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# CALENDAR ANOMALIES AND RISK IN THE WINE EXCHANGE MARKET

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## ABSTRACT

*This paper examines calendar anomalies, in particular, the monthly effect in the international wine exchange market. The empirical findings suggest that there is a March effect for the Liv-ex Fine Wine 500 Index, a May effect for the Liv-ex Fine Wine 100 Index and the Liv-ex Claret Chip Index and a June effect for the Liv-ex Fine Wine Investables Index. We find that the market risk is higher in March and June for the Liv-ex 500 Index and the Liv-ex Investables Index, respectively. However, this higher market risk is not the cause of the monthly effect.*

**Keywords:** wine, monthly effect, efficient market hypothesis, risk, GARCH

## INTRODUCTION

Financial assets such as stocks and bonds have often been the most popular investment instruments due to their high returns. However, the Capgemini and Merrill Lynch World Wealth Report 2010 claimed that crises, ongoing concerns about financial markets and a lack of confidence in regulatory bodies and financial institutions have caused investors to seek protection against downside risk. Investors have shifted their focus to a broader spectrum of portfolio risk, especially to non-financial assets or passion investments.[1] The report stated that individuals with high net worth are engaging in passion investments because of their tangible, long-term value, and these investments are expected to expand.

Wine has become a popular passion investment not only because of its high returns compared with other non-financial assets but also because wine's correlation with stocks is not very significant (Masset & Henderson, 2009). For instance, a case of Chateau Lafite Rothschild 2000 that cost £2,560 in 2004 was worth £18,400 in 2010, which is a 611% increase. Furthermore, the production of fine wine is limited due to fixed vineyard areas; only 480,000 bottles of Chateau Lafite Rothschild are produced per year.[2] The supply of fine wine will eventually diminish because people who invest in the best vintages would also savour the wine. Thus, the scarcity of fine wine drives fine wine prices up over time. In addition, the emergence of e-commerce has enabled buyers and sellers worldwide to trade. Websites such as Wine Spectator, Decanter and London International Vintners Exchange provide much-needed information about wine and wine investment. Wine exchanges also provide a global marketplace for major wine buyers and sellers, including merchants, retailers and wine funds, to invest in wine.

Numerous empirical studies have been performed on non-financial assets such as paintings, violins, antique furniture and wine. Some studies (Baumol, 1986; Graeser, 1993) contended that not all collectibles provide a sound financial investment. For instance, investment in paintings, Stradivarius (the world-famous violin) and American antique furniture are found to exhibit poor returns compared with financial instruments. However, empirical studies on wine as an alternative investment resulted in mixed conclusions. Some studies (Jaeger, 1981; Sanning et al., 2008; Baldi et al., 2010) found that investment in wine provides positive returns, while the others (Krasker, 1979; Burton & Jacobsen, 2001) found that the expected returns from storing wine were no larger than the return from riskless assets.

The Efficient Market Hypothesis (EMH) proposes that investors will not able to make full use of public information to generate abnormal return because the market reflects the available information (Fama, 1969). In contrast with EMH, calendar anomalies assert that the stock market is inefficient because stocks perform better in certain calendar periods. Popular studies on calendar anomalies include the *January effect*, in which stocks gain in January; the *weekend effect*, in which stocks perform better on Fridays; and the *holiday effect*, in which stocks perform better on the days before holidays. These anomalies imply that market inefficiency exists because investors can use stocks' historical patterns to earn abnormal returns. Most studies on calendar anomalies employed the bootstrapping method, the portfolio rebalancing hypothesis and the Fama-French three-factor model for the analysis.

This paper examines the presence of a monthly effect in the international wine exchange market. In addition, we aim to determine whether market risk is higher in certain months and to examine whether risk is a reason for the monthly effect. For the first time, we marry the two established research areas, i.e., the wine market and calendar anomalies, in a single study. As alternative/passion investment emerges as a replacement for the traditional stocks investment, it is important and timely to verify the validity of the EMH in the wine market. As the current literature on wine investment focuses on examining performance and the rate of return, we contribute to the literature by studying the efficiency of the wine market. We believe that this paper is the first to investigate the calendar effect on the wine market. The findings of this paper may provide some perspective for investors and market players on whether they can earn abnormal returns with the monthly effect investment strategy in the wine exchange market.

## WINE MARKET AND LITERATURE REVIEW

Traditionally, wine-producing countries in Europe include France, Italy and Spain. Wine is also produced in New World countries such as Argentina, Australia, Chile, New Zealand, the United States and South Africa. In addition, wine production in China has increased over the years because of increasing domestic demand. Rising incomes and the image of wine-drinking as a status symbol for the middle class have caused an increase in domestic demand for wine in China.[3]

The finest wine is fundamentally determined by geographical region in Europe, while in New World Countries, wines are labelled by their varietal names and grape combinations.[4] In France, wines from Bordeaux and Burgundy are considered world-renowned, and they are categorised through a complex appellation system.[5] The Bordeaux Brokers Union introduced 'The 1855 Bordeaux Classification' to classify chateaux[6] that produce the highest quality wine from the first growth (premier cru) up to the fifth growth. The "cru" classification of Burgundy wine begins with Grand Cru, followed by Premier Cru, which reflects the implied quality associated with the potential of a particular *terroir*[7] in producing high-quality wine.

Most empirical studies (Landon & Smith, 1997; Steiner, 2004; Oczkowski, 2006; Schamel, 2006; Carew & Florkowski, 2010) on wine focus on the determinants of wine prices. The determinants include colour, grape variety, region of origin, vintage, volume, age, critics' scores and temperature. Hedonic price analysis is commonly employed to investigate the determinants of wine prices. Hedonic price is defined as the implicit price of the product's attributes (e.g. wine's colour and grape variety) and these attributes are determined from the observed prices of differentiated products (e.g. other wines) and the specific number of characteristics associated with the products (Rosen, 1974). The observed market price of a good is comparable to a tied package of characteristics, and the price difference between the observed price and the observed characteristics becomes evident when the price differences among goods are recognised.

Literature on wine in the economy is mainly focused on determining which of the characteristics are associated with the observed market price of a bottle of wine. Shamel and Anderson (2003) estimated a hedonic price function on the well-known Australian James Halliday wine data to differentiate the implicit prices for sensory quality ratings, wine varieties, region and winery reputation attributes in the vintages from 1992 to 2000. They showed that vintage ratings by independent critics, winery ratings and classic wine categorisation have a significant positive impact on a consumer's willingness to pay for premium wine. Steiner (2004) adopted hedonic price analysis to estimate the implicit Australian wine price. The result suggested that consumers value the regional origins of the grapes and their varieties jointly as proxy for brands. Haeger and Storchmann (2006) studied the most expensive category of table wine, Pinot Noir, from Burgundy using hedonic price analysis and found that wine-making skills, brand reputation and explicit pricing policies account for a large share of price variations but that wine ratings do not strongly explain the price variations.

In finance, research on wine as an alternative to financial investment remains limited. Krasker (1979) investigated the rate of return from storing wine using data on wine prices from Heublein Wine Auctions covering a four-year period from 1973 to 1977. By employing the generalised least square (GLS) procedure, the author found that the net expected return on wine does not far exceed the return of riskless assets; therefore, wine would not be an unusually good investment. Jaeger (1981) re-examined Krasker's study by using the same data source for the eight-year period from 1969 to 1977. She noted that Krasker's procedure in finding a subnormal (less than the normal) rate of return is biased due to the wine surplus in 1974 to 1975 that drove French wine prices below the market price. Jaeger (1981) claimed the expansion of data improves the calculated return of wine and found that wine outperforms Treasury bills by USD16.60 per case per year (a case contains 12 bottles of wine).

Burton and Jacobsen (2001) used the repeat-sale, semi-annual wine auction data from William Edgerton that compiles a record of wine sold at major auction houses such as Christie's, Sotheby's, Davis & Company and others from 1989 to 1992. They provided evidence that an aggregate portfolio of investment in wine shows an impressive nominal annual return of 8%. Masset and Henderson (2009) employed auction data from Chicago Wine Company between January 1996 and February 2007, and their results showed that investing in wine may yield attractive performance in terms of average returns and volatility. Scanning et al. (2008) analysed the level and quality of Bordeaux wine returns by employing the Fama-French three-factor model and the Capital Asset Pricing Model (CAPM) using monthly hammer auction prices from the Chicago Wine Company for eight-year periods. Their results showed that *investment grade wine*[8] provides positive returns on average (0.60% to 0.75% per month and 7.5%

to 9.5% per year) in excess of those forecasted by well-accepted models. Investment-grade wine has the advantage of low exposure to market risk factors, thus providing a good source of diversification for investors seeking hedge investments.

We cannot avoid discussing literature on the calendar effect. Because it is well established, we review it briefly in this section[9]. Early research of seasonal variation in certain months was recorded by Wachtel (1942), who observed the Dow Jones Industrial Average from 1927 to 1942. Wachtel (1942) reported that 30 stocks from the Dow Jones displayed a frequent seasonal rise from December to January. Many researchers proposed the tax loss selling hypotheses and window dressing as explanations for the January effect. In the United States, investors are able to sell securities that decline in value to realise losses that can be used to reduce their taxable income.

Branch (1977) supported the tax loss selling but concluded that tax loss selling has little or no impact on stock prices in an average year. Rienganum and Shapiro (1987) observed that after the imposition of capital gain tax 1965, the British stock return data apparently exhibited tax effects in January and April (British tax year-end is in April). Tinic and West (1987) summarised that the January effect existed in Canada's stock market as a whole from 1950 to 1980. Although their findings do not support the proposition that taxes are the sole cause of seasonality in stock returns, they insisted that tax is still a factor that must be considered. Chen and Singal (2004) argued that the January effect is largely due to tax loss selling and tax gain selling. Grin and Moskowitz (2004) concluded that the long-term reversal effect appears only in January and that the significant momentum that exists outside of January seems to be driven by the end-of-year tax loss selling.

Nevertheless, some studies seem to propose otherwise. Haug and Hirschey (2006) found a persistent January effect for small capitalisation stocks in equal weighted returns even after the Tax Reform Act of 1986. They suggested that the January effect remains a small-cap phenomenon and has been unaffected by the Tax Reform Act of 1986. There are other studies (Ritter & Chopra, 1989; Reinganum & Gangopadhyay, 1991; Porter et al., 1996) that attempt to explain the January effect with other theories, such as accounting information hypotheses, portfolio rebalancing and turn of the month liquidity hypotheses.

## DATA AND METHODOLOGY

The data in this paper are adopted from London International Vintners Exchange (Liv-ex). Liv-ex is an exchange for investment in graded wine based in London.

There are four indices in Liv-ex: the Liv-ex Fine Wine 100 Index, the Liv-ex Fine Wine 500 Index, the Liv-ex Claret Chip Index and the Liv-ex Fine Wine Investables Index. The Liv-ex 100 Index comprises the 100 most sought-after fine wines where there is active trading in the secondary market. It is calculated monthly using the Liv-ex Mid Price for each component wine. The sample period is from July 2001 to December 2010. The Liv-ex 500 Fine Wine Index is based on the Current Best List Price (the least expensive) for each component wine from the last 30 days[10]. The main criterion for wine to be included in the Liv-ex 500 Fine Wine Index is attracting a strong secondary market. The sample period is from January 2001 to December 2010.

The Liv-ex Claret Chip Index consists of top-rated Bordeaux Left Bank First Growth only and is price-weighted. It is calculated weekly using the Liv-ex Mid Price. The sample period is from December 2003 to December 2010. The Liv-ex Fine Wine Investables Index comprises Bordeaux red wine from 24 leading chateaux with wine dated as far back as the 1982 vintage. The index is calculated using Liv-ex Mid Price with weightage applied to account for older vintages and wine produced in smaller quantities. The Liv-ex calculates Mid Prices for selected wine from 2001 onwards, whilst prior component wines are derived from an extensive collection of historical price data from leading fine wine merchants. The sample period is from January 1988 to December 2010.

The raw index series are converted into a series of returns expressed as a logarithmic return:

$$R_t = ln\ (P_t / P_{t-1}) * 100\%$$

where $P_t$ *and* $P_{t-1}$ are the wine index at time $t$ and time $t-1$.

Table 1 reports the descriptive statistics of all series showing the average monthly return and the standard deviation for the "extreme" months during the sample period. "High" refers to the month with the highest monthly return and "low" is the month with the lowest return. The Liv-ex 100 shows the highest mean return (0.0297) in May and the lowest mean return (–0.0086) in September. The Liv-ex 500 has the highest mean return (0.0172) in March and the lowest mean return (0.0012) in November. The Liv-ex Claret Chip demonstrates the highest mean return (0.0479) in May and the lowest mean return (–0.0105) in October. The Liv-ex Investables exhibits the highest mean return (0.0413) in June and the lowest mean return (0.0001) in November. Overall, the highest months are around end of spring or beginning of summer, while the lowest months are in autumn. January is neither the highest nor the lowest month in the wine exchange market.

The highest risk as indicated by the standard deviation is in October for the Liv-ex 100, Liv-ex 500 and Liv-ex Claret Chip. Although the highest mean return is found in the first half of the year, the highest risk is found in the second half of the year. However, for the Liv-ex Investables, both the mean return and risk are the highest in June. In contrast, all indices have the lowest risk in the second half of the year except the Liv-ex Claret Chip, whose lowest risk is in February. None of the months with the lowest mean return are consistent with the lowest risk or vice-versa. These results suggest that the modern portfolio theory, which is that higher return will accompany higher risk, is not true in the international wine exchange market.

Table 1
*Descriptive statistics for return series*

| Series | Liv-ex 100 | | Liv-ex 500 | | Liv-ex Claret Chip | | Liv-ex Investables | |
|---|---|---|---|---|---|---|---|---|
| Period | 7/2001 – 12/2010 | | 1/2001 – 12/2010 | | 12/2003 – 12/2010 | | 1/1988 – 12/2010 | |
| Variable | High | Low | High | Low | High | Low | High | Low |
| Month | May | Sept. | March | Nov. | May | Oct. | June | Nov. |
| Mean | 0.0297 | –0.0086 | 0.0172 | 0.0012 | 0.0479 | –0.0105 | 0.0413 | 0.0001 |
| Month | Oct. | Dec. | Oct. | Sept. | Oct. | Feb. | June | Aug. |
| Standard deviation | 0.0601 | 0.0139 | 0.0187 | 0.0080 | 0.0850 | 0.0147 | 0.0607 | 0.0133 |

We employ three models to investigate the existence of the monthly effect in wine returns. We start from the standard ordinary least square (OLS) model with a monthly dummy (Model 1):

$$R_t = \alpha_0 + \alpha_1 R_{t-1} + \alpha_2 DUM_t + \varepsilon_t$$

where $R_t$ is the return on wine series and *DUM* is the dummy variable for the respective month to capture the possible monthly effect (it can be any month) in the return series. If a monthly effect exists in a particular month, then $\alpha_2$ for that particular month will be positive and significant. We test the monthly effect for all twelve months from January to December to identify the monthly effect.[11]

Although there are more studies using the Generalised Autoregressive Conditional Heteroskedasticity (GARCH) model in the finance literature, there have not been yet any studies in the wine market. The GARCH model is employed because it is parsimonious and because it avoids over-fitting. Model 2 using the GARCH (1,1) model is shown to be a parsimonious representation of asset return dynamics. By using the GARCH structure, the focus is on the inter-temporal mean-variance relations instead of the cross-sectional return beta risk relations. If the market risk is priced, the conditional variance will be positively correlated with the market returns. Model 2 and 3 are adopted from Sun and Tong (2009).

Model 2 is the GARCH (1, 1) model with a monthly dummy as follows:

$$R_t = \alpha_0 + \alpha_1 R_{t-1} + \alpha_2 DUM_t + \varepsilon_t,\ \varepsilon_t|\phi_{t-1} \sim N(0, h_t)$$

$$h_t = \beta_0 + \beta_1 h_{t-1} + \beta_2 \varepsilon^2_{t-1} + \beta_3 DUM_t$$

where $h_t$ is the variance of $\varepsilon_t$ conditional upon the information set $\phi$ at time $t$ - 1 and is modelled following an ARMA (1, 1) process. The conditional variance is employed as a proxy for the market risk anticipated by investors. If market risk is higher in that month, $\beta_3$ in the variance equation would be positive and significant. Hence, the conditional variance might have seasonality in that month.

Model 3 is constructed to explain the situation where the monthly effect is due to higher risk in that month. If risk is higher in that month, the conditional volatility should be higher in that month as well. Model 3, following the GARCH-M model, is used to determine whether risk is a possible reason for the monthly effect:

$$R_t = \alpha_0 + \alpha_1 R_{t-1} + \alpha_2 DUM_t + \alpha_3 h_t + \varepsilon_t,$$
$$h_t = \beta_0 + \beta_1 h_{t-1} + \beta_2 \varepsilon^2_{t-1} + \beta_3 DUM_t$$

If market risk is higher in that month and it is the cause of the monthly effect, $\alpha_3$ would be significant and positive while $\alpha_2$ would be statistically insignificant or its magnitude would be much smaller than the $\alpha_2$ in Model 2 because a regression of the market return on conditional volatility together with the monthly dummy should explain away (at least partly) the significant of $\alpha_2$. herefore, the conditional variance (a proxy for market risk) should have explanatory power for the monthly dummy in the mean equation.

## EMPIRICAL RESULTS

As usual, the ADF and PP unit root tests reveal that all the log series are stationary at $I(1)$. The results of Model 1 are presented in Table 2. We report the results for only the highest and the lowest mean returns. For the Liv-ex 100, the May dummy is positive but insignificant, whereas the September dummy is negative and significant at the 5% level. On the other hand, the result for the Liv-ex 500 is consistent with the descriptive statistics with the highest mean return positive in March and the lowest mean return negative in November; both dummies are significant at the 5% level. The mean return is 0.9% higher than the average monthly return of 0.5% in all other months. Next, the result for Liv-ex

Claret Chip shows that the highest mean return in May is positive and significant at the 10% level. However, the October dummy is negative but insignificant. The result for Liv-ex Investables is also consistent with the descriptive statistics of the highest mean return being positive and significant in June, but the November dummy, although negative, is not significant. In sum, the OLS model provides evidence that there are monthly effects in the international wine exchange market.

Table 2
*Estimated results of Model 1*

| Series | Liv-ex 100 | | Liv-ex 500 | | Liv-ex Claret Chip | | Liv-ex Investables | |
|---|---|---|---|---|---|---|---|---|
| Period | 7/2001 – 12/2010 | | 1/2001 – 12/2010 | | 12/2003 – 12/2010 | | 1/1988 – 12/2010 | |
| Variable | High | Low | High | Low | High | Low | High | Low |
| Month | May | Sept. | March | Nov. | May | Oct. | June | Nov. |
| Constant | 0.0047$^{*}$ | 0.0075$^{***}$ | 0.0046$^{***}$ | 0.0061$^{***}$ | 0.0061 | 0.0097$^{**}$ | 0.0064$^{***}$ | 0.0098$^{***}$ |
| | (1.7482) | (2.7859) | (3.1951) | (4.2805) | (1.4989) | (2.2953) | (3.1945) | (4.6731) |
| $R_{t1}$ | 0.4907$^{***}$ | 0.5015$^{***}$ | 0.4246$^{***}$ | 0.4281$^{***}$ | 0.5352$^{***}$ | 0.5346$^{***}$ | 0.1750$^{***}$ | 0.1842$^{***}$ |
| | (5.9445) | ( 6.2261) | (5.0212) | (5.0677) | (5.8623) | (5.7540) | (3.0520) | (3.0910) |
| Dummy | 0.0133 | 0.0208$^{**}$ | 0.0090** | 0.0093$^{**}$ | 0.0249$^{*}$ | 0.0179 | 0.0318$^{***}$ | 0.0103 |
| | (1.4478) | ( 2.4444) | (2.1447) | (2.2185) | (1.8846) | (1.3293) | (4.8160) | (1.4955) |

Note: ***, **, and * refer to significance at 1%, 5% and 10%, respectively. Values in parentheses are *t*statistics.

The results for Model 2 are presented in Table 3. For the Liv-ex 100, the positive and significant May dummy shows the existence of May effect. However, the negative $\beta_3$ in May does not indicate any higher market risk in that month. However, for the Liv-ex 500, the March and November dummies show consistent results with both descriptive statistics; Model 1. The $\beta_3$ for March is positive and significant and is 0.02% higher than normal. This finding indicates that market risk is higher in March and that the conditional variance might have seasonality in March. The November dummy variable is negative and highly significant. In the case of the Liv-ex Claret Chip, the May dummy variable also is positive and highly significant. The $\beta_3$ for May is positive but insignificant. This finding indicates that market risk is not higher in May. However, the October dummy is negative and insignificant. The result for Liv-ex Investables shows that there is a June effect because the June dummy is positive and highly significant. The mean monthly return in June is 3.20% higher than the average monthly return of 0.61%. The November dummy is negative and becomes significant compared with Model 1. The $\beta_3$ for June is positive and significant with the conditional variance 0.26% higher than normal. This result indicates that market risk is higher in June and that the conditional variance might have seasonality in June. In sum, we find a March effect in the Liv-ex 500, a May effect in the Liv-ex 100 and Liv-ex Claret Chip and a June effect in the Liv-ex Investables. The market risk is higher in March and June for Liv-ex 500 and Liv-ex Investables, respectively.

The LMstatistics for all series show that ARCH effects are not present. The LjungBox test statistics, Q and $Q^2$, are not significant for all series, which suggests that our models are well specified.

Table 3
*Estimated results of Model 2*

| Series | Liv-ex 100 | | Liv-ex 500 | | Liv-ex Claret Chip | | Liv-ex Investables | |
|---|---|---|---|---|---|---|---|---|
| Period | 7/2001 – 12/2010 | | 1/2001 – 12/2010 | | 12/2003 – 12/2010 | | 1/1988 – 12/2010 | |
| Variable | High | Low | High | Low | High | Low | High | Low |
| Month | May | Sept. | March | Nov. | May | Oct. | June | Nov. |
| Mean equation | | | | | | | | |
| Constant | 0.0034* | 0.0052*** | 0.0051*** | 0.0073*** | 0.0068** | 0.0041* | 0.0061*** | 0.0082*** |
| | (1.6483) | (4.0143) | (3.9828) | (6.0795) | (2.1508) | (1.7876) | (3.1567) | (3.3838) |
| $R_{t1}$ | 0.6319*** | 0.5516*** | 0.5034*** | 0.4563*** | 0.5758*** | 0.5256*** | 0.3493*** | 0.3894*** |
| | (8.1239) | (6.0283) | (7.6987) | (7.3313) | (8.4189) | (5.2242) | (4.2078) | (3.8556) |
| Dummy | 0.0107** | 0.0017 | 0.0096** | 0.0101*** | 0.0326*** | 0.0227 | 0.0320*** | 0.0108* |
| | (2.0888) | (0.2113) | (2.5173) | (3.2306) | (2.6487) | (0.8849) | (3.3547) | (1.6951) |
| Variance equation | | | | | | | | |
| C | 0.0005*** | 0.0003** | 0.0000*** | 0.0001*** | 0.0005*** | 0.0007*** | 0.0005*** | 0.0007*** |
| | (3.3549) | (2.3025) | (3.2002) | (3.2663) | (2.8648) | (4.4629) | (10.0038) | (7.9859) |
| $\varepsilon^2_{t-1}$ | 0.9377** | 0.9243** | 0.1687*** | 0.1673*** | 0.6903*** | 0.2377** | 0.3213*** | 0.4779*** |
| | (2.3946) | (2.2142) | (15.7378) | (6.4768) | (4.9780) | (1.9733) | (5.1369) | (5.2600) |
| $h_{t-1}$ | 0.1823 | 0.1001 | 1.0245*** | 0.8130*** | 0.1987 | 0.1464 | 0.0365 | 0.0935 |
| | (0.9454) | (0.5685) | (298.61) | (8.1329) | (1.2711) | (1.0042) | (0.6674) | (1.2655) |
| Dummy | 0.0003** | 0.0002 | 0.0002*** | 0.0000 | 0.0048 | 0.0043* | 0.0026*** | 0.0001 |
| | (2.5527) | (0.5341) | (24.7921) | (0.7590) | (1.2562) | (1.6824) | (3.6689) | (0.6288) |
| Diagnostics Tests | | | | | | | | |
| LM(1) | 0.4861 | 0.0150 | 0.0220 | 0.0190 | 0.3163 | 0.0168 | 0.2626 | 0.0003 |
| Q(12) | 11.341 | 10.857 | 15.918[a] | 14.129[a] | 13.023 | 11.985 | 2.5212[b] | 16.950[c] |
| $Q^2$(24) | 15.366 | 14.766 | 21.615 | 28.235 | 9.2364 | 18.394 | 20.718 | 13.201[d] |

*Note*: ***, **, and * refer to significance at 1%, 5% and 10%, respectively. Values in parentheses are *t*statistics.
[a, b, c, d] at lag 10, lag 2, lag 11 and lag 23, respectively.

The results for Model 3 are reported in Table 4. For the Liv-ex 100, the conditional variance in the mean equation is negative and insignificant, implying that the May effect is not explained by the higher market risk. For the Liv-ex 500, we find that the conditional variance in the mean equation is negative and insignificant. The coefficient of the March dummy in the mean equation is larger than those in Model 2 and significant, which indicates that the higher market risk does not explain the March effect. The Liv-ex Claret Chip result indicates that the conditional variance in the mean equation is positive and significant at the 5% level. The coefficient of the May dummy in the mean equation is negative and not significant. There is no indication that the market risk is the cause of May effect. Nevertheless, $\beta_3$ for May in the variance equation is not significant and smaller than those in Model 2. hus, market risk is not higher in May. The Liv-ex Investables result shows that the conditional variance in the mean equation is negative and significant at the 1% level and does not suggest that market risk is priced. The coefficient of the June dummy in the mean equation is positive and significant with a larger magnitude than those in Model 2, which indicates that the June effect is not related to the higher market risk in June.

Table 4
*Estimated results of Model 3*

| Series<br>Period | Liv-ex 100<br>7/2001 – 12/2010 | | Liv-ex 500<br>1/2001 – 12/2010 | | Liv-ex Claret Chip<br>12/2003 – 12/2010 | | Liv-ex Investables<br>1/1988 – 12/2010 | |
|---|---|---|---|---|---|---|---|---|
| Variable | High | Low | High | Low | High | Low | High | Low |
| Month | May | Sept. | March | Nov. | May | Oct. | June | Nov. |
| Mean equation | | | | | | | | |
| Constant | 0.0033** | 0.1071*** | 0.0006 | 0.0080*** | 0.1121** | 0.0753 | 0.0102*** | 0.0173 |
| | (2.0475) | (4.3486) | (0.0850) | (2.6337) | (2.4832) | (1.4421) | (3.7387) | (0.5120) |
| $R_{t1}$ | 0.4383*** | 0.3265*** | 0.5130*** | 0.4820*** | 0.3155*** | 0.4304*** | 0.3662*** | 0.3857*** |
| | (7.8222) | (3.5780) | (7.0782) | (7.1240) | (2.6677) | (2.7563) | (4.4683) | (3.1441) |
| $h_t$ | 0.0392 | 0.0127*** | 0.0005 | 7.7574 | 0.0136** | 0.0088 | 7.1394* | 0.0036 |
| | (0.0453) | (3.8740) | (0.6817) | (0.4670) | (2.2401) | (1.2998) | (1.6862) | (0.8073) |
| Dummy | 0.0010 | 0.0077 | 0.0112*** | 0.0092** | 0.0052 | 0.0447* | 0.0519*** | 0.0116* |
| | (0.2825) | (1.0850) | (2.6917) | (1.9858) | (0.1733) | (1.9538) | (3.2449) | (1.7092) |
| Variance equation | | | | | | | | |
| C | 0.0002*** | 0.0003** | 0.0000* | 0.0001*** | 0.0004*** | 0.0006** | 0.0005*** | 0.0007*** |
| | (3.2460) | (4.4240) | (1.6648) | (3.1980) | (3.1868) | (5.4152) | (9.9404) | (5.9338) |
| $\varepsilon^2_{t-1}$ | 1.0309** | 0.7070*** | 0.1485*** | 0.1849*** | 0.6015*** | 0.2338** | 0.3213*** | 0.4855*** |
| | (2.5012) | (3.5527) | (8.6727) | (6.4630) | (4.3479) | (2.1224) | (4.4368) | (4.8474) |
| $h_{t-1}$ | 0.0368 | 0.0293 | 1.0135*** | 0.8537*** | 0.0321 | 0.1144 | 0.0402 | 0.0960 |
| | (1.4674) | (0.7855) | (51.9862) | (9.3037) | (0.5743) | (0.8972) | (0.6804) | (1.0027) |
| Dummy | 0.0002*** | 0.0002 | 0.0001** | 0.0001 | 0.0014 | 0.0041 | 0.0026*** | 0.0001 |
| | (2.9383) | (0.5428) | (2.4424) | (0.5466) | (0.9217) | (1.6197) | (3.5134) | (0.5866) |
| LM(1) | 1.9807 | 0.0001 | 0.1635 | 0.0337 | 0.0905 | 0.0293 | 0.0643 | 0.0010 |
| Q(12) | 14.467 | 14.669 | 11.329 | 10.473 | 12.460 | 14.085 | 3.5754[a] | 14.532[b] |
| $Q^2(24)$ | 24.173 | 11.116 | 21.397 | 23.875 | 8.8089 | 18.603 | 21.577 | 12.556[c] |

*Note*: ***, **, and * refer to significance at 1%, 5% and 10%, respectively. Values in parentheses are tstatistics. [a, b, c] at lag 2, lag 10 and lag 22, respectively.

The LMstatistics show that ARCH effects are not present, and the LjungBox statistics show that there is no serial correlation between the error terms. Hence, we confirm that our models are well specified with Model 3.

## CONCLUSIONS

This paper investigates the monthly effect in the Liv-ex wine market. We find a March effect in the Liv-ex 500, a May effect in the Liv-ex 100 and Liv-ex Claret Chip and a June effect in the Liv-ex Investables. Although market risk is higher in March and June for Liv-ex 500 and Liv-ex Investables, respectively, this higher market risk is not the cause of the monthly effect. Therefore, we conclude that calendar anomalies, in particular, the monthly effect, exist in the Liv-ex wine market. Investors may gain abnormal returns if they buy or store wine in the month with the lowest mean return and sell it in the month with the highest mean return.

The possible explanations of the monthly effect could be related to economic conditions, the grape harvesting period and demand from Asian buyers. Cevik and Sedik (2010) found that the global financial turmoil and the economic recession had an adverse impact on the global wine demand, causing a 42% decline in fine wine prices in the second half of 2008. According to the *2010 Economic Report of the US President*, the global financial crisis began in September 2008. During the second quarter of 2009, the world showed the first hint of recovery, with an average growth rate of 2.4%. This could be one of the reasons why the four indices recorded the highest mean return in the first half of the year (March, May and June) and the lowest mean return in the second half of the year (September, October and November).

The monthly effect in the wine market could also be affected by the grape harvesting season, which normally occurs from late September to early October in the Northern Hemisphere (France, Italy and Spain) and from February to April in the Southern Hemisphere (Chile, Argentina, Australia, South Africa and New Zealand). All four Liv-ex indices consist mostly of the wines from France, followed by Italy, while the Liv-ex 500 has approximately 2.7% of wines from the New World countries in the Southern Hemisphere. Thus, the March, May and June effects that were found in the three indices could be due to the time lag between harvesting and the time when experts evaluate the quality of wine. In other words, buyers wait for expert ratings such as those by Robert Parker before deciding to buy wine.

Emerging market economies, such as China, which increased the demand for wine, could be another explanation for the monthly effect. Cevik and Sedik

(2010) found that emerging market economies contribute to most of the incremental change in aggregate demand; they have a greater significance in determining price fluctuations. We suspect the increase in demand is due to wine fair and wine trade shows, which are commonly organised from March to June. For instance, The Vinexpo organised 'The Vinexpo Asia Pacific' in Hong Kong on 23 to 25 May 2006, 27 to 29 May 2008 and 25 to 27 May 2010. The expo attracted 800 exhibitors from 32 countries and provided a platform for trade professionals from the wineproducing regions in the world. China's membership in the World Trade Organisation, which began in December 2001, has allowed the tariff on imported wine to be cut from 65% to 14%. The tariff cut has encouraged more exhibitions and trade shows in China. For example, The International Wine and Spirits Exhibition and the World Famous Wine Festival in Guangzhou have been held twice yearly in May or June and November since 2005. In Beijing, the International Dedicated Wine Exhibition is held once a year in May, and the Wine China Exhibition is held at the end of April. In Chengdu, 'Tang Jiu Hui,' or the Alcoholic Drinks Trade Show, is held in March, while in Shanghai, the International Wine Trade Fair is held in June. Nevertheless, future research could examine the relationship between the monthly effect and the factors mentioned above.

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## NOTES

1. Passion investment is the investment in luxury goods such as jewellery, gems, watches, coins, musical instruments, wines and art.
2. see (Lyons, 2010).
3. see (Black, 2011).
4. see (Laube & Molesworth, 1996).
5. Appellation refers to the area where a wine's grapes are grown.
6. A chateau is a wine estate with its own winery and vineyards.
7. Terroir is the interaction of soil, climate, topography and grape variety in a specific site, making each wine from a specific site distinct.
8. Investmentgrade wine, or IGW, includes Bordeaux classed growths, and several red Burgundies, such as Domaine de la RomaneeConti and La Tache.
9. Readers may find more literature review from Lean et al. (2007) and Lean and Tan (2010).

10. The lowest price that is received from any merchant in the last 30 days. If no price is received in that period, the lowest list price from the first preceding calendar month where the wine is listed is used.
11. Because of space limitations, we report only the results for the highest mean return; others are available upon request.

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