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How to choose an Hedge Fund? Impact of qualitative characteristics on performances

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1. INTRODUCTION

Thanks to the progress of finance engineering, alternative investments have raised importance in the finance world during the last years. Inside this sector the hedge fund industry has grown rapidly, it has become more popular with institutional and especially high net worth investors. But the question is: what is a hedge fund? There are many ways to define this typology of investment. Hedge funds are unconventional funds of investment: they follow different strategies to reach a result which is not related to a benchmark, as the common model of investment fund with restrictions on operation and risk appears.

As a result, as detailed in the second chapter, the amount of assets under management by hedge funds has grown from around \$40 billion in 1994 to an estimated \$600 billion in 2007. In line with this issue, the number of hedge funds worldwide has grown to around 6000 units.

Agarwal and Naik (2005) report that there has been a shift in the type of hedge fund investor: in the early 1990s, the typical hedge fund investor was a high net worth U.S. individual investor (who needs onshore funds), but today the typical investor is an institutional investor (who prefers offshore funds due to tax reasons).

Since 1994, however, hedge fund advisors and fund of funds operators have been collecting performance and other data on hedge funds. This has allowed researchers to take a more serious look at hedge fund industry. Even if research in this area is still at the beginning of its life, it has become clear that hedge funds are a lot more complicated than common stocks and bonds and may not be as phenomenally attractive as many hedge fund managers and marketers want investors to believe.

Researchers have examined whether this growth is accompanied by positive risk-adjusted performances. Some studies find that top-performing hedge funds can consistently deliver alpha, and their performance cannot be explained by luck (Fung and Hsieh (1997, 2004), Ackermann et al. (1999), Brown et al. (1999), Agarwal and Naik (2004), Kosowski et al. (2007), Fung et al. (2008), and Jagannathan et al. (2010)).

Others papers have studied how some characteristics of hedge funds impacted to build these performance (Agarwal and Naik (2004), Roon et al. (2009), Ben and Moussawi et al.(2010), Brown et Goetzmann et Ibbotson (1999), Ding et al. (2009), Liang, and Park (2008), Agarwal et Naik (2009)).

This research continues to work along this literature. In particular on the available database (Lipper TASS), I analyzed hedge fund performances in three steps:

- I. *Qualitative on Strategies*: To understand which should be the best strategy, I considered performance, volatility, skewness, kurtosis, alpha and all seven factors of Fung and Hsieh (2004)
- II. *Qualitative on Characteristics*: To identify which should be the optimal sequence of features that a hedge fund should have to satisfy particular requirement. To do it, I used performance, alpha and mean square error values.
- III. *Quantitative on Alpha/Mean Square Error*: (I divided all my data with cluster analysis by alpha and mean square error, and I ordered them by risk-adjusted performance). To verify all my conclusions I analyzed the composition of the best clusters.

In each step I evidence all my conclusions with statistics and graphs. This thesis is built in three chapters. In the first I present an overview of what a Hedge Fund is and detail which characteristics might be important to add value. I divided all features in three class:

- *Hedge Fund: Structure*. In this class I put some properties like the currency of fund (Usd/Others Currency), strategy and the location of it: offshore/onshore.
- *Hedge Fund: Management*. There are four variables that connect the course of hedge fund and the money of management. These are: Personal Capital, High Water Mark, Management and Incentive Fee.
- *Hedge Fund: Manage*: There are several papers that studied the importance of some features that I signaled here. In this section I had liquidity variables, like Redemption Notice, Lock up period and Pay out Period, and leveraged variables; like Lev. / No Lev. and Average of Leveraged.

For each of them a short description is presented and the main conclusions about these in literature are reviewed. In addition, only for the property strategy¹, I exposed shortly some statistics of each strategy index. I compared each course with the S&P 500² index and the Hedge Fund industry Index to read better the evolution of each category during the sample period.

¹ I download the index strategy by <http://www.hedgeindex.com/hedgeindex/en/default.aspx?cy=USD>

² This is a general index that combines all strategies.

In the third chapter I exposed the methodology, which particular attention to the Fung and Hsieng model and the Clustering approach.

The fourth chapter resumed all my conclusions with the same section that I wrote previously.

The approach proposed in this thesis differs from the available literature, since I propose to analyse all features together and to describe them in different way, as previously explained. Furthermore, I employed not only returns, and its dispersions, but total return, alpha and risk exposures. The main aim was to test if these characteristics added real value or simply more dispersion of returns. In the descriptive analysis, I always show all distributions with box plots that helps to visualize all distributions and not only a part of them. In my opinion layout is the most useful way to allow some stable valuations. However, in many research papers I found only few statistics which analyzed means or Sharpe ratio. These values are too sensible from commercial dataset. In particular some outliers might shift the results in one sense or another way. With the target of reducing this possible bias, in every step I illustrated the complete distribution of each variable I analyzed.

To be able to perform the analysis I have been obliged to clean the sample in some parts when it was evident that part of the data presented unreasonable values. Furthermore, I took only funds with more than 36 months of track. This is in line to most part of the research in the field, since funds that have shorter life, often have many bias like I explain in the beginning of the fourth chapter. Often, the number of months of reported returns is lower than the length of their life. The reason of this behavior might be connect with the aggressive trade positions taken by the management of these funds. Moreover there is no history which allows us to take some reasonable valuations about their risk-adjusted performance using some tools like linear regressions and ratios.

In my opinion, the popular measure of risk-adjusted performance, known with the name of "Sharpe ratio", is useless for this particular cases, since this type of ratio gives back good estimation only for the normal distribution, that is completely described with the first and the second moment of the distribution, but not in the case of fat tails and high (positive or negative) levels of skewness.

This work is the first one that analyzed all these features, of the Hedge Funds, together and show complete performance distributions, alpha and mean square errors. In particular, I decided to compare all these values to improve my understanding of performances: in fact, to use only a classic performance analysis could really distort the

conclusions much more for this industry, than in mutual funds, as showed in literature. For these reasons at the end I used alpha values to try to clean data by leverage and others risks. Furthermore, I used mean square errors to capture the idiosyncratic risk, that alpha cannot take. To do it, I employed the model proposed by Fung and Hsieh to calculate alpha and mean square error (MSE) values. The values that I took were always weighted by the significance³, following the scheme of:

$$(\text{alpha} * (1-\text{p_value}))$$

In the last part of chapter 4 I applied cluster analysis to alpha and MSE, to verify all my previous work. The idea behind was to find clusters with positive risk-adjusted performance and to examine their compositions. I thus considered Hierarchical cluster to find the natural number of clusters. I compared this type of cluster analysis with the K-means approach. This step allowed me to indentify some possible outliers that I have deleted from my sample. Finally, I opted for K-means analysis that allows me to better divide the positive risk-adjusted performance area than Hierarchical clustering.

In conclusion, the market of Hedge Fund results to be efficient. The choice of Hedge Fund strategy is the consequence of singular requirement in portfolio allocation. This outcome appears clear in connection with the first paragraph of the fourth chapter where I displayed how each strategy implies specific expositions to equity, bond, forex, currency and commodities risks. Not all the characteristics seem to have impacts on value, as detailed in the appendix. However the features that I classified inside Hedge Fund: Structure and Manage seem to add some values on performances.

The algorithm adopted to divide data in clusters, could be improved since it seems like to be a good selector of funds like I displayed in the Appendix. In particular it selected stable funds that have a great risk-adjusted performance. These clusters have funds with peculiar statistics. They have positive stable performance, low volatility and low risk in each factors than the others clusters.

³ My blend on a significance level is 0,05. I changed in zero all values with a p-value higher than this blend.

2. Hedge Fund Overview

There isn't a precise or universally accepted definition of hedge fund. Originally, the first hedge fund structure appeared in 1949⁴ (John Wiley Sons), like a private partnerships that took long and short equity positions to reduce net market exposure in exchange for accepting a lower rate of investment return. Nowadays the word "Hedge" have two different meanings: hedging fund, or Hedge Fund. In fact to define it is necessary to know the organization and the structural characteristics of the portfolio. The first indicates a portfolio where some risks are covered using different strategies. The second meaning has a wide number of definitions:

"A hedge fund is a private investment portfolio, usually structured as a limited partnership, open to accredited investors, charging an incentive-based fee, and managed by a general partner with every financial tool imaginable at his disposal."

(Sierra Capital Planning Inc.)

"A multitude of skill-based investment strategies with a broad range of risk and return objectives. A common element is the use of investment and risk management skills to seek positive returns regardless of market direction."

(Goldman Sachs & Co.)

"A loosely regulated private pooled investment vehicle that can invest in both cash and derivative markets on a leveraged basis for the benefit of its investors."

(Thomas Schneeweis, University of Massachusetts)

Hedge Fund is a investment vehicle where the manager invest the money through flexible investment policies where the only limit is the strategy declared.

At the present, a Hedge Fund has five main characteristics⁵:

- I. The manager is free to use a wide range of financial instruments;
- II. The manager can realize the short selling,
- III. The manager can use the leverage;
- IV. The manager's profit comes from a management fee, which is fixed, and from a rate of fee on profits.

⁴ The Handbook of Alternative Assets. John Wiley & Sons. P. 36

⁵ Investment strategy of Hedge Funds. P.º2

- V. The manager invests a sizable part of his personal assets in the fund he manages, so as to bring his own interests in line with those of his clients.

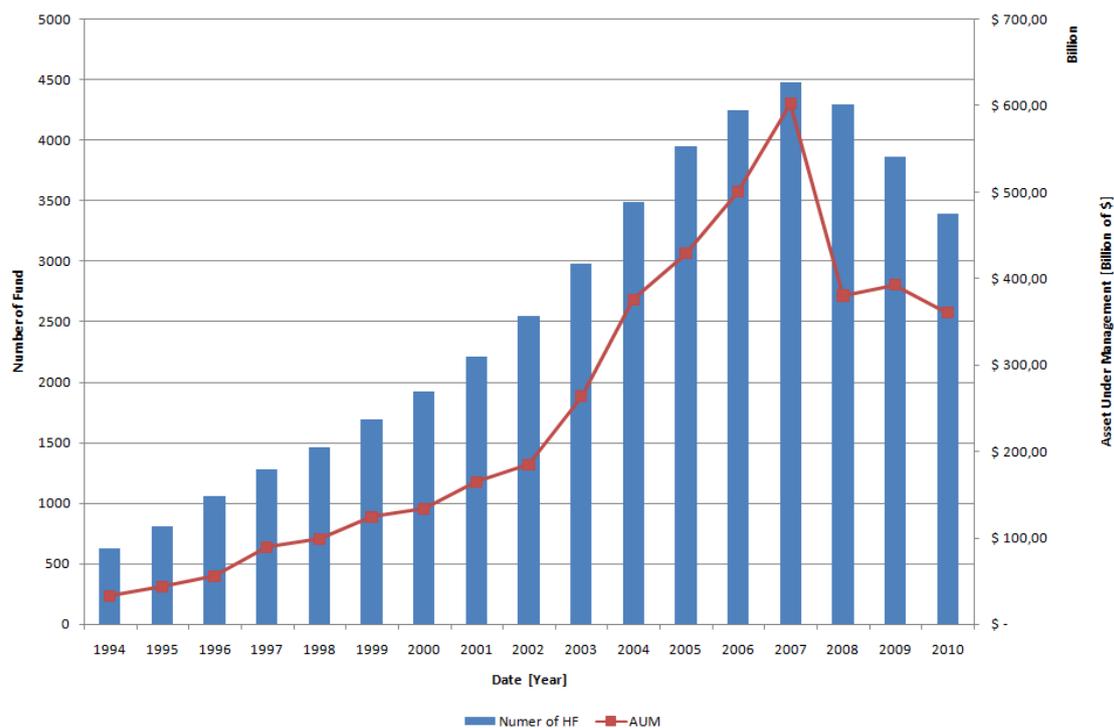
The law does not require lots restriction for it, only in the shore country the regulation puts some limits, like the type of people that could invest in these funds.

Start in the end of '50 this business grew, but it is only in 1990 that the number of hedge fund companies⁶ boomed.

This process might due of some characterized of this environment⁷:

- Low barriers to entry;
- Appealing fee structure;
- For successful manager the strong supply of money.

Following the financial bubble of the first year of 2000, this market duplicates the number of funds, about 2500 in 2002 to less than 4500 in 2007, and the asset under management from less than \$ 200 to \$ 600 Billion. In 2008 the world discovered that all the market is connect and the correlation of financial product might change, so some instruments that are uncorrelated or negatively correlate will be became positively correlate. The financial crises touch many companies in this sector, in particular some funds failed and others take big losses in that period. The changing of equilibrium in the financial market reduce the prospective of this business, until 2011 where this decline seems to be stabilized.



⁷ Investment strategy of Hedge Funds. P. 7

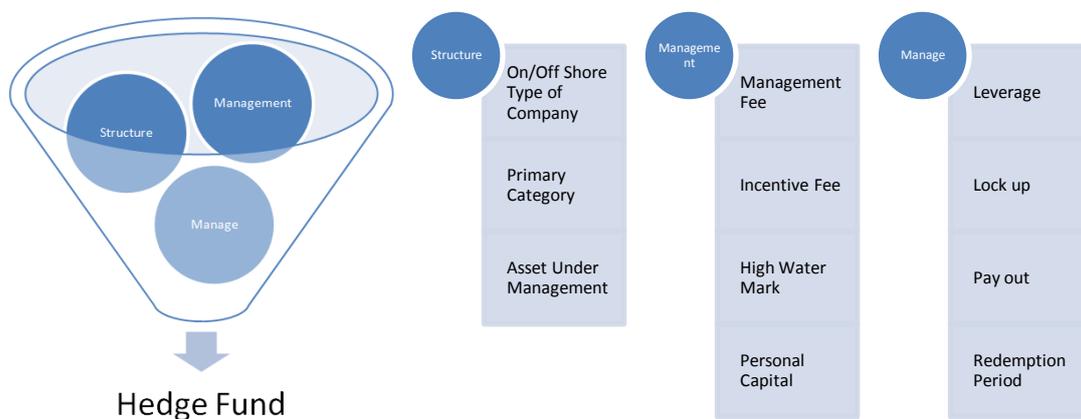
Some important Cases:

To understand more the importance of this sector I have reported some real cases that left a sign in history. In 1992, these alternative investment instruments started to draw the attention of the press and of the financial community, when George Soros' Quantum Fund made huge profits anticipating the depreciation of the British Pound and of the Italian Lira. The exit of the British Pound and the Italian Lira from the European monetary system in September 1992 allowed Soros to cash the incredible profit of \$ 2 billion.

Later, hedge funds bounced back into the headlines when, in the first nine months of 1998, Long Term Capital Management, managed by John Meriwether and including two Nobel laureates in Economics (Myron Scholes and Robert Merton), generated a staggering \$4 Billion loss, starting a domino effect that left many banks, financial institutions and big brokers in many countries teetering on the brink of default. Only the prompt intervention of a bail out team led by the Federal Reserve of Alan Greenspan avoided the onset of a systemic crisis.

2.1 Characteristics Overview

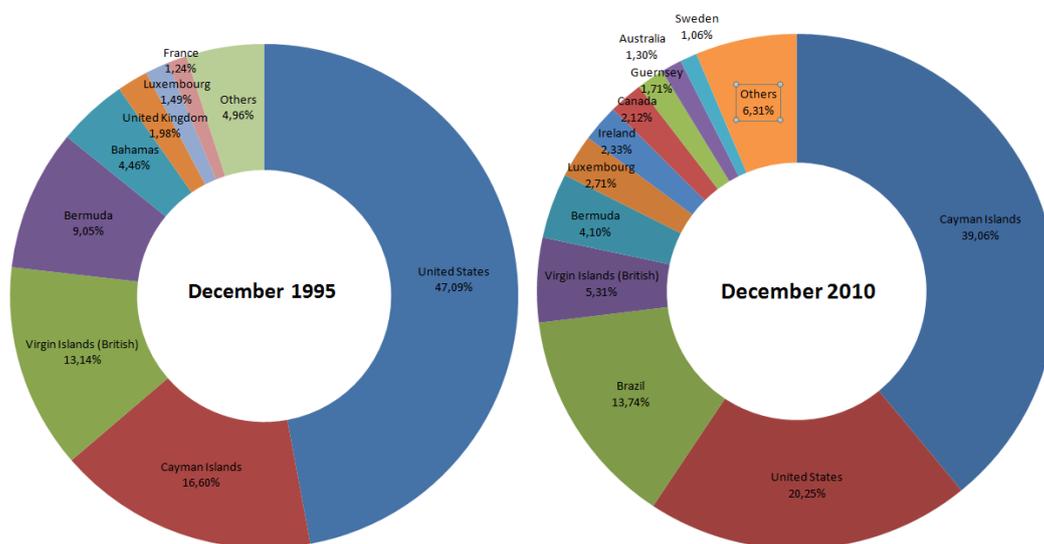
In this section I explained some characteristics, not exhaustive of Hedge Fund. In particular I analyzed what I think have more impact in managing a fund, dividing the feature in three class: Structure, Management, Manage.



2.2 Structure

Off shore on shore

The distribution of hedge fund in the world is influenced from countries regulations. In fact many funds decided to stay where benefited of low restriction⁸: fiscal for itself or for their clients, or for level of liability for the partner. In the common sense states are divided in “Off Shore” and “On shore”. For the second one, regulations fixed more limits and impositions, an example is leverage that can take, in this country are fixed maximum level of risk. In my data, in December 1995 the funds were 52,20% On Shore and 47,80% Off shore but after 15 years the funds Off shore are 64,45% against 35,55% of On shore.



This process show how this business use regulation and fiscal arbitrage⁹ in this segment to earn more money. In recent years the governments of On shore countries started to discuss this practice because big flows of money leaving the country to others places, caused some problems in monetary policies and equilibrium of balance state.

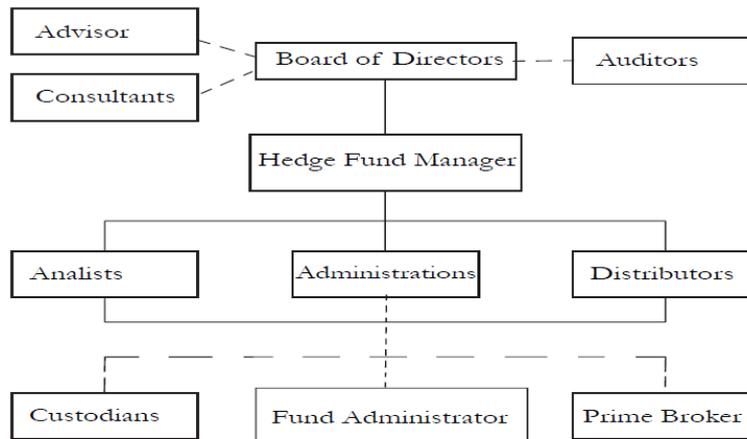
Structure and Type of company

The structure is flexible and not so heavy , this allow to be fast in decision when market changes. To reach these targets funds outsourced many services. Each fund has

⁸ Aragon et Liang, 2006, Onshore and Offshore Hedge Funds: Are They Twins?, Arizona State University

⁹ Brown, S. J., W. N. Goetzmann, and R. G. Ibbotson, 1999, Offshare Hedge Funds: Survival and Performance, Journal of Business 72, 91 - 119.

many prime broker to be get their asset allocation secret. The most important figure in this organism is Hedge fund manager that, with his team, can decide asset allocation, risk, position trading, etc...



Strategy¹⁰

Mutual funds are classified by dividing them into markets and sectors in which they invest, an example is found xxx that invests in equity, medium and big capitalization of European market. Instead hedge funds hadn't a clear and unique classification. In literature there are several classifications that break them down first by investment style followed by the management and second in terms of market or sector. The problem is that these classifications are too general and often inside the same class we see funds with different behaviors like return and risk. This is the consequence of multiple style that manager made. A determinate investment strategy is not a static universe, the trade position and the main characteristics within this one change during the life of the fund. This means that, passing the time, the return and the risk are volatile. These strategies change constantly and are affected from fluctuations of their assets under management.

¹⁰ Stefanini Filippo, 2005, Investment strategies of hedge funds, Book, John Wiley & Sons Ltd.

Nelken Izzy, 2006, Hedge Fund Investment Management, Book, Elsevier Finance.

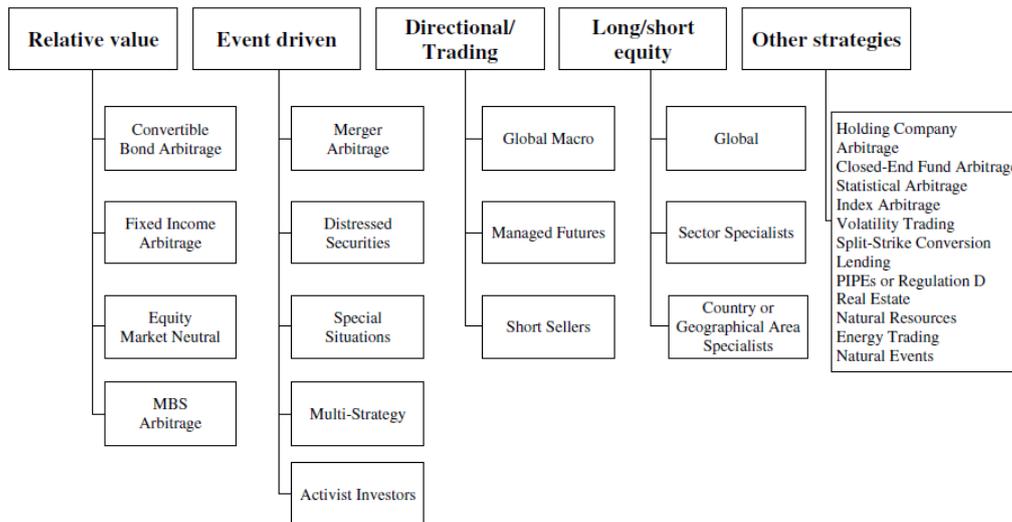
L. Maginn John, L. Tuttle Donald, W. McLeavey Dennis, E. Pinto Jerald, Managing Investment Portfolios, Book, John Wiley & Sons Ltd.

LhabitantFrançois-Serge,2006, Handbook of Hedge Funds, Book, John Wiley & Sons Ltd.

Connor, and Woo, 2003, An Introduction to Hedge Funds, working paper, Financial Markets Group, London School of Economics.

Brown et Stephen et Goetzmann, 2001, Hedge Funds With Style, working paper, Yale School of Management, Yale University.

Similar genera:¹¹



Each class identify species, the main styles in this classification are:

- I. Relative Value;
- II. Event Driven;
- III. Directional Trading;
- IV. Long/Short Equity;
- V. Others Strategies;

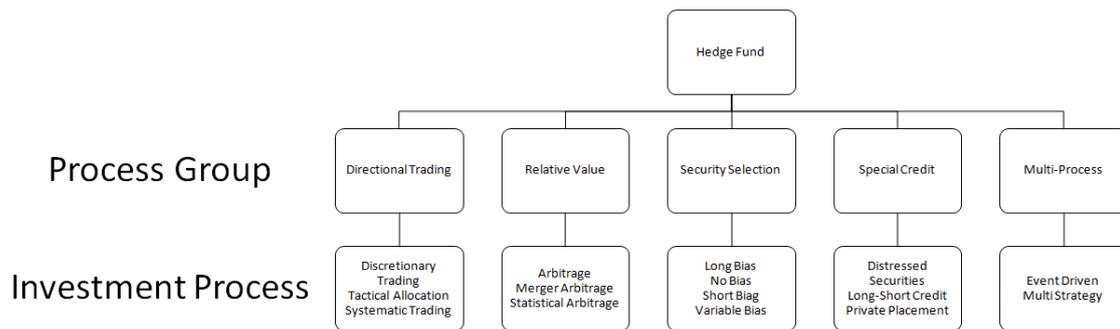
The first, Relative Value, took their value on spread trade where they play with correlation of product, hedging some risks, and gain in some inefficiencies of the market.

The second and the fourth have the same names of strategies, this is another prove of freedom that the manager had in managing the funds. Inside them the trade position might follow some important events that can interest company, country, politics...etc.. or follow the direction of the (bull or bear) market.

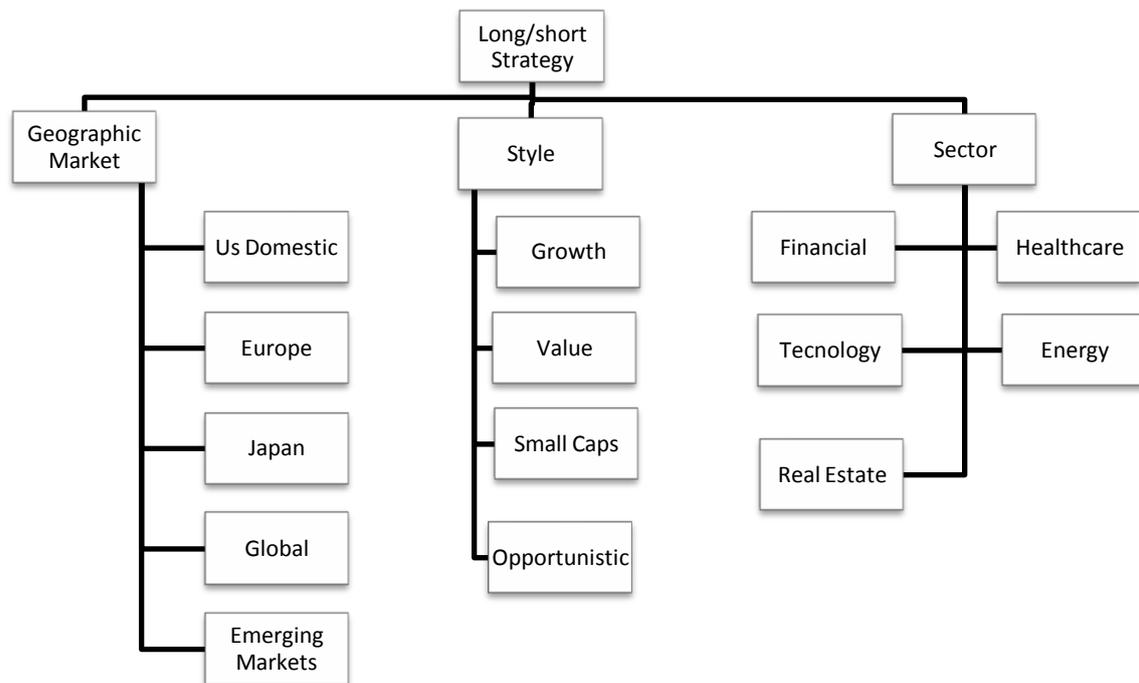
Instead funds within Directional Trading class invested their many long or short, one risk or more, more or less the same way as a bet. This type of investment strategy is very risky but might produce very high performance if the direction of fund portfolio is right. All the most recent and innovative strategies find place inside Other Strategies that is a residual category.

In literature other classifications divide strategies, as the figure below.

¹¹ Stefanini Filippo, 2005, Investment strategies of hedge funds, Book, John Wiley & Sons Ltd

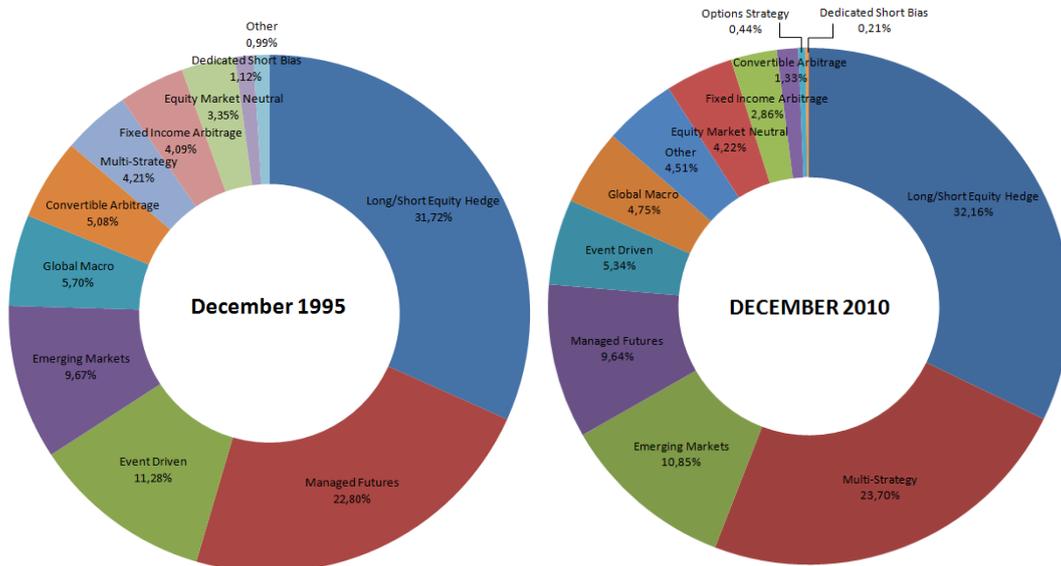


As is prefigured before the difference in the asset allocation so risk/return of different Hedge Fund can't be explained only by the strategy. The performance of two funds with same characteristics (strategy, currency, leveraged...) can be uncorrelated, as show for Long/Short strategy the difference inside this funds might be very big for the geographic market, style and sector.



The hedge fund industry is evolving every year. In the last decade this sector saw the birth of many strategies. The fist strategy was Long /Short Strategy following by Global Macro. These were the principal classifications of this young sector. In the last years all the financial markets change the own importance inside various sectors. New markets are followed with big interest by foreign investors, this is the case of emerging market. In the follow graph I illustrated the change in my dataset. As we can see the

popularity of some strategies fallen while some others increased. Some possible reasons should be research in the last performance of these strategies. In particular some categories suffered the first impact of crises and the default of big exponent of these classes like the case of Long Term Capital.



Others Consideration:

Following I reported the performance of the index of principal strategy¹². Some considerations, that we have to remember, are:

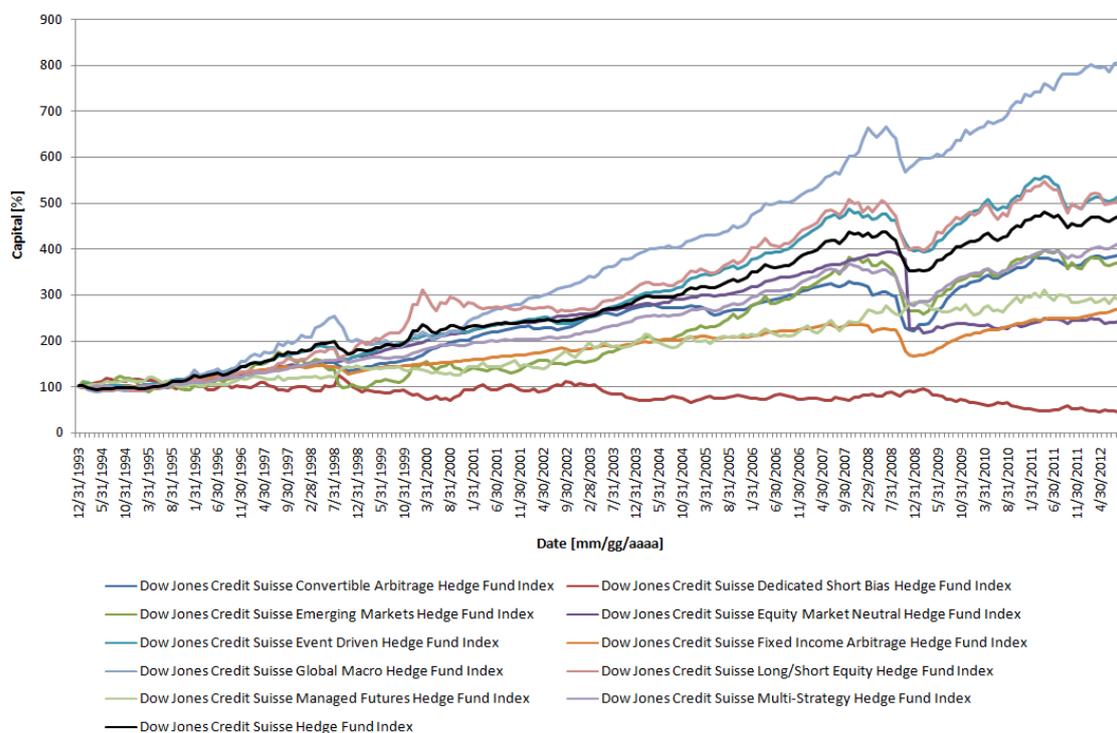
- Correlation between different strategy ;
- Risk that each strategy take:
 - Credit;
 - Concentrate (not Diversification);
 - Currency;
 - Default;
 - Liquidity;
 - Other risk...

All these considerations are more important than in 2007 when the financial crises gave serious problems to the balance of funds¹³. In particular we saw how all strategies have suffered in this period. As show in the next figure the course of singles

¹² Amenc et al., 2002, Benefits and Risks of Alternative Investment Strategies, working paper, Edhec Business School, Lille.

¹³ Amin, G. and H. Kat, 2003, Stocks, Bonds and Hedge Funds: No Free Lunch!, Journal of Portfolio Management, Summer

strategies took different ways in the first 5 years. In particular there is big dispersion after the 2000. This year in finance signed the border because the world market never been the same. After this date became more volatile and correlate into itself. Here it's visible the impact of Financial Crises in 2008 for each fund however for the crises in 2011 only some strategies have some consequences from it. Some conclusions I might take already here, but it's difficult because I don't know how these index are built. The best index-strategy is Global Macro, following by Event Driven and Long/Short Equity, the most stable fund is Manage Future, this particular business didn't feel the crises. The worst fund strategy seems to be Short Bias when even in the crises didn't take value.



Long short

In its simplest conception, the strategy of going long and short would minimize the exposure to equity markets and reduce systemic risk. The aim of this strategy is to make money by choosing a pair of stocks and about creating a "spread" or positive differential by buying an undervalued stock and selling a stock overvalued.

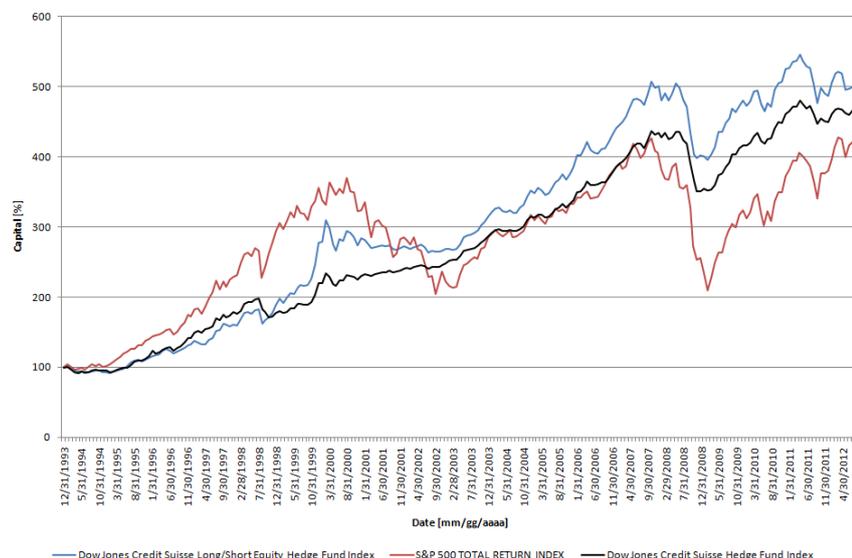
Obviously variations on this strategy are endless and depend on the skill and ability to analyze of the hedge fund manager. Many long / short hedge funds take many open positions in the market to reduce their overall risk and to expand their fund.

Historically managers of Long / Short Equity Hedge Funds have outperformed

traditional managers as demonstrate from the ability to generate a high correlation when they were bullish and a low correlation in bearish times. Hedge Funds are classified according to their management style. There are several classifications, but none is universally accepted. Hedge fund managers, who are taking business decisions in a portfolio, mainly use this strategy. This is a common strategy among hedge fund managers, and is driven by betting on the direction that a stock is going to take. The long side of the equation is a bet that an investment in shares rises in value. The shorter end is a bet that the value of the stock will decline.

Long / Short equity strategies are directional strategies, sometimes when the market changes, the management can decide to be market neutral but after a short term they change its portfolio, investing in assets using short and/or long positions.

Dow Jones Credit Suisse Long/Short Equity Hedge Fund Index	
Performance 1Y	0,86%
Performance 3Y	11,70%
Performance 5Y	7,16%
Performance 10Y	90,76%
Average Year Performance	10,39%
Standar Deviation	11,66%
Skewness	76,87%
Kurtosis	27,46%



Equity Neutral

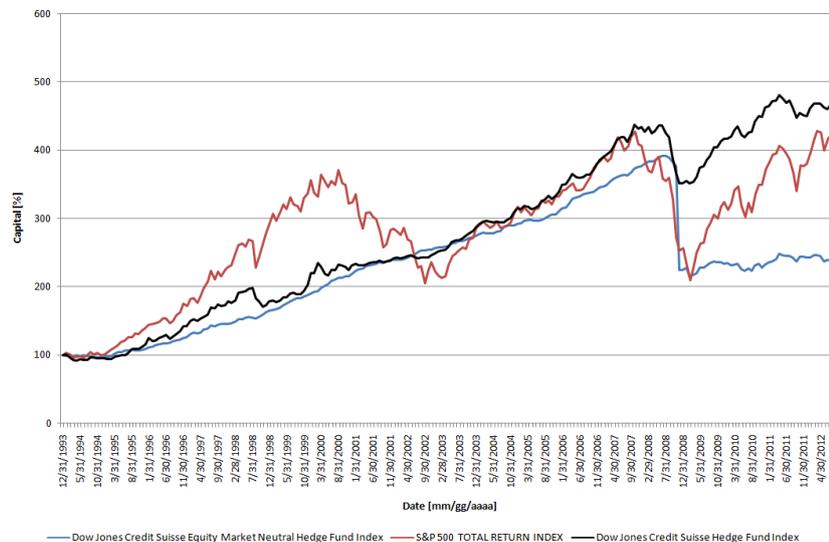
Hedge funds often adopt Market-Neutral strategies, which are designed to exploit equity market inefficiencies and usually involves being simultaneously long and short matched equity portfolios of the same size within a country¹⁴. One of the main strategies in the world of hedge funds strategies is "market neutral" where the investor takes a bullish position in a market (for example Nasdaq 100) and, at the same time, a bearish position in another index (S&P 500) trying to manipulate the spread between two assets which have high correlation. Market Neutral portfolios are designed to either be beta or

¹⁴ Chapter 9. Equity Hedge Fund Strategies – Equity Market Neutral Funds

currency neutral, or both. These hedge funds tend to separate stock picking from asset allocation decisions.

For this reason, a market-neutral manager can only show positive returns when the stocks he buys outperform the stocks he has sold. Therefore they can only be effective when they show skills in stock picking. In order to earn returns from this strategy, there has to be a noteworthy return difference between the top and the bottom performing stocks in a sector. These funds are the least volatile of all hedge fund strategies. The low volatility allows investors to earn the risk-free rate, an alpha from long and short stock selections.

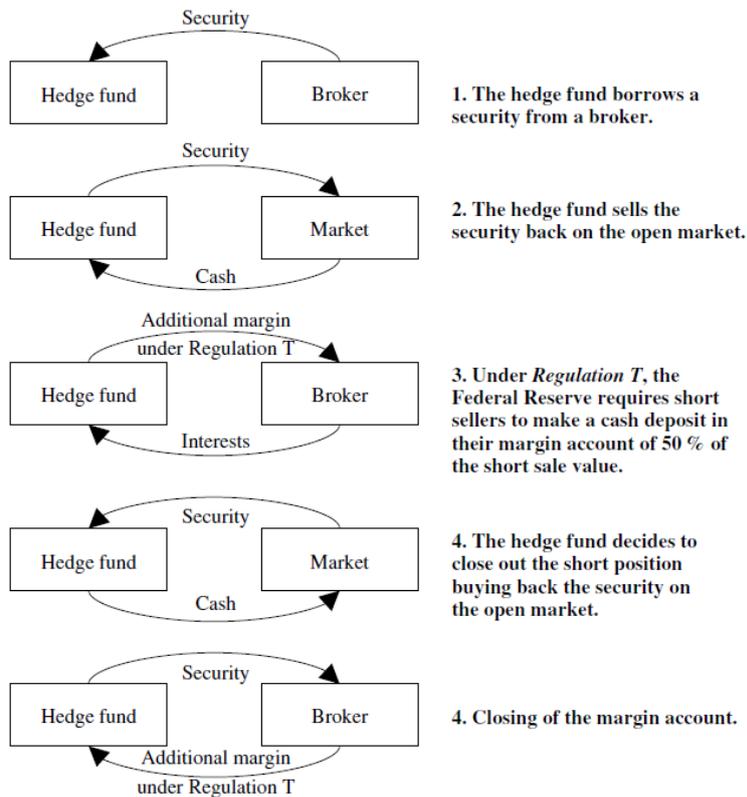
Dow Jones Credit Suisse Equity Market Neutral Hedge Fund Index	
Performance 1Y	-0,45%
Performance 3Y	2,85%
Performance 5Y	-33,51%
Performance 10Y	-4,52%
Average Y Performance	6,08%
Standar Deviation	12,46%
Skewness	-286,99%
Kurtosis	1019,69%



Dedicate short bias

Short sellers follow the conventional wisdom, according to which you should buy low and sell high. Here, however, the stock is sold first and bought later. Following I illustrate the flows in the process of short selling. Short sellers borrow shares and sell them on the market with the idea of buying them back later at a lower price. To short sell a stock, it is necessary to borrow it from a broker and immediately sell it on the market. Then it's necessary to deliver the stock back to the counterparty by buying the same amount of shares later on the open market. If the repurchasing price is lower than the initial selling price there is a profit, otherwise the manager will suffer a loss. Short sellers also make money from the liquidity interest originate from selling the stock short. The liquidity which is held as restricted credit by the brokerage company lending the shares: the short seller will earn interest on these cash proceeds, called short interest rebate. The outcome of the transaction depends on the manager's stock picking ability and market

timing. Profits from short sales are taxed at the short-term capital gain rate, irrespective of how long the position remained open. Unlike traditional investors, who look for undervalued companies, short selling managers look for overvalued ones. Short selling hedge funds do not disclose the names of the companies they are selling short to their investors, for fear that the market might stand in the way and try to cause a squeeze. It is



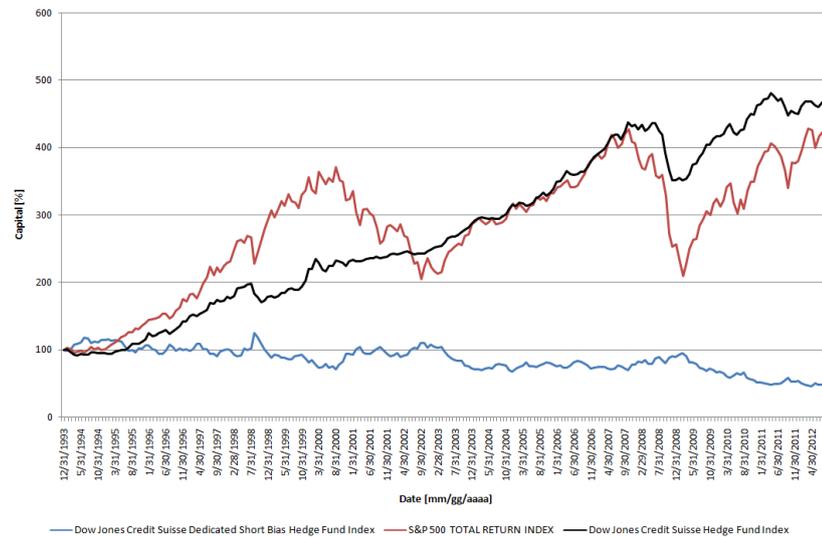
common practice among hedge fund managers to comment on short sales only after they have been closed out. If a manager believes a stock overvalued, he will ask his broker to sell the stock short: the broker will then lend the desired number of shares to the manager, requiring the manager to return them within a given period of time, defined in advance.

Short selling exposes the short seller to a potential

unlimited downside risk: if the share price goes up, he will have to repurchase the stock whatever its price at contract maturity. Some readers may wonder how is it possible to make money on stock without having it. Even after this explanation on how short selling works, it may still appear confusing, especially if one tries to compare this mechanism with everyday's life.

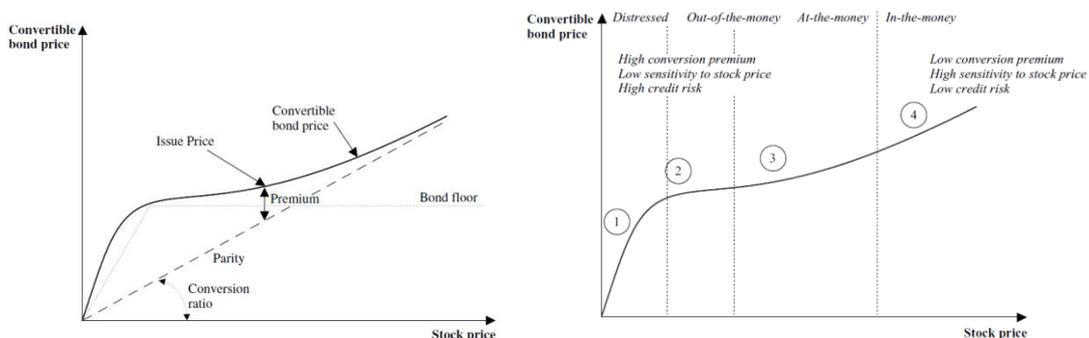
In the last years the Authority for the exchange market decided to stop the short selling in the regulated markets for some months. This practice is used to defend the market against short seller. In the summer of 2012 many European countries decided to stop short selling for Credit Default Swap because the power of some Hedge Funds destabilized the views of the market on the possibility of default for some countries.

Dow Jones Credit Suisse Dedicated Short Bias Hedge Fund Index	
Performance 1Y	-14,75%
Performance 3Y	-36,40%
Performance 5Y	-39,22%
Performance 10Y	-54,95%
Average Year Performance	-3,25%
Standar Deviation	17,98%
Skewness	131,45%
Kurtosis	164,84%

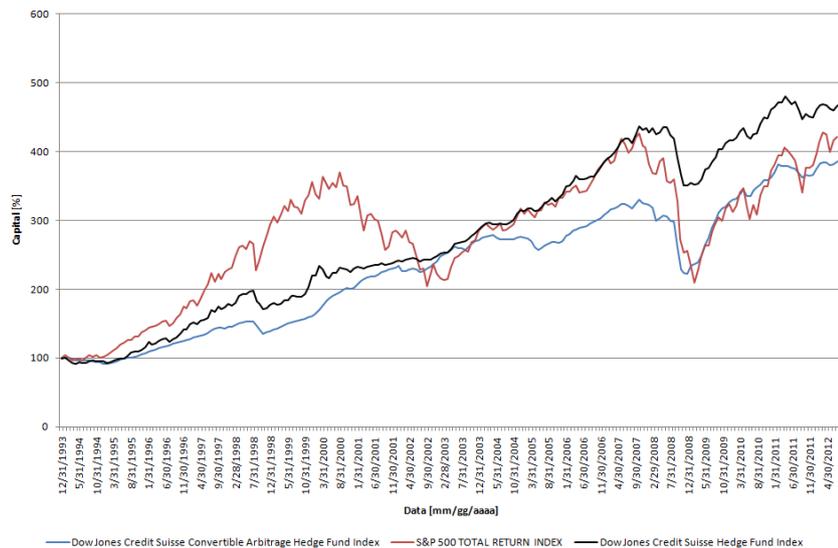


Convertible arbitrage

This strategy primarily involves taking long positions in convertible bonds or warrants, hedged with a short position, typically in the underlying stock. The profit opportunities are the mispricing of these products. In fact, in many cases, they are not accurately priced due to illiquidity in the convertible debt and warrant markets. As compared to the markets in the underlying common stocks, uncertainty concerning the call or redemption features of convertible securities and lesser market focus on these derivatives as opposed to the equities into which they are convertible or exercisable. This strategy try to set the delta of the portfolio as close to zero as possible. This means that the change in value of the portfolio for an infinitesimal change in the value of the underlying is zero. Figure I illustrate the linkage of convertible bond price and stock price.



Dow Jones Credit Suisse Convertible Arbitrage Hedge Fund Index	
Performance 1Y	4,82%
Performance 3Y	28,57%
Performance 5Y	21,90%
Performance 10Y	70,65%
Average Year Performance	8,33%
Standar Deviation	8,22%
Skewness	47,07%
Kurtosis	1,83%



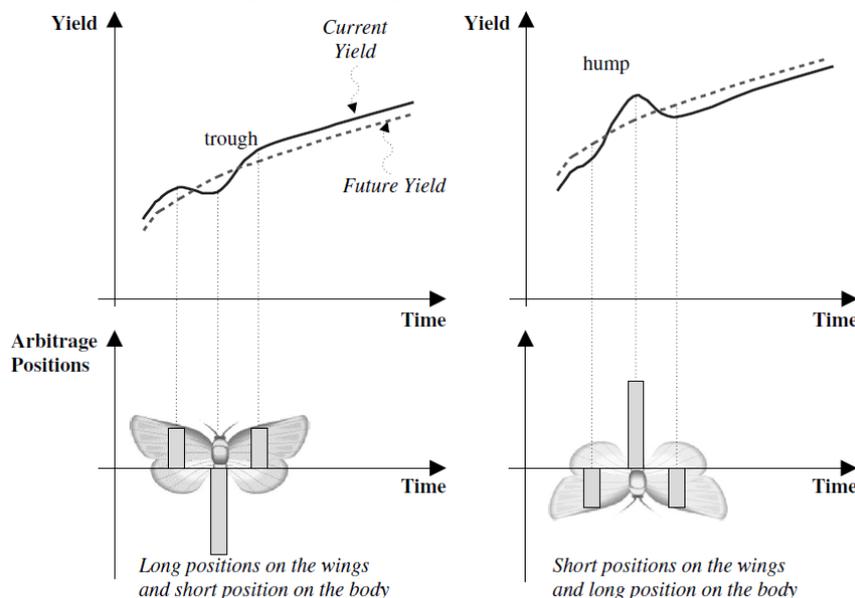
Fixed income arbitrage

This strategy attempts to capture mispricing developed between related classes of fixed income securities — mispricing which may be exploited, on a leveraged basis, for significant returns. This style type includes basis (e.g., cash vs. futures), yield-curve and credit spread trading, as well as volatility arbitrage. An unusually high degree of leverage is often available, and often emphasized, in fixed income arbitrage. In pursuit of their goal of both steady returns and low volatility, the arbitrageurs can focus upon interest rate swaps, US non-US government bond arbitrage, see US Treasury security, forward yield curves, and/or mortgage-backed securities.

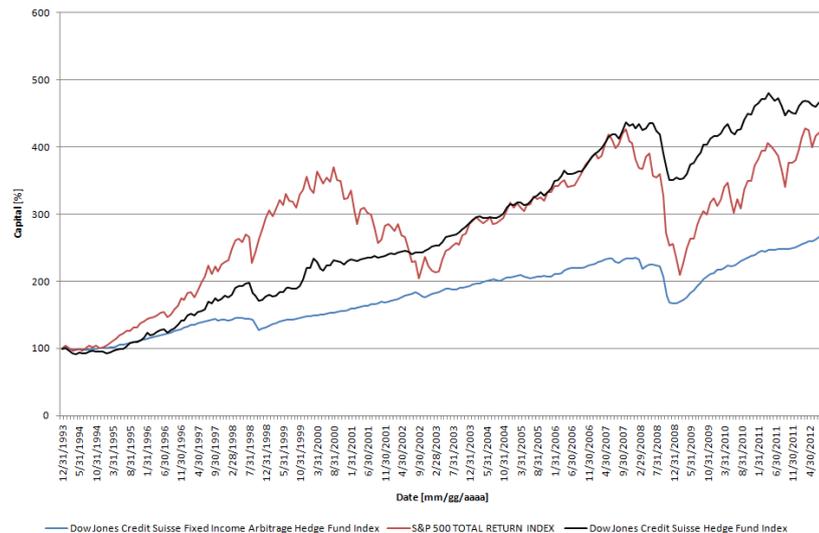
The two main categories of Fixed Income Arbitrage are:

1. Relative Value: Construction of a diversified portfolio with the goal of maximizing return and minimizing risk.
2. Market Neutral: Minimizing risk by taking long and short positions and maximizing return by taking advantage of pricing anomalies between sectors in the Fixed Income market.

Following I show an example of typical strategy.



Dow Jones Credit Suisse Fixed Income Arbitrage Hedge Fund Index	
Performance 1Y	8,37%
Performance 3Y	35,91%
Performance 5Y	18,22%
Performance 10Y	46,43%
Average Year Performance	6,01%
Standard Deviation	6,60%
Skewness	-70,12%
Kurtosis	92,16%

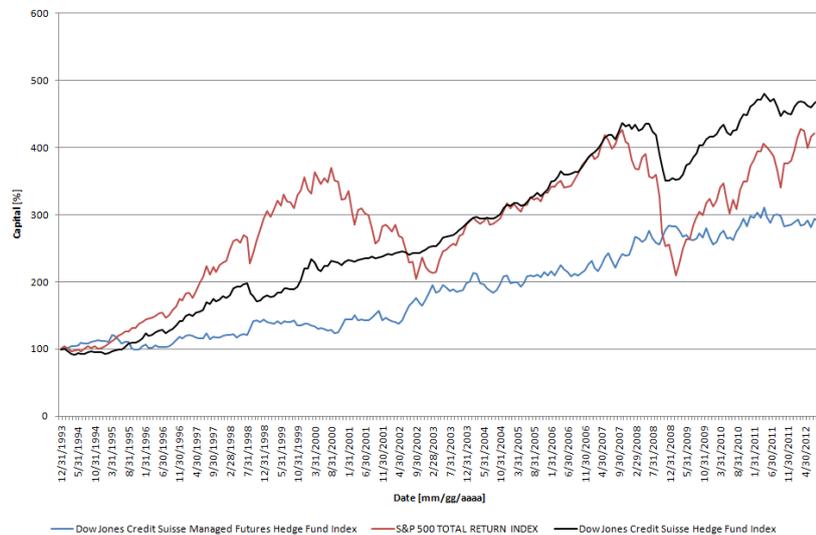


Manage Future

This type of alternative investment was established to trade in global futures, options and Forex markets, where takes long and or short positions, in which successful performance does not depend on continued upward movement in traditional equity or bond markets. The managed futures strategy is similar to the macro strategy: both are directional strategies investing prevailingly in futures listed worldwide. The primary difference is that in the managed futures strategy the fund manager's emotions are eclipsed by the use of computerized models that automatically make trading decisions. The fund manager can re-adjust the trading model parameters only periodically. They use many models that are processed by a computer in real time in order to pick a trend in each of more than 100 different futures markets and on different time horizons. They follow the trend until it dies out, first with a back testing on historical data, then with the management of a test portfolio, and finally with the management of true data in real time. A good trading system must minimize the brokerage fees paid by the fund to brokers, minimize volatility and minimize slippage, which curbs the strategy's profitability. In fact, an overly intensive trading may accumulate high brokerage fees that negatively affect performance. Risk management is very important, and to this end sophisticated risk management systems are put in place. Often back testing is misleading, in that it is relatively easy to find a model that suits the historical data. However, the application of a similar model to a computer-assisted trading system rests on a very potent assumption: the future will behave exactly as the past. A very questionable assumption, just think of events such as the outbreak of the Gulf war, the terrorist attacks of 11th September 2001, etc. Managed futures can be concentrated in a limited

number of positions or offer a diversification on a wide variety of futures markets: currencies, interest rates, equity indices, bond indices, energy, base and precious metals, agriculture commodities, etc.

Dow Jones Credit Suisse Managed Futures Hedge Fund Index	
Performance 1Y	-3,45%
Performance 3Y	9,61%
Performance 5Y	31,17%
Performance 10Y	70,53%
Average Year Performance	5,87%
Standar Deviation	7,53%
Skewness	-21,61%
Kurtosis	-98,16%



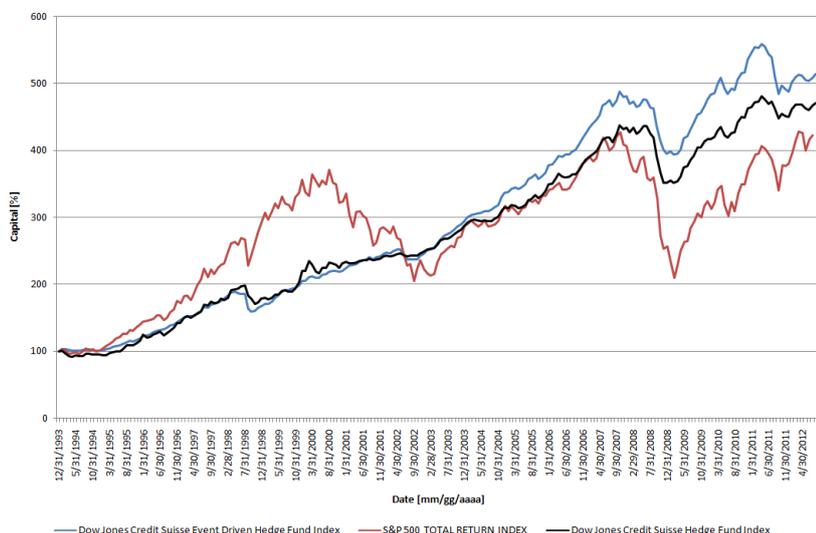
Event Driven

This is a strategy that tries to capitalize on corporate events. It can encompass a variety of situations, including takeover bids, restructurings, spin-offs, mergers, liquidations, bankruptcies. Substantial profits may be generated by managers who correctly analyze the impact of the anticipated corporate event, predict the course of restructuring and take positions accordingly. Because of its concern with micro triggering events, this family of strategies is also called bottom up. Sometimes an event-driven hedge fund will focus upon one of those bottom-up strategies in particular, in which case it may be referred to as a risk arbitrage, a distressed securities.

Examples of Event Driven strategies include:

- Deal Arbitrage
- Distressed Securities

Dow Jones Credit Suisse Event Driven Hedge Fund Index	
Performance 1Y	0,76%
Performance 3Y	16,57%
Performance 5Y	10,25%
Performance 10Y	116,33%
Average Year Performance	9,66%
Standar Deviation	7,94%
Skewness	-37,93%
Kurtosis	-112,69%

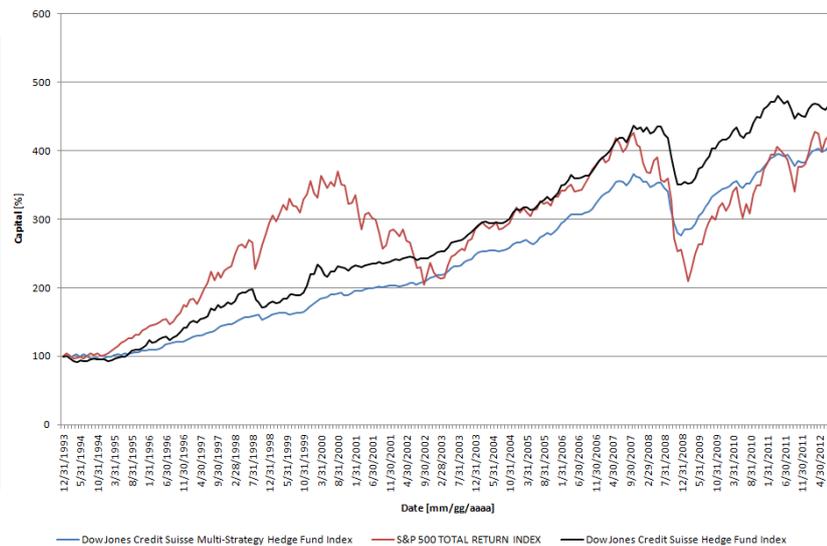


Multi-Strategy

Multi-strategy funds can offer investors access to a variety of strategies, provide considerable capacity and enhance the risk-adjusted returns of a diversified or concentrated investment portfolio. They might seek returns from running money focused on shorting equities, investing in global real estate projects, and seeking momentum focused event driven strategies. The diversification benefits help to smooth returns, reduce volatility and decrease asset-class and single-strategy risks. These funds may allocate funds in to a certain strategy in response to market trends allowing them to more easily capitalize on favorable market conditions. Due to the unpredictable nature of this type of hedge fund, the volatility is variable. A downside to this form of investing is that they will rarely be the highest performing hedge fund over a short time period. This is because the diversification dilutes the returns of any highly profitable strategy. The long term consistency, however, generally outweighs this risk. I haven't seen this type of fund very often as only the largest funds will have the resources to effectively employ the strategy. The investment objective of multi-strategy hedge funds is to deliver consistently positive returns regardless of the directional movement in equity, interest rate or currency markets. In general, the risk profile of the multi-strategy classification is significantly lower than equity market risk. By definition, multi-strategy funds engage in a variety of investment strategies. The diversification benefits help to smooth returns, reduce volatility and decrease asset-class and single-strategy risks. Strategies adopted in a multi-strategy fund may include, but are not limited to, convertible bond arbitrage, equity long/short, statistical arbitrage and merger arbitrage. Shifting risk to more than one fund and/or strategy reduces the risk of the overall investment program. The value in multi-strategy funds is providing the hedge fund manager with the flexibility to capitalize on the best opportunities in his varied skill set. Single-strategy funds are limited in the scope of their investment opportunities. When the inefficiencies in a specific expertise of a single-strategy fund wane, managers may reduce exposure by shifting into cash or remain invested in sub-optimal opportunities. Multi-strategy funds can allocate capital away from less-attractive strategies to those that offer superior opportunities. Moreover, multi-strategy funds can offer investors considerable capacity as investor capital is allocated across several strategies. Multi-strategy funds are not managed by those with merely mediocre skills in a variety of strategies. Rather, successful multi-strategy managers have developed "best of breed" investment programs in each of his strategies. Flexibility, capacity and high risk-adjusted returns are some of

the benefits of multi-strategy funds. Seldom will multi-strategy funds be the best performing category of hedge funds over a short-term time horizon. Diversification of strategies will water down the returns of a single strategy during a very "hot" period.

Dow Jones Credit Suisse Multi-Strategy Hedge Fund Index	
Performance 1Y	6,17%
Performance 3Y	26,95%
Performance 5Y	17,53%
Performance 10Y	98,85%
Average Year Performance	8,52%
Standar Deviation	6,04%
Skewness	-69,13%
Kurtosis	-0,71%



Global macro

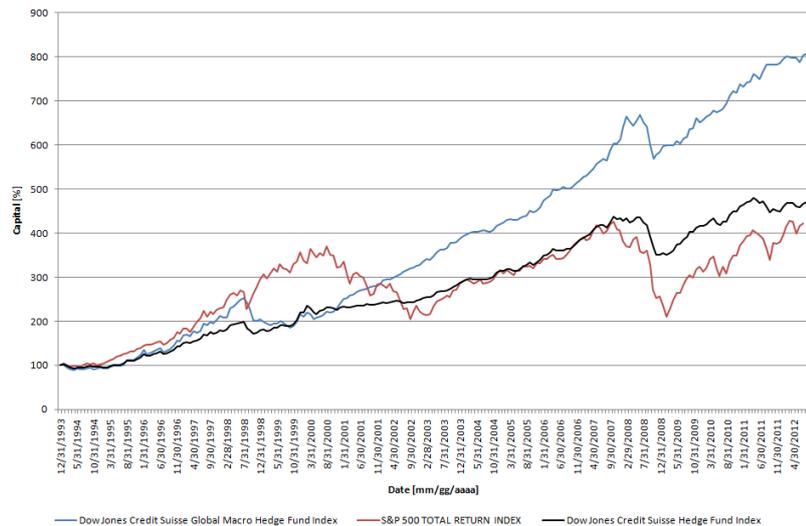
This style invest in those markets and instruments which they believe provide the best opportunity. Global Macro portfolios can include position:

- a. Stocks
- b. Bonds
- c. Currencies
- d. Commodities in the form of cash
- e. Commodities in the form of derivatives.

The managers using top-down economic analysis, may make directional bets on currencies, stocks and interest rates. They may also play the spreads between securities of different countries or others. This style give more freedom to the managers to decide the possible trading: directional, spread, neutral; and the product to gain with their idea. Often these funds are leveraged and highly volatile.

Possible examples of this strategy are to make a profit from the following kind of circumstances: Swiss franc as a safe haven; gold as a safe haven; Russia's economy depends on oil; East European economies are converging towards the European Union; oil prices rise when there are geopolitical risks, etc. Traditional investors are not able to benefit from these financial themes with the same effectiveness as hedge funds.

Dow Jones Credit Suisse Global Macro Hedge Fund Index	
Performance 1Y	3,19%
Performance 3Y	30,31%
Performance 5Y	42,95%
Performance 10Y	154,69%
Average Year Performance	13,43%
Standar Deviation	12,49%
Skewness	-49,03%
Kurtosis	321,68%

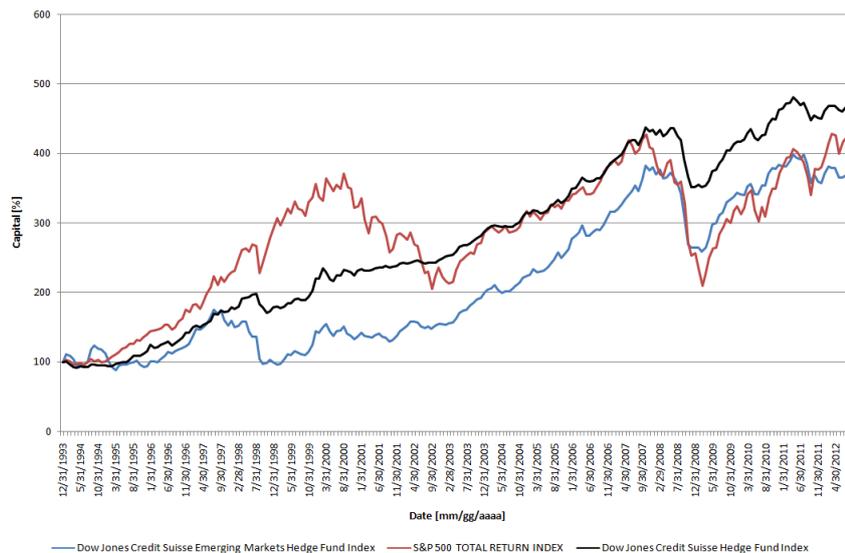


Emerging market

Emerging markets strategies focus on traditional fixed income, value and growth equity investments in markets outside of the United States and Western Europe, including Asia and Latin America as well as Eastern Europe, Africa and the less developed Mediterranean economies. Emerging markets are highly volatile and information relating to the securities traded in these markets is often difficult to obtain. Such inefficient markets offer excellent opportunities for the resourceful manager.

Examples of emerging markets include China, India, Mexico, Brazil, Chile much of the term "rapidly developing economies" is now being used to denote emerging markets such as The United Arab Emirates, Chile and Malaysia that are undergoing rapid growth. In recent years, new terms have emerged to describe the largest developing countries such as BRIC and BRIMC.

Dow Jones Credit Suisse Emerging Markets Hedge Fund Index	
Performance 1Y	-3,68%
Performance 3Y	18,13%
Performance 5Y	7,32%
Performance 10Y	145,56%
Average Year Performance	8,42%
Standar Deviation	18,88%
Skewness	-41,45%
Kurtosis	106,98%



Options Strategy

Options strategies range from complex volatility strategies to a simple covered call approach. Options are the right, but not the obligation to purchase an asset at a specific price on a specific date and time. Options exist in both the regulated exchange environment as well as in the over-the-counter market.

Many options strategies are geared toward speculating on the direction of implied volatility (IV) which is a mean reverting process. One of the easiest ways to speculate on implied volatility is to trade futures or ETF's that follow the direction of implied volatility. For example, one of the most prolific products is the VIX volatility index which measures the level of at-the-money implied volatility of the S&P 500 index.

Generally, implied volatility moves around in a well defined range which allows strategies to create an approach in which IV is purchased at the bottom end of a defined range, and sold at the upper end of a defined range. Other types of volatility strategies include purchasing and selling Straddles, Strangles and Iron Condors. These types of strategies attempt to take advantage of not only implied volatility, but additionally the shape of the volatility strike map curve. The skew, which is defined by the shape of the volatility curve, changes as supply and demand for out of the money options change. The skew fluctuates independently and does not follow at-the-money implied volatility which is the benchmark for volatility trading.

Other strategies include covered call selling, which is an income producing trading strategy, along with outright naked long and short sales of options. Covered calls allow a portfolio manager to hedge their downside exposure and receive a guaranteed income in return for capping the upside. Naked calls and puts simultaneously speculate on the direction of the underlying market along with the direction of implied volatility.

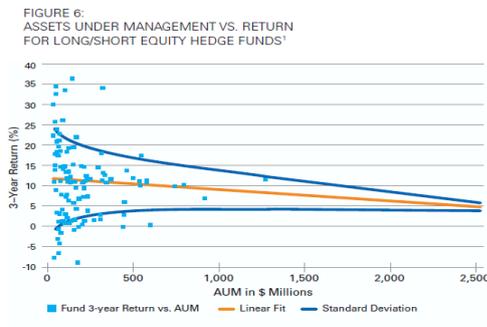
Others:

There are others strategies that here I don't explain, because there aren't clear expose in my database, like: fund of fund, distressed securities, merger arbitrage, etc... For my research this type of classification don't give me any addiction information, so I can't extract any more data for my conclusion. This type of answer principal wants take the others world of funds but it's possible that many funds might choose this reply to obscure the fund from any valuation again others hedge funds or some benchmarks.

Asset under management

The importance of this feature, it's evidence in many studies, where are analyzed the impact of this factor on the return. For all strategies more big are the funds less volatile are the return of them. The reason it's the difficulty of manage big amount in

some markets. Some strategies might manage, in theory, few or a lot of money in the same way; because the main asset is very liquid, but the risk, to take some directional trade, so the exposure of big losses will be so high that may bring the fund in default, for this reason they preferred to be more prudent. To show this fact I explain an study on Long Short Equity strategy.



Source: CISDM
Data represents period 12/31/00–12/31/03

EQ - Long/Short				
	< 20mm	20 - 100	100 - 500	500mm+
Total Funds	236	357	286	110
10th Percentile	12.85%	10.86%	8.40%	9.88%
25th Percentile	6.48%	5.67%	3.52%	3.61%
50th Percentile	-0.78%	0.16%	-0.77%	-0.12%
75th Percentile	-7.78%	-5.98%	-6.47%	-5.83%
90th Percentile	-13.49%	-14.68%	-11.49%	-10.89%

This is confirmed in the figure and in another research¹⁵ with the Table that shows at the top. The deciles are ranked in annualized returns from January 2008 through July 2010 of representative funds in the HFN database grouped by \$AUM. Asset groups are determined by beginning period to accurately represent performance by fund size. For example, funds in the <\$20mm group have \$AUM less than \$20mm at the end of December 2007. As show this data there are a “popular” size for each strategy, for this one are 20-100 mm with 357 funds. In general when investors want good performance and accept to take risks, they will choose a small hedge fund, on the contrary when they want stable returns, they will then choose a big hedge fund.

2.3 Hedge Fund: Management

The big difference when takes two hedge funds with same strategy and characteristics are the management and their skills. There are some variables that might conditioner decision of them and the values of their risk aversion, these are: Management Fee, Incentive Fee, High water mark and Personal capital.

FEE: Management Fee, Incentive Fee, High-water mark.

The first it's a percentage of asset under management or a fixed import that manager takes every year. The second it's a percentage of extra performance, calculate like difference of rate of return of the fund and high-water mark that are fixed in the contract. More high are incentive fee and high-water mark more management want show

¹⁵ The Role of Long/Short Equity Hedge Funds in Investment Portfolios, 2004 R. McFall Lamm, Jr. (Ph.D.), Chief Investment Strategist, Working Paper, Deutsche Bank Group.

that they might earn good return, but might be very risky for the fund, because for do it they might take more risk like big leveraged, liquidity risk, etc...

Personal Capital

When an Hedge fund was founded the most important steps it's to find client for the fund. In this time and then it's vital that the investor trust in the management so many time they invest their own money inside fund to join the objective of their client. Doing this wealthy people and the institutional investor knowing that even the management risky its money inside the fund, so all the actor have the same interest.

2.4 Hedge Fund Manage

Lock Up Period, Payout Period, Redemption Notice

In the recent years liquidity risk has become the principal risk¹⁶, many banks failed for this cause. For Hedge Funds is one of most important problems that the management must take in consideration when invest all their asset. This problem is amplified because most funds take their profit with illiquid product so become fundamental to manage well treasury. Three important feature regulate this problem.

Lock Up Period¹⁷ is a time windows when the capital are lock inside the fund and the client can't take out. This time allow to manage the money in complete freedom, in fact the fund can invest all this amount in illiquidity position.

Redemption Period¹⁸ is defined like the number of days between two consecutive pre-specified redemption dates. Investors are allowed to withdraw their capital only at these pre-specified times of the year.

Payout Period is a time between the enquiry of client, in pre-specified redemption dates, and withdraw out by the fund.

In the financial crises when all market crash down, this type of variables make the difference, to leave the management to study the better strategy to liquid its portfolio to safe the position of other client in the fund. Some studies found a correlation between some big movies of the market, in the middle of the crises, and the politics of hedge funds.

¹⁶ Ben-David, I., F. Franzoni, and R. Moussawi, 2010, The Behavior of Hedge Funds during Liquidity Crises, Working paper, Ohio State University

¹⁷ Roon, F. A., J. Guo, and J. R. Horst, 2009, Being Locked Up Hurts, Working Paper, Tilburg University

¹⁸ Boyle et Zhu, 2010, Hedge Fund Redemption Restrictions Financial Crisis and Fund Performance

3 Methodology

In finance there are several tools to evaluate performance¹⁹ but this typology of sector allow only few instrument, the principal that I use in my research is Alpha value. The main reason of this situation is the fat tail of performance distribution of this funds. In particular, ratio like Sharpe, Sortino, Treynor are not useful because they use means and volatility that are the principal value to describe a normal distribution but not others, so the result of this rate undervalue the real risk²⁰ to have big loss or big gain. In this type of ratio the hypothesis of normality distribution are too heavy to use for Hedge Funds.

3.1 Alpha and Beta

In literature²¹ we find many paper where try to find a right way to clean the returns from risk exposures. In this way we found Aness²² and Clifford²³ (2004), fund and Hsieh (2004), Jaeger and Wagner (2005). The first proposed breaking HF alpha into beta exposure to other HF and manager skill alpha. The second analyzed Hedge fund returns with traditional betas and nontraditional betas, which include trend-following exposure or momentum ad several derivatives-based factors. Finally increased their R² by adding in other hedge fund factors and concluded that HF generate return primarily through risk premiums and only secondarily through imperfect markets²⁴.

Difficult to track this sector

The opaqueness of hedge funds operations and the lack of performance reporting standard make it hard to formulate expectations of hedge fund performance that reflect current economic outlook. This lack of performance reporting standard and the relatively short history of hedge fund returns further make it hard to assess their long-term performance pattern.

¹⁹ Park and Staum, 2004, Performance persistence in the alternative investment industry, Paradigm capital management inc.

Bollen, N. P. B. and R. E. Whaley, 2009, Hedge Fund Risk Dynamics: Implications for Performance Appraisal, Journal of Finance 64 (2), 985-1035.

²⁰ Chan et Getmansky et Haas, 2007, Systemic Risk and Hedge Funds, Financial Service Research Center, School of Business and Economics.

²¹ The ABCs of Hedge Funds: Alphas, Betas, and Costs, Financial Analysts Journal, vol. 67, no1: 15-25

²² An alternative Future. Journal of Portfolio Management, vol. 30, no5: 94-103

²³ An alternative Future: Part II. Journal of Portfolio Management, vol. 31, no1: 8-23

²⁴ Jaeger and Wagner 2005, p.22

This factors and the diversity inside each fund rent difficult to choose beta to calculate the alpha factor.

In fact we have to identify the beta values to correlate with Hedge Funds. In many cases it's very difficult to find a group that could be good for everyone. In particular like I showed previously some strategies are very differently like risks that they took. So a general regression with a particular beta values might be good to explicate only some strategies and inside them only determinate category (I want remember the diversity that might be inside one strategy like I write for Long/Short Equity). When we have some beta that seem to produce some stables results we have to take in mind that the positive of alpha don't means extra-performance or more skill of management. This result should be saw with more attention and very high alpha might hide big risks that aren't express like beta in the regression. Others consideration we need to do, that all our valuations are based on historical data so these can't foresee the future. This problem are more present with Hedge Fund than on simply equity or bond because this sector have active management that change the policies of risk management and money management for their trade. This means that yesterday a fund had few exposition of equity risk, today complete zero, but tomorrow very high value. This question is amplify by the catastrophic risk that this fund hide, to have big return they take many risks, an example it's the strategy Even Driven or Global Macro where many time their positions are concentrate in a bet that something happen or not. Finally, this method have many problems, therefore it's the most appreciate and the most use in literature.

3.2 Fung and Hsieh

In this research I used Fung and Hsieh model to discover the alpha, separating the hedge fund returns by using all the seven factors. This valuation I did for each fund even for some subcategory where some factors haven't many sense.

The Model:

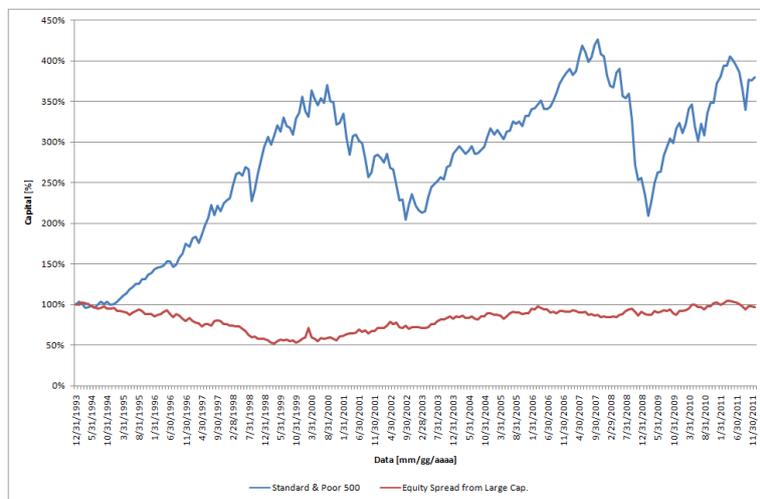
$$Y = \alpha + \beta \text{ Market} + \beta \text{ Equity Liquidity} + \beta \text{ Free Rate} + \beta \text{ Spread Rate} + \beta \text{ Bond spread} + \beta \text{ Currency} + \beta \text{ Commodity} + \varepsilon$$

Betas represent the common sources of risk in hedge fund returns. These factors are used to construct an APT-like (Arbitrage Pricing Theory) hedge fund risk-factor model where the factor loadings (betas) are permitted to vary over time. The payoff of this model can be significant. Consider the analogy with equities. Equity risk factors can

be modeled using the Capital Asset Pricing Model (CAPM) or the Arbitrage Pricing Theory (APT). These models separate the return of an equity investment into two parts: systematic and idiosyncratic. Thus far, seven risk factors have been identified. Not all risks are significance for all strategies, in fact for Long Short Equity should be correlated with only equity risk so the first and the second betas. I took in all my consideration not only systematic risk but even idiosyncratic risk calculated by mean square error.

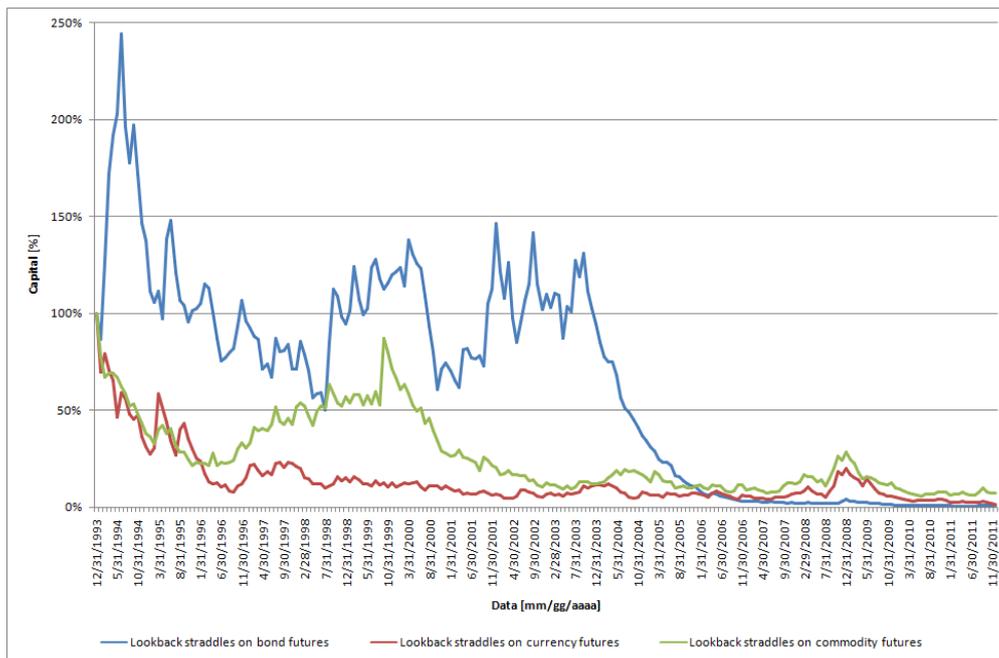
Empirical evidence shows that these seven risk factors can jointly explain a major portion of return movements in hedge fund portfolios, as proxied by funds-of hedge funds. Below I report the course and some statistics of all Beta.

	Standard & Poor 500	Equity Spread from Large Cap
Performance 1Y	2,11%	-5,26%
Performance 3Y	48,59%	7,00%
Performance 5Y	-1,24%	6,27%
Performance 10Y	33,35%	36,78%
Average Y Performance	9,68%	0,28%
Standar Deviation	19,56%	9,35%
Skewness	-76,32%	-46,21%
Kurtosis	17,92%	102,67%



	Change in 10 Y maturity Yield	Spread of Baa yield to FR 10 Y
Performance 1Y	-39,82%	-13,93%
Performance 3Y	-18,18%	-37,72%
Performance 5Y	-56,58%	-15,59%
Performance 10Y	-61,10%	-34,78%
Average Y Performance	-2,91%	-1,35%
Standar Deviation	23,78%	12,24%
Skewness	52,39%	45,21%
Kurtosis	5,39%	46,35%





Portfolio Lookback straddles	on bond futures	on currency futures	on commodity futures
Performance 1Y	8,18%	-53,34%	-4,99%
Performance 3Y	-82,64%	-92,35%	-73,91%
Performance 5Y	-78,78%	-72,93%	-17,34%
Performance 10Y	-99,55%	-76,34%	-63,95%
Average Y Performance	-11,13%	-6,88%	-2,39%
Standar Deviation	48,51%	58,52%	48,79%
Skewness	75,71%	204,72%	117,51%
Kurtosis	-4,39%	546,96%	186,83%

These trend-following factors are constructed based on the article by William Fung & David A. Hsieh, "The Risk in Hedge Fund Strategies: Theory and Evidence from Trend Followers," *Review of Financial Studies*, 14 (2001), 313-341.

3.3 Clustering²⁵

In this research I try to divide the funds in some cluster analyzed alpha factor and mean square error that means extra-return and idiosyncratic risk to see if are some connections with the performance of funds and other variables like: strategy, asset under management, leveraged, lock up period, etc...

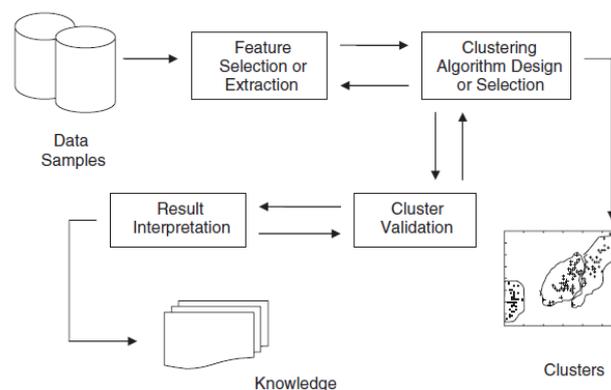
²⁵ Many parts of this paragraph are taken by the guide of Mathwork and the book Clustering Rui Xu Donald C. Wunsch (2009)

Rui Xu Donald C. Wunsch, 2009, Clustering, Book, John Wiley & Sons Ltd.

Cluster analysis is a way to examine similarities and dissimilarities of observations or objects. Data often fall naturally into groups, or clusters, of observations, where the characteristics of objects in the same cluster are similar and the characteristics of objects in different clusters are dissimilar.

There are different types of cluster analysis, under each one there are different philosophies: Bottom-up or Top Down. The first want that each object is a separate cluster and only then merger it into one with some measure of similarity. Instead Top down start with one cluster and then we divide it into a specific number until a prefixed number or other rule. Aldenderfer and Blashfield (1984) summarized the goals of cluster analysis in the following four major aspects:

- Development of a classification;
- Investigation of useful conceptual schemes for grouping entities;
- Hypothesis generation through data exploration;
- Hypothesis testing or the attempt to determine if types defined through other procedures are in fact present in a data set.



Clustering algorithms partition data objects (patterns, entities, instances, observances, units) into a certain number of clusters (groups, subsets, or categories). However, there is no universally agreed upon and precise definition of the term cluster.

One cluster definition, as pointed out by Backer and Jain (1981), “ in cluster analysis a group of objects is split up into a number of more or less homogeneous subgroups on the basis of an often subjectively chosen measure of similarity (i.e., chosen subjectively based on its ability to create “ interesting ” clusters), such that the similarity between objects within a subgroup is larger than the similarity between objects belonging to different subgroups.”

Moreover, a different clustering criterion or clustering algorithm, even for the same algorithm but with different selection of parameters, may cause completely different

clustering results. For instance, human beings may be classified based on their ethnicity, region, age, socioeconomic status, education, career, hobby, weight and height, favorite food, dressing style, and so on. Apparently, different clustering criteria may assign a specific individual to very different groups and therefore produce different partitions. However, there is absolutely no way to determine which criterion is the best in general.

In literature there are different cluster criteria like:

- Hierarchical clustering;
- Partitional clustering (K means);
- Neural network-based clustering;
- Kernel-based clustering;
- Sequential data clustering;

For this work I use Hierarchical clustering to find the natural number of cluster, then I use this information to set K-means clustering. I verify how each fund fall in a cluster to individuate some possible outliers.

Hierarchical clustering

In my research I set my distance with *Euclidean distance*

$$d_{st}^2 = (x_s - x_t)(x_s - x_t)^T$$

I used *Average Linkage* that uses the average distance between all pairs of objects in any two clusters:

$$d(r, s) = \frac{1}{n_r n_s} \sum_{i=1}^{n_r} \sum_{j=1}^{n_s} dist(x_{ri}, x_{sj})$$

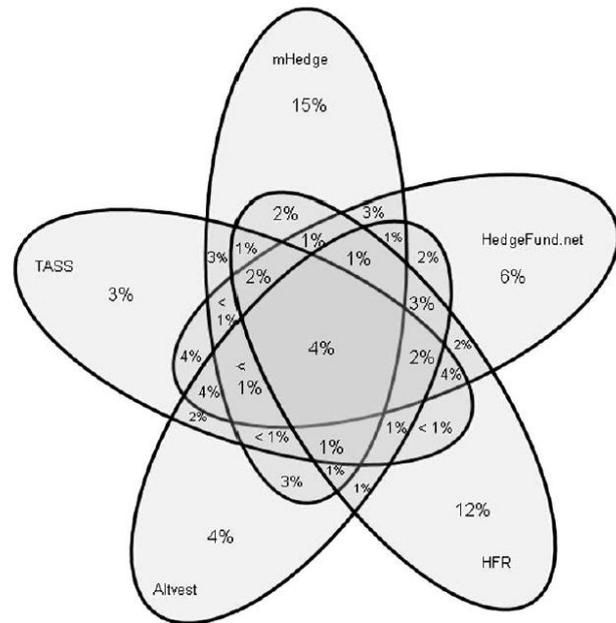
I decided to set my algorithm in this mode because it was the choice that optimize cophenet (a measure of similarity).

4. ANALYSIS AND RESULT

4.1 Data

A number of databases track hedge fund returns: Altvest, Hedge Funds Research (HFR), HedgeFund.net (now part of Lipper HedgeWorld), Lipper TASS, mHedge,... Our data come from a Lipper TASS started in January 1994 and terminated in December 2010.

Although this, a fund might be in one or some of these, there is substantial overlap between the databases, they do include different funds. The intersection of these databases is described in the following figure. For my purpose one database it's sufficient, to expand this study there will be more interesting to verify the conclusion on a combination of the databases than any individual database.



Potential Biases in Hedge Fund Data²⁶

Reporting to these databases is voluntary, and funds may stop reporting for a variety of reasons. This may be caused by the fund going out of business or, alternatively, by the fund closing to new investments and no longer having an incentive to report. For these variety of reasons, the data used in hedge fund research are not as clean as the data used in mutual fund research, which can generate potential biases: survivorship bias, self-selection bias, backfilling bias, misreported returns and data.

²⁶ Agarwal et Vyacheslav et Jiang, 2009, Inferring Reporting-Related Biases in Hedge Fund Databases from Hedge Fund Equity, Graduate School of Business, Columbia University.

Aiken, A. L., C. P. Clifford, and J. Ellis, 2009, Out of the Dark: Hedge Fund Reporting Biases and Commercial Databases, Working paper, Arizona State University

Bollen, N. P. B. and V. K. Pool, 2008, Conditional Return Smoothing in the Hedge Fund Industry, Journal of Financial and Quantitative Analysis 43 (2), 267-298.

Brown, S. J., W. N. Goetzmann, R. G. Ibbotson, and S. A. Ross, 1992, Survivorship Bias in Performance Studies, Review of Financial Studies 5, 553 - 580.

Survivorship bias.

Fung and Hsieh (2000) estimate the difference in performance between a portfolio of all surviving funds and a portfolio of all funds to be 3% annually. Similar estimates are found in Brown, Goetzmann, Ibbotson, and Ross (1992). Survivorship bias was a problem before 1994, when data vendors generally discarded funds that ceased reporting. However, after 1994 we have a “graveyard” sample, which includes the prior returns of the funds that ceased reporting. The inclusion of this graveyard sample minimizes the survival bias. However, as funds drop out of the sample, we assume the funds are liquidate in the next month.

Self-selection bias.

Reporting is voluntary, so a bad fund has no reason to report, and a fund that is very good closes quickly and does not have any reason to “advertise.” Fung and Hsieh (1997b) claim that these effects offset each other and should not create a bias. Agarwal, Fos, and Jiang (2010) find that the performance of reporting and non-reporting funds does not differ significantly, but funds that report seem to exhibit a deterioration in performance after reporting initiation and termination. Nevertheless, this bias is somewhat mitigated by our use of a comprehensive database.

Backfilling bias.

Hedge fund databases tend to be backfilled, i.e. although typically funds only start reporting to a database some time after their actual start-up, when they do, their full track record is included in the database. Since only funds with good track records will eventually decide to report, this means that the available data sets are overly optimistic about hedge fund performance. As shown in Posthuma and Van der Sluis (2003), on average actual hedge fund returns may be 4% per annum lower than reported.

Smoothed returns.

Several authors (e.g., Asness, Krail, and Liew 2002) present evidence that the returns of hedge funds exhibit positive serial correlation, which is consistent with the returns being smoothed. If this is the case, the Sharpe ratios as well as information ratios will be biased upward. To adjust for this bias, a paper of Getmansky, Lo, and Makarov (2004) suggested a correction. This problem perhaps born to the difficulty to generate up-to-date valuations of their positions, in particular when they invest in illiquid assets. When confronted with this problem, administrators either use the last reported transaction price or a conservative estimate of the current market price, which creates artificial lags in the evolution of these funds’ net asset values. As shown in Brooks and Kat (2002), this will

lead to very substantial underestimation of hedge fund risk, sometimes as high as 30–40%.

Misreported returns and data.

Most data vendors didn't verify any information that they simply receive by the fund managers and their partners. This means that inside of this data there will be present a number of possible errors: misreporting or simple mistake. Many researchers found that hedge funds reported more small gains than small losses, an example it's the paper of Bollen and Pool (2009). They note that this discontinuity is less pronounced in equity market neutral funds. As misreported data are in this database for some class, when this is clear we change the value in n.d. to try to doesn't distort our research.

This type of sector are very young, most data vendor and ours only started collecting data around 1994. This problem increased if we consider the financial time series where is collocate: financial boom around 2000 and then two or three crises in many sector that touch some market, Russia bubble, Argentina default, born of Euro in Europe.... All data have only monthly information not more update and sometimes this are hypothetic because many time the position of Hedge Funds are in illiquid product that aren't trade in regulated market.

Others characteristics:

As I explain, in some part of the text before, funds may be classified in the same strategy group, might doesn't produce similar returns. This problems are with their indices, similar indices from different index providers may behave very differently, so the true risks of hedge funds tend to be seriously underestimated, sharpe ratios and alphas of hedge funds can be highly misleading.

In addition, I eliminate each fund that have less than 36 months of history.

4.2 Analysis

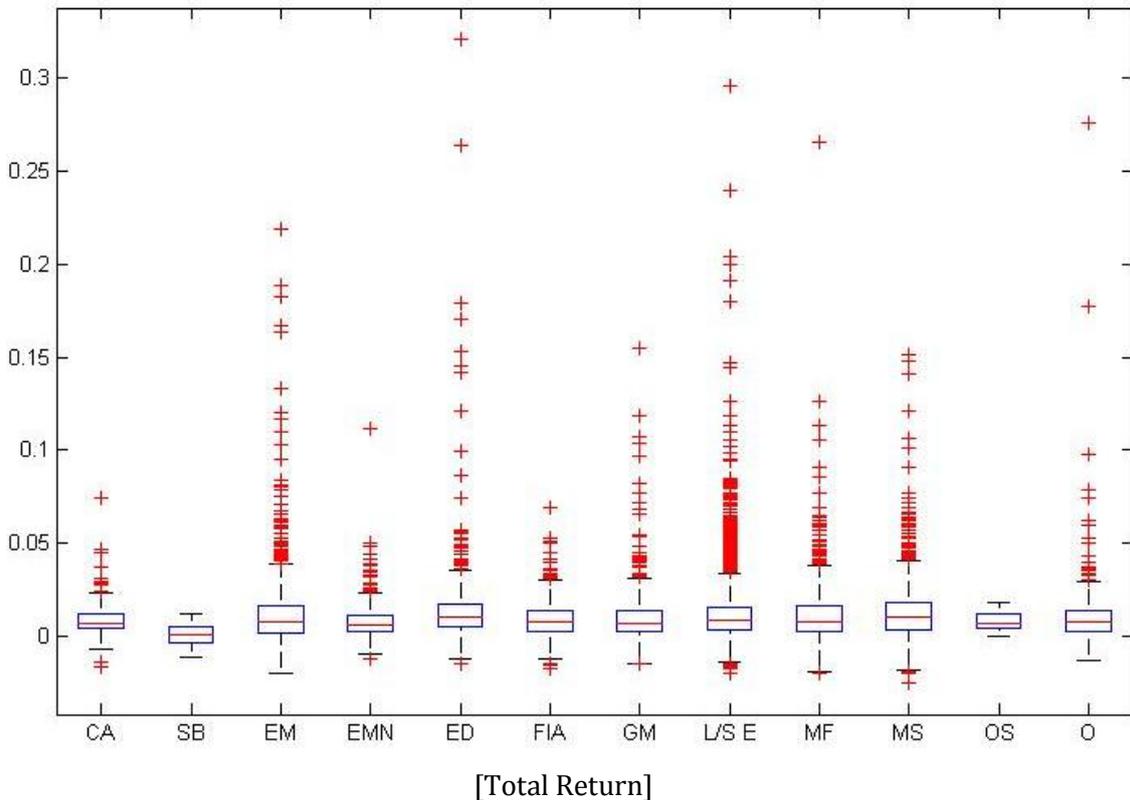
My research has two different sections: qualitative and quantitative, in all I tried to understand the impact of different characteristics on Hedge Funds performance and risk.

In the first section I separated my data by the strategy, and I divided each consideration looking at performance, alpha and mean square error to try to understand more the contribution of these features on the value process.

In the second I use quantitative method to split my data in cluster, in particular I use only alpha and mean square error, that represent extra performance and

idiosyncratic risk, to evaluate if there will be a connection with high alpha and some feature.

4.2.1 Qualitative Analysis on Strategy

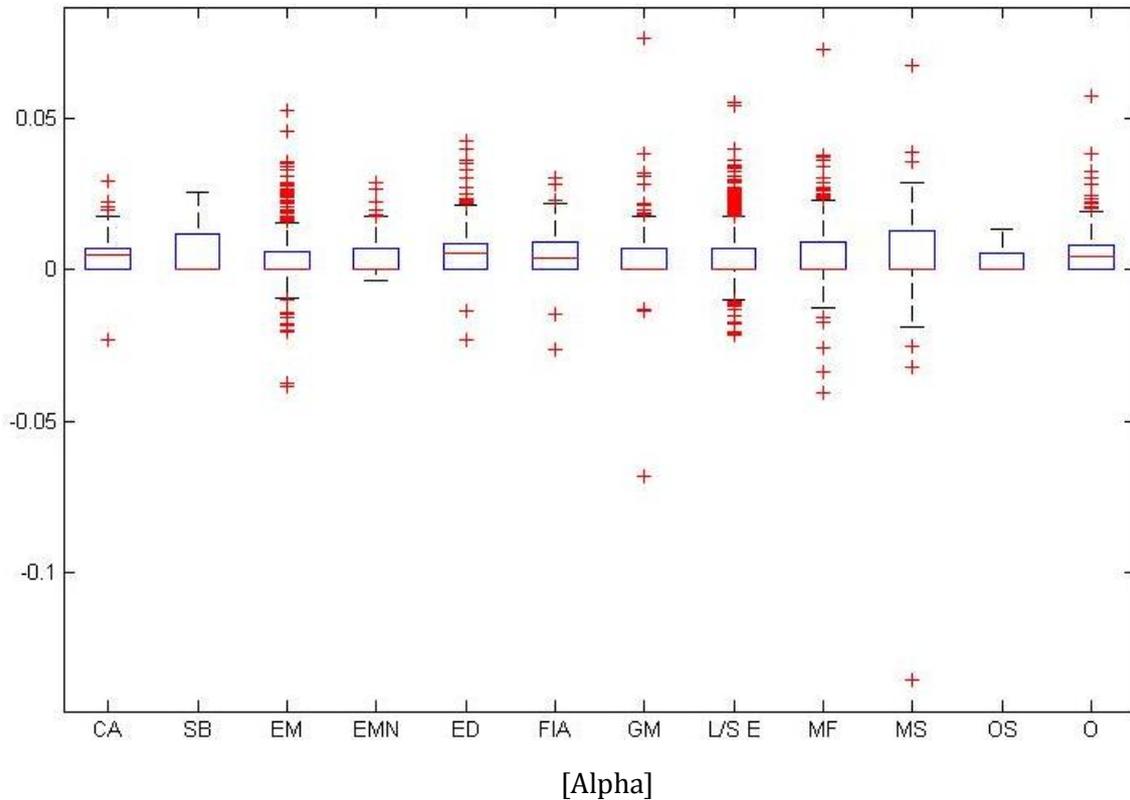


CA = Convertible Arbitrage
 SB = Dedicate Short Bias
 EM = Emerging Market
 ED = Even Driven
 EMN = Equity Market Neutral
 FIA = Fixed Income Arbitrage

GM = Global Macro
 L/S E = Long/Short Equity
 MF = Manage Future
 MS = Multi-Strategy
 OS = Option Strategy
 O = Others

In this figure I showed the distribution of total return performance weighted for the time to did it, for each strategy of my data sample. As we can see some strategies have big tails, in specific Long Short Equity that is the most important in this market, following of Emerging Market and Multi-Strategy. As I specify before, all data with label Other is useless because I can't do any analysis and Option strategy has few funds inside, so the valuation might be not stable. This image remark that the strategy is a fundamental information when we study this type of investment. As I show in the next paragraph different strategies have different risk and volatility. More or less the big part of the market gives the same performance but the main difference it's the tail of distribution and the skewness of it. In particular Dedicated Short Bias has more stable performance than others, following by Equity Market Neutral and Convertible Arbitrage.

In this section I need to remark that Dedicated Short Bias is the worst strategy in my data. The most profitable one are Emerging Market, Event Driven, Long/Short Equity, Manage Future and Multi-Strategy.



To understand better this process I calculate alpha coefficient for each fund. This coefficient is more useful for some strategies where the regression allow to explicate better the value process. One possible way to meliorate this valuation might be to regress the sample in different time windows, another one is to move one fixed window inside all the time series, this might show some connections between strategies and financial crises, etc...

With this parameter I can confirm some conclusions, or open an area to research. Here the more stables strategies are Equity Market Neutral , Dedicated Short Bias, Even Driven (Option Strategy has few value to explain stable conclusion).

The most profitable strategies here seem to be Global Macro and Dedicate Short Bias, because they haven't negative tails, however we have to note that this alpha is weighted by the significance, so I analyzed it only when the alpha improves my research with more information. I changed in zero all values with a p-value higher than my blend (5%), to avoid any mistake in my conclusion. Further positive alpha is not immediately equal means to extra return but might due to others risk that I don't take in my regression, these kind of strategies might hide these types of risk.

Instead Multi-Strategy seems to be the most risky strategy, in absolute, where the management is able to build a good portfolio or not. Global Macro, Manage Future and Emerging Market are others difficult strategies to manage. The reason should be the different risk that each strategy takes: Multi-Strategy and Global Macro can invest everywhere and with all types of products, so they are more exposed to different types of risk than others strategies, so more difficult to manage. Manage Future works with product in leverage: this amplify the volatilities of their result. Instead Emerging Market invests its money in a illiquid market where it's difficult to value the position and to change very fast the portfolio.

Before analyzing the impact of each variable in this sector I want to explain many statistics for each strategy.

- *Average Monthly Return*

As I report before even here some strategies give high level of dispersion of monthly return. In particular Long/Short Equity, Multi-Strategy and Emerging Market are strategies with higher tail. Even Driven seems to be good because has more positive tail than negative. The most stable strategies are Dedicated Short Bias and Equity Market Neutral.

[Figure 1]

- *Volatility*

As I think the same strategies with big tail in return distribution, have also high monthly volatility. Require more studies the distribution of Emerging Market and Dedicated Short Bias where all values of quantile are much high than other strategies. In particular the difference between Emerging Market and Multi-Strategy or Even Driven, that have more or less the same values in the back figure of: Performance, Alpha, Average Monthly Return but have different distribution of volatility, in fact the first has high value for each quantile than the others two, which have some big tails but all distribution is concentrate more in low value of risk. So inside this group seems to be better Multi-Strategy and Even Driven.

[Figure 2]

- *Skeness & Kurtosis*

Alternative Investments, in particular Hedge Fund, is popular for the big tails of its distribution. Some results little surprise me, in particular Convertible Arbitrage and Fixed Income Arbitrage, that have a distribution of Kurtosis higher than all others strategies, and Equity Market Neutral, where we see funds with very big tails. This

behavior might be due to a mistake of categorized funds. We need to take in evidence that Dedicated Short Bias has smaller tails than all others strategy. The same results I found for Skeness.

[Figure 3] [Figure 4]

- *Beta 1: Standard & Poor 500*

It's clear that big part of funds, that I have in my sample, are positive correlate with this risk (remember that all values that are not significance it changed in zero). However there are some funds that show negative correlation. Long/Short Equity is the most correlate with this risk, and also multi-strategy. In particular this might means that inside multi-strategy should have a considerable part of Long Short Equity in own portfolio. It's clear also that Dedicate Short Bias has only negative exposition on this type of risk. Manage future and Global Macro haven't a clear direction with this type of factor, this maybe might be due to diversify of trade that expose these strategies in positive or negative sense. The exposition that Emerging Market has with this factor is a sign of connection of exchange market. Convertible Arbitrage, Fixed Income Arbitrage and Equity Market Neutral have positive connection with this risk.

[Figure 5]

- *Beta 2: Equity Spread from Large Cap*

Even for this factor Long Short Equity results the most exposed, following by Multi-Strategy. Also here we have the same situation that we have saw to Beta 1 for Dedicate Short Bias, Global Macro and Manage Future, for the same reason. Instead here Equity Market Neutral show how is correlate with this type of risk, so its portfolio hasn't simple directional trade, but spread trade like it's confirm here.

[Figure 6]

- *Beta 3: Change in 10 Y maturity Yield*

This type of risk is connect with the market, the recent course of exchange market remark with more importance this factor that the rate of bond fixed the blend of convenience to invest in equity or in bond. This seem to be confirmed by Long Short Equity that result the most connect, even if doesn't invest in this market, following by Manage Future and Emerging Market.

[Figure 7]

- *Beta 4: Spread of Baa yield to FR 10 Y*

More or less the same discuss for Beta 3 I might to do for this risk, but this type of risk is negative correlate with the fist factor where we might found the same expositions.

[Figure 8]

- *Beta 5: Lookback straddles on bond futures*

The expositions of this type of risk for each strategy seem to be equal to sum of Beta3 and Beta 4.

[Figure 9]

- *Beta 6: Lookback straddles on currency futures*

Manage Future is the most connect with this risk, the others strategy show various exposition due to different currency risk.

[Figure 10]

- *Beta 7: Lookback straddles on commodity futures*

This type of risk is more present in Manage Future Funds where they trade with future in positive, spread, and negative direction strategies. Another way is the exposition inside Long Short Equity and Emerging Market that might due to the connection with emerging market exchange and the commodities market.

The result of Multi-Strategy is opposite of what I think to find, a possible reason that inside Multi-Strategy the portfolio is diversify with not only positive weight.

[Figure 11]

Qualitative Analysis on Characteristics

In this part I try to verify if some characteristics of Hedge Fund might add value or not.

Hedge Fund: Structure

- *Other Currency/Usd*

In this data, the currency of funds seem to don't affect to performance, alpha coefficient and risk. Only few funds fall over this valuation. This is interesting because seem that currency risk is hedging well.

[Figure 12a]

[Figure 12b]

[Figure 12c]

- *Asset Under Management*

How found in literature the funds with few asset under management are the most volatile, this is confirmed in the figure, even result the most risky. The reason might be that, when the asset increase, management can diversify more the risk however they have to put more attention in their trade because moves huge money in market expose it a liquidity risk. Need one consideration funds that don't communicate how many asset they have, this cluster showing more possibility of more performance and alpha but with more mean square error.

[Figure 13a]

[Figure 13b]

[Figure 13c]

- *On Shore/Off-Shore*

In my research seems that will be On shore produce little, positive, difference in performance and alpha value. So low restriction seems don't impact to value of funds, however this distinction, and the mode of market, that see an augmentation of Off-shore funds, might be due to fiscal impact on withdraw of their clients.

[Figure 14a]

[Figure 14b]

[Figure 14c]

Hedge Fund: Management

- *Management Fee*

More or less the different class of management fee doesn't show big evidence to effective impact on risk or on performance. The little difference that we can see should be due to different number of funds that each class have.

[Figure 15a]

[Figure 15b]

[Figure 15c]

- *Incentive Fee*

There isn't big difference between fund with low or high incentive fee. There are some fund in the tail of distribution that seem that fund with high incentive fee have more positive outliers, but this it isn't confirm to last class of fee, where we see thin tail but this might be due of number of funds inside it.

[Figure 16a]

[Figure 16b]

[Figure 16c]

- *High Water Mark*

There are no evidence about connection with this feature and performance and idiosyncratic risk of funds. This result complete the sense of previous effect because this characteristic represent the blend over start to calculate the incentive premium of the management.

[Figure 17a]

[Figure 17b]

[Figure 17c]

- *Personal Capital*

There isn't any support to conclude that there is correlation to this feature and performance/risk of funds. This result show that the fund, where the manager invest their money inside, like their clients, have more or less the same performance in positive and in negative. This contradict a sideboard that the fund with personal capital are manage better than another where the management don't risk their money.

[Figure 18a]

[Figure 18b]

[Figure 18c]

Hedge Fund: Manage

- *No Leveraged/Leveraged*

Both variable are not determinate to produce or destroy value for a fund. This means that not leveraged can make big performance and big losses as leveraged funds. This show how might be underestimate the risk to invest in a non leveraged Hedge Fund.

[Figure 19a]

[Figure 19b]

[Figure 19c]

- *Average Leverage*

There are some evidence that different leveraged has to add value for funds. In particular we see that in the first three class of leverage seem produce more performance because the distance of three quintiles are more high than others class. This means that are more probability to bring more performance. Then this class the performance appear more concentrate but with more outliers. Mean square error show that change class add, in general, risk. However we have two class where the risk fall. This result might verify in others studies. A possible reason might be that have little leveraged allow to bring more value, but when this become too high the risk to fail trade so to close in default, become more high. To reduce this risk it's reasonable that management take trade with low risk that give low performance but with big leverage amplify the performance also the risk. Here this result might be due of few funds that are in this class. It's interesting to verify if there is a "optimum" value of Leveraged and the associated risk.

[Figure 20a]

[Figure 20b]

[Figure 20c]

- *Lock Up Period*

There are little evidence that emerge in my studies that more long is lock up period, more high are the quantiles of performance / alpha distribution instead means square error appear reduce than other class of this variable. This type of result should be verify in others sample before to conclude this argumentation. A possible reason of this result is the possibility that manager have to invest all this money in very illiquid asset, because their amount are lock for a determinate period of time.

[Figure 21a]

[Figure 21b]

[Figure 21c]

- *Pay Out Period*

In my data the most common value of pay out period are the first and the second class, so a low value of day to withdraw the investment. However in my studies I found that more high is time to pay out more high is performance and alpha value, if we see not outliers so tail of distribution but the all quantile of it. This result should be verify in others study, maybe using others database, one possible reason might be more

possibility that the management have to liquidate the position. This seem be confirmed by risk.

[Figure 22a]

[Figure 22b]

[Figure 22c]

▪ *Redemption Notice Period*

There isn't evidence that the value of this feature has some effect in performance of funds, but needed to remark that seems have some impact on idiosyncratic risk. This result might be verify in more study.

[Figure 23a]

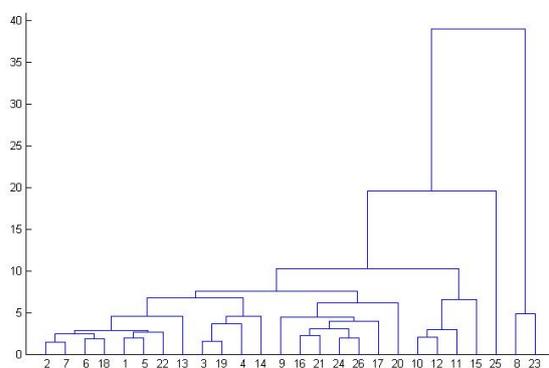
[Figure 23b]

[Figure 23c]

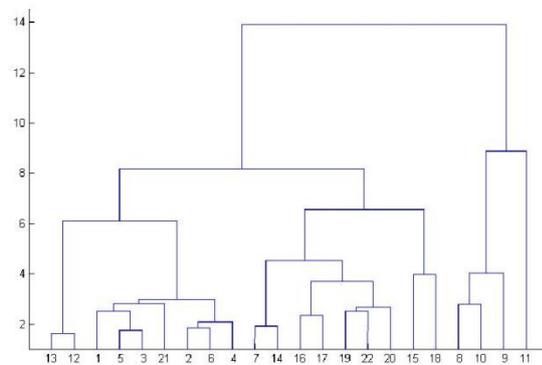
4.2.2 Quantitative Analysis

In this section I divided my data in cluster by alpha and mean square error value. I did this to research the impact of some characteristics to performance value (Alpha/Mse) of funds and to verify the before conclusions. I took the coefficients value of my regression and I weighted them by the p-value, with a blend of significance level equal to 0,05. All values over this blend I considered not significance so I put all the alpha values to zero. Before to calculate the cluster I standardized all my values (alpha and Mse) to didn't distort my valuations.

Next step I divided my sample with Hierarchical clustering to find the natural number of cluster. The figure below show the evolution of my data, after the first division I tried to find the outliers. Already in the first dendrogram we can see that some clusters are far than others, (the distance is calculate how the way to arrive from one cluster to another). The cluster 23, 8 and 25 represent clusters of funds that are very far than others, these things I verified also with k-means so I decided to consider them like outliers so I deleted them by my data. I recalculated the clusters and the high of my tree is smaller than before, like I show in the dendrogram below, and as we can see the tree is more compact.



[First Dendrogram]



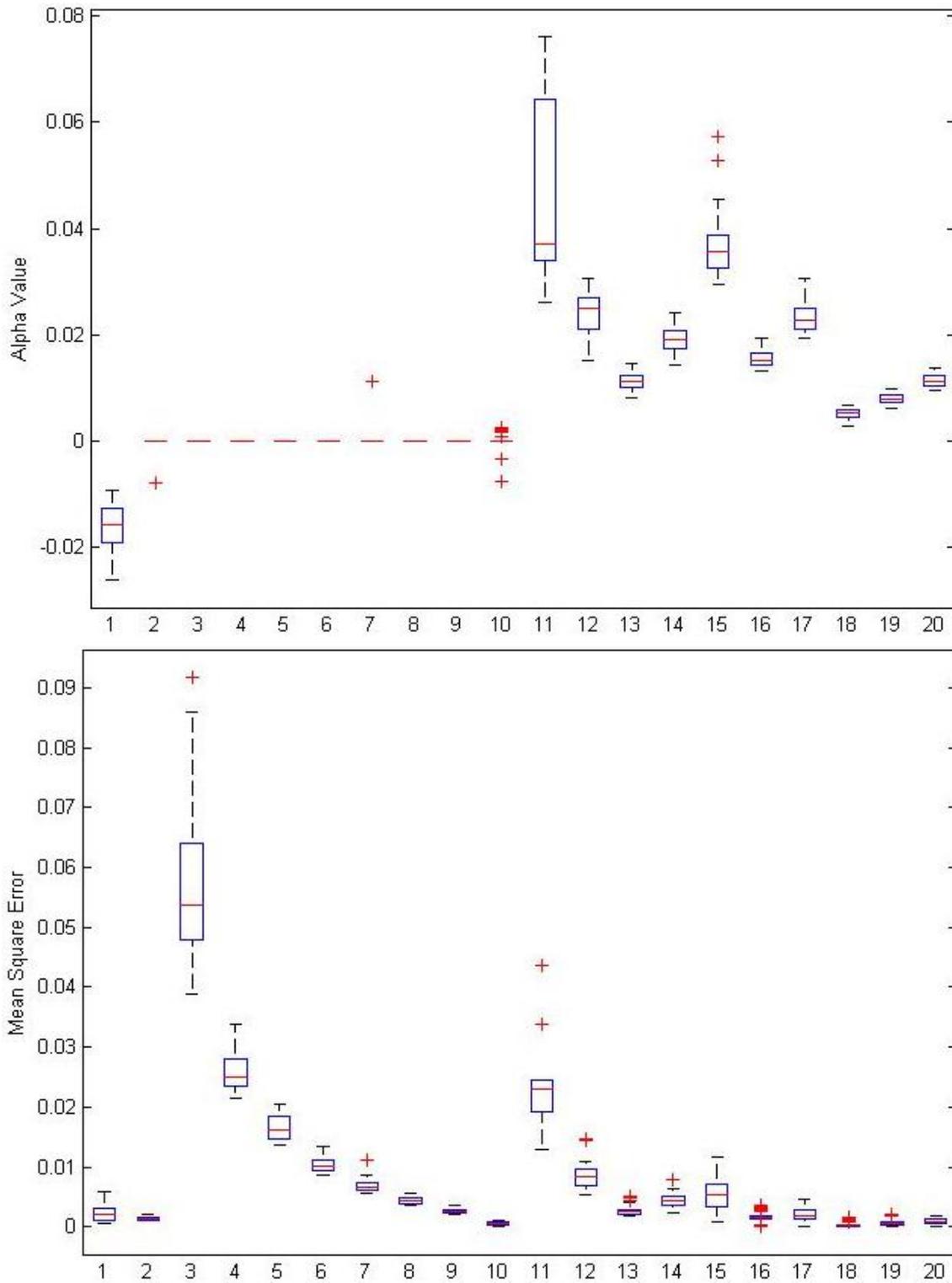
[Second Dendrogram]

After this step I tried to see how k-means dividing the data into cluster, below I show where Hierarchical in row and K-means in column split my sample. In particular I saw that k-means clustered better the area of performance so I decided to use it for my research. In two times I merge clusters to have each ones with a minimum of funds inside and allow me to take some stable conclusion. Doing this process I followed what I found with Hierarchical clusters, in particular I joined the funds in the yellow cells.

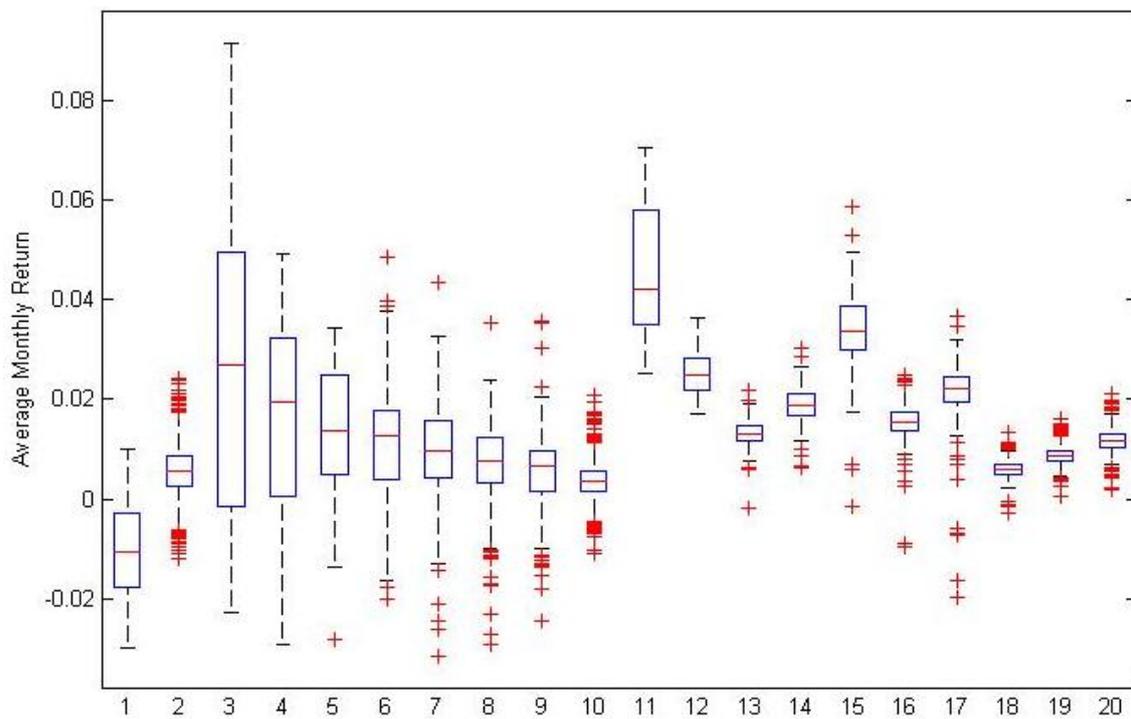
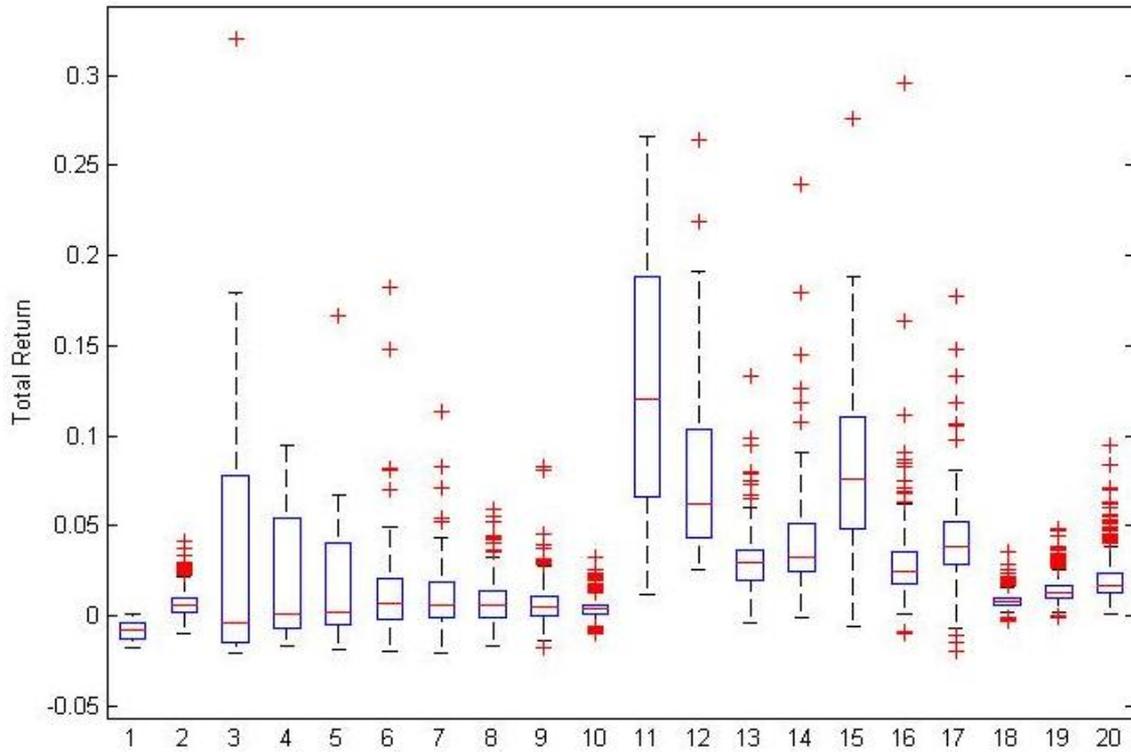
H/ K	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1											1											
2	41	1									1											
3			6	11																		
4					20																	
5						44	112	59														
6								114	215													
7		14							123	691												
8		517																				
9		455																				
10		295																				
11		24																				
12		5																				
13		4																				
14		3																				
15		17																				
16		1									1											
17											86											
18											63											
19											1155											
20												6	5								3	
21														35	3	89	28	12	116			
22												10			168	23		419		555	711	477

The clusters that finally I found are 20. I order this list by the ratio Alpha / Mse. In the first section below I analyzed some statistics like: alpha value, mse, total return, monthly return, standard deviation, skewness, kurtosis and all beta value; in the second section I showed the composition of each cluster for each feature.

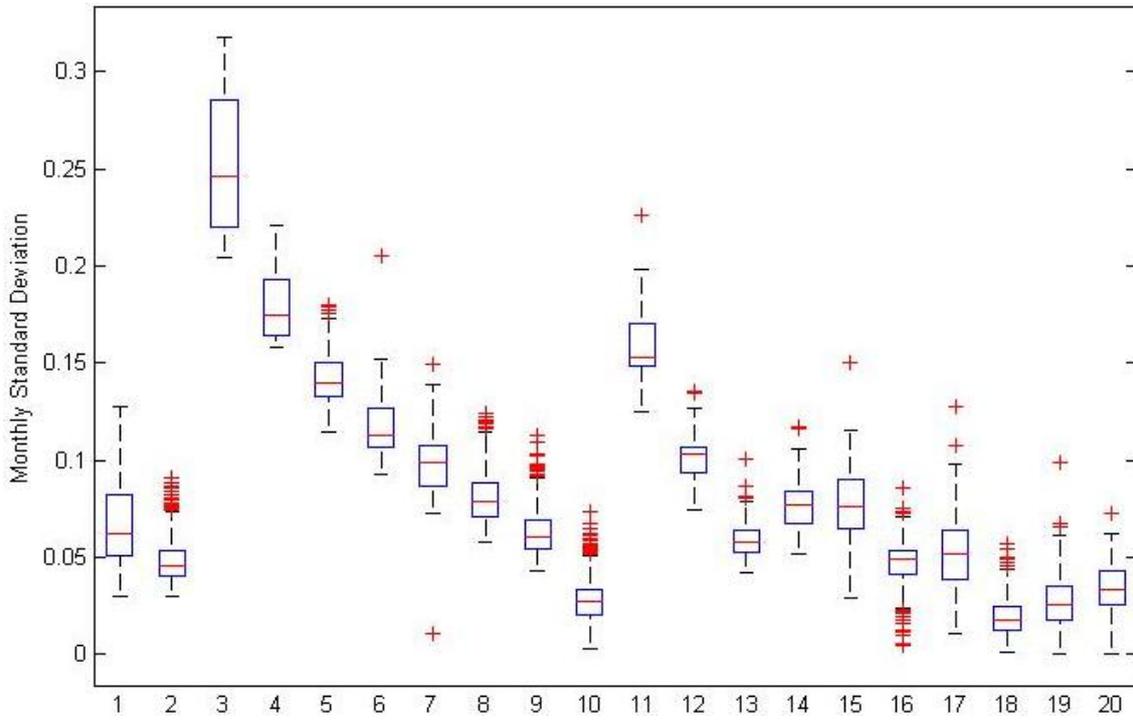
As we can see in the figure below the cluster with more extra return isn't the final cluster 20 but the clusters before, this is the consequence of my decision about order where I preferred maximize the extra performance correct by idiosyncratic risk than only simply alpha value.



Similar impact there is if we see the figure of Total Return and Average Monthly return. In the first figure the clusters under 11 so with zero or negative alpha have the second and the third quantile under zero, while the clusters over 11 have the same quantile positive over zero. The last group is the most stable, this is confirm by the second figure and then.

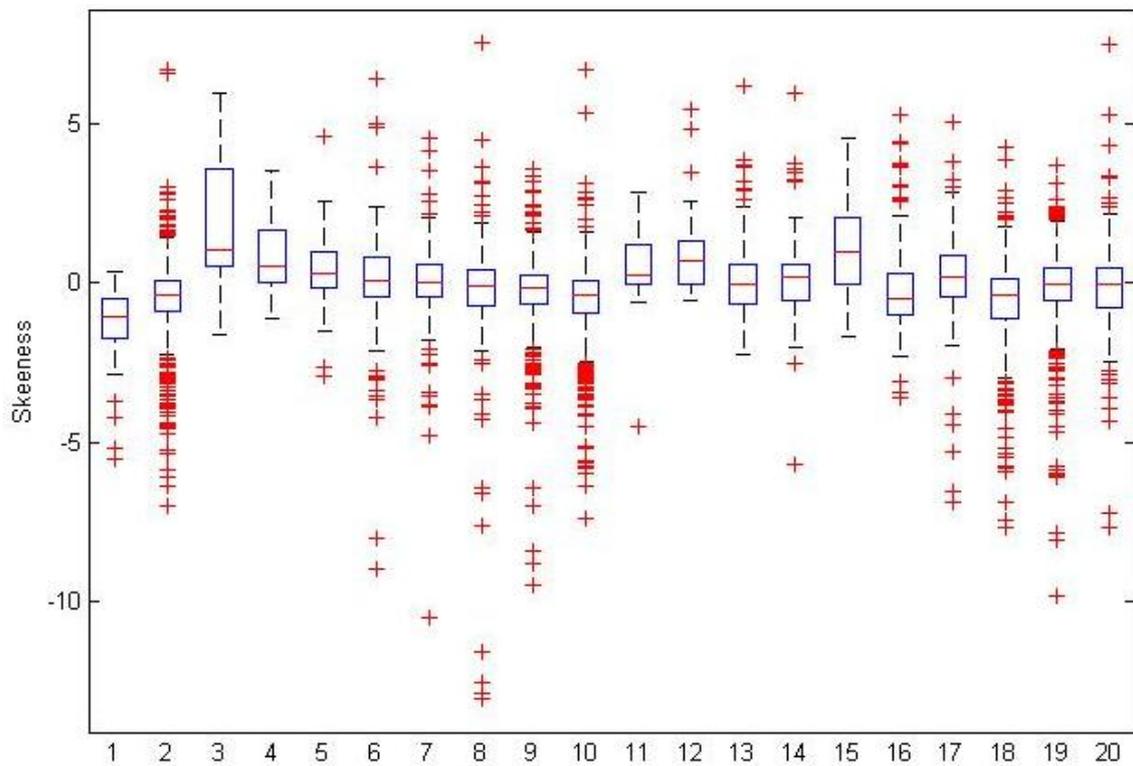


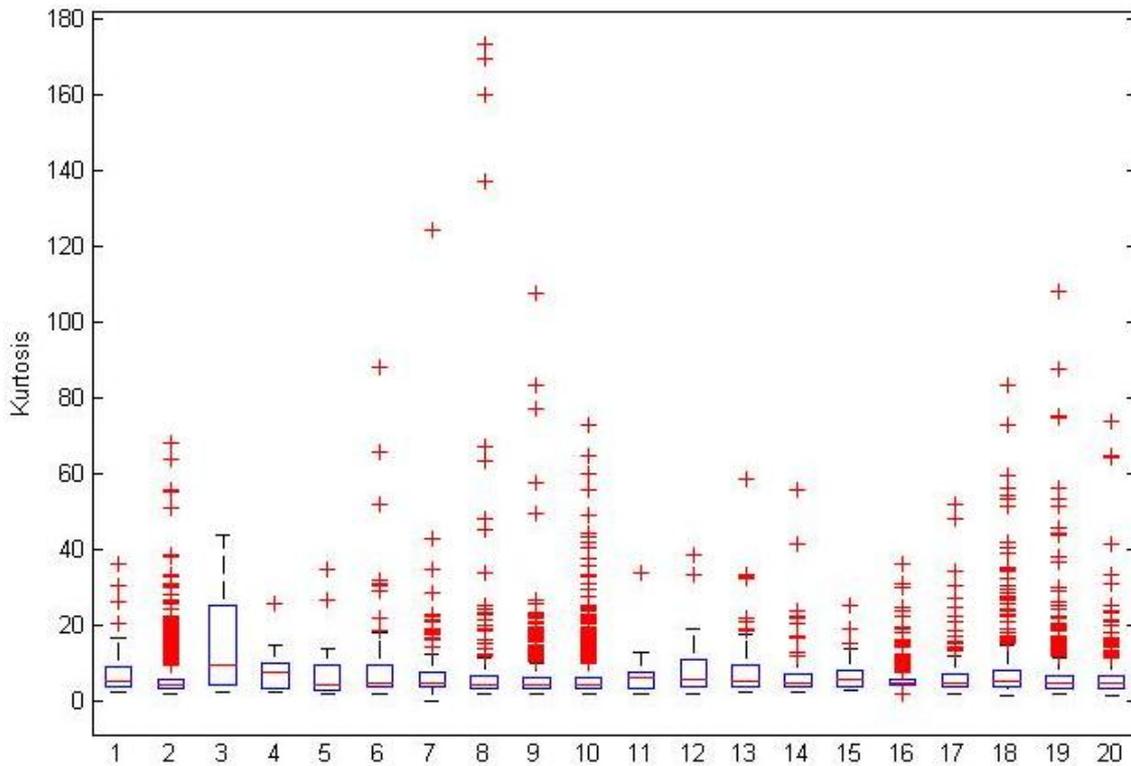
The Average Monthly Return show that is possible a connection with positive alpha and stable dispersion of returns. Monthly Standard Deviation it's the consequence of order decision, in particular the better funds have few volatility than others funds.



As is show below inside each cluster there are funds with complete different distributions of return, however the cluster 18, 19 especially the last have the first and the second momentum with low dispersion.

s

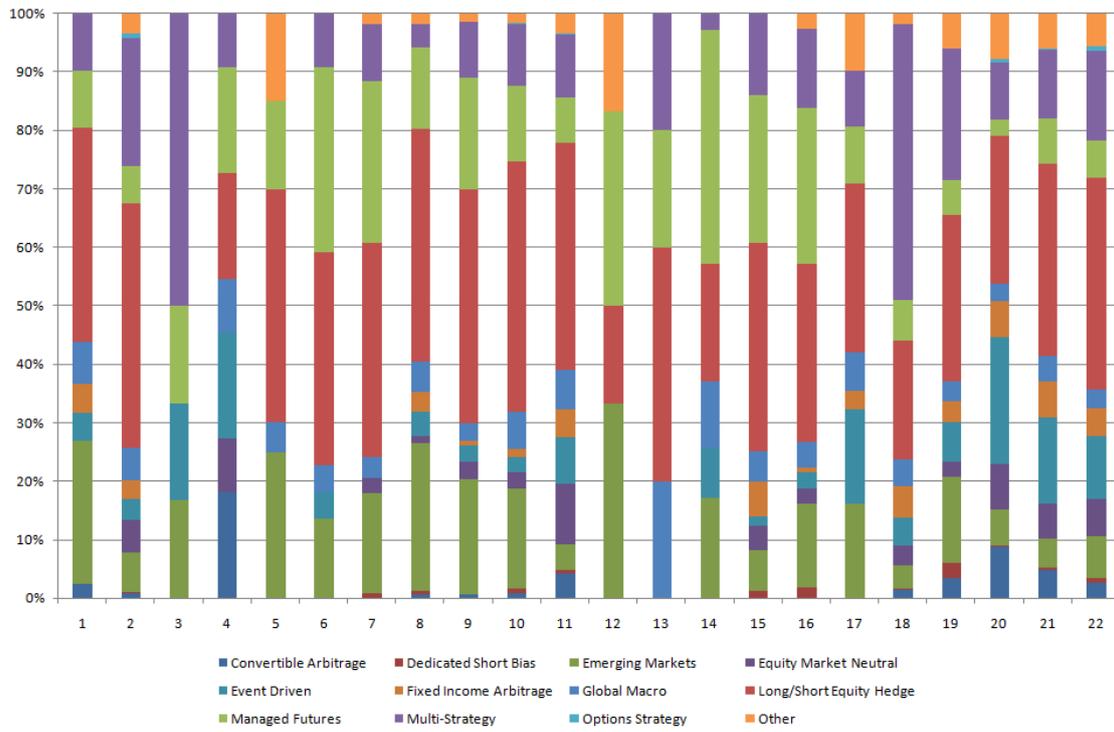




In the appendix I report others figures that illustrate the expositions of risk for each cluster. The information than I can take are: the cluster, 3 to 10 are the most risky, in fact inside these clusters there are funds that take different position with huge risk in positive or in negative, while the clusters 18 to 20 are lesser exposit to each risk. Another information are the risk most common, where result equity risk the most “popular” while others are pretty much equal to zero with some exceptions.

[Figure 36] [Figure 37] [Figure 38] [Figure 39] [Figure 40] [Figure 41] [Figure 42]

In the next figure and in the Appendix I show the composition of each cluster, in particular each feature that I considered in my research. Doing this I couldn't find any clear information that might justify some conclusions about some characteristics that help to generate value. These results are important to contradict some clichés that manager want that the market believed. These clichés are about management fee but especially for incentive fee, high water mark and personal capital. All these variables connected the revenue and the capital of management to the fund value. These might produce different behavioral on manager that don't optimize the asset allocation to follow some objectives like self earns, so they take some risks, or not to safeguard their money, so they might lose some possibility of earns.



[Figure 24] [Figure 25] [Figure 26] [Figure 27] [Figure 28] [Figure 29]

[Figure 30] [Figure 31] [Figure 32] [Figure 33] [Figure 34] [Figure 35]

5. Conclusion

Hedge fund industry is a complex world, where even the definition of hedge fund is not clear and definite. This situation is been preserved by management that every time try to hide every information that might discover fund trade strategy. Inside commercial database the information have bias and this is confirmed in many studies, so all results of research in this sector might be not stable. As I found in my research it's difficult to conclude which will be the best strategy or the best characteristics in absolute that a fund should have: all depends of what we want, stable performance, or a possibility of a very huge performance? This answer opens to different results. In particular when we choose a Hedge Fund we have to keep in mind how this is connected and correlated with our portfolio. This last step open to a multiple answer for the previous question.

However there are some results that I showed before and I prefer to underline here:

- I. *Structure*: The only features that in my data help to create value are the Strategy and the amount of Asset Under Management. All others factors, Usd/Other Currency and On Shore/Off Shore, don't give me any clear sign to conclude something. This is an important signal especially for the last feature that explains that the main reason of recent mode to open a Hedge Fund in Off Shore country is only for fiscal arbitrage opportunities of their clients.
- II. *Management*: All characteristics here: Management Fee, Incentive Fee, High Water Mark and Personal Capital, don't give me any difference that might confirm that to have some specific type of them might be reduce risk or add value. This should be verified in other studies but if this result is right according the market: underestimates the risk of some funds, in particular all fund where are personal capital, and overestimates the performance of funds that have huge high water mark and incentive fee.
- III. *Manage*: As found in the literature all variables that have impact on liquidity are important to add value and to reduce risk. A question which remains open and needs more studies is leveraged, because the result appear not clear. In fact the figure that shows two classes Not Lev./Lev. doesn't give me any difference in performance or risk. However the figure that shows different classes of leverage seems to produce effect, as I show in chapter 4.

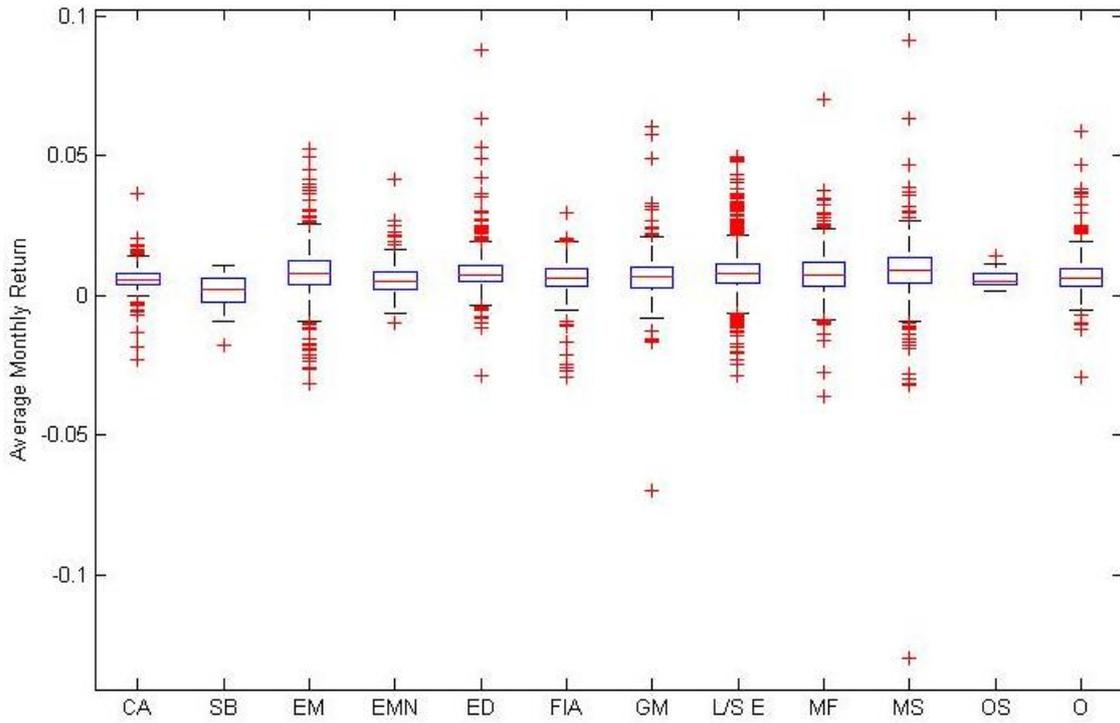
The quantitative analysis doesn't give any more clear information about the characteristics or strategies that should have a good fund and this confirms the efficiency of the market. However the cluster division gives a good selection of funds as evidenced in many statistics, and there is room for further research to refine this results. A possible way should be to fix a time window of analysis and move this one to generate a ranking of funds.

6. Reference

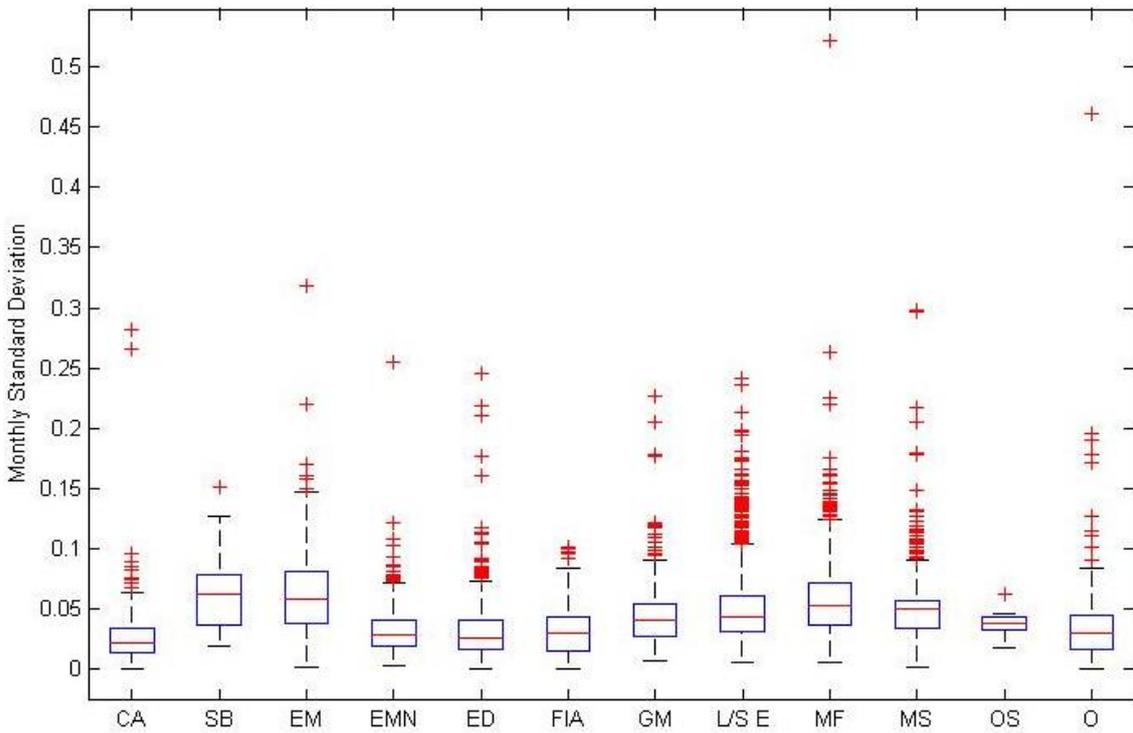
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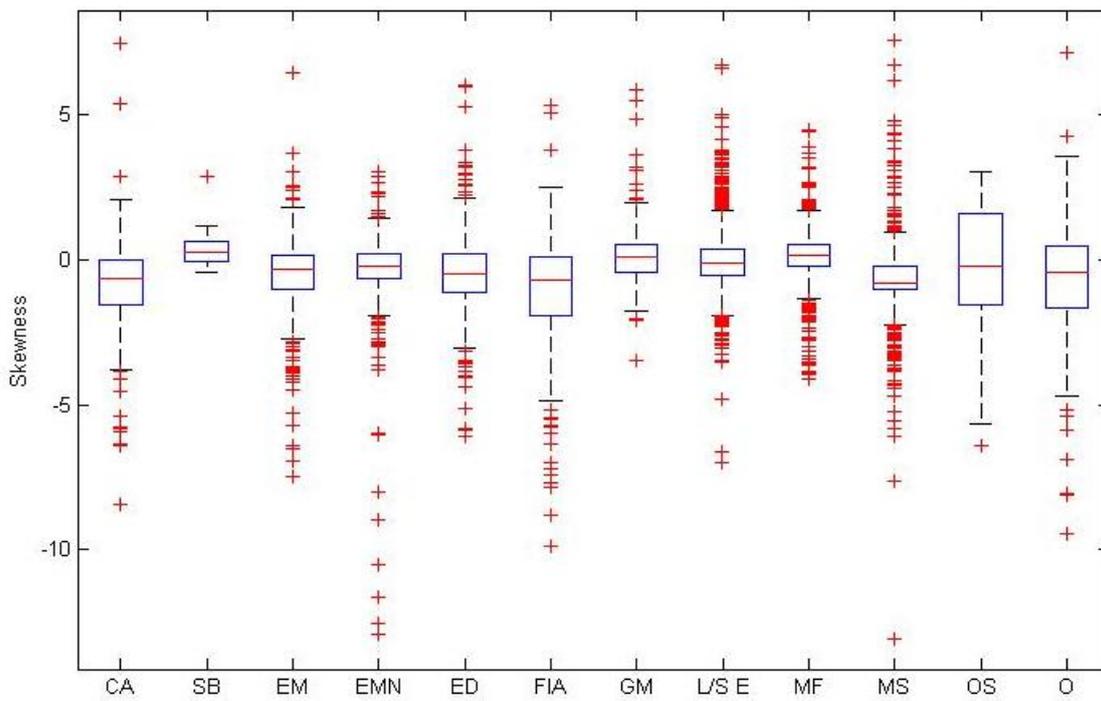
A.1 Appendix



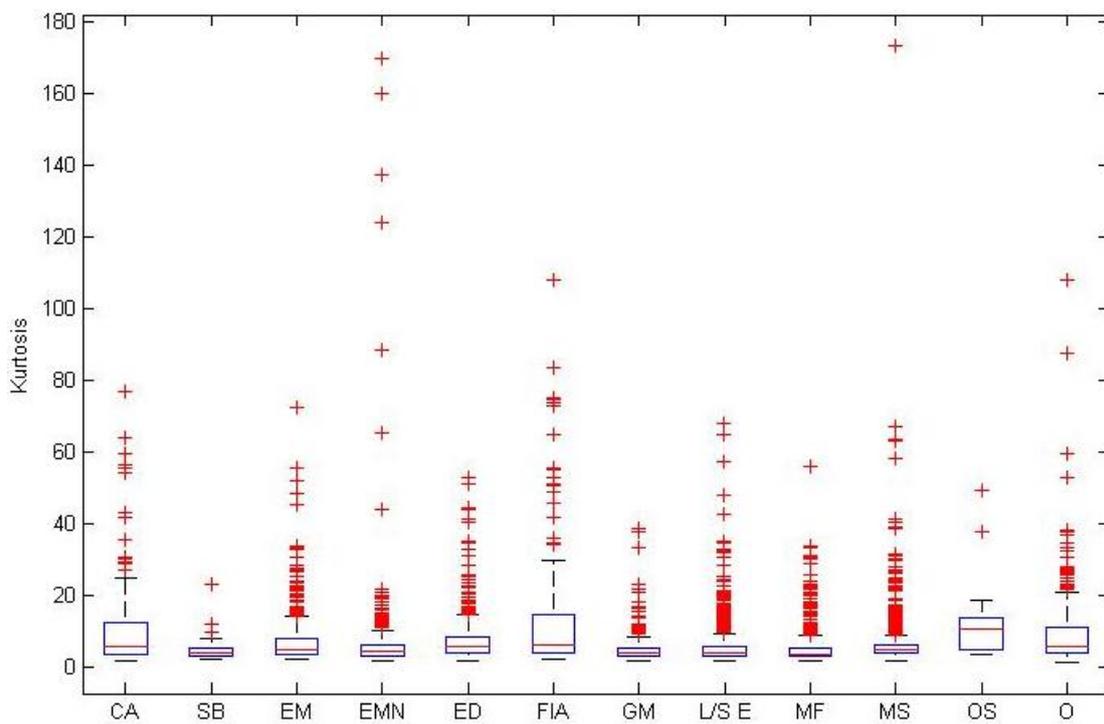
[Figure 1]



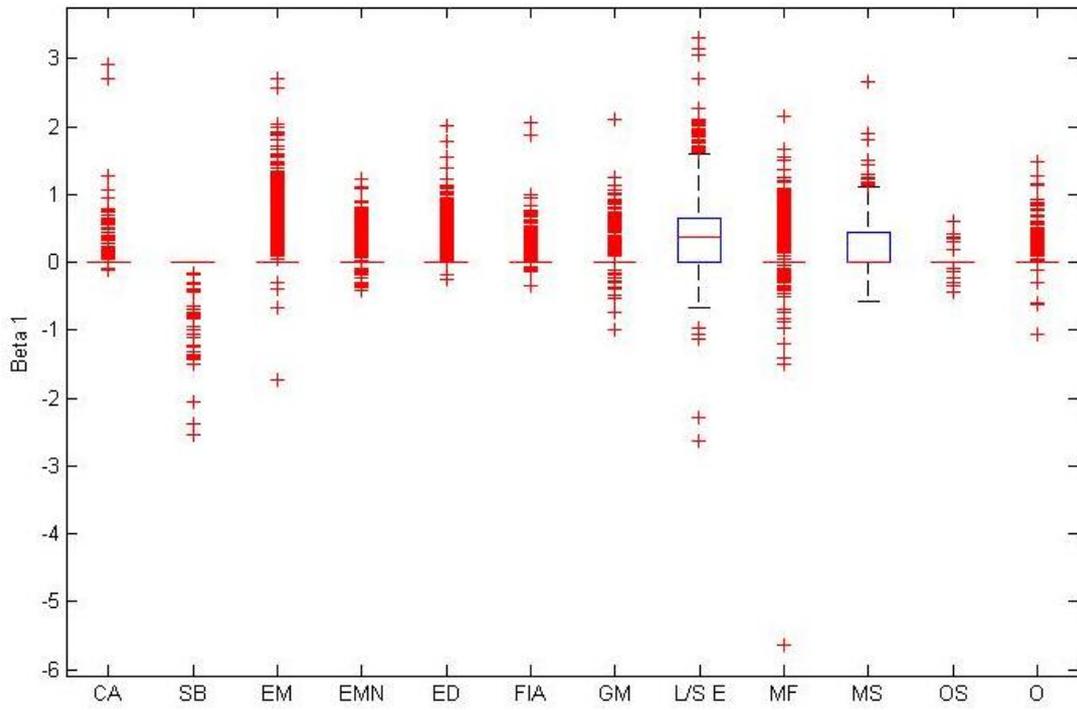
[Figure 2]



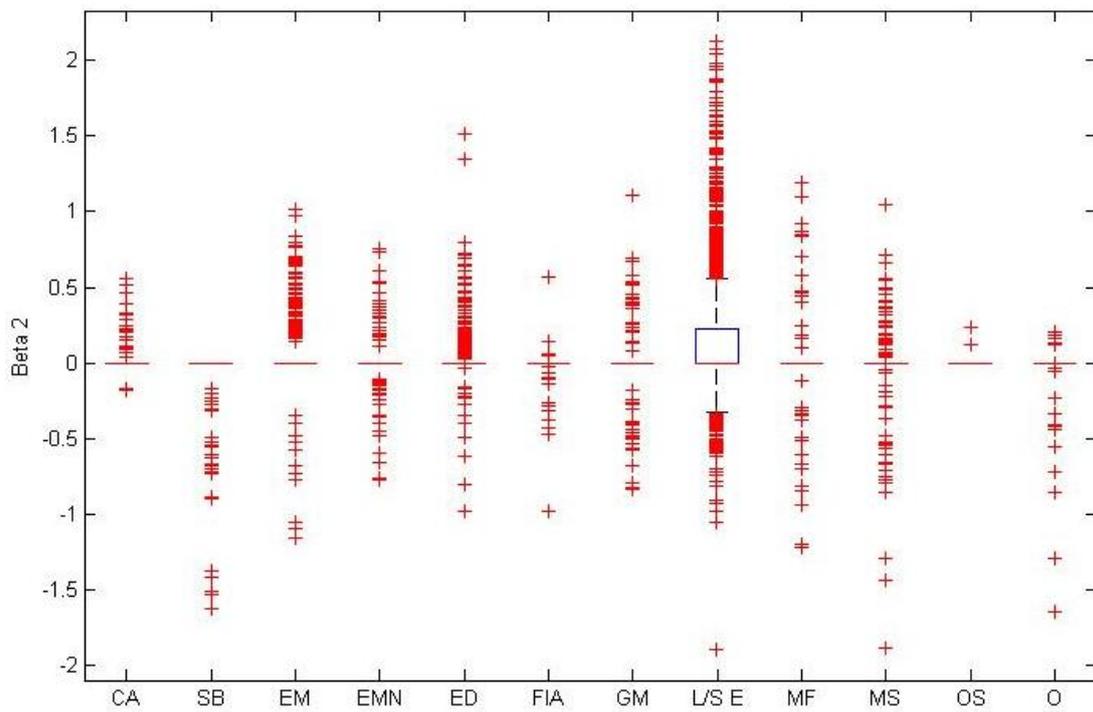
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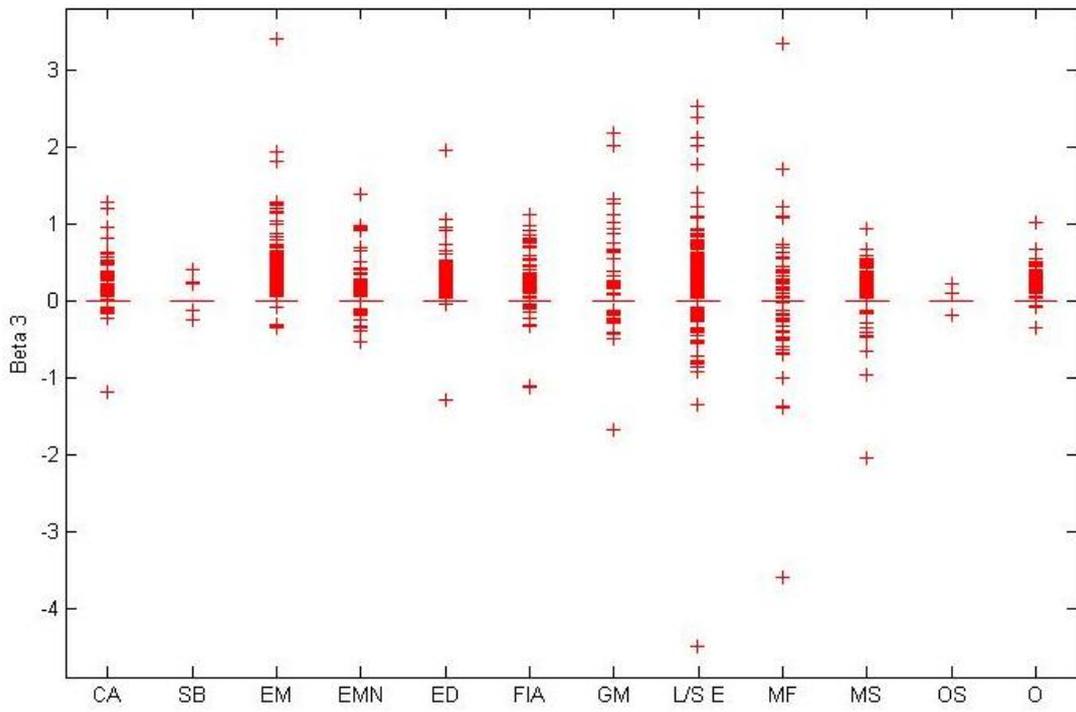
[Figure 4]



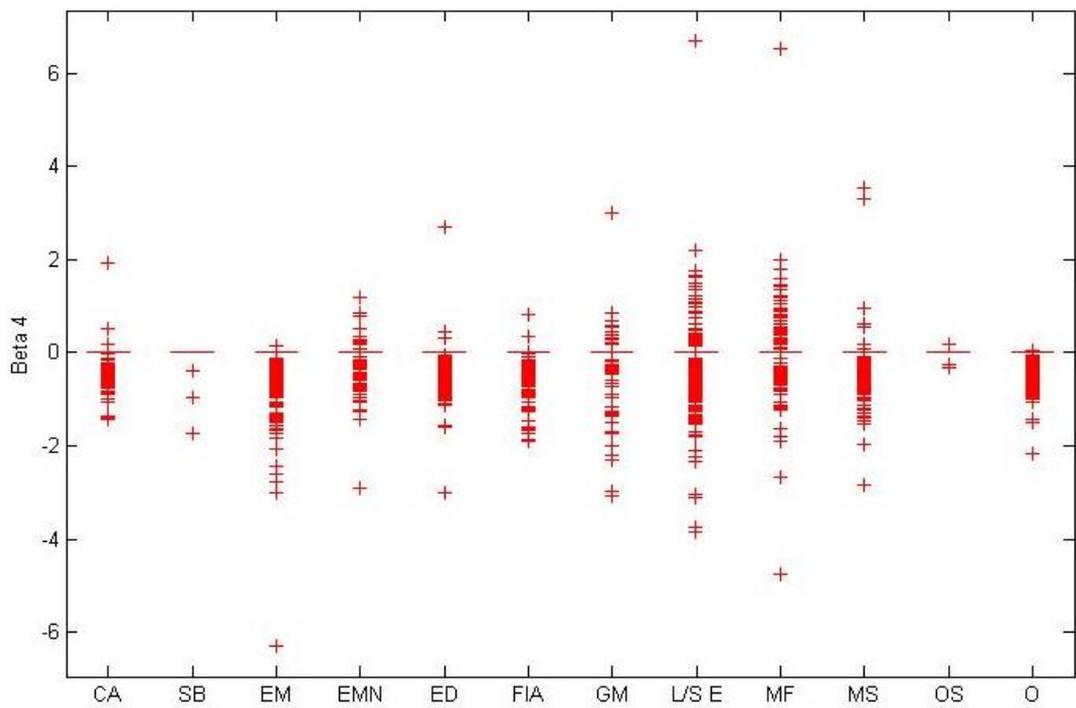
[Standard & Poor 500, Figure 5]



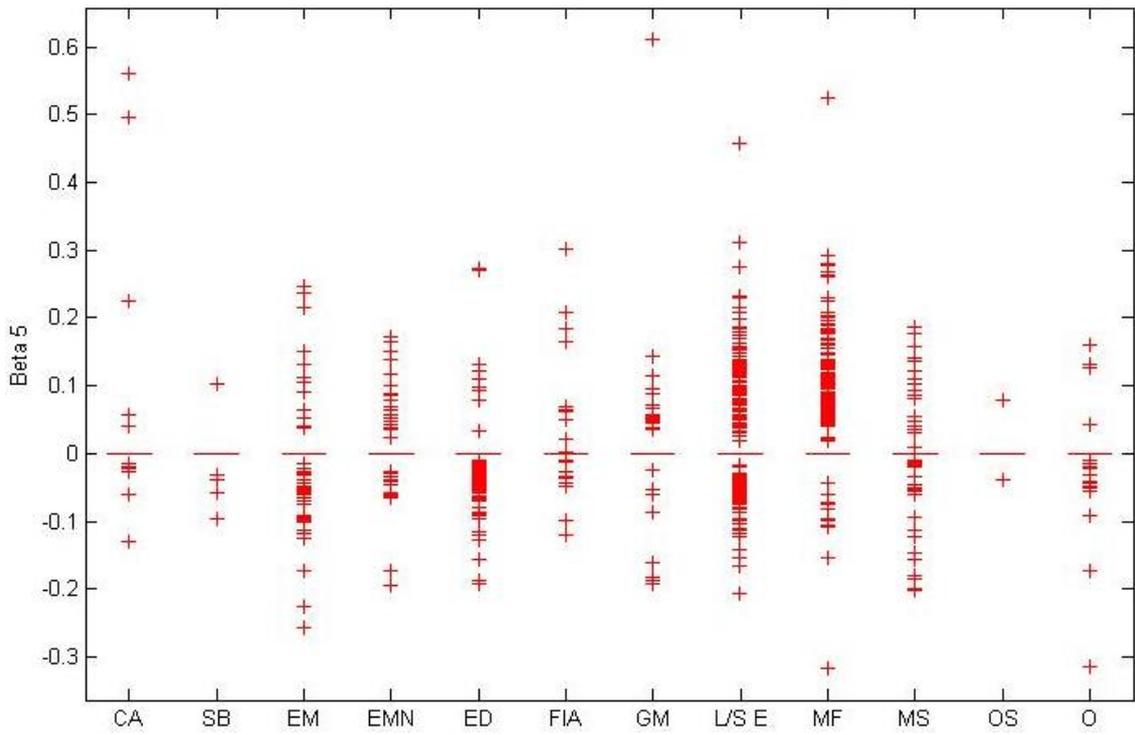
[Equity Spread from Large Cap, Figure 6]



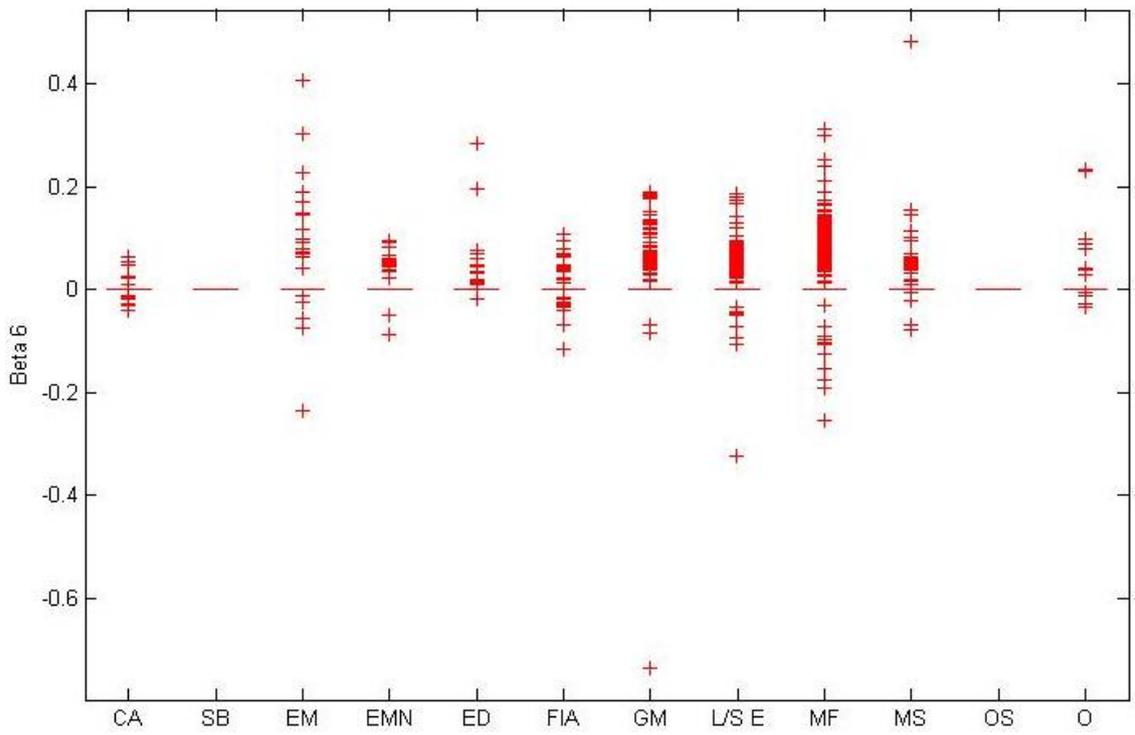
[Change in 10 Y maturity Yield, Figure 7]



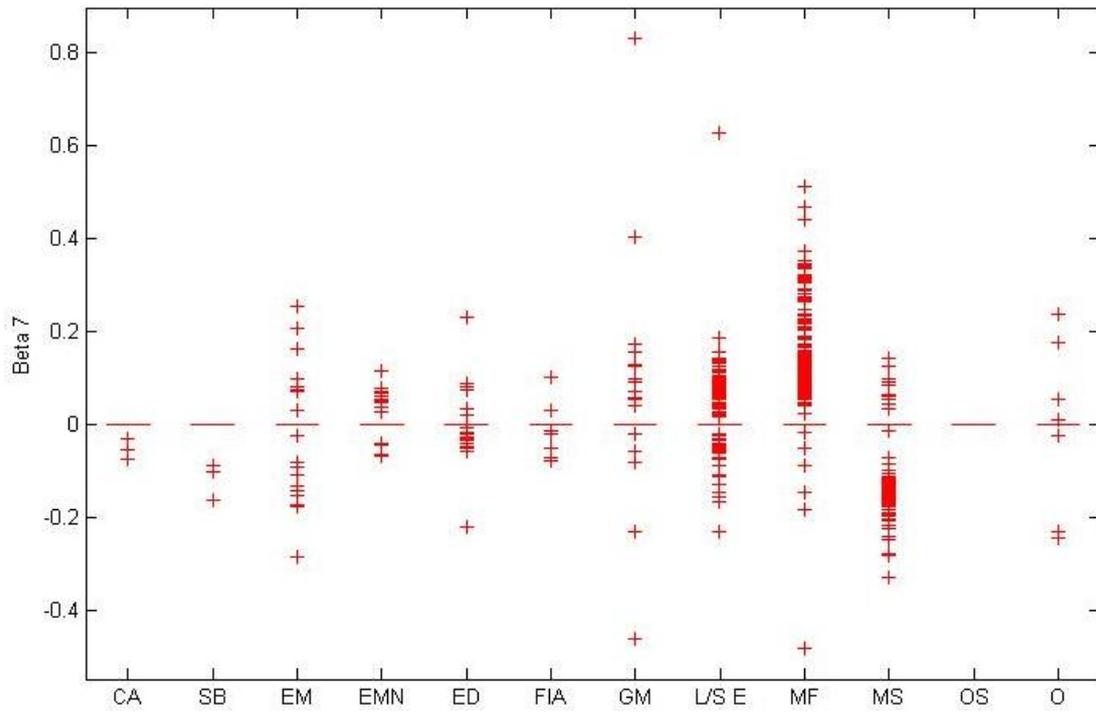
[Spread of Baa yield to FR 10 Y, Figure 8]



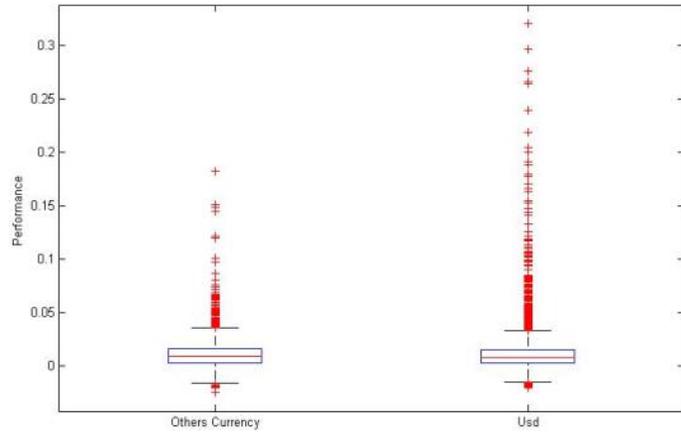
[Lookback straddles on bond futures, Figure 9]



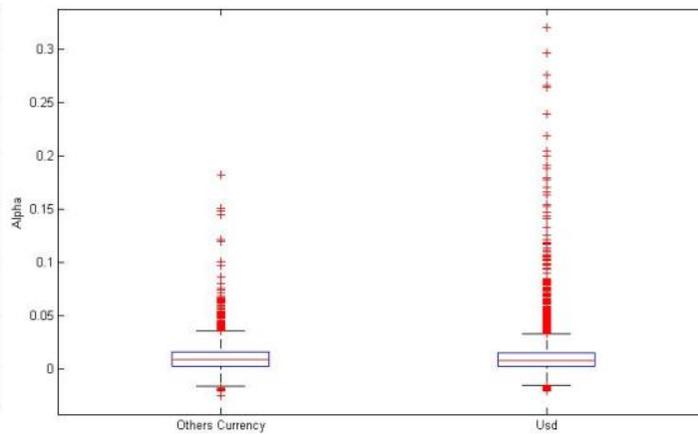
[Lookback straddles on currency futures , Figure 10]



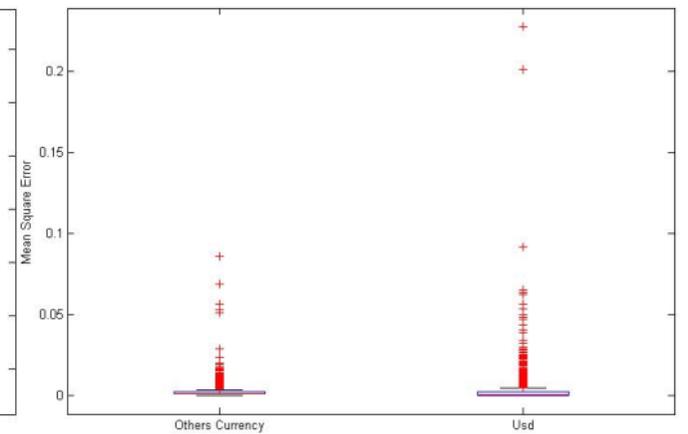
[Lookback straddles on commodity futures, Figure 11]



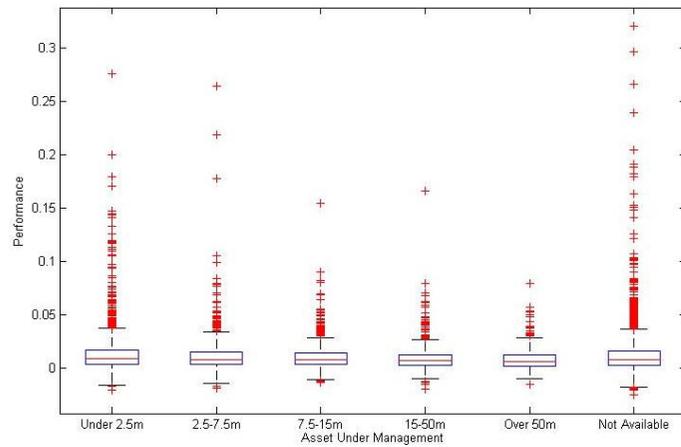
[Figure 12a]



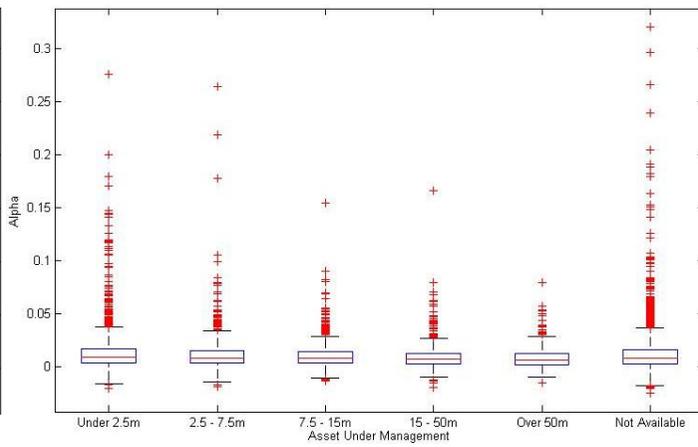
[Figure 12b]



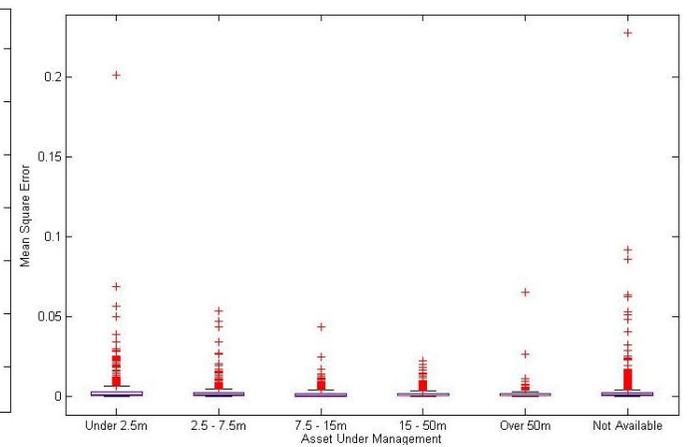
[Figure 12c]



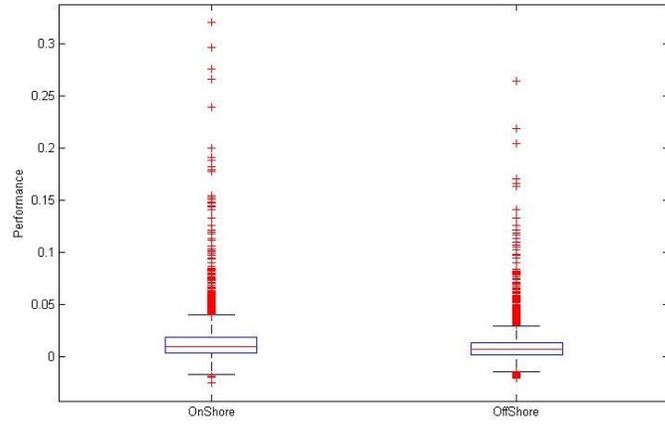
[Figure 13a]



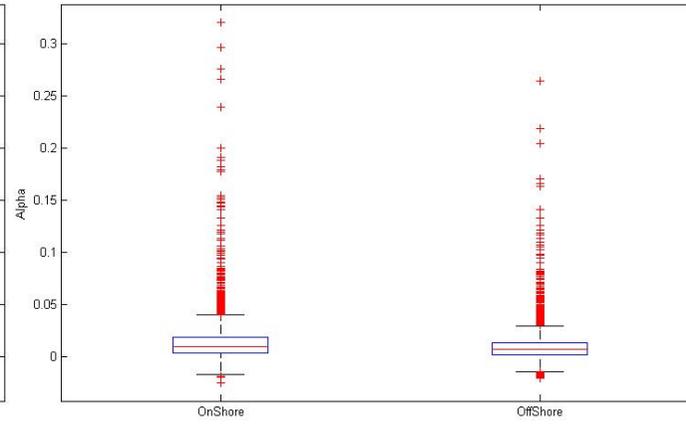
[Figure 13b]



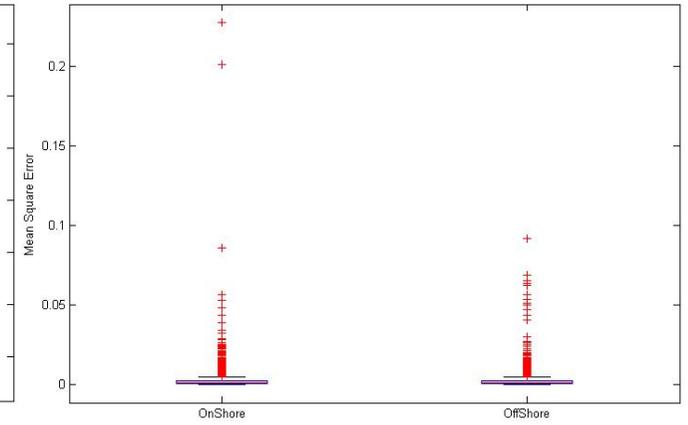
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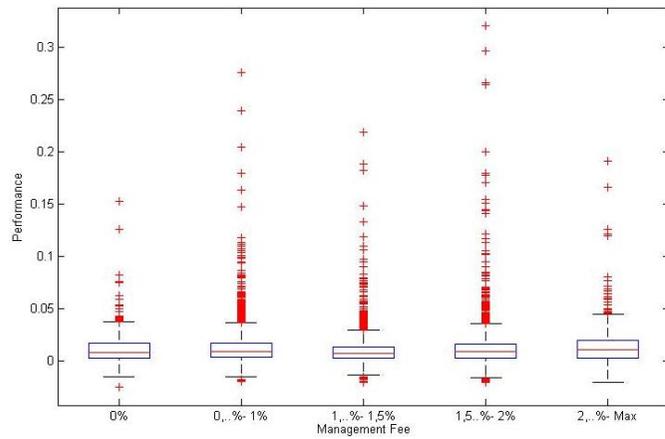
[Figure 14a]



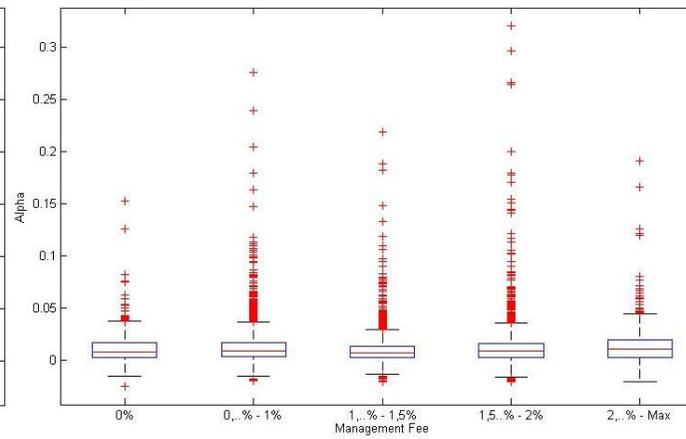
[Figure 14b]



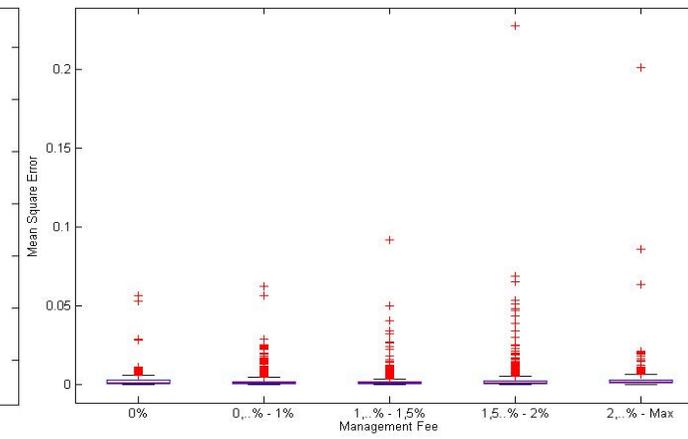
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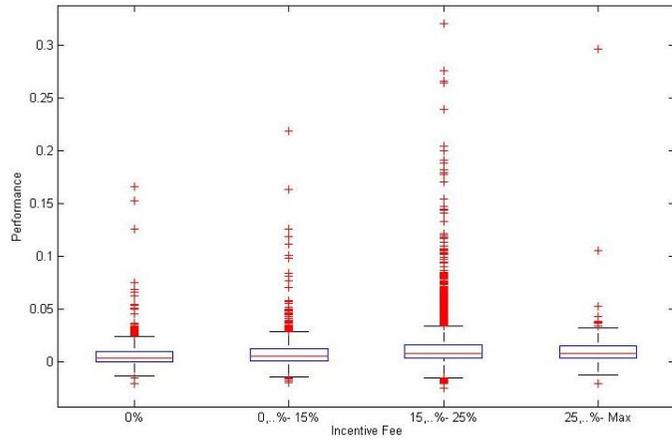
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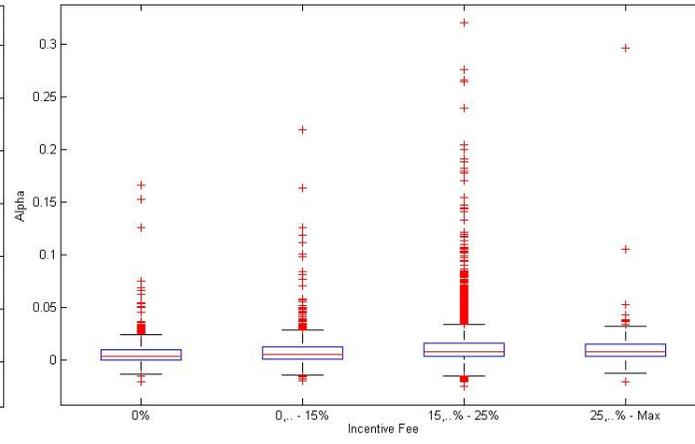
[Figure 15b]



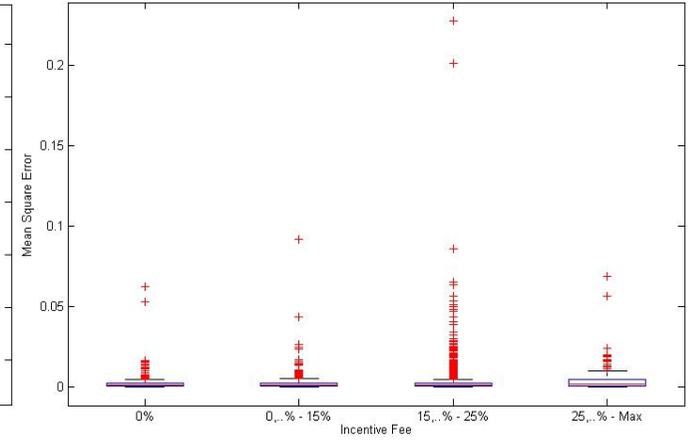
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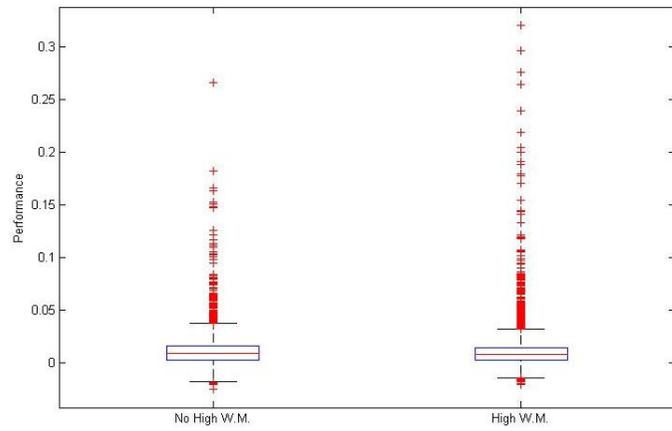
[Figure 16a]



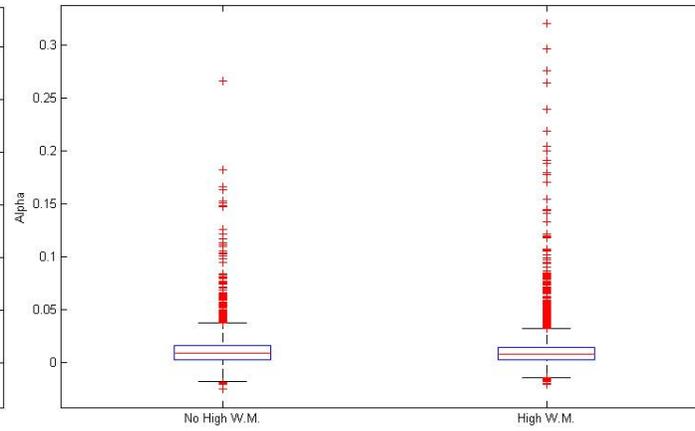
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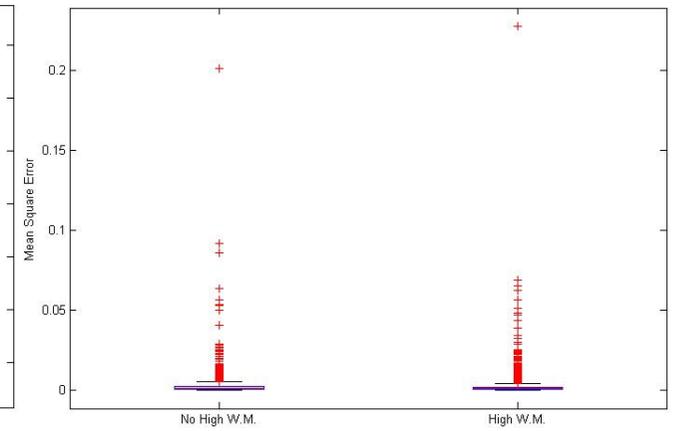
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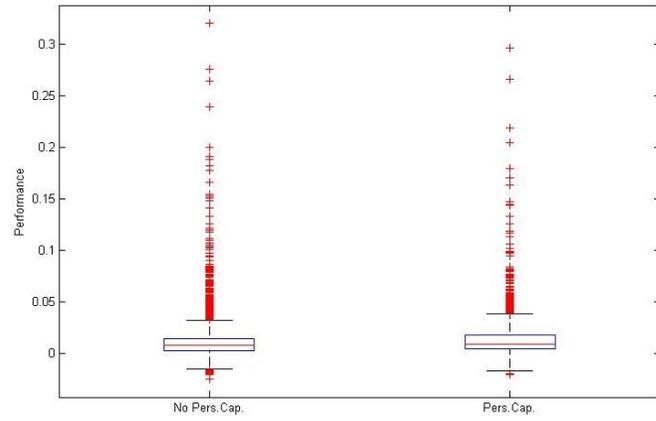
[Figure 17a]



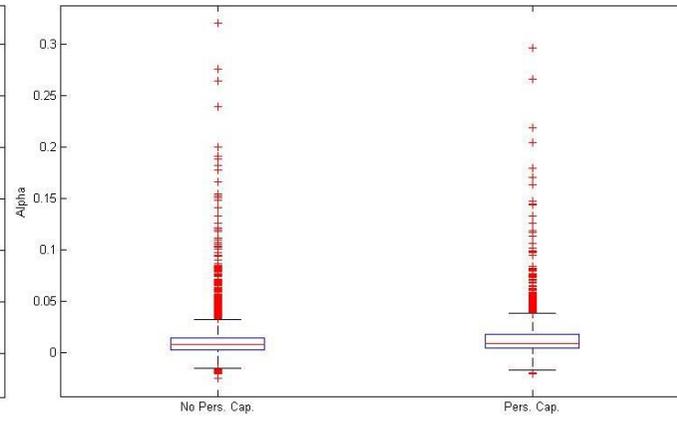
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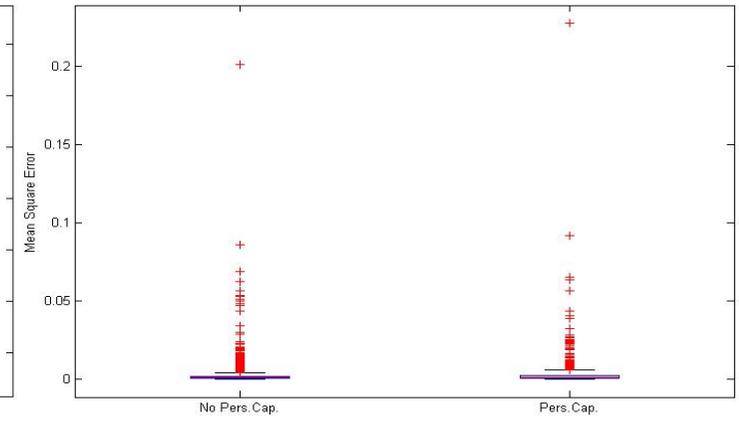
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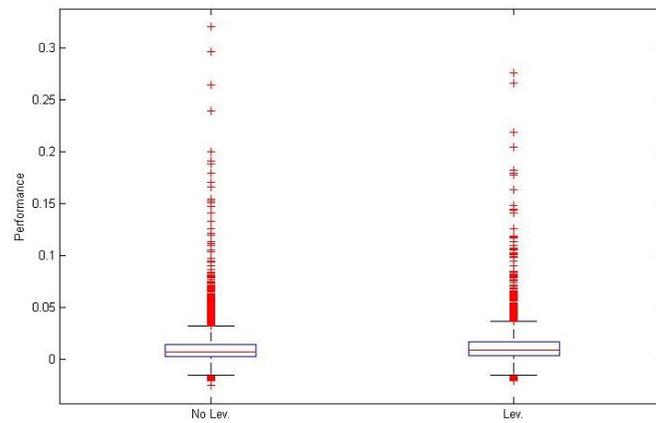
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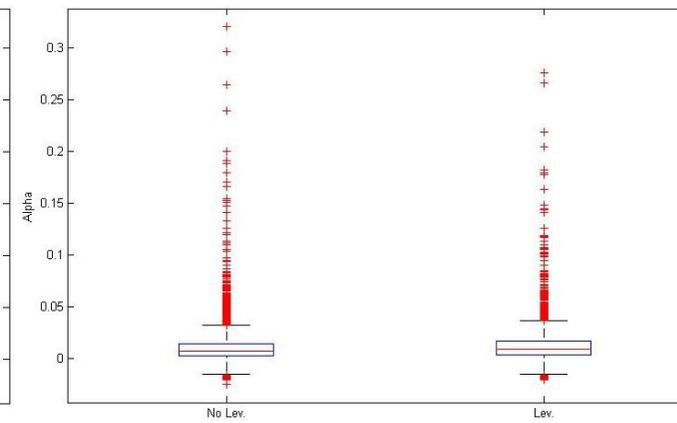
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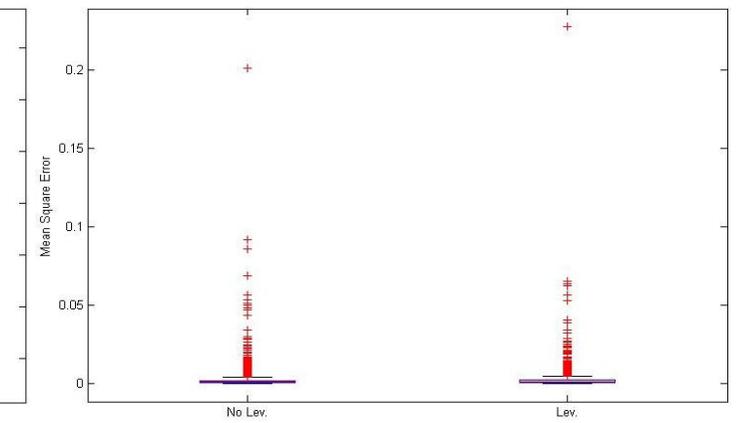
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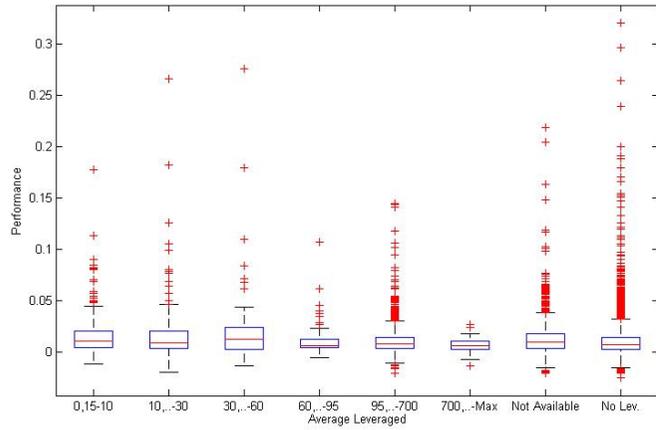
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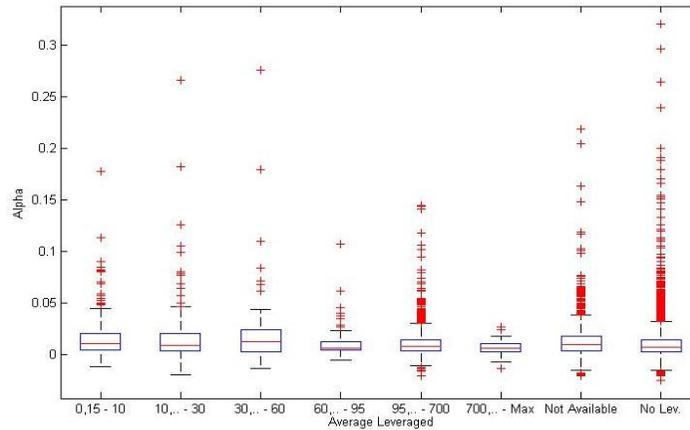
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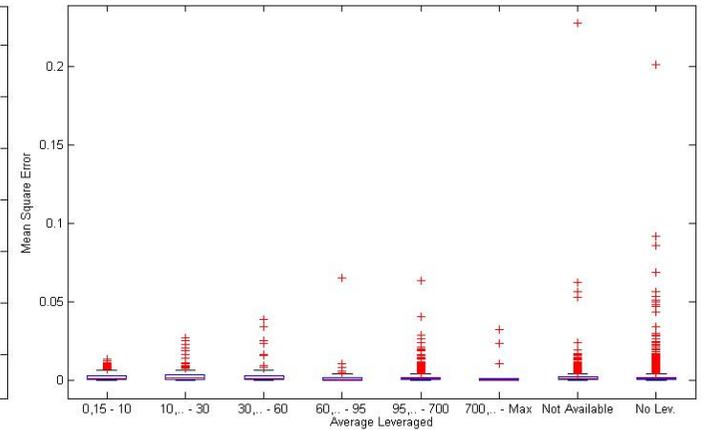
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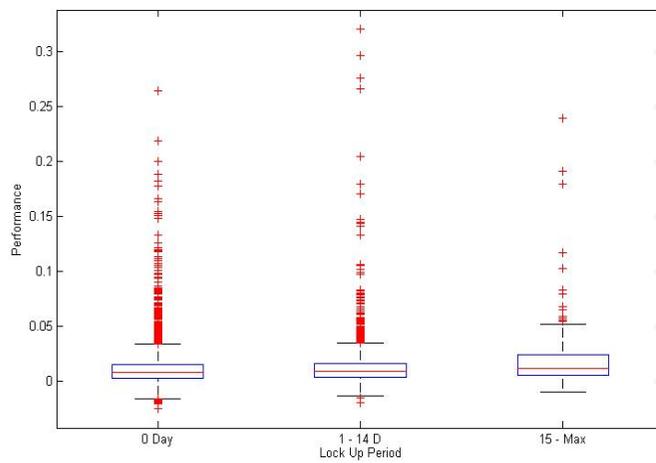
[Figure 20a]



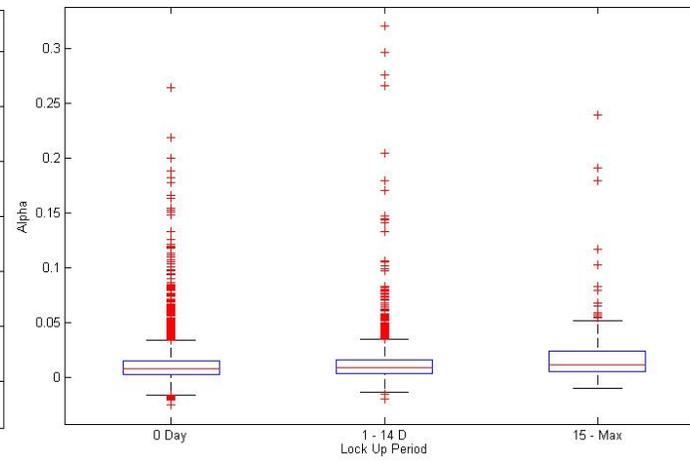
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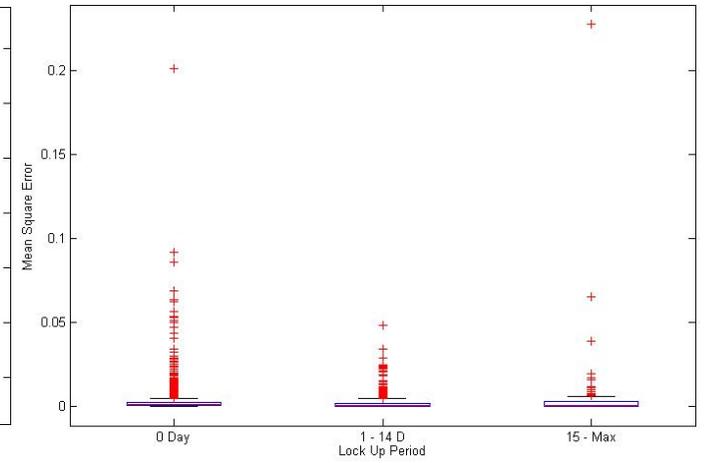
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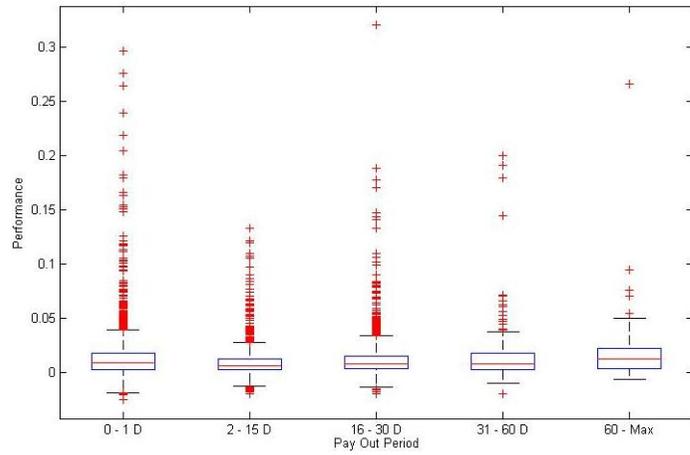
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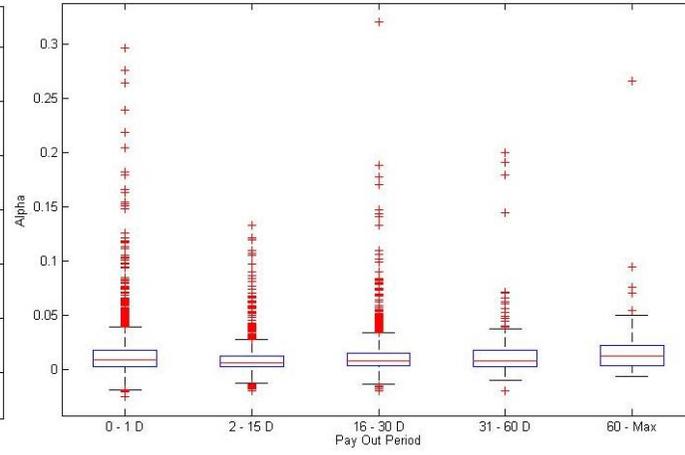
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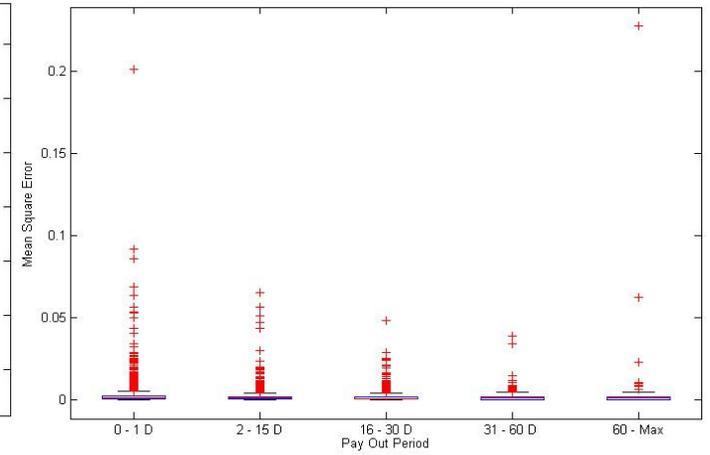
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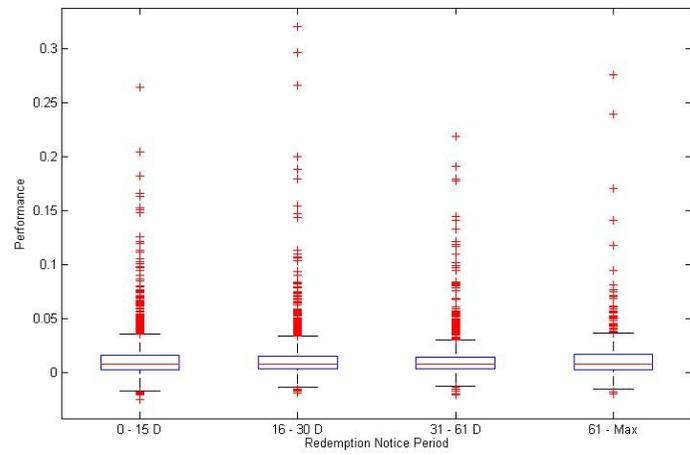
[Figure 22a]



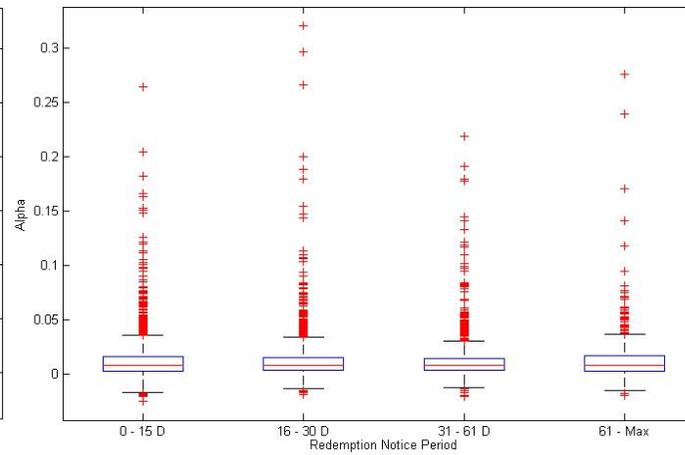
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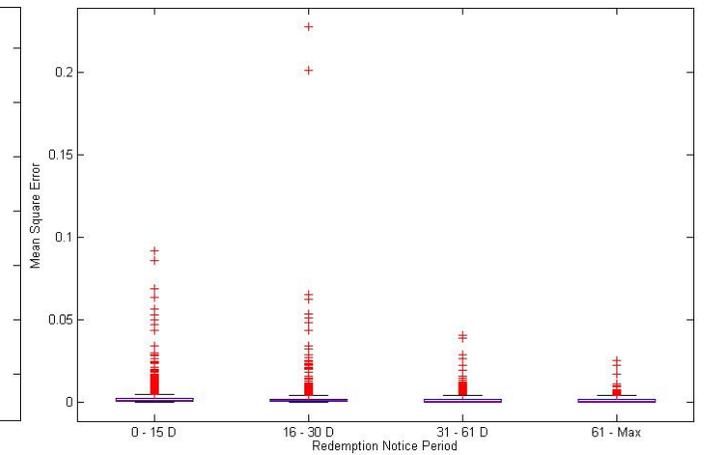
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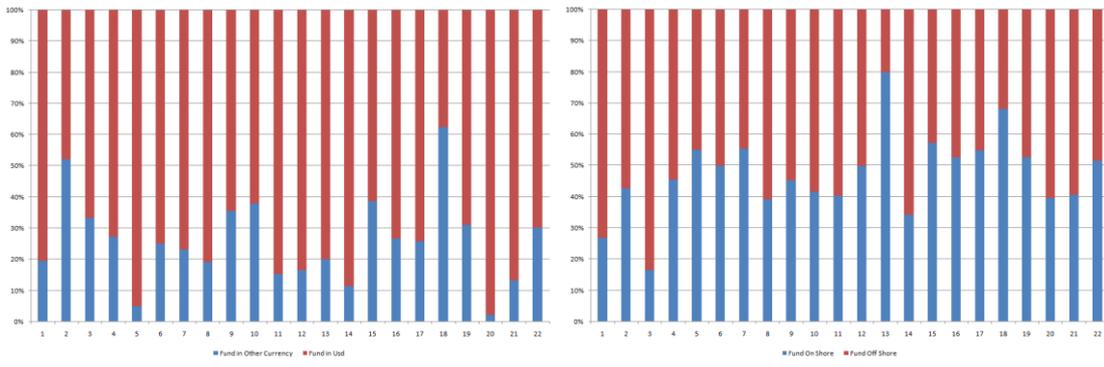
[Figure 23a]



[Figure 23b]

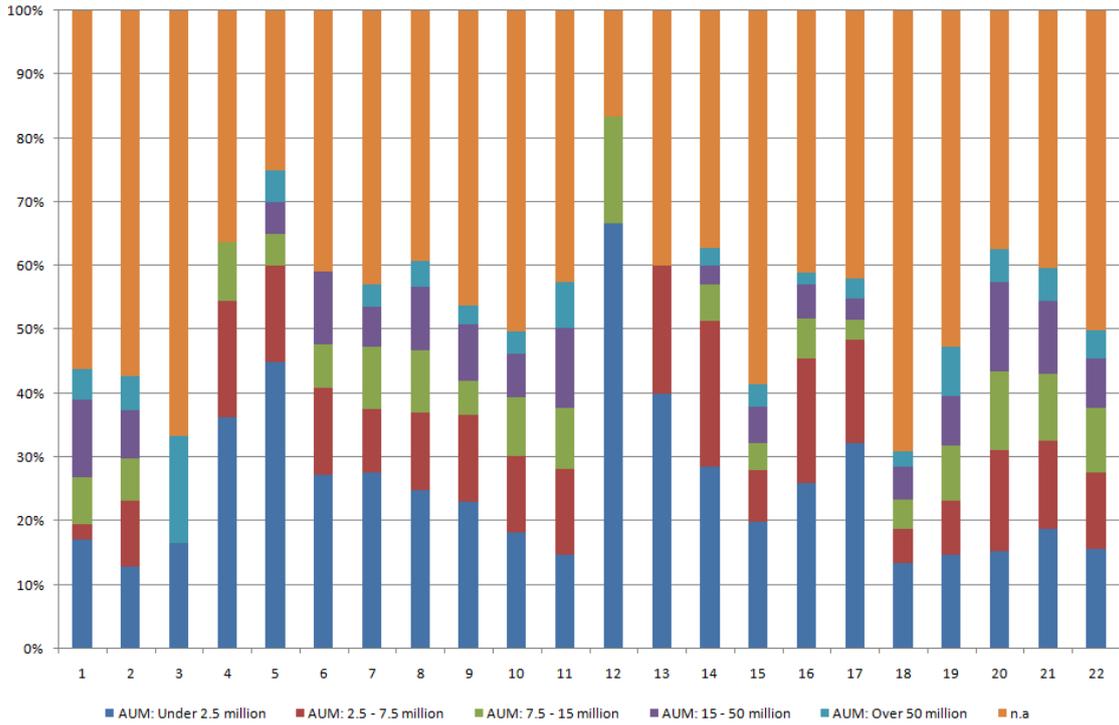


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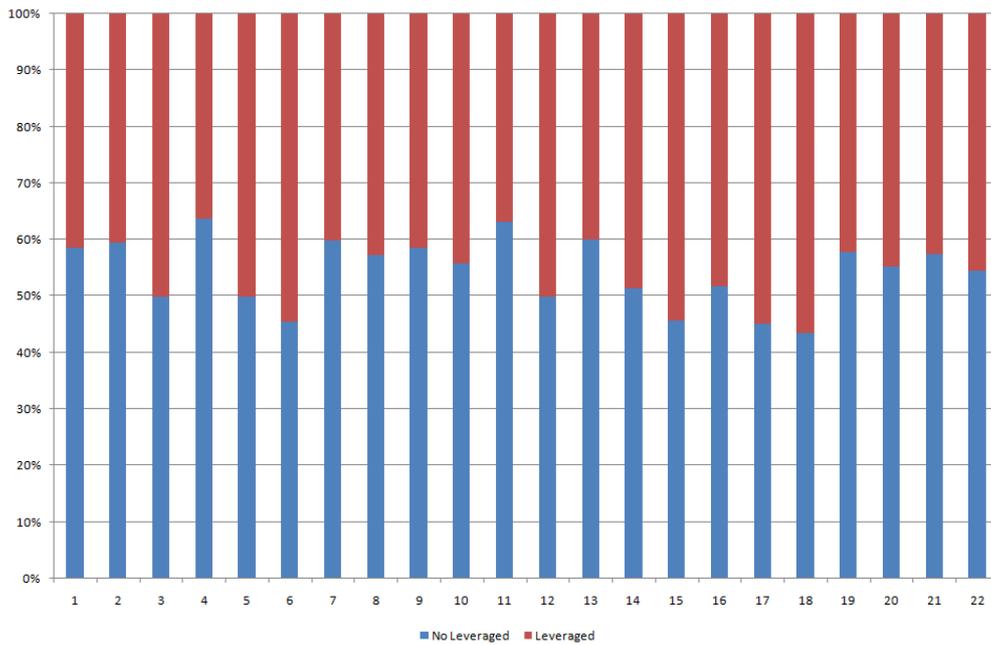


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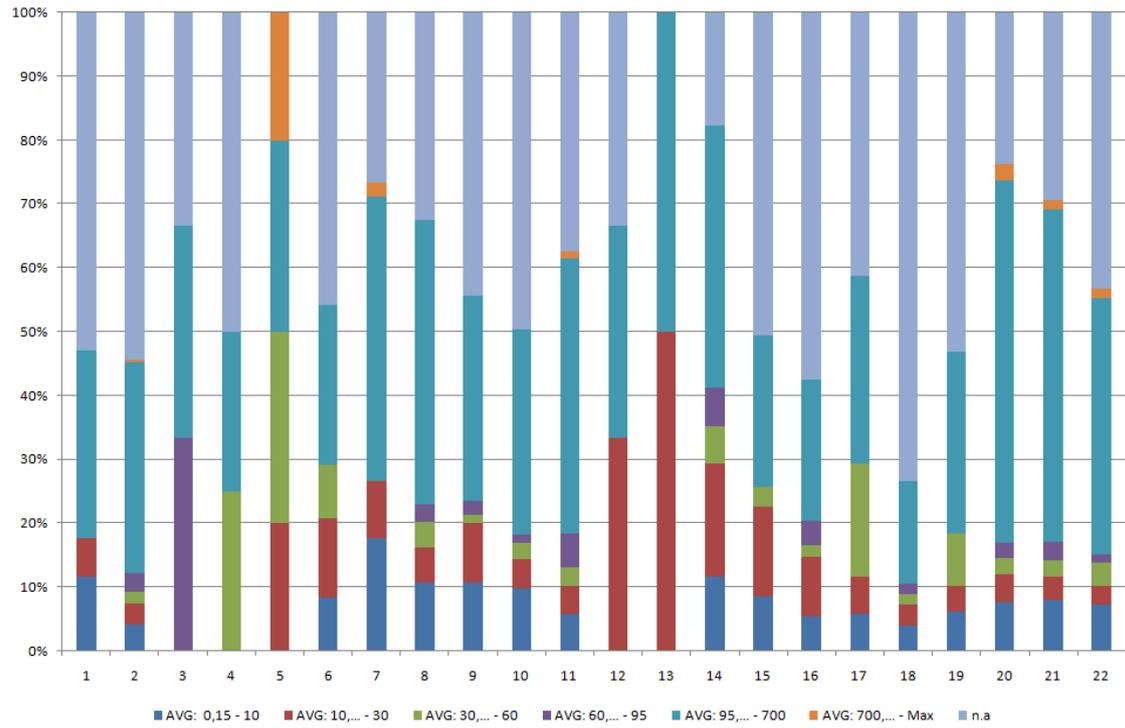
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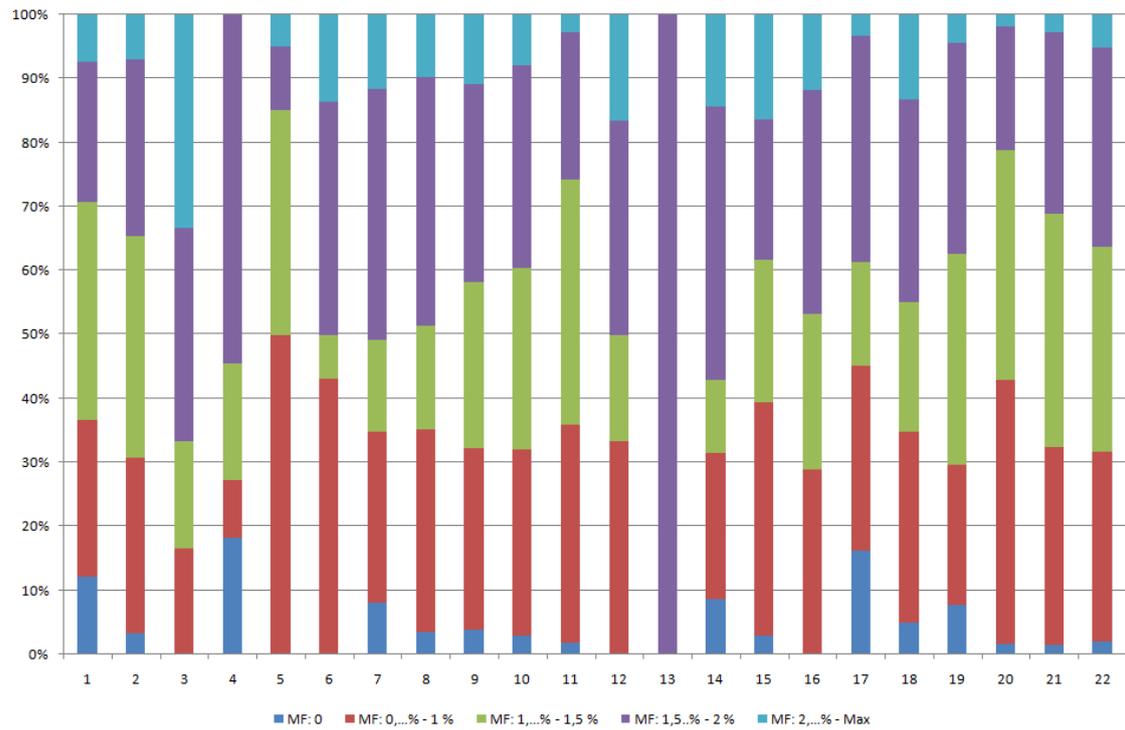
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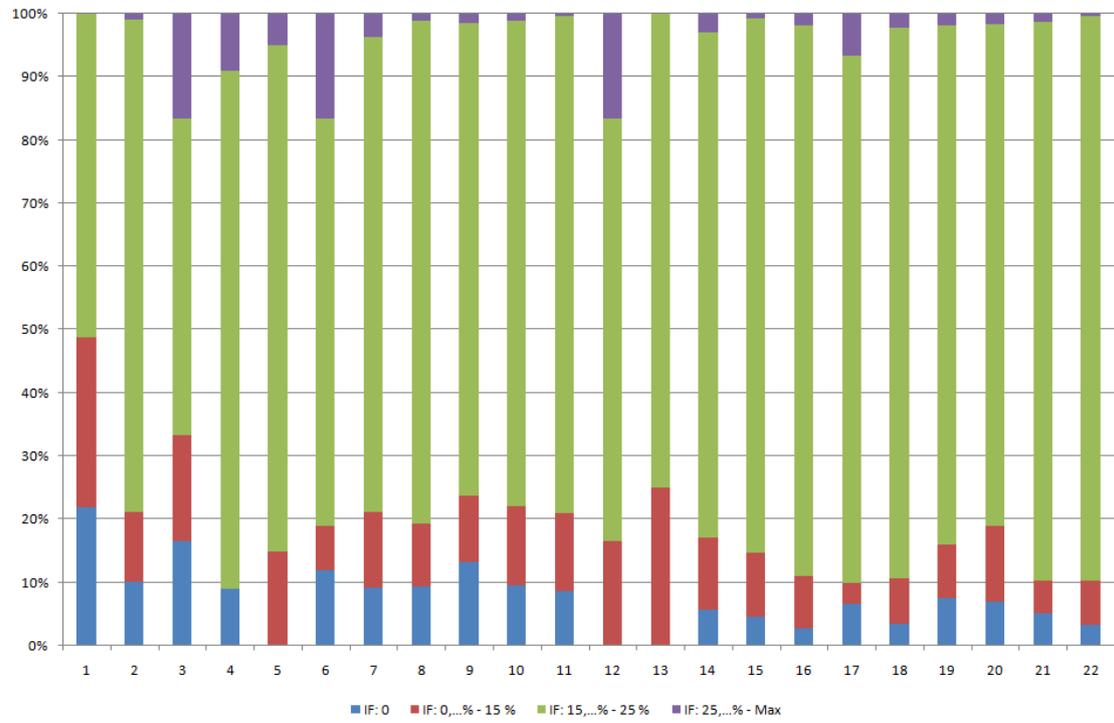
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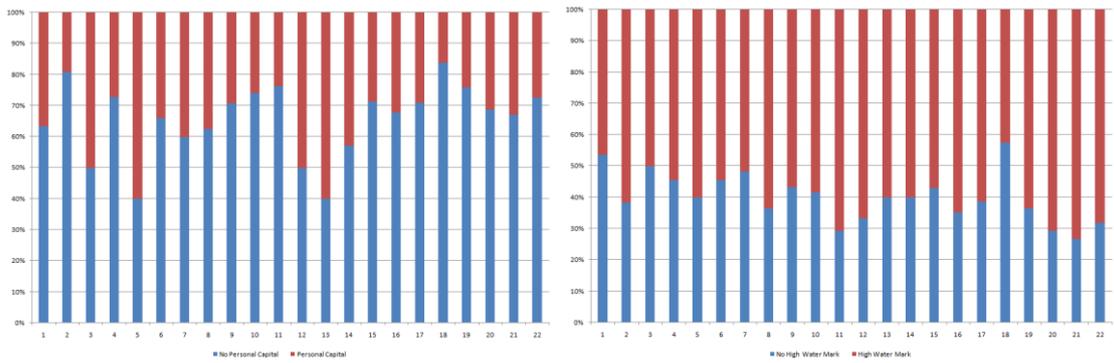
[Figure 28]



[Figure 29]



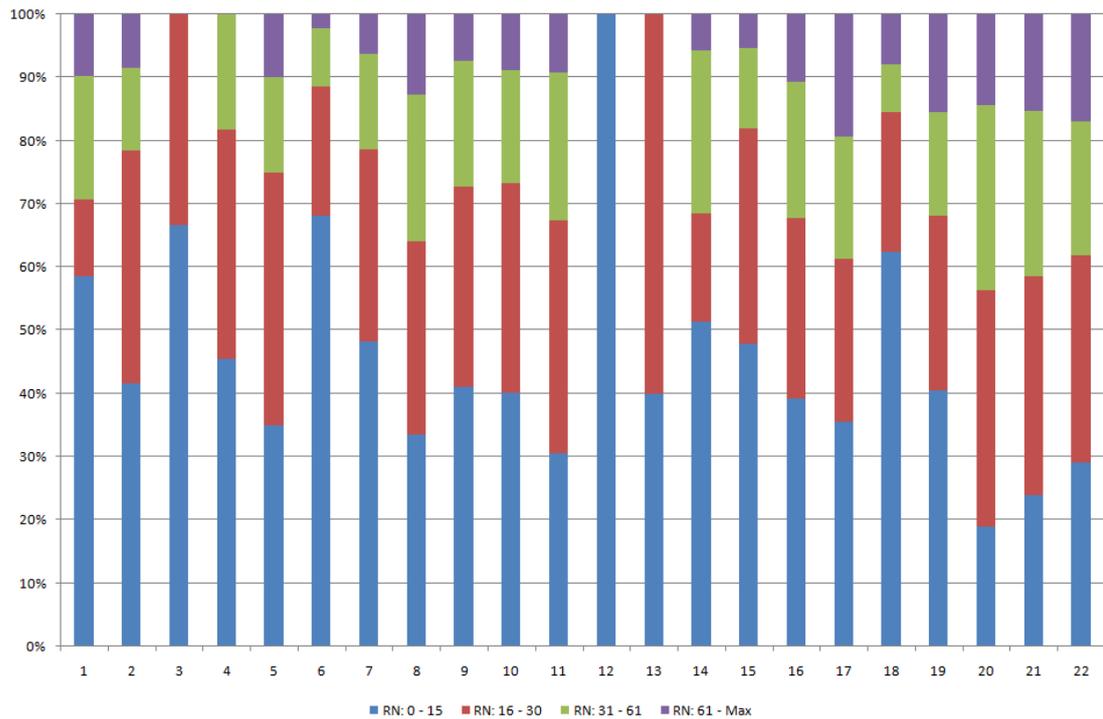
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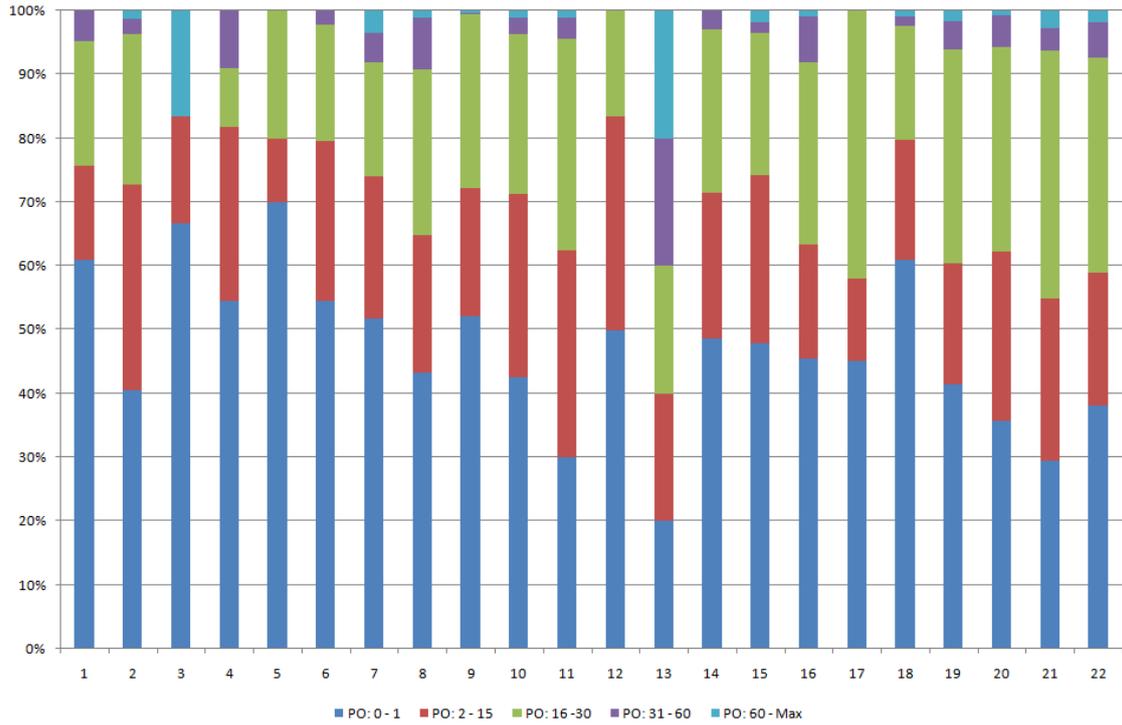


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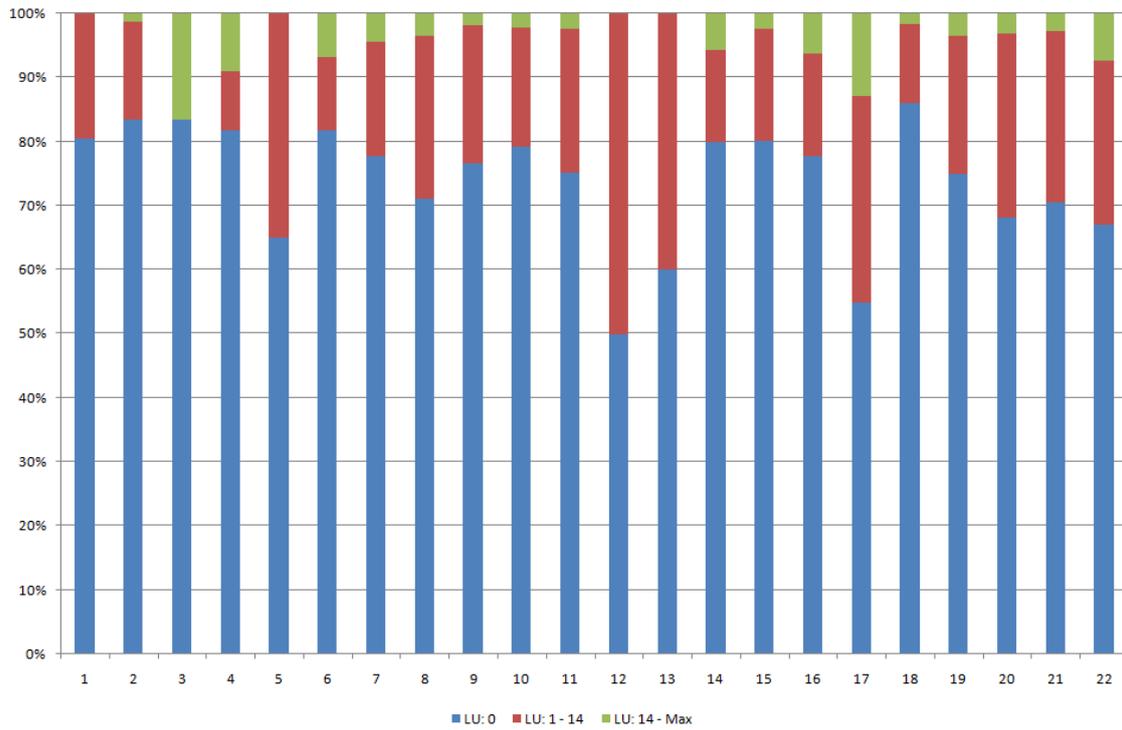
[Figure 32]

[Figure 33]

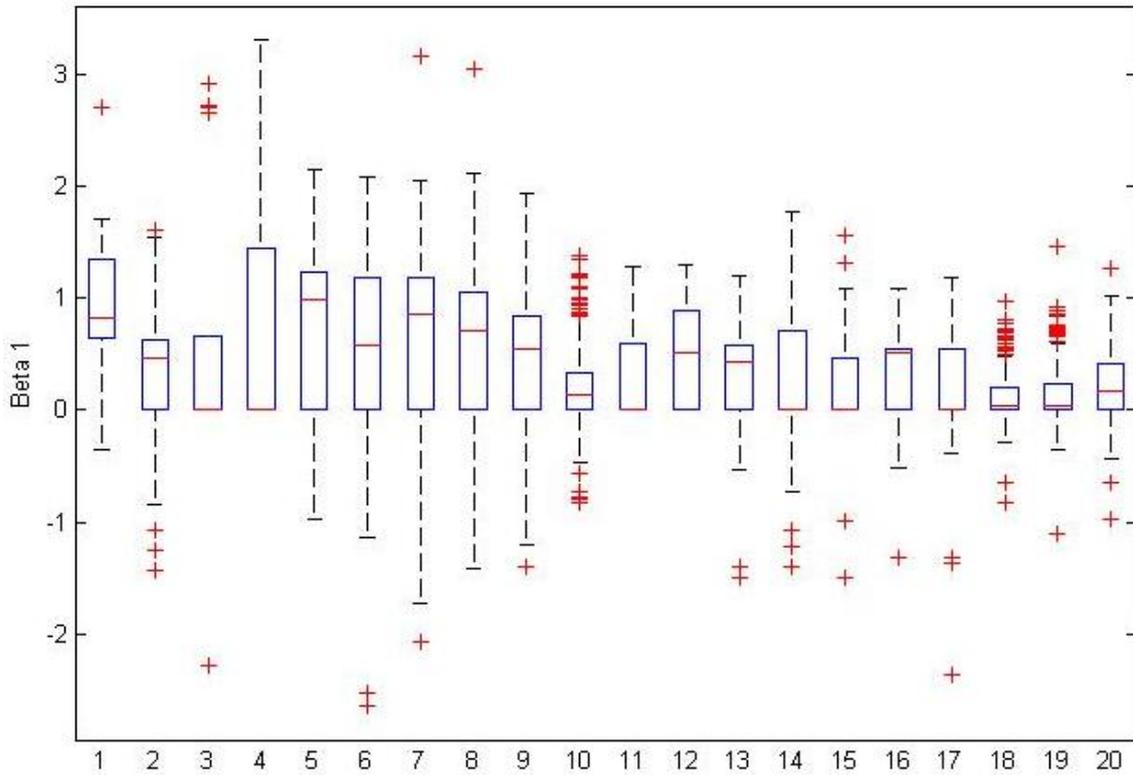




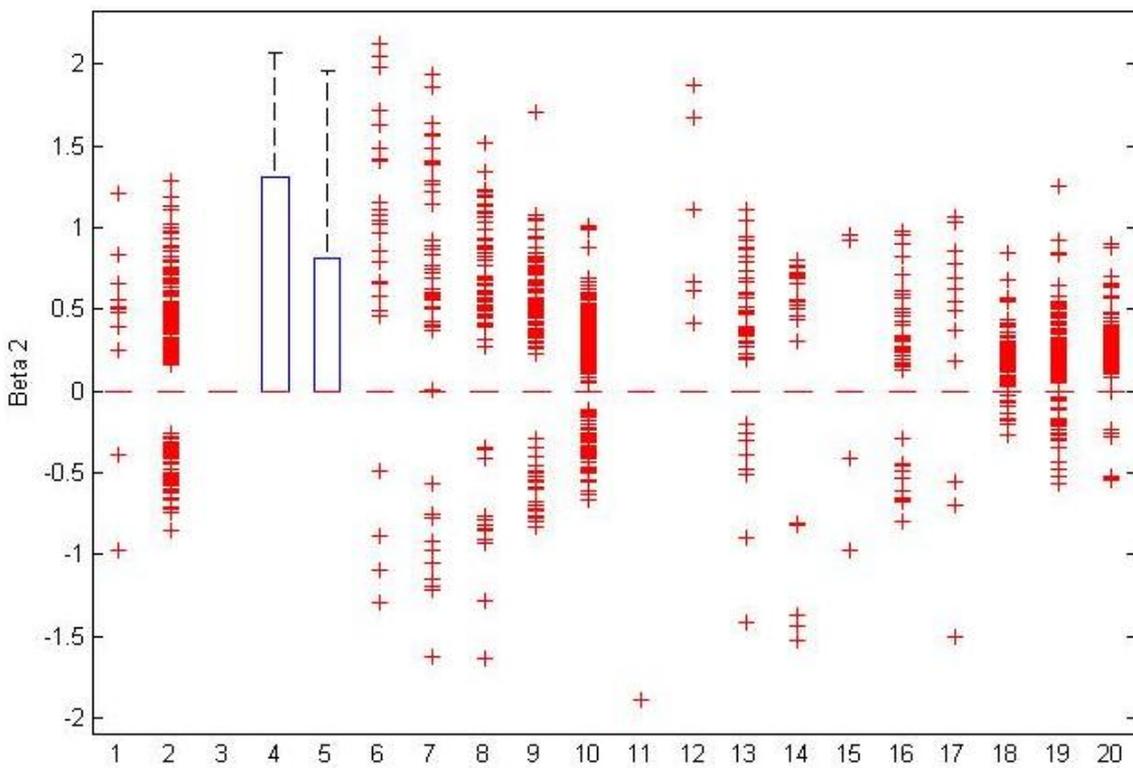
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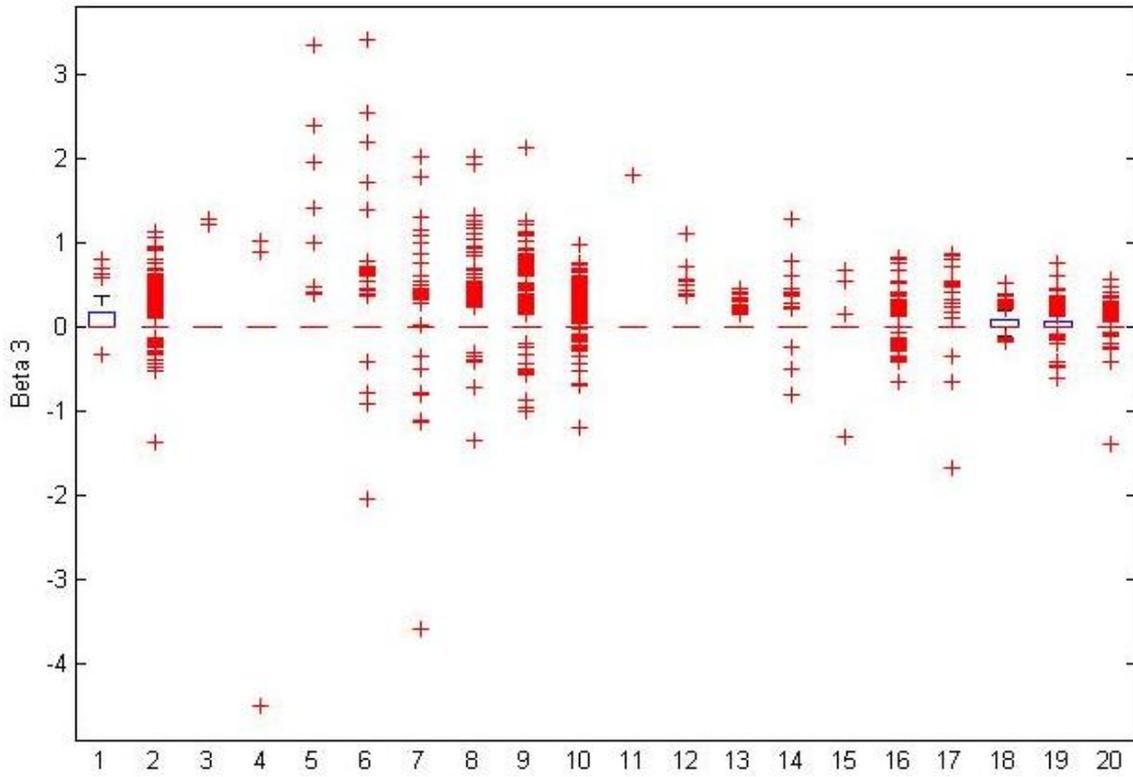
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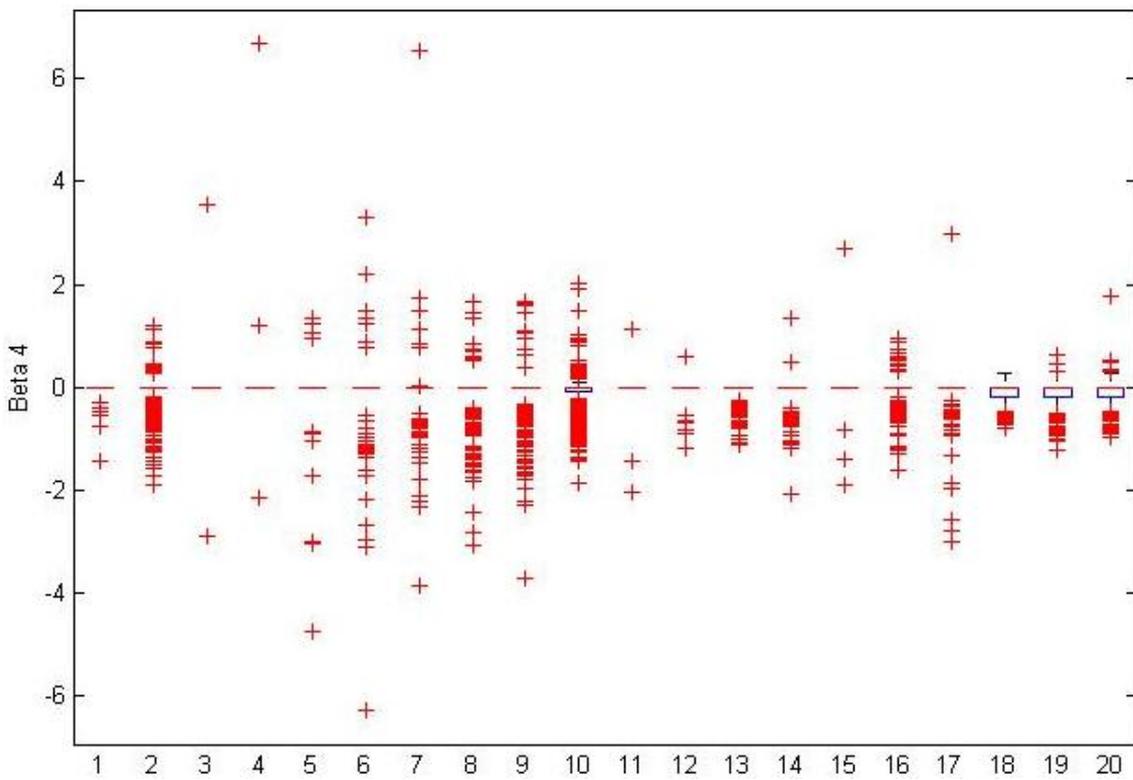
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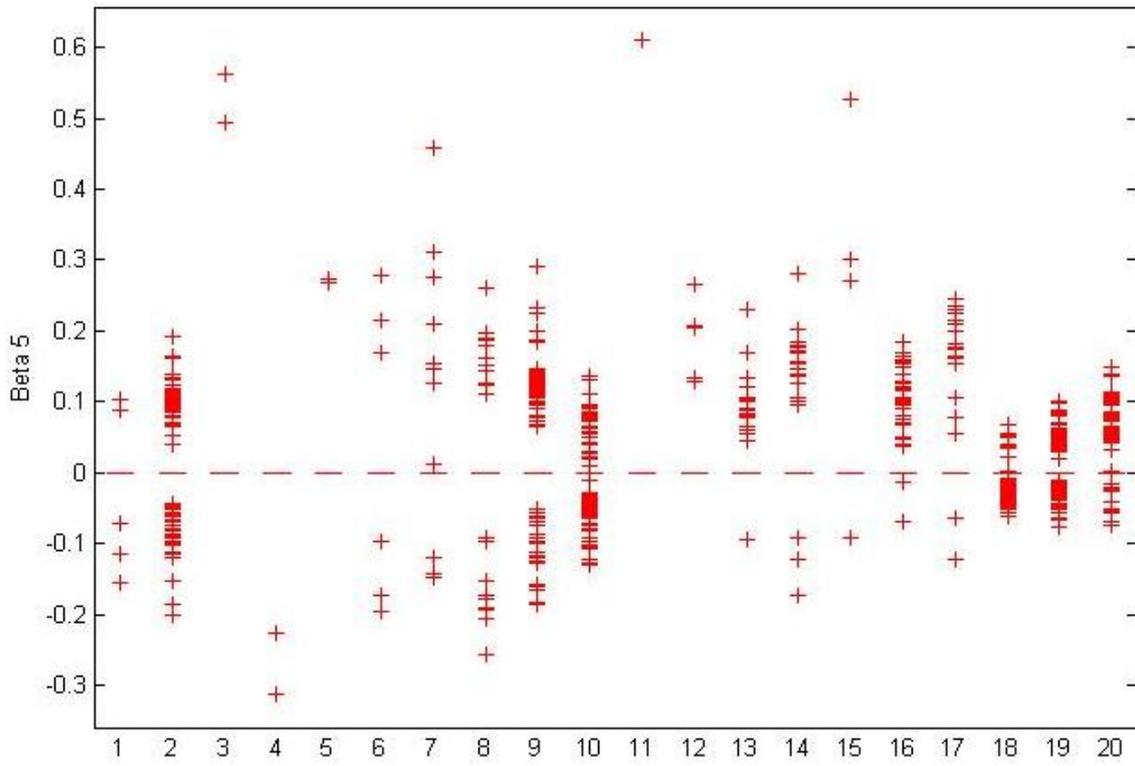
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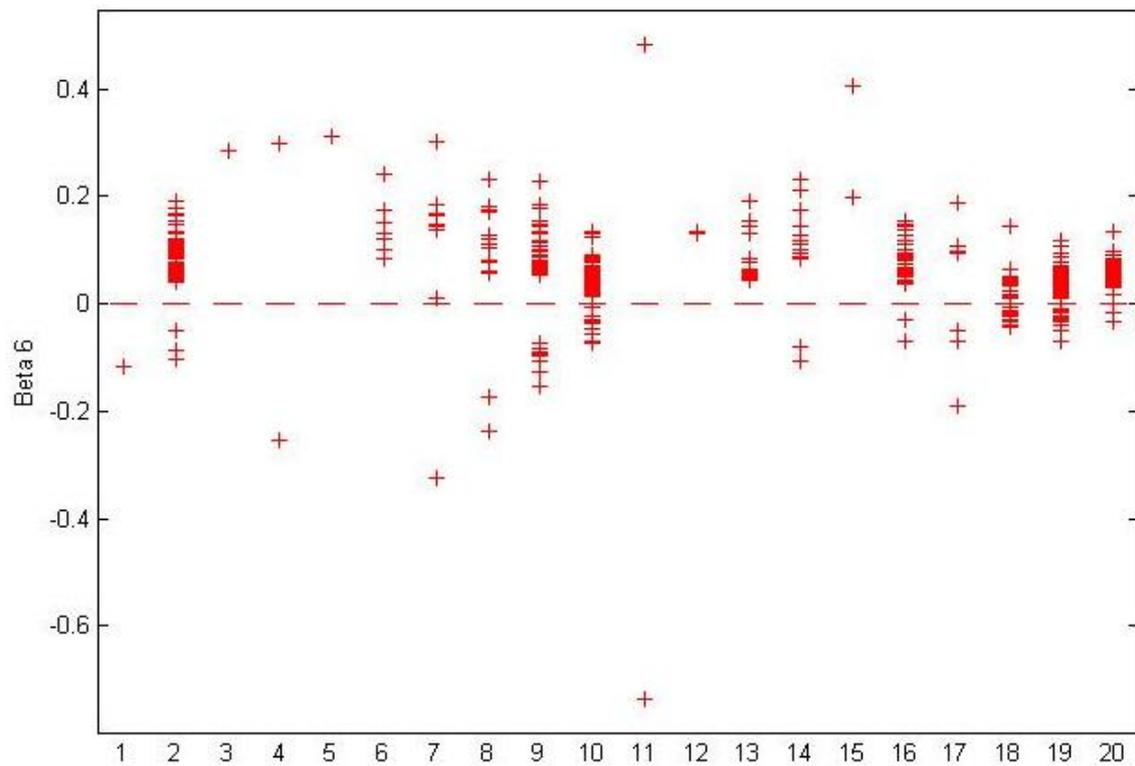
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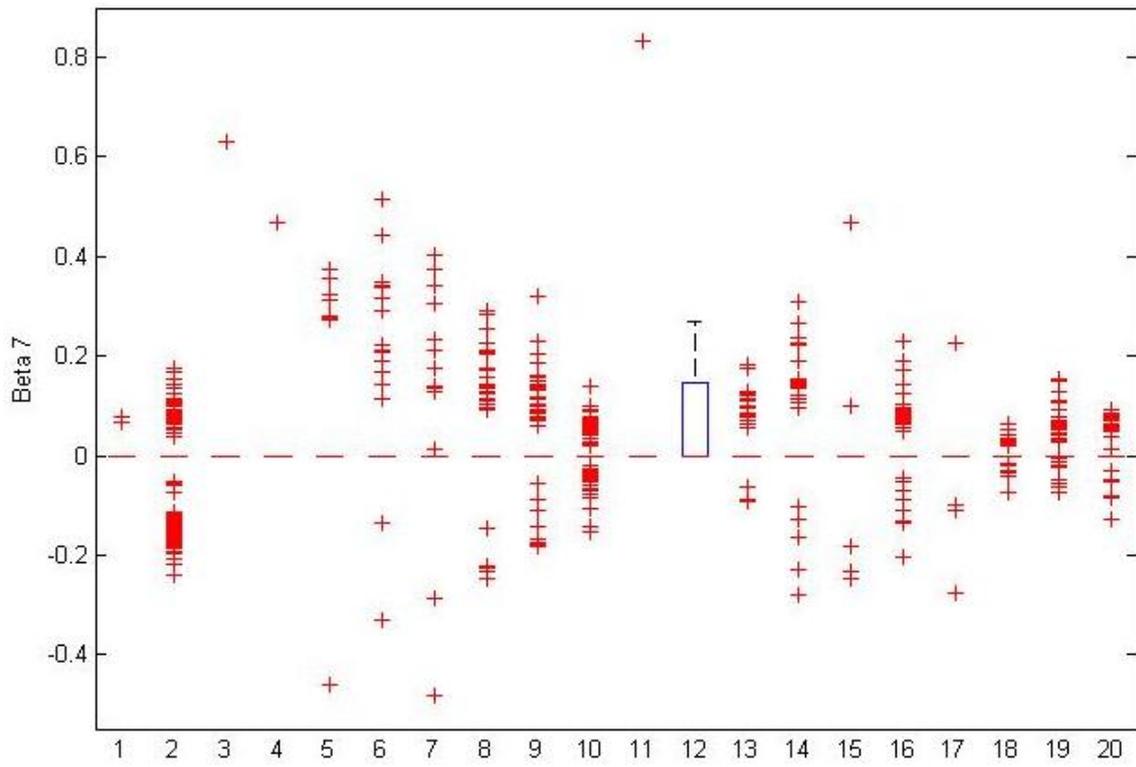
[Figure 39]



[Figure 40]



[Figure 41]



[Figure 42]