Hedge Fund Risk Return Analysis

A Glimpse at Hedge Funds using the VIX Index

An Interactive Qualifying Project Report

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Abstract

The goal of this project is to assess and analyze the strategies and ultimately performances of different hedge funds over the past 20 years utilizing the CBOE Volatility Index (VIX). Since hedge funds are traditionally not regulated by the Securities and Exchange Commission (SEC), investing in hedge funds has always been deemed extremely risky. However, investors have also been drawn to invest in hedge funds exactly because of this factor, with a firm belief of "higher risk, higher returns". In this report, we look closely at the performances of different hedge fund styles/strategies (rather than that of any specific hedge funds) and pay special attention to how they performed during significant financial events.

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Panel A: Full Sample, Jan 1994 – Jan 2015

Panel B: Market Crash, Jan 2008 – March 2009

1. Introduction and Goals

1.1 Project Scope

Looking at data on different hedge fund strategies to assess their performances, our main purpose was to make one step closer to finding the answer for the one question that all hedge funds investors were asking themselves, "Are hedge funds really hedging?" In this Interactive Qualifying Project (IQP), we look at each hedge fund style's performances, assess their ups and down during historically significant financial events. To do this, we did regression analysis and utilized a single factor implied volatility risk model on the VIX data from the Chicago Board Options Exchange. *Table 1: Description of Hedge Fund strategies styles* briefly introduces all the hedge fund strategies styles this report is going to discuss and analyze.

Table 1: Description of Hedge Fund strategies styles

and their abbreviations

Strategy Name	*Abbre.*	*Description*
Convertible Arbitrage	CON	Take positions in both the convertible bonds and stocks of a particular company by simultaneously purchasing the convertible bond and short-sell the underlying common stock at the same time to exploit the price inefficiency between the two
Dedicated Short Bias	DSB	Hold both long and short positions in the market but dedicated to holding short positions Benefits gained by market declines
Emerging Markets	EM	Focus on financial assets in emerging markets such as China and India, with the

		assets ranging from bonds, stocks to real estates, commodities and derivatives
Equity Market Neutral	EMN	Holding both long and short positions of financial assets and maintain it at market-neutral level (zero correlation with unwanted source of risk)
Event Driven	ED	Invest based on the price inefficiency caused by specific corporate events (merger and acquisitions, bankruptcy, reorganization)
ED - Distressed	EDD	Buy the securities like stocks, bonds, bank debt of bankrupt or nearly bankrupt firms and try to gain by reverting the situations of the companies to increase the values of the financial assets and resell
ED - Multi Strategy	EDM	Maintain involved in a wide variety of corporate transactions, such as mergers,

		shareholder buybacks, security insurance, financial distress, reorganization or other capital structure adjustments.
ED - Risk Arbitrage	EDRA	Take a long position in stock of a target company, and short position in an acquiring company to create a hedge
Fixed Income Arbitrage	FIA	Purchase and sell fixed income and fixed income related financial assets to exploit from small price discrepancies by assuming opposing positions in the market
Global Macro	GM	Invest in several types of financial assets based on anticipating and capitalizing on global macroeconomics events. Mainly use derivatives to make bets against currencies, interest rate, stock.
Long/Short Equity	LS	Take long positions in stocks that are predicted to increase in value and take

		short positions in stocks that are expected to decline in values.
Managed Futures	MF	Managed futures accounts are managed by money managers/commodity trading advisors rather than the fund's owner. These accounts can have various weights in stocks and derivative investments.
Multi-Strategy	MS	Use a combination of different strategies

1.2 Interdisciplinary Importance and Global Importance

In this study, disciplines across multiple fields such as finance, economics, and psychology were discussed. Since the VIX index has been well known as the “fear gauge”, we discuss how psychology of the investors and behavioral finance can affect the risks and returns of each hedge fund strategies styles. Regression Analysis Tools in Microsoft Excel was utilized to build a single-factor model for our data.

The project definitely has a global significance, especially to the finance industry. As this research goes on, its result can not only help economists gain more insights on the predictability of hedge funds’ returns using the VIX index, but also help investors have a closer look at the real values/returns of each investment strategy in hedge funds before actually investing.

2. Review of Literature

2.1 Literature on Hedge Funds and Predictability in their returns

There are generally two observed main approaches to assess the predictability of hedge funds returns in the existing literature: in-of-sample and out-of-sample. While the in-of-sample approach uses the collected return data to calculate volatility, the out-of-sample approach generally uses the historical data to forecast into the future.

One of the recent articles that employ the out-of-sample approach is “Hedge fund return predictability: To combine forecasts or combine information?” The article was written by Ekaterini Panopoulou and Spyridon Vrontos and was published in 2014. Instead of depending on a single predictor model, the article combines individual forecasts using various combining methods. Three main classes of combining schemes were introduced. The simplest method, the mean combining scheme, attaches equal weights to all individual models. The second was originally proposed by Stock and Watson (2004), proposed to form weights based on the historical performance of the individual models over the hold-out out-of-sample period. And last but not least, the cluster combining method, was introduced by Aiolgi and Timmermann (2006).

2.2 Literature on the VIX index

The Volatility Index (VIX), provided by the Chicago Board Options Exchange, measures the implied volatility derived from S&P 500 option prices. Also known as the "fear gauge", VIX is also widely known as the measure for investor sentiment and anticipation for risks.

Literature on specifically the relationship between the VIX index and hedge funds returns is still quite scanty. Article titled "VIX as a Companion for Hedge Fund Portfolios", published in 2005 by Srikant Dash and Matthew T. Moran, tried to address and explore the relationship between VIX and hedge fund returns. They concluded in the article a negative and asymmetric correlation profile between VIX and the hedge fund returns.

Figure 2 below shows a time series of VIX, with several significant financial events that occurred throughout the years, in which we can obviously see the peaks in VIX, correlating to the investors' fear and uncertainties, when these events happened. Figure 3 summarizes the frequency of different VIX peaks throughout time.

Figure 1: Time Series of VIX

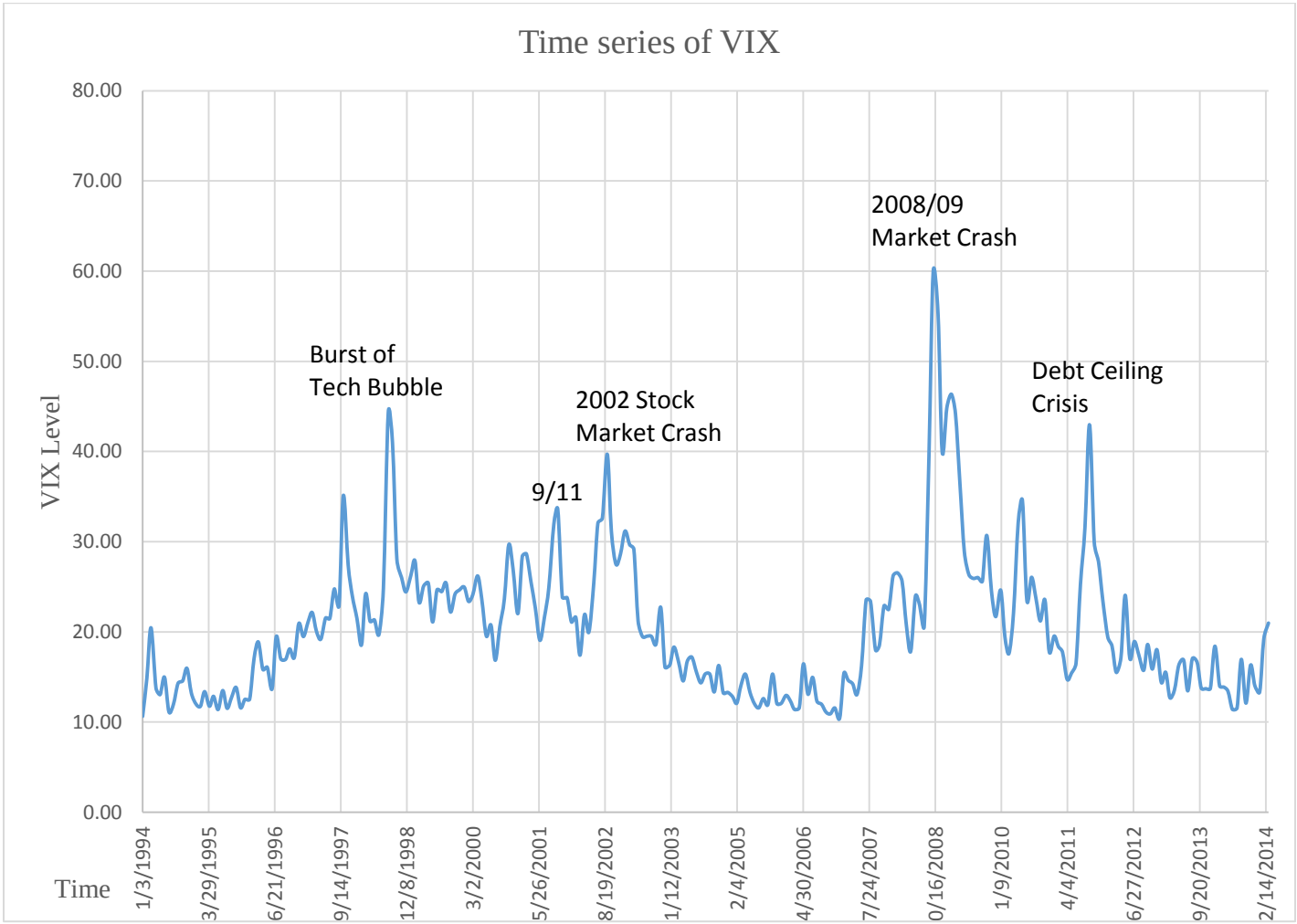
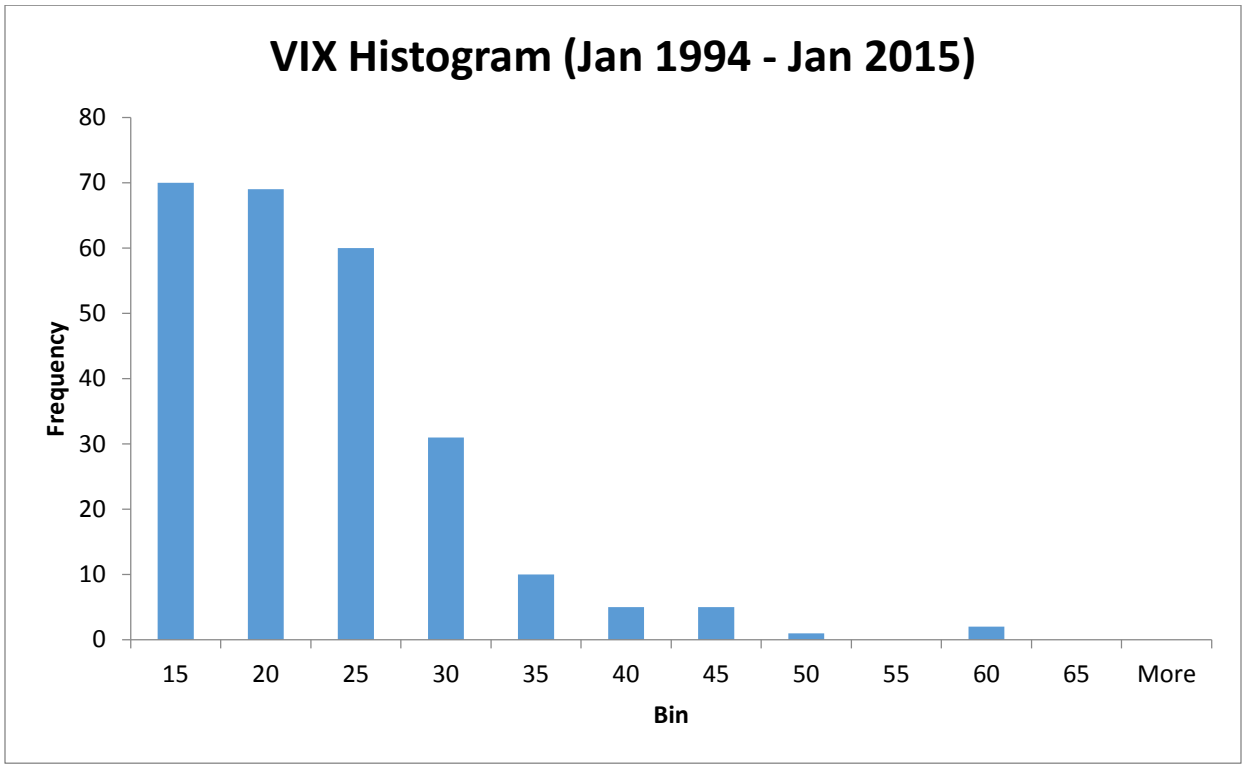


Figure 2: VIX Histogram (Jan 1994 – Jan 2015)



2.3 Gaps in Existing Literature

The paper "Hedge Fund Returns Predictability under the Magnifying Glass", published in 2013 by Doron Avramov, Laurent Barras and Robert Kosowski , adapted from the Journal of Financial and Qualitative Analysis applied both in and out of sample approach to analyze the predictability of hedge funds. VIX was mentioned, though not extensively, as one of their 4 economically motivated macro variables/instruments to track changes in business conditions, along with the default spread, the dividend yield, and aggregate fund flows. The authors did not look extensively into VIX data to directly predict the hedge funds returns; they

simply used VIX to “proxy for changes in market uncertainty”. However, the article did acknowledge the usefulness of VIX data in improving the predictability of the benchmark linear pricing models used in hedge fund industry.

Prior to that, another article titled “Predictability in Hedge Fund Returns”, published in Financial Analysts Journal, 2003 by Noel Amenc, Sina El Bied and Lionel Martellini, also included VIX as one of the 10 meaningful variables that can measure one of many financial risk dimensions – volatility risks. In this article, however, the authors were choosing the subset of variables that allowed them ot measure good in-sample explanatory power.

3. Data and Methodology

3.1 Data on Hedge Funds

Figure 3a: ALL

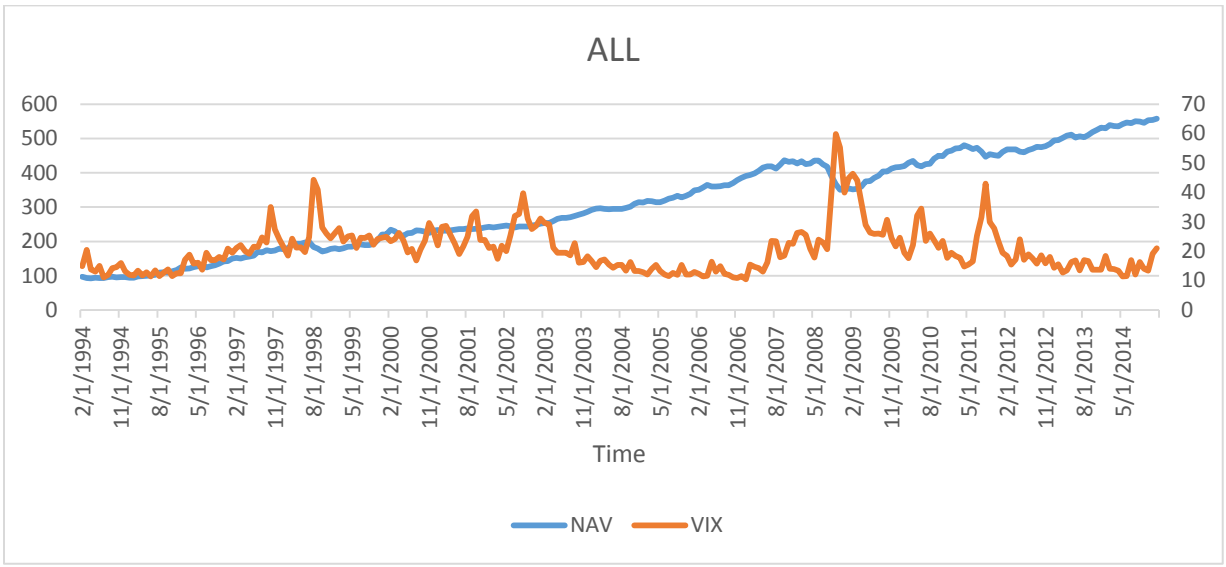


Figure 3b: Convertible Arbitrage

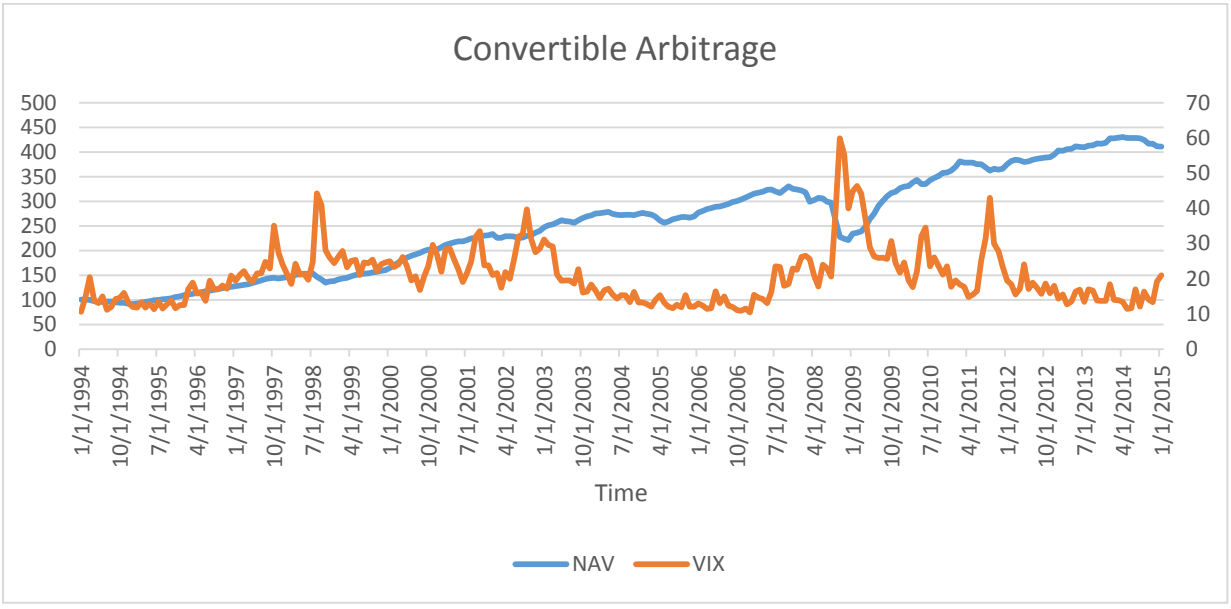


Figure 3c: Dedicated Short Bias

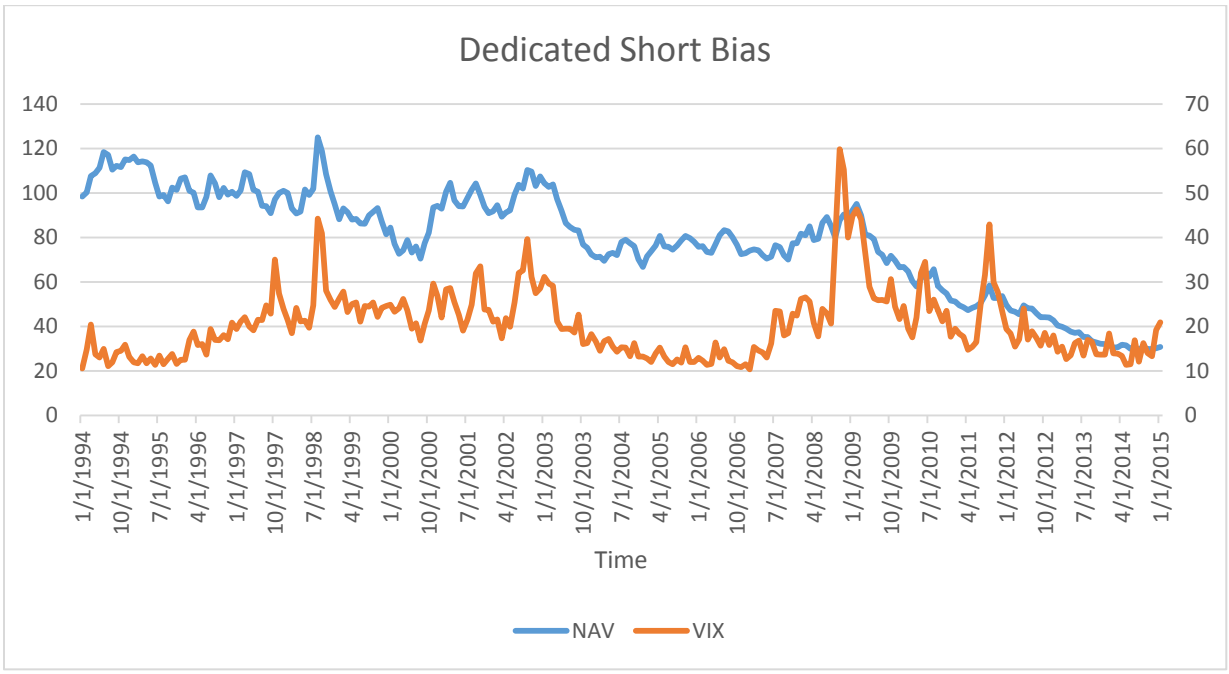


Figure 3d: Emerging Markets

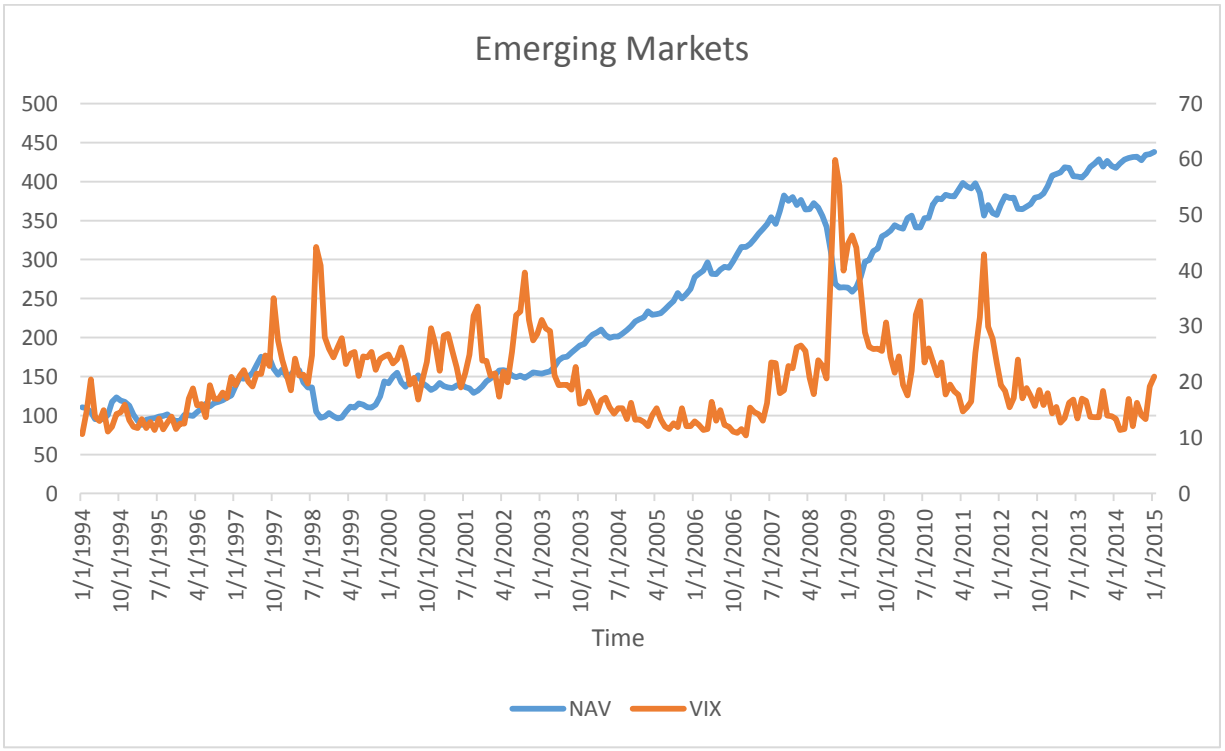


Figure 3e: Equity Market Neutral

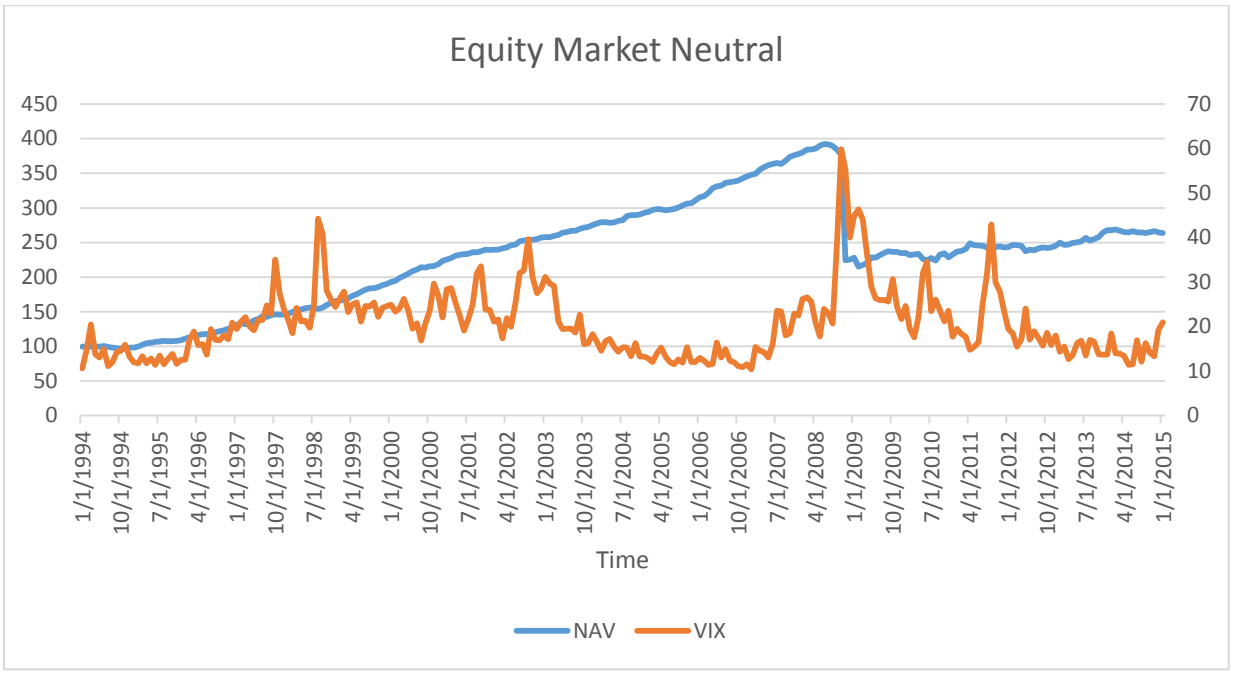


Figure 3f: Event Driven

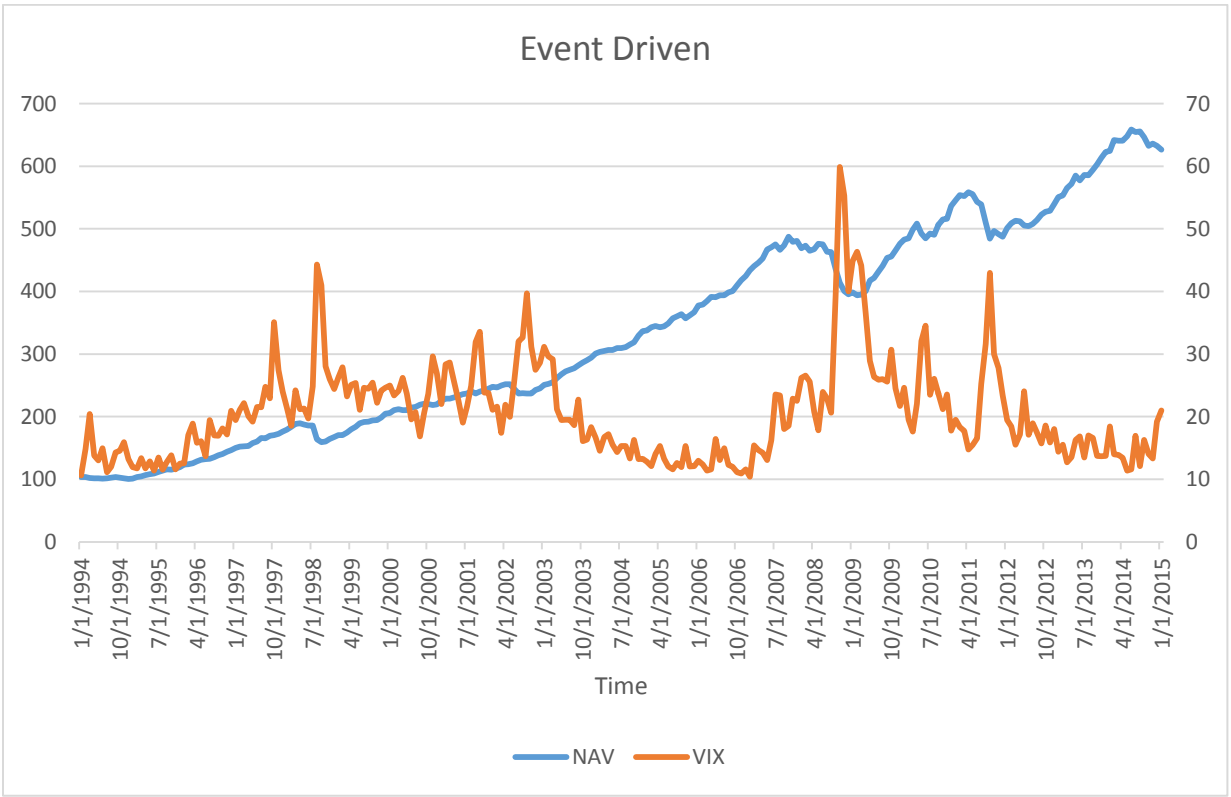


Figure 3g: Event Driven - Distressed

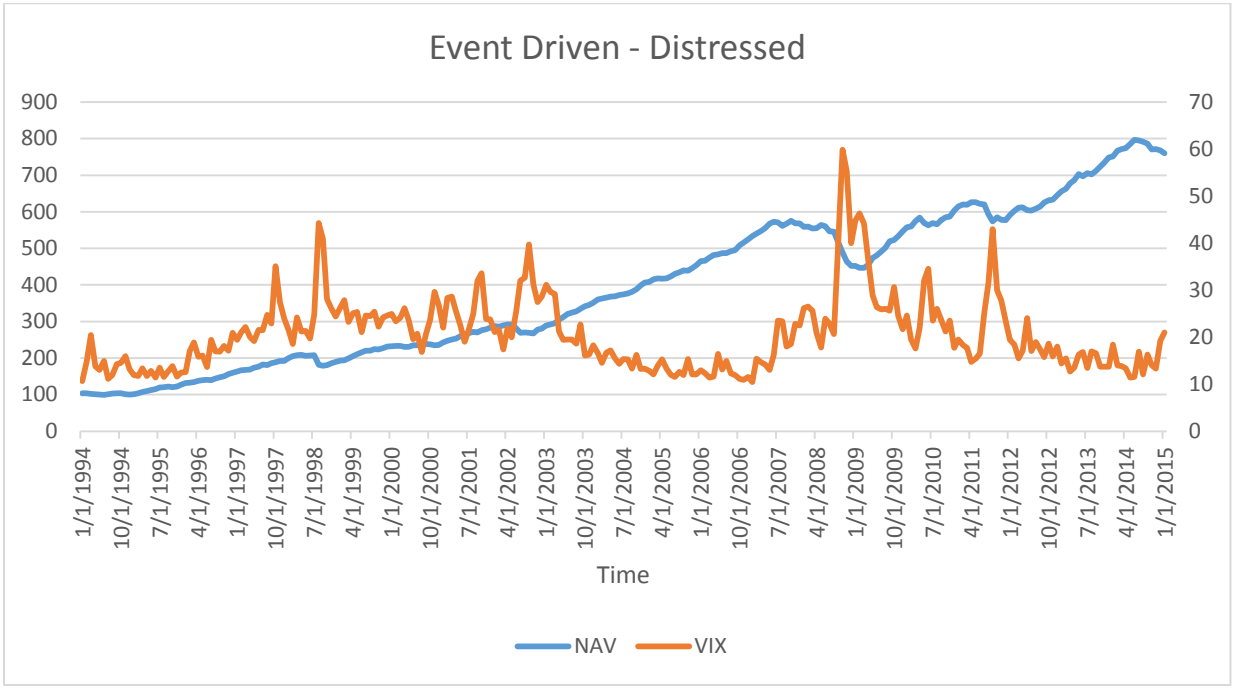


Figure 3h: Strategy Market for Event Driven – Multi Strategy

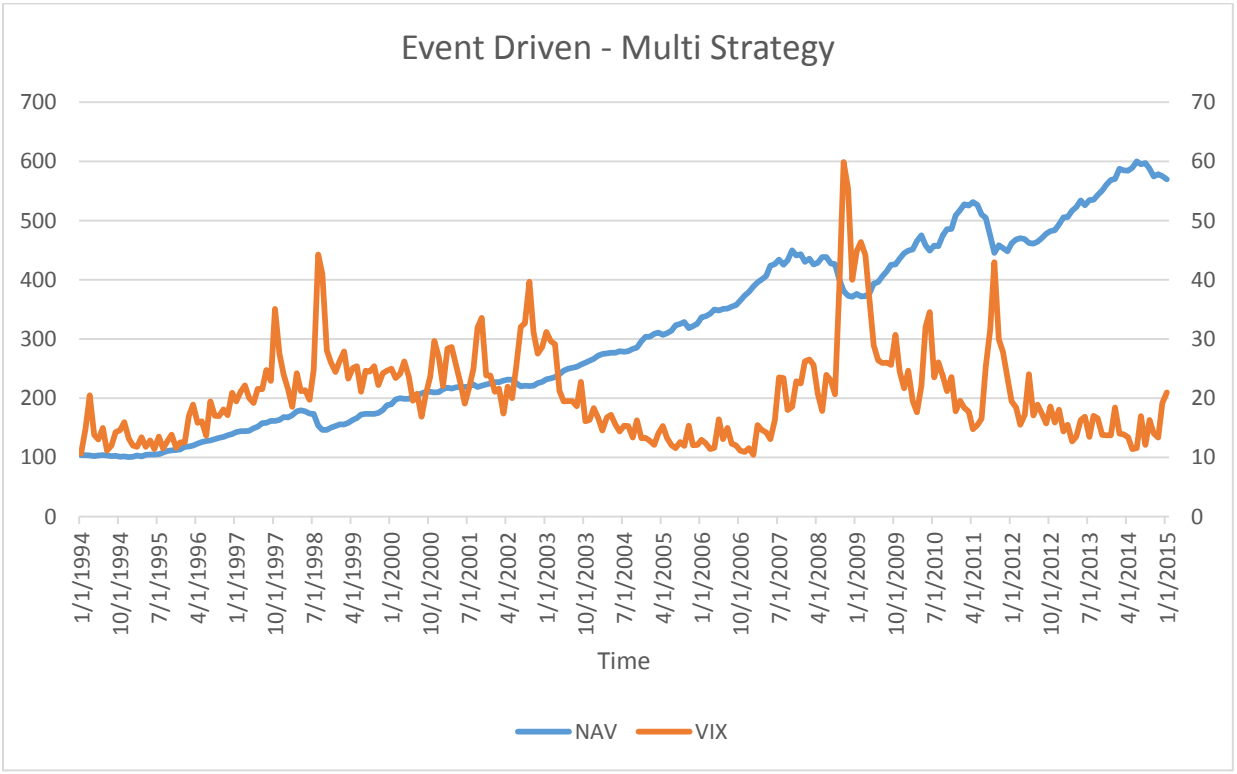


Figure 3i: Event Driven – Risk Arbitrage

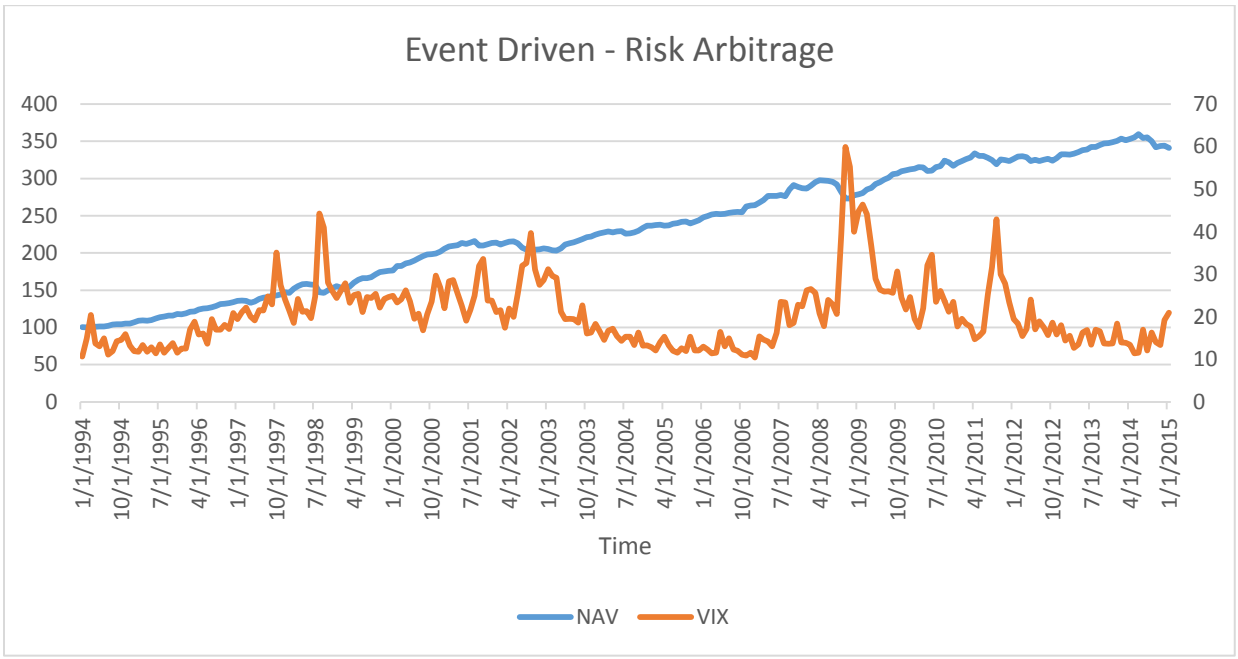


Figure 3j: Fixed Income Arbitrage

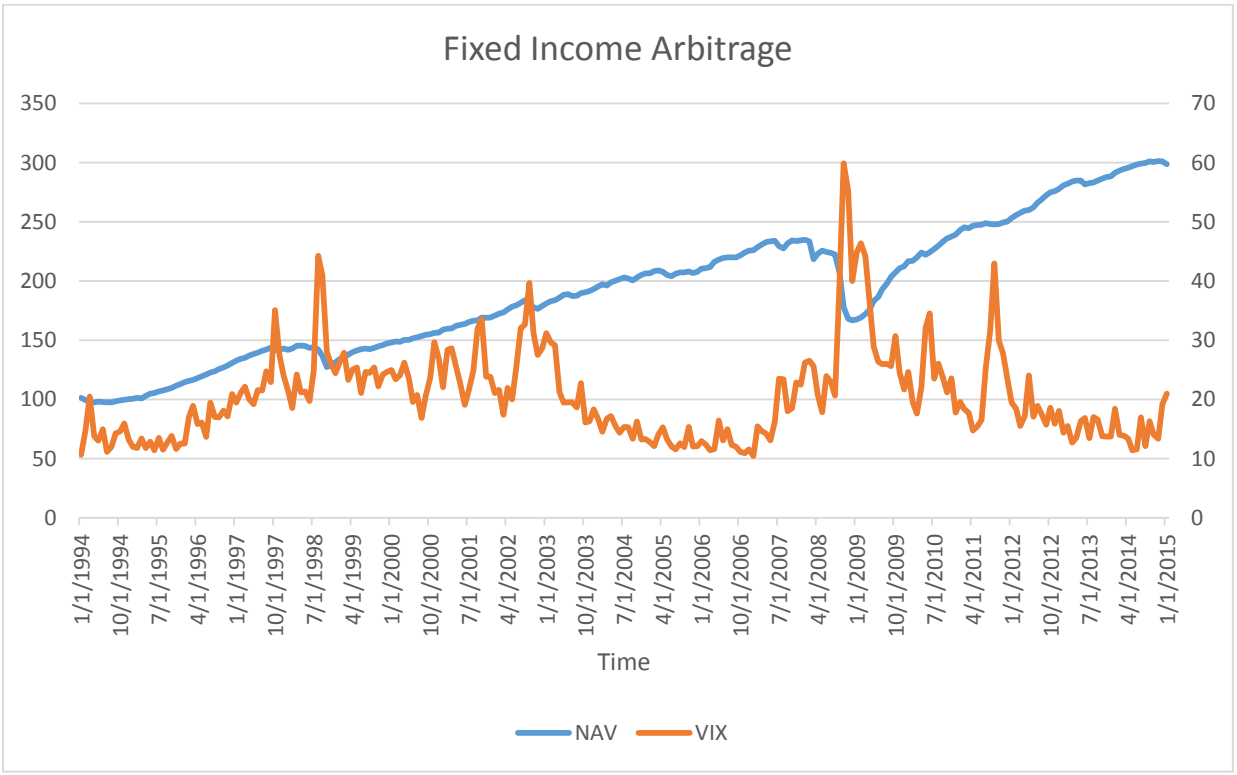


Figure 3k: Global Macro

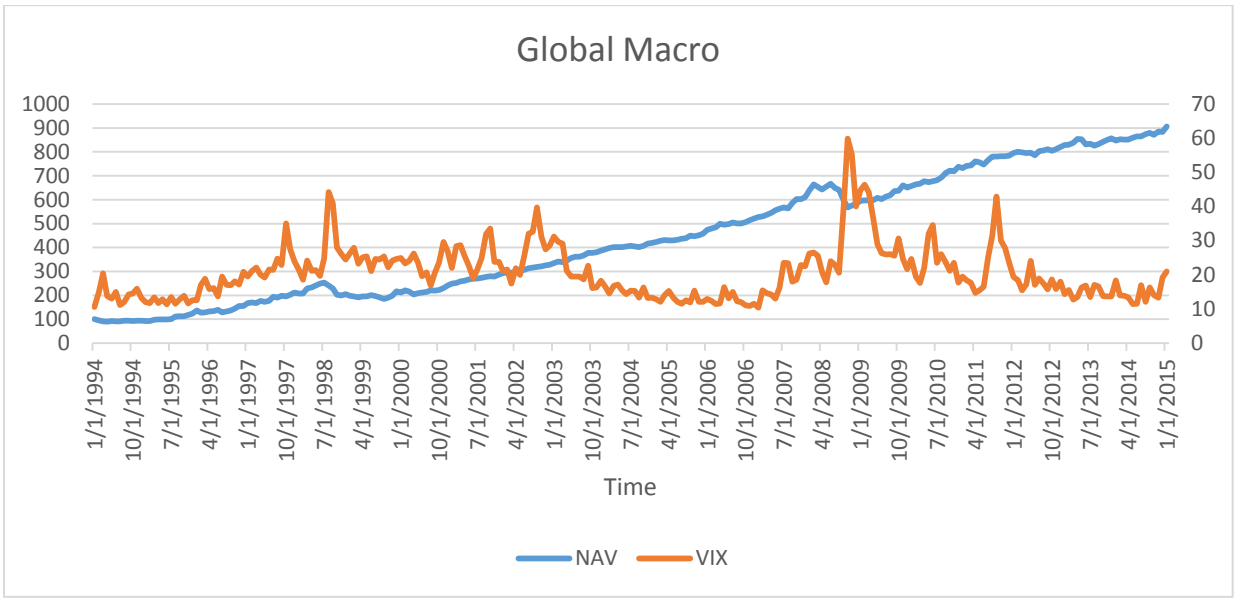


Figure 3l: Long/Short Equity

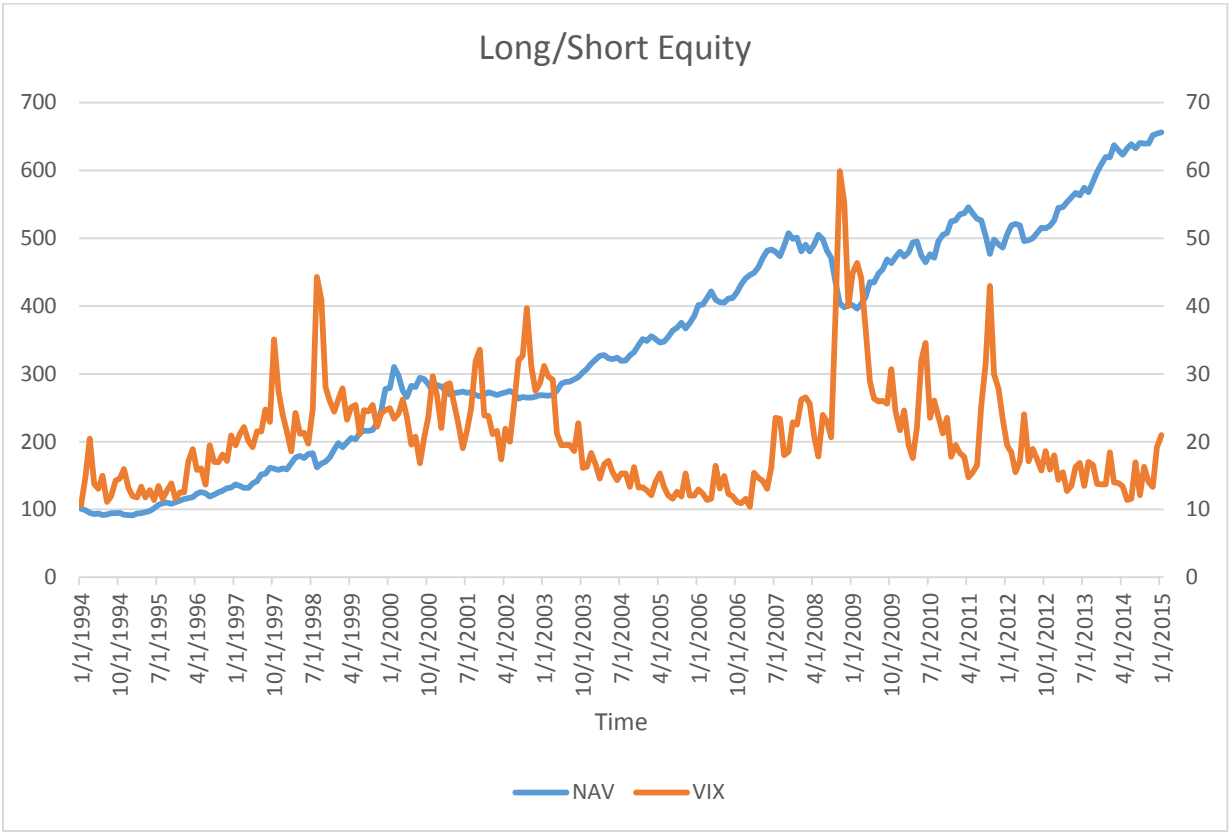


Figure 3m: Managed Futures

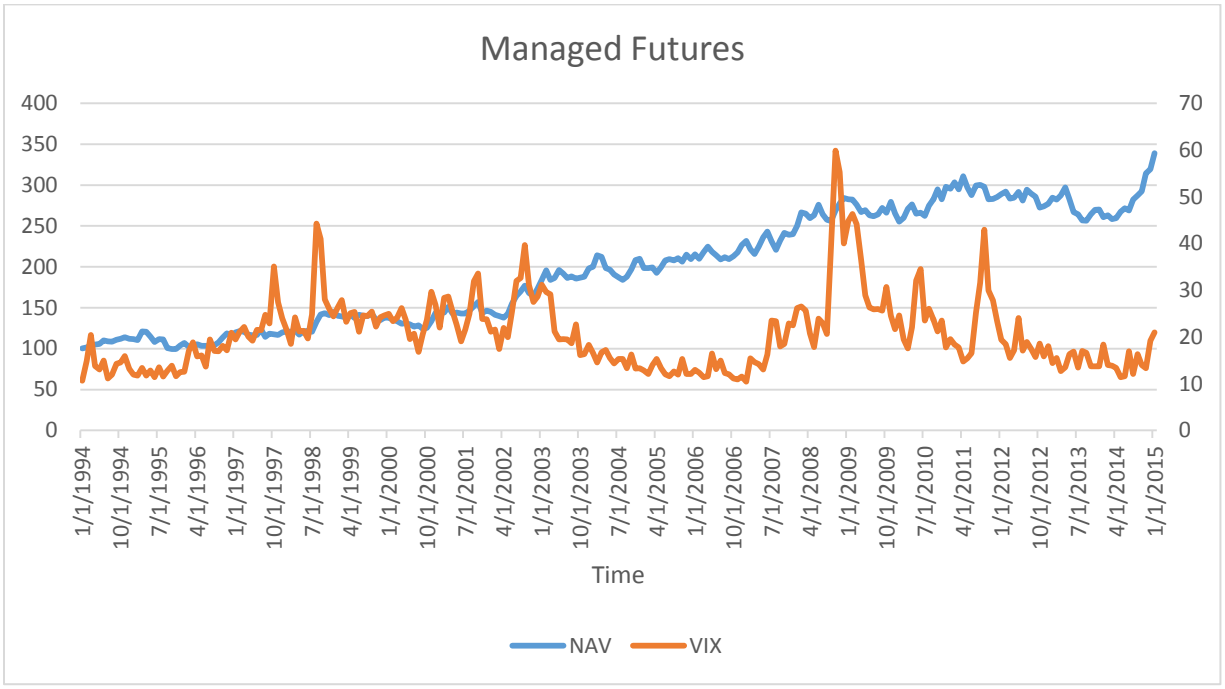


Figure 3n: Multi Strategy

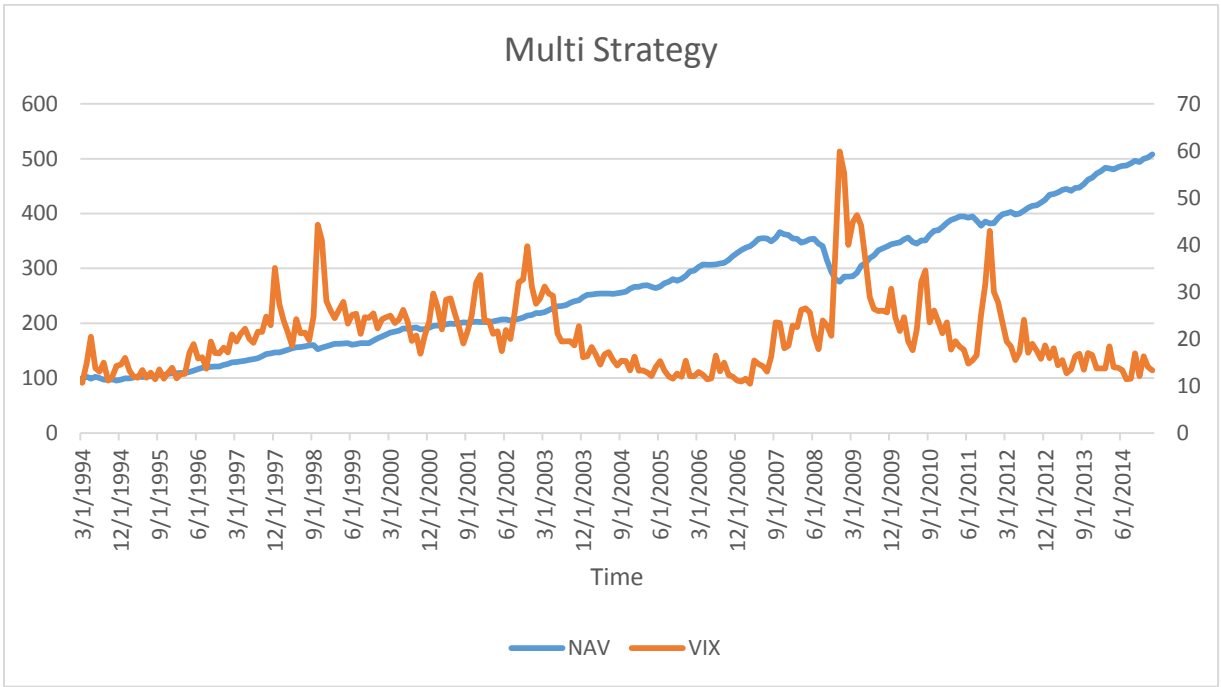
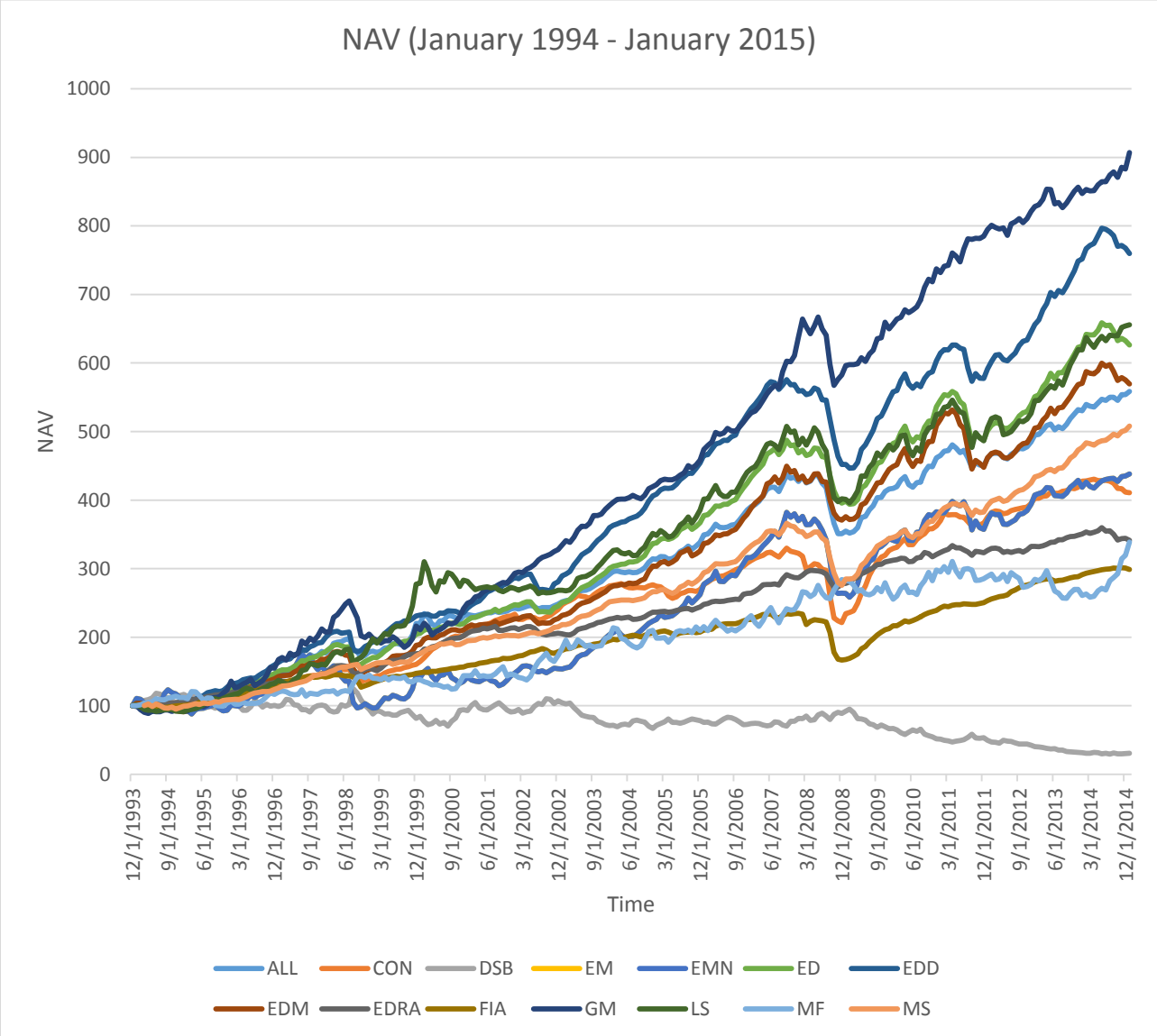


Figure 4: Net Asset Value (NAV) time series graph



3.2 Regression Analysis

Using Excel, we were able to get the following summary output for ALL hedge fund styles.

Figure 5: Regression Summary Output Example for ALL

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.361971							
R Square	0.131023							
Adjusted R Square	0.127561							
Standard Error	1.921304							
Observations	253							
ANOVA								
	df	*SS*	*MS*	*F*	*ignificance F*			
Regression	1	139.7032	139.7032	37.84551	3E-09			
Residual	251	926.5434	3.691408					
Total	252	1066.247						
	Coefficients	*tandard Erro*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*Jpper 95.0%*
Intercept	2.613539	0.336744	7.76121	2.13E-13	1.950336	3.276743	1.950336	3.276743
X Variable 1	-0.09416	0.015305	-6.15187	3E-09	-0.1243	-0.06401	-0.1243	-0.06401

Our main concern with this summary output is the t-statistic and the p-value provided. The values were indicated and categorized due to their significant nature using "*" symbol.

The t-statistic uses means and standard deviations of 2 sample sets of values to compare. The value of a t-statistic would have to be equal to or greater than 2 in

order for it to be significant. In this example summary output for ALL, the t-statistic is indeed significant.

Linear regression analysis is generally used to estimate the relationship between two variables, one dependent and one independent (as known as the predictor factor). In this case, the dependent factor is the hedge funds' returns, while the independent factor is VIX. The analysis would help us estimate The general formula for linear regression is:

Y = a + bX + error, where

Y = the variable we are trying to predict. In this case, the variable is "Ri" – representing hedge funds' returns

X = the variable we have already known, used to predict Y. In this case, the variable is VIX.

a = intercept

b = slope

error = regression residual

The specific quation used for our single-factor model:

$R_i = a + b_i*VIX + error$

(*) denotes significance at the 5% level

Table 2: Single-factor Implied Volatility Risk Model

(Panel A) Full sample: January 1994 – January 2015

Hedge fund style	a	b_1	Adjusted R^2
ALL	2.6135* (7.7612)	-0.0942* (-6.1519)	0.1276
Convertible Arbitrage	1.6206* (4.8716)	-0.0517* (-3.4199)	0.0407
Dedicated Short Bias	-2.9984* (-3.7441)	0.1234* (3.3892)	0.0400
Emerging Markets	4.0407* (5.9187)	-0.1683* (-5.4243)	0.1014
Equity Market Neutral	3.2841* (5.6784)	-0.1412* (-5.3733)	0.0996
Event Driven	2.7856* (9.9143)	-0.1003* (-7.8564)	0.1942

ED - Distressed	2.9818* (10.2587)	-0.1062* (-8.0360)	0.2015
ED - Multi Strategy	2.7107* (8.7633)	-0.0985* (-7.0063)	0.1602
ED - Risk Arbitrage	1.2591* (6.3257)	-0.0377* (-4.1656)	0.0609
Fixed Income Arbitrage	1.9573* (7.4431)	-0.0742* (-6.2120)	0.1298
Global Macro	1.9886* (4.3641)	-0.0544* (-2.6264)	0.0229
Long/Short Equity	2.9196* (6.4468)	-0.1060* (-5.1478)	0.0919
Managed Futures	-0.1395 (-0.2396)	0.0303 (1.1445)	0.0012
Multi-Strategy	1.7800* (7.0834)	-0.0549* (-4.8165)	0.0819

(Panel B) Market crash: January 2008 – March 2009

Hedge fund style	A	b_1	Adjusted R^2
ALL	2.0260 (1.1401)	-0.0986* (-2.0367)	0.1836
Convertible Arbitrage	2.1073 (0.5725)	-0.1208 (-1.2051)	0.0313
Dedicated Short Bias	-2.0205 (-0.5227)	0.0881 (0.8370)	-0.0219
Emerging Markets	2.3738 (0.7802)	-0.1398 (-1.6872)	0.1165
Equity Market Neutral	12.5133 (1.4132)	-0.4721 (-1.9578)	0.1683
Event Driven	1.6026 (1.1078)	-0.0851* (-2.1590)	0.2073
ED - Distressed	2.1472	-0.1094*	0.3882

	(1.6808)	(-3.1439)	
ED - Multi Strategy	1.2903 (0.7897)	-0.0714 (-0.0714)	0.1011
ED - Risk Arbitrage	0.8953 (0.7825)	-0.0273 (-0.8769)	-0.0168
Fixed Income Arbitrage	4.3648 (1.4894)	-0.1871* (-2.3446)	0.2431
Global Macro	1.6466 (0.7123)	-0.0523 (-0.8302)	-0.0227
Long/Short Equity	1.3790 (0.5869)	-0.0824 (-1.2876)	0.0449
Managed Futures	-0.8511 (-0.3647)	0.0519 (0.8159)	-0.0245
Multi-Strategy	1.6770 (0.8245)	-0.0943 (-1.7030)	0.1195

3.3 Descriptive Statistics

Table 3: Descriptive Statistics

(Panel A) Full sample: January 1994 – January 2015

Hedge fund style	*Mean*	*Sample Variance*	*Standard Deviation*
ALL	0.6798	4.2311	2.0570
Convertible Arbitrage	0.5587	3.7554	1.9379
Dedicated Short Bias	-0.4648	21.7459	4.6633
Emerging Markets	0.5840	16.8835	4.1090
Equity Market Neutral	0.3832	12.0931	3.4775
Event Driven	0.7251	3.1889	1.7858
ED - Distressed	0.8015	3.4440	1.8558
ED - Multi Strategy	0.6877	3.7091	1.9259
ED - Risk Arbitrage	0.4851	1.3734	1.1719
Fixed Income Arbitrage	0.4325	2.5870	1.6084

Global Macro	0.8715	6.9179	2.6302
Long/Short Equity	0.7434	7.3523	2.7115
Managed Futures	0.4824	11.0423	3.3230
Multi-Strategy	0.6500	2.2074	1.4857

Hedge fund style	*Skewness*	*Kurtosis*	*Rewards to Variability*
ALL	-0.3261	3.0736	0.1607
Convertible Arbitrage	-3.0503	20.2782	0.1488
Dedicated Short Bias	0.5292	0.9863	-0.0214
Emerging Markets	-1.2673	8.0961	0.0346
Equity Market Neutral	-13.5593	203.7372	0.0317
Event Driven	-2.4131	12.8178	0.2274
ED - Distressed	-2.4027	13.6586	0.2327
ED - Multi Strategy	-1.9187	9.1158	0.1854
ED - Risk Arbitrage	-1.0284	4.9539	0.3532

Fixed Income Arbitrage	-5.0207	39.5292	0.1672
Global Macro	-0.1812	4.7491	0.1260
Long/Short Equity	-0.2523	3.7633	0.1011
Managed Futures	-0.0777	0.0040	0.0437
Multi-Strategy	-1.8852	7.3543	0.2945

(Panel B) Market crash: January 2008 – March 2009

Hedge fund style	*Mean*	*Sample Variance*	*Standard Deviation*
ALL	-1.354	7.413	2.723
Convertible Arbitrage	-2.036	26.808	5.178
Dedicated Short Bias	1.001	28.028	5.294
Emerging Markets	-2.420	20.081	4.481
Equity Market Neutral	-3.677	180.682	13.442
Event Driven	-1.314	5.061	2.250
ED - Distressed	-1.604	5.113	-0.834

ED - Multi Strategy	-1.158	5.692	2.386
ED - Risk Arbitrage	-0.042	2.467	1.571
Fixed Income Arbitrage	-2.052	21.747	4.663
Global Macro	-0.146	10.015	3.165
Long/Short Equity	-1.446	11.078	3.328
Managed Futures	0.927	10.189	3.192
Multi-Strategy	-1.558	9.006	3.001

Hedge fund style	*Skewness*	*Kurtosis*	*Rewards to Variability*
ALL	-0.920	0.052	-0.183
Convertible Arbitrage	-1.381	1.721	-0.076
Dedicated Short Bias	-0.180	-0.989	0.036
Emerging Markets	-1.699	3.323	-0.121
Equity Market Neutral	-3.762	14.356	-0.020
Event Driven	-0.756	-0.050	-0.260

ED - Distressed	-0.834	-0.406	-0.314
ED - Multi Strategy	-0.769	0.169	-0.204
ED - Risk Arbitrage	-1.206	1.068	-0.017
Fixed Income Arbitrage	-1.847	3.488	-0.094
Global Macro	-0.680	0.143	-0.015
Long/Short Equity	-0.706	-0.048	-0.131
Managed Futures	0.170	-1.078	0.091
Multi-Strategy	-0.832	0.477	-0.173

4. Conclusions

Looking at the regression analysis, we definitely can say that the VIX Index is an influence of hedge fund returns. The dedicated short bias is a perfect example of that, being the only model with a positive slope, indicating how the hedge fund style focuses on "shorting", and thus becoming the only investing style that did well in the market crash 2008. All in all, the VIX in our single-factor model not only anticipates the investors' "fear" of risks, but also tells us the mentality and returns of hedge funds, showing us if they do well, either in financial crisis or overall. Although we can't quite answer the question if hedge funds really do hedge just yet, looking into VIX is sure to get us closer.

Investors can certainly utilize the same method of creating a single-factor model with VIX data to get corresponding data on hedge fund returns. There are still, nevertheless, numerous aspects that factor into why investors decide to invest in hedge funds. Our research was based on a huge set of data, yet did not really focus on any specific hedge funds. This should also be kept in mind while investors utilize our regression analysis model with the VIX Index to avoid generalized predictions about specific hedge funds returns. However, since the Volatility Index

is just one of many huge economical factors, further research analyzing hedge fund returns basing on other predictor variables should be conducted.

5. References

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