Electricity	kWh l^{-1}	3.75E-04
Potassium metabisulphite	g l^{-1}	6.25E-03
Colloids	g l^{-1}	1.88E-02
Tanning	g l^{-1}	1.25E-03
Lightener	kWh l^{-1}	1.75E-03

Table 4. Input in glass bottle packaging (per 125 ml of wine).

Input	Unit	Amount
Glass bottle	g	75
Cork closure	g	6.88E-01
Capsules	g	1.33E-01
Label	g	1.40E-01
Electricity	kWh	4.00E-03
Water	g	2.00E-02
Nitrogen	g	1.00E-01
Cardboard	g	6.34

2.2.4. Packaging

Three different wine packaging systems were considered: 0.75 l glass bottle, 20 l PET keg and 20 l steel keg.

Both the glass bottle and the PET keg are one way, while the steel keg is recyclable; therefore, the amount of steel per FU depends on the reference market scenario (Italy, Germany, or USA) and on the lifetime of the kegs. The winery declared that the life cycle of steel kegs lasts about 10 years and the number of roundtrips depends on the destination: 9 roundtrips/year for the Italian scenario, 5 roundtrips/year for the German scenario, and 2 roundtrips/year for the US scenario.

Considering the weight of the 20 l steel keg (6.4 kg, or 40 g FU^{-1}), its lifespan and the number of roundtrips, the right amount of steel FU^{-1} for each scenario is the following:

- 0.4 g steel FU^{-1} in the Italian scenario
- 0.8 g steel FU^{-1} in the German scenario
- 2.0 g steel FU^{-1} in the US scenario.

Tables 4, 5 and 6 show the input used for each type of packaging.

To calculate the amount of packaging film used to wrap pallets, the European standard pallet size (0.8 m x 1.2 m) with an average height of 1.8 m [29] were assumed.

Table 5. Input in PET keg packaging (per 125 ml of wine).

Inputs	Unit	Amount
PET	g	6.25E-01
Capsules	g	7.25E-02
Electricity	kWh	3.88E-04
Fuel	g	2.38E-03

Table 6. Input in steel keg packaging (per 125 ml of wine).

Inputs	Unit	Amount		
		ITA	GER	USA
Stainless steel	g	4.45E-01	8.00E-01	2.00
Capsules	g	7.25E-02	7.25E-02	7.25E-02
Electricity	kWh	3.13E-03	3.13E-03	3.13E-03
Water	g	1.25E-01	1.25E-01	1.25E-01
Nitrogen	g	1.25	1.25	1.25

2.2.5. Transport

The wine wholesalers are located in Verona (for the Italian scenario), Frankfurt (for the German scenario)

and New York (for the US scenario) respectively, thus causing a different environmental impact due to both the distance and the vehicles used during transport. The estimation of vehicle emissions was carried out considering the average values of emissions from the use of Euro 4, Euro 5 and Euro 6 lorries [29], light commercial vehicles and, for the US scenario only, transoceanic ships.

- Italian and German scenarios: The distance between the winery and the wholesaler is 700 km for the Italian scenario and 1,450 km for the German scenario; a lorry (32 tonnes) was considered for the transport. The average distance from the wholesaler to the retailers was assumed at 150 km for both scenarios, considering a light commercial vehicle.
- US scenario: For overland transport from the winery's headquarters to the port of Livorno (Italy), 550 km were assumed with a 32-tonne truck. For transport from Italy to the wholesaler located in the port of New York, a transoceanic ship with cooling was considered. From the wholesaler to the retailer, a light commercial vehicle was considered, for an average distance from wholesaler to retailer of 50 km.

2.2.6. Retailer refrigeration

During the refrigeration phase, the electricity consumption for the glass bottle scenario was assumed to be 1.025E-03 kWh FU^{-1} in 12 hours of refrigeration (average time assumed before wine tapping). For the PET keg and steel keg scenarios, the use of electricity is limited to the tapping phase (Table 7) and the refrigeration is managed using inert gases, leading to a refrigerant loss, which was also considered. The leakage of R404A and its three components for FU are shown in Table 7; as also reported by Amienyo and Azapagic [24], the Global Warming Power of R404A was estimated in 3.860 kg CO2 eq. kg^{-1}.

2.2.7. Packaging end of life (waste management)

The end-of-life phase of packaging systems was modelled by considering disposal scenarios consisting of incineration, landfilling, and recycling processes. PET keg and glass bottle are one way, while the steel keg is used for 10 years, then replaced at the end of the life cycle. Regarding the percentages of these processes, official data from each scenario was assumed: ISPRA for Italy [30]; the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety for Germany [31], and United States Environmental Protection Agency for the USA [32].

2.2.8. Scenario modelling

A key option for reducing the environmental impact of wine consumption is closely related to the weight of packaging. In defining the alternative scenario, the potential reduction in life cycle environmental impact was analysed by considering alternative packaging containers with a weight reduction of 33% per glass bottle, PET keg and steel keg.

2.3 LCC methodology

Life cycle costs were evaluated according to [24,33] the methodological approach given in Hunkeler [34]

Table 7. Leakage of refrigerant R404A and its component (amount per 125 ml of wine).

Refrigeration leakage	GWP	R404A losses	1,1,1 – Trifluoroethane	Pentafluoroethane	1,1,1,2 – Tetrafluoroethane
PET keg	2.90	7.50E-04	3.90E-04	3.30E-04	3.00E-05
Steel keg	2.90	7.50E-04	3.90E-04	3.30E-04	3.00E-05

Table 8. Waste management scenarios.

Disposal scenario	Glass			PET			Steel		
	Italy	Germany	USA	Italy	Germany	USA	Italy	Germany	USA
Recycling	74%	85%	31%	44%	93%	14%	78%	91%	74%
Landfilling	26%	9%	55%	13%		69%	22%	9%	21%
Incineration		6%	13%	43%	7%	17%			5%

and Swarr [35] concerning the Conventional LCC calculation.

The following equation (Eq. 1) includes the phases and material useful to calculate the LCC of 125 ml of wine from field to wholesaler.

$$LCCw = Cc + Cp + Cwpb + Ct \quad (1)$$

Where:
LCCw wine life cycle costs of 125 ml of wine
Cc costs of vine cultivation
Cp costs of packaging (glass bottle or PET keg or steel keg)
Cwpb costs of wine production and bottling
Ct costs of transport to wholesaler (Italy, Germany or United States)

All cost items are given per functional unit and reported in the unit of measure € $125ml^{-1}$.

All costs for cultivation, packaging, wine production and bottling were collected directly from the case study company. The LCC was conducted following an activity-based costing approach. In addition, different cost separation criteria and cost centres were taken into account in order to elaborate the balance sheet data set.

Table 9. Categories of direct and indirect costs.

Category	Type of cost	Description
A_1	Direct	Raw materials (Wine)
B_1	Direct	Oenological products
B_2	Direct	Water
B_3	Direct	Detergents
B_4	Direct	Plant electricity consumption
B_5	Direct	Cooling system electricity consumption
B_6	Direct	Inert gas
B_7	Direct	Eno-registers consulting fee
B_8	Direct	Estimates for losses of product
B_9	Direct	Depreciation
B_{10}	Direct	Lab analysis
B_{11}	Direct	Microfiltration membranes
B_{12}	Direct	Rectified grape must concentrate
C_1	Direct	Packaging materials
D_1	Indirect	Production labour
D_2	Indirect	Production equipment depreciation
E_1	Indirect	Leased assets
E_2	Indirect	Consumables
E_3	Indirect	Logistical
E_4	Indirect	General
E_5	Indirect	Bank charges
E_6	Indirect	Personnel
E_7	Indirect	Depreciation

In analytical cost accounting, the most commonly used categories are *direct* and *indirect* costs [36]. Therefore, the primary criterion for separating costs is based on the distinction between:
- Direct Costs, which are allocated directly to cost objects, based on an objective measurement of the input consumed by the cost object;
- Indirect Costs, which are allocated or charged indirectly to the cost object because the amount of the input consumed by the cost object in question has not been objectively measured.

The above categories have been broadly divided (as shown in Table 9) into direct and indirect costs.

Category A includes direct costs for raw materials; category B (B1, B2, …, Bn) includes direct costs of different types; while category C is the direct cost for packaging. Category D indicates indirect costs and considers labour costs for packaging (D1) and depreciable assets (D2); finally, category E includes general indirect cost centres (E1, … Em).

The transport phase for the three scenarios is external to the company and was calculated through the analysis of contracts with transport companies.

3. RESULTS AND DISCUSSION

As shown in Figure 2 and 3, the resource (expressed in MJ of primary energy) and climate change (kg CO2 eq.) indicators in the three scenarios were compared to assess the environmental impact of glass bottle, PET keg and steel keg packaging for the selected FU.

For both indicators, the total environmental impact of each type of packaging is given by the sum of the following phases:
- Cultivation
- Winemaking
- Packaging
- Transport to the wholesaler
- Transport to the retailer
- Refrigeration
- Waste management

As the cultivation and winemaking techniques are the same regardless of the type of packaging, their environmental impact is equal for each scenario. In terms of resources used, the sum of their values is the highest of all the phases considered (2.3 MJ primary energy FU^{-1}), while in terms of GWP they barely reach 0.06 kg CO2 eq. FU^{-1}.

In terms of resource consumption, the vineyard cultivation and winemaking phases remain among the most

impactful; however, in the case of scenarios involving the use of glass bottle packaging, the latter becomes relevant in defining the overall impact.

The production steps that lead to a greater difference between the three scenarios considered are packaging and transport for two reasons: 1) the amount and type of raw material used in packaging and 2) the distance between cellar and retailer. The glass bottle is the most impactful packaging, followed by the PET keg and the steel keg; the higher quantity of raw material used for the glass bottles and the total weight of each batch led to a greater environmental impact.

Regarding the impact of transport, it is obviously linked to distance: the greater the distance, the higher the environmental impact. Therefore, the "US scenario" has the highest values, followed by the "German scenario" and the "Italian scenario".

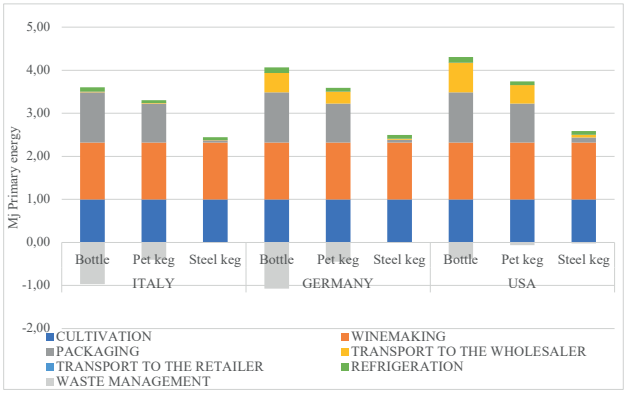

Figure 2. Resources: environmental impact of glass bottle, PET keg and steel keg in the three scenarios considered (Italy, Germany and USA).

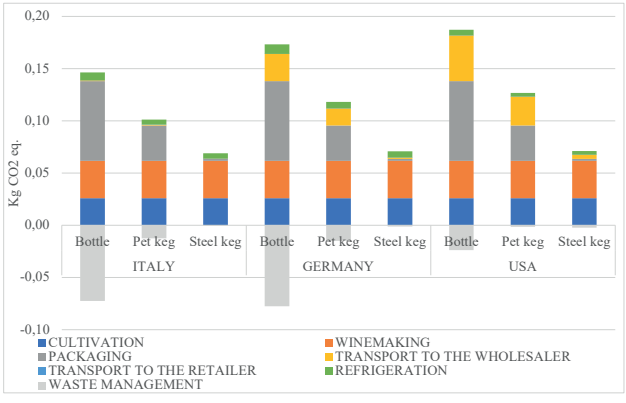

Figure 3. Climate change: environmental impact of glass bottle, PET keg and steel keg in the three scenarios considered (Italy, Germany and USA).

Also considering waste management, glass bottles can become competitive again in Italy and Germany, thanks to the high level of recycling of this material and the low percentage of landfill disposal.

Table 10 shows the results of the scenario analysis, highlighting the different impact of packaging weight reduction in the market scenarios investigated. A significant change emerges with the use of the glass bottle as the primary packaging container. In this case, the Climate Change indicator shows a reduction in impact of as much as 1/3 for the commercial scenario on a domestic scale, clearly evidencing the impact of this type of container on the product life cycle. Less sharp results were obtained on a regional and international scale, but again there is evidence that a significant share of the overall impact is attributable to the container. For the PET keg container, the reduction results, although appreciable, are more limited, also considering the large volume transported per single unit. The use of the steel keg shows no significant difference, considering the re-use of the container for several trips. These results also express the relationship between packaging weight and distance travelled to market, highlighting the strong environmental impact of packaging for short-marketed products.

The cost analysis shows the high competitiveness of the steel keg format compared to the PET keg and the glass bottle, due to the possibility to reuse the packaging and thus spread the purchase costs over many trips. The least competitive scenario is where the glass bottle is used, mainly because of the cost of buying glass. Considering the costs incurred by the winery to deliver the wine in the three scenarios (Table 11), it can be seen that, on the domestic market, the most competitive format is the steel keg; for the European destination, the choice of one of the two keg formats analysed does not influence the total cost. For the US scenario, the most competitive format is the steel keg (-3.4% compared to PET).

Looking at individual cost items, raw material (wine), category A is the item that alone accounts for most of the costs in the PET and steel keg scenarios, while for the glass bottle, category B represents the highest costs.

The packaging (category C) in steel keg accounts for 0.3% of production costs; this value rises to 3.5% for PET keg and 4.1% for the glass bottle.

Going into greater detail, the wine production and bottling phase (categories B and D) differ in the use of the three types of packaging, due to manual labour in the bottling phase and in all the phases prior to bottling, such as the cleaning of each container, the management of the bottling line, and the subsequent activities of warehouse logistics. In particular, category B is

Table 10. Scenario modelling results (33% of weight reduction for packaging).

	Glass			PET			Steel		
	Italy	Germany	USA	Italy	Germany	USA	Italy	Germany	USA
Resources	-13%	-12%	-10%	-7%	-7%	-6%	-2%	-1%	-1%
Climate change	-30%	-26%	-15%	-8%	-7%	-6%	0%	0%	0%

Table 11. Cost analysis results (€ FU^{-1}).

Format	Production cost categories					Transport scenario			Total costs scenario		
	Cultivation	Wine production and bottling				IT	GE	US	IT	GE	US
	A	B	C	D	E						
Glass bottle	0.1150	0.1221	0.0116	0.0100	0.0263	0.0163	0.0350	0.0383	0.3013	0.3200	0.3233
PET	0.1150	0.0394	0.0069	0.0113	0.0263	0.0113	0.0250	0.0276	0.2100	0.2238	0.2264
Steel keg	0.1150	0.0132	0.0005	0.0163	0.0263	0.0225	0.0525	0.0475	0.1938	0.2238	0.2188

higher for the glass bottle because of the higher energy consumption of the various machines that constitute the line, compared to the keg plant and the high incidence of the fixed costs of the plant. Conversely, category D is higher for kegs because the incidence of the cost of personnel employed in the various operations is higher than for other production lines.

Turning to transport costs, carriers define unit costs that depend on the kilometres travelled and the type of material. PET packaging is the cheapest on all routes because it is the lightest in terms of volume transported. Glass remains competitive on the domestic market, but not on the European and US markets. For steel packaging, the return of the empty container is also considered in the costs shown.

Packaging in the food industry has to consider various environmental and economic requirements in addition to marketing, logistics, and production. As another study [37] points out, there are two central elements to focus on when choosing the right packaging: the packaging material and the packaging end-of-life. The packaging sector evolved initially because of the need to produce new materials for technological reasons related to wine transport and preservation. Currently, the need to find effective ways to reduce costs and environmental impact have led to new design paradigms [38].

This study shows that wine steel and PET have comparable and significantly better economic performance than glass packaging, with steel achieving the best environmental results. Similar considerations were expressed by Brock and Williams [39] who found that glass and the recycled glass bottle are still the most impactful packaging. Another study confirms the findings of this work for beer [40], with glass containers appearing to be the most expensive compared to steel. Reusable packaging systems therefore appear to be more competitive in the supply chain than single-use packaging, as also demonstrated by Mahmoudi and Parviziomran [41].

In these terms, it is difficult to find alternative solutions considering on the one hand the tradition of using the glass bottle container and, on the other hand, the perception of the consumer.

Not all studies agree on the importance of wine packaging, but it seems that bottle design may play an important role in some old-world markets that are more tied to tradition [42], but also in relation to more innovative products, as for fruit wines that highlight the fundamental role of packaging in defining the attractiveness of the product [43]. A recent study [44], indicates that Portuguese consumers associate the heavier glass bottle with better quality and a higher price, while at the same time expressing concerns about the presence of plastic in the packaging that may reduce recyclability and reuse.

This condition is less evident for tap wine, but the cultural link with tradition can potentially influence the choice. Nevertheless, the role of the consumer has been changing in recent years, and more and more attention is being paid to environmental claims and to the communication of the role of limiting impacts by wineries [45], which now consider their carbon neutrality and containment process as development objectives in the medium and long term.

Moreover, in the last few years, experiments are being conducted to evaluate alternative packaging such as bio-

plastic bottles, which would guarantee a reduced environmental footprint but would be more expensive [46,47]. Compared to our case study, the use of PET kegs seems to be interesting from an economic point of view; however, from a circular economy perspective and considering the increasing awareness of consumers on the use of recyclable and reusable products compared to the classical disposable ones, it seems inevitable for companies operating in the beverage sector to adopt green strategies [48].

In addition, when considering wine packaging, one must actually refer to three levels of packaging: primary packaging, which includes the container intended for the end consumer and with the function of protecting and advertising the product; secondary packaging, used to group bottles, for example in cardboard boxes; tertiary packaging, such as containers used to combine groups of packages into larger loads for transport [49]. The discourse, therefore, becomes broader and refers to many materials, paper, cardboard, plastic, and wood *in primis*. These materials are also chosen by the industry according to the form of distribution.

The transport of wine has emerged as one of the main causes of environmental impact both because of direct emissions, mainly due to fuel consumption during logistics and product handling, but also indirectly because it determines the choice of packaging materials, especially secondary and tertiary packaging, and therefore requires more effective solutions. Other studies also confirm the results of this research and emphasise the need to analyse the role of packaging in the agro-food system from a holistic point of view considering its interaction with the logistics phase [50].

Finally, focusing on the end-of-life results obtained by the different packaging systems, the glass bottle generated the greatest environmental benefits, due to its efficient waste management system, mainly based on recycling. However, its impact is greater than the other two systems, as reuse, in the case of steel keg, seems to be a strong point for sustainability, as confirmed by other authors [51]. In order to limit environmental impacts and costs, new packaging, such as bag-in-box and Tetra Pak with integrated use of cardboard or paperboard layers, has entered the wine market in recent years, with the dual aim of maximising the volume transported and containing costs, while at the same time reducing environmental impact at the end of life. However, even these products are only partially recyclable [52].

3. CONCLUSIONS

This study lays the basis to support wineries, merchants, and retailers in their choice of wine packaging, taking into account the different target markets.

This is the first study in the wine sector to consider the entire product life cycle, by assessing both the dynamics and environmental impacts and costs with reference to all phases of the life cycle (production, transformation, distribution, consumption, and end of life). In this way, it has been possible to respond to a need of the industrial and logistics worlds that until now were not in a position to highlight the cost and environmental impact hot spots of the various phases that characterise wine consumption. We have been able to confirm that the glass bottle is still the most popular and appreciated packaging among consumers, probably for sentimental reasons and links with tradition. However, this container has obvious limits from the point of view of the circular economy, considering the limited volume transported for the same weight of the container, compared to other alternatives available on the market today.

Considering the above, companies are studying the possibility of using alternative packaging on the on-premise market, given that the use of glass bottles requires skilled employees, high cost technology, large space for storage and bottling equipment such as additional pack accessories: cork, screwcap, or cardboard. In addition, as the scenario analysis also showed, the traditional packaging consisting of the glass bottle makes a strong environmental contribution to the entire life cycle of the wine.

In this respect, PET kegs prove to be particularly competitive, especially because of their limited weight and considering that each keg carries the equivalent of more than 26 glass bottles; moreover, wineries do not have to consider backhaul and handling charges and there is no need to store empty containers. In addition to the obvious advantages for logistics and limited costs, the one-way use of this container, coupled with not always guaranteed recyclability, introduces doubts about its use from an environmental point of view.

The steel keg has interesting technological features, theoretically no end-of-life (unlimited use), and cleaning, filling, and packaging technologies that are much easier to handle than the bottle crate, and which are much less expensive. Furthermore, this container has a high material performance in terms of wine shelf life and is also suitable for sparkling wines.

On the other hand, this packaging has return transport costs, administration (book-keeping) and handling costs for the management of a keg, initial investment costs for the keg, and repair costs (higher for long routes or constant circulation rate). Therefore, companies need a surplus of containers throughout the year to manage seasonal fluctuations. Moving empty kegs over long

routes increases the environmental impact and transport costs, and the process of washing and sanitising kegs before each use wastes water, energy, and chemicals.

Reusable packaging systems appear to be a viable alternative to replace single-use packaging in supply chain systems. The decision-making processes of companies should therefore include an analysis of the feasibility of using reusable packaging systems considering environmental and economic factors.

The future of research could lie in new forms of packaging eco-design, using materials with low environmental impact throughout the life cycle, aimed at improving container management in the logistics system. Therefore, with a view to optimising the whole chain, both environmental and economic factors should be considered organically through optimisation models applicable at cellar level. Furthermore, for future studies, it will be useful to consider case studies related to larger volume production, as the case examined refers to a production example of a medium-high range, low-volume wine. Likewise, the research should also investigate other markets, including emerging ones.

Another aspect concerns the consumer's approach to wine from different containers, which often favours glass. Consumer behaviour could be directed towards less impactful packaging with appropriate information campaigns both on the quality aspects of wine – which does not vary in containers made of different materials – and on the social commitment to reduce the impact of wine on the climate.

Finally, a central role could be played by institutions at various levels, both central and local, which could promote market-based schemes to reduce emissions based on taxes on environmental externalities, to internalise society's costs for the use of impactful packaging, and to translate environmental impacts into economic form.

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Wine Economics and Policy

Firenze University Press
www.fupress.com/wep

OPEN ACCESS

Citation: Roberta Sardone, Simonetta De Leo, Davide Longhitano, Roberto Henke (2023). The new CAP and the challenge of sustainability: a synthetic indicator for the Italian wine sector. *Wine Economics and Policy* 12(1): 63-80. doi: 10.36253/wep-13468

Data Availability Statement: All relevant data are within the paper and its Supporting Information files.

Competing Interests: The Author(s) declare(s) no conflict of interest.

The new CAP and the challenge of sustainability: a synthetic indicator for the Italian wine sector

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Abstract. Among the keys enabling the actors of the food chain to become more sustainable, the Strategy assigns an important role to knowledge and information. For this reason, the Farm to Fork Strategy aims to make the Farm Accountancy Data Network (FADN) the main data source of sustainable indicators, turning it into a Farm Sustainability Data Network (FSDN). Wine not only represents one of the most important products of the Italian agri-food system (value of turnover and exports), but it is also characterised by a widespread use of traditional certification systems (PDO/PGI, Organic), to which in recent years specific certifications of sustainability have been added, evaluated through its threefold dimension: economic, environmental, and social. Indeed, wine is much ahead of other sectors in the process of sustainability certification both for the process and the product itself. The paper is an effort to test the current set of information included in the FADN and some related computable indicators as a feasible tool for the assessment of sustainability in the wine sector. The goal of this paper is twofold. Firstly, we assess the actual level of sustainability of the wine sector in Italy through an indicator that synthetizes the three dimensions (economic, environmental, and social) of sustainability at the regional level. Secondly, more in general, we test the current capacity of the FADN information to provide a reliable measure of sustainability given the intention of the EU legislator to switch the European data network from FADN to FSDN.

Keywords: sustainability, wine sector, CAP Reform, FADN.

1. INTRODUCTION

The last few years have seen the prevalence of the paradigm of sustainability in all fields of production and development. After the launch of Agenda 2030 in 2015 and the 17 Sustainable Development Goals by the United Nation Organisation, all subsequent public policies were aligned to these main policy goals, including EU policies.

With regards to agriculture, the Food and Agriculture Organization of the United Nations (FAO) had already adopted in 1989 a concept of "sustainable agriculture and rural development" based on environmental conservation (soil, water, and animal and vegetal genetic resources), economic viability, and social acceptance [1], aligned with the sustainable development concept from the Brundtland Report and the three dimensions of sustainable development: environmental, social, and economic [2].

Whitin the Common Agricultural Policy (CAP), elements of sustainability were introduced by Agenda 2000 and since then the concept has gained increasing visibility and relevance. Recently, the Farm to Fork Strategy (2020) has set the goal of making the EU food system a standard for sustainability at the global level [3,4,5]. Among the key factors that enable actors in the food chain to become more sustainable, the Strategy assigns an important role to knowledge and information. For this reason, the Strategy aims to turn the Farm Accountancy Data Network (FADN), already widely used in the economic evaluation of agricultural policies, into the Farm Sustainability Data Network (FSDN), the goal of which will be to collect data for new and more accurate sustainability indicators. The transformation of the FADN will be one of the main future challenges, due the fact that its original purpose was limited to the evaluation of the economic performance of farms. The Italian FADN, however, represents an exception, as it has long since broadened the scope of its dataset and, consequently, the type of variables collected. Thus, the capacity of the Italian FADN to measure sustainability more comprehensively is worthy to be tested[1].

Wine not only represents one of the most important products of the Italian agri-food system (value of turnover and exports), but it is also characterised by a widespread use of traditional certification systems (PDO and PGI) and a significant share of organic production. In recent years specific sustainability certifications have been added, which are evaluated in their economic, environmental, and social dimensions. Moreover, wine is often associated with high profile tourism experiences, which add to the perception of wine consumption as a "full experience", connecting good food, convivial lifestyle, and the enhancement of local territories [6].

The increasing attention to the issue of sustainable production processes has also been reinforced by the International Organisation of Vine and Wine (OIV), which has supported the definition of a common ground of general principles of sustainable wine and vine production, and the adoption of a global vision, taking into account environmental, social, economic, and cultural aspects [7].

For all these reasons, and thanks to the many different sustainability programs launched in Italy – the most popular of which are V.I.V.A. and Equalitas[2] – the Italian wine sector is far ahead of others in the certification of sustainability both for the process and the product itself [8,9].

This work aims to test the extent to which the current set of information included in the Italian FADN is suitable for building a feasible tool for assessing the sustainability of the wine sector at the regional level in Italy. The relevance of sustainability in the Italian wine sector and the advanced stage of the Italian FADN in tracing and measuring sustainability make this study particularly innovative and can support the transition from theory to the practical implementation of the three dimensions of sustainability. In fact, after a test phase in the next few years, in 2026 the implementation roadmap of the new FSDN has scheduled the introduction in the database of additional variables necessary to measure the environmental and social performance of farms at the European level.

To our knowledge, other recent studies assessing the sustainability of the wine sector have successfully focused on various aspects of production through questionnaires to wine producers [10,11,12]. Other research has investigated the sustainability of the chain as a whole, focusing mainly on organic production [13] or on models of sustainable business in the wine sector [14]. No recent studies have sought to build a specific context-related synthetic set of sustainability indicators, as it is proposed here. The present study also constitutes the first ever attempt to include social elements of sustainability in the synthetic measure, according to the "triple bottom line principle" [15].

The objective of this paper is therefore twofold. First, we assess the actual level of sustainability of the Italian wine sector with an indicator that synthetizes the three dimensions of sustainability (economic, environmental, and social), developed through a multi-criteria approach (Sustainability Wine Index – SuWI). This indicator can be used to assess the level of sustainability of Italian regions over time. To render measurements comparable across regions, the variables used to build the indicator take the local context into consideration as much as possible. The second and more general objective is to test the current capacity of the current FADN dataset to pro-

[1] For more information on the Italian FADN, please visit https://rica.crea.gov.it/

[2] There are other interesting sustainability schemes at the national and regional level, such as SOSTAIN in Sicily. However, the present analysis is limited to the two most relevant national programs, which the Ministry of Agricultural, Food and Forestry Policies is working to harmonize.

vide a reliable measure of sustainability, in anticipation of the EU legislator's intention to switch from FADN to FSDN[3]. Based on the FADN dataset, the performance of the wine sector is assessed for Italian Regions according to the three dimensions of sustainability, defining a set of indicators for each of them. We then propose a synthetic sustainability indicator based on the results for each Region in each of the sustainability dimensions, which facilitates more general reflections on the use of the current Italian FADN as a sustainability data network.

2. SUSTAINABILITY IN THE WINE SECTOR

2.1 Background and literature review

The wine sector has been particularly affected by the theory and practice of sustainability, for many different reasons: the sector is associated with high profile, responsible consumption; it affects the state of health of local territories; it characterizes local development in a specific way; and it involves both primary production (vines) and the processing industry (wine factories).

An important boost in the recognition of a sustainability certification has come from the many OIV resolutions, which define the general principles of sustainable wine and vine production, including environmental, social, economic, and cultural aspects [16]. In addition, other initiatives focus on specific issues, such as traceability [17] or greenhouse emissions and carbon footprint in the wine industry [18]. It is interesting to observe that both scholars and policy-makers agree on considering sustainability applied to viticulture and wine-making as something different from organic (or biodynamic) production, given the broader and more holistic value placed on the former [9]. In fact, it is now agreed to interpret sustainability not only as an environmental concern but also as a social and economic one: rather than limiting the approach merely to an environmental dimension [19] a proper consideration of the ecological, economic, and social dimensions of sustainability can lead to a change in the unsustainable modes of production and consumption, thus contributing to protecting and managing natural resources and enhancing a bio-economic and circular approach to development [8,20,21].

It is often argued that sustainable viticulture frameworks are the response by the wine territories to the latent demand from customers and markets for more transparency in terms of processes and environmental impacts; they are also viewed as a way to highlight and systematize current practices or to improve and promote innovation processes [9]. For this reason, many studies have focused on the effects of including sustainability issues in strategies of vine-growing and wine production, as well as on consumer perception of the main differences between conventional and sustainable wine, including organic production, certification of origin, bio-dynamic wines, and "free wines".

Given the complexity of a product such as wine, its identification with its origin, and the steady growth of "sustainable" lines of production, reviews on these matters are always very careful in analysing segments of products as well as segments of consumers, which differ widely according to country, region, habits, and attitudes towards environment and sustainability. Previous studies have attempted to classify and compare different tools and legislation across different producer countries, both from the "old wine world" and "new actors" [22,9,23,24].

In the recent literature, many works rely on the conceptualisation of sustainability that originated among wine makers, particularly in the United States and Spain. Pullmann et al. [10] compare wineries and food processors in the US in terms of sustainability, highlighting differences in practices and in performance impacts. Their main findings concern the environmental dimension and show how wine producers in the US are far ahead of food processors in addressing sustainability. Pomarici et al. [11] analyse the perception among Californian wine producers of the costs and benefits (both in economic and environmental terms) of joining a sustainability scheme implemented by the State of California. While most farmers interviewed recognised some form of benefit from sustainable practices, some costs we are also acknowledged. However, all agreed on the positive effect of sustainability on quality and vineyard health. Garcia-Cortijo et al. [12] focus on four drivers of sustainability in Spanish wineries: marketing, financial resources, technologies, and innovation. Their main finding is that consumers perceive communication and innovation as more important than financial and technological resources. This kind of analysis is key to draft policies that support the switch to a sustainable approach and to enhance specific sustainability certifications. Finally, Ferrer et al. [14] propose a model of sustainable business in the Spanish wine sector, associating Spanish wineries to archetypic models, identified as either "high sustainability" or "low sustainability". These differ in terms of the type of marketed product, the integration in the supply chain, and the policies required,

[3] With specific annual surveys it will be also possible to use FSDN to measure the evolution of sustainability in wine production, facilitating periodic comparisons both at the farm and the territorial level.

and sustainability is perceived as an increasing element of competitiveness on the internal and external market.

With regard to studies that look more specifically at the Italian market, Broccardo and Zicari [25] explore the role of sustainability in the business model of small and medium farms operating in the wine sector in Italy. They focus on the profitability of family-owned businesses and on sustainability as a vehicle to innovation in the long run. Their paper illustrates how Italian farms operating in the wine sector integrate sustainability in their business models. The Wine sector in Italy is composed mainly of small and medium size family-owned farms, as well as in Spain and France, the main European producers. In Italy, the wine sector has reached high levels of performance, both in terms of production and exports, becoming one of the standards of excellence of the national agri-food sector. Through interviews with wine producers, relevant academic works [26,27,28] have shown that a significant number of farms has become involved in some sort of "sustainability projects" in order to meet specific needs of their customers, both end consumers and intermediaries (Ho.Re.Ca.). The focus of these projects included organic farming, energy saving, and the reduction of chemical inputs. According to Broccardo and Zicari [25], for most of the interviewed farms, sustainability was understood not only from an environmental point of view, but also from a social one, such as work conditions and quality products. Moreover, for younger producers, sustainability was also perceived as a way to increase territorial stewardship and defence. While a broad interest in sustainability is declared by both family and non-family businesses, its practical implications vary substantially. Sustainability is mostly associated with environmental issues, while the combination of environmental with either social or economic issues is less frequent, especially among non-family farms. Firms that are sensitive to sustainability do not always seek to reduce costs; rather, their main goal is to improve customer fidelity through sustainability goals.

The following studies focus on consumers' choices, and specifically on their perception of sustainable production. Capitello and Sirieix [24] analysed Italian and French consumers' perceptions of sustainable versus conventional wine. The study shows how consumers associate different characteristics and beneficial aspects with different categories of sustainable wines, also depending on their level of knowledge of the sector and their personal involvement with wine consumption. A cross-national study conducted in seven wine-producing countries by Szolnoki [22] revealed different understandings of sustainability in the wine industry even between wine producers located in the same region or country. Recent studies have highlighted that different sustainability certifications have appeared in the past decade in many wine-producing regions [9,29,30]. However, the management of sustainability remains underdeveloped in many of the certification frameworks. In a cross-country analysis of several sustainability-assessment frameworks, Flores [9] noted that sustainability frameworks focus on operational issues, while strategic thinking remains underdeveloped. In addition, according to Moscovici and Reed [30], there is a need for more research into the consumer perspective of sustainability certifications. Capitello and Sirieix [24] demonstrate that there is a lot of room to improve the perception of sustainability in wine certifications and that sustainable wine marketers should place a greater emphasis on the level of consumer involvement with wine and the specific associations made by consumers with the sustainable wine category they want to promote.

Several recent studies have shown that consumers are interested in wines produced in an environmentally friendly or socially responsible manner [31,32,33,34]. However, compared with other industries, consumers hold the perception that the wine industry is already relatively 'green', and this creates one of the biggest barriers to the success of the sustainable wine sector [35,36]. Wine is generally perceived as a 'natural' product; thus, unlike for other 'natural' food products, claims of wine being organic have failed to create an important element of differentiation [8,33,36,37]. The sustainable wine market is evolving into a market segment with a vast growth potential and further product differentiation. So, consumer involvement with the quality of sustainable products and efforts in sustainable production practices remain a challenge for the wine industry.

For the Italian sample, the results confirm previous studies on the sustainable wine market [38]. Among the product-attribute associations, Italian respondents attach importance to the environment and ethics, while price of products does not appear to be relevant. Sogari et al. [39] also confirm a direct relationship between positive attitudes towards sustainable wine, stronger belief in environmental protection, and willingness to pay more. This study also brings new insights in relation to consumers' involvement with wine and EMCB (ethically minded consumer behaviour). EMCB does not appear to be sufficient to explain differences in consumers' perceptions of different sustainable wines. Consumers who best differentiate among wines are interested in sustainability to a limited extent, their choices being driven more by the intrinsic quality of the product than by the sustainability of the process.

Another stream of literature focuses on the shift from traditional to sustainable production, such as in the case of the work by Chaminade and Randelli [40]. The authors focus especially on the territorial dynamics of the innovation process and, more specifically, on the role of territorially embedded innovation ecosystems (TEIE) in accelerated sustainability transformations, with a particular focus on the establishment of the biodistrict of Chianti classico.

Another relevant issue, investigated by Merli et al. [41], is that of building solid indicators for measuring sustainability. This topic is particularly relevant when sustainability becomes key in the allocation of public support to the wine sector and to agriculture in general [42]. It also directly involves the FADN in the debate, since it has often been indicated as the relevant dataset for measuring and assessing the level of sustainability of the main agricultural processes and products. The work by Merli et al. [41] stresses once again the need to investigate sustainability not only through environmental indicators but also by including economic and social ones. However, using Life Cycle Assessment (LCA) as the main methodology, it is very difficult to create a common ground for measuring sustainability, because "life cycle" is interpreted in different ways: from farm to product consumption, from farm to gate, and so on. In general, there is a problem with the definition and dimension of sustainability, and with the definition of the life cycle of the product, and this is particularly true for wine. For this reason, there has been a proliferation of methods and standards for sustainability assessment, in the old as in the new wine production world, and each of them, as reviewed by Merli et al. [41], has its own pros and cons. Sustainability indicators should measure the impact of business activities through a scientific, objective, and shared method. This process should be conducted with the support of stakeholders representing different viewpoints. This would improve both consistency of measurements and scientific solidity. The goals set should focus on a common ground leading to strategies for sustainability, acknowledging, at the same time, differences characterizing individual territories, in terms of production and consumption. The identification of shared and comparable tools is essential in building business networks aimed at achieving sustainability in vineyards and wineries. The variety of instruments, indicators and certifications that have been proposed worldwide may lead to confusion for both farms and consumers, who are unlikely to understand the real benefits of sustainable wine production. The authors conclude that it is crucial to develop a common indicator set for sustainable wine production in order to define clear metrics to monitor the industry's environmental, economic, and social impacts.

2.2 The Italian Programs for Wine Sustainability

Outside the academic world, the interest in sustainability of the wine sector in Italy is proven by the wide range of sustainability programs launched in recent years by private producers and consortia. The large number of different strategies, guidelines, and practices is a positive sign of the concern regarding the issue of sustainability in viticulture. However, farmers and producers might not have a clear understanding of the opportunities and benefits deriving from the implementation of a certain sustainability program [8].

As a matter of fact, sustainability has become a key issue for the Italian wine industry. Currently, V.I.V.A. and Equalitas are the two main voluntary wine sustainability certification schemes operating in Italy. Both are based on the three pillars of sustainability (economic, social, and environmental) and apply to the entire life cycle: from the vineyard to the bottle of wine. Moreover, they are both based on a principle of continuous updating of the goals and improvement of the results. Despite some common aspects, the two programs present several important differences.

V.I.V.A. is a public certification established in 2011 by the Ministry of Environment, in cooperation with two Research Centres, Opera of the University "Cattolica del Sacro Cuore" and Agroinnova of the University of Torino. In joining this scheme, winegrowers and winemakers accept to follow certain guidelines and to measure their performance using a well-defined set of international standards, referring to four different significant indicators: 1) air, measured through the carbon footprint applied to the life cycle of a wine bottle; 2) water, measured through the direct water scarcity footprint and the non-comprehensive direct water degradation footprint; 3) vineyard, measured mainly via quantitative and qualitative analysis of the impacts produced on water resources, soil, and biodiversity; 4) territory, taking into account the issue of the landscape (abandonment of vineyards, eco-sustainable materials and native species) and also socio-economic aspects.

The social aspects refer mainly to the relationships established with the local community, the staff (training and salary) and the relationship with the consumers, whereas economic aspects refer to the investments made, the adoption of methods of a green or circular economy, and the acknowledgment of a fair remuneration for the different actors in the value chain. Participation in the scheme is communicated with a label and

a QR code that allow consumers to identify the score for the single wine bottle and for the whole organization. Recognition of this labelling in foreign markets is still in progress. To date, about 40 wineries (number steadily increasing) and more than 60 different wines have joined this certification program.

Equalitas is a private certification, established in 2015 thanks to the initiative of Unione Italiana Vini, Federdoc, with the participation of Gambero Rosso, CSQA and Valoritalia. The scheme is addressed to the needs of the entire supply chain: from small producers, to cellars and bottlers, up to cooperatives. Within Equalitas, sustainability refers not only to the three traditional dimensions – environmental, social, and economic – it also includes two additional pillars: socio-environmental and communication. Participation in the program involves the adoption of virtuous behaviors, compliant with specific requirements periodically updated and tiered as major, minor and recommendations, combined with the use of verifiable and measurable Indicators, certified by a third-party entity. Equalitas is characterized by a gradual approach to sustainability goals, and the results achieved are monitored by an annual Sustainability Report. The certification can be obtained by a single producer or by a territory and refers to three different dimensions: the organization standard, the product standard, and the territory, when it involves at least 60% of a specific PDO/PGI. To date, more than 60 wineries (including 2 in Spain, thanks to an agreement with the Federación Española del Vino) and about 40 different wines are certified.

The differences in the sustainability initiatives in the wine sector are an opportunity for the sector as a whole; however, overlapping methodologies and results which can lead to confusion should be avoided. According to Corbo et al. (2014), a common notion of sustainability should be shared and promoted in the Italian wine sector with the cooperation of academic scholars, institutions, and stake holders. This would provide consumers with greater awareness and a clearer knowledge of the benefits and costs of sustainability. Moreover, a common language and framework is needed, in order to better understand and solve shared problems in vine-growing and the wine industry. Finally, a single and shared sustainability framework and brand could enhance the competitiveness of Italian wine on foreign markets, particularly on those promoting sustainable products, which are where Italian wine is mostly positioned.

In this spirit, the Italian Ministry of Agricultural Policies, Food and Forestry (MiPAAF) introduced in 2020 a legal framework (law 77/2020) to reach a common sustainability standard that would harmonize the two protocols V.I.V.A. and Equalitas, using as starting point the "Sistema di Qualità Nazionale di Produzione Integrata" – SQNPI (National Integrated Production Quality System), which is a voluntary certification programme for agricultural and agri-food products generated using integrated production techniques. For the wine sector, the SQNPI was supposed to be supplemented with additional sustainability requirements, taken from the two aforementioned certifications, which remain autonomous and operational. In this way, Italy will be the first EU Member State to have a national system, shared by the wine chain, to acknowledge and assess the performance of sustainability, that the law itself requires to relate to the new FADN.

The two Italian voluntary sustainability certification programmes are comprehensive and of high methodological value. At the same time, due to the importance of the FADN for the European Farm to Fork Strategy and the Italian law, its ability to assess the sustainability of the wine sector is worth to be tested. However, due to the type of variables and indicators available within the FADN, it is currently impossible to compare farms included in it and those participating in the V.I.V.A. and Equalitas programmes, as the latter are based mainly on international standardised indicators which cannot be calculated via the FADN. Nevertheless, the FADN is able to assess the sustainability of the wine sector in line with the following definition, adopted by the OIV *"Global strategy on the scale of the grape production and processing systems, incorporating at the same time the economic sustainability of structures and territories, producing quality products, considering requirements of precision in sustainable viticulture, risks to the environment, products safety and consumer health and valuing of heritage, historical, cultural, ecological and landscape aspects."* [7].

3. DATA AND RESEARCH METHODOLOGY

The data for the present analysis of sustainability in the Italian wine sector are based on an FADN sample. More precisely, the sample consists of 3,995 units of which 2,983 are farms specialized in vine-growing and 1,012 are farms specialized in wine-making[4]. The two groups have been analysed separately – keeping a distinction between farms that only produce grapes for wine and farms that also directly produce wine own – in order to take into account the considerable differences in the structural equipment and in the consequent eco-

[4] More precisely, within the FADN, a farm is considered specialised when the majority (about three quarters) of the production value is due to vine-growing or wine-making.

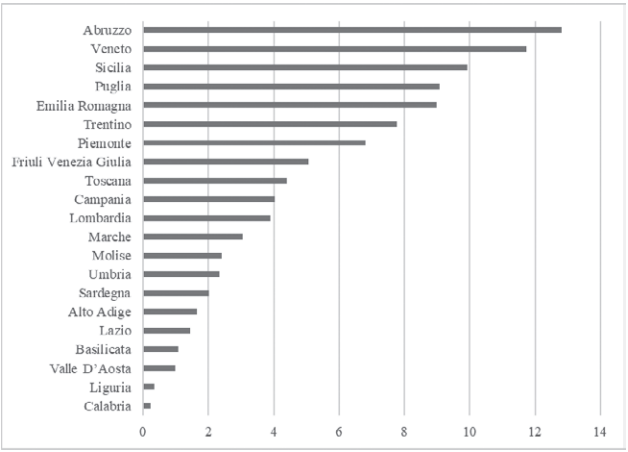

Figure 1. Italian FADN: distribution of vine-growing farms by regions (%). Source: Our elaborations on FADN data 2017-2019.

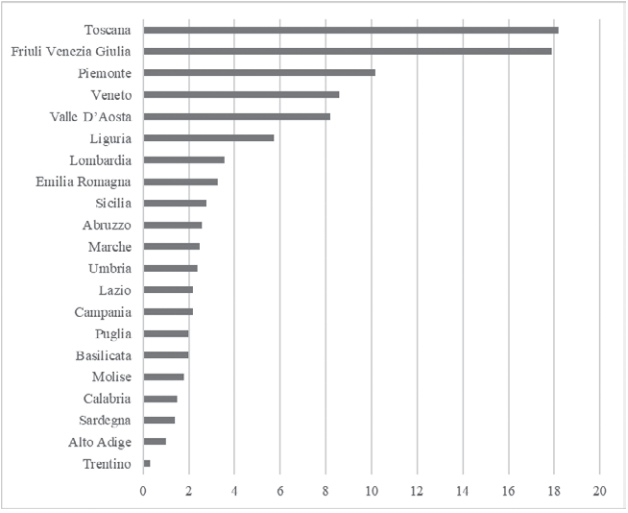

Figure 2. Italian FADN: distribution of wine-making farms by regions (%). Source: Our elaborations on FADN data 2017-2019.

nomic profiles of farms in the two groups [43][5]. The following figures show the regional distribution of farms in the FADN sample that either only produce grapes for wine (Figure 1) or are also engaged in wine processing (Figure 2)[6].

A selection of variables from the FADN, referring to the sample organised in the two subgroups indicated, was used as the basis for the calculation of the wine sector sustainability indicator. The methodology used to calculate the SuWI follows the methodology of the Sustainable Farm Index– SuFI [45], which was developed as a variant of the Agri-Environmental Footprint Index approach methodology [46].

The calculation of the index is based on a multicriteria approach specified from an assessment criteria matrix (ACM) based on the three dimensions of sustainability – environmental, economic, and social – linked to the farm management of the sample selected. More precisely, the ACM is formed by column vectors that indicate the three dimensions of sustainability, while the row vectors indicate the set of indicators used within the farm management to calculate the SuWI. The indicators were extracted from variables available in the FADN on the grapevine sector for the accounting years 2017-2018-2019 and have been observed at the regional level. In Table 1, the selected indicators are listed and described, and the reason they were chosen (contextualization) in relation to the three dimensions of sustainability is explained.

It should be noted that the indicators have been selected according to the specific characteristics of the wine-producing and vine-growing sectors, rather than basing them on the territorial context of each region. However, this level of approximation is compatible with the objectives of the present research, the main goal of which is to test the current and the potential functionality of the FADN to conduct large-scale sustainability analyses. Future research could incorporate the territorial dimension in a more structured way.

Once identified, indicators were normalized to make them comparable and to proceed with the calculation of the farms' sustainability indices by adding the weighted scores for each of the levels within the evaluation matrix. To this end, indicators were converted into scores according to the relationships between indicator values and level of sustainability. The relationships observed can be linear, or non-linear, and scaling can be categorical or binary (Mortimer et al., 2009). For non-dichotomous indicators, the score was predominantly assigned by dividing the observations into quartiles; on the contrary, for dichotomous indicators the score assigned was equal to 10 and 5 (respectively, presence or absence)[7]; finally, for other indi-

[5] It is worth noting that, for an even more accurate sustainability analysis, the FADN sample should have been separated into four sub-groups, in order to take into account the quality of the grapes and wines produced. However, the small size of the sample did not lend itself to such detailed segmentation.

[6] The two groups in the FADN sample, jointly considered, have been compared with other official statistical sources (National Institute of Stastistics - ISTAT). The distribution of the farms in the FADN is generally in line with the overall distribution of the Italian farms with grapevines, with small differences due the sample characteristics (minimum economic dimension) [44] and the presence of farms with grapes not for wine in some southern regions.

[7] For example, this is the case for organic farming. All farms certified as organic were considered equally committed to environmental pro-

Table 1. Indicators used in the development of the sustainability index and their contextualization.

Indicator	Description	Contextualization
Economic dimension		
Net added value per hectare of utilized agricultural area	Represents the productivity of the land net of current costs, depreciation, provisions, taxes and duties and gross of subsidies.	Well assessed profitability indicator
Net added value per labour unit	Represents labour productivity net of current costs, depreciation, provisions, taxes and duties and before subsidies.	Well assessed profitability indicator
New investments	Represents the new investments that are made by the farm over the course of a year	Economic viability of the farms in the long term
Current costs on revenues	Ratio of costs incurred for current management to revenue	Well assessed profitability indicator
Income from Other Gainful Activities	Revenues from complementary activities to agricultural ones such as agritourism, active Contracting, Active Rentals, other Complementary revenues	Farm diversification is an indicator of additional income
Environmental dimension		
Nitrogen content per hectare of Utilized Agricultural Area	Represents the quantity (quintals) of nitrogen present in fertilizers used per hectare of agricultural area.	Indirect indicator of the level of intensity linked to fertilization
Incidence of toxic pesticide expenditure on the total pesticide expenditure	Represents the incidence of farm expenditure for toxic and very toxic pesticides on the total pesticide expenditure	Impact indicator on natural and antagonistic entomofauna
Agro-climatic-environmental payments	Indicates whether the farm has received agro-climatic-environmental payments	Reports farms eligible for RDP agro-environment payments
Organic farming	Indicates the presence of organic farming practices	Reports farms that follow organic production therefore with a high degree of environmental sustainability
Altitude	Represents the location of the farm (plain, hill, mountain)	Enhances the ecosystem services related to high altitude viticulture (e.g. hydrogeological stability, carbon storage, etc.)
Social dimension		
Farmer's age	Represents the age of the farm' handler	Innovation propensity and maintenance of agricultural activity
Family labour unit per hectare of Utilized Agricultural Area	Represents the ratio of family labour units per hectare of agricultural area	Family employment potential
Labour unit per hectare of Utilized Agricultural Area	Represents the ratio of labour units per hectare of agricultural area.	Local employment potential
Certifications (PDO/PGI)	Represents the presence of farm certifications	Social capital indicator, due to the beneficial effects for the local community
Farmer's education	Represents the level of education of the farmer	Higher level of knowledge allows for better farm management
Farmer's gender	Represents farmer's gender	Gender equality provides social value

cators, scores were assigned on the basis of specific evaluations (e.g. farmer's age and farmer's education).

According to this methodology, both the selected indicators and the scores assigned to each of them were carefully tested through a specific questionnaire submitted to a qualified group of stakeholders: experts in wine sector, the FADN, and sectoral policy from academic and technical-scientific world. The result of the score scaling process is shown in Table 2.

Prior to aggregating the normalised indicators, a weight was assigned to the indicators selected within each dimension (the sum of the weights at the dimension level is = 1). Within each dimension, the indica-

tection, obtaining a score of 10. The score was assigned regardless of whether farms receive CAP support. Indeed, the resources for organic farming in Italy are not sufficient for all applications, so the presence/absence of support cannot be considered a discriminating factor. In addition, the identification of the organic method does not consider possible technical issues, but only looks at the participation or not in a certification system defined by the most recent EU strategic documents, and this merely indicates that it is sustainable in comparison with conventional methods.

Table 2. Scaled scores of selected indicators.

Indicator	Unit	Scaling	Score
Net added value per hectare of utilized agricultural area	€/ha	< 0	0
		I quartile	2
		II quartile	4
		III quartile	7
		IV quartile	10
Net added value per labor unit	€/LU	< 0	0
		I quartile	2
		II quartile	4
		III quartile	7
		IV quartile	10
New investments		No	5
		Yes	10
Current costs on revenues	€	I quartile	10
		II quartile	7
		III quartile	4
		IV quartile	2
Income from Other Gainful Activities		No	5
		Yes	10
Nitrogen content per hectare of Utilized Agricultural Area	Q./ha	I quartile	10
		II quartile	7
		III quartile	4
		IV quartile	2
		Not valued	5
Incidence of toxic pesticide expenditure on the total pesticide expenditure	%	0	10
		>0 and <25%	3
		>25% and <50%	2
		>50% and <75%	0
		>75%	0
Agro-climatic-environmental payments		No	5
		Yes	10
Organic farming		No	5
		Yes	10

Indicator	Unit	Scaling	Score
Altitude		Plain	5
		Hill	8
		Mountain	10
Farmer's age	year	<70	2
		60 a 70	4
		50 60	6
		40 50	8
		<40	10
Family labour unit per hectare of Utilized Agricultural Area	lu/ha	I quartile	2
		II quartile	4
		III quartile	7
		IV quartile	10
Labour unit per hectare of Utilized Agricultural Area	LU/ha	I quartile	2
		II quartile	4
		III quartile	7
		IV quartile	10
Certifications	N.	0	2
		1	6
		>1	10
Farmer's education		no degree / elementary school license	2
		middle school license	4
		professional diploma / high school diploma	8
		short degree / degree / specialization	10
Farmer's gender		female	10
		male	5

Source: Our elaborations on FADN data 2017-2019

tors were assessed as being of equal importance[8]. The final aggregation procedure then led to the calculation of the sustainability index where the SuWI obtained is expressed on a scale of values between 0 (low level of sustainability) and 10 (high level of sustainability).

Summarising, for each farm in our FADN sample the multidimensional sustainability index is given by the weighted average of the scores assigned to the same farm linked to the indicators belonging to each of the three dimensions considered. Therefore, the SuWI of each farm represents the weighted average of the three sustainability index categories: economic, environmental, and social. Finally, single data referred to all farms in the two groups are reaggregated to obtain a value of the SuWI at the regional level. Table 3 and the following show the results of these calculations.

The last step in this assessment is a sensitivity analysis, which allows comparisons of farms in each Region by considering different scenarios[9]. More precisely, we

[8] The weights assigned to the indicators belonging to the economic dimension is equal to 1/5 (as we have identified five indicators in the economic dimension); the weights assigned to the indicators belonging to the environmental dimension is equal to 1/5 (as we have identified five indicators in the environmental dimension); the weights assigned to the indicators belonging to the social dimension is equal to 1/6 (there are six indicators).

[9] The word "scenario" is used here to represent alternative definitions of sustainability, each giving more importance (weight) to one specific dimension.

first created what we called a "balanced" scenario, in which each dimension of sustainability assumes the same relevance in the creation of the synthetic indicator (each weighing 33.3%); then, we built three additional different scenarios, each of them characterized by different levels of importance assigned to each dimension: what we called the economic, environmental, and social scenarios. In these scenarios, the dominant dimension accounts for 50% of the total weight, while the other two 25% each. To assign a higher weight to each of the three dimensions allows us to rank the performance of each of the two different groups of farms from a specific point of view (or scenario), and subsequently to identify the most performing regions according to each analysed dimension. Therefore, the SuWI has also been calculated under the three additional scenarios.

4. DISCUSSION OF RESULTS

4.1 The SuWI in the balanced scenario

The analysis moves from the "balanced" scenario, in which the three dimensions of sustainability are weighted equally. Overall average scores roughly ranged from just over 5 to nearly 8 in both vine-growing farms and wine-making farms, although the index itself could vary between 0 and 10. The average value of SuWI is equal to 5.97 for the first group and to 6.30 for the second, confirming the good level of diffusion of sustainability practices within the national wine sector (Table 3)[10]. This result is not surprising given the high attention devoted in the wine sector to the sustainable practices and quality labels previously described. However, although the variability in the scores is not large, the differences in the mean values are statistically significant both within the groups and between the different regions (F_{2980} = 39.331 for vine-growing farms and F_{1010} = 18.670 for wine-making farms; p-value <1%).

Analysing the results at the regional level it emerges that in the case of vine-growing farms the best results are achieved by Valle d'Aosta and Trentino-Alto Adige, while the lowest performances are found in the case of Sardegna, Emilia-Romagna and Marche, although the values do not differ much from the national average. In the case of the wine-making farms similar features are displayed, with Trentino-Alto Adige and Valle d'Aosta among the best performing regions, while Sardegna, Puglia and Molise are the regions with the lowest scores.

To better understand these results, it is helpful to look at the partial scores obtained for each sustainability dimension. Indeed, it must be recalled that SuWI is a synthetic and complex index composed of weighted indicators within each dimension (Table 4 and Table 5). In the case of Trentino-Alto Adige and Valle d'Aosta, the fact that farms are located in mountain areas grant them a sort of environmental advantage, according to the construction of the evaluation matrix. This result can in part be justified by the importance that viticulture could have in these contexts in terms of providing ecosystem services related, for example, to hydrogeological stability, landscapes with tourism value, the conservation of biodiversity, and above all the maintenance of agricultural activity in disadvantaged territories.

By contrast, this aspect could penalize other regions in achieving a good environmental index if farms are mainly located in lowland areas, where viticulture is more likely to be focused on quantity rather than quality, which also has repercussions in terms of crop intensification. In this regard, it should be noted that the region with the best environmental performance is Calabria,

Table 3. Balanced scenario: SuWI by type of farm and by Italian region.

Vine-growing farms		Wine-making farms	
Regions	**SuWI**	**Regions**	**SuWI**
Valle d'Aosta	7.22	Alto Adige	7.87
Alto Adige	7.14	Valle d'Aosta	7.35
Trentino	6.47	Trentino	6.98
Lombardia	6.32	Veneto	6.73
Umbria	6.23	Liguria	6.47
Veneto	6.19	Friuli Venezia Giulia	6.36
Liguria	6.15	**Italia**	**6.30**
Calabria	6.12	Campania	6.29
Lazio	6.05	Umbria	6.25
Friuli Venezia Giulia	6.03	Toscana	6.23
Abruzzo	5.98	Lazio	6.22
Italia	**5.97**	Sicilia	6.14
Piemonte	5.95	Lombardia	6.11
Campania	5.95	Calabria	6.01
Toscana	5.93	Piemonte	6.00
Molise	5.87	Abruzzo	5.91
Puglia	5.69	Basilicata	5.90
Basilicata	5.68	Marche	5.84
Sicilia	5.66	Emilia Romagna	5.79
Marche	5.63	Molise	5.43
Emilia Romagna	5.58	Puglia	5.31
Sardegna	5.57	Sardegna	5.23
$F_{(2980)}$	39.33	$F_{(1010)}$	18.67
p-value	< 1%	*p-value*	< 1%

Source: Our elaborations on FADN data 2017-2019.

[10] A preliminary comparative analysis was also carried out referring to other specializations. In particular, a comparison with permanent crops confirms the relatively higher performance of the wine sector. This justifies and supports the choice made for this explorative exercise through the FADN and, at the same time, reflects the advanced level of sustainability achieved by the wine sector, thanks to the well-structured certification currently in place.

Table 4. Vine-growing farms: economic, environmental, social indices in the balanced scenario.

Regions	Economic index	Regions	Environmental index	Regions	Social index
Trentino	6.68	Calabria	7.83	Alto Adige	7.63
Friuli Venezia Giulia	6.68	Valle D'Aosta	7.55	Valle D'Aosta	7.63
Valle D'Aosta	6.48	Umbria	7.52	Liguria	6.72
Alto Adige	6.38	Alto Adige	7.42	Trentino	6.70
Veneto	6.36	Lazio	7.09	Abruzzo	6.45
Emilia Romagna	6.03	Lombardia	7.04	Veneto	6.15
Puglia	5.96	Sicilia	6.91	Campania	6.13
Lombardia	5.95	Campania	6.74	Piemonte	6.08
Umbria	5.90	Marche	6.67	Lombardia	6.07
Italia	**5.83**	Toscana	6.58	**Italia**	**5.78**
Liguria	5.82	Molise	6.32	Friuli Venezia Giulia	5.74
Molise	5.81	**Italia**	**6.31**	Lazio	5.73
Piemonte	5.79	Basilicata	6.14	Calabria	5.55
Toscana	5.69	Veneto	6.06	Toscana	5.52
Abruzzo	5.44	Piemonte	6.05	Basilicata	5.49
Basilicata	5.41	Abruzzo	6.04	Molise	5.47
Marche	5.32	Puglia	6.04	Sardegna	5.39
Lazio	5.32	Trentino	6.03	Umbria	5.25
Sardegna	5.31	Sardegna	6.00	Sicilia	5.12
Campania	4.98	Emilia Romagna	5.96	Puglia	5.06
Calabria	4.97	Liguria	5.92	Marche	4.90
Sicilia	4.96	Friuli Venezia Giulia	5.66	Emilia Romagna	4.75

Source: Our elaborations on FADN data 2017-2019.

thanks to its high incidence of organic farms within the regional FADN sample and the consequent absence of the use of toxic pesticides.

Trentino-Alto Adige and Valle d'Aosta show high scores also for other dimensions, especially for the social dimensions in both groups of farms. This may be partially linked to the fact that the farms belonging to these regions are generally highly specialised in quality wines, having achieved many different certifications, which would imply a greater number of social relationships, as well as the important share of female entrepreneurship in the sample.

On the other hand, for the economic dimension a polarization in performance emerges, with the North-East Regions prevailing over the southern ones. This result is in line with expectations, considering the strategic importance of the wine sector in the agricultural economy of these Regions [47]. It is worth noting that some important Regions with a high vine-growing vocation and tradition nevertheless show lower economic sustainability indices than the national average (Sicilia and Puglia only for wine-making farms). This may be due to the composition of production in terms of prevailing quality types (wines with or without certifications), which is still quite diverse among Italian geographical areas[11].

In addition, the results achieved by the indicator in the economic dimension are only in a few cases aligned with those obtained in the other two dimensions. This is the case of Sicilia, which, while obtaining a good positioning of the environmental index in both groups (the organic farms in Sicilia are widespread with a low consumption of nitrogen and toxic pesticides), is on the contrary penalized by the results in the economic

[11] Other studies based on the Italian FADN sample have showed a generally higher performance for the farms specialised in the production of quality wines [43,44].

Table 5. Wine-making farms: economic, environmental, social indices in the balanced scenario.

Regions	Economic index	Regions	Environmental index	Regions	Social index
Alto Adige	7.92	Calabria	8.23	Alto Adige	7.92
Veneto	7.28	Trentino	8.20	Valle D'Aosta	7.41
Valle D'Aosta	6.87	Valle D'Aosta	7.96	Trentino	7.33
Friuli Venezia Giulia	6.64	Alto Adige	7.76	Liguria	6.98
Toscana	6.15	Umbria	7.58	Lazio	6.48
Italia	**6.15**	Campania	7.47	Veneto	6.30
Emilia Romagna	6.07	Sicilia	7.30	Lombardia	6.27
Piemonte	5.99	Basilicata	6.82	Abruzzo	6.21
Liguria	5.90	Lazio	6.75	Campania	6.15
Sicilia	5.54	Sardegna	6.67	Toscana	6.13
Umbria	5.54	**Italia**	**6.65**	**Italia**	**6.13**
Lombardia	5.54	Veneto	6.61	Friuli Venezia Giulia	6.10
Marche	5.49	Liguria	6.52	Marche	5.78
Abruzzo	5.48	Lombardia	6.51	Basilicata	5.75
Lazio	5.43	Toscana	6.40	Calabria	5.71
Trentino	5.40	Molise	6.34	Piemonte	5.67
Puglia	5.25	Piemonte	6.33	Umbria	5.64
Campania	5.25	Friuli Venezia Giulia	6.33	Sicilia	5.58
Molise	5.22	Emilia Romagna	6.30	Puglia	5.14
Basilicata	5.14	Marche	6.26	Emilia Romagna	4.98
Sardegna	4.37	Abruzzo	6.05	Molise	4.71
Calabria	4.11	Puglia	5.55	Sardegna	4.65

Source: Our elaborations on FADN data 2017-2019.

and social dimensions. Similarly, Emilia-Romagna and Puglia, despite good economic performance in the vine grape sector (less so in the wine sector), are penalized in the social and environmental dimension, which in part can be attributed to the high intensity of the farms. Campania, Toscana and Piemonte are in line with the national average, being regions traditionally suited to viticulture, while, in the case of wine-making farms, Toscana and Piemonte are placed below the national average. In the case of Toscana, the economic and social dimensions reduce the global result of the SuWI, probably due to the high average age of the farmers, the low recourse to waged workforce as well as the persistence of economic difficulties. The most relevant scores for Piemonte are the quantity of pesticides used, which is an indicator of a high degree of intensity of the farming activity, together with a low level of education of farmers (compared to the national average) and a reduced number of new investments.

In sum, these results confirm that the current structure of the FADN is still mainly oriented to capturing economic aspects and less suited to explaining the interactions between the different dimensions of sustainability in a comprehensive and contextual manner. Additional improvements and integrations need to be put in place, especially in terms of social and environmental statistics, in order to fruitfully turn the accounting network (FADN) into a reliable data bank for sustainability (FSDN).

4.2 The SuWI in the alternative scenarios

As mentioned above, a further analysis was carried out on three different scenarios, each emphasising one of the three dimensions of sustainability. This simulation aims to test the robustness of the multidimensional sustainability index for the vine-growing and wine-making farms in identifying the effects of various policies that may enhance one or the other of the dimensions of the

Table 6. Vine-growing farms' sustainability performance in the alternative scenarios.

Economic scenario	SuWI	Enviromental scenario	SuWI	Social scenario	SuWI
Valle D'Aosta	7.03	Valle D'Aosta	7.30	Valle D'Aosta	7.32
Alto Adige	6.95	Alto Adige	7.21	Alto Adige	7.27
Trentino	6.52	Umbria	6.55	Trentino	6.53
Veneto	6.23	Calabria	6.54	Liguria	6.29
Lombardia	6.22	Lombardia	6.48	Lombardia	6.26
Friuli Venezia Giulia	6.19	Trentino	6.36	Veneto	6.18
Umbria	6.14	Lazio	6.31	Abruzzo	6.10
Liguria	6.07	Veneto	6.16	Campania	5.99
Italia	**5.94**	Campania	6.15	Piemonte	5.98
Piemonte	5.90	Liguria	6.09	Umbria	5.98
Toscana	5.87	Toscana	6.09	Calabria	5.97
Lazio	5.87	**Italia**	**6.06**	Lazio	5.97
Molise	5.85	Abruzzo	6.00	Friuli Venezia Giulia	5.95
Abruzzo	5.85	Molise	5.98	**Italia**	**5.93**
Calabria	5.83	Sicilia	5.97	Toscana	5.83
Puglia	5.76	Piemonte	5.97	Molise	5.77
Campania	5.71	Friuli Venezia Giulia	5.94	Basilicata	5.63
Emilia Romagna	5.69	Marche	5.89	Puglia	5.53
Basilicata	5.61	Basilicata	5.79	Sicilia	5.53
Marche	5.55	Puglia	5.78	Sardegna	5.52
Sardegna	5.50	Emilia Romagna	5.68	Marche	5.45
Sicilia	5.49	Sardegna	5.68	Emilia Romagna	5.37

Source: Our elaborations on FADN data 2017-2019.

index. For example, one could wonder what the effects of "deep green" measures imposed by a European or a National policy could be on the vine-growing and the wine-making farms.

The three simulated scenarios confirm, to a certain extent, the results of the "balanced" scenario, with the only exceptions of Calabria in the South and Friuli Venezia Giulia, in the North, for both groups of farms (Table 6 and Table 7), while Campania differs only for the vine-growing farms. Calabria's environmental performance is very good, but its economic and social performance is definitely poorer. On the contrary, Friuli Venezia Giulia features a satisfactory economic performance but the environmental one is much poorer, which implies a rather high level of intensiveness in the farm management and the technical performance.

Comparing the different scenarios, in the case of vine-growing farms in the economic scenario, the number of regions above the national average value (5.94) is lower (8) than in the other two scenarios (respectively 11 for environmental and 13 for social). Moreover, the top group of regions for the economic index includes only regions from the North-East plus Umbria, whereas the other two groups over the average are much more heterogeneous. It should be noted that the north-eastern regions and, to a lesser extent Umbria, are quite specialised in vine-growing and wine-making, with a high share of the sectoral value added.

Table 7. Wine-making farms' sustainability performance in the alternative scenarios.

Economic scenario	SuWI	Enviromental scenario	SuWI	Social scenario	SuWI
Alto Adige	7.88	Alto Adige	7.84	Alto Adige	7.88
Valle D'Aosta	7.21	Valle D'Aosta	7.47	Valle D'Aosta	7.36
Veneto	6.87	Trentino	7.28	Trentino	7.07
Trentino	6.58	Veneto	6.70	Veneto	6.62
Friuli Venezia Giulia	6.43	Campania	6.59	Liguria	6.60
Liguria	6.33	Umbria	6.58	Friuli Venezia Giulia	6.29
Italia	**6.26**	Calabria	6.57	Lazio	6.29
Toscana	6.21	Liguria	6.48	**Italia**	**6.26**
Umbria	6.07	Sicilia	6.43	Campania	6.26
Campania	6.03	**Italia**	**6.39**	Toscana	6.21
Lazio	6.02	Lazio	6.36	Lombardia	6.15
Piemonte	6.00	Friuli Venezia Giulia	6.35	Umbria	6.10
Sicilia	5.99	Toscana	6.27	Sicilia	6.00
Lombardia	5.96	Lombardia	6.21	Abruzzo	5.99
Emilia Romagna	5.86	Basilicata	6.13	Calabria	5.94
Abruzzo	5.81	Piemonte	6.08	Piemonte	5.92
Marche	5.76	Marche	5.95	Basilicata	5.87
Basilicata	5.71	Abruzzo	5.95	Marche	5.83
Calabria	5.54	Emilia Romagna	5.91	Emilia Romagna	5.58
Molise	5.38	Molise	5.66	Puglia	5.27
Puglia	5.30	Sardegna	5.59	Molise	5.25
Sardegna	5.02	Puglia	5.37	Sardegna	5.09

Source: Our elaborations on FADN data 2017-2019.

Moving to wine-making farms, there seems to be a little less variability in the values achieved by each Region in the three dimensions. Only 6 Regions show a higher-than-average value (6.26) in the economic scenario, while this figure rises to 9 for the environmental scenario (average score 6.39) and 7 for the social one (average equals 6.26). Once again, it is especially north-eastern regions (Trentino, Alto Adige, Veneto) and mountainous regions (Valle d'Aosta and Liguria) that place high in the ranking in all the scenarios considered. All in all, in the case of wine-making farms, there seems to be a higher homogeneity and contiguity in the three scenarios presented. This is definitely a topic worth investigating in the future with proper instruments.

These analyses confirm the power of the FADN as a tool for evaluating and monitoring farms' overall performance. However, as regards sustainability, the necessity to further develop the FADN has been confirmed. The main goal, as indicated by the Commission itself, will be collecting additional information with an adequate level of detail, both at the farm and the territorial level. Clearly, this must be a long-term adjustment process that will take some time and effort throughout the European FADN network, with the crucial support of the Commission and research offices, which will need to be involved in impact assessments and territorial analyses.

Another key point is that of the representativeness of the FADN sample and its robustness. Particularly relevant for the analysis of sustainability in the wine sector is the exclusion – due to the EU regulations 79/56 and 1217/2009 – from the sample of micro farms (EDU < 8,000 euro) which constitute a significant portion of all farms in Europe and particularly in Italy, especially in marginal territories and in specific production sectors,

including the cultivation of wine grapes. Such a feature of the Italian FADN sample might, for example, affect the overall assessment of social and environmental sustainability. In the move from the FADN to the FSDN, some statistical rethinking and adjustment of the construction of the sample would be appropriate and advisable.

On the whole, our SuWI shows encouraging results when applied to the wine sector. However, it is necessary to select proper homogeneous groups of farms (vine-growing and wine-making) to make the analysis fit better to the sectoral characteristics. Moreover, it reveals some critical issues in the use of the FADN database for a global sustainability analysis – in its threefold dimension – due to its current structure.

5. CONCLUSIONS

In the framework of the new CAP 2023-2027, in which support to farmers is increasingly coupled to specific desirable behaviours, the creation of a synthetic indicator including all three dimensions of sustainability, and applicable to specific sectors, is becoming one of the main challenges [48,49]. To this end, contributions for the construction of synthetic indicators of sustainability are appropriate and even necessary. Many recent works have tested a wide range of synthetic measures of sustainability, but there are no previous studies that have used the FADN for this purpose. Nevertheless, in a few years the FADN should become, according to the EU Commission itself, the main source of data on and measurements of desirable farming behaviours aimed at enhancing sustainability.

The exercise through the FADN has highlighted some relevant challenges. The most important of these are the representativeness of the samples, the replicability of the measures, the generalisation of the indicators, the statistical robustness, and the effectiveness in identifying specific connections between an observed action and the level of sustainability achieved. Our exercise focused on the wine sector, one of the most advanced production systems in terms of certification of sustainability in Italy, so it is interesting to see how it actually performs with regards to sustainability in its three dimensions, based on a series of simple but rather effective indicators originating from the FADN and aggregated in a single indicator like the SuWI. The wine sector is interesting as a case study because it is ahead of other sectors in Italy and other European and non-European countries in the matter of sustainability labels and quality acknowledgment by consumers. A high number of recent papers, as mentioned above, have reported on the awareness of the consumers, the efforts of the producers to become more sustainable, and the advancements in the policy design to combine, alongside the recent strategies of the EU, production goals with environmental and social concerns.

This is the first attempt to apply this methodology to the wine sector and, while it has been quite effective in reflecting the full complexity of the concept itself and in comparing performances in space and possibly in time too, it does not allow one to describe in absolute terms how sustainable a farm, or a group of farms, or a specialised territory is. More work is needed in this respect.

With regard to the composition of the index proposed here, it implies necessarily a sort of compromise amongst the three dimensions considered: the economic, environmental and social dimensions of sustainability. This "average" value of performance could help overcome the idea of possible trade-offs amongst the three dimensions, so that the environmental (natural resources) and social (labour) dimensions of sustainability would no longer be considered constraints, but rather as opportunities to maximise economic values (profits and revenues) [11,50]. Future developments in the method of calculating the SuWI, using appropriate methodologies, could also take into consideration the evaluation of the reciprocal effect (adjunctive or diminutive) among indicators within the different dimensions and between the three pillars of sustainability. However, both innovative policies and new micro and user-friendly technology (digital technology and precision farming) have contributed to reducing the traditional trade-offs among sustainability goals, so that economic goals can be boosted within a more general framework of social and environmental sustainability.

With regards to the performance of the Italian regions as measured by the SuWI, the regional ranking shows significant differences in the position of the Italian regions according to the two groups of farms. Among the wine-making farms, the SuWI shows a greater variability of scores; furthermore, a smaller number of regions achieved a result that was above the Italian average, suggesting that the most sustainable wine-making farms are concentrated in a few regions.

This study also explains the current potential of the Italian FADN for use in sustainability analyses. From this preliminary assessment of the wine sector, some interesting recommendations emerge, aimed at increasing the capability of the FADN for the analysis of sustainability, and more in general in the agricultural sector, as indicated in the Farm to Fork Strategy and confirmed in the roadmap for the construction of the new FSDN.

With regards to data, the main shortcoming identified is the lack of or weakness of some information, which has been overcome here with the use of proxies, which, however, make the link between the variables chosen and the specific dimension of sustainability rather unstable and weaker than they should be. However, it must be said that the analytical structure of the FADN has historically been optimized on the economic dimension of farms, while the environmental and social dimensions have only recently begun to be regularly observed, recorded, and enhanced. The analytical structure of the Italian FADN, which provides for the allocation of costs to individual production processes, makes it possible to indirectly measure the quantities of some technical inputs (e.g. nitrogen and phosphorus) with a good degree of approximation. On the contrary, in the case of pesticides it is not yet possible to identify variables that consider the quantity used and the degree of toxicity. But it is above all in the social dimension that improvements are needed to obtain more precise and solid indicators, so that when the FADN turns into the FSDN, it can indeed have a powerful and reliable set of data for the global assessment of sustainability.

ACKNOWLEDGMENTS

This work has been carried out with the key contribution of the Italian FADN, with the goal of enhancing the use of data for policy analyses and the dissemination of results. An earlier version of this work was presented at the 11th AIEAA Conference "CAP, Farm to Fork and Green Deal: policy coherence, governance and future challenges", Viterbo, 16-17 June 2022.

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Wine Economics and Policy

Firenze University Press
www.fupress.com/wep

OPEN ACCESS

Citation: Étienne Montaigne, Samson Zadmehran, Alfredo Coelho, Yacine Messaoudène (2023). Analysis of the 2007-2008 Hérault premiumized grubbing-up campaign: a tool to better understand Fischer-Boel's 2008-2011 grubbing-up campaigns and the desire in 2022 to reintroduce locally premiumized grub-ups. *Wine Economics and Policy* 12(1): 81-99. doi: 10.36253/wep-12781

Data Availability Statement: All relevant data are within the paper and its Supporting Information files.

Competing Interests: The Author(s) declare(s) no conflict of interest.

Analysis of the 2007-2008 Hérault premiumized grubbing-up campaign: a tool to better understand Fischer-Boel's 2008-2011 grubbing-up campaigns and the desire in 2022 to reintroduce locally premiumized grub-ups

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Abstract. In 2022, in Bordeaux due to a structural oversupply, grape growers' syndicates have asked to reimplement premiumized grub-ups in order to bring the market back to equilibrium. However, in today's CMO no legal basis exists to conduct such a policy. In this article, we go over the policy of planting rights (transformed in 2016 into planting authorization) and of premiumized grub-ups. In undertaking this historical review of Europe's grubbing-up policy, we analyze in detail Pierre Bartoli's 1982 thesis and studies of the Observatoire de l'Hérault (Dyopta) that take into account experts' opinions and statistical viewpoints. This review enables us to present the main indicators in order to "objectively" analyze data that we received from a 2007/2008 grubbing-up campaign in Hérault. Our originality is the analysis of a subset consisting of 341 Viniflhor applications for grubbing-up premiums, which represents 20% of all beneficiaries receiving premiums. The applications were later sent with the applicants' consent to a development agency that transmitted them to us. Within this subset, we selected 51 grape growers with whom we conducted a qualitative and quantitative survey. Our goal was to identify their real motivations for grubbing up their vines. We then put forward synthesized results explaining the qualitative interviews and run the data through an econometric model. The main results are that many grape growers grubbed up only a small fraction of their vineyards mainly to cash in on the premiums in times of dire wine crisis. Grubbing ups of young "improving varietals" reinforces this analysis. Furthermore, the 2007/2008 grubbing-up campaign comes a year just before the 2008/2011 Fischer-Boel grubbing-up campaigns that wanted to reduce Europe's vineyard of 175,000 ha of vines by eliminating the least efficient grape growers. We thought it would be interesting to shed light on this 2008 wine CMO policy by using the results of the 2007/2008 grubbing-up campaign.

Keywords: sustainability, wine sector, CAP Reform, FADN.

1. INTRODUCTION

Unlike the New World's viticulture, the potential of the European grape production is controlled through planting rights introduced by the 1976 wine CMO and planting authorizations since 2016 and the 2013 CMO[1]. Planting rights gave the EU the possibility to control the area planted in vines and therefore participated to the long-term regulation of the wine market. Historically, the UE wine market was also controlled by other short-term methods such as distillation, but it is another method that has attracted our attention: grub-ups and specifically premiumized ones. Interestingly, it seems that one could imagine grub-ups as the flip side of planting rights: the EU commission enlarges the area planted in vines by issuing additional rights and diminishes it by introducing permanent grub-ups. Currently under the 2013 CMO, premiumized grub-ups are no longer available as a policy tool to control the production potential of European vineyards. However, today in 2022, Bordeaux's grape growers' syndicates are seeking to reintroduce a legal framework to be able to use them.

In this paper we had access to data from the 2007/2008 Hérault grubbing-up campaign that consists of 341 application files that the Hérault Chamber of Agriculture received and transmitted to us. The particularities and importance of our data are linked to its rarity (individual grubbing-up data is difficult to access) and to the fact that it sits at the end of the 1999 wine CMO and right before the beginning of the 2008 wine CMO. The 2007/2008 Hérault grubbing-up campaign is part of a set of campaigns that followed the 2004 worldwide overproduction crisis and its intent was clearly to regulate supply by diminishing it. Our 2007/2008 campaign immediately precedes the three 2008/2011 grubbing-up campaigns (2008 wine CMO) that were introduced by the European commission and Commissioner Mrs. Mariann Fischer-Boel in order to improve the competitiveness of European grape growers by grubbing-up 170,000 ha. This improvement was deemed necessary before the liberalization of the market through the disappearance of planting rights in 2016.

In our work, on a given population and in a limited area, we aim to do an in-depth analysis of the grubbing-up policy at the dawn of the new EU policy promoted by Mrs. Fischer Boel. Our article's first ambition is to analyze the 2007/2008 Hérault grubbing-up campaign by looking in detail at what was grubbed up. Our second ambition is to study the motivations that directed the grape growers' decision. To do so we conducted 51 qualitative interviews with grape growers contained within our initial sample (341 application files). Furthermore, we use these analyses as an exploratory tool in the event of a future reflection on the evaluation of the 2008/2011 EU grubbing-up policy. By doing so, it appears that the reasons put forward in European texts' recitals were focused on eliminating "old and inefficient" small grape growers and did not take into account, at least in Hérault, all of the grape grower's microeconomic and technical motivations.

2. HISTORY OF EUROPEAN WINE CMOS FOR THE PRODUCTION POTENTIAL MANAGEMENT

It has now been more than eighty years since France and Spain implemented rules commonly known as planting rights to control the planting of vines [1,2]. Following King's Law's logic [3], their aim is to prevent anarchic plantings of vines that would come to weigh on the wine supply within the next three years[2] and perhaps cause the collapse of prices on the wine market. Starting on January 1, 2016, planting rights became planting authorization[3] and still remain a pillar of the wine CMO as they manage the capacity of wine production [4]. However, this was not always the case in the European Union (UE): originally in 1970 the UE recuperated the French market organization except for planting rights meaning that from the 1970 to 1976 planting rights did not exist in the EU except in France. In 1976, the UE decided to activate planting rights in order to face a table wine overproduction crisis induced by "wine wars" between France and Italy that caused riots [5]. As winemakers rioted in 1976 in Montredon-Corbrières (Languedoc-Roussillon, France), they faced the CRS[4]: during the clashes both a CRS captain and a winemaker died [6]. Planting rights/authorizations have gone on to become the hallmark of the UE wine policy.

[1] For a historic and long-term vision of French viticulture, interventions and regulations, see Chevet et al. (2018) [1] and Meloni and Swinnen (2013) [2].

[2] In general, it takes three years for planted vines to mature and produce grapes that will come to the market.

[3] With the 2013 CMO, planting rights have been transformed into planting authorizations but have retained the same impact on controlling production. Also, the new rules forbid to transfer the title to other producers. This constraint highly affects the evolution and the capacity to control the evolution of vineyards.

[4] *Compagnies Républicaines de Sécurité*: an elite French police force specialized in facing riots.

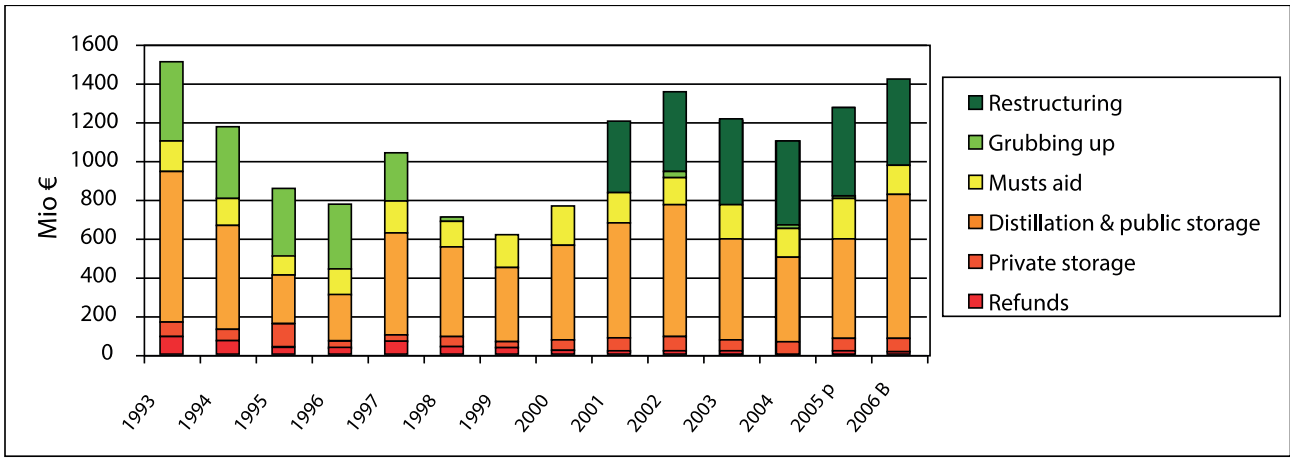

Figure 1. Evolution of the wine CMO's budget allocated to grubbing up. Source: Challenges and opportunities for European wines – 16.02.2006 – slide 42 [12].

2.1 1976 wine CMO: adoption of "(Re)planting[5] rights and grubbing premiums

In 1976, facing social tension, the European Commission decided to manage the capacity of wine production by prohibiting the planting of any new vines and by doing so recreated de facto "(re)planting rights." In other words, a grape grower could only plant an area of vines if he had previously grubbed up an equivalent area. Simultaneously, the European Commission created premiums for grape growers grubbing up their vines to compensate the suspension of their rights to plant for six years (Council Regulation (EEC) No. 1163/76) [7].

Later, premiums for permanent grub-ups, resulting in the permanent disappearance of planting rights, appeared and were maintained through the following wine CMOs [8]. Economically, this policy had an impact on the wine market: until the middle of the '90s grubbed-up areas brought the European wine market to a general quantitative equilibrium [9]. Other measures concerning restructuring, favoring the transition to PGI and PDO have participated in a better adaptation to the market. From the 1988/1989 campaign to the 2004/2005 one, premiumized grub-ups resulted in the permanent disappearance of roughly 500,000 ha of vines in all of the EU [10]. Figure 1 gives the share of the grubbing-up budget in the wine CMO budget from 1993 to 2005 (light green). In regard to the dimensions of the EU vineyards, on a period going from 1990 to 2007, the French ones grew on average from 4 ha to 9 ha, the Spanish ones from 3.5 ha to 5.5 ha, the German ones from 2 to 3.5 ha and the Italian ones from 1 ha to 1.5 ha. However, there is still a large number of small vineyards left and some were even created during the 2007/2012 grubbing campaigns as a result of splitting the vineyards in order to be able to receive the premiums. From 2010 to 2020 changes appear as restructuring financed by the CAP becomes the principal policy tool affecting Languedoc vineyards instead of CMO ones such as planting rights and grubbing-up campaign [11].

2.2 1999 wine CMO: creation of the reserve for rights, reserve rights and "new" planting rights

The introduction of the 1999 wine CMO[6] refined the management of planting vines in the EU[7]. This reform arrived in the midst of fears of an insufficient wine supply, at least in certain markets, due to: (1) the systematization of premiumized grub-ups from 1976 to 1997, (2) three consecutive small harvests (1995/1996; 1996/1997; 1997/1998) [13] and (3) flawed diagnostics made during the 1993/1994 amendment of the previous wine CMO [14,15]. In refining its management, the 1999 wine CMO created a reserve system to save forsaken or unused planting rights and clearly distinguished three categories of planting rights: (1) replanting rights (previous grub-

[5] In 1999, this first category of planting rights will be renamed replanting right in order to differentiate it from the two newly created categories. Hence the parentheses.

[6] Council Regulation (EC) No. 1493/1999 of May 17, 1999.

[7] "This suppleness is comforted by the level of the community's production of wine. The 1996, 1997 and 1998 harvests were situated at levels clearly below the previous years. This was the background for the discussions that took place and that resulted in the new 1999 basic rules, which decided to create the new planting right quotas for the member States." [13]

Table 1. Replanting rights held by the grape growers (ha, EU-15, 2000/2006).

In ha	2000/2001	2001/2002	2002/2003	2003/2004	2004/2005	2005/2006
Czech Republic	NR	NR	NR	0	154	192
Germany	3900	4235	4184	4366	4436	4285
Greece	2376	2376	560	1682	1206	987
Spain	74,189	83,315	80,949	82,814	88,475	88,412
France	45,094	47,611	51,942	44,823	43,749	43,702
Italy	42,056	44,448	41,103	47,748	46,502	52,465
Cyprus	NR	NR	NR	467	596	596
Luxembourg	0	0	0	12	0	0
Hungary	NR	NR	NR	12,509	13,525	14,266
Malta	NR	NR	NR	0	0	0
Austria	12,592	12,695	5313	5501	8897	9030
Portugal	12,809	10,737	12,045	13,541	17,124	17,124
Slovenia	NR	NR	NR	0	276	251
Slovakia	NR	NR	NR	0	500	500
Subtotal EU 15	193,016	205,417	196,097	200,488	210,390	216,004
Subtotal EU 10	NR	NR	NR	12,976	15,051	15,805
Total	193,016	205,417	196,097	213,463	225,441	231,809

Source: Communications of the Member States according to table 7.2 and, where applicable, table 7.1 of the Annex to Regulation (EC) n. 1227/2000, cited by Commission of the European Communities. Commission report to the European Parliament and the Council on management of planting rights pursuant to chapter I of Title II of Council Regulation (EC) n. 1493/1999. Brussels: Commission of the European Communities; 2007.

up required), (2) new planting rights (a new right created ex-nihilo) and (3) planting rights from the reserve.

As we've seen replanting rights already existed in the former wine CMOs: planting an area of vines was only possible if an equivalent area of vines was grubbed up elsewhere. In 2000/2001, replanting rights remaining in grape growers' portfolios represented an area of 193,016 ha. By 2005/2006 this area had increased to 216,004[8] ha [16]. Table 1 illustrates the evolution of the area of replanting rights held by grape growers from 2000/2001 to 2005/2006 in major EU wine-producing countries.

The 1999 wine CMO created ex-nihilo an overall 51,000 ha quota (Art. 6(1) of R. 1493/1999)[9] of new planting rights (Art. 3(2) of R. 1493/1999) which was distributed to 8 countries as

Table 2 indicates. This table also shows that only 68% of the quota equaling to 34,783 ha of rights to plant new vines were allocated and the rest were directed towards the newly created rights' reserve [16].

Table 2. Use of the newly created planting rights for planting vineyards to produce quality wines and table wines with geographical indication.

	Quota distributed (ha)	New planting rights used (ha)	Percentage of use (%)
Germany	1534	471	31
Greece	1098	1098	100
Spain	17,355	17,107	99
France	13,565	9377	69
Italy	12,933	3688	29
Luxembourg	18	0	0
Austria	737	0	0
Portugal	3760	3041	81
Total	51,000	34,783	68

Source: Communications of the Member States according to Table 2.2 of the Annex to the Regulation (EC) n. 1227/2000 and article 6 of Regulation (EC) n. 1493/1999.

The 1999 wine CMO created national and regional "reserves" to recuperate unused new planting rights and replanting rights that were set to expire. On three campaigns from 2000/2001 to 2003/2004, the reserves held 68,000 ha [16]. Members States or their regions could access these reserve rights if an inventory of their wine production showed that their wine supply was below

[8] This number rises to 231,809 ha if we include the 10 wine producing Member States that joined the European Union on May 1st, 2004 after the Athens treaty: Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia.

[9] This handing out did not have major impact on determining the production capacity. The decrease in wine consumption has led to premiumless grub ups and reconversions in many wine-producing countries.

their demand. When applying, young and recently settled grape growers were given priority.

All in all, the three categories of planting rights represented 275,797 ha or 8.3% of the European vineyards consisting of 3,326,542 ha [16].

From the 2000/2001 campaign to the 2007/2008 one, grubbing-up was carried out with the help of limitless community (European) funding. Each Member State specified the regions where the intervention would be applied. In France, small regions and small surfaces were first concerned for the initial four campaigns and the average grubbing rate was 1,200 ha/year. Then, due to the 2004 global overproduction crisis, this measure became more widely solicited and over the next three campaigns, from 2005 to 2008, the average national grubbing rate rose to 14,000 ha/year. 70% of all grub-ups happened in Languedoc-Roussillon with 9,740 ha/year. These three grubbing-up campaigns were far superior to the following three from the 2008/2011 "Fischer Boel" Operation.

2.3 2008 wine CMO: a thirst for competitiveness

In 2006, a procedure that would profoundly modify the 1999 wine CMO appeared. It was initiated by discussions between the different European bodies—the European Commission, the COPA-COGECA and the European Parliament—and based on two documents provided by the European Commission [17,18] and three by the Commission of the European Communities [12,19,20] and completed by studies ordered by the European Commission and the European Parliament [14,21–23].

The European Commission's proposal took into account the hardships of the European wine sector, which were linked to a never before witnessed worldwide overproduction of 50 to 60 million extra hectoliters[10] [24,25]. This crisis impacted to a certain degree all wine actors, including Australia and other countries from the New World and the southern hemisphere. The economic situation worsened in the EU due to an internal decrease of wine consumption in the traditional wine producing countries and a significant increase in imports of New World wine entering northern European markets, especially the United Kingdom. The European Commission concluded that this situation existed due to a lack of competitiveness from the European producers because their farm sizes were too small [26].

In its communication "Towards a sustainable European wine sector," the European Commission retained the scenario "Profound Reform of the CMO—Variant B—Two-step" and justified its choice by stating: "The first phase is restoring market balance and the second phase is building improved competitiveness, including the abolition of planting rights. The principal feature of variant B would be a structural adjustment, i.e., temporarily reactivating the grubbing-up scheme. The system of restrictions on planting rights would be extended until 2013, when it would expire. The least competitive wine producers would have a strong incentive to sell their planting rights or to grub up with subsidies. Rapidly, competitive producers can be expected to focus more on the competitiveness of their enterprise, as the cost of planting rights will no longer hamper expansion. In the medium to long term this would represent a reduction in their fixed production costs" [19]. This scenario would span 5 years, aim to grub up 400,000 ha and allocate 2.4 billion euros towards premiums. Incentives were also given to grape growers to act quickly as the value of the premiums received would decrease in the second and third years of the policy. Promoting competitiveness and fighting oversupply were truly at the heart of this policy project.

However, this scenario was not validated and a second proposal was negotiated in 2007. After many debates and a parliamentary text putting forward more than 500 amendments [27], the Council of ministers approved the 2008 wine CMO[11] reform (Council Regulation (EC) No. 479/2008 of April 29, 2008), which included a new grubbing policy. In it, the original target of 400,000 ha was first reduced to 200,000 ha spanning 5 years and then, furthermore, to 175,000 ha on a 3-year period—2008/2009, 2009/2010 and 2010/2011—with premiums also decreasing in the second and third years.

This three-year grubbing policy is defined in the 2008 wine CMO under TITLE V, PRODUCTION POTENTIAL, CHAPTER III Grubbing-up scheme. Arguments for such a scheme are stated in recitals 3, 58 and 68: "Moreover, some of the existing regulatory measures[12] have unduly constrained the activities of competitive producers."—recital 3; "While the transitional prohibition on new plantings has had some effect on the balance between supply and demand in the wine market, it has at the same time created an obstacle for competitive producers who wish to respond flexibly to increased demand."—recital 58 and finally "Where producers consider that the conditions in certain areas are not conducive to viable production, they should be given the option of cutting their costs and permanently withdrawing these areas from wine production and should be enabled either to pursue alternative

[10] Each year the OIV publishes data in regards to wine production.

[11] The new wine CMO dealt with the organization of the wine common market. It modified rules (EC) No. 1493/1999, (EC) No. 1782/2003, (EC) No. 1290/2005 and (EC) No. 3/2008, and repealed rules (CEE) No. 2392/86 and (EC) No. 1493/1999.

[12] Commonly understood as planting rights, as confirmed by recital 58.

Table 3. Level of the premium provided for in Article 98 of Regulation (EC) n. 479/2008 ANNEX XV.

Historical yield per hectare (hl)	Premium (EUR/ha)		
	requests approved in 2008/2009	requests approved in 2009/2010	requests approved in 2010/2011
(1)	(2)	(3)	(4)
≤20	1740	1595	1450
>20 and ≤30	4080	3740	3400
>30 and ≤40	5040	4620	4200
>40 and ≤50	5520	5060	4600
>50 and ≤90	7560	6930	6300
>90 and ≤130	10,320	9460	8600
>130 and 160	13,320	12,210	11,100
>160	14,760	13,530	12,300

Source: Commission Regulation (EC) n. 555/2008 of 27 June 2008.

activities on the relevant area or to retire from agricultural production altogether."—recital 68.

Through these recitals the grubbing-up policy appears to intervene simultaneously on supply and efficiency with objectives to respectively eliminate planting rights[13] and foster economies of scale in grape farms. It is also put forward as a way to eliminate the least productive producers, by enticing then with a premium. Article 102 "procedure and budget" defines how to target the least productive grape grower through a set of rules prioritizing the access to the premium. Priority is given to those (1) grubbing up the entirety of their vineyard or completely ceasing their wine-related activity and (2) to applicants aged 55 or higher. Furthermore, premiums increase with the yield and decrease in the second and third years as shown in Table 3 This gradualness is part of the European Commission's tradition, as it believes that it should compensate the loss in revenue in proportion to the yield[14].

This grubbing-up policy was successful as EU countries used a 100% of the available budget and seamlessly reached the 175,000 ha target and 160,550 once the application files were treated[15].

Simultaneously to the implementation of three grubbing-up campaigns, the 2008 wine OCM (CE n° 479-2008) reorganized the management of viticulture by means of the NSPs, "the national support programs". These programs provided a fixed budget for each country and gave each Member State (MS) the possibility to choose its objectives "à la carte within a menu", and with the possibility of doing so at the regional level. By doing so, Europe was thus giving itself other means of continuing to improve its viticultural performance, in particular by three preferred means in France: restructuring and reconversion (37.8%), investment (32.3%) and promotion (14.3%) ((CE) n° 479-2008, art. 10-11-15 confirmed by (CE) n° 32013R1308 art 43-52) [30].

2.4 2013 CMO: abolition of planting rights and the end of premiumized of grubbing-up campaigns

The 2008 wine CMO introduced the abolition of planting rights by 2015, a decision that led to debates and controversies within the wine industry. Responding to the uproar, the 2013 CMO transformed planting rights into planting authorizations and introduced a yearly growth limitation corresponding to 1% of the area planted in vines. Authorizations are free, they cannot be sold on a market like planting rights could. Economically argued limits were also introduced at the PGI and PDO level. Grape growers can plant as many vines as they want as long as national and local limits are not attained. In the south of France [11], with the exception of Charentes exposed to strong growth in demand for cognac, local limits have not been very much used. Hérault area planted in vines has stabilized around 80,500 ha since 2011, after having lost 40,931 ha from 1988 to 2010 with the permanent abandonment premium [31].

Grape growers use today CAP tools, such as restructuring instruments, that let them get financial help in order to plant improving varietals, change the distance between rows, changing the canopy management, introduce irrigation, improve environmental aspect such as planting hedges. But it appears that the CAP's tools are not sufficient to replace the effects of a grubbing-up campaign in regard to bringing the market back to equilibrium, particularly in on a regional market. Recently, in 2022, Bordeaux has been pleading for a grubbing-up campaign, but under the 2013 CMO there is no legal basis to fund it [32,33].

[13] Planned next was the liberalization of vine planting by making disappear all planting bans (i.e. planting rights). The start of this plan ranged from 2015 to 2018 and many reasons in the text supported and motivated their definitive disappearance. But as the deadline approached, many European professionals and many locally elected representatives questioned the soundness of this deregulation as they feared disastrous consequences.

[14] Delord and al. (2016) have questioned the relationship between yield, size and profitability in viticulture [18].

[15] Upon further notice FranceAgriMer determined that 160,550 ha resulted in premiumized grub-ups [28]. Dacian Ciolos confirmed the 160,000 ha of grubbed up vines in the April 19, 2012 speech [29].

3. HÉRAULT 2007/2008 CAMPAIGN: A CASE STUDY TO SHED LIGHT ON THE 2008/2011 EU GRUBBING POLICY AND THE QUESTION OF THE REINTRODUCTION OF LOCALIZED PREMIUMIZED GRUB-UPS IN 2022

3.1 The importance of Hérault and past studies in Languedoc-Roussillon

Historically[16] the Languedoc-Roussillon region, where Hérault is situated, has been very prone to grubbing up: from 1977 to 2010, this policy resulted in the disappearance of 40% of the vineyard (166,000 ha) [35]. According to the *Cour des comptes*, the grub-up of high-yield vines and vineyards being qualitatively restructured led Languedoc-Roussillon's mean yield to drop from 80 hl/ha in 1980 to a bit more than 50 hl/ha in 2009 [35]. This court adds: "The focus of the grubbing-up subsidy policy on a region traditionally prone to overproduction, added to the restructuration policy has profoundly modified this region's landscape and the wine supply. It has favored the going out of business of many small polyvalent producers and has led to an upgrade of the product range" [35, p. 24–25]. In France, the 2008 wine CMO grubbing campaign resulted in more than 58,000 ha of vines removed and not surprisingly most came from Languedoc-Roussillon and Hérault [35]. From 2005 to 2010, 69% of all grubbed-up areas in France and receiving premiums happened in Languedoc-Roussillon [35].

Past research has already been conducted in Hérault on grub-up motivation, particularly the study done by Pierre Bartoli and Marc Meunier in 1982 [36]. In "*La politique de reconversion viticole : résultats de la prime d'arrachage en Languedoc-Roussillon 1976-79*"[17] [37] the goal was to examine the consequences of the *distribution of sizes* on production systems. They wanted to understand the farmers' governing motivations, their adequacy with the wine policy and analyze the socio-economic situation. This study showed the importance of the gap between the objectives set forth for reconversion premiums and the actual results. This gap appeared not only at the level of zones and farm structures, but also at the one dealing with the types of grubbing-up implemented and their reasons.

The Observatoire viticole de l'Hérault's (2005) [38] study *"Étude d'impact des arrachages définitifs dans l'Hérault"*[18] updated the 1997 works of Aigrain et al. [39] by undertaking a very precise statistical analysis, taking into account quantities and geographical areas, on a period ranging from 1988 to 2003. It showed that grub-ups were mostly located in the coastal plain, in urban and peri-urban areas. It also took note of the regression of the number of small size farms, the grub-ups within areas of appellation, the acceleration in the loss of the traditional varietals and the grub-ups of improving varietals. The study also showed "that from 1988 to 1991, the reasons for grubbing up gathered from the analysis are diffuse. Their results show that premium value arrived in first place (83% of grub-ups received a premium). A need for diversification is also very present (80%) and it is hard to dissociate decision-making elements, such as retirement (30%), family reasons (24%) from a need for cash (10%)" [38]. However, they did not precisely state their survey's sources and methodology.

Nevertheless, this study cites through "experts' statements" the possible motivations for primed grub-ups: "(1) some grape growers that are dealing with hardships, take advantage of this chance to improve finances (grubbing up small surfaces), (2) small farms (<5 ha), farmers that will retire soon and have nobody to takeover, will be the first concerned, (3) for certain farms the whole area may be grubbed up" [38, p. 16]. We find the same reasoning that had been expressed by the European Commission as the study cites their arguments and explicitly leans on them.

Our analysis also aims to complete and further advance these previous works by pinpointing the real motivations (economic and social) that push grape growers to permanently grub up, partially or totally, their vines. This leads to a finer analysis of the adequacy between the actual grub-ups and the future objectives set forth by the policy within the 2008 wine CMO.

3.2 Our analysis of the 2007/2008 grubbing-up campaign

Any economic policy decision taken at a level as aggregated as viticulture in Europe cannot take into account all the situations of grape growers and all their motivations for grubbing up their vines. Few data have been published on either the age of grape growers or on their economic performance to justify the a priori choices made. Being considered as common knowledge was enough to make these facts relevant. Furthermore, the success of this policy according to selected criteria has substantiated the merits of the common knowledge. To us, it seemed interesting to deepen the thought process

[16] For a general view of French viticulture see Alonso et al. (2019) in The Palgrave Handbook of Wine Industry Economics [34].

[17] The wine conversion policy: results of the grubbing-up premium in Languedoc-Roussillon 1976-79.

[18] Impact study of final grubbing up in the Hérault.

on the EU 2008/2011 grubbing-up policy by analyzing the technical and microeconomic data originating from a genuine database capturing the grape growers' motivations and behaviors adopted during the last subsidized grubbing-up campaign (2007/2008) using the previous 1999 wine CMO rules.

It should be noted that this is France's second largest grubbing-up campaign during the entire 1999/2011 period with 6,278 ha grubbed up and of which 4,040 ha happened in Languedoc-Roussillon. Also, the 2007/2008 campaign gave the possibility to introduce specific rules locally. This was authorized by the 1999 wine CMO, adopted at the French national level and defined regionally by the "interprofessions" (inter-professionnal organisations) as they had the possibility to exclude any appellation or any varietals within an appellation from being grubbed up[19].

There are several reasons for doing so (1) because precise data on the 2008 wine CMO grubbing-up scheme is extremely hard to encounter due to privacy rules and (2) according to experts (INAO and FranceAgriMer) this data may not be representative as rumor is that some grape growers split-up their grape farms and made their elderly grandparents owners of the areas to be grubbed up in order to maximize their chances of receiving their premium. Therefore, the 2008/2009 data may be skewed and therefore the previous 2007/2008 campaign may be more representative of grape growers' natural motivation as it does not incite them to change their behavior.

Our analysis acknowledges the 2004 world oversupply crisis that impacted all wine-producing countries in the world. Falling prices created financial hardships for farms and cooperative cellars [41, 42[20], 43[21], 44[22]]. Our complementary hypothesis is that numerous grub-ups were motivated by the consequences of the economic crisis due to falling prices and that grubbing-up premiums were also a means of survival for many grape growers, as they could use these premiums to reimburse bank loans contracted to purchase land or to plant vines in order to meet the '90s new qualitative orientation. The 2004 supply crisis was followed by a strong demand crisis in 2008 due to the subprime mortgage crisis, which extended hardships for grape growers and increased their resort to grubbing up.

3.3 Hypotheses

Using a typology of grape growers, we state the following hypotheses on their use of premiums resulting from permanently grubbing up their vines:

- Freshly installed young grape growers facing a budget and indebtedness crisis: for them, premiums will be of great help in facing current farm expenses and to pay back loans and debt.
- Grape growers near retirement: grub-up premiums guarantee them a decent retirement.
- Grape growers that can no longer face the crisis: their belief is that grape-growing has no future in the region and has become a rewardless enterprise. Therefore, they decide to grub up their vines and with the help of the premiums, they invest in other crops (wheat, fruits, vegetables, etc.). They may reorient themselves towards other sectors they deem more rewarding.
- Grape growers owning land near urban centers: their vineyards are grubbed to transform their land lots into building plots.

4. MATERIALS AND METHOD

4.1 The sources of information: 341 Viniflohr application files

Viniflhor[23] manages premiumized grub-ups in France and grape-growers must submit to them an application file. In addition to its administrative task, Viniflhor analyzes the information in the files to compile grubbing-up statistics at the levels of the city, the department, the region and the country that are published on the site of the *Observatoire viticole (Dyopta)*[24]. Spatialized data is highly interesting especially at a

[19] "Geographical areas that can benefit from the premium for definitive abandonment of area of vineyard under the 2007/2008 campaign for the Languedoc-Roussillon region: […] for the department of Hérault, all areas under vines, excluding areas planted with Clairette (white) grape variety in the PDO 'Clairette du Languedoc' and areas planted with Cinsault grape variety (red) in Vin de Pays des 'Côtes de Thongue'" [40].

[20] "The study clearly illustrates the crisis. The majority of winemaking farms from Languedoc Roussillon cannot survive with the actual wine prices. We add to this the deficiency of the yields. Sacrifices have been made to 'hold on' (few private withdrawals) but we note strong restrictions on investments (on average €10,000 per farm in 2007, €6,000 in 2008)" [42].

[21] "The Languedoc-Roussillon economy: 90% of the grape-growing farms appears to be in financial hardship. The CER (Center of rural economy) of Languedoc-Roussillon presented this week an alarming report on the financial situation of the region's grape growing farms. According to this study conducted within the scope of the regional wine production observatory, the financial situation of the wine-growing farms has strongly deteriorated within the last three years" [43].

[22] "In reality it's mostly Languedoc-Roussillon that is going to grub up its vineyards. The crisis is here, worst and more profound than anywhere else and the winemakers' cash reserves are totally depleted" [44].

[23] Now FranceAgriMer.

[24] Today this privately owned company is defunct.

fine scale, but it only allows us to randomly approach and survey grape growers that have decided to grub as Viniflhor's management of grubbing-up premiums anonymizes all application files to ensure confidentiality meaning that individual grape growers are theoretically inaccessible.

An exception was made for the 2007/2008 grubbing-up campaign as professional wine organizations demanded Viniflhor to insert in the application files an optional consent form for grape growers allowing their application files to be forwarded to a development agency. France directly funded 2007/2008 campaign and it was the last one before the implementation of the new EU grubbing-up policy (2008/2011). The idea was to allow an ongoing thought process to improve future targeted interventions in order to better follow up on grape growers and their grubbed-up lots. The main points were economic monitoring and managing landscapes. In the case of our study, consenting grape growers accepted that their contact information and the content of their accomplished grub-ups be transmitted to the Hérault Chamber of Agriculture (local extension service). 341 files representing about 20% of all Hérault applications for the 2007/2008 premiums were transmitted. However, on certain files, certain information was missing as some questions remained unanswered.

As the application files were handed over to us by the Hérault Chamber of Agriculture, we did not construct the survey sample. Furthermore, in regard to the French laws concerning privacy (CNIL), we do not have any information on the entirety of the population that grubbed up their vines. Therefore, we are unable to see if our 20% sample represents or not and if it is biased or not in regard to the Hérault population grubbing up their vines during the 2007/2008 campaign. It could therefore appear, a priori, as a sample created by convenience since it is true that, within the grubbing-up application files, the choice "is favorable to the transmission of the file to a development organization" is not subject to any known statistical references.

However, a posteriori, once we look closer, this is not the case of our survey sample. In fact, we can do the hypothesis that the population grubbing up their vines is representative of the total population of grape growers in Hérault. To do so, we use the criterion "size of the vineyard". When characterized by this criterion, our sample survey comes very close to one created by quota sampling using data contained in a survey conducted in 2007 by the Hérault Department on the size of grape farms in Hérault. [45]. Our sample's variable concerning the size of grape farms when regressed against the one contained in the 2007 Hérault survey results in a coefficient of determination equal to 0.78 (R^2 using Pearson's method).

The transmitted information was limited and contained: identification of the farmer and his farm, direct or indirect farming, owner-farmer or tenant-farmer leasing land, farm's total area in vines and grubbed-up areas, winemaking location, list of lots being grubbed up including age of vines, their classification and if appellation wine was being produced, and the area grubbed up. Quite surprisingly, the farmer's age and yield were missing. These elements are essential in calculating the premium amount and should have normally been included. We assume their absence was due to the fact that Viniflhor directly gathered this data on site during the field evaluation prior to the grub-ups and immediately evaluated premiums, according to Table 4, as it completed the processing of the files.

Table 4. Premium for the permanent abandonment (2007/2008 grb-up campaign, amount in euros by yield and by hectares.

Total area to be grubbed up	Vineyard area within the farm	Yield (hl/ha)	Premium amount (€/ha)
Less than 10 ares	Any area	Any value of yield	0
From 10 ares to 25 ares	Lower or equal to 25 ares	Any value of yield	4,300
	Higher than 25 ares		
More than 25 ares	Higher than 25 ares	Yield lower or equal to 20	1,450
		Yield higher from 20 to 30	3,400
		Yield higher from 30 to 40	4,200
		Yield higher from 40 to 50	4,600
		Yield higher from 50 to 90	6,300
		Yield higher from 90 to 130	8,600
		Yield higher from 130 to 160	11,100
		Yield higher than 160	12,300

Source: Viniflhor [40]

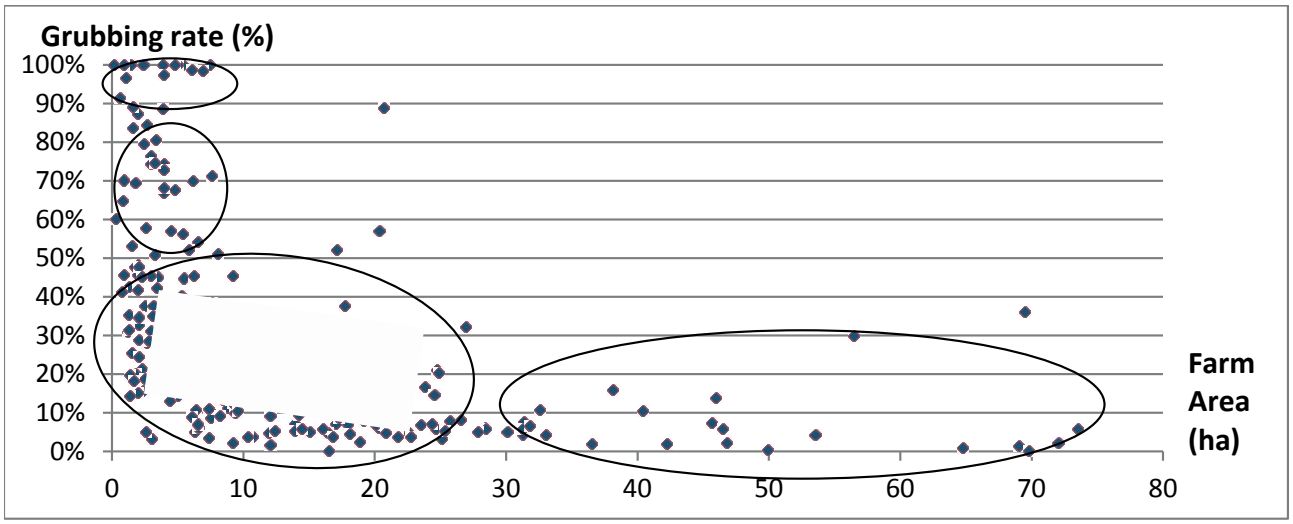

Figure 2. Grubbing-up rates according to total areas of vines (341 farms) 2007/2008 Hérault. Source: 341 Viniflhor application files submitted with authorization to development agencies [4].

4.2 Sources of information: a survey of 51 grape growers

After waiting 9 months, from September 2009 to March 2010, we completed our study by individually surveying 51 grape growers. Indeed, as the 341 files were not anonymized we constituted a sub-sample containing 51 grape growers selected by size strata [46] and using telephone interviews, we were able to complete the information contained in the application files. Our survey included detailed questions on farm structure and grub-up motivations. Questions included the sex and age of the grape growers, the legal entity of their farm, how they acquired it, the size of their farm, the planted area of each varietal, the area of the varietals being grubbed up, the motivations for grubbing up, questions on the financial situation of the grape grower, questions of past grub ups, the presence of other crops on the farm, questions on grants received, questions on the possibility of an heir taking over. Included was also a non-directive qualitative commentary from grape growers on their economic situation.

The goal was to have access to a sample that best represented the concerned population. Many questions were not fully answered, but a certain number of them enabled us to confirm certain qualitative results.

5. RESULTS

5.1 The grubbing-up rates

The grubbing-up rate is an excellent indicator to measure the application of the grubbing-up policy. As shown in Figure 2, we can define four groups of application files. The first group includes the smaller sized grape growers that grubbed up all or almost all their vines. The total area of their vineyard is 10 ha or less. The second group is similar to the first in vineyard size. Its specificity is that the grubbing-up rate is lower, between 50 and 80%. They often conserve a small land lot to grow vines to keep a link with the cooperative cellar. This guarantees grapes for family consumption and a family revenue. They are trimming down on their size. The European Commission specifically targeted these models. The third model englobes small and medium-sized farms that only grubbed up a smaller part of their vineyard: 1 to 30%. These grub-ups are limited. Many farmers justify their decision of "selling a lot with vines" because of the opportunity to sell in a land market depressed by the crisis [47] and to find cash to reimburse loans. The fourth group gathers all the large farms. The areas grubbed up are high in absolute values, but much lower in relative values. Grubbing-ups represent a sort of "option value" on the future, as it enables to balance the accounting books while they await the market's evolution and the impact of the European grubbing-up campaign on the prices. The decision to quit, maintain oneself or again, increase in size will depend on the future sectorial situation. Figure 3 gives another illustration of this data.

5.2 The varietals

We analyzed the grub-ups of 273[25] grape growing farms based in Hérault and their corresponding

[25] Varietal data was missing from 68 wine estates.

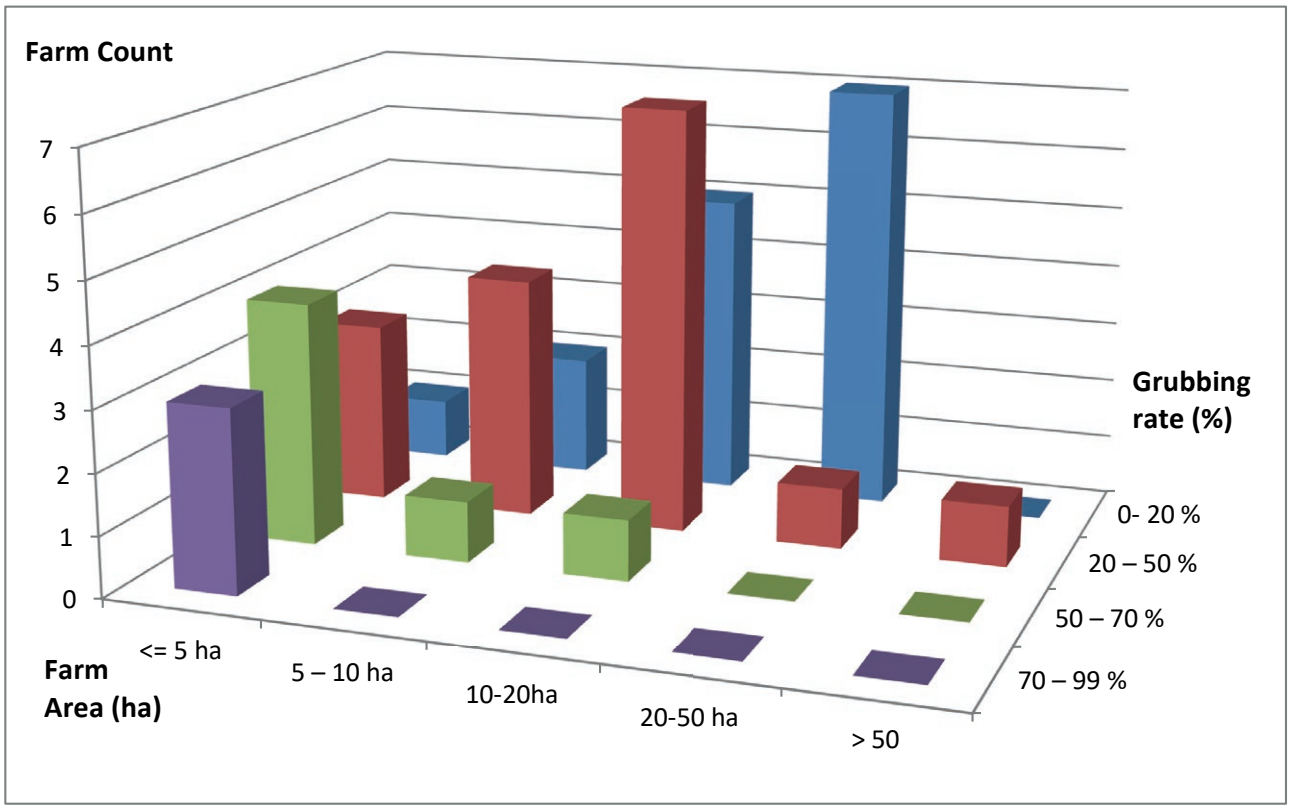

Figure 3. Headcount of surveyed farms according to their area and grubbing-up rate (341 farms) 2007/2008 Hérault. Source: 341 Viniflhor application files submitted with authorization to development agencies [4].

1,029 land lots, for the year 2007 – representing 484 ha of grubbed-up vines. The grubbed-up varietals can be categorized into two principal categories: traditional varietals and improving varietals as shown in Figure 4. Among the latter, some are considered as southern qualitative varietals such as Syrah or Grenache, and are found in the PDO specifications (cahier des charges). Others, such as Cabernet Sauvignon and Merlot, are excluded from the Languedoc PDO specifications. These were principally developed for the Pays d'Oc wine category [48,49]. The traditional varietals (Carignan, Aramon, Alicante, Cinsault, Terret-Bouret, white Ugni) are considered as either too abundant or too productive when planted in the plain. The Ministry of Agriculture's policy and subsidies for restructuration have favored the reduction in share of these varietals in the Hérault vineyards. The eight most grubbed-up varietals represent three quarters of all the grub-ups (361 ha/484 ha). Among those 83% are traditional varietals and 17% improving varietals.

More than a third of grubbed-up vines are Carignan: 184 ha (38%). Other major traditional varietals from the Languedoc vineyard are Cinsault (53.3 ha or 11%), Grenache (47.6 ha or 10%), Aramon (21.6 ha or 4%) and Alicante (46.6 ha or 10%). Added to these traditional varietals are improving varietals such as Syrah (38 ha or 8%), Cabernet Sauvignon (25 ha or 5%) or Merlot (19 ha or 4%). The remaining grubbed-up hectares are either made up of traditional varietals from Languedoc (Mourvèdre) or other improving varietals (Viognier). We even found some table grapes (Danlas or Dabovki), but their proportions remain minimal and stay below the 1% mark.

To refine our analysis, we looked at the age of the grubbed-up vines (Figure 5) and in doing so we retained 4 age categories with a 25-year interval (0 to 24 years, 25 to 49 years, 50 to 74 years and 75 to 100 years). The major fact observed is that most of the improving varietals are grubbed up before they reach 25 years. 92% of grubbed-up Cabernet Sauvignon (22.9 ha/24.9 ha) and Merlot (12.4 ha/13.5 ha) were less than 25 years old. In regard to Syrah, 85% of grubbed-up vines were under the age of 25. Oppositely, the age at which traditional varietals are grubbed up was much older: almost 2/3 of Carignan vines (108.5 ha/165.9 ha) were grubbed up between ages 25 and 49. About a 1/4 of grubbed-up

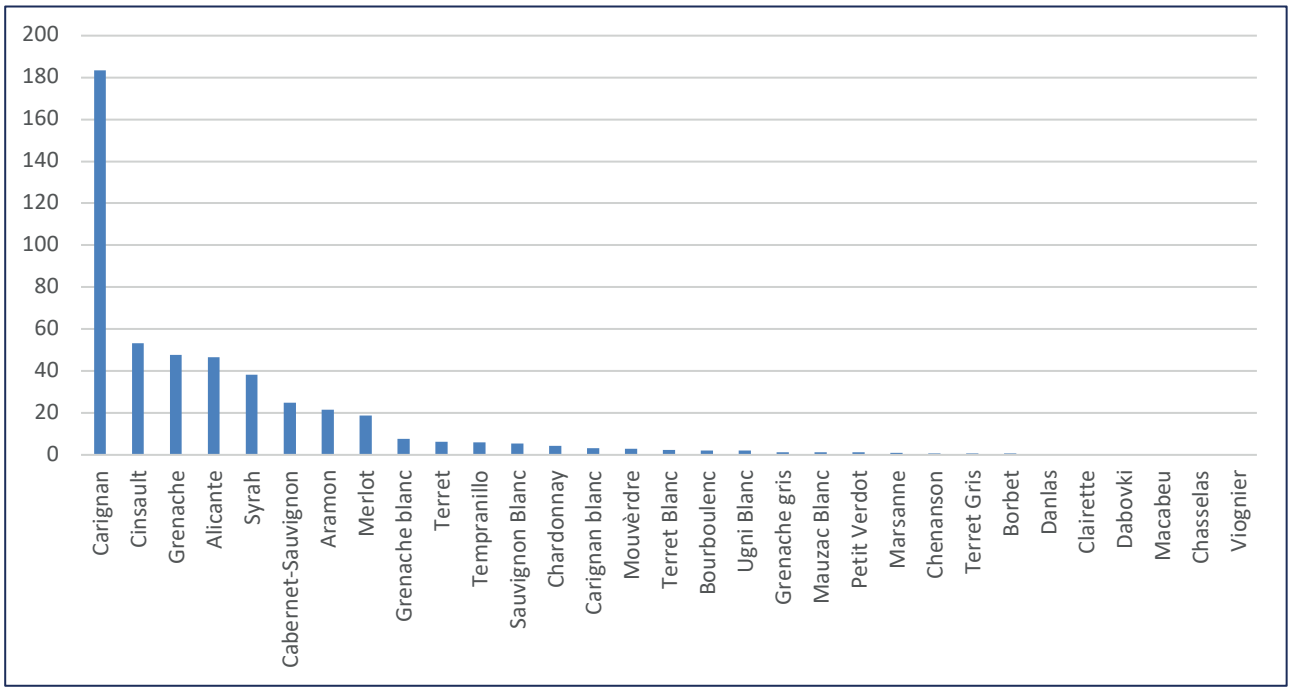

Figure 4. Grubbed-up areas (ha) according to varietals (2007/2008 Hérault). Source: Viniflhor application files submitted with authorization to development agencies (273 estates as some data was missing in the files) [4].

Carignan vines were between ages 50 and 100 (46.7 ha). We find similar age ranges for other traditional varietals as the age of 93% of grubbed-up Alicante is between 25 and 49 years. 42.5% of grubbed-up Aramon is located within the same range and 53% within the range of 50 to 100 years. Only in the varietals Grenache and Syrah did we see vines under the age of 25 having been grubbed up: 46% and 28% respectively. However, when we look at the varietals between the ages 25 and 49, the grub-ups represent respectively 46.5% and 64%.

When looking at the grubbed-up varietals and their ages as illustrated in Figure 5, we can state that the main goal of eliminating the oldest vines and the least adapted to the market demand constituted the main part of the intervention. However, an important part of "improving varietals," about a sixth were removed. This sends us to other explanations that are of a microeconomic nature that we will now study.

5.3 The motivations

The reasons why each grape grower grubs up his vines are unique, that is, if we take into account the history of his farm, the specificities of his vineyard, his outlook on the future, his financial situation, if his farming business is full time or part-time, the existence of side revenues, etc. We conducted a survey in order to pursue our idea of testing the relevance of the "reaction" induced by the European Commission's economic policy.

Our goal is (1) to shed light on the impact of the premiums on the behavior of grape growers during the 2007/2008 campaign (the grubbing-up policy preceding the three-year campaign of the 2008 CMO), (2) but also use these finding to reflect on the new grubbing policy born from 2008 CMO and see which of our findings appear, or not, in Fischer Boel's decision to grub-up 175,000 ha.

We surveyed grape growers that grubbed up their vines. We recorded word for word their reasons, expressed directly from the grape growers, for their grub-ups. Twenty reasons were noted (Table 5). We have been very thorough in recording these motivations. Oftentimes we recorded two or three, near or complementary reasons coming from the same grape grower (on average two and a half).

These motivations can be placed in five large categories:

- Economic reasons are dominant: a lack of profitability and a need for cash. Almost half of the answers dealt with economic reasons. Our hypothesis of the impact of the economic crisis on the situation of farms has been confirmed. The goal can be to leave the business or simply to have access to more dis-

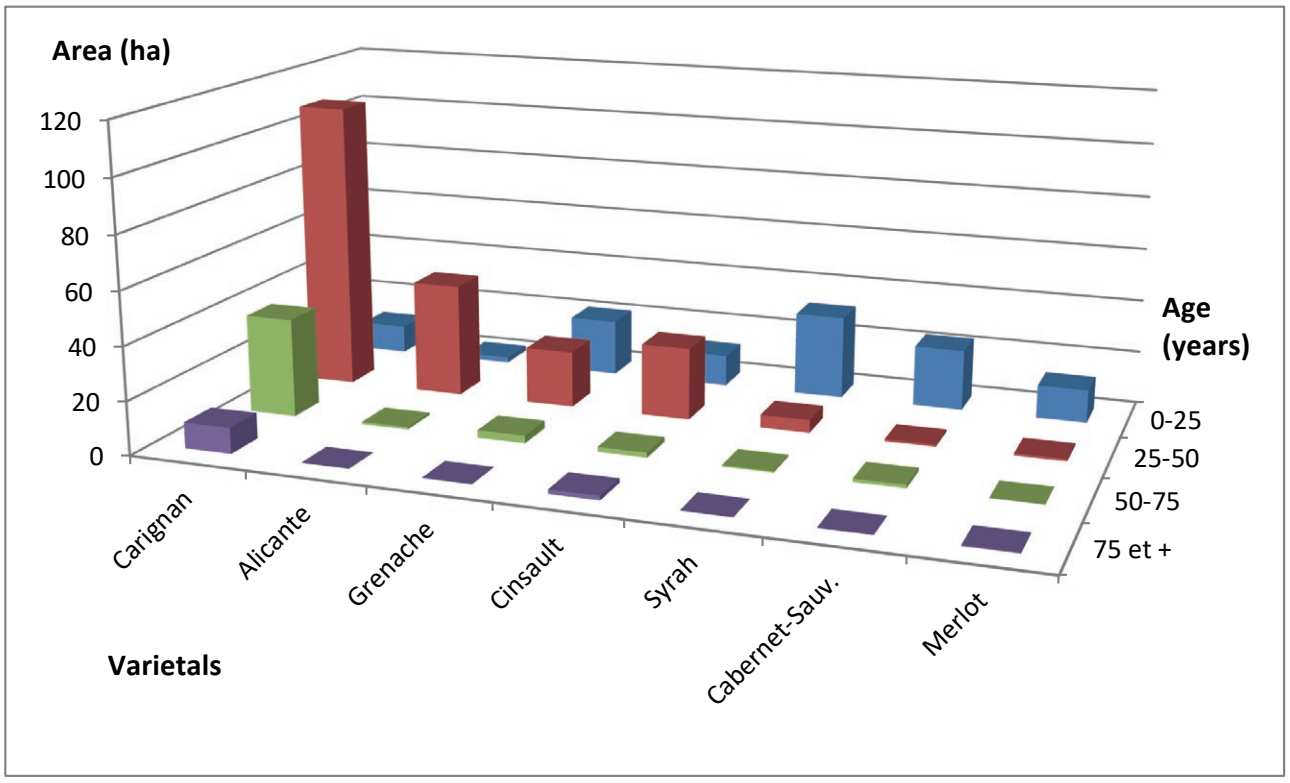

Figure 5. Grubbed-up areas according to varietals and age of the lots (2007/2008 Hérault). Source: Viniflhor application files submitted with authorization to development agencies (273 estates as some data was missing in the files) [4]

posable cash. The additional cash may be used to change businesses—linked to farming or not—or reduce debt. The premium enables to transform land capital into financial capital in a period when the market for vineyard land is limited [47]. The land prices adjust themselves to the value of the premium added to the value of bare land.

- Then come the reasons associated to the farmer's "life cycle." These reasons are almost cited as much as the economic reasons. They are similar to the wine CMO whereas: The premiums allow grape growers to retire with additional capital. It is a type of retirement annuity[26]. Old age often goes hand in hand with retirement and the absence of a buyer or a successor. This happens with the departure of land leasing farmers and sharecroppers. The owner due to his old age cannot himself take over the work needed for the vines. Lack of time and a second activity are motivations that are slightly different. Low profitability is the reason that leads to reevaluate the opportunity cost linked to the time committed to grape growing. Death and health problems speak for themselves.
- Farm reorganization is less frequently cited. Reducing the size can be linked to a reduction of payroll taxes, particularly by laying off a farm worker. It can free up additional time for a family member that can then take on another business. Grubbing up vines from land lot situated far away from the farm's center will reduce the distances within the farm. This can be analyzed as a cost reduction (distance) or as a waiting strategy to purchase, at a later date, better situated land or vines. The goal is to increase the rationality of farming. Here, we are also looking at a deal that in a time of crisis is impossible to go forward with because of a lack of buyers. The nature of the investment made with the premiums is not clearly stated. But it is also linked to a strategy of future farm enlargement or reorientation of the estate. The possibility of transforming a freed-up land lot into a building lot is only cited once. The intent here to perform a double dividend: turn the estate into cash and cash in on the real estate profits. Bartoli and Meunier's [36] study had shown that this double dividend was meaningful in the suburbs of the Languedoc plains and in many villages. For our survey, this dimension seems statistically too limited.

[26] In French this is called: "indemnité viagère de départ".

Table 5. Reasons for grub-ups.

Economic			57	45%
Absence of profitability	38	30%		
Need for cash	19	15%		
Life cycle			44	35%
Retirement	4	3%		
Old age	3	2%		
Lack of workforce to hire	4	3%		
Lack of time due to second activity	11	9%		
Death	1	1%		
Departure or absence of the land leasing farmer or sharecropper	7	6%		
No buyer/successor to take over business	7	6%		
Health problems	7	6%		
Farm Reorganization			7	6%
Size reduction	1	1%		
Recentering the farm	3	2%		
Investment	1	1%		
Land purchase	1	1%		
Building plots	1	1%		
Technical			10	8%
Old vines or in bad state	10	8%		
Activity reorientation			9	7%
Direct sales	1	1%		
Oenotourism	2	2%		
Development of another crop	5	4%		
Change of business	1	1%		
Total	127	100%	127	100%

Source: Data from the 51 grape growers surveyed [4].

- The age of the vines or their poor state is a technical reason that is very rational. The remaining question would be to know if it was appropriate to subsidize these grub-ups. Sooner or later these lots would have been eliminated and their contribution to the excessive supply was low. The premiums, however, were the right answer to Brussels targets. Lots that are in bad state have a low profitability and therefore coincide with the elimination of the least productive grape growers. However, we must state that this motivation is rather rare in our sample.
- A new orientation for farm activities also constitutes an answer to the objectives of the commission, but in a more indirect way. Developing a more profitable business, changing business models, developing another crop, selling directly to customers, and organizing oenotourism, all these goals meet the target of improving competitiveness and support the need for extra cash.

5.4 Econometric model: ordinary least square regression

In order to further explain the reasons for grubbing up within the data gathered from our 51 grape growers, we have used an ordinary least square (OLS) regression where X_i are the k explanatory variables and Y is the dependent variable. The model is linear and for each sample n the value y_n is:

$$y_n = \sum_{i=0}^{k} ß_i x_{ni} + \epsilon_n$$

The coefficient ß are found by minimizing the error of prediction.

In our model Y is the grubbing rate and the k X_i explanatory variables are: grape grower's sex and age, his need for cash and profitability, his agricultural activity, belonging to a cave coop, having an heir to take over the vineyard, if the grape grower had already previously been in a grubbing-up campaign. Other variables included are the age of the vines being grubbed up and several important varietals: Carignan, Syrah, Aramon, Grenache, Merlot, Cinsault and Sauvignon.

Our OLS model has led to interesting results that are shown in Table 6. It seems that there is an average correlation between having a tendency to grub up less and the fact of being a man (-0.172*) or of planning an agricultural activity after the grub-ups (-0.199*). This tendency to grub up less seems to be strongly correlated to being optimistic (-0.291**) and having an heir wishing to take over the family vineyard (-0.374**). These correlations are rational. The fact that a correlation exists between grubbing up and being a man is linked to the fact the low number of women (12 women, 23.5%).

The other strong correlations in our OLS regression are linked to varietals. It appears to that a strong correlation exists between a high percentage of grubbed-up vines and the grubbing-up of varietals Aramon (0.316**) and Merlot (0.369**). Conversely, it seems that the more grape growers own Cinsault (-0.259**), the less they tend to grub it up. This data on varietals should be put into perspective with the historical evolution of Languedoc grape varietals.

The grubbing-up of Aramon is logical as it is one of the old Languedoc varietals planted in the plains and linked to mass production of table wine. Today the area planted in Aramon is still deemed excessive meaning that more should be grubbed up. The explanation of grubbing up Merlot is more counterintuitive as Merlot is one of the first improving grape varietals introduced into the Languedoc vineyards. Several interpretations

Table 6. Econometric analysis using the OLS.

	(1)	(2)	(3)
male	-0.187*	-0.158	**-0.172***
	[-1.95]	[-1.62]	[-1.81]
grape_grower_age	0.00803**	0.00891*	0.00621
	[2.08]	[1.93]	[1.31]
need_for_finance		0.0230	0.130
		[0.22]	[1.25]
other_agri_activity		-0.105	-0.199*
		[-0.92]	[-1.89]
coop		-0.0678	-0.118
		[-0.53]	[-0.87]
heir		-0.400**	-0.374**
		[-2.62]	[-2.49]
optimistic		-0.264**	-0.291**
		[-2.06]	[-2.31]
previous_grub_up		-0.0891	-0.128
		[-0.71]	[-1.07]
age_of_vines		-0.00322	-0.00298
		[-1.12]	[-1.09]
carignan			0.103
			[1.00]
syrah			0.0858
			[0.68]
aramon			0.316**
			[2,39]
grenache			0.0349
			[0,33]
merlot			0.369**
			[2.73]
cinsault			-0.259**
			[-2.07]
sauvignon			-0.198
			[-1,23]
_cons	0.0835	0.330	0.391
	[0.37]	[0.88]	[0.94]
N	49	49	49
R2	0.152	0.348	0.573

Source: Zadmehran (2016) [50].

may be put forward explaining why they have a higher tendency to be grubbed up. Firstly, these may be the first generation of Languedoc Merlots introduced in the 80's probably planted in poor ecological condition (soil, microclimate, canopy management). In such a case, their grubbing-up and potential replacement are justified. Another interpretation is that the grape growers' situation is too dire to take into account the quality of this varietal. Yet another possibility is that the grubbing-up is linked to the impossibility of selling the plot planted in Merlot. Finally, it must be noted that all three interpretations may be combined.

Cinsault is a dual-purpose varietal (it is also a used to produce table grapes) traditionally found in Languedoc. Recently it has been revisited by many Languedoc PDOs, particularly in Corbières, Pic Saint-Loup and Saint-Chinian and currently benefits by the high demand for rosé wines. Furthermore, special rules in Hérault banned its grubbing-up in certain appellations [40].

It is interesting to note that our model does not show any strong correlation between the grubbing-up rate and the age of the grape grower, the financial situation of the grape grower, a participation in a cooperative, the age of the vines, the existence of the previous grubups. Furthermore, in regard to the varietals there appear no strong correlation between the grubbing-up rate and Carignan, Syrah, Grenache and Sauvignon.

6. CONCLUSION

Can the grubbing campaigns that followed the period we studied, i.e. after 2007/2008, be clarified or, conversely, can it enlighten the micro-economic analysis of our survey on the permanent grubbing-up awarded in Hérault?

The three campaigns that followed, 2008/2009, 2009/2010 and 2010/2011, were the implementation of Commissioner Mariann Fischer Boel's project of massive grubbing-up schemes oriented first on the equilibrium of the market, then on the improvement of the productivity of European viticulture. This orientation was formalized in the criteria required for allocating aid: the grubbing-up of an entire vineyard or the grape grower's age needed to be higher than 55 years. As such, this grubbing-up policy allowed elderly people without heirs or any economic prospects to exit their business and at the same benefit from the cashing out of their capital.

Simple criteria were needed to implement Fischer Boel's policy, however, these criteria could not take into account qualitative aspect such as the choice of grape varietals to be grubbed up (see improving grape varietals of the 2007/2008 survey), nor the financial needs of grape growers under pressure from banks due to debt stemming from the crisis of overproduction in 2004 (Cf. motivations). In fact, it is also known that the selected criteria have caused families to divide their vineyards to meet the threshold and benefit from this funding (see the partial uprooting observed in 2007/2008).

The realization of this operation was a success as it reduced the EU's vineyard production potential and allowed the early retirement of many operators. In the

years that followed, the question of premiumized permanent grub-ups was settled. In fact, at first our work only serves to improve our understanding of the impact of a "dated" agricultural policy measure.

Subsidized grubbing-up policies have been implemented since a long time in many grape-producing countries. The European Commission has finally adopted this tool to achieve an identical goal: regulate the supply through the control of the production potential. Even though the question of how to improve productivity has been set at the forefront as a justification for the intervention, the target is truly, in a first step, the impact of the reduction of supply potential on the market. From this point of view, the policy was highly efficient since 160,550 ha were grubbed up.

In our analysis, limits we faced stemmed from the sampling method as the selection of grape growers was volunteer-based and thereby affects the representativeness of our quantitative evaluation. Also, by using indirect productivity variables, age and total area grubbed up, the 2008 wine CMO rules for the 2008/2009 grubbing-up campaign gave priority to older grape growers and those grubbing up all their vines. However, it seems quite certain that these tools/variables take into account all aspects of the decision-making process to grub up and the data collected renders it difficult to analyze multifactorial motivations. Furthermore, the quality policy appears to be put on the back burner since there are no criteria taking into account the nature of the grape varieties.

As for perspectives to improve our analysis, there is work to be completed by improving the data processing, renewing the survey after 2011 (last campaign) and continuing to monitor data on the number of grape farms and their sizes, by particularly taking into account private estates and cooperatives.

Our analysis of the grubbing-up rates of the 2007/2008 campaign show that some of the least efficient farmers were eliminated through the deletion of their farms and when varietals of the grubbed-up grape are taken into account, the results merge towards those expected by the new 2008 wine CMO as most of the grubbed-up grapes are old or not sought-after varietals. However, one sixth of the eliminated lots are young improving varietals.

The analysis of the motivations encompasses a large diversity of motivation and is mainly split between economic reasons linked to the crisis and the life cycle of the grape grower. The economic crisis and the premiums led a certain number of grape growers that had established vineyards in the '90s to use the subsidies to reduce their debt. The 2008 wine CMO enabled a certain proportion of windfall for grape growers offsetting the impacts of the 2004 global supply crises (overproduction) and the 2008 demand crisis (subprime): premiums just as much help grape growers "get by" as improve productivity.

In their 2016 article, Kim Anderson and Hans Jensen [51] criticized how the OECD interpreted the subsidies paid by the European Union to the grape-growing sector. When trying to attempt to rectify the retained values, they added in the grubbing-up premiums. Would the grubbing-up premium be a social subsidy helping the aged and non-efficient grape growers to retire? Or would it be a larger subsidy helping the "wine industry"? Our study on the 2007/2008 grub-up campaign, the ultimate one before the introduction of the 2008 wine CMO, gives us the following results: half of the grub-ups are done by grape growers for reasons that will be targeted by the 2008/2011 grub-up campaigns (the rejuvenation of the vines and grape growers) and the other half of the grub-ups are related to a windfall effect enabling grape growers to survive the crisis and wait for better days, even by grubbing up improving varietals. We can only wonder if this windfall effect will also appear in the 2008/2011 campaigns.

7. DISCUSSION

Premiumized grub-up campaigns should therefore theoretically be a policy of the past. However, news emanating from the wine market brings us back to reality. Indeed, as overproduction reappeared in Bordeaux, the question to grubbing up 8,000 to 10,000 ha of vines is again being brought up [32].

On May 23, 2022, during the general assembly of the Bordeaux Wine Interprofessional Council (CIVB), the CIVB president stated that "European texts do not currently allow to finance through public money permanent grub-ups. Reminding this does not mean that we are against grubbing up, it means that these texts must be changed to remedy it" [32]. In its subtitle, the newspaper prints: "Faced with the abandonment of vines and the depression of winegrowers, the interprofession wants to convince other French and European regions to release community funds to grub up surplus plots".

The question to grub up a significant area of vine is again on the rise, but the mechanism for a collective financial incentive through premiums no longer exists. The possibility of reintroducing this scheme through the French NSP raises many questions such as what specific criteria to introduce (exclusion of area or grape varieties, minimum surfaces, age of the winegrower or the vines, etc.). More questions arise, notably economic and

political ones (on what budget to take the means of this campaign, at what level to ask for the individual bonus, what contribution to ask from the interprofession or the region, how to involve and obtain the agreement of the European Commission and its funding?)

At the microeconomic level, our work very modestly highlights a set of economic policy questions: how to take into account the economic situation of wine-growers, how not to destroy part of the quality grape varieties, and which criteria should be selected for a grubbing-up campaign and premiums should be directed towards which producers. The new policy of planting authorizations has had consequences on the price of land: how will this effect be taken into account in a new grubbing-up intervention? [4]

Furthermore, it appears that the question of premiumized grubbing should no longer exclusively be seen in terms of qualitative categories of wine, i.e. table wines versus quality wines. In fact, this question should take into account both national and global markets that are increasingly respectfully segmented into regions and countries. The 2007/2008 Hérault rules of excluding grubups in certain appellations or certain varietals in certain appellations could be used in the case of Bordeaux.

Finally, on a more general note, from a historical perspective, perhaps grub-up campaigns should just be seen as a succession of long-term stop-and-go policies essential to balancing the market?

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Wine Economics and Policy

Firenze University Press
www.fupress.com/wep

OPEN ACCESS

Citation: John C. Spence (2023). The impact of fees on customer purchasing behavior and beliefs in winery tasting rooms: A scoping review. *Wine Economics and Policy* 12(1): 101-113. doi: 10.36253/wep-12973

Data Availability Statement: All relevant data are within the paper and its Supporting Information files.

Competing Interests: The Author(s) declare(s) no conflict of interest.

The impact of fees on customer purchasing behavior and beliefs in winery tasting rooms: A scoping review

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Abstract. Purpose: This scoping review presents a summary of studies that examined the impact or influence of tasting fees in wineries on the purchasing behaviour, beliefs, obligation to buy wine, and willingness to pay for such fees. Methods: A search was conducted in August 2021 and updated in March 2022 of databases (i.e., Academic Search Complete, Scopus) and hand searching using terms such as wine, tasting fees, and charges. Documents were included if they were databased studies, published in English, and related to the research question. They were then coded for characteristics of the document, design, sample, winery, purchasing behaviour and beliefs, and findings. The coding and analysis were conducted between August 2021 and March 2022. Findings: Of 195 possible documents, 16 remained after a title and abstract scan, and 12 were included after a full-article scan. The reviewed studies were conducted primarily in Australasia (60%) and North America (28%) and a majority of findings were derived from surveys or interviews. A majority of the findings suggested that customers and industry professionals did not support the adoption of tasting fees at the cellar door (64%). Though, mixed impact was noted for purchasing behaviour (i.e., volume, money spent), slightly stronger negative associations were seen for intention to visit the winery or purchase wine in the future, willingness to pay for fees, and obligation to buy wine. Originality: This is the first systematic review to examine the impact or influence of tasting fees on purchasing behaviour and beliefs in wineries.

Keywords: wine tourism, tasting fees, charging, obligation, cellar door, willingness to pay.

1. INTRODUCTION

The tasting room experience at wineries is critically important for customer satisfaction [1], [2], [3], [4], [5], [6], [7] and sales [8] [7]. In fact, service-related factors are often more important to purchase and re-purchase decisions than wine quality [9]. For wineries, the cellar door helps them distribute wine at a relatively low cost, develop brand loyalty, and increase sales [10] [5]. For the customer, visits to wineries allow the opportunity for education (about the region, production, and the product), tastings, comparison shopping, and further exploration of the winescape [11].

An increasingly important aspect of the cellar door experience is the requirement of a tasting fee to sample the wines. These fees can serve several purposes. First, they may discourage those individuals seeking to consume free alcohol with little intention of actually purchasing any wine. For instance, the owner of Nicholson River Winery in the Victoria region of Australia estimated that the introduction of a tasting fee resulted in a 20 percent reduction in visitors to the cellar door (see Travers [12]). Second, fees may cover the cost of having more staff, and more educated/qualified staff, to offer a more thorough educational experience for the customer. The time lost serving people at the cellar door, especially those who do not purchase wine, is a significant cost factor for wineries [12]. Third, because the wine consumed due to tastings reduces inventory and shrinks profits, especially for smaller wineries [13] [14], fees can help recoup or balance these expenditures. Fourth, fees foster an expectation on the part of the customer that the product has some worth or value. Finally, tasting fees are a potential revenue source for wineries. However, tasting fees are not without controversy. The first study to examine the impact of the introduction of such fees, concluded they could reduce visits by 30 percent among Australians who had previously purchased wine [15]. Basically, visitors to wineries expect to taste all of the wines offered absent of a tasting fee [5] [14]. The assumption being that part of the cost of doing business is to offer free tastings so that the customer can make an informed decision as to whether they want to purchase a particular wine.

In North America, tasting fees are more the norm than not. According to a survey of 233 wineries based in California, Washington, Oregon, Michigan, Virginia, and Canada, 59 percent of wineries reported charging a fee for tastings in 2007 [16]. This apparently was an increase of 8 percent from the previous year. Though smaller or less developed wine regions in the United States (US), such as Idaho [17], were less likely to require tasting fees, the vast majority of wineries in the larger more established regions such as Napa and Sonoma charge fees [18]. Furthermore, those fees are much higher for the Sonoma ($30 USD) and Napa ($58 USD) regions than the average for US wineries overall ($25 USD) or those outside of California and Oregon ($15 USD) [18]. Similarly, a cursory review of web pages of wineries in the Okanagan and Niagara regions of Canada, reveals that the majority of wineries charge tasting fees in 2022.

In other parts of the world, the implementation of cellar door tasting fees has varied. Though fees were first charged for tastings at wineries in the Yarra Velley in 1997, a majority of wineries in that region had fees in place by 1999 [12]. In contrast, a majority of wineries in South Australia continued to "shun the concept' of tasting fees in 1999 [12]. More recently, the proportion of Australian wineries charging tasting fees has increased from 29 percent in 2018 [19] to 73 percent in 2021 [20]. Furthermore, the amount charged for a standard tasting increased by 31 percent in 2021 and approximately 30 percent of wineries charged a non-refundable fee for a standard tasting [20]. In New Zealand, the proportion of wineries charging tasting fees appears to have declined between 1997 and 2010 [21] [22]. For instance, according to the New Zealand National Wineries' surveys, 51 percent of wineries reported charging tasting fees in 1997 while 25 percent did so in 2010 [21]. During that period, Beverland [23] reported that all wineries in West Auckland offered free tastings. More recently, a survey of 51 wineries from Australia, New Zealand, and South Africa reported that 52 percent charged for tastings [24]. More often than not, these charges were for premium tastings and were refundable with purchases. Finally, based on interviews with industry experts, Bitsch et al. [25] states that wine touring activities such as tastings are generally free of charge in Germany.

Apart from brief summaries provided by Travers [12] and Hanf and Giering [26], no reviews have been published on the impact of tasting fees on customer satisfaction or purchasing behaviour. Thus, understanding of how and if tasting fees influence purchasing behaviour and the factors that may moderate these relationships is limited. Given that many wineries in regions in Australasia, North America, and South Africa have introduced tasting fees, yet preliminary studies suggested doing otherwise (e.g., [23] [15], the purpose of this scoping review was to identify all studies examining the impact of tasting fees on purchasing behaviour and beliefs about tasting fees. Furthermore, sense of obligation [8] [27] and willingness to pay [25] [26] appear to be relevant theoretic constructs that may mediate the role of tasting fees on purchase decisions and attitudes. Therefore, along with obtaining an understanding of the type and breadth of research that has been conducted on the topic, this review explored the impact or influence of tasting fees on: (1) purchasing behaviour (volume, money spent) of cellar door visitors; (2) beliefs about/toward the winery; (3) intention to visit the winery or purchase wine in the future from the winery; (4) willingness to pay for tastings; and (5) obligation to buy wine.

2. METHODS

2.1 Protocol and registration

Because of the small body of research available on the impact of tasting fees, the scoping review method was chosen because it is an appropriate format to summarize the extent of existing literature on broad topics and identify research gaps in the evidence [28]. The steps for the review were based on a recommended framework for scoping reviews [28] [29] and the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) [30]. However, the protocol of this review (i.e., a description of the rationale, hypothesis, and planned methods of a review), was not formally registered because scoping reviews are not currently accepted for registration with the International Prospective Register of Systematic Reviews (PROSPERO).

2.2 Eligibility criteria

Studies were included if they met the following inclusion criteria: (1) examined wine tasting fees; (2) measured wine purchasing behavior and/or beliefs about the winery, intent to purchase wine in the future, willingness to pay for fees, or obligation to buy wine; (3) was a data-based study (quantitative or qualitative); (4) either published or grey literature; and (5) published in English. Data from both individual customers or consumers and industry professionals (e.g., wine makers, winery owners) were eligible for inclusion.

2.3 Information sources and search

Searches were conducted in Academic Search Complete (1994 to 2022) and Scopus (1983 to 2022) up until March 13, 2022. The search strategies were derived from the research questions and keywords noted in relevant papers (e.g., Kolyesnikova and Dodd, 2009 [27]; McNamara and Cassidy, 2015 [31]). The specific search terms included the following: wine, tasting, fee* or charge*. To identify additional relevant documents, manual searches were conducted on the table of contents of nine journals (International Journal of Wine Business Research; International Journal of Wine Research; Journal of Consumer Research; Journal of Hospitality & Tourism Research; Journal of Travel Research; Journal of Travel & Tourism Marketing; Journal of Wine Economics; Journal of Wine Research; Wine Economics and Policy) for the years 2017 to 2021. Finally, hand-searching, tracking new documents (e.g., Google Scholar), and checking the reference lists of included documents were performed throughout the process.

2.4 Selection of sources of evidence

Once the initial search was completed, a screening was conducted of the titles and abstracts of the documents. During this process, the reviewer determined whether a document should be included, and if excluded, the reason for exclusion was recorded. A full-text screening was then performed on the remaining documents.

2.5 Data charting process and data items

Data extraction was conducted by the author from August 2021 to March 2022. Given the small number of included documents, and that one coder was involved, all documents were double coded. The following information was extracted using a codebook: characteristics of the studies (i.e., author, year, publication status/type); characteristics of samples (i.e., population, sample size, age, sex, level of wine experience, study design); characteristics of wineries (i.e., location – continent, location – country, location – wine region, provenance – country, provenance – region); characteristics of wine purchasing behaviour and beliefs (i.e., research questions); and purpose and findings. Because a document could have information on more than one of the research questions (e.g., wine purchasing behavior, intent to purchase wine in the future, willingness to pay for fees), more findings than documents were noted.

2.6 Synthesis of results

Frequency analyses for categorical variables and content analyses for the main findings were conducted [29]. The meanings of the main finding were categorized using the themes developed from the analytic framework of this review: wine purchasing behaviour or beliefs, willingness to pay tasting fees, and obligation to buy wine. The direction of impact of tasting fees on purchasing behaviour, beliefs about the winery, and intent to purchase or visit the winery in the future (i.e., negative, positive, neutral), along with feelings of obligation to purchase (not obligated, obligated, neutral) and willingness to pay tasting fees (unwilling, willing, neutral) were coded and the corresponding frequency was calculated. A list of all documents included in this review is presented in the Appendices (see also Table A1).

3. RESULTS

Figure 1 provides a flow chart of the search and study selection process. A total of 195 potential includes were identified through the initial search of databases (n = 176) and additional sources (n = 19). After the removal of duplicates, 194 documents were screened for the title and abstract review. At this stage, 178 documents were excluded primarily because they did not examine the impact of tasting fees in relation to any of the stated objectives or provide empirical data (e.g., commentaries). The remaining 16 documents underwent full-text review. A further 4 documents were then excluded for not meeting the inclusion criteria; which yielded 12 documents and 25 findings being included in the final synthesis.

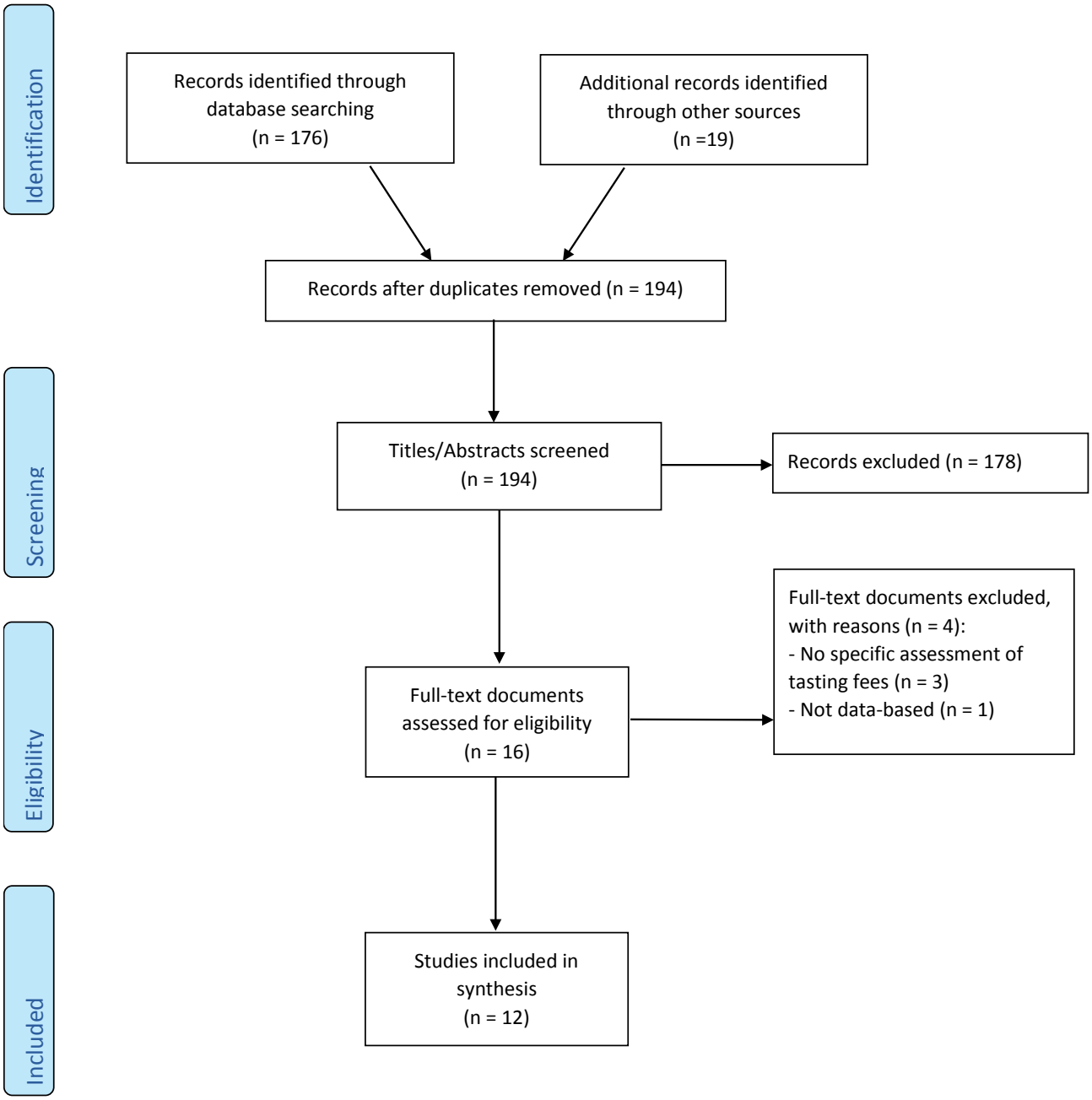

Figure 1. PRISMA Chart.

The vast majority of included documents were published (92%) with most being journal articles (75%). The disciplines of the document sources were in tourism & travel (50%), wine (33%), and food & beverages (17%). Of note, the first document was published in 1997 [15] and the most recent in 2022 [2]. A majority of findings were derived from samples that were of mixed age (83%), mixed sex (96%), tended to be visitors to wineries (44%) or wine tourists (36%), and had medium (64%) or high (20%) experience with wine (see Table I). As for the wineries and wine regions, a majority of findings came from Australasia (60%) or North America (28%), from countries such as Australia (48%) and the United States (28%), and from regions that were considered established (58%) or new or developing (29%). The provenance of the countries involved was considered to be established (100%). Finally, a majority of findings, were from surveys (60%) or interviews (24%).

As reflected in Table 2 (and Table A2 in the Appendices), most of the findings related to willingness to pay tasting fees ($n_{findings}$ = 9; 36%) or impact of fees on purchasing behaviour ($n_{findings}$ = 6; 24%). Overall, a majority of the findings had a negative valance in regard to the impact of tasting fees on wine purchasing behaviour, beliefs, intentions, obligation to buy and willingness to pay ($n_{findings}$ = 16; 64%). Specifically, the few findings for purchasing behaviour (volume, $) were split between negative ($n_{findings}$ = 4; 67%) and positive ($n_{findings}$ = 2; 33%) impacts of fees. For instance, "Visitors who had free wine tasting spent more money at the wineries than visitors who paid a tasting fee" (Kolyesnikova and Dodd [27], p. 816), whereas "…it is clear that visitors spent more at wineries that charged a fee…" [32].

The findings for beliefs were either negative ($n_{findings}$ = 2; 67%) or neutral ($n_{findings}$ = 1; 33%). One finding implied that customers held more positive views toward wineries that did not charge tasting fees, "…visitors who tasted wine at no charge felt significantly more appreciative of the personnel who provided services than did visitors who paid a tasting fee" (Kolyesnikova and Dodd [27], p. 816), while another observed no impact of fees on customers' "…attitude towards the winery" (Thomas and Galbreath [33], p. 8).

For intention to visit or purchase from the winery in the future, a majority of findings suggested that tasting fees had a negative effect ($n_{findings}$ = 3; 75%). For example, "…for a winery wishing to attract the youth market, charging a tasting fee would not appear appropriate…" (Hall and Treloar [22], p. 123), and "An entrance fee would generate revenue but reduction in visitation may be a poor trade-off for these wineries" (Taylor et al. [17], p. 73). In the first published study on the topic, King and Morris [15] concluded that "…wineries could lose 36% of visitors" (p. 383) with the introduction of tasting fees at the cellar door.

On the question of willingness to pay tasting fees, more than half of the findings suggested a lack of willingness ($n_{findings}$ = 5; 56%), while several supported a willingness to pay ($n_{findings}$ = 3; 33%). For instance, "… the majority of respondents would not stay at the winery and taste the wine if there was a charge" (McNamara

Table 1. Characteristics of the sample and the wineries ($n_{findings}$ = 25).

Variable		$N_{findings}$	%
Characteristics of sample			
Age Group			
	Young adults	3	13
	Middle-age	1	4
	Mixed	19	83
Sex			
	Male	1	4
	Mixed	23	96
Population			
	Visitors to wineries	11	44
	Wine tourists	9	36
	Industry professionals	2	8
	University students	3	12
Experience with wine			
	Low	2	8
	Medium	16	64
	High	5	20
	Mixed	2	8
Characteristics of the winery			
Location: Continent			
	North America	7	28
	Europe	2	8
	Australasia	15	60
	Mixed	1	4
Location: Country			
	United States	7	28
	Australia	12	48
	New Zealand	2	8
	Germany	2	8
	Other	1	4
	Mixed	1	4
Provenance: Country			
	Established	25	100
Provenance: Region			
	New or developing	7	29
	Established	14	58
	Mixed	3	13

Table 2. Impact of tasting fees on purchasing behaviour, beliefs, intentions, willingness to pay fees, and obligation to buy wine ($n_{findings}$ = 25).

Research Question	$N_{findings}$	% within group
Impact of tasting fees on purchasing behaviour (volume)	4	
Negative	3	75
Positive	1	25
Impact of tasting fees on purchasing behaviour ($)	2	
Negative	1	50
Positive	1	50
Impact on beliefs toward/ about winery	3	
Negative	2	67
Positive	1	33
Impact on intention to visit or purchase from the winery	4	
Negative	3	75
Positive	1	25
Willingness to pay a tasting fee	9	
Unwilling	5	56
Willing	3	33
Neutral	1	11
Obligation to buy wine	3	
Not obligated	2	67
Neutral	1	33

and Cassidy [31], p. 15) and "The idea of charging fees for tasting proved to be a controversial issue and it was suggested by the majority of wineries that tasting fees would never be charged (with the exception of groups)" (Beverland [23], p. 126). In contrast, Bitsch et al. [25] explored willingness to pay tasting fees among Germany university students and concluded that "…consumers are willing to pay positive prices for wine touristic activities" (p. 2492).

In terms of obligation to buy wine in the presence of tasting fees, the findings implied a lack of obligation ($n_{findings}$ = 2; 67%) or neutral (1; 33%). For instance, "… visitors who paid a tasting fee felt less obligated to end their visit to the winery with a purchase (Kolyesnikova and Dodd [27], p. 816) and "…nearly half (48 percent) of respondents indicated that they would not necessarily buy wine if they paid for a tasting" (McNamara and Cassidy [31], p. 13). Whereas, King and Morris [15] found that "The attitude of these tourists was varied…" (p. 383) when it came to obligations to buy.

4. DISCUSSION

This review presents a summary of studies that examined the impact or influence of tasting fees in wineries on the purchasing behaviour, beliefs, and willingness to pay for such fees. A limited number of studies and findings were available to review and few have been produced on the topic since 2015. The included studies were conducted primarily in Australasia and North America and a majority of findings were derived from surveys or interviews.

Though a majority of the findings suggested that customers and industry professionals did not support the adoption of tasting fees at the cellar door, some variation was observed across the research questions examined in this review. Mixed impact was noted for purchasing behaviour (i.e., volume, money spent), whereas slightly stronger negative associations were seen for intention to visit the winery or purchase wine in the future, willingness to pay for fees, and obligation to buy wine. One of the more salient findings was that tasting fees are associated with perceived service failure of wineries among 90,000 TripAdvisor reviews [2]. Factors that appeared to moderate these relationships were the provenance of the wine region [17], the size of the winery or wineries [17], and the perceived quality of the winery or wines served [32] [31]. For instance, small wineries in developing regions are much less likely to have tasting fees and their customers are more likely to expect free tastings. As recounted by an owner of a small winery in a developing region in California, "[w]e know from informal surveys that, when asked, visitors state they object to paying for wine tasting…" (Zucca [14], p. 8). However, the most important factor was whether purchases of wine were reimbursed [23] [31] or gifts or snacks were offered with the tasting [31] [34].

The offering of free samples to stimulate interest in products and to encourage purchases has long been an effective marketing strategy [35] [36]. For instance, in-store offerings of free beer and wine samples can increase sales by as much as 70% to 300% for those products [39]. According to reciprocity theory [35] [36], consumers who feel more gratitude and obligated toward a winery will likely spend more on wine [26]. However, the presence of a tasting fee reduces the sense of gratitude and obligation [37], [15], [27]. For instance, Kolyesnikova and Dodd [27] observed that visitors to wineries with complimentary tastings spent significantly more money and experienced a greater sense of obligation to make purchases than those visitors who paid for tastings. Thus, unless the customer is receiving something for their fee beyond the wine sample itself, they may not feel obligated to pur-

chase wine as part of their visit. Offering reimbursements on wine purchases or gifts or food with the tastings may foster some sense of reciprocity on the part of the customer [31] [34]. For example, food offerings with tastings in wineries are associated with customer satisfaction [4]. In addition to reimbursement or gifts/food offerings, one option is to employ a pay-what-you want scheme in which the customer determines the price they are willing to pay for the tasting [25] [26]. Of course, this all depends on whether wineries are seeing the tasting fee as a mechanism for weeding out freeloaders and recouping costs or a source of revenue.

If tasting fees are supposed to dissuade the casual customer and allow wineries to provide a higher level of service to the potentially loyal customer [38], then we would expect that satisfaction is higher for wineries that charge fees or in regions that have adopted fees in comparison to those that have not done so. However, along with the findings of this review, other research challenges this notion. According to TripAdvisor reviews of five major international wine regions (Hunter Valley, Napa Valley, Mendoza, Stellenbosch, Tuscany), the Napa Valley ranks fourth in popularity, third in perceived quality, and first in perceived service failure [2]. Yet, Napa has the most extensive and expensive tasting fees in the world. The average cost of tastings in Napa are $58 USD and premium wines are tasted for $90 USD [18]. In 2021, per-person spending at the cellar door in Napa was up less than 1 percent from 2019, while it was down 10 percent in Sonoma County [18]. Aside from COVID-related explanations, it is possible that customers in those regions are feeling the pinch of the tasting fees and are reacting with their wallets and their reviews of service. Thus, assessments of service quality (e.g., [7]) and the broader winescape [11] should consider the impact of tasting fees on customer satisfaction and purchase decisions.

4.1 Implications for practice

Several potential implications for wineries can be garnered from this review. First, if the intent of a tasting room is to generate interest in a winery and to stimulate sales, then requiring a tasting fee without any reimbursement after a purchase is not an effective strategy. While it may generate revenue in the short term, the findings of this review suggest such practices will not inspire customers to revisit or to purchase wines from the winery in the future. Thus, wineries should consider waiving tasting fees with the purchase of wine. Second, the perceived quality of the tasting room experience is critical to customer tolerance of fees. Visitors are willing to pay for tastings if they feel they learned something about the winery, wines, and/or region while receiving value for money in terms of the quality of the wines tasted. Therefore, if the argument for having such fees in place is to partly cover the costs of capable and knowledgeable staff in the tasting room, that fact should be apparent to the customer. Finally, the cost of tastings has increased dramatically in the past few years and this may impact visitations and sales in the tasting room. For instance, a standard tasting fee in the United States increased by an average of 50 percent from 2019 ($21 USD) to 2021 ($31) [18]. This was due primarily to wineries attempting to recoup lost revenue resulting from the COVID-19 pandemic. Along with the fact that many wineries are retaining a by-appointment model for visits [18], the question becomes whether wineries can attract new and younger customers to their venues [39]. As mentioned previously, given that this review identified negative perceptions about tasting fees, it will be important for wineries to demonstrate value for money and emphasize a high quality tasting experience.

4.2 Limitations

This review has several limitations that should be acknowledged. First, though assessment of quality is not a requirement of a good scoping review [28], a majority of the findings in this review were from cross-sectional designs (e.g., surveys) and interviews. Thus, internal validity is low and any causal claims should be made with caution. Second, most of the studies were conducted in Australia and the United States. Since variation exists in the extent to which tasting fees are employed in various countries and regions, more research should be conducted in developing regions (e.g., China, United Kingdom) and in more established ones such as Canada, Chile, France, and South Africa. Finally, it was surprising to find so few studies examining the impact of tasting fees. Given the controversial nature of these fees [12], and that calls have been made for more research on the topic (e.g., [14]), it is unclear why so few studies have been conducted. Regardless, the findings of this review should be treated with caution.

5. CONCLUSION

This paper presents the first systematic review to examine the impact or influence of tasting fees at the cellar door on purchasing behaviour, beliefs, and obligation to buy wine. A majority of findings suggested mixed impact of tasting fees on purchasing behaviour but negative impact or influence on beliefs toward the winery,

willingness to pay for fees, and obligation to buy wine. Furthermore, if tasting fees are to be employed, both customers and industry professionals suggested wineries should consider reimbursing purchases of wine (e.g., [23] [31]). However, more research is required on the topic, especially in countries and regions that are less established. Finally, these findings have relevance for theory (e.g., reciprocity theory, willingness to pay) and suggest that frameworks such as the winescape [11] and servicescape [7] should recognize the importance of tasting fees in the customer experience at the cellar door.

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APPENDIX

Studies included in the review

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Table A1. Descriptive information for each study included in the review

Author	Country	Region	Participants	Design	Purpose
Barbierato (2022)	ARG AUS Italy SA US	Mendoza, Hunter Valley, Tuscany, Stellenbosch, Napa Valley	Visitors	Survey	The purpose of this work is to study the issues of service quality and service failure during visits to cellar doors in the five regions where wine tourism is most developed: Hunter Valley (AU), Mendoza (AR), Napa Valley (the USA), Stellenbosch (ZA), and Tuscany (IT) (p. 1).
Beverland (1999)	NZ	West Auckland	Wine tourists & industry professionals	Survey Interview	"This research seeks to place wine tourism within the general market context in New Zealand" (p. 119).
Bitsch (2020)	Germany	Rheingau	University students	Experiment	"The following experiment analysed if consumers have a willingness to pay for wine tastings."
Charters (2009)	AUS NZ	Swan Valley, Western Australia, Yarra Valley, Victoria, & Waipara Valley	Visitors	Interview	"The overall aim of this research have been to investigate visitor perceptions of service in winery tasting rooms" (p. 124).
Hall (2008)	AUS NZ		University students	Survey	"The aim is to identify the impact of tasting fees at the cellar door on the wine consumer behaviour of the Generation Y market" (p. 117).
Holecek (2014)	US	Michigan	Visitors	Survey	"To obtain the information relating to wine purchase and consumption behavior."
King (1997)	AUS	Western Australia/Margaret River	Visitors & industry professionals	Survey Interview	"This article examines the opinions and attitudes of… wine tourists towards cellar doors charging tasting fees" (p. 382).
Kolyesnikova (2009)	US	Texas	Visitors	Survey	"…examining possible differences between wine tourists who paid for tasting and those who did not pay a tasting fee" (p. 811).
McNamara (2015)	AUS	Queensland	Visitors	Survey	To assess "the consumer's perceptions and reactions to charging for wine tastings and under what circumstances" (p. 11).
Roberts (2006)	AUS	Victoria, South Australia, & Queensland	Wine tourists	Interview	"…to develop a greater understanding of the factors that are important or enhance the experience of tourists visiting wine regions" (p. 47).
Taylor (2004)	US	Canyon County, Idaho	Visitors	Survey	"…to discover which variables influence tourists to spend an afternoon touring Canyon County wineries" (p. 60).
Thomas (2021)	AUS	Western Australia	Visitors	Survey	"…developing a better understanding of the different consumer segments that visit wineries and what service offering mix (e.g. wine tasting, restaurant, gift shop, gallery/museum, etc…) represents an appropriate value proposition for them." (p. 1)

ARG = Argentina; AUS = Australia; NZ = New Zealand; SA = South Africa; US = United States.

Table A2. Study-specific findings for the research questions.

Author	Research Question						Finding
	Purchase Behaviour		Beliefs	Obligation	Intention	Willingness	
	Vol.	$					
Barbierato (2022)			-				Co-occurrence of service failure subreviews for all five wine regions: "The tasting theme is present only in the global graph, but highlights a rather debated problem [60], [61]: whether or not to charge a 'tasting' –'fee' at your cellar door" (p. 20).
Beverland (1999)					-	-	"Charging tasting fees that were not redeemable against a purchase would have a significant impact on visitors" (p. 127) "The idea of charging fees for tasting proved to be a controversial issue and it was suggested by the majority of wineries that tasting fees would never be charged (with the exception of groups)" (p. 126).
Bitsch (2020)						-, -	"In short, our main findings are that consumers are willing to pay positive prices for wine touristic activities" (p. 2492).
Charters (2009)						+	"While many participants said that some sort of exchange felt necessary at the tasting room, particularly where the service experience has been excellent, it is unclear whether charging a tasting fee is an appropriate response" (131).
Hall (2008)					-		"Overall, the results have shown that for a winery wishing to attract the youth market, charging a tasting fee would not appear appropriate…" (p. 123)
Holecek (2014)	+	+				+	"Although it is clear that visitors spent more at wineries that charged a fee, it is possible that the difference is spending was the result of other factors." "Almost 71 percent of respondents said they don't avoid tasting rooms that charge a fee while 29 percent said they do."
King (1997)				0	0	-	"The attitude of these tourists was varied with some people stating that although they often did buy at the wineries when there was a tasting fee they did not feel compelled to buy the wine…" (p. 383). "Due to the impact of the results, wineries could lose 36% of visitors" (p. 383)
Kolyesnikova (2009)		-	-	-			"The proposition that all wineries introduce tasting fees was not generally accepted by association members…" (p. 382). "Visitors who had free wine tasting spent more money at the wineries than visitors who paid a tasting fee" (p. 816). "…visitors who tasted wine at no charge felt significantly more appreciative of the personnel who provided services than did visitors who paid a tasting fee" (p. 816). "…visitors who paid a tasting fee felt less obligated to end their visit to the winery with a purchase" (p. 816).

Author	Research Question					Finding
	Purchase Behaviour		Beliefs	Obligation	Intention	Willingness	
	Vol.	$					
McNamara (2015)				-		-	"…nearly half (48 percent) of respondents indicated that they would not necessarily buy wine if they paid for a tasting" (p. 13). "…the majority of respondents would not stay at the winery and taste the wine if there was a charge" (p. 15).
Roberts (2006)						-	"For many visitors there was still the expectation that there would be complimentary wine tasting, as this had become accepted as 'part of the ethos' of visiting a winery" (p. 51).
Taylor (2004)					-		"An entrance fee would generate revenue but reduction in visitation may be a poor trade-off for these wineries" (p. 73).
Thomas (2021)	-	-	0			-	"Raw data suggests that introducing a tasting fee has no impact on improving wines sales (ATV, AVV, IPS and SC%)" (pp. 7-8). SC%, AVV, & IPS decreased after introduction of the fee. "…whilst most visitors had a negative attitude towards being charged a tasting fee, this had no impact on their attitude towards the winery or willingness to recommend the winery to others (p. 8).

+ = positive impact/influence of tasting fees; – = negative impact/influence of tasting fees; 0 = neutral impact/influence of tasting fees.

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