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Time-varying causality among whisky, wine, and equity markets

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ABSTRACT

Whisky has entered the category of alternative investment assets, with particularly attractive returns on certain bottles. The literature has shown the diversification benefits of investing in collectible assets, such as fine wine, but analyses dedicated to whisky investment remain scarce. Using different causality tests – parametric, non-parametric, and time-varying – applied to whisky, wine, and the MSCI World indices, we analyze the connection/disconnection between rare whisky, fine wine, and financial markets over a 13-Year period, from January 2010 to January 2023, in weekly frequency. Our results show that whisky and wine respectively provide attractive diversification opportunities when combined with stocks, except during "hectic" periods. Conversely, the combination of whisky and wine appears to be riskier in terms of portfolio diversification, especially since the COVID-19 pandemic.

1. Introduction

Alternative investment assets, including hedge funds, real estate, commodities, and even collectibles (Fraser-Sampson, 2010; Mundi and Kumar, 2023; Nahmer, 2020), may have noteworthy diversification properties because of a low correlation with standard assets like stocks, bonds, and money market instruments (Dobrynskaya and Kishilova, 2022; Masset and Weisskopf, 2018; Nahmer, 2020).

Collectibles have benefited from an extended literature covering a variety of investment vehicles: artworks (Baumol, 1986; Mei and Moses, 2002; Renneboog and Spaenjers, 2013), cars (Laurs and Renneboog, 2019; Martin, 2016), stamps (Dimson and Spaenjers, 2011; Franses and Knecht, 2016), LEGO sets (Dobrynskaya and Kishilova, 2022; Shanaev et al., 2020), and alcoholic beverages (Breeden, 2022; Le Fur, 2023; Le Fur and Outreville, 2019; Moroz and Pecchioli, 2021; 2019; Outreville and Le Fur, 2020; Tegtmeier, 2022).

The particular segment of investment-grade alcoholic beverages covers only two assets thus far, i.e., wine and whisky, but with a substantial increase in specific investment tools for both of them: auctions, investment funds, specialized platforms and price indices.

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This development makes the analysis of this asset category particularly fruitful and relevant (see Masset et al., 2021 and Aytaç et al. (2018, 2016) for wine and Tegtmeier (2022) and Le Fur (2023) for whisky).

The literature in wine economics has confirmed that wine, as observed for other collectibles (Le Fur, 2023), is an illiquid asset (Coffman and Nance, 2009; Masset et al., 2021; 2016). Despite this, several works have underlined the properties of certain wines as investment assets, noting positive returns (Aytaç et al., 2018; Dimson et al., 2015; Masset et al., 2020) with potential diversification benefits (Ben Ameur et al., 2022; Cardebat and Jiao, 2018; Masset et al., 2021; Masset and Maurer, 2021) because of low correlation with stock markets (Bouri et al., 2018; Masset and Henderson, 2010; Sanning et al., 2008). However, the literature does not present a consensus regarding the properties of wine as an investment asset, highlighting, in certain periods, negative performances (Aytaç et al., 2018; Di Vittorio and Ginsburgh, 1996), or null to only short-term diversification benefits (Ben Ameur et al., 2024, 2022; Dimson et al., 2015; Nahmer, 2020).

Regarding whisky, the literature concordantly acknowledges its performances and diversification properties as an investment asset while highlighting an increasing degree of liquidity (Lennon and Shohfi, 2021; Tegtmeier, 2022). However, in comparison to the wine literature (Le Fur et al., 2024; Le Fur and Outreville, 2019), this body of work is likely too limited to observe significant heterogeneity in methodologies and results, supporting the need for additional research. Moroz and Pecchioli (2019) draw a comparison between wine and whisky as investment assets, noting that while the former may be perceived as an unstable asset, the latter may be regarded as stable. This distinction stems from the fact that, unlike wine, the aging process for whisky ceases once it is bottled, thus its quality remains consistent over time. This difference between wine and whisky means at least two things for the potential investor. Firstly, as whisky's intrinsic characteristics do not alter over time, there is no information asymmetry between buyers and sellers concerning asset's quality. Except for potential counterfeiting issues, mere knowledge of the bottle label provides sufficient information to agree on the quality of the whisky. Secondly, given that the vintage does not impact whisky quality, a sophisticated investor with good knowledge of the whisky industry may anticipate profit opportunities on the investment market.

Given the differences underlined by Moroz and Pecchioli (2019) between wine and whisky, we propose to investigate how these assets correlate with financial markets and with each other using a time-varying Granger causality approach. More precisely, we study the connection/disconnection between rare whisky, fine wine, and stock markets over a 13-year period, from January 2010 to January 2023, using market index data on a weekly basis. In order to investigate the potential causal relationship among these markets, we implement a recent time-varying Granger causality approach in line with Shi et al. (2020, 2018). Our results show that rare whisky and fine wine present respectively a potential lever for portfolio diversification when they are combined with "classic" assets such as stocks, except during very specific and short periods. However, the combination of whisky and wine appears to be riskier in terms of portfolio diversification, especially in the recent period.

By doing so, we make three major contributions.

First, we contribute to the literature on alternative investments in alcoholic beverages by studying the interactions between a market for stable assets, i.e. whiskies, and a market for unstable assets, i.e. wines. Wine offers investors an opportunity to make a bet on time because of the aging process, whereas whisky does not. Studying the interactions between these two assets might be insightful for further studies which could try to understand the channels of investors' risk aversion in alternative assets.

Second, we participate in the development of an emerging literature on whisky investment. We complement the previous mean-variance analysis of Tegtmeier (2022) with higher frequency data, combined with an alternative method that allows us to determine the origination and termination date for any period of Granger causality. We also extend the analysis of Le Fur (2023) by considering the relationships between rare whisky and two other markets, providing a better overview of the portfolio diversification opportunities offered by wine and whisky.

Third, our analysis can be insightful for potential investors who might be interested in diversifying their asset portfolio with collectibles. Whisky and wine have demonstrated the possibility of significant positive returns, which makes them interesting for both private and institutional investors. Our analysis allows investors to develop profitable investment strategies by exploiting signals of information inefficiency and anticipating price movements more effectively.

The remainder of the paper proceeds as follows. Section 2 describes our data and provides summary statistics. The methodology employed for our empirical analysis is presented in Section 3 and the results are depicted in Section 4. Section 5 concludes with a discussion of implications and suggestions for further research.

2. Data

The dataset covers the period starting January 2010 up to the end of January 2023 in weekly frequency (680 observations), depending on the respective availability of the different data.

For the whisky and wine indices, we use respectively the Icon 100 Index and the Vintage 50 Index (Source: Rare Whisky 101), and Liv-ex Fine Wine 50 (Source: Bloomberg). The Icon 100 includes 100 iconic collectors' bottles. They are highly sought-after and regularly traded at auction in the UK but do not necessarily always go up in value. The Vintage 50 charts the performance of 50 of the oldest, rarest bottles of single malt Scotch whisky ever produced. The bottles have been selected for their rarity and, in all cases, old vintage and/or significant age statement. The Liv-ex fw50 tracks the price movements of the most heavily traded commodities in the fine wine market, i.e., Bordeaux First Growths. It includes only the ten most recent vintages (excluding *En Primeur*, currently 2006–2015), with no other qualifying criteria applied.

For financial markets, we use the MSCI World index (Source: Factset / in US dollars). The MSCI W is a free float capitalization weighted index, designed to measure global developed market equity performance.

The whisky and wine indices can be respectively considered, following Cardebat and Jiao (2018), as proxies for the performances of

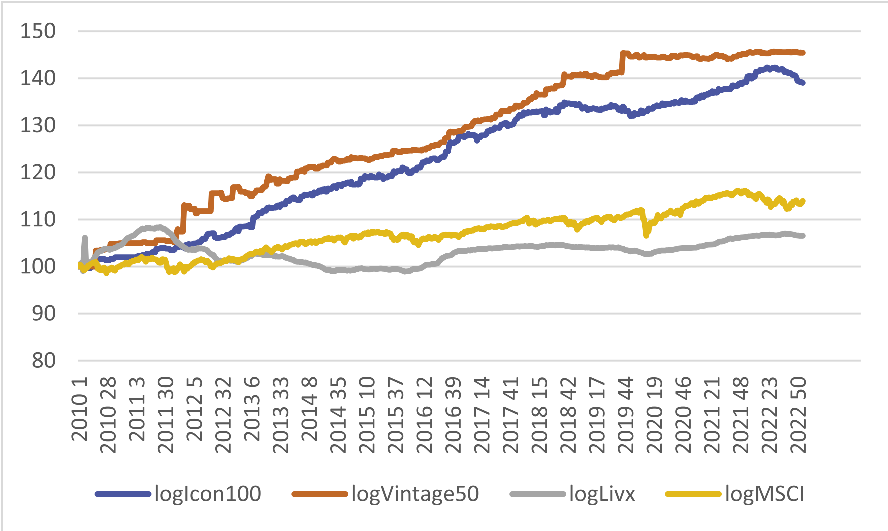


Fig. 1. Evolution of the whisky, wine and MSCI W indices (in logarithmic returns, January 2010 = 100).

typical whisky and wine investment portfolio, while the MSCI W indicator can be used as a proxy of financial markets (Cardebat and Jiao, 2018; Faye et al., 2015).

Table A1 provides descriptive statistics of the data and Table A2 presents the correlations between the variables considered. Within the investigation period, whisky exhibits the highest average weekly return, with a mean of 0.12 % and 0.14 % for the Icon 100 and Vintage 50, respectively. The average returns of the other asset classes range from 0.02 % for Liv-ex fw50 to 0.06 % for MSCI W. The highest volatility is observed for MSCI W, with 0.93 %, while Icon 100 has the lowest (0.60 %). Note that whisky and wine returns exhibit low correlation with equity markets, as well as with each other (Table A2).

In order to provide an initial view of the performance of the different asset classes considered, Fig. 1 displays the indexed evolution of the whisky, wine and MSCI W indices. Within the period considered, the series show divergent trends. The trend of the Liv-ex fw50 is relatively stable over the entire period studied; unlike the other series, which show an upward trend. The Icon 100, and even more so Vintage 50, undergo a singinficant increase between 2010 and 2023 (with a maximum of 145.66 for Vintage 50). During the COVID-19 crisis, we observed that the MSCI W and Icon 100 indices fell, with a different time frame, unlike the Vintage 50, which continued its upward trend, before stabilizing. It is therefore possible that the whisky indices are independent from stock market fluctuations. However, to study more finely the links between the stock market index and the indices relating to whisky and wine, we perform causality tests as explained in the next section.

3. Methodology

We evaluate the role of whisky as an alternative asset class, employing causality tests (like Baldi et al., 2013, Bouri, 2013, Faye et al., 2015, and Cardebat and Jiao, 2018). The econometric analysis is based on three causality tests, in order to determine the predictive and causal character between the indices. More precisely, we seek to determine whether the dynamics of the stock market (MSCI W) can make it possible to predict future returns on alternative investments (whisky and wine). This character of unilateral causality provides information on the interest of diversifying an investment portfolio. The presence or absence of causality allows us to consider whisky as a hedge for portfolio diversification. In the absence of causality, there is a possible diversification benefit. Lastly, we try to determine how the stock market influences (or not) the wine and whisky markets. In addition, we also test the causality, going from "wine" to "whisky".

Firstly, we estimate a two-variable Granger causality model (like Cardebat and Jiao, 2018, for example), by focusing on unilateral relations ranging from the stock market index to alternative investments. We test the null hypothesis that MSCI W does not Granger cause Icon 100, Vintage 50 or Liv-ex fw50, against the alternative. Granger (1969) assumes a parametric and linear relationship for the conditional mean.

Secondly, we proceed with non-parametric causality tests (Diks and Panchenko, 2006), which make it possible to identify possible nonlinear causal dynamics. These tests are in line with the work of Hiemstra and Jones (1994) and they allow causality to take any functional form. Non-parametric tests are even operational in the event of instable parameters, which can especially occur in the presence of structural breaks. The improvement of Diks and Panchenko (DP) allows the consideration of potential variations in the conditional distributions of the variables and thus limits the excessive rejection of the null hypothesis of non-causality. Thus, it is possible to detect nonlinear relationships over time, such as asymmetry, persistence, and structural breaks.

Thirdly, we appraise the potential time-varying causality between the whisky index, the wine index and the financial markets. To estimate the time-varying causal relationship between the whisky index, the wine index, and the financial markets, we propose to

Table 1
ADF and Zivot and Andrews tests.

		Vintage 50		Icon 100		Liv-ex fw50		MSCI W	
		No trend	With trend	No trend	With trend	No trend	With trend	No trend	With trend
ADF	Level	-28.54***	-28.72***	-10.12***	-10.49***	-18.05***	-18.04***	-28.35***	-28.33***
Zivot and Andrews - IO	Level	-33.02***	-33.11***	-29.08***	-29.34***	-39.10***	-39.02***	-29.77***	-29.78***
Zivot and Andrews - AO	Level	-33.06***	-33.14***	-29.57***	-29.40***	-39.25***	-39.09***	-28.89***	-28.89***

Note: All variables are computed as weekly logarithmic returns. *, **, and *** indicate statistical significance at the 10, 5, and 1 % levels, respectively.

Table 2
Granger causality and non-parametric tests results.

	Granger causality		DP	
Lag order	1	2	1	2
MSCI W → Icon 100	1.01	1.66	-2.575	-1.82
MSCI W→ Vintage 50	2.31	1.60	-2.74	-2.72
MSCI W → Liv-ex fw50	0.17	0.10	-0.64	-0.58
Liv-ex fw50 → Icon 100	1.40	0.90	1.44*	-0.22
Liv-ex fw50 → Vintage 50	0.15	0.25	1.44*	0.93

Note: The tests are conducted over the period (2013–2023 - 524 data points) due to the limited variation in whisky indices before 2013 (see Exhibit 1). All variables are computed as weekly logarithmic returns. *, **, and *** indicate statistical significance at the 10, 5, and 1 % levels, respectively.

implement the causality procedure of Shi et al. (2020, 2018). With this methodology, based on Granger causality, it is possible to assess the stability of causal relationships over time, with a stationary VAR model (Shi et al., 2018) or with a lag-augmented VAR (LA-VAR) model to make non-stationary variables in the VAR model possible (Shi et al., 2020).

This methodology detects periods of instability in the causal relationship with three time-varying causation algorithms: forward recursive causality, rolling causality, and recursive evolving causality. From a VAR model, an intensive recursive calculation of Wald test statistics is implemented:

$$y_{1t} = \varnothing_0^{(1)} + \sum_{k=1}^{m} \varnothing_{1k}^{(1)} y_{1\ t-k} + \sum_{k=1}^{m} \varnothing_{2k}^{(1)} y_{2\ t-k} + \varepsilon_{1t} \tag{1}$$

$$y_{2t} = \varnothing_0^{(2)} + \sum_{k=1}^{m} \varnothing_{1k}^{(2)} y_{2\ t-k} + \sum_{k=1}^{m} \varnothing_{2k}^{(2)} y_{2\ t-k} + \varepsilon_{2t} \tag{2}$$

where y_{1t} and y_{2t} represent respectively the whisky index and the wine index or MSCI W.

The null hypothesis of no Granger causality from y_1 to y_2 is verified by testing the joint significance of $\varnothing_{1k}^{(2)}$ $(k = 1, \ldots, m)$ by means of a Wald test. Different statistics are compared with a sequence of test statistics of Granger causality, one for each time period of interest. We then resort to a rolling window estimation of the traditional Wald statistics, which is a real-time-varying test based on supremum (sup) Wald statistic sequences using a forward recursive (Thoma, 1994), a rolling window (Arora and Shi, 2016; Swanson, 1998), and recursive evolving algorithms (Phillips et al., 2015a, 2015b).

Shi et al. (2020) suggest that the last procedure yields the best results. In this procedure, Wald statistics over $[f_1,f_2]$ with a sample size fraction of $f_w = f_2 - f_1 \geq f_0$are denoted by $Wf_2(f_1)$ and the sup Wald statistics are expressed as follows[4]:

$$SW_f(f_0) = \frac{sup}{(f_1,f_2) \in \wedge_0, f_2 = f} \{w_{f_2}(f_1)\} \tag{3}$$

where $\wedge_0 = \{(f_1,f_2)\colon 0 < f_0 + f_1 \leq f_2 \leq 1,\ and 0 \leq f_1 \leq 1 - f_0\}$

In this context, it is possible to determine $\widehat{f}_e$ and $\widehat{f}_f$ which are the first estimated chronological observations whose test statistics respectively exceed or fall below the critical values for the origination and termination points in the causal relationship.

$$\widehat{f}_e = \frac{inf}{f \in [f_0, 1]} \{f : SW_f(f_0) > scv\}\ and\ \widehat{f}_f = \frac{inf}{f \in [\widehat{f}_e, 1]} \{f : SW_f(f_0) > scv\} \tag{4}$$

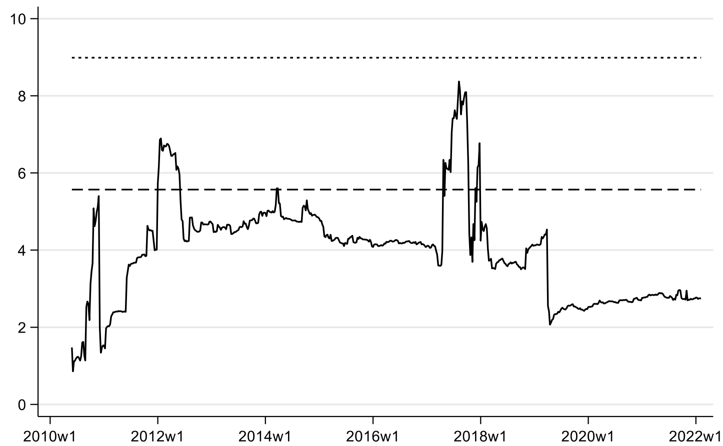
where *scv* is the corresponding critical values of the SW_f statistics.

In view of the superiority of the recursive evolving window procedure, we investigate the potential time-varying causality between the whisky index, the wine index and the financial market using the procedure described in this paper.

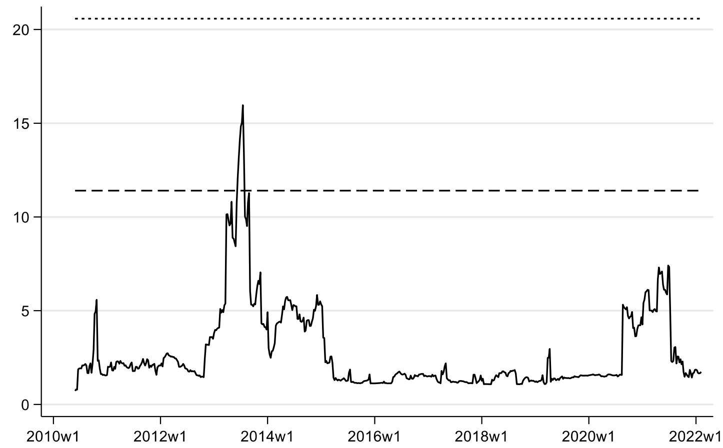
[4] See Hammoudeh, Ajmi, and Mokni (2020).

(a) Recursive evolving-heteroscedasticity MSCI W → Icon 100

(b) Recursive evolving-heteroscedasticity MSCI W → Vintage 50



(c) Recursive evolving-heteroscedasticity MSCI W → Liv-ex fw50



(caption on next page)

Fig. 2. Time-varying causality from MSCI W to Icon 100/Vintage 50/Liv-ex fw50,(a) Recursive evolving-heteroscedasticity MSCI W → Icon 100, (b) Recursive evolving-heteroscedasticity MSCI W → Vintage 50, (c) Recursive evolving-heteroscedasticity MSCI W → Liv-ex fw50
Note: this figure exhibits the time-varying causality (recursive expanding Wald test) with bootstrapped statistics (90th – and 95th – percentiles) from MSCI W to Icon 100, Vintage 50 and Liv-ex fw50. All variables are computed as weekly logarithmic returns.

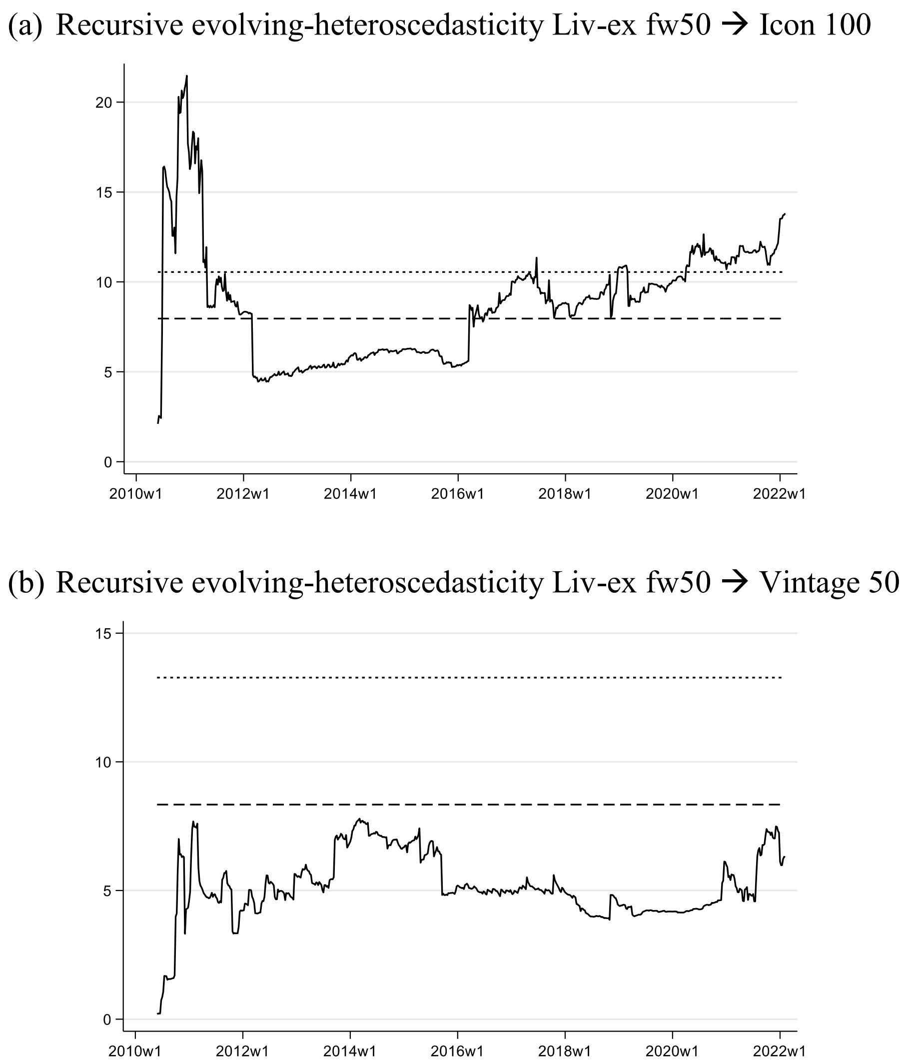


Fig. 3. Time-varying causality from Liv-ex fw50 to Icon 100/Vintage 50, (a) Recursive evolving-heteroscedasticity Liv-ex fw50 → Icon 100, (b) Recursive evolving-heteroscedasticity Liv-ex fw50 → Vintage 50
Note: this figure exhibits the time-varying causality (recursive expanding Wald test) with bootstrapped statistics (90th – and 95th – percentiles) from Liv-ex fw50 to Icon 100 and Vintage 50. All variables are computed as weekly logarithmic returns.

4. Empirical analysis and results

Before conducting the causality tests, we implement Augmented Dickey-Fuller (ADF) and Zivot and Andrews (ZA) tests to test the degree of integration of the variables. The results are reported in Table 1. They show that all of the series are stationary in level.

As illustrated in Table 2, two tests reject the null hypothesis of non-causality: Liv-ex fw50 → Icon 100 and Vintage 50, with a lag length of one period and 10 % significance. We can conclude that the stock index does not Granger-style the whisky indices in a parametric and linear framework; unlike the Liv-ex fw50 which causes the whisky indices (with non-parametric causality tests) over the period 2013–2023.

In order to extend these linear and non-linear causality tests, we implement time-varying causality tests. Indeed, it is very likely that the series present causal dynamics during specific periods (such as the euro-zone crisis or the COVID-19 crisis). We then focus our analysis, using this methodology.

To estimate the VAR and to conduct the dynamic time-varying granger causality tests, we use the TGVC Stata module (Otero et al., 2022) like Fromentin (2022) or Mohamad and Fromentin (2023) for example. We follow different steps: determine the order of integration; choose the VAR model with BIC criteria; and carry out causality tests for the full sample, and especially time-varying causality tests. We are able to conduct causality tests with a stationary VAR model (Shi et al., 2018). Then, like Shi et al. (2020), lag orders are selected using BIC with a maximum length of 12.

The time-varying Wald test statistics are depicted in Figs. 2 and 3, from MSCI W to wine/whisky indices and from wine to whisky indices respectively, with their bootstrapped critical values (90th and 95th percentiles). We find no significant Granger causal relationships between MSCI W and Icon 100 (except for a very short period in 2022 - during Russia's invasion of Ukraine), suggesting that stock market and whisky markets are not related. At a significance level of 10 %, the MSCI W → Vintage 50 causality only applies during short periods (in 2012 and 2017). During these specific periods, it would seem that the predictive character of the stock market towards this index is operative. The causality from MSCI W to wine is only significant at the end of the European debt crisis.

Concerning the causality from wine to whisky (Fig. 3), the results show an asymmetrical character with regard to its significance during specific phases, and depending on the index considered. More specifically, the relationship from Liv-ex fw50 to Icon 100 appears to be not very significant from 2012 to 2016, whereas it is particularly strong in the period 2010–2011, and becomes increasingly significant from 2016, even more so during the COVID-19 crisis. These results suggest that wine and whisky market activities become more closely related with time, along with the recent development of the whisky investment market. Thus, wine and whisky should be considered with caution when combined to achieve a better portfolio diversification level, particularly in specific uncertain periods like the recent COVID-19 crisis. Concerning the causality between the "wine" index and the Vintage 50 index, it is not significant over the entire period.

5. Conclusion

Using different causality tests, this article analyzes the connection/disconnection between rare whisky, fine wine, and financial markets from January 2010 to January 2023. The stock index does not Granger-cause the whisky indices in a parametric and non-parametric framework. However, taking a time-varying Granger causality approach, we show the existence of causal relationships that are particularly significant in specific periods. In complement, the relationship from Liv-ex fw50 to Icon 100 becomes particularly strong from 2016, and even more so during the COVID-19 crisis and Russia's invasion of Ukraine.

Whisky and wine respectively provide attractive diversification opportunities with stocks, except in hectic periods. However, the combination of whisky and wine appears to be riskier in terms of portfolio diversification, especially in the recent period, which suggests that investors should select whisky expressions with caution.

Finally, our findings complement the emerging literature on whisky investment (Lennon and Shohfi, 2021; Tegtmeier, 2022; Le Fur, 2023), but suggest the necessity for further research to delve deeper into the investigation of whisky's properties as an investment asset. Such complementary research seems particularly relevant with regard to both the literature on wine investment and the characteristics of the whisky investment market.

CRediT authorship contribution statement

Vincent Fromentin: Writing – original draft, Validation, Methodology, Conceptualization. **Bruno Pecchioli:** Writing – original draft, Validation, Investigation, Data curation, Conceptualization. **David Moroz:** Writing – original draft, Validation, Investigation, Conceptualization.

Data availability

The authors do not have permission to share data.

Author agreement statement

We the undersigned declare that this manuscript is original, has not been published before and is not currently being considered for publication elsewhere. We confirm that the manuscript has been read and approved by all named authors and that there are no other persons who satisfied the criteria for authorship but are not listed. We further confirm that the order of authors listed in the manuscript has been approved by all of us. We understand that the Corresponding Author is the sole contact for the Editorial process. He/she is responsible for communicating with the other authors about progress, submissions of revisions and final approval of proofs.

Appendix

Table A1
Descriptive statistics.

	Icon 100	Vintage 50	Liv-ex fw50	MSCI W
Mean	0.001195	0.001363	0.000234	0.000599
Median	0.000000	0.000000	0.000247	0.001312
Maximum	0.042263	0.114371	0.115881	0.043422
Minimum	-0.020229	-0.023271	-0.156785	-0.053319
Std. Dev.	0.005982	0.008507	0.008389	0.009348
Skewness	1.278103	7.251668	-5.563077	-0.842764
Kurtosis	9.298193	78.64570	238.4543	8.445717
Jarque-Bera	1309.040	168,090.9	1,574,271.	920.7440
Probability	0.000000	0.000000	0.000000	0.000000
Sum	0.812518	0.927066	0.159030	0.407077
Sum Sq. Dev.	0.024296	0.049140	0.047788	0.059328
Observations	680	680	680	680

Note: all variables are computed as weekly logarithmic returns.

Table A2
Pearson correlations between the variables used.

	Icon 100	Vintage 50	Liv-ex fw50	MSCI W
Icon 100	1000			
Vintage 50	0,263	1000		
Liv-ex fw50	0,034	-0,010	1000	
MSCI W	-0,006	-0,060	-0,024	1000

Note: all variables are computed as weekly logarithmic returns.

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