Fine Wines: a Study of Financial Returns with a Focus on the Covid-19 Pandemic and Key Implications of Wine Frauds

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Abstract

This dissertation investigated how fine wines can be a valid asset class and how they have performed in terms of returns in the past 6 years, with a focus on the COVID-19 pandemic. It analyzed the extensive literature around fine wines and the definition of fine wine and attempted to link the fine wine phenomenon to relevant notions in the literature on strategy and management theory.

Qualitative data gathered through expert interviews aimed at validating fine wines as an asset class and to understand better what influenced price increases of fine wines, as well as how fake wines may limit the market and hamper growth. Fine wines were confirmed to be a valid asset class, recently gaining more interest due to the Covid-19 pandemic and the growth of fine wines into Asian markets. Experts further acknowledged that fake wines are a serious threat and that investors should always be careful, especially when buying from China, and buy directly from producers or trusted sales representatives to avoid fakes.

Quantitative data used from the eWibe proprietary database, to analyze price trends and study price behavior. Fine wines have demonstrated the ability to deliver, on average, a 60% gross return over 6 years, which can increase up to an average 90% by selecting the fine wines produced in the two best performing regions, namely Burgundy in France and Piedmont in Italy. Finally, by comparing these two, we found that the April 2021 adverse weather had an average impact on Burgundy's prices of 12%.

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ABSTRATO

Esta dissertação investigou como os vinhos finos podem ser uma classe de bens válida e como atuaram em termos de retorno nos últimos 6 anos, com enfoque na pandemia da COVID-19. Analisou a literatura sobre vinhos finos e a definição de vinho fino e tentou ligar o fenómeno do vinho fino a noções relevantes na literatura sobre estratégia e teoria de gestão.

Dados qualitativos recolhidos através de entrevistas de peritos para validar os vinhos finos como uma classe de bens e de compreender o que influenciou os aumentos de preços, assim como os falsos podem limitar o mercado e dificultar o crescimento. Os vinhos finos foram confirmados como sendo uma classe de ativos válida, ganhando mais interesse durante a pandemia de Covid-19 e ao crescimento dos vinhos finos nos mercados asiáticos. Os especialistas reconheceram que os vinhos falsos são uma séria ameaça, os investidores devem ter cuidado, especialmente quando compram da China, e comprar diretamente aos produtores para evitar falsificações.

Dados quantitativos usados do banco de dados proprietário eWibe, para analisar tendências de preços e estudar o comportamento dos preços. Os vinhos finos têm demonstrado a capacidade de proporcionar, em média, um retorno bruto de 60% ao longo de 6 anos, que pode aumentar até uma média de 90%, selecionando os vinhos finos produzidos nas duas regiões com melhor desempenho, nomeadamente Borgonha e Piemonte. Comparando estas duas regiões, constatamos que o clima adverso de Abril de 2021 teve um impacto médio de 12% nos preços da Borgonha.

Título: Vinhos finos: um estudo de retorno financeiro com enfoque na pandemia da Covid-19 e principais implicações das fraudes do vinho

Autor: Niccolò Manfredi Carlo Maria Scattoni

Palavras-chave: Vinhos finos, vinhos falsos, retorno do investimento

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Qualitative data were gathered through expert interviews aimed at validating fine wines as an asset class and to understand better what has influenced price increases of fine wines, as well as how fake wines may limit the market and hamper growth. Fine wines were confirmed to be a valid asset class, recently gaining more interest due to the Covid-19 pandemic and the growth of fine wines into Asian markets. Experts further acknowledged confirmed that fake wines are a serious threat and that investors should always be careful, especially when buying from China. The best way to avoid fakes, according to experts, is to buy directly from producers or trusted sales representatives.

Quantitative data were used from the eWibe proprietary database, to analyze price trends and study price behavior, with a focus on the impact of the frost that hit France in April 2021. Fine wines have demonstrated the ability to deliver, on average, a 60% gross return over 6 years, which can increase up to an average 90% by selecting the fine wines produced in the two best performing regions, namely Burgundy in France and Piedmont in Italy. Finally, by comparing these two regions, we found that the April 2021 adverse weather had an average impact on Burgundy's prices of 12%.

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Analisou a extensa literatura sobre vinhos finos e a definição de vinho fino e tentou ligar o fenómeno do vinho fino a noções relevantes na literatura sobre estratégia e teoria de gestão.

Foram recolhidos dados qualitativos através de entrevistas de peritos com o objectivo de validar os vinhos finos como uma classe de bens e de compreender melhor o que influenciou o aumento dos preços dos vinhos finos, bem como a forma como os vinhos falsos podem limitar o mercado e dificultar o crescimento. Os vinhos finos foram confirmados como sendo uma classe de activos válida, ganhando recentemente mais interesse devido à pandemia de Covid-19 e ao crescimento dos vinhos finos nos mercados asiáticos. Os peritos confirmaram ainda que os vinhos falsos são uma séria ameaça e que os investidores devem ser sempre cuidadosos, especialmente quando compram à China. A melhor forma de evitar falsificações, segundo os especialistas, é comprar directamente aos produtores ou aos representantes de vendas de confiança.

Foram utilizados dados quantitativos da base de dados de propriedade da eWibe, para analisar tendências de preços e estudar o comportamento dos preços, com enfoque no impacto da geada que atingiu a França em Abril de 2021. Os vinhos finos demonstraram a capacidade de proporcionar, em média, um rendimento bruto de 60% ao longo de 6 anos, que pode aumentar até uma média de 90%, seleccionando os vinhos finos produzidos nas duas regiões com melhor desempenho, nomeadamente Borgonha em França e Piemonte em Itália. Finalmente, comparando estas duas regiões, constatamos que o clima adverso de Abril de 2021 teve um impacto médio de 12% nos preços da Borgonha.

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TABLE OF CONTENTS

1.0 INTRODUCTION

Fine wines are not only a luxurious good, often associated with more educated palates, but have also become an investment instrument that benefits from the limited supply and the ability of premium wines to improve and thus appreciate with age. Approximately twenty-five percent of high-net-worth individuals around the globe have a wine collection, which represents, on average, two percent of their total wealth (Mitchell, 2012).

Fine wine is deemed a class of alternative assets and differs from typical financial assets (cash, stocks and bonds) in several ways (Luxen, 2018). First, it tends not to be correlated to the systematic risk of stock markets. Unlike a debt instrument, it does not pay any periodic cash flow since its value is embedded in the physical product itself. Then, fine wine has a limited supply that diminishes over time with consumption, thus it does not obey the normal rules of market equilibria where price is simply the intersection of demand and supply. Next, fine wine is a heterogenous product with numerous attributes that can affect its integrity and quality[1]. Finally, assessing wine quality and reliability is extremely difficult and various characteristics might be valued differently by experts, whose judgment is critical for wine pricing and reputation (Luxen, 2018). For these reasons, the price discovery and determination processes for fine wines are complex and dynamic, a point many authors address in the literature.

Investors are increasingly considering wine as an investment vehicle. Indeed, many articles on "wine investments" have been published over the last two decades. A search for "wine investment" on Google returned more than 30,000,000 results (as of April 2022), a 120x multiplier effect when compared to 10 years ago.

The turn of the millennium represents a key inflection point in the timeline of the fine wine market. In the early 2000s, the bursting of the Dot.com bubble led many investors to consider alternative asset classes, among them, fine wines. Throughout the global financial crisis, fine wine was used to hedge against volatility thus bolstering the demand side (Moschini, 2022). On a more sinister note, the notorious counterfeiting operation of Rudy Kurniawan began to unravel.

[1] As an example, two identical bottles might have developed in different ways and thus display different characteristics, resulting in different price points.

Between 2008-10, the Liv-Ex 1000 index had returns slightly above 0%, whereas the FTSE lost about 25% and gold futures fell nearly 5%. Over the period spanning 2015-17, on the other hand, the Liv 1000 returned 10%, while the FTSE appreciated roughly 9% and gold futures 8%, according to Business Wire[2]. These results increased interest in fine wines and spurred growth of the industry. Not surprisingly, the same seems to have happened in 2020, as the market for fine wines grew by 16% in Europe (Moschini, 2022).

Fig 1 – some of the well-known fine wines in the world

In February 2020 a Dom Perignon 2008 had an ex-vat average price[3] on the website Winesearcher.com of €149, two years later that same bottle trades at €246 a bottle. That is a 65.1% gain in two years, which is pure net profit considering that private individuals trading fine wine has 0% capital gain tax in most jurisdictions. Another good example is the Krug Vintage 2008, released on the market at an ex-vat price of €320 in September 2021, 6 months later it traded at €576, yielding the seller an incredible 80% gain in 6 just months. The 2008 vintage was excellent for Champagne (Wine Searcher editorial, 2020)[4] and these examples might be considered outliers. However, they are proof of the validity of fine wine investing and highlight why the industry has gained more attention over the last two decades.

[2] Business Wire, a Berkshire Hathaway company, is a global leader in press release distribution and regulatory disclosures. It operates with 16 global offices and reaches 162 countries.
[3] A wine's average price on wineseracher.com is calculated considering all available offers for a wine, with the top and bottom 20% tails removed. These average prices are updated daily, and exclude sales tax, which can vary considerably from country to country.
[4] Article accessible at: https://www.wine-searcher.com/vintage-2008-champagne

Fine wines have earned more attention not only from investors, but also among the scientific community. There exists solid research concerning financial returns associated with fine wine investing and increasing interest concerning fine wine frauds. As a financial investment, fine wines have a proven track record of appreciating during periods of macroeconomic uncertainty and can be used as a financial parachute. The global financial crisis of 2008 has given the chance to fine wine investments to prove themselves.

This paper aims to observe the development and evolution of the fine wine market through the Covid-19 pandemic to better understand the role of fine wine investments as an alternative asset class and hedge against asset volatility, inflation, rising interest rates, and other factors causing declines of traditional asset classes. This is of considerable importance in the macroeconomic outlook of 2022.

Research Question: The Research question this thesis seeks to investigate is as follows:
Is fine wine becoming a more accepted asset class, especially in the wake of the COVID-19 pandemic?

2.0 DEFINING FINE WINE

There are various conceptions that contribute to the definition of fine wine. As a first step into the literature, a series of definitions was analysed to come to a broader and more inclusive understanding of the term. According to the wine critic Jancis Robinson[5], fine wine is defined as: "a wine with charm, refreshment, intrigue, balance, aging potential, development in the glass, terroir[6] expression, persistence, and memorability. In short, it is a wine that improves in both glass and bottle as well as having an interesting nose, spreading across the palate with various notes, and building towards the finish". Her definition is focused on the characteristics and emotions that a fine wine imparts to its drinker. Robinson also mentions aging potential and the equilibrium among the several variables analysed during tasting.

Vicard (2019) interrogates the definition of fine wine in detail across many dimensions and variables. She sheds light on the controversy of not having a commonly accepted definition and

[5] Jancis Robinson is a British journalist, writer, and wine critic. She has been described by Decanter as the most respected wine critics and journalists in the world. She writes daily for JancisRobinson.com and weekly for the Financial Times. She began discussing wine in 1975 and has been with FT since 1990.
[6] "Terroir" is defined as the mix of soil quality and weather characteristics.

gathers all the relevant factors needed to give an exhaustive definition. She then provides a succinct definition composed of a list of variables – quality, emotion, and expression of truth[7].

Regarding quality, Vicard (2019) considers key determinants to be an interesting nose[8] that spreads across the palate and builds toward the finish, development in the bottle and in the glass, balance between the essential components[9], internal harmony and finally aging potential along with the capability of being drinkable at every stage of its development.
The second factor considered, emotion, refers to the ability of fine wine to affect the drinker's inner self, delivering a memorable unique and personal experience. Last, the expression of truth reflects the intentions of the winemaker, his or her aim to represent the terroir at its best and to create a homogeneous product with a clear *fil rouge* that connects all the elements together, pushing the boundaries of wine from being a mere drink towards presenting a "work of art".

Some scholars define fine wine as the best 25 Bordeaux wines, plus a minority coming from other regions (Milner,2011). Masset et al. (2016, p. 201) asserts that 95% of Liv-Ex[10] turnover comes from Bordeaux wines and more than half of this is concentrated in five first growths of the Medoc region[11]. Other authors consider a broader definition where fine wines entail the possibility of being an investment with a potential return (Baldi et al. 2013; Introvigne et al. 2017).

A recent comprehensive definition of fine wine is given by Le Fur and Outreville (2019) who define the term as reserved for exceptional wines from the world's best vineyards with the highest quality grapes and the most acclaimed winemakers. They specify that along with the best known and renowned five first growths of Bordeaux, there are other exceptional wines in

[7] This definition is the result of more than 200 interviews conducted between 2017 and 2019. Interviewed individuals are influential trade members and industry experts from all over the world.
[8] "Nose" refers to the sensations gathered when analyzing the wine by smelling it.
[9] Essential components are color, structure, nose, taste (E.g., notes, finish, minerality, tannins, etc.)
[10] The Liv-ex company was founded in 1999. It offers fine wine trading services for professionals and displays wine prices along with wine price indices presented as the reference on the fine wine markets. Their fine wine indices are built based of transaction prices recorded on their site. See https://www.liv-ex.com/home.do for a complete description of their methodology, including the wine composition of each index, which gets updated constantly. These indices are extensively used in the literature, see for example Masset and Henderson (2010), Kourtis et al. (2012), Bouri (2013), Cevik and Sedik (2014).

[11] They are respectively four from Mèdoc: Chateau Laffite Rothschild, Chateau Mouton Rothschild, Chateau Margaux, Chateau Latour; and one from Pessac Léognan: Chateau Haut Brion.

Bordeaux, Burgundy, Australia, California, Italy, Portugal, and Spain, thus expanding the geographical limit considered by previous authors.

3.0 LITERATURE REVIEW

Before introducing the scientific literature on the pricing of fine wines and their investment returns, as well as relevant management theory, it is useful to look at the nature of fine wine as a leisure good. According to Veblen[12] there are classes of goods that do not follow the law of demand. Such goods are identified in two opposed cases, Veblen and Giffen goods. Veblen goods display a rise in demand after prices rise above a certain level, which collides with the typical demand curve, whereas as the price increase demand diminishes. The Veblen Effect is associated to the perception of quality, as a higher price is seen as evidence of the producer improving quality. In addition, Veblen goods are often positional goods[13], where a concentrated distribution of the good increases its demand. Fine wine, due its limited supply and concentrated distribution is studied by several authors as a leisure good, when investigating the presence of Veblen effect (Heffetz, 2004; Bouri 2015; Dahm 2018).

3.1 PRICING AND RETURNS LITERATURE:

Fine wine appreciates over time for several reasons. These include age (Storchmann, 2012) and growing demand along with limited supply, as producers focus on quality rather than quantity with grapes coming from unique and restricted areas of land (Outreville, Le Fur 2017). Growing demand was propelled by the emergence of new markets, most importantly China, Hong Kong, and Singapore (Bouri, 2015).

The vineyards from which exceptional grapes are harvested are very limited in surface area and often located on barely accessible slopes. For this reason, fine wine makers could be argued to have a sustainable competitive advantage, according to the Resource-Based View of Jay

[12] Thorstein Veblen was an American economist and sociologist who studied the phenomenon of conspicuous consumption in the late 19th century. In 1899 he published his first and most famous book *The Theory of the Leisure Class*, where he discusses the how the pursuit and possession of wealth affects human behavior, criticizing wealthy individuals who he believed had fallen into unproductive practices of conspicuous consumption and conspicuous leisure.

[13] Positional goods are valued by how they are distributed among society. In case of limited and concentrated supply the ownership of such goods enables a higher relative standing in society.

Barney (1991) [14], when their vineyards exhibit VIRN [15] resources. On this account competitiveness is based on a firm's ability to marshal a set of unique and idiosyncratic rare, non-substitutable, and inimitable resources (Rumelt, 1984; Barney, 1991). It may be of interest for future research to assess whether fine wine makers display casual ambiguity. These means that the linkage between the resources controlled by a firm and its sustainable competitive advantage is not understood completely[16].

Some studies challenge the classical RBV[17] in the wine making industry. Humphreys & Carpenter (2018) outline that large and market-driven wine makers achieve competitive advantage by playing a status game, rather than strategically investing in their strategic resources or in innovation. In the management literature, the RBV and as an explanatory tool for competitive advantage has also been extensively critiqued as being tautological or lacking predictive force (Priem & Butler, 2001). Postrel (2018) notes that there is no settled definition as to what competitive advantage actually means and the term is plagued by ambiguity.

Teece et al. (1997) sought to rescue competitive advantage by linking it to the theory of Dynamic Capabilities (DC). As Barreto (2010) argues, a firm's dynamic capability entails four elements – the "potential to systematically solve problems, formed by its ability to sense opportunities and threats, to make timely and market-oriented decisions, and to change its resource base". DC is thus a multidimensional approach where no individual variable fully described the phenomenon (Barreto, 2010; Edwards, 2001). More recently, Lieberman (2021) argues that although well-entrenched in the literature and in business thinking, the notion of competitive advantage is not intellectually sustainable.

When approaching the scientific literature about fine wines, two different prospective can be identified. The first includes studies that concentrate on the heterogeneous nature of fine wines when considering them as an experience good[18]. The theory and literature behind this suggest that the typical price determinants are quality, the reputation of the wine or winemaker, and the status of the wine's geographical appellation. Other characteristics mentioned as inputs for the

[14] Barney studies the sources of competitive advantage for firms, building on the assumption that key strategic resources are heterogeneously distributed and a source of differentiation.
[15] VIRN stands for valuable, rare, inimitable and non-substitutable resources.
[16] A comparative analysis of fine wine makers competitive advantages and performance could be limited by the unavailability of financial data for private wine makers.
[17] RBV: Resource-Based View
[18] An experience good is defined as a good that is difficult to judge and evaluate in terms of quality, features, or price point before the actual purchase.

pricing functions articulated by authors include the vintage, grape variety, and grape growing area[19]. An important issue with this approach is that quality as a variable is difficult to measure and to keep constant and homogenous across different studies. Clearly, its components can vary greatly and have multiple dimensions. It also entails parameters of uncertainty and subjectivity. For example, according to Charters and Pettigrew (2008) quality is a multi-dimensional phenomenon that incorporates external and internal characteristics. The intrinsic properties considered in hedonic models[20] are, for example, grape variety and vintage, while an extrinsic characteristic is expert evaluation.

Kahneman, Knetsh and Thaler (1991) famously speak about the endowment effect whereby an economist who loves wine buys a few Bordeaux wines for $10 that then appreciate to $200. The person now only drinks the wine occasionally and is not willing to sell the wine or to buy new bottles at the higher price. This illustrates a number of irrational behavioral biases including the endowment effect, status quo bias, and loss aversion. Tversky and Kahneman (1981) also examine framing effects where a wine is perceived as being more valuable if decanted and served in a fancy glass, or if it comes from an expensive bottle but is in fact a cheap wine.

If we treat price as a proxy for quality and competitiveness, Ashenfelter (2008) predicts variability in quality and prices of Bordeaux vintages by modelling the weather and finds an estimated real return related to weather of between 2-3% per annum. Alternatively, Gergaud et. Al (2008) point to land characteristics, termed terroir, and technologies as the main factors used to model prices. Regarding technology, its adoption by wine makers is demonstrated to be positively correlated with innovation efforts, along with sustainable practices and firm size. The innovation efforts carried out by wine producers ultimately have a positive effect on financial performance (Dogru, Peyrefitte 2022). This focus on innovation as a source of attaining an edge is also aligned with key economists and strategic management theorists such as Schumpeter (1942) who proposes that innovation is the engine of creative destruction in competitive

[19] Or commonly referred as Terroir.

[20] Hedonic price theory is a fundamental technique used to explain the variability in wine prices. It normally involves a two-step procedure, in which a hedonic function is estimated in the first stage, normally through a regression; next, in the second stage, the implicit price of a specific factor is derived as the partial derivative of the hedonic equation with respect to that specific factor. The model is usually run together with variables representing a set of preferences and buyer's income. Hedonic price theory is extensively used in several different markets and for many goods. For fine wine market it is employed to gauge the impact of different factors on wine price.

capitalism, Drucker (2002) who seeks to unpack forms of innovation, Christensen (1997) whose notion of the innovator's dilemma distinguishes between sustaining and disruptive innovation, and Porter (2013) who discuss innovation as a causal phenomenon for preferred business outcomes.

In the wine-related literature, other authors rely on experts' opinions (Masset, Weisskopf, & Cossutta, 2015)[21], such as wine ratings to model price predictions in order to forecast which wines will be outperformers. Instead of focusing on quality, another group of researchers tries to understand how individual and collective reputation (Costanigro, McCluskey, & Goemans, 2010)[22] correlate with price differences when analysed together. Wines highly ranked in a classification system show higher price points (Malter, 2014). This focus on quality and recognized status is the result of strategic decisions put into place by winemakers. Quality and public recognition can be a source of competitive advantage. However, according to Mintzberg (1985) strategy should be thought of as an emergent phenomenon. Thus, since winemakers deal with continuous uncertainty with regard to obtaining recognition and gaining high scores from experts, winemaking is the outcome of a strategy that emerges over time as intentions collide with and accommodate a changing reality.

Interestingly, Ginsburgh et al. (2013) analyze more than a hundred chateaux in the Médoc wine region. They show that weather, along with technology and other variables, are able to explain 67% of price variability. When reputation is included[23], the ability of the model to explain price variability increases to 85%. This helps explain why high ranked chateaux charge premium prices and how classification as a measure of quality is reflected in prices.

With rare exceptions, most authors look at wines from the Bordeaux region in France, given the limited availability of data from elsewhere. Their results are therefore not applicable

[21] Masset, Weisskopf, & Cossutta,2015 take into account the ratings of 12 influential wine critics on the Bordeaux *en primeur* market. Their results indicate that European critics are more severe and less transparent with their judgements than their American counterparts. In addition, over the period of vintages analyzed, respectively from 2003 to 2012, the critics Robert Parker and Jean-Marc Quarin are found to be the most influential on wine prices, with corresponding premiums of 10% and 7% respectively. Last, such impacts on prices are found to be higher for wines and chateaux not included in the original classification of 1885.

[22] Costanigro, McCluskey, & Goemans in 2010 developed a conceptual framework for jointly analyzing the effect of product, firm, and collective reputations on market price. In their analysis they consider Californian wines and discover that, by considering together individual and collective reputation of a geographical area, the reputation premia migrates from collective to individual specific names as price increases.

[23] Reputation effects in this study are the wine classifications of Bordeaux from 1855.

worldwide. Given these limitations, Masset et al. (2021) extend the variables used to consider fine wine as an experience good, using competitive and opaque markets with Switzerland as a proxy. Their findings suggest that wine producers in Switzerland reviewed pricing and positioning in light of fewer information asymmetries when influential wine experts began to review Swiss wines[24].

The second approach in the literature on pricing and returns of fine wines regards them as alternative financial assets. Investors and researchers have devoted considerable effort studying the benefits of portfolio diversification[25] strategies since the introduction of modern portfolio theory (Markowitz, 1959). The premise is that a diversified portfolio of relatively uncorrelated assets dampens volatility, thereby delivering more return per unit of risk. Diversifying a portfolio by adding more exotic non-correlated asset classes to the mix can be taken to be a core competency (Prahalad & Hamil, 2009) of strategic management of assets.

However, at first researchers only included different equities in a portfolio. Later the studies and practices evolved and included other asset classes such as bonds, real estate, and commodities. In a third phase other alternative assets like collectibles, fine wine, and art have been added to the mix of investment strategies. Overall, in the literature on fine wine returns, when fine wine is considered an alternative asset class, mixed results can be observed due to the different datasets of wines, inaccuracies on price, different IRR time horizons, transaction costs and maintenance costs which cause issues for the heterogeneous models used by authors (Le Fur, Outreville, 2019).

Krasker (1979) analyses returns on wine investments over the period 1973-1977 and considers wines from Bordeaux and Californian Cabernet Sauvignons. He found no evidence of capturing a meaningful risk premium which suggests that the small sample of wines considered did not outperform riskless assets. Jaeger (1981) instead found a risk premium of 12% suggesting that Krasker's (1979) results might have been biased by the oil crisis of the early 70s. Jaeger also found operating costs related to wine investments to be lower than Krasker's operating cost assumptions (Jaeger, 1981). According to Le Fur and Outreville (2019), the starting point of

[24] The wine experts are associated with Robert Parker and his team called "The Wine Advocate".
[25] Portfolio diversification is a risk management strategy that aims at reducing the overall volatility, computed as the portfolio's standard deviation, by combining heterogeneous assets. The idea is that assets with diverse idiosyncratic price actions have low correlations or, ideally, no correlation at all, and do not move in tandem. This is taken to mitigate specific risk (also called unsystematic risk).

academic research investigating fine wine returns was the launch of the newsletter Liquid Assets: The International Guide to Fine Wines created by Orley Ashenfelter (1986), analyses returns of wines.

Since the early 2000s wine has become a progressively more studied investment class. Fine wine has demonstrated strong performance and low correlations with respect to more traditional financial assets. Sanning et al. (2008), using the Fama-French Three-Factor model and CAPM, obtain above average returns of 0.75% per month for Bordeaux fine wines. They also show there is low exposure to systematic financial asset risk, thus providing valuable portfolio diversification. Masset et al. (2010) also show that adding fine wine to a portfolio improves portfolio diversification.

Other works have managed to gather extensive data over time, to reach broader conclusions about the effectiveness of fine wine investments over the long-term. Dimson et al. (2015) use historical prices of Bordeaux Premier Crus to study the impact of aging on wine prices and the long-term performance of fine wine. They use an arithmetic repeat-sales regression over the period 1900-2012 and conclude by estimating a return of 4.1% for fine wine investment net of all operating costs, which they claim to be higher than bonds, art, and stamps over the same period. They also find a positive correlation between wine and equity returns and evidence of in-sample return predictability.

3.2 ASSET MANAGEMENT THEORY

In 1952 Harry Markowitz published his seminal paper "Portfolio Selection" in the *Journal of Finance* and was later awarded a Nobel prize for his work on Modern Portfolio Theory (MPT). A key element of his theory is diversification, to gain more return per unit of risk while mitigating idiosyncratic volatility[26]. In MPT an investor bundles different types of investments together to create a smoothing effect between assets that depreciate versus those that appreciate. As markets rise overall in accordance with its systematic volatility, the portfolio value rises too, mitigating large fluctuations.

[26] Idiosyncratic risk or volatility is the risk inherent in a particular investment due to its unique characteristics.

MPT has been criticized because it evaluates portfolios based on overall mean variance, rather than downside risk. Post-modern portfolio theory (PMPT), developed by Brian M. Rom and Kathleen Ferguson[27] in 1991, attempts to improve MPT by utilizing a different notion of risk. PMPT uses the standard deviation of negative returns as a measure of risk, opposed to the overall standard deviation of returns used in MPT. Sortino and Price (1994) developed the Sortino ratio which improves the commonly used Sharpe ratio (1966). The former distinguishes between upside and downside volatility which the Sharpe ratio failed to do. In summary, portfolio theory describes how risky assets should be valued and the importance of diversification to improve portfolio optimization. A well-diversified portfolio is characterized by low correlation between investment vehicles; thus, it is necessary to spread risk across different asset classes (Jurevičienė & Jakavonytė, 2015). Diversification is defined as a strategy to reduce the exposure to risk by forming a portfolio of assets with less than perfect rates of return (Hibbert et al., 2012).

A diversified portfolio can outperform traditional asset classes, such as stocks, bonds, real estate, and cash, or also alternative asset classes, such as gold, rare coins, art and fine wine (Greenwood, 2008). Typically, equity prices are related to the individual characteristics of firms, measurable with ratios such as price to earnings, cash flow over price, debt to equity and dividend over price. In addition to these firm specific factors, industry indicators and general market conditions, along with geopolitical forces, are considered. Fine wine has several characteristics that differentiate it from traditional assets. Research about the price determinants of fine wines is summarized in the following section.

Since the early 2000s, investing in these collectibles has become fashionable (Masset et al.,2016). Fine wine is a tangible asset like gold, silver, and artwork, and this makes its price to perform well during inflationary periods (Roseman, 2012). Gold, traditionally, is regarded by investors as a “safe haven”, a valuable commodity that has several traits attracting investors, especially in times of uncertainty and high volatility. Thus, gold demonstrates a stable performance during crises and periods of economic instability. It further is a highly liquid asset that investors can easily sell and monetize (Chen, 2019).

[27] Brian M. Rom and Kathleen Ferguson were two software engineers that elaborated the theory while working on software designs using modern portfolio theory.

Graph 1 shows the comparison between gold and fine wine returns, the latter represented by the Liv-ex 1000 index[28]. Most recently, in 2020 and 2021, gold has had negative real returns, as opposed to the Liv-ex 1000's real return, using the G20 CPI index as a proxy for inflation, of approximately 12% in 2021 alone.

Graph 1

Source: Fine wine data from Liv-ex as of 31 Jan 2022; the performance was calculated in GBP and will vary in other currencies. Gold price data from goldprice.org; performance calculated as USD/ounce and will vary in other currencies.

Fine wines have a favorable risk-return profile and low correlation with other assets (Masset and Henderson, 2010) and thus have attracted much more attention from investors as a means of portfolio diversification. Buori (2015) finds average negative correlation between fine wine and the equity markets of the United States and Europe. He provides evidence of the ability of fine wine to hedge equity risk in the United States, United Kingdom, Germany and France.

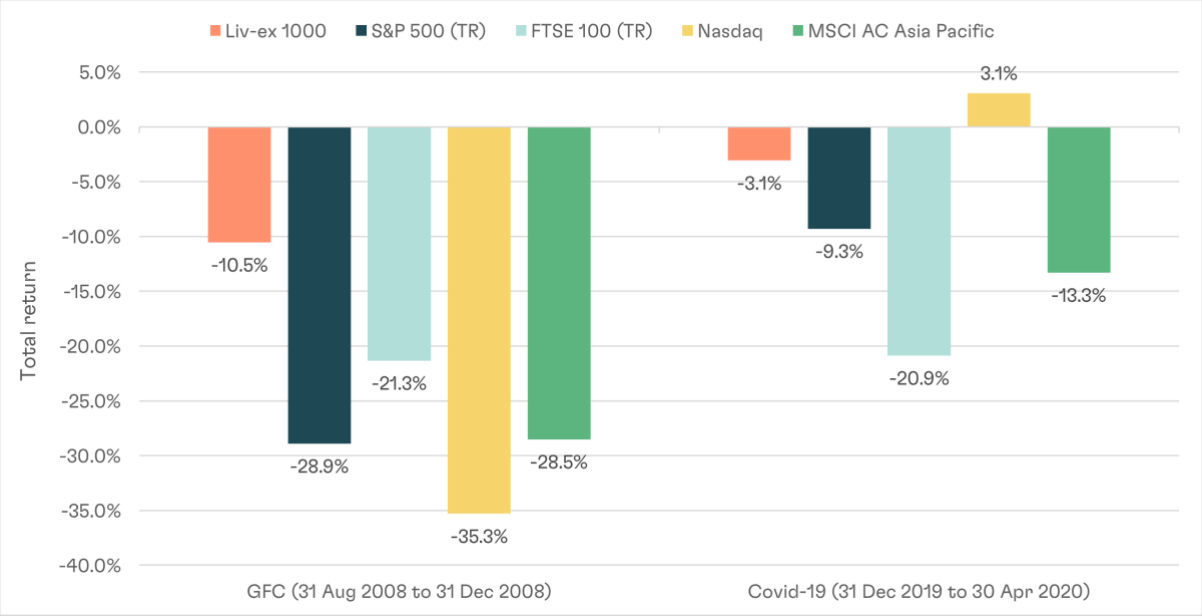
Masset et al. (2021) use a unique and deep database to measure the performance of wine investments in the period 2003-2014. They state that returns can be largely explained by lack of liquidity in the market and show that fine wines tend to react with a one to three month lag relative to changes in general market conditions, which is a similar to results obtained by Baldi et al. (2010) where fine wine returns are held to adjust more slowly to market downturns when

[28] Liv-ex 1000 is the broadest measure of fine wine market and the most used as a proxy. It includes the 1000 most traded fine wines on Liv-ex.

compared to more traditional assets. As such, they can function as a financial hedge, justifying their presence in a portfolio in times of crises. Masset & Weisskopf (2010) looked at the fine wine market after the 2008 Global Financial Crisis (GFC) and found evidence of positive returns, along with positive skewness and kurtosis of s fine wine portfolio. During the GFC these effects were most pronounced, improving overall portfolio diversification when it is needed most.

The GFC of 2008 also has a significant negative impact on the demand side for fine wines, due to the adverse income and wealth effects on economic agents. Graph 2 shows the downturns of fine wines compared to other asset classes during the GFC, compared to the first months of the Covid-19 pandemic.

Graph 2



S ource: Liv-ex, investing.com.

These preliminary results of what transpired during the first months of 2020 may confirm the degree of non-correlation of fine wine from global macro events identified by several authors in the literature.

Cardebat et al., (2020) estimated the impact of Covid-19 on average prices of fine wines market at a macroeconomic level to be roughly -30%. The authors benchmarked world GDP contraction and supply turmoil due to work restrictions. In addition, they suggest that a market freeze could contribute to a market recovery in 2021.

The GFC of 2008 is the most recent event used to benchmark the short and medium-term price volatility of fine wines. According to Masset & Weisskopf (2018), fine wine prices dropped by 25% after the summer of 2008, in a market where transaction volume was at a record low. Then, interest from investors, that led to a market bubble in the fine wine industry came around the beginning of 2009 and which caused a runup in prices that popped in the third quarter of 2011. This rally was fueled by the buzz around the extraordinary quality of the 2009 and 2010 vintages in Bordeaux (Cardebat et al., 2020).

The question that remains to be answered is what the fate for fine wines at the end of the Covid-19 pandemic will be. And how will global macroeconomic trends of 2022, characterized by high inflation and rising interest rates, drive investor decisions regarding the asset class?

3.3 FRAUD LITERATURE

Wine frauds are an extensive problem, and, from an historical point of view, the victims of wine frauds are the end consumers (Holmberg, 2010). However, wine frauds can also affect producers directly as well as distributors and auction houses. There are several types of frauds and authors have distinguished them according to historical differences in fraud practices (Lecat, Brouard, Chapuis, 2016). Fraud and counterfeiting wines violate Intellectual Property Rights laws (Shen, 2018) or other criminal statutes according to the nature and scope of the fraud (Holmberg, 2010). Among the several forms of frauds identified by authors, two categories are discussed by Holmberg (2010). Consumption fraud includes frauds aimed at the market in general such as adulteration of wine, whereas collector frauds are aimed at the very top of the wine market (fine wines).

Regarding consumption fraud, there is a great deal of history associated with this form of subterfuge. In Ancient Rome during the first half of the 1st Century, Gaius Plinius Secundus[29] complained about the abundance of cheap Falernian wine[30], which was probably adulterated with water. According to Eisinger (1982) the widespread practice of adulterating wine with a

[29] Also called Pliny the Elder (AD 23/24-79), he lived under the Roman Emperor Vespasian, with whom he was a friend. Gaius Plinius Secundus was a Roman author, natural philosopher, and naturalist. He is known for his career as military commander, provincial governor, and writer of several works narrating the "German Wars".
[30] Falerian wine was a popular white wine in Ancient Rome. The name comes from its production site, Mount Falernus, which is close to the border between the two Italian regions of Lazio and Campania. Falernian wine was made with a commonly known Italian grape, the Aglianico.

grape juice called Sapa, obtained through a volume reduction process by boiling in lead vessels, was common among winemakers in the Roman Empire. This practice led to lead poisoning and there is evidence of adding lead to wine until the end of the nineteenth century all over Europe. In the 14th century King Edward III ordered tavern-keepers to serve wine directly from barrels in front of customers to prevent adulteration of good quality wine mixed with weak and corrupted wine. Stanziani (2009) discusses wine adulteration techniques in France during the eighteenth century. He writes about both completely safe adulterations with water, sugar, or dried grapes, or with dangerously added plaster[31]. Stanziani underlies how wine legislation and regulation were not responsive to consumer needs and that the main aim of state regulation was to ensure the circulation of information and fair trade rather than to protect public health.

More recently, in April 2016, a French winemaker sold 30,000 hectolitres of Spanish wine labelled as French[32] in the Aude region of Languedoc-Roussillon in southern France. Such practices are illegal but not uncommon among winemakers in France since Spanish wine can be procured cheaply and is easily mixed with French wine to increase production volumes. Consumption fraud, thus, mostly refers to adulteration of wine to increase volumes, prices, or both. It does not specifically refer to fine wines and it is not a common occurrence within this category.

On the other hand, collector fraud is a far more recent phenomenon. Every author that discusses wine frauds after March 2012 refers to Rudy Kurniawan[33] as the greatest collector fraud ever, or at least, until now. Due to its audacity and scale, this case made the issue of counterfeiting wines very public and there is even a Netflix documentary on the scandal called *Sour Grapes* (2016)[34]. Kurniawan was an influential individual who, in the early 2000s, managed to participate in a large portion of market for old and rare wines, spending up to $1 million a month at auctions (Barbos, 2020). After a series of incidents in 2007, some doubts arose over the legitimacy of Kurniawan's bottles that he was selling from his own collection. Christies withdrew some of his wines from a 2007 sale (Hellman 2007). In a private and separate tasting

[31] The plastering of wine refers to adding plaster to wine during the resting or refining process. It is also interesting that a slang expression for being drink is "getting plastered", although the expression is held to have arisen only in the 1900s.
[32] Article accessible on https://www.decanter.com/wine-news/french-wine-fraud-spain-languedoc-317219/
[33] Rudy Kurniawan, whose real name is believed to be Zhen Wang Huang by investigators, was sentenced to 10 years imprisonment in 2014. He was released in November 2020 and deported to Indonesia. Rudy Kurniawan has been the first person in US criminal justice history to be convicted of wine fraud.
[34] Link to the movie trailer https://youtu.be/hPUYuwSRwB8, full movie https://youtu.be/5LGibBYuj5U

more than 50% of the bottles provided by Rudy Kurniawan proved to be fakes. Even if Kurniawan's behaviour was widely known, auction houses continued to accept bottles from him, often "sight unseen" (Hellman 2008) until he was arrested.

The first substantial case that led to a lawsuit against Kurniawan for selling counterfeit bottles took place in 2008. At that time, Laurent Ponsot, owner of the historic Domaine Ponsot, requested the auction house Acker Merral & Condit[35] to remove 22 lots of Domaine Ponsot wines, specifically Domaine Ponsot Clos St Denis 1945. In actuality, the Domaine only made the first bottling from this vineyard in 1982. Rudy Kurniawan was arrested on March 8 2012[36].

According to Laurent Ponsot, faking still happens but on a much smaller scale since fraudsters know the possible consequences. In addition, the most expensive wines now have state-of-the-art anti-fraud protection, from DNA labels to Blockchain technology authentication. Similarly, James Miles[37], in an interview for Liv-Ex in February 2013, declared that after the Rudy Kurniawan scandal major chateaux in Bordeaux began taking the problem more seriously, investing in proof tag technology and tracking sales connections.

The counterfeiting and distribution process of fake fine wines affects all market participants, harming final consumers or collectors as well as producers, merchants, and auction houses. Barbos and Hartman (2020) examined the reputational effects[38] of third-party agents by analysing market responses to two disclosures of auction houses having auctioned fake wines. They found that three houses associated with a 2012 incident suffered reputational losses estimated as an average decline in equilibrium prices of all wines by 4.5%. In addition, they also saw evidence of lower sales volumes of older wines, relative to other channels.

[35] Acker Merral & Condit sold more than $35 million of Rudy Kurniawan's wines in only two auctions, according to records.
[36] A search of Kurniawan's home conducted by the FBI revealed a large counterfeiting operation including a corking machine, fake labels of fine wines, empty bottles, and a collection of mixtures of cheaper wines to mimick more valuable ones.
[37] Liv-Ex director James Miles discusses iv-Ex and the fine wine market with Jeff Leve, director of The wine cellar insider. Full interview accessible at https://www.liv-ex.com/2013/02/wine-cellar-insider-interviews-james-miles/
[38] Reputational effects help mitigate adverse selection and thus reduce market inefficiencies. Adverse selection is typically caused by information asymmetries, that is why most markets rely on reputation and have established quality assurance mechanisms to better inform potential buyers. With such mechanisms, consumers reward or punish actors based on reputational criteria.

4.0 PRELIMINARY ANALYSES

4.1 FINE WINE MARKET

The Fine Wine industry had an estimated sales volume deal of €14.1B, a 1,76% increase from 2020 (Euromonitor International, Fine wine market report, 2021, Exhibit 1).

The Table represented in Exhibit 1 shows market data by country, sorted by 2021 market share.

Exhibit 1

Country	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2021- % mkt share
United Kingdom	2.001 €	1.956 €	1.930 €	1.912 €	1.925 €	1.953 €	1.955 €	1.968 €	1.998 €	2.073 €	2.042 €	14,70%
USA	955 €	1.026 €	1.098 €	1.178 €	1.219 €	1.258 €	1.286 €	1.304 €	1.307 €	1.805 €	1.306 €	12,81%
France	1.496 €	1.512 €	1.538 €	1.577 €	1.628 €	1.666 €	1.732 €	1.735 €	1.761 €	1.642 €	1.647 €	11,65%
Canada	761 €	803 €	908 €	997 €	1.120 €	1.210 €	1.296 €	1.360 €	1.450 €	1.511 €	1.439 €	10,72%
Japan	1.209 €	1.162 €	1.272 €	1.294 €	1.308 €	1.321 €	1.321 €	1.300 €	1.290 €	1.262 €	1.270 €	8,95%
China	1.136 €	1.147 €	993 €	935 €	930 €	968 €	1.020 €	1.074 €	1.117 €	1.012 €	1.182 €	7,18%
Italy	817 €	811 €	820 €	833 €	876 €	918 €	953 €	977 €	1.005 €	912 €	929 €	6,47%
Germany	741 €	744 €	749 €	755 €	769 €	785 €	800 €	815 €	831 €	877 €	841 €	6,22%
Switzerland	540 €	556 €	564 €	564 €	573 €	578 €	576 €	573 €	577 €	616 €	600 €	4,37%
Australia	167 €	176 €	196 €	206 €	233 €	273 €	317 €	349 €	331 €	360 €	380 €	2,55%
South Korea	194 €	232 €	264 €	288 €	307 €	320 €	321 €	322 €	322 €	311 €	312 €	2,20%
Netherlands	289 €	283 €	276 €	292 €	294 €	299 €	306 €	310 €	315 €	302 €	305 €	2,15%
Spain	251 €	250 €	241 €	242 €	249 €	261 €	271 €	283 €	298 €	287 €	297 €	2,04%
Russia	245 €	275 €	293 €	288 €	262 €	268 €	268 €	274 €	272 €	281 €	282 €	1,99%
Sweden	104 €	108 €	112 €	117 €	123 €	129 €	132 €	136 €	138 €	148 €	148 €	1,05%
Mexico	55 €	60 €	66 €	70 €	76 €	85 €	95 €	105 €	114 €	107 €	106 €	0,76%
Poland	47 €	51 €	55 €	61 €	67 €	71 €	71 €	72 €	76 €	66 €	70 €	0,47%
Hong Kong, China	68 €	72 €	74 €	74 €	74 €	75 €	76 €	80 €	75 €	59 €	60 €	0,42%
Romania	39 €	40 €	40 €	41 €	47 €	48 €	51 €	54 €	56 €	58 €	60 €	0,41%
South Africa	58 €	61 €	64 €	66 €	70 €	71 €	72 €	73 €	74 €	57 €	48 €	0,40%
Philippines	53 €	60 €	58 €	63 €	69 €	75 €	80 €	85 €	95 €	54 €	61 €	0,38%
Brazil	77 €	89 €	90 €	89 €	86 €	66 €	71 €	68 €	67 €	52 €	60 €	0,37%
Thailand	33 €	36 €	39 €	42 €	46 €	50 €	53 €	56 €	59 €	48 €	45 €	0,34%
Singapore	30 €	31 €	33 €	36 €	39 €	40 €	41 €	42 €	42 €	45 €	46 €	0,32%
Turkey	10 €	11 €	12 €	28 €	30 €	30 €	32 €	38 €	42 €	33 €	29 €	0,23%
United Arab Emirates	31 €	32 €	34 €	36 €	37 €	38 €	37 €	37 €	38 €	27 €	28 €	0,19%
Argentina	24 €	27 €	32 €	35 €	38 €	33 €	42 €	40 €	30 €	25 €	26 €	0,17%
Taiwan	10 €	11 €	12 €	14 €	15 €	16 €	18 €	19 €	22 €	24 €	25 €	0,17%
Malaysia	11 €	12 €	13 €	15 €	17 €	19 €	20 €	22 €	24 €	24 €	23 €	0,17%
Ukraine	12 €	13 €	15 €	14 €	15 €	15 €	15 €	16 €	18 €	19 €	19 €	0,13%
Indonesia	4 €	4 €	4 €	4 €	5 €	5 €	5 €	6 €	7 €	5 €	5 €	0,04%
Total Market size	***11.467 €***	***11.648 €***	***11.896 €***	***12.164 €***	***12.543 €***	***12.940 €***	***13.334 €***	***13.591 €***	***13.849 €***	***14.098 €***	***13.690 €***	
YoY Growth	-	***1,56%***	***2,08%***	***2,20%***	***3,02%***	***3,07%***	***2,96%***	***1,89%***	***1,87%***	***1,76%***	***-2,98%***	

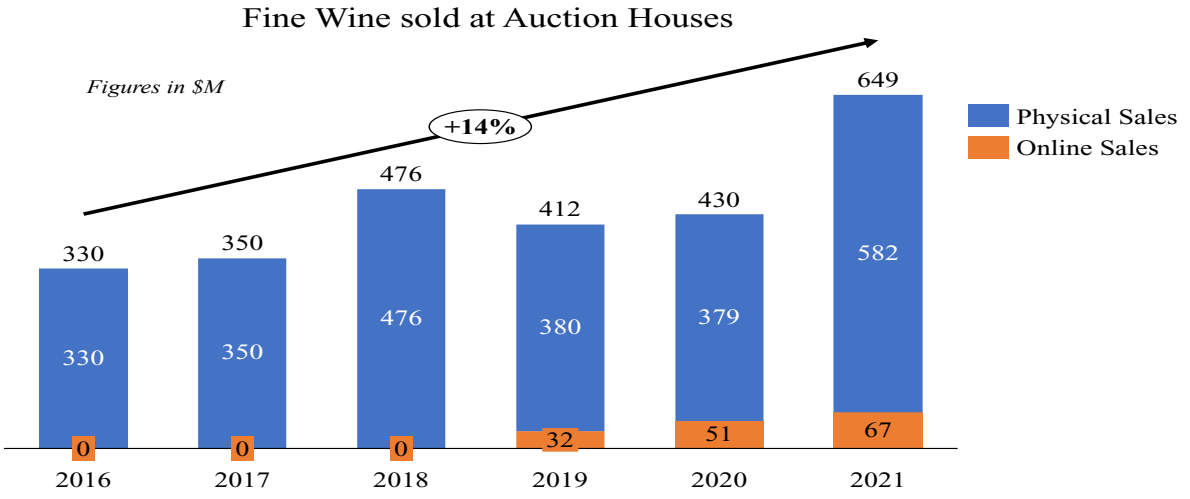
Figures in million €

The time horizon considered in the report includes the last 10 years (2012-2021) and provides a forecast about market's growth in 2022. The Fine Wines Market has been growing in this period by a CAGR of 1,88% and it never had negative year over year growth, within the observed timeframe. The United Kingdom is the largest geographical market, with a 14.70% market share, followed by the USA (12.81%) and France (11.65%). Auction Houses represent an important part of the fine wine market. Historically, they have played a key role in providing liquidity to the market, being an important exit strategy for big collectors.

Exhibit 2 shows the annual sales of fine wines sold at auction houses since 2016, displaying a compounded annual growth of 14% over a 6-year period. Online sales or digital auctions, tracked since 2019, have grown from $51M to $67M from 2020 to 2021, pushing the wine-auction annual revenue total over the $600M mark. Over the three years tracked, digital sales at auction houses have already grown by 109%, signalling to the market that in the upcoming years this sales channel will gain even more importance. The Covid-19 pandemic has played a

crucial role in the digitalization of sales and processes, and the case of digital auction is a good example.

Exhibit 2



Note: Online sales tracked since 2019
Source: The world of Fine wine – March 2022

By comparing the overall market size and the fine wine sales reported by auction houses, sales represent 4.6% of the overall total. Despite the slowdown in 2020 due to Covid-19, the auction market has rebounded significantly establishing a new record high in sales in 2021 with a +36% from the previous record of $476M in 2018. Overall, since 2016 the market has grown at a CAGR of 14%, well above the 1.97% CAGR at which the world fine wine market grew since 2016.

4.2 FAKE WINE MARKET

According to a study conducted by the EUIPO[39] (2016), 2.3% of sales of wine are lost each year due to counterfeiting, in addition, 4.4% of sales of spirits, also estimated in the research. This translated into a direct loss of 4,800 jobs in the sector across the EU with legitimate manufacturers employing fewer people. The loss related to VAT taxes and exercise duties is estimated to be approximately €1.2 billion. The EUIPO (2016) study estimates that in the EU annual sales of spirits and wine amount to approximately €38 billion.

[39] European Union Intellectual Property office is the agency responsible for registration and protection of trademarks and community designs valid across 27 member states of the EU. It was founded in 1994 and is based in Alicante, Spain. The rights granted complement national intellectual property rights that are also linked to the international IP system.

Maureen Downey[40], founder of Chai consulting and Winefraud.com, suggested that the 2020 pandemic brought many opportunities for fake wine makers.[41] The increase in online sales, both retail and auction, along with the lack of proper controls due to travel restrictions and even layoffs throughout industry, hugely favoured criminal counterfeiting activities. In addition, she believes that consumers and investors have preferred online quick sales rather than creating relationships with wine merchants, a gap is filled by counterfeiters. Maureen Downey estimates that wine fraud is a $3 billion blight in the industry, which represents 21% of total market size according to estimates by Euromonitor (2021).

As proof of Maureen Downey's statement, on October 14th 2020, the Italian Guardia di Finanza discovered and dismantled a massive counterfeit operation near Milan, Italy, where fraudsters had counterfeited more than €2 million of the widely appreciated Super Tuscan Sassicaia, produced by Tenute San Guido. The perpetrators were arrested for selling the fake wine on the internet and shipping bottles all over the world.

In November 2020, Tannico, one of the biggest wine e-commerce hubs in Italy, was involved in a scandal where a fake Tignanello 2001, a famous Super Tuscan wine produced by Antinori, was received by a customer who posted pictures on various social media platforms. Tignanello, according to Winefraud.com is one of the most counterfeited wines of late, and its prices can range from €100 up to €200, depending on the vintage. Very recently, in March 2022, more than 8000 bottles of Fake Penfolds Bin 407 were seized[42] by the police in a maxi operation in the Jiangsu province in China, along with a workshop full of materials needed for faking. It was estimated by officials covering the case that more than $12 million of product was sold through an online platform used by the counterfeiters.

[40] Downey served as the FBI's key expert witness in the Kurniawan case.
[41] More https://www.theguardian.com/food/2022/feb/27/wine-crime-is-soaring-but-a-new-generation-of-tech-savvy-detectives-is-on-the-case
[42] Full article accessible at https://www.decanter.com/wine-news/police-seize-counterfeit-penfolds-wines-in-china-477015/

5.0 DATA AND METHODOLOGY

To study the performance of fine wines, we took a two-pronged approach. Semi-structured interviews with 8 experts from a cross section of the wine industry were conducted. A semi-structured approach permits flexibility and facilitates gathering a broad array of insights when interviewing experts (Kvale, 1994). For our qualitative and quantitative analysis, eWibe[43], a proprietary dataset was used. It includes historical price data that starts in July 2016, until July 2022, thus covering a full 6-year timeframe.

Approximately 800 fine wines were analysed, from 82 different producers, exclusively from Italy and France. This selective choice is justified by the fact that fine wines from Italy and France are the only ones traded on the eWibe platform, thus being the only data points available to study. Aware of this geographical limitation, an invitation is made to replicate this study in the future with a more comprehensive database of fine wines from other producer countries and with a broader timeframe of analysis.

In the following sections, first, the data obtained from the Semi-structured interviews is presented and discussed. Second, the data from the eWibe database is presented and commented, along with other relevant data such as the comparable assets selected to study the validity of fine wines as an investment. Finally, in the next chapter, the regression analysis studying the price behavior of fine wines in the scenario of an extreme weather event is presented and discussed.

5.1 DATA FROM EXPERTS' INTERVIEWS

The data collected through interviews was exclusively qualitative. The aim was to first understand whether fine wine is considered an asset class and what are the reasons behind it. Secondly, it was asked to the experts to express their opinion about the recent price hikes witnessed in the markets, the causes behind it with particular attention towards the impact that Covid-19 and the recent inflationary spikes of 2022 might have played. The fine wine price hikes are exposed graphically in the fine wine indices section of this paper. Lastly, experts were

[43] eWibe is a fine wine investing platform in Italy. It offers several services through its platform, such as historical prices, tools for listing bottles, an open market to trade fine wine and storage services.

asked to comment on the most faked wines in the market and newest technologies available to spot fakes, as well as some good practices to reduce an investor's exposure to fake wines.

Eight experts with different backgrounds were interviewed, the table below provides information about their profiles. A Copy of the questions asked to the experts can be found in Appendix 3.

Table 1

EXPERT	*ROLE*	*COMPANY TYPE*
L. Panciera	*Collector and investor*	*Wine fund*
R. Chachra	*Wine collector and investor*	*Tech*
D. Chiesa	*Sommelier and collector*	*Michelin-starred restaurant*
P. Holowka	*Wine collector and investor*	*Banking*
N. Asaro	*Wine merchant and collector*	*Food processing*
F. Rabellino	*Wine merchant and collector*	*Wine distribution*
B. Vialle	*Head of wine sales*	*Wine auctions*
R. Tolomei	*Wine merchant and sommelier*	*Wine reviews - consulting*

All experts interviewed are passionate about fine wines as a consumable and most of them work with fine wines on a daily basis, by both selling it as a consumable or as an investment asset. The experts have a heterogenous geographical and professional distribution.

5.1.1 FINE WINE AS AN ASSET CLASS

All but one expert, considered fine wine an asset class. Among them, 4 out of 8 experts mentioned the ability of certain fine wines to improve in quality over time as a key characteristic making fine wine an asset class. In addition, 6 out of 8 experts stated that the limited and diminishing supply over time is the fundamental logic behind its price appreciation, thus validating even further fine wine an asset class.

The expert who did not consider fine wine as an asset class preferred to consider it a consumable good and believed that speculation around fine wines has gotten to a point where the limit between what is reasonable and what is not is very blurred. In this regard, 3 out of 8 experts interviewed considered excessive speculation to be among the reasons for which fine wine

might not be considered an asset class, while 2 out of 8 experts saw fine wine as an asset class due to its "bond-like" stability and the solid positioning it has among collectibles. All experts considered fine wine a collectable good where the "passion" component plays an important role. According to 4 out of 8 experts, understanding fine wines is essential to be an investor and collector. Regarding colleting wines, all experts agreed that can it be stored for a long time thanks to its longevity potential.

5.1.2 FINE WINE PRICE HIKES, THE ROLE OF COVID AND ALTERNATIVES

First, regarding the logic behind recent price increases in the fine wine secondary market, wine experts had several different reasons that are summarized in Graph 3 in the Appendix 1. In short, the number one cause held to be responsible for the price increase of fine wines was growth in demand due to a change in consumer habits during the Covid-19 lockdowns. Experts mentioned this 50% of the time, and two specified that spending during lockdowns was reduced, but overall salaries were not. The result has been exploding demand once the lockdowns were removed. As cause number two, 37.5% of the time, experts mentioned both, increasing demand from Asian countries, and smaller supply of fine wines due to extreme weather events that are drastically reducing volumes. Asians, and in particularly Chinese successful professionals, buy fine wines as a status symbol, according to two experts.

Other reasons mentioned included the current supply chain disruptions and the speculation by irrational investors also observed in other luxury markets like fine watches. Regarding the issues related to supply chains, experts pointed to difficulties in finding labels, corks, and glass bottles, as well as increased costs and time for shipments.

Second, experts were questioned about the role that the Covid-19 pandemic and the current inflationary dynamics experienced by countries all over the world might have had on the prices of fine wines. Four out of 8 experts outlined how the Covid-19 pandemic has pushed the wine industry towards digitalization, especially in terms of sales channels. As a matter of fact, in 50% of cases experts declared that the digitalization of the fine wine industry has pushed up demand considerably.

When it comes to inflation, experts had similar views. They all believed higher costs for materials has had no impact or only a small one on prices of fine wines, as price increases in the components of a wine bottle, such as the glass and labels, represent only a tiny percentage

of margins. In addition, 2 out of 8 experts mentioned that inflation will eventually lower the demand for fine wines as consumers become forced to spend more on other essential items like food.

Finally, experts were asked what they considered as potential alternatives to fine wines as asset classes. Exhibit 3 shows the word cloud representing graphically the words used most frequently. Whisky was the most accredited as 4 out of 8 experts mentioned it first. Secondly, luxury watches were indicated to be a potential alternative, as well as other spirits like Tequila and Gin. Other mentions included collectible arts, luxury handbags, handmade jewelleries, and vintage classic cars.

Exhibit 3

5.1.3 FAKE FINE WINES TECHNOLOGIES AND BEST PRACTICES

The last section of the interviews was dedicated to gaining information about the newest technologies used to spot fake wines, comments about the most faked wines out in the markets and to learn about best practices for buying fine wines.

Regarding technologies, 5 out of 8 experts said companies are deploying blockchain technology not only to track production from grapes until the finished bottle, but also to monitor sales in

the secondary market with the use of NFTs[44] and QR codes. Two experts highlighted that there is growing interest around services that allow one to buy fine wines directly from producers and store them close to the point of sale. By doing so wines do not travel and do not get continuously exchanged from person to person, as an NFT is used as a medium of exchange in the transaction, and the ownership is irrevocably registered on the blockchain.

In addition to blockchain technology, 2 experts also mentioned bottle enhancements like special labels, corks, and hidden codes on the bottles visible only through special lights, as techniques used by producers to limit counterfeiting of wines. These initiatives complement the skilled eyes of trained professionals who are often hired by private collectors or auction houses to analyse lots before they go on sale. According to an expert involved with auction sales, a detail to which they pay particular attention when evaluating lots are bottles with special formats (i.e., Double magnums, Melchiors, etc.) or when private sellers mention that the wines were gifted to them.

Fig 2 – Blue lights are used to control for special signs on labels and verify validity

Experts were then asked their opinion regarding the most faked wines in the markets. Interestingly, 5 out of 8 experts had previous encounters with fakes, at auctions or tasting events. According to their personal knowledge and experience the three most cited names were

[44] NFTs stays for non fungible tokens. They are cryptographic assets on a blockchain and have unique identification codes and metadata to distinguish them.

DRC (Domaine de la Romanée Conti) wines, Chateau Lafitte Rothschild and Sassicaia. Overall, experts said that fine Chateaux from Bordeaux and Burgundy wines with price tags above the €1000 are often of interest to counterfeiters. Three experts outlined that in China the issue of fake wines is considerably more diffused and buying from Hong Kong or Singapore represents a high risk, if the source is not well known and trusted.

To conclude, experts were asked about practices to reduce a collector's or investor's exposure to fakes. All experts signalled that the number one thing to do is always to buy directly from the producers or from sales representatives. Another possibility that two experts asserted is to be part of a closed circle of wine experts and connoisseurs where purchases are often done in a group to mitigate risk and have increased control.

Fig 3 – Side by side comparison of an authentic and a fake Rouget Vosne-Romanée; the fake bottle is on the left.

Buyers should be aware that the more a fine wine travels, the worse it gets and for this reason knowing the history of a wine and its provenance are crucial. According to 2 experts, knowing the products well and being educated in recognizing fine wine properly is a best practice to spot fakes, as counterfeiters often commit simple mistakes as can be observed in Figures 3 and 4. Figure 3 has a fake on the left which could be easily recognized by someone who knows how the real product looks, as a mistake of this importance is an obvious indicator.

Fig 4 – Fake Romanée Conti one of the most expensive wines in the world, and most faked.

In figure 4 instead, the two bottles in the middle can be recognized as fakes due to the oversized neck labels with the "MONOPOLE" word being completely straight instead of curved.

5.2 EWIBE DATABASE

The monthly prices reported in the eWibe proprietary dataset (73 time periods) came from Liv-ex. The prices refer to real transactions occurring among certified merchants in the primary market [45]. Liv-ex prices are reported as Euro (€)/bottle, calculated with the low-price methodology[46], and are free from any VAT taxes[47]. In addition to monthly ex-vat prices, the database contains categorical variables that help describe and identify the listed wines.

[45] The fine wine primary market is where merchants buy directly from producers, trade wine among themselves without releasing them to the public.

[46] Low-price methodology reports the monthly price of a wine as the lowest price observed in a transaction that occurred in that timeframe. This relies on the theory that if a trader managed to sell at that price, it is the most efficient in the market and as such is the equilibrium price.

[47] Trading wines VAT-free assumes that the fine wines are stored the whole time in a public bonded warehouse.

The summary Table 2 below lists the variables and their description:

Table 2

N#	***Variable name***	***Variable type***	***Description***
1	*Wine name*	*Categorical nominal*	*Refers to the name of the wine*
2	*Producer*	*Categorical nominal*	*Refers to the name of the producer*
3	*Vintage*	*Categorical ordinal*	*Indicates the year in which the grapes used for that wine were harvested*
4	*Type*	*Categorical nominal*	*Indicates the type of wine, Red, white, champagne, or sweet wine*
5	*Country*	*Categorical nominal*	*Refers to the country of production*
6	*Region*	*Categorical nominal*	*Refers to the Region of production (e.g., Bordeaux or Piedmont)*
7	*Sub-Region*	*Categorical nominal*	*Refers to the Sub-Region of production (e.g., St. Emilion or Barolo)*
8	*Lifecycle*	*Categorical ordinal*	*Refers to the stage of life at which the bottle is currently at (Hold, Not at Peak, Peak, Past Peak)*

In addition to the descriptive variables listed above, several other variables pertaining to experts' grades have been integrated into the database through WineSearcher.com.

The following Tables 2 and 3 display the descriptive statistics respectively by Country and by region:

Table 3

Country	***Obs***	***%Freq***
France	*522*	*67.10%*
Italy	*256*	*32.90%*
TOTAL	*778*	*100%*

French wines represent most of the fine wines included in the database, mostly because French wines from Bordeaux have the longest history and reputations as investment grade wines. Overall, there are almost 800 fine wines included in the eWibe database.

Table 3 highlights the importance of fine wines produced in Bordeaux, as they represent 32% of the overall database.

Table 3

Region	Obs	%Freq
France:		
Bordeaux	*250*	*32%*
Burgundy	*115*	*15%*
Champagne	*81*	*10%*
Rhone	*76*	*10%*
Italy:		
Tuscany	*136*	*17%*
Piedmont	*96*	*12%*
Veneto	*17*	*2%*
Trentino A.A.	*7*	*1%*

Italian wines have a significant presence in the database, with Tuscany and Piedmont accounting for up to 30% of the total. Italian fine wines have gained considerable momentum in the past 3 years (since 2019). According to Liv-ex director Justin Gibbs[48], Italian fine wines, mostly Barolo from Piedmont and Brunello di Montalcino from Montalcino, Tuscany have reached the same renown as French wines from Bordeaux and Burgundy.

The following sections contain preliminary studies and graphical analyses with regional indices, where the performance of fine wines is compared. However, before looking into the fine wine indices, Table 4 summarizes the descriptive statistics of the variable price in euros.

Table 4

Variable	***Obs***	***Mean***	***Std. Dev***	***Min***	***Max***
Price	43,929	1,114	2,747	81	48,115
By type					
Sparkling	5,252	342	461	94	4,162
White	4,022	3,038	4,339	91	24,801
Red	34,533	1,010	40	81	48,115
Sweet	122	331	42	135	405

Overall, the average price for a fine wine in the eWibe database is more than €1,110. The prices fluctuate considerably from a minimum of just €81 up to a maximum of 600 times more. The breakdown by type allows us to gather more information, notably the minimum price tags are

[48] Justin Gibbs is now deputy chairman and Exchange director at Liv-Ex. After beginning his career in banking, he left in the year 2000 to start Liv-Ex with the current CEO James Miles.

all close to each other, but the same cannot be stated for the maximum values which show great dispersion.

Red wines represent 78% of the wines under analysis, followed by sparkling fine wines, which are mostly Champagne. Red wines are so numerous because they are acknowledged in the industry to enjoy the greatest stability and aging capacity over time. The high number of observations is due to the fact that each wine has up to 72 datapoints, depending on when it was released to the secondary market.

5.2.1 FINE WINE INDICES

To compare the different fine wines included in the dataset, several fine wine indices were built applying different criteria. In total 11 fine wine indices were created by clustering the fine wines separately. All indices were on a 100-point scale, where each monthly % variation for the index, was computed as the average % change among all the fine wines included in the index. This methodology allowed us constantly to add fine wines with different price points over time to the index.

The timeframe for the indices was the same covered by the overall database, beginning in July 2016 until the most recent data available, July 2022.
Table 5 describes the 11 fine wine indices employed in this paper.

Table 5

#N	***Name***	***Type***	***Description***
1	*Market Index*	*Broad index*	*Includes all ≈ 800 fine wines in the database*
2	*eWibe25*	*Most traded*	*Includes the 25 most traded wines in eWibe (popularity index 1)*
3	*eWibe50*	*Most traded*	*Includes the 50 most traded wines in eWibe (popularity index 2)*
4	*eWibe100*	*Most traded*	*Includes the 100 most traded wines in eWibe (popularity index 3)*
5	*Italy*	*Country*	*Includes all Italian fine wines from the database*
6	*France*	*Country*	*Includes all French fine wines from the database*
7	*Bordeaux*	*Region*	*Includes all fine wines from Bordeaux (Chateaux) in the database*
8	*Burgundy*	*Region*	*Includes all fine wines from Burgundy (Domaine) in the database*
9	*Champagne*	*Region*	*Includes all fine wines from Champagne in the database*
10	*Tuscany*	*Region*	*Includes all fine wines from Tuscany (Super Tuscan) in the database*
11	*Piedmont*	*Region*	*Includes all fine wines from Piedmont in the database*

Among the 11 indices there a general Market index including all the fine wines in the database. Its goal is to give a general idea of market trends for fine wines. Then, there are 3 popularity indices respectively, including the 25, 50 and 100 most traded fine wines.

The three indices are expected to have high correlation and provide low diversification between them, as eWibe100 includes the 50 and 25 most traded, as the eWibe50 includes also the eWibe25 fine wines. Lastly, there are geographical indices. First, there are the two country indices for France and Italy, followed by regional indices for the most famous fine wines traded in these iconic and legendary regions.

Below is a summary table with descriptive statistics:

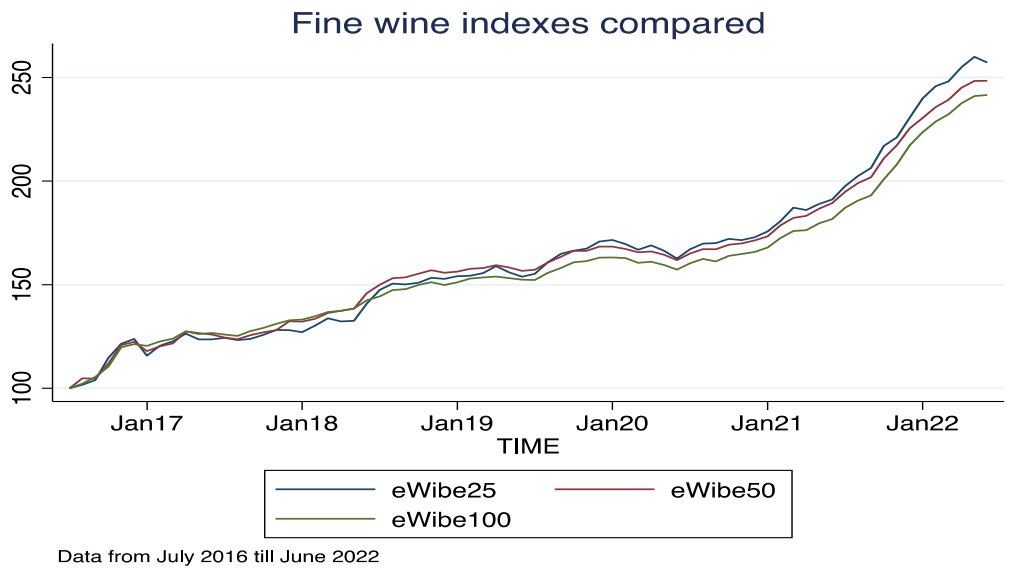
Table 6

Variable	*Obs*	*Mean*	*Std. dev.*	*Min*	*Max*
eWibe25	73	160.92	37.35	100	258.01
eWibe50	73	160.32	34.48	100	247.38
eWibe100	73	156.54	31.75	100	240.51
Italy	73	163.55	31.68	99.25	244.88
France	73	163.11	36.39	100	240.08
Bordeaux	73	143.07	15.91	100	179.93
Burgundy	73	223.04	83.17	100	469.07
Champagne	73	173.66	40.62	100	278.09
Piedmont	73	180.68	45.38	99.39	269.74
Tuscany	73	150.58	30.64	99.31	221.31

Since July 2016, Burgundy appears to have had the greatest upside growth, displaying the highest maximum observed value (469.07), which is more than twice as much than the maximum reached by the Bordeaux fine wine index, at 179.93 (79.93% return). Among the two Italian regions analysed, the Piedmont index displays a higher mean and maximum when compared to Tuscany, suggesting better performance.

Graph 4 helps to better visualize and compare the performance of the eWibe and country indices:

Graph 4



The fine wine indices displayed exhibited significant upside over the past 6 years. The eWibe25 index leads with the greatest return of 158%, followed by the eWibe50 at 147% and France at 244%. On average, it took the indices 2 years to gain 50%, while it took another 3 years to gain an additional 50%. All indices show a steep increase in their slope from mid-2021 onwards. In the next section a comparison with more traditional assets is used to better understand whether the spike in prices in the last year is common to several asset classes or unique to fine wines. As can be observed, the indices show an almost identical pattern, suggesting high correlation among them.

The eWibe indices, along with the broader market index, have a fairly commensurate performance over the considered timeframe. The eWibe25 has the highest returns while the eWibe100 exhibits the lowest among the 3.

The table below reports the correlation matrix of the fine wine indices representing the market.

Table 7

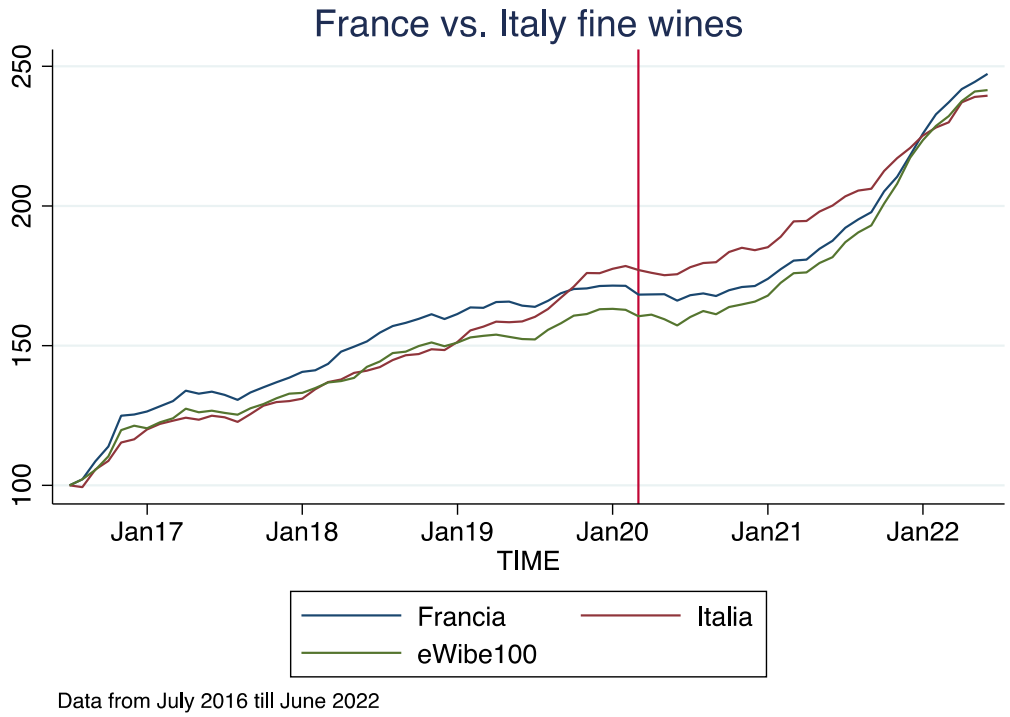
	Mkt Index	*eWibe25*	*eWibe50*	*eWibe100*
Mkt Index	1			
eWibe25	99.34*	1		
eWibe50	99.64*	99.81*	1	
eWibe100	99.52*	99.74*	99.83*	1

** p = 0.05*

All the market indices are highly correlated among themselves, thus providing no means of diversification. For this reason, going forward in the analysis only one will be considered – the eWibe100, as it is the worst performing of the 3.

Graph 5 illuminates the differences between the French and Italian indices. Even if discrepancies among the two are minimal (144% vs. 140% return) The history of the two leaves no doubt about which is the market leader so far.

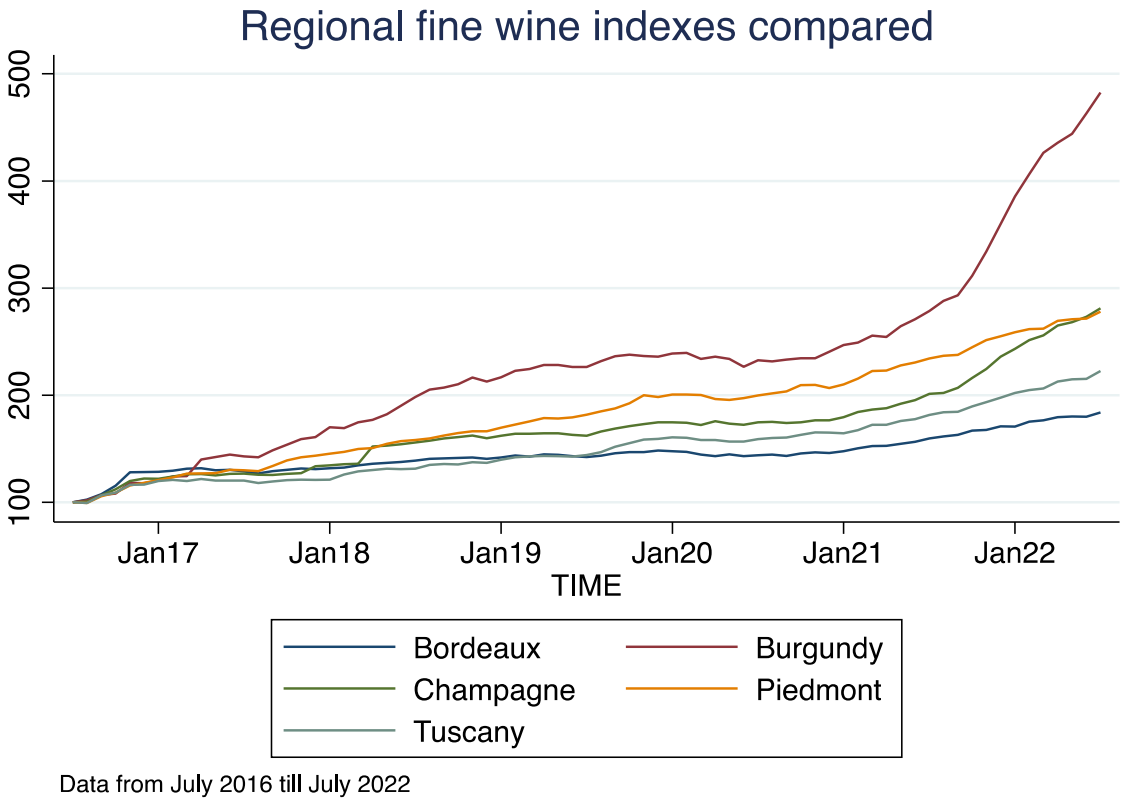
Graph 5



France has reconquered its first place before the beginning of 2022 after being surpassed by the Italian fine wines back in November 2019. Interestingly, throughout Covid-19, the Italian fine wine index always outperformed the French. The red vertical line indicates the month of March 2020, when the Pandemic first started. The eWibe100 represents the overall market performance, included in the chart to provide context. The eWibe100 outperformed the two country indices until it matches the Italian index at the very end of 2021.

Graph 6 provides even greater detail about the fight between French and Italian fine wines. It has a breakdown of the two country indices into their most relevant regional indices to observe whether components of the Italian country index outperform French peers.

Graph 6



The Burgundy index clearly outperforms the overall market, the French index and all the other indices considered so far. It took only one year and a half to gain 100%, compared to the 2 years, on average, for the broader indices to gain 50%. In the past 6 years, the Burgundy index has always delivered above average results, and it now has a peak 369% return, way above the second highest 178% achieved by the Champagne index. Bordeaux, well established in the markets and more stable, has delivered the lowest return among regional fine wine indices with a 79.93% increase in six years. The other regional indices have more than doubled during the same timeframe. An interesting contest to observe is between the Champagne and Piedmont indices in the first months of 2022 with Piedmont wines being surpassed by Champagne after a 3 yearlong dominance.

Table 8 sheds some light on the wines from Burgundy, as the regional index displays extraordinary incredible. The cluster of fine wines from Burgundy includes 115 wines.

Table 8

Variable	***Obs***	***Mean***	***Std. Dev.***	***Min***	***Max***
Price Burgundy	*6,499*	*5,096*	*5,531*	*99*	*48,115*

Over 72 months there are 6,499 price observations with a minimum of €99 up to the extraordinary high €48,115 which is the price for a bottle of Romanée Conti 2015 in May 2022. The average price per bottle for a Burgundy fine wine is almost €5,100, substantially higher than the average price of €580 for a wine from Bordeaux. These prices might suggest that the selected fine wines from Burgundy are niche of outperformers which had a huge price run-up.

5.2.2 COMPARABLE ASSETS

To compare fine wine returns to other investments, traditional indices were selected for comparison. Table 8 lists the selected assets and describes them.

Table 9

#N	***Name***	***Type***	***Description***
1	*S&P500*	*Market index*	*Tracks the performance of 500 US companies, founded in 1965 is the most important stock benchmark for the US and world economy*
2	*Nasdaq composite*	*Market index*	*Nasdaq composite index includes more than 3,700 stocks included in the Nasdaq stock exchange. It is heavily weighted toward the tech sector*
3	*Gold*	*Commodity*	*Gold spot prices in USD, the price is per ounce of gold.*
4	*Core inflation*	*Index*	*Sticky price consumer index without Food and Energy*

The Standard and Poor's 500 is one of the most followed equity indices, representing the 500 largest companies by market cap in the United States. It is a useful benchmark for investors as the goal of funds is typically to generate α, which means above-market returns. The Nasdaq composite index is also one of the 3 most tracked market indices along with the S&P500 and the Dow Jones industrial average. Finally, as a measure for inflation, the consumer price index (CPI) is used, which excludes food and energy prices as they are the most inflationary in times of crisis. In the analysis the CPI is referred to as "core inflation". It is used to gain an idea about real returns for all assets considered in the analysis.

The table below summarizes the descriptive statistics for the alternative asset mentioned above.

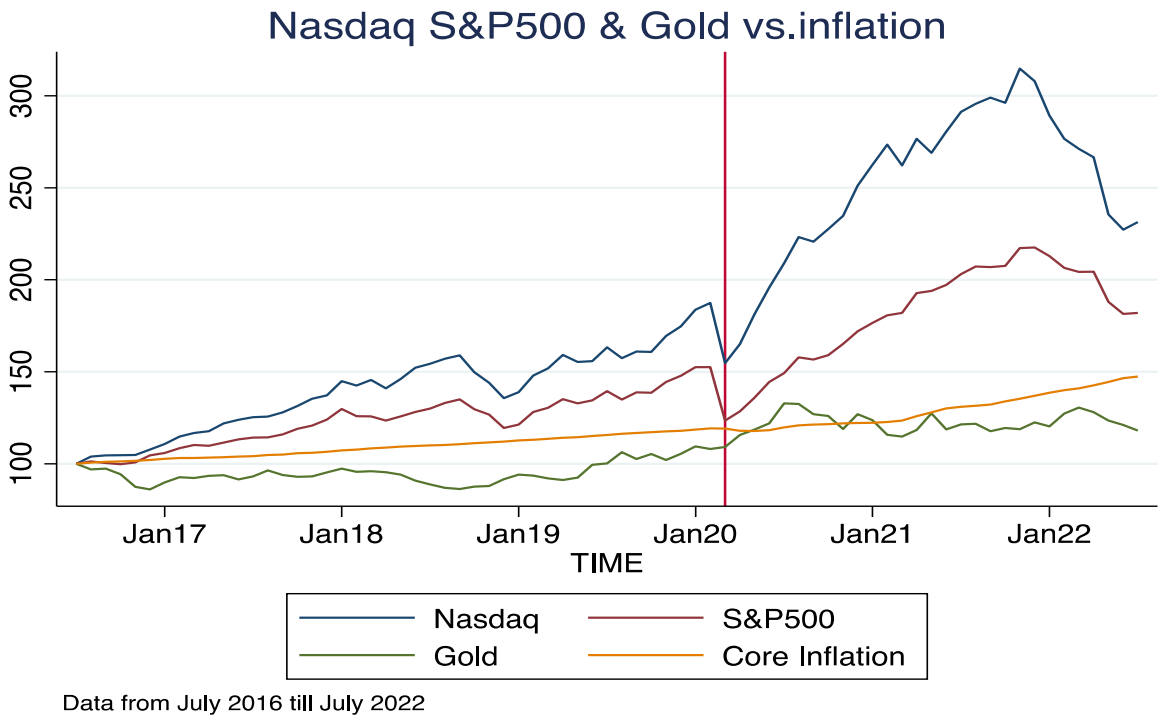
Table 10

Variable	*Obs*	*Mean*	*Std. dev.*	*Min*	*Max*
Nasdaq	73	183.51	63.66	100	314.79
S&P500	73	145.98	34.91	99.73	217.54
Gold	73	110.73	18.91	84.92	144.29
Core Inflation	73	116.73	12.04	100	146.53

Surprisingly, only the Nasdaq composite and CPI have a minimum of 100, meaning that they have never fallen below the initial value registered back in July 2016. The Nasdaq composite index has the highest maximum value reached with a record return of 215% when it peaked in November 2021 as shown in Graph 6 below. The S&P500 has had a similar performance over time, more constant in terms of volatility and returns when compared to its tech peer.

Graph 7 shows the performance of the Nasdaq composite index along with the S&P500, gold and core inflation.

Graph 7



The two stock market indices display great volatility after March 2020 associated with the monetary policies that Central Banks adopted to counterbalance exogenous shocks from the Covid-19 lockdowns.

Overall, since July 2016 the Nasdaq composite index has delivered a return of 127%, well above the 81% achieved by the Standard and Poor's 500. Gold closed the month of June 2022 up only 32% above the starting line, 6 years before. It has had a considerable run-up during the first half of 2020, after which, it normalized. It is interesting to note that core inflation has been on a positive trend throughout the whole period under analysis. In particular, the curve has accelerated since the beginning of 2021 and is now at record highs. The CPI[49] index in the US has reached +9.1% in the month of June 2022[50], a 40-year high, according to Bloomberg[51].

5.2.3 COMPARATIVE ANALYSIS

This section compares the performance of the fine wine market with comparable assets presented before. Analyses are always relative to gross returns, and do not account for trading fees, maintenance fees, eventual taxes on profits for financial assets and other relevant taxes to be paid when buying and selling assets.

Table 11 summarizes the descriptive statistics of monthly percentage variations for all assets taken under analysis.

Table 11

Variable	*Obs*	*Mean*	*Std. dev.*	*Min*	*Max*
Fine wine indexes					
Market Index	73	1.29%	1.55%	-1.54%	8.75%
eWibe25	73	1.39%	2.33%	-6.52%	10.23%
eWibe50	73	1.32%	1.91%	-3.57%	8.04%
eWibe100	73	1.27%	1.60%	-1.41%	8.52%
Country indexes					
Italia	73	1.27%	1.36%	-1.14%	6.24%

[49] The CPI, or consumer price index is one of the most common indices used for inflation. It represents the price of a weighted average market basket of consumer goods and services, purchased by households.
[50] Regular CPI is computed by taking the Year-on-Year price difference
[51] Article accessible at: https://www.bloomberg.com/news/articles/2022-07-13/us-inflation-accelerates-to-9-1-once-again-exceeding-forecasts

Francia	73	1.30%	1.74%	-1.85%	9.69%
Regional Indexes					
Bordeaux	73	0.86%	1.84%	-1.78%	10.96%
Burgundy	73	2.27%	2.90%	-3.09%	13.11%
Champagne	73	1.49%	2.29%	-1.81%	13.04%
Piedmont	73	1.43%	1.48%	-1.88%	6.44%
Tuscany	73	1.15%	1.54%	-1.48%	7.09%
Comparable assets					
Nasdaq	73	1.26%	4.46%	-17.48%	9.81%
SP500	73	0.91%	3.63%	-19.07%	6.34%
Gold	73	0.45%	3.73%	-8.27%	10.79%
Core Inflation	73	0.54%	0.45%	-0.96%	1.88%

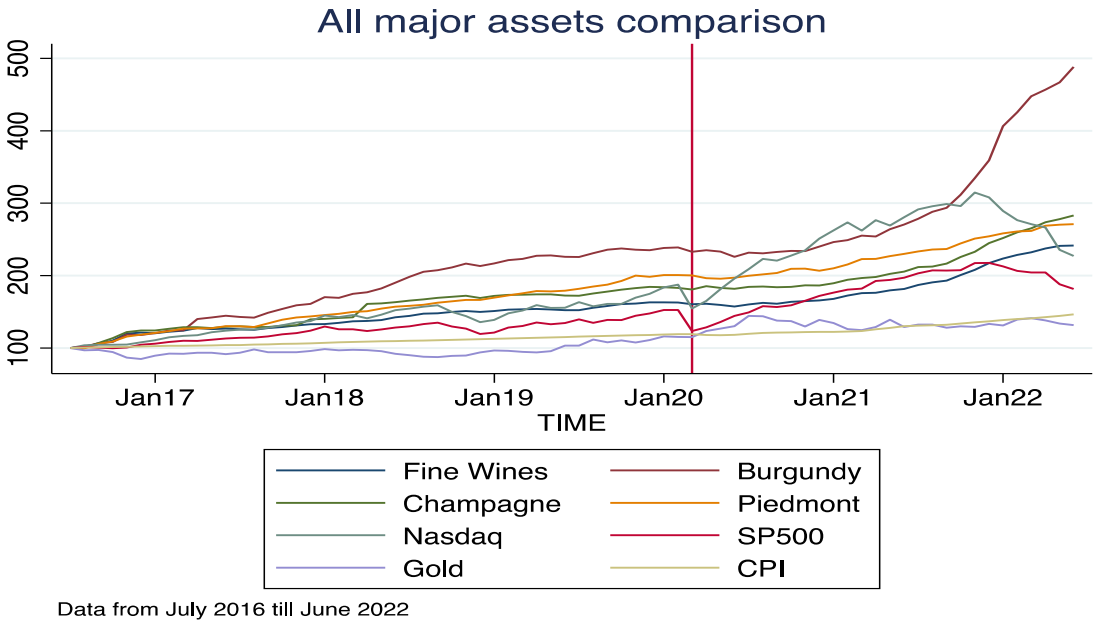
Table 11 suggests that fine wines had stronger performance than other traditional assets.

The highest mean for the monthly price variations can be observed for the Burgundy regional fine wine index, follow by the Champagne and Piedmont indices. Among the fine wine indices there is no evidence of monthly drops below the -7% threshold, while the same cannot be said for stock-related indices as the S&P500 registered a low of -19% in March 2020. The CPI has the greatest stability as an index, as expected, even though gold has lower average monthly appreciation. This suggests what was observed in Graph 6, negative real returns for gold. All the fine wine indices display a higher monthly average price increase than other asset classes and have lower volatility.

Graph 8 compares selected indices.

Since the eWibe market indices have very similar performance and high correlation, only the eWibe100 is considered as “Fine Wines”. The same applies for country indices which places the regional indices – Burgundy, Champagne, and Piedmont – in most significant relief.

Graph 8



Over the 6 years period, fine wines returns have been surprisingly robust compared to other assets analysed. The S&P500 performance has been poorer the eWibe100 and other regional indices. The Nasdaq composite index has outperformed all other assets from mid-2020 up until the end of 2021. It has now dropped below all the fine wine indices. The Burgundy fine wine index is, once again, confirmed to be the absolute winner in performance, even though it is quite hard to buy all the rare wines included. The 115 Burgundy fine wines have outperformed all other assets for almost the entire time and are now at record highs.

Excluding gold, all real returns are positive in the 6-year timeframe, however this might not hold true with a different time horizon. To answer this question Appendix 7 reports the performance of the same assets, but with a reduced timeframe – the beginning of the current year 2022. The S&P500 and the Nasdaq composite index have fallen the most since the beginning of 2022, dropping 15% and 22% respectively. The eWibe100, Champagne and Burgundy are the only three indices that are still above the CPI, keeping a positive real return. Piedmont fine wines have been increasing since the beginning of the year, but at a slower pace

than the CPI. Gold returns have fallen, and are now almost at parity, but negative in terms of real returns as inflation eroded almost 6% of purchasing power at the end of June.

6.0 REGRESSION ANALYSIS

Throughout the 6 years taken under analysis there has been a considerable number of exogenous shocks, at both a macroeconomic and wine specific level. The incredible performance of the fine wine indices has been caused, as stated by 6 out of 8 wine experts interviewed, by an increase in demand, and lower availability of bottles in the market. The tables 12 and 13 in the Appendix summarize the most relevant exogenous shocks that occurred from 2016 till July 2022.

To better understand the most recent price increases and improve the predictability of the prices for future exogenous events, a regression analysis was performed with the goal of understanding the impact on prices of the latest extreme weather event analysable. The big frost that hit France during the spring 2021 lowered substantially the yields of producers, especially in the region of Burgundy, according to experts' interviews.

According to Davide Chiesa, sommelier at a Michelin starred restaurant in Bergamo, Italy, some of the most famous producers in Burgundy lost up to 100% of grapes during the 2021 frost and have been producing wines by using their previous reserves. Overall, it is estimated that France witnessed a -28% in volumes due to the frost, resulting in a decade low production. Appendix 5 displays the total production of wine for Italy and France from 2016 till 2021. As shown, prices for Burgundy wines have a higher mean and a much greater variance. To account for these greater prices, and outliers, the variable price is log transformed.

6.1 REGRESSION METHODOLOGY

6.1.1 VARIABLES

The regression has as the dependent variable the **natural log of the price** of fine wines, by producer. The variable price is log transformed to simplify its interpretation and account for the outliers present. The summary statistics of the variable can be found in Appendix 6. The prices of fine wines over time are extracted from Liv-ex.com and they are the lowest monthly observed price, per transaction. By having these metrics, prices tend to limit overestimation and allow a clean dataset with only reliable prices.

The dependent variables included in the model are:

- French: a dummy variable taking the value of 1 for all French fine wine producers after April 2021
- Post: a dummy variable taking the value of 1 for all observations after April 2021
- Post French: an interacted dummy variable taking the value of 1 for all observations of French fine wines observed after the April 2021 frost.
- Post Burgundy: a dummy variable taking the value of 1 for all observations of Burgundy wines after the April 2021 frost
- Semesters: a numerical encoded variable used as time control, representing the different semesters included in the analysis, from the first semester of 2020 until the first semester of 2022.
- Producers: a numerical encoded variable used as identifier control, representing the 62 different producers included in the analysis.

6.1.2 DATABASE FORMATTING

The analysis, as well as the graphical outputs presented in the previous chapter were carried out with Stata, a statistical software that allows to manipulate large datasets, create visualizations, and run analyses in a semi-automated manner.

Statistically, the model used is a panel regression. Panels are composed by repeated observation of the same entities, in this case wines, over time. Panel datasets are used as a combination of cross-sectional data and time series data. The cross sections are represented by the two countries under consideration, which are Italy and France, while the time-series are composed of monthly prices from July 2016 until July 2022. The database used came in a wide format and was reshaped as long, by setting up a unique identifier for the wines, renaming all the needed variables and building a proper time variable to observe the different monthly prices. A long format is required by Stata to correctly process the codes that run the analyses. The panel dataset created results that were unbalanced as the wines did not all have the same number of observations but fluctuated from a minimum of 49 up to a maximum of 73. Wines with less than one year of observation prior the analysed shock in April 2021 were excluded.

6.1.3 SELECTION BETWEEN FIXED AND RANDOM EFFECTS

The panel dataset was analysed to address which model was most appropriate. In addition to being unbalanced, the panel under consideration was fixed with the same wines observed each period. The panel model was used to observe effects in groups (in this case wines) or time effects, or both, to deal with heterogeneity producing fixed or random effects.

To test which model was the most appropriate, specific tests can be performed. The logic behind these tests is to compare it to a Pooled Ordinary Least Squares (OLS) model. First, to test the validity of the Fixed effect model an F-Test was conducted to understand if a FE model improved the Goodness of fit compared to an OLS. In actuality, the Wald test was used, which is an equivalent to the F-Test to observe whether the Goodness of fit (R^2) improves when using a Least Squares Dummy Variable model (LSDV) instead of a Pooled OLS.

Exhibit 3 reports the result of the Wald test, where the null hypothesis of having all the coefficients equal to 0 is rejected[52], thus proving that there are fixed effects. Frost and Post are the two-time dummy variables identifying the treatment period (Frost) and the post treatment period (Post), the pre-treatment period is left out as reference category.

Exhibit 3

```
. test french_post  Frenchdummy

 ( 1)  french_post = 0
 ( 2)  Frenchdummy = 0

       F(  2,  4401) =    3.49
            Prob > F =    0.0306
```

The result showed that a fixed effect model would have more consistent and efficient estimates than a Pooled OLS. To test the presence of Random effects, the Breusch and Pagan's (1980) Lagrange multiplier (LM) test was performed. This test examines whether individual specific variance components are 0. The null hypothesis H_0: $\sigma^2_u = 0$, if rejected signals the presence of random effect in the panel data and that the model would have more explanatory power than a

[52] In a regression $y_{it} = \alpha + \mu_i + X_{it}*\beta + \varepsilon_{it}$, the null hypothesis states that all dummy parameters except for the one used as a reference category are all equal to zero. $H_0 : \mu_1 = \ldots = \mu_{n-1} = 0$. On the contrary, by demonstrating that at least one parameter is not zero, we accept the alternative hypothesis. Rejected at 95% C.I.

Pooled OLS. The null hypothesis was not rejected, thus validating the absence of random effects in the panel and confirming that fixed effects were the proper way to go. Results are displayed in Exhibit 4.

Exhibit 4

```
Breusch and Pagan Lagrangian multiplier test for random effects

        ln_price[Producers,t] = Xb + u[Producers] + e[Producers,t]

        Estimated results:
                         |       Var     SD = sqrt(Var)
                ---------+-----------------------------
                ln_price |    .9174344       .9578279
                       e |    .0251629       .1586281
                       u |          0              0

        Test: Var(u) = 0
                                  chibar2(01) =     0.00
                              Prob > chibar2 =   1.0000
```

6.1.4 ADDITIONAL TESTS

After establishing that a fixed effect model was proper, there were additional tests conducted to verify the presence of Heteroskedasticity, Cross-sectional independence and Serial Correlation. These can be important to address the error terms of a panel regression that cause the results of a regression to be inconclusive.

Heteroskedasticity refers to a situation where the variance of the error terms is not constant. With a panel containing wines, the predefined definition of wines within groups may cause heteroskedasticity as the variance of the group-wise series can differ considerably. To test the presence of groupwise heteroskedasticity, a Wald test was conducted. The result, in Exhibit 5 confirmed the presence of groupwise heteroskedasticity, as expected. To account for this issue, robust clustered standard errors were selected as an option in the regression command. This divided observations into smaller groups, allowing for correlation within groups but limiting correlation among groups, thus eliminating groupwise heteroskedasticity.

Exhibit 5

```
Modified Wald test for groupwise heteroskedasticity
in fixed effect regression model

H0: sigma(i)^2 = sigma^2 for all i

chi2 (62)  =   30130.94
Prob>chi2 =      0.0000
```

Secondly, panel models, meaning both fixed effects and random effects, assume the error terms to be independent along the different cross-sections. To test cross-sectional dependence, T>N (N are observations over time and T cross-sections unit), according to the paper "Testing for cross sectional dependence in Panel data models". The xtcsd command in STATA allows us to close the gap with the Breusch–Pagan LM test written by Christopher F. Baum. For unbalanced panel data, with a T>30, Frees (1995, 2004) proposes a test based on the sum of the squared rank correlation coefficients. The results, shown in Exhibit 6, show that the null hypothesis of cross-sectional independence was rejected, thus indicating the presence of cross-sectional dependence. To mitigate this issue of concern and avoid invalid test results, the robust standard error option was included in the regression.

Exhibit 6

```
Frees' test of cross sectional independence =    19.732, Pr = 0.0000

Warning: A normal distribution had been used to approximate Frees' Q distribution
```

Finally, we tested Autocorrelation on the fixed effect model. Serial correlation refers to the situation where time-series or panels have errors related to a specific time period that carry over into future time periods. As previous results already indicated the presence of Heteroskedasticity and Cross-sectional dependence, the presence of Autocorrelation was expected. The Wooldridge test for autocorrelation in panel data was performed through Stata with the *xtserial* command. The p-value of 0, as shown in Exhibit 7, did not allow us to reject

the null hypothesis, thus confirming the presence of autocorrelation. To account for this limitation, robust clustered standard errors were used.

Exhibit 7

```
Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,      61) =    482.701
           Prob > F =      0.0000
```

6.2 REGRESSIONS RESULTS AND DISCUSSION

6.2.1 RESULTS AND DISCUSSION

Table 12 reports the results of the regressions. Over the time periods observed the highest increase in average prices happened in the 1st semester of 2022 with a +13% from the previous semester, up by 62%, on average from the 2nd semester of 2016. Producers' coefficients were not reported due to insignificant information as their betas are the average % price difference from the reference category. They are included as Fixed effects to explain variance in the model. The R^2 was quite high and the interpolation of dummies French Post results was statistically significant, with a coefficient of -0.038. Results showed that after the frost in France of April 2021, Italian wines in general outperformed French wines, on average, by almost 4%.

It can be argued that comparing French wines from Bordeaux, Burgundy, and the Rhone regions to Italian wines from Piedmont, Tuscany, Trentino Alto Adige, and Veneto does not represent an optimal test, as many other unobserved variables might have influenced the price performance differential. Fixed Effects were used to account for unobserved characteristics and diminish exposure of the model to omitted variable bias.

However, it could also be stated that Italian wines together do not compose a valid control group – French and Italian wines have different characteristics and unobservable factors limiting proper comparison. To improve the findings gathered and to explore other possibilities, the regression was filtered for observations pertaining only to Burgundy and Piedmont. Column

3 of Table 12 reports the results of the regression with these filters active. White wines from Burgundy are also excluded from the analysis as only red wines from Piedmont are included in the control group.

The coefficient French Post, that captures once again the effect of the frost on French wines (Burgundy only, this time), is statistically significant and has a positive value of 0.1195. This indicates that, on average, after the April 2021 frost, prices of fine wines from Burgundy (excluding whites) increased almost 12% more than the control group (Piedmont wines). This is the opposite of the negative result obtained previously for all French wines, when compared to all Italian wines (-4%). In addition, the Semesters dummy variables, all statistically significant, display interesting differences from results obtained previously. Over the observed 6-year time horizon, prices of Burgundy and Piedmont wines have on average grown by 90%, with the biggest price increase from the 2nd semester of 2021 to the 1st semester of 2022. Another interesting jump in average prices happened in 2018, in tandem with the best recent vintage years for the two regions.

During 2020, both regressions show how the average prices of fine wines were unaffected by market crashes in the stock market and the broader economy. Average prices remained flat, up 1% Year-over-Year. This finding is important as it confirms the stability that fine wine can have in periods of crisis and extreme volatility, acting as a diversifier within a portfolio comprised of equities, bonds, cash, and gold.

Table 12

VARIABLES	1- France and Italy	2-Burgundy and Piedmont	
			Robust standard errors in parentheses
French Post	- .0379223***	0.1195**	*** p<0.01, ** p<0.05, * p<0.1
	(0.0506)	(0.0893)	
2017 1st Semester	0.1222***	0.1124**	
	(0.0076)	(0.0388)	
2017 2nd Semester	0.1343***	0.1707*	
	(0.0104)	(0.0856)	
2018 1st Semester	0.1930***	0.3207***	
	(0.0125)	(0.0851)	
2018 2nd Semester	0.2545***	0.4601***	
	(0.0142)	(0.0081)	
2019 1st Semester	0.2874***	0.5219***	
	(0.0148)	(01045)	
2019 2nd Semester	0.3196***	0.5701***	
	(0.0154)	(0.1173)	
2020 1st Semester	0.3268***	0.5870***	
	(0.0153)	(01203)	
2020 2nd Semester	0.3292***	0.5887***	
	(0.0152)	(0.1246)	
2021 1st Semester	0.3884***	0.6290***	
	(0.0159)	(01599)	
2021 2nd Semester	0.4877***	0.7084***	
	(0.0173)	(0.1964)	
2022 1st Semester	0.6172***	0.9095***	
	(0.0195)	(0.2047)	
Producers FE	YES	YES	
TIME FE	YES	YES	
Observations	4,145	915	
R-squared	63.74%	65.71%	
Number of id	62	13	

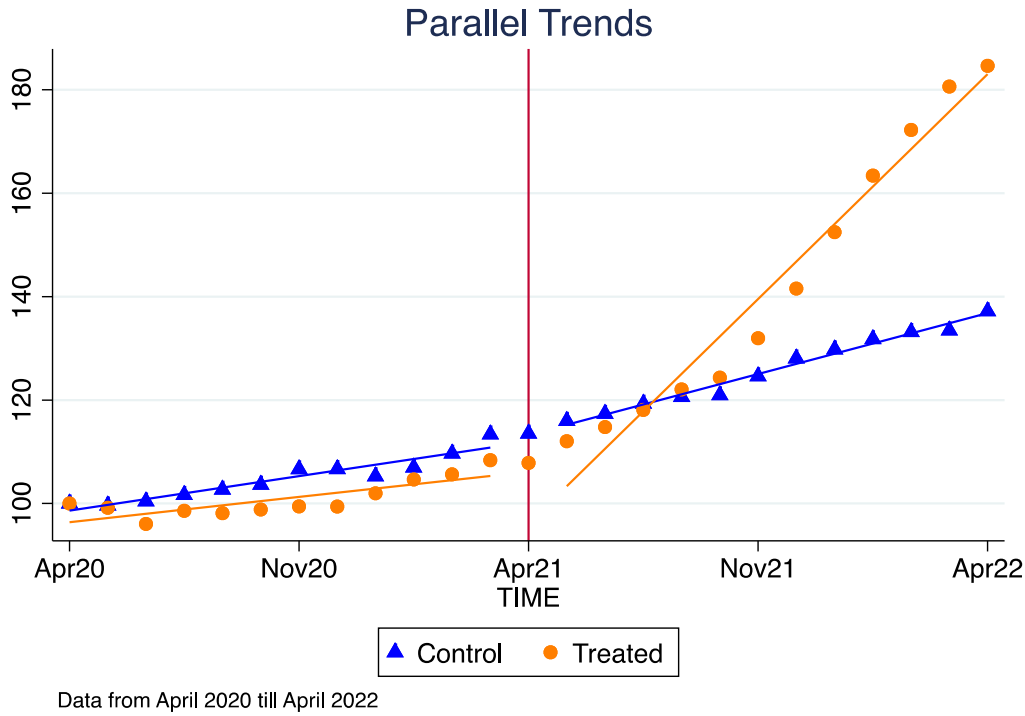
6.2.2 PARALLEL TREND

Burgundy yields, as mentioned previously, had the worst losses during the frost of 2021 and for this reason these wines represent an interesting test group. In addition, as observed in the previous chapter, Burgundy has been the best performing region in terms of price appreciation (Graph 6). This raises questions concerning how to explain the dramatic upward trend.

Piedmont wines present a good control group for various reasons. First, Piedmont's finest wines, Barolo and Barbaresco, are only produced from one grape, the Nebbiolo. Similarly, Burgundy fine reds are only produced with Pinot Noir. In addition, these two grape varietals are both very sensitive to soil conditions and weather events.

To confirm the validity of using Piedmont wines as a control when testing the impact that the Frost of April 2021 had on Burgundy prices, Parallel trends were plotted with fitted lines in Graph 9 with a limited observed time of 2 years, one prior the shock and one year post shock. Appendix 8 displays the entire time period analysed, from mid-2016. In both graphical representations we see that before the shock of April 2021, the average prices show an almost perfect parallel trend, clearly observable in Graph 9. Post shock, the effect of the Frost is evident, with a sudden spike in Burgundy average prices.

Graph 9



7.0 LIMITATIONS AND FURTHER RESEARCH

The aim of this research was to validate fine wines as an asset class, by gathering expert opinions and analysing quantitatively the performance over the last 6 years of a selected sample cohort of fine wines.

Despite the positive results, the quantitative research was limited to the last 6 years. This was due to the ease of finding price data which tends to be difficult to procure. The sample was also restricted to fine wines from France and Italy only. A more complete study, with both a longer time horizon and a broader sample including the fine wines from other regions of the world would present more comprehensive and generalizable results. In addition, although a diverse and representative group, the sample of experts was limited and the insights gathered are exclusively qualitative, while future research might focus on more quantitative data and a broader sample of experts with even more diversified backgrounds.

The Covid-19 pandemic appears to have influenced both fine wine demand and supply. Dedicated studies about consumer habits, changes and in particular the shift towards digital platforms for both producers and certified sellers might be of interest for better understanding the mechanics behind this phenomenon. Regarding the supply side, future research could investigate the economics of fine wineries to understand how supply chain shortages and increased complexities in the logistic sector affected the industry to confirm our findings.

Regarding the quantitative analysis, the same foregoing limitations apply. Results might be challenged due to the weakness of the panel data or the strength of the model. As an example, a generalized least squares (GLS) model might be able to reduce even further the Heteroskedasticity, Cross sectional dependence and Autocorrelation encountered with our methodology and extrapolate more meaningful conclusions.

Fine wines remain a broad and complex subject to analyse and with further interest growing around it in terms of consumption and investments, this field of research is destined to grow.

8.0 CONCLUSIONS

The expert interviews shed light on what is happening in the fine wine industry to validate whether fine wine can be considered a viable asset class or not. Most experts did view it as a valid investment and saw the industry as evolving rapidly, especially in the wake of Covid-19 lockdowns. The raise of digital sales as well as a growing interest in luxury products is driving up the price of all collectibles, including fine wines.

This asset class has proved to be a stable investment in times of crisis, as average prices remained flat when the COVID-19 pandemic hit. In addition, the fine wines categories analyzed showed an average gross return of 60% over a 6-year horizon, or 8% compounded annually, which grows to approximately 90%, or 11.3% compounded annually, when considering the fine wines from Burgundy, France and Piedmont, Italy.

An important issue, confirmed by experts, is the presence of fakes in the markets. However, Blockchain applications to trace production processes and actual sales of individual bottles is evolving rapidly and many use cases are being developed. More traditional anti-counterfeit measures, like special labels and corks are expected to remain an important element for wine merchants and collectors when evaluating bottles. The riskiest market is Asia and best practices requires extensive due diligence and validation by specialists to avoid fakes. Buying directly from producers is recommended.

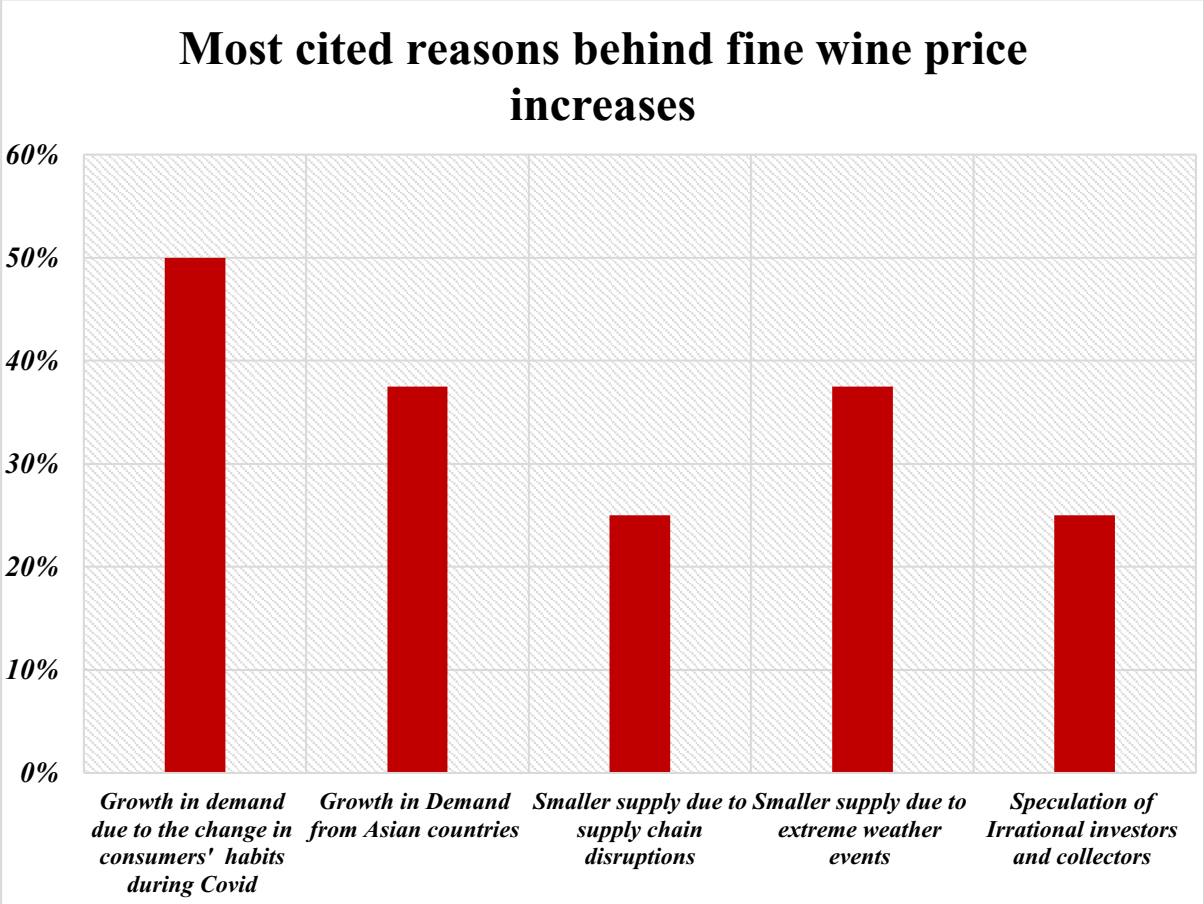
This paper can be used by wine merchants, private collectors, and fine wine related businesses to draw conclusions about fine wines as an investment class from the extensive data analysed. The timeframe to from July 2016 until July 2022 is a period with interesting exogenous shocks. This paper also presents best practices applicable to avoid fakes.

Furthermore, this paper adds to the literature by looking at fine wine returns over a period that had not been studied previously during Covid-19 and the first semester of 2022. In addition, it evaluates, through expert interviews. the impact of high inflation on the industry, finding it to have minimal impact until today. The paper also demonstrates applicability of key concepts from management theory to the wine industry, ranging from strategies for achieving competitive advantage to Prospect Theory.

9.0 APPENDICES

Appendix 1

Graph 3



Appendix 2

Table 12 – Broad Economy exogenous shocks

YEAR	***SHOCK NAME***	***SHOCK DESCRIPTION***
2017-2019	*Trade War US China*	*Affected overall worldwide trade, imports and exports not only of the two superpowers, but also affected European countries and developing economies*

2017-2019	*Brexit*	*The UK is the biggest market for sales of fine wines[53]. Its exit from the European Union affected trade and the supply chains*
2020-2022	*Covid-19 Pandemic*	*The Covid-19 pandemic has affected worldwide trade and economy, also affecting consumption of food and wine across the globe.*
2022	*War in Ukraine*	*The war in Ukraine has affected European trade and especially the food supply chain, as well as the labour market related to wine producers who often source manual labour from eastern Europe.*

Table 13 – Wine Specific shocks

YEAR	*SHOCK NAME*	*SHOCK DESCRIPTION*
2017	*Major weather events*	*A combination of frosts in France during the spring of 2017 and heat waves in Italy during the summer, put winemakers into a difficult position.*
2018	*Record production*	*2018 was an almost perfect year for wine production, both Italy and France had record volumes and high quality of grapes*
2019	*Weather events*	*A combination of frosts during spring and heat waves during summer altered the production of wine in both Italy and France*
2020	*Labor shortages*	*During the harvest of 2020 Italian producers had difficulties in finding skilled workers due to the travel limitations enacted by governments to contain the spread of Covid-19*

[53] According to the Euromonitor study presented in section 4.1: the fine wine market

2021	*Extreme weather events*	*During the Spring of 2021 an incredible frost hit France. Overall approximately 30% of production was lost with regions in Burgundy that lost up to 100% of production.*

Appendix 3

Wine Expert interviews

Questions:

- *Key economics*

1) Is fine wine, in your opinion, an asset class?
    a. If yes, how would you characterize its core features as such?
    b. If no, why not?
        i. Is it likely to become more of one (an asset class) in the future?

    c. What are factors that promote wine as an asset class?
    d. And what are impediments to it being as such?

2) Fine wines had an incredible price run up recently, to what factors would you attribute such increase?
    a. Has Covid-19 and the recent inflation spike had any effect on fine wines as an asset class?

3) Among the different types of fine wines traded and used as investments, which ones have performed the best in terms of returns since the beginning of covid? And during the last 5 years?

4) What are some investment alternatives to fine wines? Why?

5) How can the irrationality of several individuals drive up the price of fine wines? Have you ever experienced such case?

- *Fake wines*

6) What are the newest technologies used to spot fakes?
7) Which are the most faked fine wines?
8) How should an investor behave to reduce the risk of being exposed to fake wines?

Appendix 4

Summary of Interviews.

L. Panciera	The expert considers fine wines as an asset class only due to its limited supply and longevity. According to him fine wine is becoming an asset class like luxury watches and collectionables, but in its nature remains a consumable good, to be enjoyed for its organoleptic characteristics. According to his expertise, there are more and more people looking at the wine market evolution and trying to amass bottles of specific vintages or Estates and Covid-19 has boosted the overall wine consumption, benefiting largely the premium and super premium categories. He thinks that overall Champagne has probably been the "best investment" category in fine wines. Regarding alternatives to fine wine, he considers spirits, and more generally all luxury goods that can nowadays be seen as investment opportunities (eg watches, jewels, handbags, etc.), as long as they are rare, exclusive, and distributed through highly selective channels. According to Panciera, "When it comes to wine, you want to be able to tell your friends that you have this particular bottle, and they don't" and this kind of behaviour drives up the price irrationally. Finally, regarding fake wines, he sees QR codes that will give you the detailed information and history of the bottle as the newest improvement. Expensive Burgundies and Chateaux from Bordeaux have been the most faked wines and buying from trusted sales representative or directly in house is the best way to avoid issues. He mentions in the end that purchasing from China is risky and most buyers from the US and UK avoid that.
R. Chachra	The expert believes fine wines are made to be enjoyed and collected by passionate individuals and not by speculators. He sees a good opportunity to eventually make a profit out of fine wines that are thus considered an asset class. According to his estimations, fine wines appreciate by 15% per annum on average.

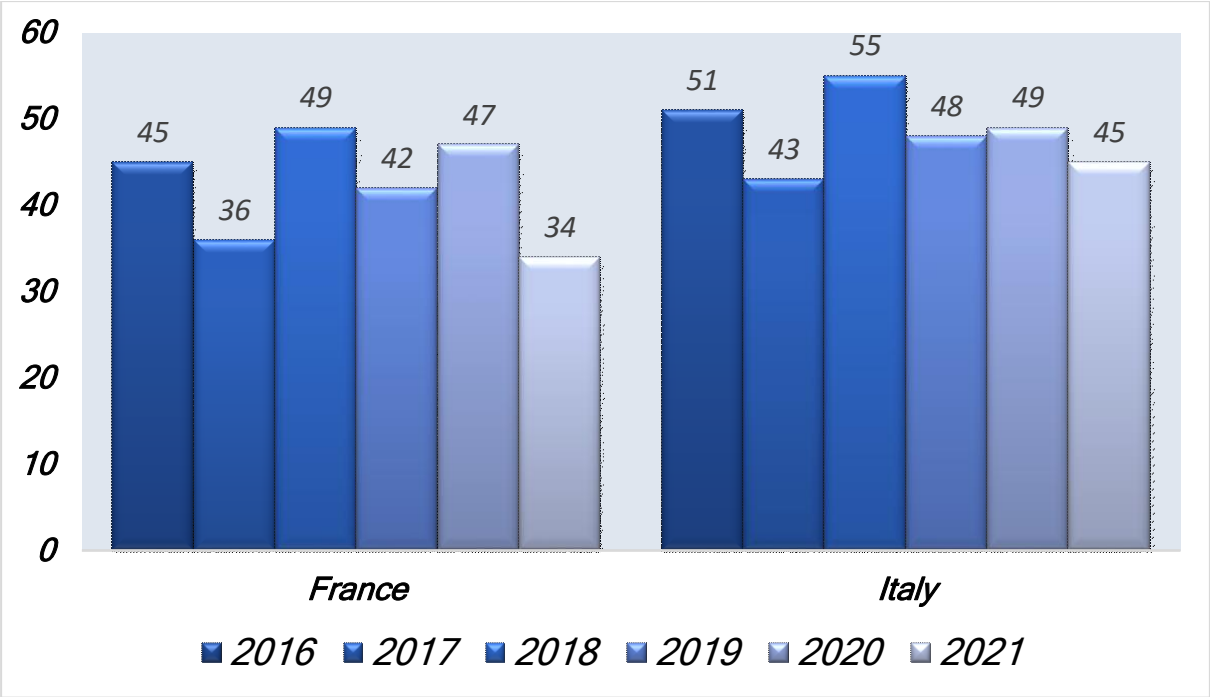
	According to the expert, fine wines are a luxury good and as such prices tend to react less to negative economic shocks. The increased demand is also due to Chinese buyers who are filling up the market. According to the expert, Covid helped reshaping the industry digitally, but inflation will eventually reduce demand as consumers reduce their spending. In terms of alternatives luxury handmade crystals, will continue to go up in value, as well as daily usable antiques. Other alternatives can be watches and collectibles. Finally, regarding fake wines, several producers are using NFTs and special labels to validate and trace the originality of their bottles. Empty bottles circulating in the market, according to the expert, remain a huge issue to solve. Investors can avoid fakes by learning and drinking, managing their own cellar and buying from the producers.
D. Chiesa	The Sommelier finds fine wines to be an asset class only for the restricted cluster of individuals who known how to properly evaluate and respect one. His quote on fine wine was "if you do not understand the product, go get some education first". He mentions high quality and longevity as key characteristics making fine wine an asset class, as well as limited production. Chiesa mentions that a problem with fine wines might be illiquidity of the asset if an owner is stuck with it and cannot resell it. According to the expert prices have been increasing due to lower production in the past two years, especially in the region of Burgundy, France, where in 2021 some top producers lost up to 100% of volumes. He believes Covid and inflation only have a minor impact and that is negligible. He also believes champagne was the best region in terms of returns and that the irrationality of certain individuals surely exists but does not alter the prices in the markets. Regarding Fakes, as a wine shop owner he personally checks bottles for customers who ask him to do so. He uses a set of lights and his deep knowledge to evaluate the bottle's integrity, labels and cork. He mentioned mostly Italian super tuscans as most fake wines now in Italy, specifying that he had no data on French wines. Finally, Chiesa underlined how buying from sales representatives is the key factor to avoid fakes and knowing the products well.

P. Holowka	The expert stated that as a collectible fine wine can be an asset class, as it is a product that is regularly bought and sold. It has a standard identifying characteristic through the branding. However, as a downside he said that It has run through cycles of intense interest and speculation, and then retreated over the past few decades and it swings in and out of favour. As key determinants he mentioned the scarcity factor, limited production that clearly created the extremely high demand and escalation of Burgundy prices. The expert also said that as limiting factors the fine wine market is very inefficient and commissions, spread bid-ask and cost of carry make it very difficult to gain money if you are a solo investor. As determinants of the price increase Holowka mentioned that there was a post covid bounce back as restaurants, clubs reopened, and general demand outlook increased across many sectors of the economy. In addition, he believes demand by some high-end collectors/speculators for scarce wines for various reasons went up considerably. He has personally witnessed the irrationality of buyers at auctions where the prices levitated out of pure competition among collectors. Regarding Fakes, the expert mentioned bottle enhancements, (chips, label security features) by some top producers, and recording of production and distribution by numbers and markets. As most faked, he gave a detailed list, among which, on the high end are Burgundies from DRC, Leroy, Vogüe, Ponsot Lafleur, and other top Maison's. The 1st growth Bordeaux, Petrus, and trophy wines – 1985 Sassicaia, 1947 Cheval Blanc. As best practices the expert focused on provenance and sellers. Buying from a trusted source should always be the preferred option. In addition, he underlined that most buyers from UK and USA would not touch anything coming from China.
N. Asaro	The expert believes that fine wines are an asset class because they now have a considerable chunk of the collectibles market and have gained a "bond-like" stability that allows to invest in it without being exposed too much to negative swings. He also mentioned an excessive speculation around the industry that should settle as inflation raises.

	In terms of pricing, he's seen prices the increases mostly due to a post Covid lockdowns demand growth, driven by the interest of wealthy individuals for higher quality. He also believes that from the supply side, producers have been doing an excellent job at positioning themselves better in the market to capture more value through branding. Like the other experts interviewed before, he does not believe that inflation is having a major impact on the fine wine industry. It is much worse for food producers, he underlined. As other experts explained, he also considers fundamental to have an education about fine wines to better understand the products and do not get fooled. Among alternatives to fine wines the expert is interested in watches, fine arts and vintage cars. Regarding fakes, he considers the traceability of old bottles to be almost impossible, and QR codes along with blockchain are being used to track newest bottles., with small advancements. He believes all pricy bottles can be faked, and that being involved in a closed circle of experts is key to avoid fakes.
F. Rabellino	The expert does not consider fine wines an asset class, as he believes it remains a consumable good that should be appreciated for its excellent qualities and to celebrate special moments. He mentioned it might become an asset class one day and that there is currently excessive speculation around the asset. He believes that Covid-19 has spurred digital sales opening many opportunities to winemakers and other businesses. For such reason prices have been moving up. He also underlined how the increasing prices are following a natural path as other luxury products have done in the past. As an alternative to fine wines, he mentioned that young individuals are switching to Marijuana. He did not expose himself over fake wines as he said to have no experience on the matter.
B. Vialle	The expert said that fine wines can be considered an asset class, but the passion component is the main one to prevail. He underlined how the irrationality of certain collectors might influence the prices at auctions, but not too much on the markets as these individuals like to show off at public events. Among the characteristics of fine as an asset class he mentioned the increasing quality over time as well as its longevity.

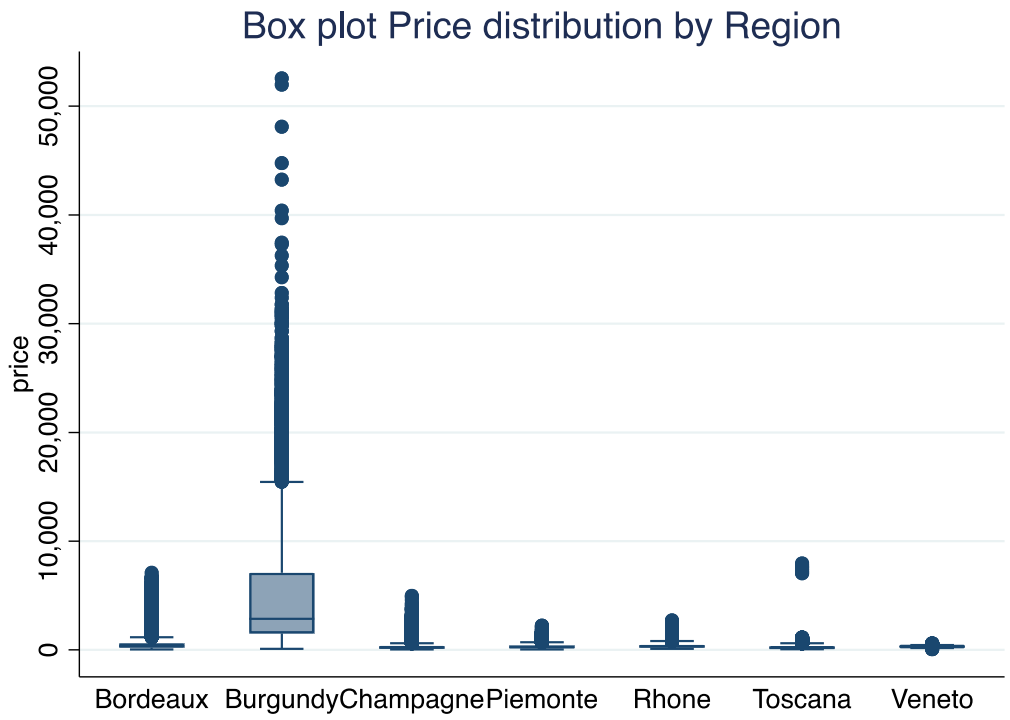
	Limited supply also plays a role and has been an important driver of prices recently as supply diminished due to weather events. Bordeaux and Burgundy according to him, are the most famous regions for fine wine investing, and Burgundy prices are the ones that have the highest price increase recently as their rarity keeps going up. Among alternatives to fine wines the expert considers Whiskey, Japanese Whiskey as well as other spirits like Tequila and Gin. Regarding Fakes, he explained the whole process they go through at the auction house he oversees, where in summary, a group of experts analyses the bottles prior the sale with blue lights and pictures databases to always have a direct confrontation. He mentioned several rising businesses that sell the wines coming directly from the producers in Burgundy, to avoid having bottles travelling all over the world. He said that NFTs in this practice have been growing and that there are several useful use cases for this new blockchain based technology.
R. Tomei	The expert considers fine wines an asset class only because of the market that has been growing around it. But he personally enjoys wines for their characteristics and likes to collect them with the purpose of drinking them in the future. As factors that have made the demand go up, thus increasing the price of fine wines, he has mentioned the ability of wine producers to better position themselves in the market and attract more interest, as well as the bounce back of demand from the Covid lockdowns, which spurred the interest of wealthy individuals in luxury goods. Regarding fake wines, he believes that traceability throughout the production process and post-sale process is key and that the blockchain applications will increase in the future in the fine wine industry, as it is already happening in the fashion industry. To spot fakes, he considers wine classes a must before entering the sectors, as knowing the products is the best way to avoid frauds.

Appendix 5

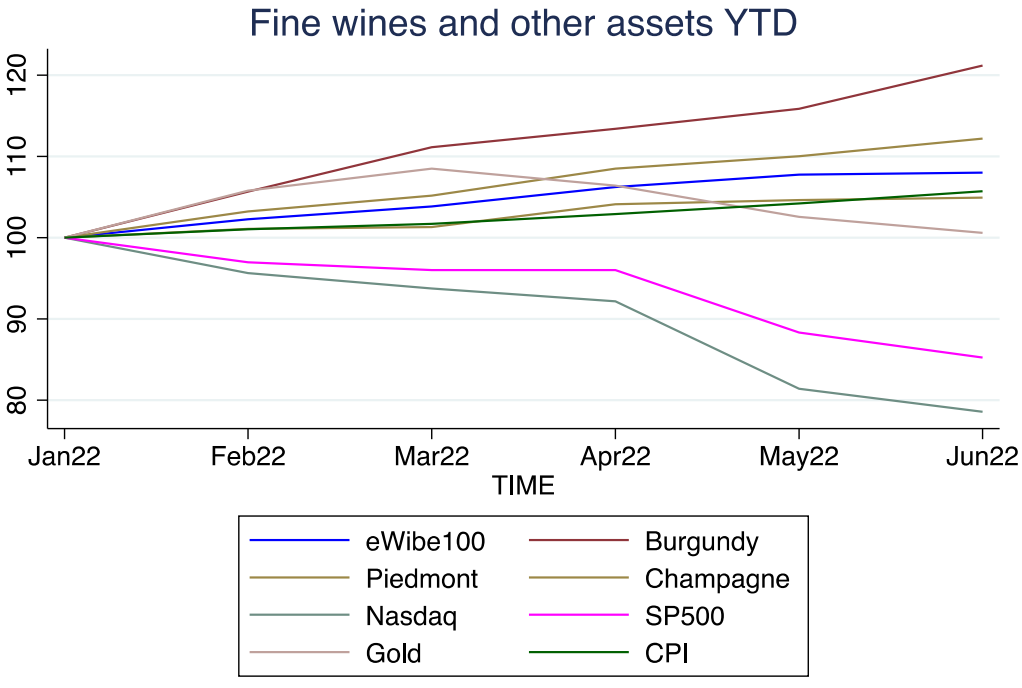


Figures in million hectoliters

Appendix 6

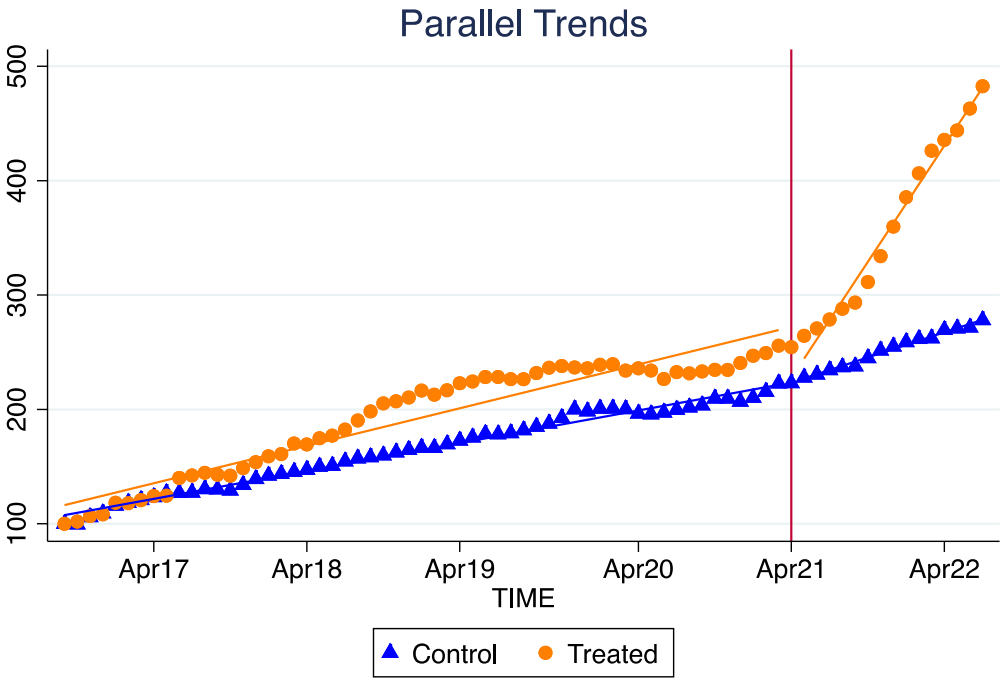


Appendix 7



Data from Jan 2022 till June 2022

Appendix 8



Data from April 2017 till July 2022

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