Implications of the Bordeaux Bubble Burst on Fine-Wine Investment

By

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Contents

Abstract

I analyzed the potential of first growth Bordeaux wines as an alternative investment to the more traditional US equities. This analysis was done with a special focus on how the Chinese economy has behaved from April 2011 to February 2016. I established that China was the major driving force for the appreciation of Bordeaux wine prior to this period, and thus the Bordeaux bubble burst in China had an adverse impact on this asset class. Using the Five-Factor Fama-French model, I concluded that for the time period under consideration, these wines have been a high risk and low return investment.

Acknowledgements

1. Introduction

Investment in alternative assets is generally considered to be profitable because these investments diversify an investor's portfolio. Many empirical studies, however, have shown that these assets, are in fact less attractive, relative to the traditional stocks and bonds. Alternative asset is a very broad term that incorporates almost anything whose investment performance is not correlated with that of bonds and stocks. It can include physical assets like real estate, paintings, fine wine; geographic regions such as emerging markets; or even collectibles. The lack of these asset's correlation with other types of investments, adds diversity to an investor's portfolio. Thus, these alternative assets complement the more traditional asset classes by providing an additional layer of diversification. These assets, however, tend to be less liquid than stocks or bonds and depending on the specific asset, performance measures and risks might be difficult to research and evaluate.

Asset classes such as paintings and fine wine are increasingly being viewed as alternative investment assets. In this thesis, I evaluated the returns given by first growth Bordeaux wines[1], specifically since 2011, to see how certain events in China have impacted this alternative asset. It is important to note that although economic events in China have driven the results of this study, the data used for wine prices and returns is the average retail price worldwide, and thus a portfolio of these securities can be used to compare the performance of wine relative to US equities.

2. Wine as an alternative investment

Wine, in particular possess certain characteristics, such as an active trading market, which allows its characterization as an alternative asset. In the past three decades, a large industry has

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[1] Refer to section 4 for details about the first growth of Bordeaux wines

developed around wine-investing. Several investment vehicles such as The Wine Investment fund-open to retail and institutional investors, situated in the UK; the Ascot Wine Management Fine Wine Fund, a Bahamian company; or the Orange Wine Fund listed on Amsterdam's Euronext stock exchange have developed to legitimize this wine-investing phenomenon. Further, the existence of The London International Vintners Exchange or the Liv-ex allows for the regular trading of wine, making it similar to any other financial asset. Finally, just like traditional assets, wine also has a futures market.

2.1 <u>Liv-Ex</u>

The London International Vintners Exchange (Liv-ex) is an exchange that was established for investment grade wine. Liv-ex is comparable to stock market indices, in that it tracks wine prices as well as reports the development of several wine price indices[i]. Founded in 1999, it serves as a global marketplace for professional buyers and sellers of fine wine. The wines traded on Liv-ex have a significant trading volume on the second-hand market, and are traded by the case. Further, Liv-ex publishes five different wine indices, whose construction is similar to a stock market index[ii].

2.2 <u>En Primeur or Wine Futures</u>

En Primeur or wine futures is the process of buying wines before they are bottled up and released to the market. These futures are purchased exclusive of Duty and VAT and then usually shipped about three years after the vintage was produced. The opening price of En Primeur is always considerably cheaper, as compared to the future price of the wine on the open market. En Primeur is oftentimes treated as the only way to secure wines that are available in very limited quantities[iii].

3. __Literature Review__

Although research regarding wine as an alternative investment is sparse, several studies have been conducted to see its viability, with mixed results and recommendation. Sanning, Shaffer, and Sharrat (2008) analyzed the level and quality of Bordeaux wine returns using the Fama-French Three-Factor model, as well as the Capital Asset Pricing Model and concluded that investment grade wines benefit from low exposure to market risk factors, and thus diversify an investor's portfolio. Krasker (1979) conducted a study analyzing the returns on storing wine and concluded that there was no actual risk premium for storing red Bordeaux and California Cabernet Sauvignon wines. However, when Jaeger (1981) extended the sample period used by Krasker and incorporated significantly lower wine storage costs, she established that fine wine does diversify an investor's portfolio by giving risk premiums in excess of 12%[iv].

Weil (1993), however, calculated the returns to wine portfolios from 1980-1992, and showed that wine assets have a 9.5% return on average that increases to 11% if the portfolio is restricted to Bordeaux wines. This displayed that returns from investing in wine were much less as compared to the New York Stock Exchange (NYSE) return, which was about 15%. Similarly, Burton and Jacobsen (2001) studied the rate of return to wine as an alternative investment and concluded that wine did not yield greater returns than financial assets, particularly if they accounted for the transaction costs and the volatility of returns[v]. Through this paper, I extended the concept used by Sanning, Shaffer and Sharrat (2008) and studied data, specifically after the global financial crisis and the burst of the Bordeaux wine bubble. Further, I analyzed the quality of returns for the first growth of Bordeaux wines using the Fama-French Five-Factor model.

4. <u>Bordeaux wines</u>

Bordeaux wines, produced in the Bordeaux region of France are some of the most famous and highly reputed wine blends in the world. Although the region produces red, white and rose wines, it is most famously known for the red variety, which is usually made from blending Cabernet Sauvignon and Merlot wines together. The Gironde estuary cuts this region through the center, creating a left bank and a right bank. The left bank blends tend to be more tannic, acidic and alcoholic than the wines from the right bank. These are powerful and rich wines, that are considered to age better than their counterpart. Thus, this is the bank that made the region famous. Right bank blends on the other hand are softer, less tannic and lower in acidity and alcohol content. Because Merlot is the dominant grape, these right bank wines are juicier and ready for consumption much earlier than Left Bank Bordeaux, often making them less expensive. The success of all Bordeaux wines can be attributed to the location of this region. This part of France not only possess an ideal climate and soil for growing grapes, but has also served as a major port city for centuries, giving local winemakers the opportunity to access different regions of the world[vi].

4.1 <u>Bordeaux Vintages</u>

A Bordeaux wine vintage is the year in which the wine was produced. This is extremely important, since metrics like yield and grape quality potential vary greatly from one year to another. This variability is the result of changing climate conditions and was studied by Orley Ashenfelter. Ashenfelter found that weather was extremely crucial in producing a good quality vintage. Particularly, a warm growing season, a dry harvest, and plenty of rainfall in the winter preceding the growing season created ideal conditions for high-quality wine in the Bordeaux region[vii].

4.2 The Bordeaux Wine Official Classification of 1855

In 1855, French Emperor Napoleon III held the Exposition Universelle de Paris, which resulted in the 1855 Classification of Bordeaux wines. He requested for a classification system for the best Bordeaux wines, which were to be displayed for tourists from around the world. These wines were ranked according to a wine producer's (chateau's) reputation and trading price, which at that time was directly related to quality. This classification was restricted only to the wines from the left bank.

The 1855 classification created the Grand Crus Classes or the Great Classified Growths list that ranked red wines from this region in importance from first to fifth growths. Since the white wines were of much less importance at the time, they were limited to the sweet varieties of Barsac and Sauternes, only being ranked from superior first growth to second growth[viii]. This historic 1855 Bordeaux Classification is one of the single most important and famous classifications of any wine region in the world. This classification has only been through two changes since it was introduced, and is still widely used, almost 160 years later[ix].

4.3 Premier Cru or First growth

Within the Great Classified Growths list, wines are further divided in five categories, with only the best wines being assigned to the highest rank of Premier Cru or First Growth. Initially, this list only consisted of four wines, Chateau Lafite Rothschild, Chateau Latour, Chateau Margaux and Chateau Haut-Brion. However, a change was made to this list in 1973, which gave another wine, Chateau Mouton Rothschild the status of Premier Cru. All the wines on the first growth list are entitled to the designation of AOC or the appellation d'origine contrôlée, which is a French government certification. Four of the wines that made it on the list come from the Medoc region- Chateau Lafite Rothschild, Chateau Latour, and Chateau Mouton Rothschild

from the Pauillac appellation, and Chateau Margaux from the Margaux appellation. However, the fifth one, Chateau Haut-Brion comes from the Pessac-Leognan appellation, which is from the Graves sub-region[x].

FIGURE 1

Map of Bordeaux region, with the Gironde estuary dividing the right and left banks. The highlighted areas are appellations whose wine is analyzed in this research. [xi]

I used data on first growth red Bordeaux wines for the purpose of this research for two primary reasons. Firstly, according to the research by Jaeger (1981), red Bordeaux wines benefit from extended aging, and thus are more often purchased for investment rather than consumption

purposes. Further, Bordeaux wines are the most heavily traded category on the Liv-ex, with them accounting for 73.8% of total regional share of trade by value in 2016[xii].

5. Data

I collected the Bordeaux wine prices used in this study from wine searcher, a web-search engine dedicated to wine[xiii]. These prices are purely the prices for a vintage at retailers and wineries and do not include the wine futures. I then used the Bordeaux wine prices to calculate the return given by each wine for every month by dividing the current month's price by the previous month's. Finally, I calculated the natural log of this to reach the returns used in all data analysis. I took the data for the Five-Factor Fama-French model directly from Kenneth French's website, where the data is updated monthly[xiv]. The five factors consist of components that measure the value weighted excess returns on NYSE, AMEX and NASDAQ stocks$(R_m - R_f)$, the difference in average return on small and large market equity firms (SMB), the difference in average return between value and growth stocks (HML), the difference in average returns between robust and weak future earnings (RMW) and the difference in returns for stocks with conservative and aggressive investment (CMA). I discuss these factors in detail in Section 8.

6. Data analysis

I analyzed the returns from the first growth of Bordeaux wines over the time period April 2011 to February 2016, with a focus on vintages from 1980 to 2010.

Looking at the returns of these 155 wines, it appears that vintages from 1980, 1981, 1984, 1987, 2004 and 2009 have out-performed the rest across all chateaux. Most of the vintages from 1980's seem to be giving a good return because these older wines have been held for longer. Thus, these wines usually bear a normal rate of return, resulting in them being more expensive over time than the younger ones[xv]. Further, wine also appreciates in monetary as well as gastronomic value

as it matures[xvi]. This happens because as the wine matures, it becomes rarer and more desirable, and if stored under proper conditions, these factors can drive up the prices. On an individual basis, while 1984 has been the best vintage for Chateau Margaux, and Chateau Haut-Brion, 1981 was the best for Chateau Latour, 2006 for Chateau Lafite Rothschild and 2000 for Chateau Mouton Rothschild. On the other hand, 2008 has consistently been the worst performing vintage for all five chateaux. (See Appendix: Figures 8-12).

Figure 2 below, which shows the average performance of all five chateaux displays a similar trend- on an average 1984 vintages had the highest return (-0.14%) and 2008 vintages had the lowest returns (-1.09%) (See Appendix: Table 12). However, even the best performing vintage gave a negative return, reasons for which I discuss in Section 10.

FIGURE 2
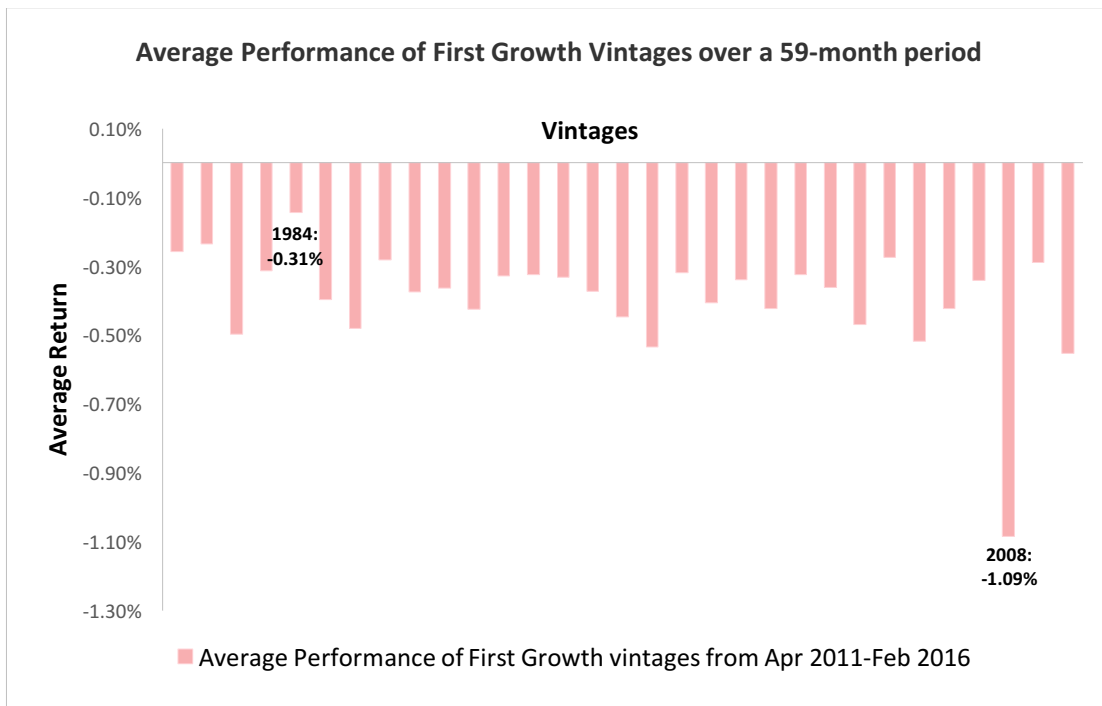
Average return given by each vintage from April 2011 to February 2016. Over the 59 months, the 1984 vintage had the best performance, yielding a -0.31% return, whereas the 2008 vintage had the worst performance, giving -1.09%

I attribute the bad performance of the 2008 vintage to the fact that 2008 was one of the coldest years in recent history, resulting in less than ideal wine growing condition. For this particular year, many of Britain's biggest wine traders did not even go to Bordeaux during the spring to taste the "primeur" or young wine and place advance orders. This resulted in almost a 30-40% discount for the 2008 wine futures, resulting in a very low return[xvii]. 2008 later proved to be a better than expected vintage, however, since this data captures returns from 2011- when the vintage would've first started selling- it results in giving the worst returns. Thus, although the data I used for this research does not include the wine futures explicitly, this particular event had an impact on the sale of actual bottles to retailers and wineries, which I captured and analyzed in this paper.

The 1984 vintage on the other hand has proven to be the best vintage over the same time-period. Although 1984 hasn't been regarded as a good vintage in wine literature, the appreciation in its prices for this data set, especially for Chateau Haut-Brion and Chateau Margaux have resulted in an increased average return for this particular vintage. It should be taken into account, however, that these increased returns are on a relative basis. 1984 was a particularly cool year, which resulted in a bad quality vintage with low prices. Thus, when prices for all other vintages fell drastically during this period of the Bordeaux bubble burst and slowdown of Chinese economy (See Section 10), the 1984 vintage prices fell relatively less. Therefore, it appears that the 1984 vintage has performed relatively better than the others during this time period.

7. **Methodology and Portfolio Creation**

For the purpose of this study, I created different portfolios consisting of the wine assets. These portfolios can primarily be divided into two categories- classification by chateau and classification by vintage.

<u>7.1 Chateau Portfolios</u>

For the chateau portfolios, I assumed that an investor is going to invest in different vintages and build their portfolio, as long as they come from the same chateau. Since different vintages, even from the same chateau, give extremely different returns, they can be considered as different 'assets'. These portfolios that were classified by chateaux, were further divided into two sub-categories- equally weighted and value weighted portfolios.

The equally weighted portfolios gave all vintages from a certain chateau the same weight for that portfolio. Since I analyzed first growth vintages from 1980-2010, this resulted in five portfolios, where each asset or vintage had a weight of 3.23%. There is a sixth portfolio in the equally weighted category, which consists of all vintages from all chateaux. Thus, this portfolio consists of 155 wines or 'securities', (five chateaux and 31 vintages per chateau) each weighing 0.65%.

TABLE 1

Descriptive Statistics for Equally Weighted Chateau Portfolios						
Portfolio	# Securities	Average Returns	Standard Deviation	Minimum	Maximum	#Obs
Bordeaux Wine	155	-0.39%	2.65%	-11.01%	11.86%	59
Haut-Brion	31	-0.21%	3.13%	-13.82%	15.01%	59
Mouton Rothschild	31	-0.21%	3.11%	-13.45%	14.85%	59
Lafite Rothschild	31	-0.88%	3.09%	-14.14%	14.12%	59
Latour	31	-0.32%	1.61%	-5.33%	4.13%	59
Margaux	31	-0.35%	3.09%	-13.64%	14.53%	59

Descriptive statistics for equally weighted portfolios classified by different chateaux

The value weighted portfolios give different vintages from a certain chateau different weights within the portfolio. This weight is determined based on the average return a certain vintage from a particular chateau has given from April 2011 to February 2016. This resulted in

five portfolios (each with 31 wines), one for each chateau, where every security has a different weight.

TABLE 2

Descriptive Statistics for Value Weighted Chateau Portfolios						
Portfolio	# Securities	Average Returns	Standard Deviation	Minimum	Maximum	#Obs
Haut-Brion	31	-0.42%	6.93%	-35.92%	36.80%	59
Mouton Rothschild	31	-0.50%	7.06%	-37.86%	36.18%	59
Lafite Rothschild	31	-0.91%	2.98%	-13.50%	13.27%	59
Latour	31	-0.45%	1.57%	-5.76%	3.70%	59
Margaux	31	-0.43%	4.39%	-22.13%	22.01%	59

Descriptive statistics for value weighted portfolios classified by different chateaux

7.2 Vintage Portfolios

For the vintage portfolios, I assumed that an investor is going to invest in all five chateaux; however, he will only invest in one particular vintage for creating one portfolio. Since I had 31 different vintages for this research, this resulted in 31 portfolios, each consisting of five wines- one from every chateau. All these portfolios are equally weighted and thus, each security will have a weight of 20%.

<div align="center">

TABLE 3

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		Average	Standard			
Descriptive Statistics for Equally Weighted Vintage Portfolios						
Portfolio	# Securities	Returns	Deviation	Minimum	Maximum	#Obs
1980	5	-0.26%	2.41%	-5.63%	5.09%	59
1981	5	-0.24%	2.18%	-5.82%	5.88%	59
1982	5	-0.50%	1.63%	-5.97%	3.09%	59
1983	5	-0.31%	1.83%	-5.32%	4.00%	59
1984	5	-0.14%	2.72%	-9.48%	6.36%	59
1985	5	-0.40%	1.90%	-7.45%	3.22%	59
1986	5	-0.48%	1.68%	-5.93%	3.63%	59
1987	5	-0.28%	2.21%	-5.24%	6.72%	59
1988	5	-0.37%	1.58%	-5.96%	2.19%	59
1989	5	-0.36%	1.58%	-5.21%	4.04%	59
1990	5	-0.43%	1.68%	-5.25%	3.08%	59
1991	5	-0.33%	2.12%	-6.56%	7.39%	59
1992	5	-0.32%	2.01%	-7.59%	5.08%	59
1993	5	-0.33%	2.04%	-6.80%	5.43%	59
1994	5	-0.37%	1.83%	-6.32%	4.97%	59
1995	5	-0.45%	1.56%	-5.57%	3.09%	59
1996	5	-0.53%	1.64%	-6.13%	4.14%	59
1997	5	-0.32%	2.01%	-5.91%	4.26%	59
1998	5	-0.41%	1.65%	-5.51%	3.79%	59
1999	5	-0.34%	1.66%	-5.03%	4.55%	59
2000	5	-0.42%	1.48%	-5.55%	3.46%	59
2001	5	-0.32%	1.70%	-5.81%	4.36%	59
2002	5	-0.36%	1.79%	-6.21%	5.39%	59
2003	5	-0.47%	1.52%	-4.82%	2.69%	59
2004	5	-0.28%	1.64%	-5.49%	5.36%	59
2005	5	-0.52%	1.49%	-4.77%	2.58%	59
2006	5	-0.42%	1.56%	-4.91%	4.13%	59
2007	5	-0.34%	1.72%	-4.81%	4.28%	59
2008	5	-1.09%	1.85%	-8.87%	4.03%	59
2009	5	-0.29%	1.90%	-5.88%	4.80%	59
2010[2]	5	-0.53%	63.16%	-350.30%	329.45%	57

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[2] See Section 11, and Appendix Figure 18, Table 15 for anomaly explanation

8. <u>Five- Factor Fama-French Model</u>

Eugene Fama and Kenneth French developed a Three-Factor Model (TFM) in the early 1990's to better describe stock returns when compared to the tradition Capital Asset Pricing Model (CAPM). The traditional CAPM only uses one variable- market beta, to measure the risks of a stock or portfolio, and assumes that this beta can sufficiently describe the expected returns on US equities. However, the TFM makes this equation more dynamic by adding firm size (SMB) and price-to-book (HML) metrics to the existing model. This three factor model proves that there exists a strong negative relationship between firm size and average return and a strong positive relationship between price-to-book ratios (value stocks) and average return. These relationships are justified by the fact that smaller firms and value firms are riskier and thus would generate a higher return. The following is the equation foe the TFM:

$$R_{it} = RF_t + \beta_{1i}(RM_t - RF_t) + \beta_{2i}(SMB_t) + \beta_{3i}HML_t + \alpha_i + \varepsilon_{it}$$

where:

R_{it} = Return on asset i at time t

RF_t = U.S. risk free rate (one-month T-bill)

RM_t = value-weighted return on all NYSE, AMEX, and NASDAQ stocks

SMB = Small Minus Big

HML = High Minus Low

α_i = intercept of regression (excess returns generated by asset)

ε_{it} = error term

Fama and French recently expanded the TFM to include two more factors, creating a Five-Factor Model (FFM). This FFM adds two new elements – future earnings (RMW) and investment

(CMA). The first component shows that companies with higher or robust future earnings will have higher stock market returns than companies with weak future earnings. The second element shows the average returns on conservative investment portfolios over aggressive investment portfolios. It suggests that firms that are not undertaking major growth initiatives give higher returns. The following is the equation for FFM:

$$R_{it} = RF_t + \beta_{1i}(RM_t - RF_t) + \beta_{2i}(SMB_t) + \beta_{3i}(HML_t) + \beta_{4i}(RMW_t) + \beta_{5i}(CMA_t) + \alpha_i + \varepsilon_{it}$$

where the additional factors can be defined by:

RMW = Robust Minus Weak

CMA = Conservative Minus Aggressive

I used this Five-Factor model to analyze the level of Bordeaux wine returns and whether it is a good investment or not.

9. <u>Hypotheses and Results</u>

9.1 <u>Hypothesis 1</u>

First Growth Bordeaux wines can be used as an alternative investment to US equities.

The returns for the first growth Bordeaux wines have an extremely low correlation to the returns given by US equities. For the purpose of this paper, I regarded the return on US equities as the excess return on the equity market, which is the value-weighted return on all New York Stock Exchange (NYSE), American Stock Exchange (AMEX), and NASDAQ Stock Market (NASDAQ) stocks minus the one-month Treasury bill rate[3].

As seen from the correlation matrices below, when I looked at chateau portfolios, their returns had very low correlation with the returns on the US equities.

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[3] $(RM_t - RF_t)$ from the Five-Factor Fama-French model

TABLE 4

Correlation matrix for equally weighted chateau portfolios

	Entire Portfolio	Haut-Brion	Mouton Rothschild	Lafite Rothschild	Latour	Margaux	US Equities
Entire Portfolio	1.00						
Haut-Brion	0.99	1.00					
Mouton Rothschild	0.99	0.98	1.00				
Lafite Rothschild	0.98	0.97	0.98	1.00			
Latour	0.62	0.53	0.53	0.52	1.00		
Margaux	0.99	0.98	0.98	0.98	0.54	1.00	
US Equities	*0.23*	*0.18*	*0.16*	*0.19*	*0.42*	*0.22*	1.00

The correlation matrix shows how 2 variables are related to each-other. The low values in the last row indicate that the equally weighted chateau portfolios have low correlation to the US equities.

TABLE 5

Correlation matrix for value weighted chateau portfolios

	Haut-Brion	Mouton Rothschild	Lafite Rothschild	Latour	Margaux	US equities
Haut-Brion	1.00					
Mouton Rothschild	1.00	1.00				
Lafite Rothschild	0.93	0.92	1.00			
Latour	0.27	0.27	0.56	1.00		
Margaux	0.99	0.99	0.96	0.40	1.00	
US equities	*0.07*	*0.07*	*0.19*	*0.42*	*0.14*	1.00

The correlation matrix shows how 2 variables are related to each-other. The low values in the last row indicate that the value weighted chateau portfolios have low correlation to the US equities

Similarly, when I looked at vintage portfolios for different decades, it gave the same result.

The returns on these portfolios too are not correlated to the returns from US equities.

TABLE 6

Correlation matrix for Vintage Portfolios- vintages: 1980-1989

	1980	*1981*	*1982*	*1983*	*1984*	*1985*	*1986*	*1987*	*1988*	*1989*	*US equities*
1980	1.00										
1981	0.63	1.00									
1982	0.56	0.76	1.00								
1983	0.50	0.78	0.86	1.00							
1984	0.53	0.73	0.70	0.75	1.00						
1985	0.54	0.79	0.89	0.84	0.73	1.00					
1986	0.49	0.76	0.86	0.86	0.66	0.87	1.00				
1987	0.55	0.77	0.74	0.79	0.72	0.79	0.72	1.00			
1988	0.51	0.67	0.81	0.82	0.69	0.83	0.83	0.72	1.00		
1989	0.59	0.79	0.87	0.87	0.71	0.83	0.90	0.77	0.84	1.00	
US equities	*0.19*	*0.39*	*0.38*	*0.39*	*0.34*	*0.38*	*0.35*	*0.24*	*0.31*	*0.32*	1.00

The correlation matrix shows how 2 variables are related to each-other. The low values in the last row indicate that the equally weighted vintage portfolios from 1980-1989 have low correlation to the US equities

TABLE 7

Correlation matrix for Vintage Portfolios- vintages: 1990-1999

	1990	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*US Equities*
1990	1.00										
1991	0.85	1.00									
1992	0.83	0.88	1.00								
1993	0.84	0.85	0.89	1.00							
1994	0.87	0.87	0.91	0.91	1.00						
1995	0.88	0.83	0.87	0.87	0.89	1.00					
1996	0.87	0.82	0.86	0.83	0.88	0.92	1.00				
1997	0.84	0.82	0.88	0.89	0.90	0.86	0.83	1.00			
1998	0.90	0.85	0.86	0.85	0.89	0.91	0.91	0.88	1.00		
1999	0.88	0.86	0.89	0.84	0.89	0.91	0.92	0.90	0.93	1.00	
US Equities	*0.42*	*0.36*	*0.30*	*0.31*	*0.28*	*0.41*	*0.31*	*0.38*	*0.39*	*0.34*	1.00

The correlation matrix shows how 2 variables are related to each-other. The low values in the last row indicate that the equally weighted vintage portfolios from 1990-1999 have low correlation to the US equities

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TABLE 8

Correlation matrix for Vintage Portfolios- vintages: 2000-2010

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	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	US equities
2000	1.00											
2001	0.88	1.00										
2002	0.89	0.92	1.00									
2003	0.90	0.90	0.89	1.00								
2004	0.88	0.93	0.94	0.88	1.00							
2005	0.89	0.86	0.82	0.87	0.87	1.00						
2006	0.88	0.91	0.87	0.86	0.93	0.88	1.00					
2007	0.85	0.88	0.88	0.82	0.88	0.82	0.93	1.00				
2008	0.84	0.76	0.78	0.76	0.80	0.81	0.82	0.78	1.00			
2009	0.83	0.83	0.83	0.80	0.84	0.86	0.86	0.87	0.75	1.00		
2010	0.15	0.08	0.11	0.15	0.07	0.11	0.05	0.02	0.05	0.09	1.00	
US equities	*0.33*	*0.37*	*0.37*	*0.37*	*0.32*	*0.35*	*0.38*	*0.34*	*0.29*	*0.44*	*0.00*	1.00

The correlation matrix shows how 2 variables are related to each-other. The low values in the last row indicate that the equally weighted vintage portfolios from 2000-2010 have low correlation to the US equities

This hypothesis can further be confirmed by looking at the results of the regression given in the table below. When returns on these portfolios are run against the Five-Factor Fama-French model, the average coefficients for all five risk exposures are very small relative to traditional equities, and some of them are even negative. Thus, these small risk factor loadings confirm that wine returns co-vary minimally with market returns and other risk factors defined by the model.

<div align="center">

TABLE 9

Average Regression Results

</div>

	Average Excess Returns	Average $RM_t - RF_t$	Average SMB	Average HML	Average RMW	Average CMA
Equally weighted Vintage portfolios	-0.00803	0.00223*	-0.00142	0.00397*	0.00068	-0.00932*
Value weighted chateaux portfolios	-0.00969	0.00221*	-0.00220	0.00335	-0.00006	-0.00875*
Equally weighted chateaux portfolios	-0.00803	0.00223*	-0.00142	0.00397	0.00068	-0.00932*

This table shows that the average regression results for the wine portfolios result in very low coefficients, indicating that these market factors have zero or a minimal effect on Bordeaux wine. The equally weighted chateaux portfolio category contains the Bordeaux wine portfolio with all 155 securities. * Indicates that a given independent variable is significant for that classification. For a detailed breakdown of level of significance, please see the Appendix (Table 13, 14, 15, 16 and 17)

Although regressions run for most of these different portfolio showed that $RM_t - RF_t$ is a positive and significant variable, indicating that the portfolios are correlated with the market, the extremely low value of the coefficient confirmed that the impact was marginal. Further for all three classifications, CMA is negative and significant, and for equally weighted vintage portfolios, HML also becomes positive and slightly significant. This indicates that market sentiment is playing a role. However, for these factors too, the coefficient was almost equal to zero, indicating a marginal and inconsequential impact (See Appendix: Tables 13-17).

Thus, these correlation matrices and regressions proved that Bordeaux wines had a low correlation to the equities market, and could be classified as an alternative investment. Since changes in the two asset classes- wine and equities, bears little to no correlation to one another and moves independently, investing in wine could be a good way to hedge or offset stock market risks.

9.2 Hypothesis 2

Bordeaux wine portfolios are riskier than US equities

Although wine can be classified as an alternative investment, it is argued that majority of wines are not investment-grade, indicating that they carry high risk[xviii]. The table below proves this hypothesis by comparing the standard deviation of wine portfolios to the standard deviation in US equities. As can be seen, regardless of how these wine portfolios were created- chateau or vintage classification- their standard deviation, which is a measure of variation, was higher than the standard deviation of US equities.

TABLE 10

Average Standard Deviation For All Portfolio Classification

Portfolio	Standard Deviation
Chateau Portfolios	3.68%
Vintage Portfolios	3.80%
US Equities	3.62%

Standard deviation is used as a measure of market volatility, and thus risk. This table shows that both chateau and vintage portfolios have a higher standard deviation, i.e., higher risk than an equities portfolio. The chateaux portfolio category contains the Bordeaux wine portfolio with all 155 securities.

This high risk can be explained by the fact that wine-investing involves steep transaction costs, storage and insurance fees and a lack of regulatory oversight[xix]. Adding to this, wine is a highly illiquid asset, since it usually takes four to five months to liquidate a collection of wine unless it is a private sale. This low liquidity adds to transaction costs as well as higher spreads and various administrative and legal fees for wine portfolios. Further, public wine sales are very infrequent, and are conducted only during the spring and fall, which are the auction seasons[xx]. Finally, while investing in wine, the onus of research and knowledge is all on the investor due to the lack of information readily available, which makes it riskier than investing in traditional assets such as stocks.

9.3 <u>Hypothesis 3</u>

Investing in these wines gives a lower return than investing in equities

In 2008, Storchmann analyzed the returns on fine wine, and concluded that wine-investing is not a good strategy, since investing in common stocks yields a higher return in the long run[xxi]. While analyzing the returns given by the first growth over a short period too (59 months), I discovered that wine is not a good investment. Running regressions on all kinds of wine portfolios-chateau or vintage, as well as value or equally weighted, confirmed this hypothesis. As seen from the table below, the average regression intercepts (Jensen's alpha[4]) are negative and almost zero.

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[4] Jenson's Alpha is the excess return of a security or portfolio of securities over the theoretical expected return

These average intercepts represent the average risk adjusted returns on the wine portfolio. This implies that first growth Bordeaux wines provide, on average, negative returns compared to the returns forecasted by the Five-Factor Fama-French model.

TABLE 11

	# Regressions	Average Regression Intercepts (Average Excess Returns)
Equally weighted Vintage portfolios	31	-0.00803
Value weighted chateaux portfolios	5	-0.00969
Equally weighted chateaux portfolios	6	-0.00803

This table shows the average coefficients for all regressions run. It can be seen that all three classifications result in a negative intercept, implying that there are negative excess returns. The equally weighted chateaux portfolio category contains the Bordeaux wine portfolio with all 155 securities.

The figures below further confirm that the excess return on any wine portfolio that I constructed has been negative.
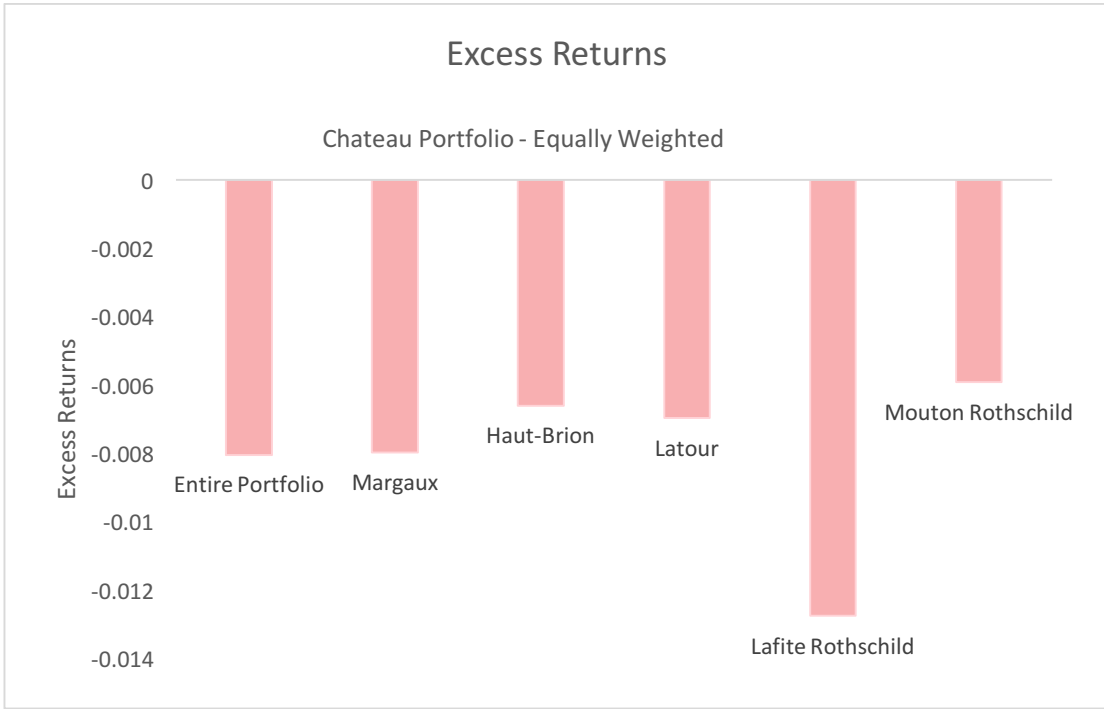
FIGURE 3

This figure shows the excess returns given by all vintage portfolios from Apr 2011 to Feb 2016. It shows that all portfolios gave negative excess returns. 1984 was the best performing vintage and 2008 was the worst. Although 2010 shows greater negative returns than 2008, that is because of missing and skewed data.

FIGURE 4
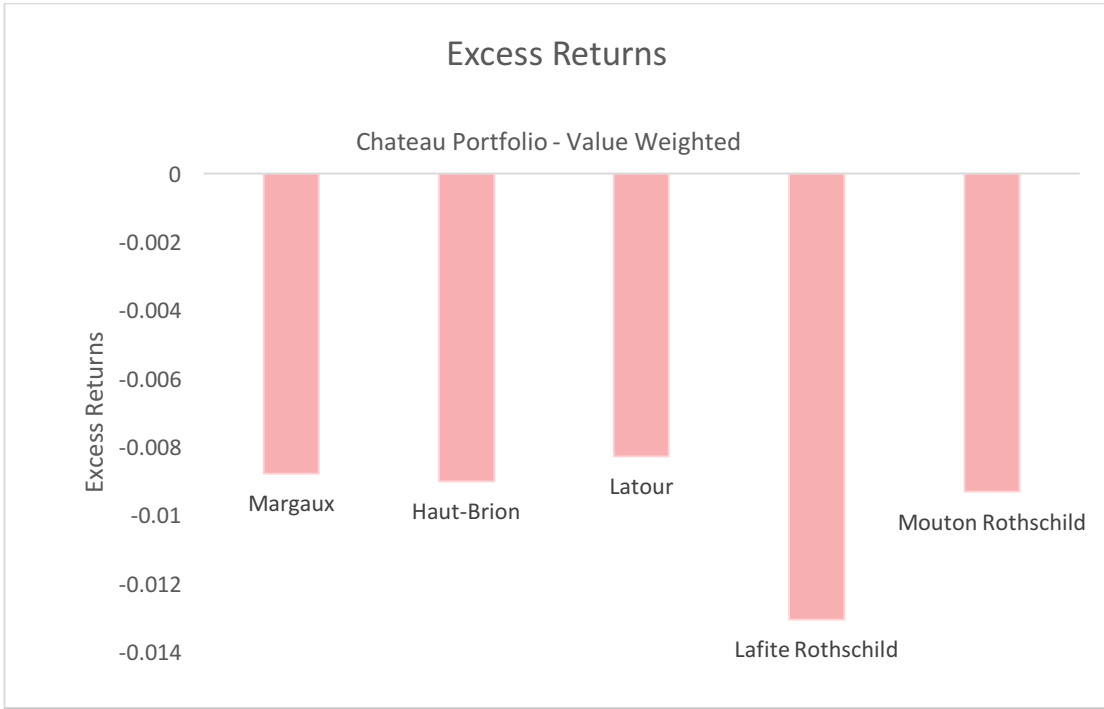
This figure shows the excess returns given by all value weighted chateau portfolios from Apr 2011 to Feb 2016. It shows that all portfolios gave negative excess returns. Chateau Latour had the best performance, whereas Chateau Lafite Rothschild had the worst

FIGURE 5

This figure shows the excess returns given by all equally weighted chateau portfolios from Apr 2011 to Feb 2016. It shows that all portfolios gave negative excess returns. Chateau Mouton-Rothschild had the best performance, whereas Chateau Lafite Rothschild had the worst

Further, when returns on all of these portfolios were plotted against the returns given by US equities, it can be seen that the equities portfolio has consistently outperformed the wine portfolios (See Appendix: Figures 13-16).

## 10. **Low Returns on Bordeaux Wine**

10.1 Burst of the Bordeaux Bubble in China

Historically, Bordeaux wines have been considered to be a good investment, giving positive excess returns[xxii]. It seems, however, that the period under analysis is an anomaly, because of which different results are being yielded.

Bordeaux vintages enjoyed a bullish period in the early 2000's, until mid-2011, when a bubble, which had been inflated due to Chinese demand, peaked and burst. According to a Liv-ex study, there is a very strong correlation between the performances of the Liv-ex Fine Wine 100 Index and the China Producer Price Index (PPI), which measures changes in the price of goods sold by manufacturers. A rising PPI indicates a rise in price for consumers, and these price pressures are usually associated with rising demand, a sign of growth. This study states that China became a key wine consumer starting in 2009, and the "correlation [seen in Figure 6] underlines the country's importance in moving the market over the years that followed" [xxiii.] This data is clear indication that fine wine prices rose and fell with the Chinese economy, making it a very important player. Thus, these factors are extremely important in explaining the trend of Bordeaux wine prices over the time period covered in this paper.

The high volatility of Bordeaux wines in mid-2011 [Figure 7] confirm the burst of the Bordeaux bubble[xxiv], and this phenomenon explained why the alpha, or the excess returns on a wine portfolio are not positive for the time period from April 2011 to February 2016.

FIGURE 6
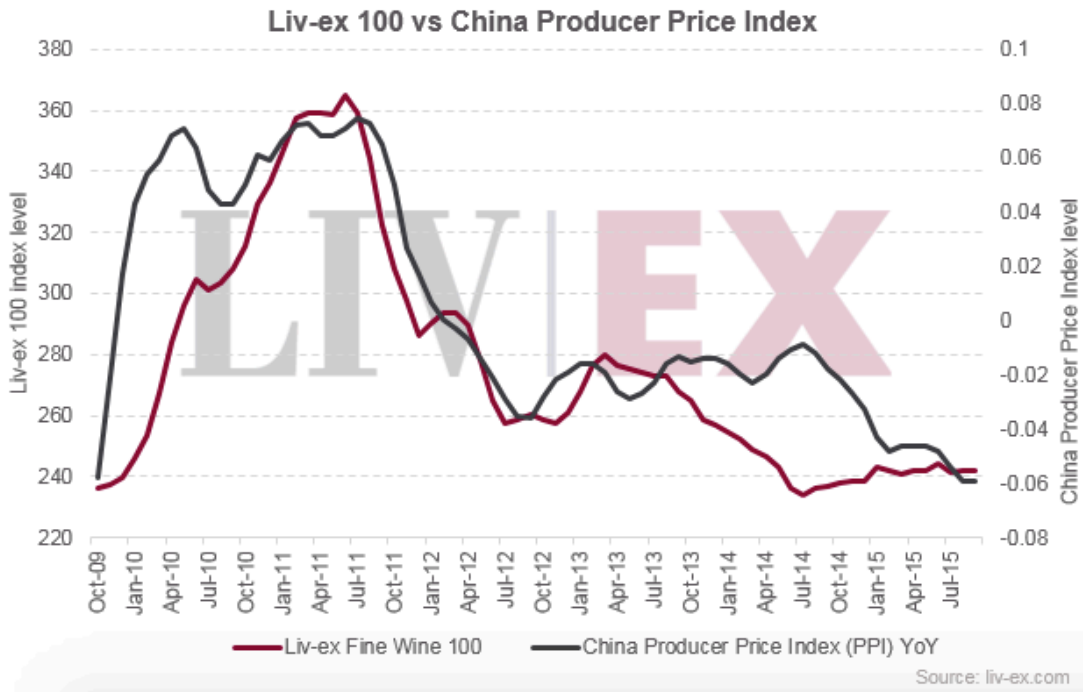
This figure shows the strong correlation between the Liv-ex 100 fine wine index and the China PPI, highlighting the importance of the Chinese economy as a driver for wine (Bordeaux) portfolio returns.

FIGURE 7
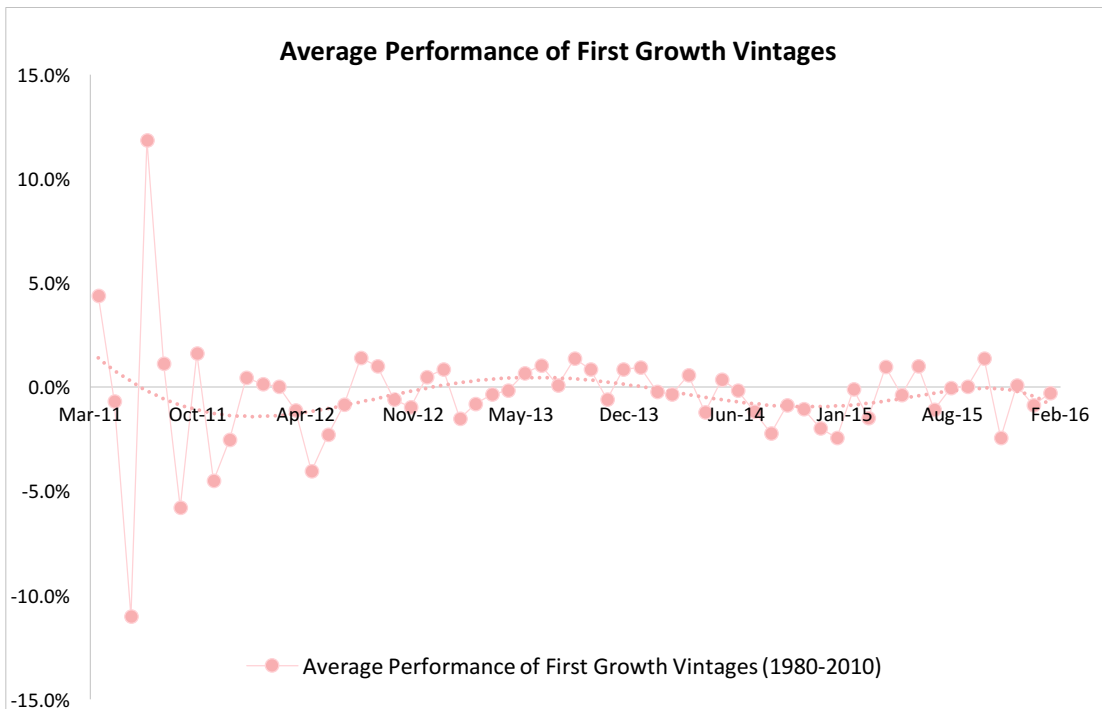
This figure shows how the vintages of all chateaux have performed in a given month. On an average, June 2011 has been the worst month and July 2011 has been the best, but this extreme volatility is due to a bubble burst leading to short-term corrections.

10.1.1 Increase in Chinese Demand of Bordeaux Wines

The early 2000's saw wine as an asset class grow exponentially around the world, but specifically in China. This was attributed to events such as the pre-Olympics Chinese bubble, when wealthy Chinese buyers, backed by the government, started investing in wine. From mid-2005 to the Olympics in 2008, the Liv-ex Fine Wine 100 index skyrocketed 152%[xxv].

After the recent great recession of 2008, Bordeaux wines also received a big boost from the exponential growth in Chinese demand after the abolition of import duties into Hong Kong. However, this led to widespread speculative demand, which ultimately burst the bubble in mid-2011, resulting in falling prices.

10.1.2 Chinese Government Regulations and Ban on Corruption

In 2011-2012, the Chinese government started forcing banks to restrict lending and hold higher reserves as measures against the global economic slowdown. This tightening of credit affected the cash supply in Hong-Kong, further worsening the situation.

During 2012-2013, the prices seemed like they were stabilizing, however the Chinese government introduced intensive measures against, and to reduce corruption by banning excess and corporate gift-giving. This Chinese ban on high-end alcohol for government officials and state-owned firms hurt the state of the country's wine market.

10.1.3 Chinese Economic Conditions

China saw an unparalleled era of extensive growth for almost three decades starting in the 1980's. the Chinese economy grew at a consistent rate of almost 10% during this period, which was three times the global average[xxvi]. The Chinese economy continued to perform spectacularly, even during the recession of 2007-08, growing 9.1% in 2009, despite most of the world suffering an economic slowdown. However, a deceleration in growth in the Chinese economy for 2015

confirmed a multi-year slow down. The growth rate for the fourth quarter of 2015 was between 6.8% and 6.9% and the annual pace was the weakest in a quarter century, which has impacted the Chinese market for luxury goods, such as Bordeaux wines[xxvii].

Weakening economic conditions supplemented by concerns regarding a Chinese real-estate bubble, starting in 2012 further affected the wine industry, as many Chinese wine distributor-importers and investors had significant investments in real-estate. Thus, "fear of the property bubble [started] making people anxious.[xxviii]"

10.1.4 Price Corrections

During the same time period, there was a correction concerning the 2010 Bordeaux futures. The Chinese bought a large volume of en primeurs in 2011, mostly for the first time and at record high prices. As these prices started tumbling, many cancelled Chinese orders resulted in an extreme downward pressure on the wine prices[xxix].

Further, the slowdown in the economy's growth also affected the wine market in China. The prices of imported Bordeaux wines fell due to economic uncertainty and the fact that "China [was] not buying at silly prices any longer[xxx]".

10.1.5 Increased Competition

Finally, Bordeaux wines also started facing competition in China from home grown wine as well as competitively priced other foreign wines. According to Vinexpo, a Bordeaux-based wine industry conference, although red wine consumption in China almost tripled between 2007 and 2013, the vast majority of wine consumed (83%), was produced domestically[xxxi].

These above mentioned factors are extremely important, since "Chinese demand was a major part of the shift in the market from 2009-2011, so while China was a big part of the drive up of the [Bordeaux wine] market, it has also been a major part of the collapse.[xxxii]"

10.2 Other Factors

Although China has been the main driver for the low returns on Bordeaux wines in the past several years, there have been some other factors that have also had an impact on the declining returns. The beginning of the Eurozone crisis in 2009, also created unfavorable macroeconomic factors, which further lead to an increase in volatility and decrease in Bordeaux wine prices during this period[xxxiii]. As investors across the globe started worrying about the deep recession in Europe, demand and prices dropped in the region, with "a load of people trying to get out of their wine", increasing the supply[xxxiv]. Finally, currency fluctuations during 2013 and 2014 led to the dropping of overseas demand for Bordeaux wine.

Compared to this, United States' stock market has performed extremely well during the same period, and as of May 2015, was witnessing the third longest bull market in American history[xxxv]. Thus, when the return on these subpar wine portfolios were regressed against the Five-Factor Fama-French Model, it resulted in negative excess returns for wine, making it a bad investment.

11. **Limitations**

The results of this research paper successfully showed that Bordeaux wines have been a bad investment, adding high risk and giving no excess returns to an investor's portfolio during the period starting from April 2011 to February 2016. However, this study has some limitations. First, the data used for this research is small. It looks at 155 different wines over a 59-month period. While it was important to stay within this period, to study the specific impact of the Chinese economy and Bordeaux bubble burst, this is a small sample size, which may have interfered with

the statistical analysis. Further, the data for wine prices and returns is missing for two months for all 2010 vintages. This would make any analysis containing the 2010 vintage slightly skewed[5].

12. <u>Conclusion</u>

This paper provides an insight into the risks and returns associated with investing in first growth Bordeaux wines as an alternative investment. It focusses particularly on the time period right after the Chinese economy began to slow down and after the Bordeaux bubble burst (2011-2016). This time period has been the main focus primarily because, starting in early 2000's, China had been a major player in the market for Bordeaux wines, exponentially driving up the prices, especially for the first growth wines. Thus, as economic conditions begin to falter in the region, it has had a severe impact on this asset class. These events have drastically changed how fine wine is seen as an investment- an asset that possess high risks and gives low returns. Although this is in contrast to many studies done in the field, those cover a wider time span, and thus this change in results emphasizes how important the recent events in China have been for Bordeaux wine.

For this research, I used the Five-Factor Fama French model, which incorporates several market factors, to prove my hypotheses. First, I found that first growth Bordeaux wines are an alternative investment, because when portfolios containing these wines are regressed against the FFM, all market factor betas are effectively zero, or negative. This proved that these wines have very little exposure to common market risk factors, thus falling under the category of alternative investment. Second, I proved that portfolios containing these securities are riskier than equity portfolios. This is seen since the standard deviation in an average portfolio- classified by chateau or vintage- is higher than the standard deviation in US equities. Finally, when these portfolios are

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[5] See Table 1, and Appendix Figure 18, Table 15 for anomaly evidence

regressed against the FFM, the average intercept is always negative or zero, confirming that the wine portfolios do not give any excess returns, i.e. the Jenson's alpha is zero or negative.

Nevertheless, even though this particular time-period has been a bad one for wine investing, it doesn't imply that the same trend is going to continue in the future. The market conditions for Bordeaux wine have improved since mid-2014. Although the demand from China is still lower than what it was at its peak, it's starting to rise, along with an improvement in other markets such as North America. As financial markets around the world have started to come under considerable pressure, the gap between wine portfolios and US equity portfolios, although present, has been constantly narrowing (See Appendix: Figures 13-16). The levelling off of the Liv-ex Fine wine 100 index has "left the fine wine market cautiously optimistic at the start of 2016[xxxvi]", making the future of this alternative asset class look brighter.
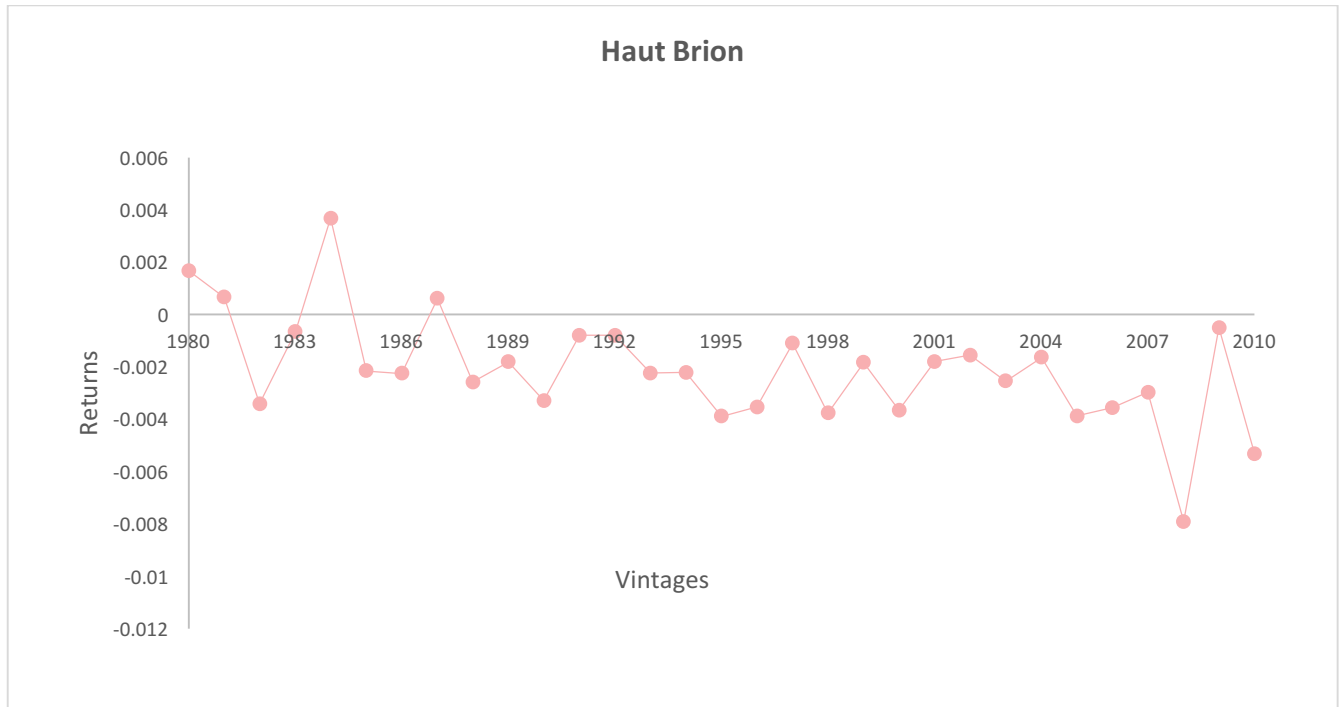
13. **Appendix**

FIGURE 8: Average return for Chateau Margaux Vintages
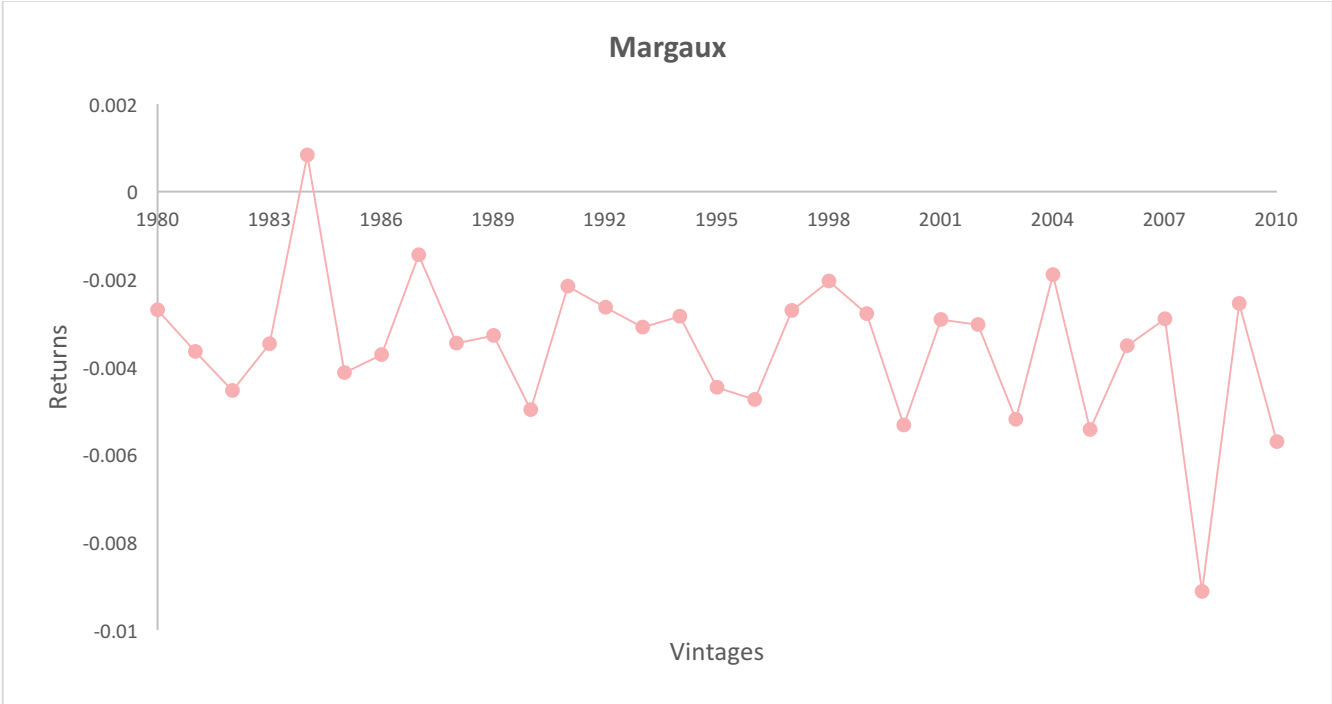
Looking at the average returns for Chateau Margaux vintages from Apr 2011 to Feb 2016 shows that 1984 was the best vintage and 2008 was the worst.

FIGURE 9: Average return for Chateau Haut-Brion vintages

Looking at the average returns for Chateau Haut-Brion vintages from Apr 2011 to Feb 2016 shows that 1984 was the best vintage and 2008 was the worst.

FIGURE 10: Average return for Chateau Latour vintages

Looking at the average returns for Chateau Latour vintages from Apr 2011 to Feb 2016 shows that 1981 was the best vintage and 2008 was the worst.
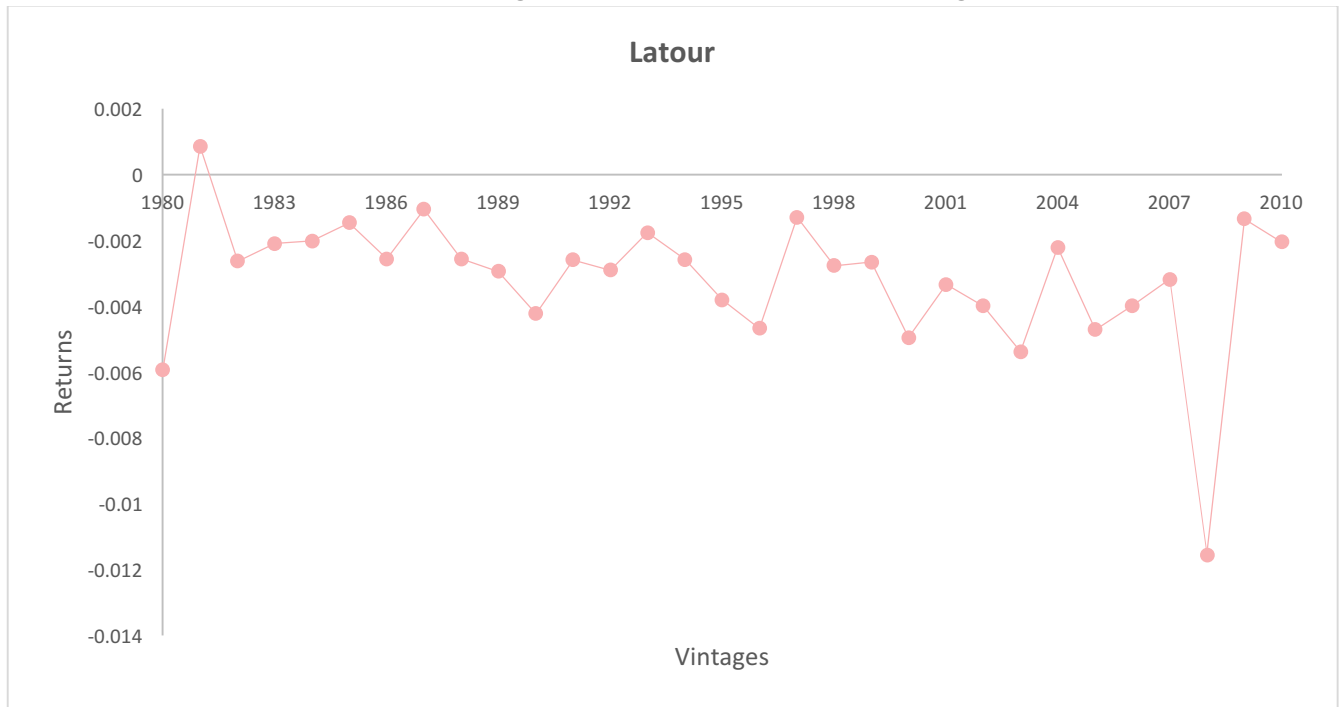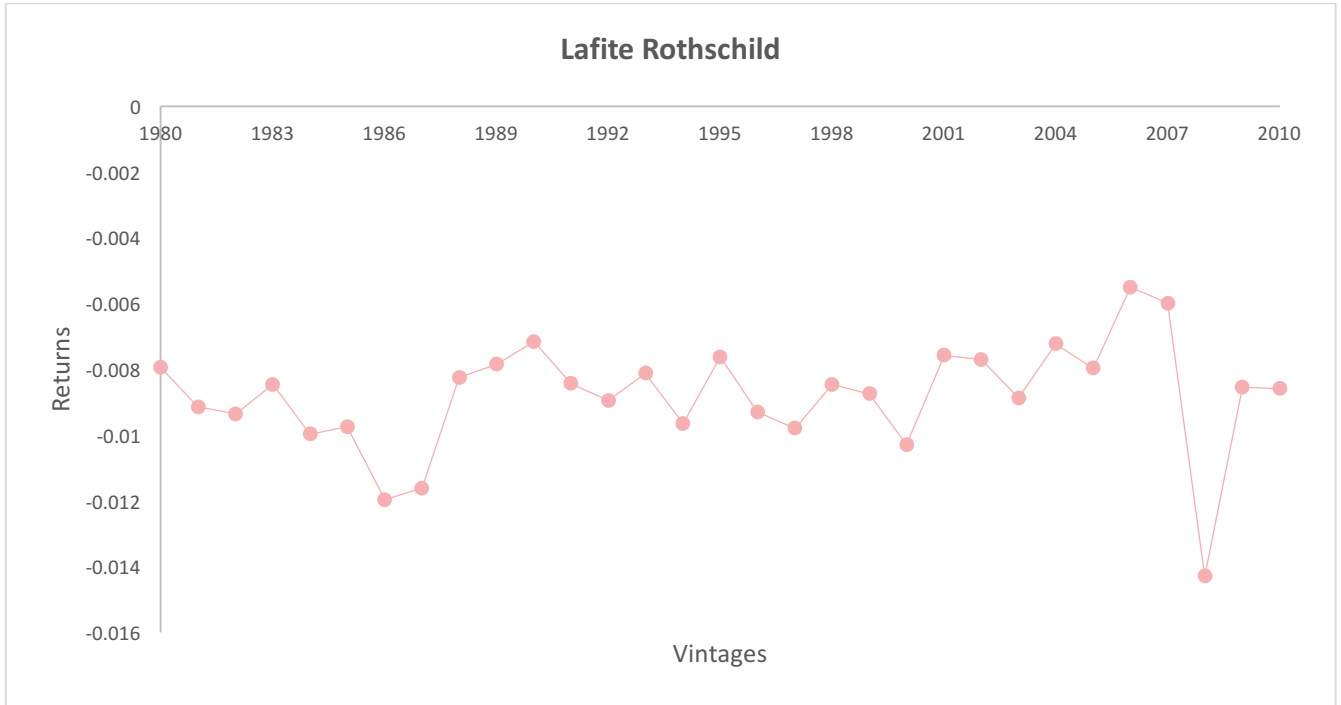
FIGURE 11: Average return for Chateau Lafite Rothschild vintages

Looking at the average returns for Chateau Lafite Rothschild vintages from Apr 2011 to Feb 2016 shows that 2006 was the best vintage and 2008 was the worst.
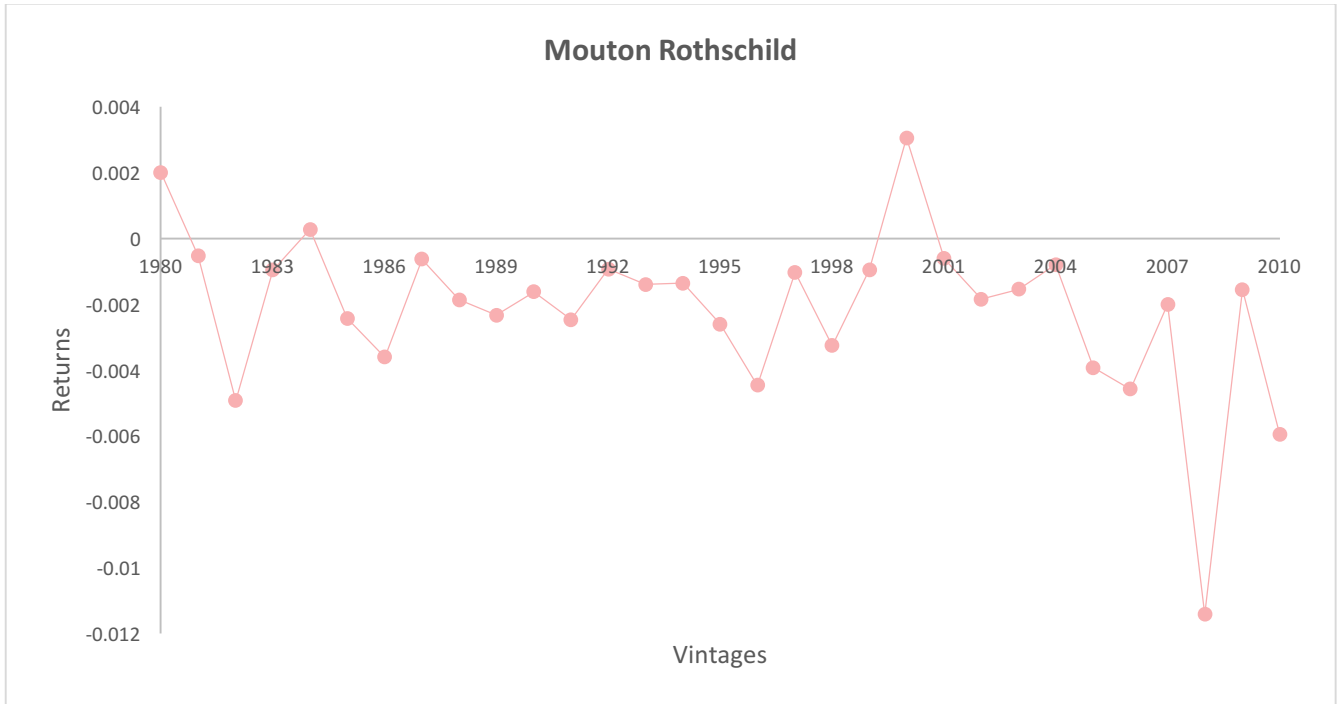
FIGURE 12: Average return for Chateau Mouton Rothschild vintages


Looking at the average returns for Chateau Mouton Rothschild vintages from Apr 2011 to Feb 2016 shows that 2000 was the best vintage and 2008 was the worst.

TABLE 12: Average performance of all vintages

| Vintage	Margaux	Latour	Lafite Rothschild	Mouton Rothschild	Haut-Brion	Average Performance
1980	-0.27%	-0.59%	-0.79%	0.20%	0.17%	-0.26%
1981	-0.36%	0.09%	-0.91%	-0.05%	0.06%	-0.24%
1982	-0.45%	-0.26%	-0.94%	-0.49%	-0.34%	-0.50%
1983	-0.35%	-0.21%	-0.85%	-0.10%	-0.07%	-0.31%
1984	0.08%	-0.20%	-1.00%	0.03%	0.37%	-0.14%
1985	-0.41%	-0.15%	-0.97%	-0.24%	-0.22%	-0.40%
1986	-0.37%	-0.26%	-1.20%	-0.36%	-0.23%	-0.48%
1987	-0.14%	-0.11%	-1.16%	-0.06%	0.06%	-0.28%
1988	-0.34%	-0.26%	-0.82%	-0.19%	-0.26%	-0.37%
1989	-0.33%	-0.29%	-0.78%	-0.23%	-0.18%	-0.36%
1990	-0.50%	-0.42%	-0.72%	-0.16%	-0.33%	-0.43%
1991	-0.22%	-0.26%	-0.84%	-0.25%	-0.08%	-0.33%
1992	-0.26%	-0.29%	-0.89%	-0.09%	-0.08%	-0.32%
1993	-0.31%	-0.18%	-0.81%	-0.14%	-0.23%	-0.33%
1994	-0.28%	-0.26%	-0.96%	-0.14%	-0.22%	-0.37%
1995	-0.45%	-0.38%	-0.76%	-0.26%	-0.39%	-0.45%
1996	-0.47%	-0.47%	-0.93%	-0.45%	-0.35%	-0.53%
1997	-0.27%	-0.13%	-0.98%	-0.10%	-0.11%	-0.32%
1998	-0.20%	-0.28%	-0.85%	-0.33%	-0.38%	-0.41%
1999	-0.28%	-0.27%	-0.87%	-0.09%	-0.18%	-0.34%
2000	-0.53%	-0.49%	-1.03%	0.31%	-0.37%	-0.42%
2001	-0.29%	-0.33%	-0.76%	-0.06%	-0.18%	-0.32%
2002	-0.30%	-0.40%	-0.77%	-0.18%	-0.16%	-0.36%
2003	-0.52%	-0.54%	-0.89%	-0.15%	-0.26%	-0.47%
2004	-0.19%	-0.22%	-0.72%	-0.08%	-0.16%	-0.28%
2005	-0.54%	-0.47%	-0.80%	-0.39%	-0.39%	-0.52%
2006	-0.35%	-0.40%	-0.55%	-0.46%	-0.36%	-0.42%
2007	-0.29%	-0.32%	-0.60%	-0.20%	-0.30%	-0.34%
2008	-0.91%	-1.16%	-1.43%	-1.14%	-0.79%	-1.09%
2009	-0.26%	-0.13%	-0.85%	-0.16%	-0.05%	-0.29%
2010	-0.57%	-0.20%	-0.86%	-0.60%	-0.53%	-0.55%

This table shows that all vintages from all chateaux have given a negative return over the time period Apr 2011 to Feb 2016. However, out of these, Vintage 1984 on average has the lowest negative return (best vintage), and Vintage 2008 has the highest negative return (worst vintage)

FIGURE 13: Equally Weighted Bordeaux Portfolios Returns
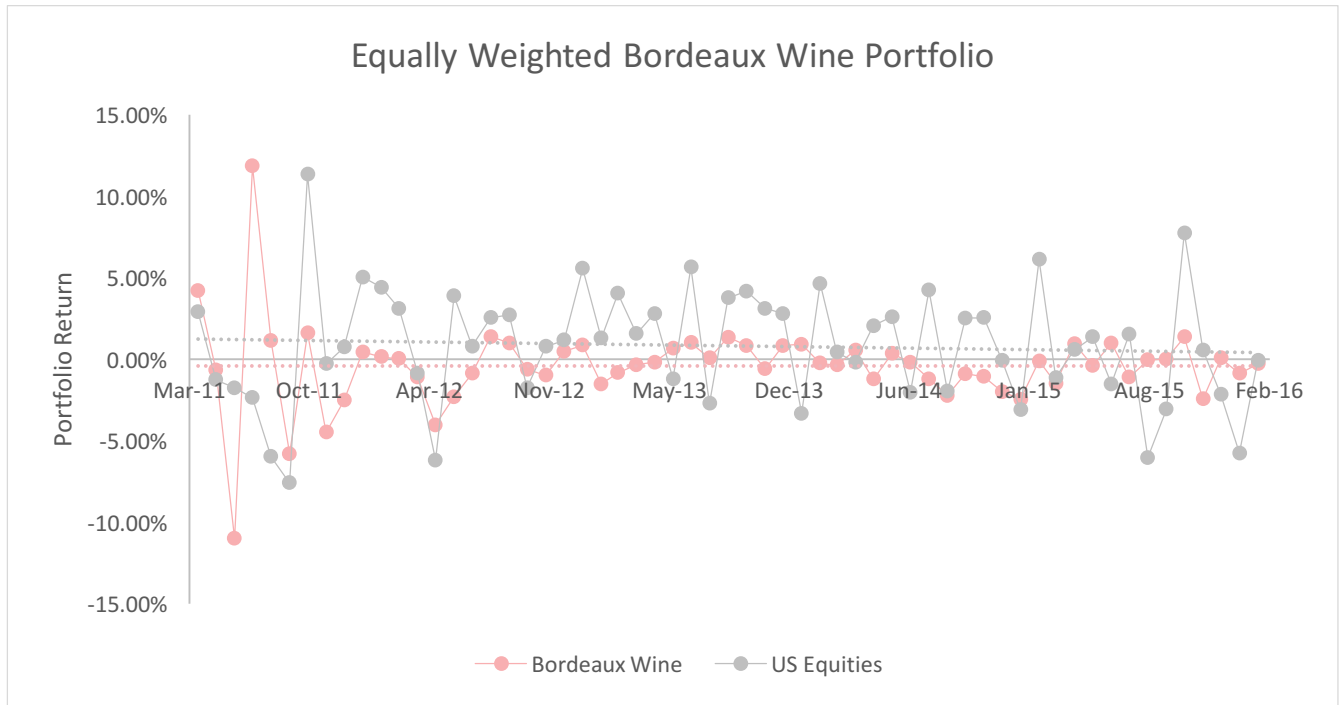
This figure shows that the equally weighted Bordeaux portfolio consisting of 155 securities has consistently underperformed and given worse returns as compared to US equities. The linear trend line for Bordeaux wine is always under the linear trend line for equities.

FIGURE 14: Average Equally Weighted Vintage Portfolio
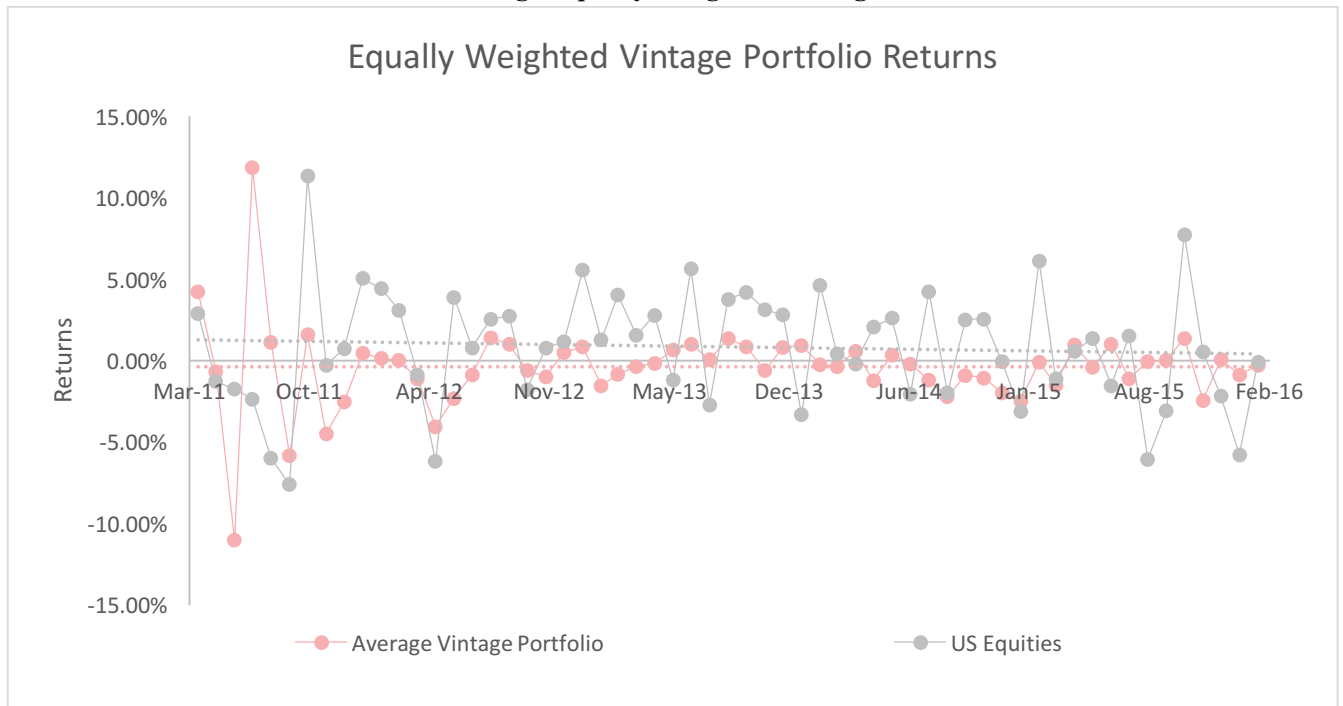
This figure shows that an average portfolio consisting of the same vintage, but from different chateaux and equally weighted has consistently underperformed and given worse returns as compared to US equities. The linear trend line for Bordeaux wine is always under the linear trend line for equities.

FIGURE 15: Average Equally Weighted Chateau Portfolio
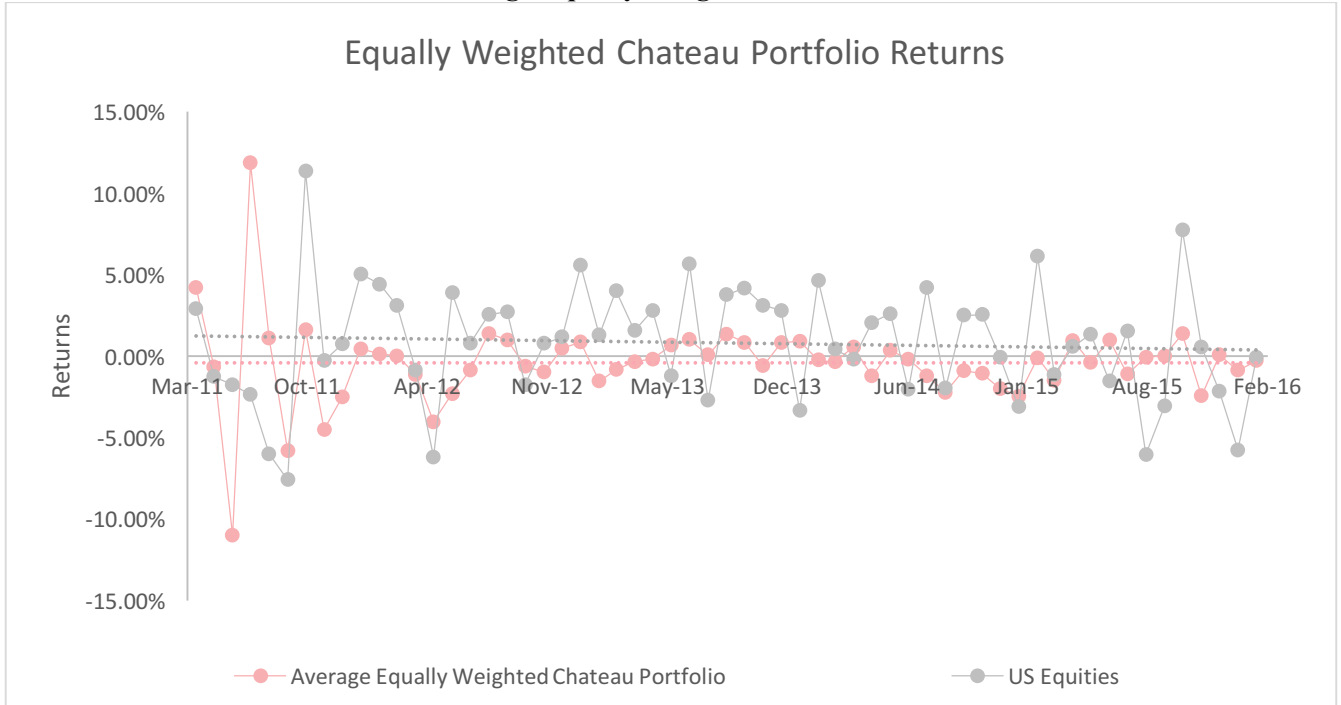
Equally Weighted Chateau Portfolio Returns

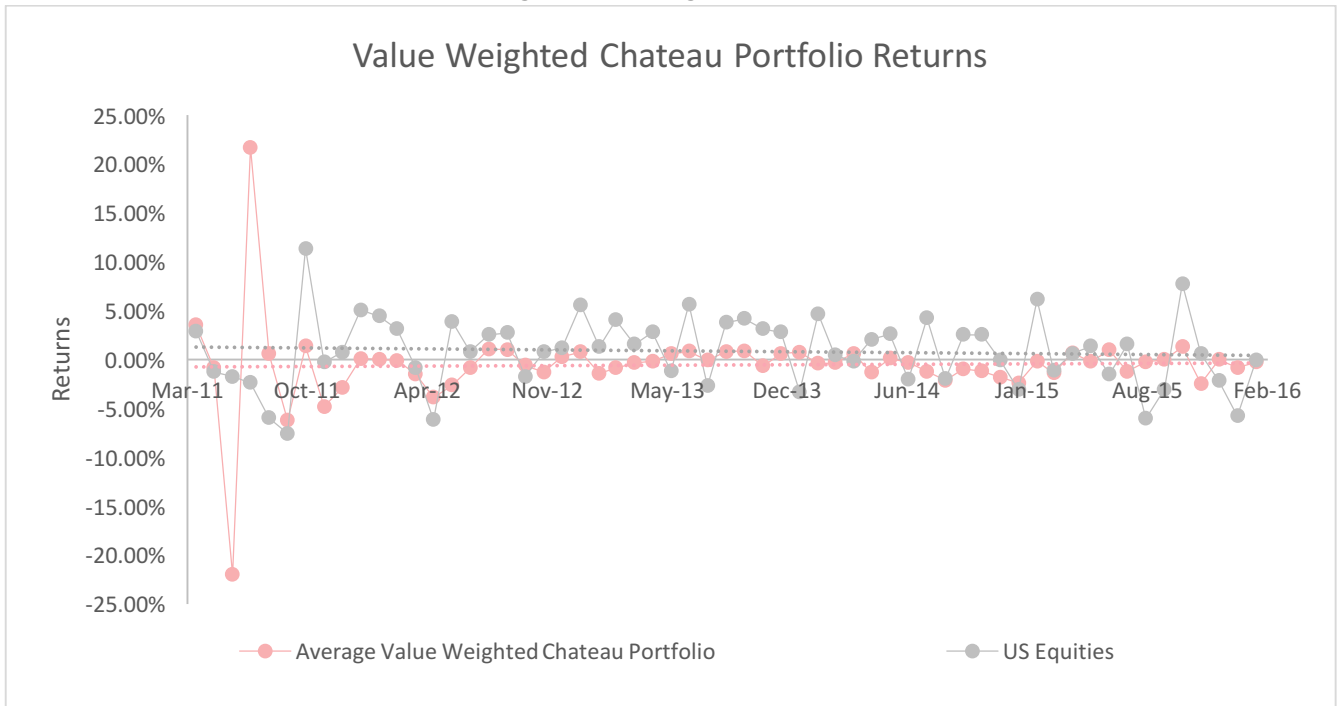This figure shows that an average portfolio consisting of different vintages, but from the same chateau and equally weighted has consistently underperformed and given worse returns as compared to US equities. The linear trend line for Bordeaux wine is always under the linear trend line for equities.

FIGURE 16: Average Value Weighted Chateau Portfolio

Value Weighted Chateau Portfolio Returns

This figure shows that an average portfolio consisting of different vintages, but from the same chateau and weighted by value, has consistently underperformed and given worse returns as compared to US equities. The linear trend line for Bordeaux wine is always under the linear trend line for equities.
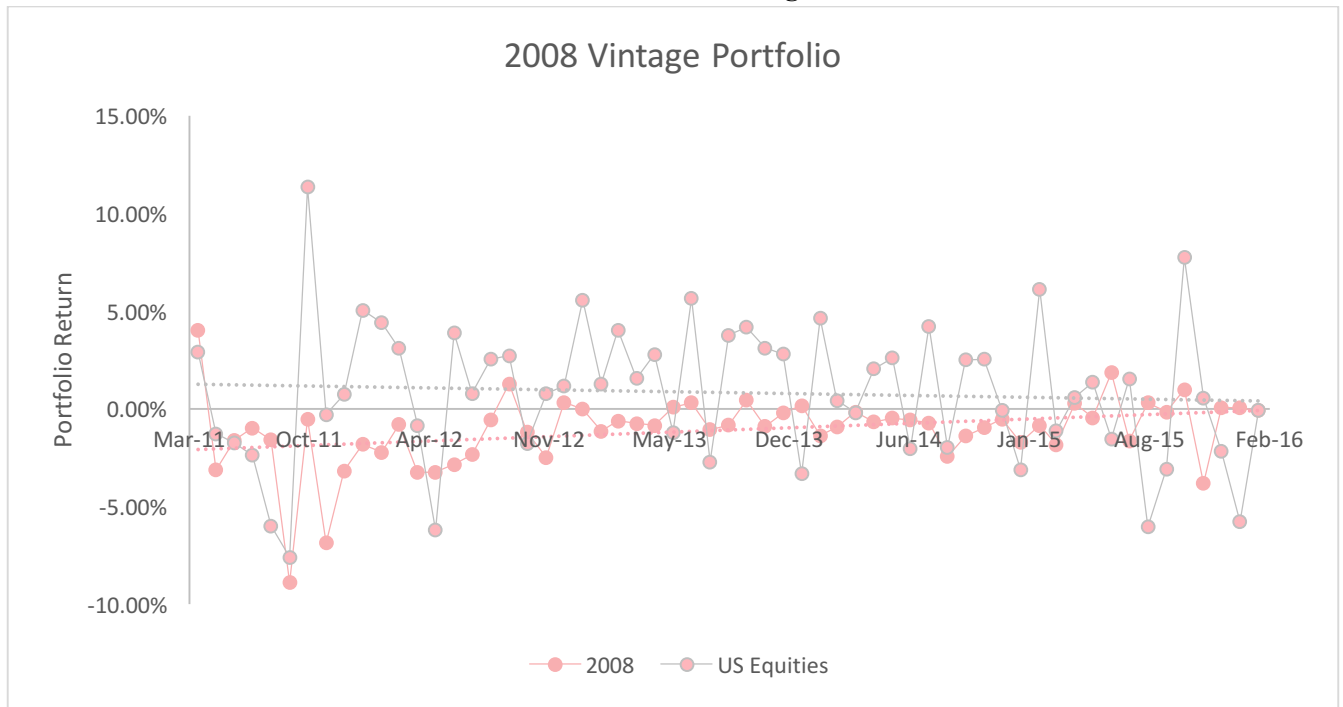
Anomaly Vintage Portfolios (Figure 17 and 18)

FIGURE 17: Portfolio for Vintage 2008

This figure shows the returns on a portfolio created using all five 2008 vintages. It shows that the gap between the 2008 portfolio and US equity return trend lines is very large, as compared to an average portfolio (Figure14). This further supplements the argument that 2008 was the worst vintage.

FIGURE 18: Portfolio for Vintage 2010
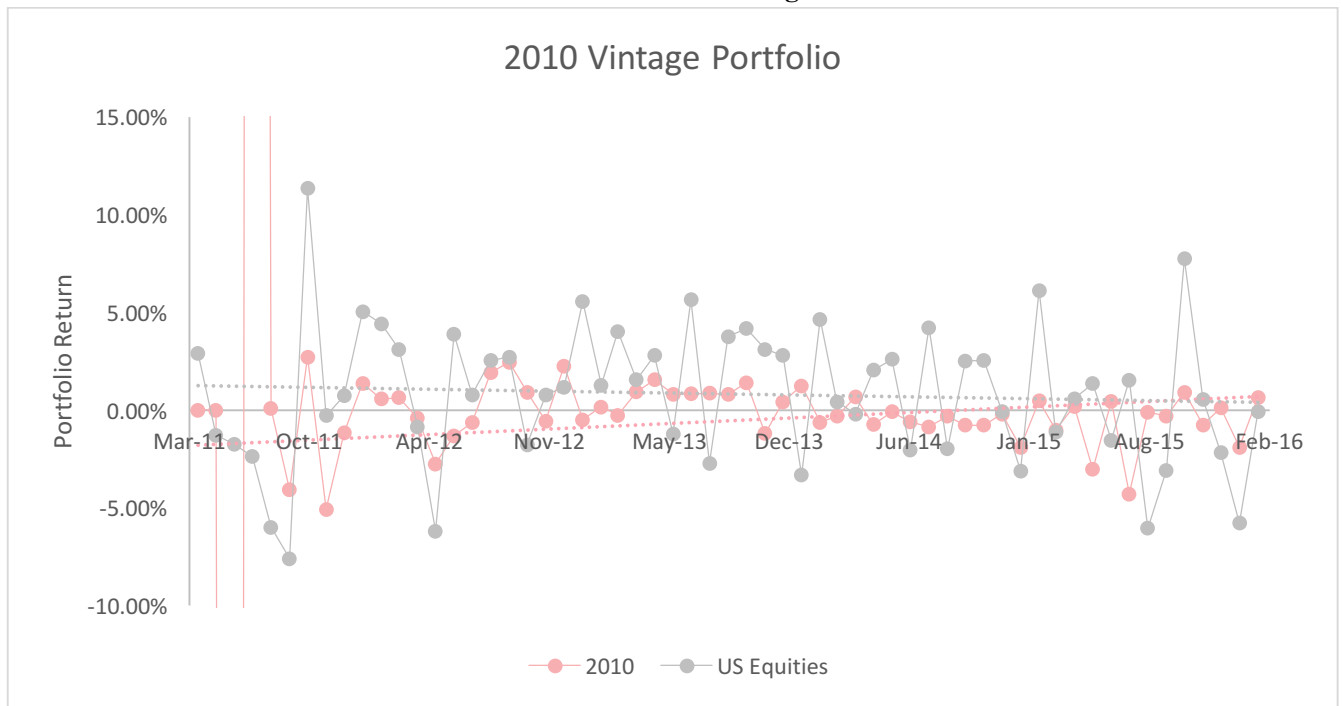
This figure shows that the data for the 2010 vintage is skewed. The two missing data points add a lot of volatility and fluctuation in the portfolio, especially in the initial period.

TABLE 13: Regressions for Equally Weighted Vintage Portfolios (1980-1989)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Intercept	-0.006	-0.006	-0.009	-0.007	-0.005	-0.008	-0.008	-0.008	-0.007	-0.008
	(0.004)	(0.003)	(0.002)	(0.003)	(0.004)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)
Rm-Rf	0.002*	0.003**	0.002***	0.002***	0.003***	0.003***	0.002***	0.002**	0.002***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
SMB	-0.003*	-0.001	-0.001	-0.001	0.000	-0.002	0.000	-0.001	-0.001	-0.001
	0.002	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
HML	0.003	0.004*	0.004***	0.004**	0.006**	0.005***	0.005***	0.005**	0.005***	0.003**
	0.003	(0.002)	(0.001)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)
RMW	-0.002	0.001	0.001	0.001	0.002	0.000	0.002	0.001	0.002	0.001
	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
CMA	-0.007*	-0.009***	-0.010***	-0.009***	-0.013***	-0.011***	-0.009***	-0.013***	-0.009***	-0.009***
	(0.004)	(0.003)	(0.002)	(0.003)	(0.004)	(0.003)	(0.002)	(0.003)	(0.002)	(0.002)
Adjusted R^2	0.046	0.173	0.318	0.234	0.174	0.311	0.258	0.241	0.269	0.287

Robust standard error in parenthesis

Significance Key: $p \leq 0.10$ $** p \leq 0.05$ $*** p \leq 0.001$

[Although certain independent variables show high level of significance, the very small (almost zero) value of coefficients make their impact marginal and inconsequential.]

TABLE 14: Regressions for Equally Weighted Vintage Portfolios (1990-1999)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Intercept	-0.008	-0.007	-0.007	-0.008	-0.007	-0.008	-0.008	-0.008	-0.008	-0.007
	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)
Rm-Rf	0.002***	0.002***	0.002***	0.002***	0.002***	0.002***	0.002**	0.003***	0.002**	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
SMB	-0.001	0.000	0.001	-0.001	0.000	-0.001	0.000	-0.001	0.000	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	90.001)	(0.001)
HML	0.005***	0.006***	0.005**	0.006***	0.005***	0.004***	0.003*	0.006***	0.005***	0.004***
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)
RMW	0.001	0.001	0.003	0.002	0.002	0.001	0.001	0.002	0.002	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
CMA	-0.009***	-0.013***	-0.012***	-0.013***	-0.012***	-0.008***	-0.007***	-0.013***	-0.009***	-0.008***
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)
Adjusted R^2	0.328	0.302	0.262	0.297	0.261	0.292	0.118	0.374	0.315	0.215

Robust standard error in parenthesis

Significance Key: $p \leq 0.10$ $** p \leq 0.05$ $*** p \leq 0.001$

[Although certain independent variables show high level of significance, the very small (almost zero) value of coefficients make their impact marginal and inconsequential.]

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Intercept	-0.007	-0.007	-0.007	-0.008	-0.006	-0.009	-0.008	-0.007	-0.014	-0.007	-0.018
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.105
Rm-Rf	0.002***	0.002***	0.002***	0.002***	0.002***	0.002***	0.002***	0.002***	0.002**	0.003***	0.003
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.027
SMB	-0.002	0.000	-0.001	-0.002	0.000	-0.001	0.000	0.000	0.000	0.000	-0.025
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.050
HML	0.005***	0.004**	0.005***	0.005***	0.004**	0.005***	0.005***	0.005***	0.005**	0.004**	-0.016
	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.071
RMW	0.000	0.001	0.002	0.000	0.002	0.001	0.002	0.002	0.000	0.002	-0.019
	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.074
CMA	-0.009***	-0.008***	-0.010***	-0.010***	-0.008***	-0.009***	-0.008***	-0.009***	-0.007**	-0.008***	-0.001
	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.110)
Adjusted R^2	0.283	0.225	0.257	0.356	0.208	0.332	0.293	0.261	0.146	0.270	-0.108

Robust standard error in parenthesis

Significance Key: $p \leq 0.10$ ∗∗ $p \leq 0.05$ ∗∗∗ $p \leq 0.001$

[Although certain independent variables show high level of significance, the very small (almost zero) value of coefficients make their impact marginal and inconsequential.]

No significant variables for the 2010 portfolio confirms the earlier mentioned skew in data

	Bordeaux Wine	Margaux	Haut-Brion	Latour	Lafite Rothschild	Mouton Rothschild
Intercept	-0.008	-0.008	-0.007	-0.007	-0.013	-0.006
	(0.004)	(0.005)	(0.005)	(0.002)	(0.005)	(0.005)
Rm-Rf	0.002**	0.003***	0.002*	0.002***	0.002*	0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
SMB	-0.001	-0.002	-0.001	0.000	-0.002	-0.001
	(0.002)	(0.002)	(0.002)	(0.0010	(0.002)	(0.002)
HML	0.004	0.004	0.003	0.005***	0.004	0.004
	(0.003)	(0.003)	(0.003)	(0.001)	(0.003)	(0.003)
RMW	0.001	0.000	0.001	0.001	0.001	0.000
	(0.003)	(0.003)	(0.004)	(0.001)	(0.003)	(0.003)
CMA	-0.009**	-0.009**	-0.009*	-0.009***	-0.010*	-0.010**
	(0.004)	(0.005)	(0.005)	(0.002)	(0.005)	(0.005)
Adjusted R^2	0.042	0.016	-0.009	0.331	0.009	-0.008

Robust standard error in parenthesis

Significance Key: $p \leq 0.10$ ∗∗ $p \leq 0.05$ ∗∗∗ $p \leq 0.001$

[Although certain independent variables show high level of significance, the very small (almost zero) value of coefficients make their impact marginal and inconsequential.

<h3 style="text-align:center">**TABLE 17: Regressions for Value Weighted Chateau Portfolios**</h3>

	Margaux	Haut-Brion	Latour	Lafite Rothschild	Mouton Rothschild
Intercept	-0.009	-0.009	-0.008	-0.013	-0.009
	(0.0020	(0.003)	(0.001)	(0.001)	(0.003)
Rm-Rf	0.002	0.002	0.002***	0.002*	0.002
	(0.003)	(0.006)	(0.001)	(0.002)	(0.006)
SMB	-0.003	-0.003	-0.001	-0.002	-0.003
	(0.005)	(0.008)	(0.001)	(0.003)	(0.008)
HML	0.004	0.002	0.005***	0.004	0.003
	(0.005)	(0.008)	(0.001)	(0.003)	(0.008)
RMW	0.000	0.000	0.001	0.001	-0.002
	(0.007)	(0.012)	(0.002)	(0.005)	(0.012)
CMA	-0.009	-0.008	-0.008***	-0.010**	-0.008
	(1.593)	(2.560)	(0.456)	(1.044)	(2.610)
Adjusted R^2	-0.053	-0.092	0.327	0.019	-0.094

<div style="text-align:center">

Robust standard error in parenthesis

Significance Key: $p \leq 0.10$ $**\ p \leq 0.05$ $***\ p \leq 0.001$

[Although certain independent variables show high level of significance, the very small (almost zero) value of coefficients make their impact marginal and inconsequential

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