

# Asset allocation and investment strategies case study



## **Asset Allocation and Investment Strategies Case Study 3: The Quant Meltdown**

1.) a.) What are the types of strategies that were especially exposed to the Meltdown?

Andrew Ang <sup>[1]</sup> notes that there are two main approaches a hedge fund undertake to obtain alpha, they can either attempt to capture market trends (through directional trading) or attempt to obtain value from arbitrage opportunities (these are market neutral hedge funds). The latter tend to neutralise market movements and profit from securities that are misvalued relative to one another as pure arbitrage opportunities are rare and fleeting.

Hedge funds typically employ one of two styles to carry out either approach, discretionary and systematic styles. The former relies upon the managers' (or traders') judgement, whereas the latter relies upon financial analysis and econometric models. The quantitative funds that suffered tremendous losses during the 2007 Meltdown were all examples of funds that employed the systematic style. Ang <sup>[2]</sup> further notes that quantitative strategies themselves can be further subdivided into two categories. The first are high frequency statistical arbitrage funds that employ highly technical strategies, large volumes of securities and high frequency trades over a short time horizon (examples are D. E. Shaw and Renaissance and Technologies Corporation). The second are market neutral funds that rely on econometric models and lower frequency statistic forecasting models over longer time horizons. They also typically rely on factor based strategies (examples are AQR and Barclay's Global Investor).

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Both statistical arbitrage and market neutral funds employ leverage in an attempt to exploit information that managers believe is factored in the market price or to gain exposure to risk that managers believe will earn a premium. Quantitative funds had experienced a tremendous inflow of capital in the early 2000s (net cash inflow more than quadrupled between 2004 and 2007 from \$10 billion to \$40.7 billion <sup>[2]</sup>). During this time the number of quant funds also increased at an unprecedented rate. However, this meant that quantitative funds were hit harder than other types of hedge fund in terms of the magnitude of the losses that they suffered during the 2007 crisis.

Several types of strategy were especially exposed to the meltdown. One such strategy was the Long Short Strategy, in which a fund will take a long position in a stock that it believes, will increase in value in the future and simultaneously take a short position in a stock that it believes, will decline in value. There are several variations of the Long Short Strategy; Pairs Trading, Value and Momentum Strategies, Short Term Reversals and Contrarian Strategies. Contrarian strategies involve going long on past losers and shorting past winners. Other types of hedge fund strategy also experienced strong negative returns during the meltdown though they were not directly affected by it. Former options trader Nassim Nicholas Taleb <sup>[3]</sup> cites some examples of these in his book *The Black Swan: The Impact of the Highly Improbable*, chiefly the Merger Arbitrage Strategy, Relative Value Strategies and Distress Debt Strategies.

1.) b.) What are the main financial and economic events that preceded the Meltdown?

Between 7<sup>th</sup> and 9<sup>th</sup> August 2007, quantitative hedge funds experienced unprecedented losses (the so called "Quant Meltdown"), one contributing factor was the high positive correlation of holdings and similar (if not identical) strategies employed by said funds. However, another contributing factor was the precipitating collapse of other asset markets. The Quant Meltdown served to expose quant funds high level of exposure to systematic risk.

The main financial and economic events that predated the Meltdown were namely the collapse of the subprime mortgage market, the bursting of the housing market bubble, securitisation and the failure of the Repo market (or indeed of any short term collateralised lending market). All of these events were positively correlated with one another and led to the chain of events outlined below.

The roots of the financial crisis can ultimately be traced back to the US housing market. In 2005, Americans held on average 2.5 times more mortgages than they did in 1997 (GDP had only grown by 50% in this time period). Additionally, subprime mortgages now made up 22% of these mortgages compared with 8% in 2003. The US government was partially responsible for this having launched Ginnie Mae (in 1968), Fannie Mae (in 1938) and Freddie Mac (in 1970) in order to facilitate the flow of credit to low to moderate income mortgage borrowers (and therefore secure votes).

Concurrently, house prices were approaching record heights, indicating a

housing bubble which eventually burst triggering a collapse in subprime loans.

The adverse effects of the collapse of the subprime market were exacerbated by securitisation. Securitisation involved removing said subprime loans from banks' balance sheets through the creation of asset backed securities. These asset backed securities were typically divided into three tranches (senior, mezzanine and junior/equity). Equity tranches were typically the first tranche to suffer losses if the asset backed security was unable to raise enough cash from its underlying assets to pay all tranches (they had the highest probability of default of the three tranches though this was compensated for by a higher interest rate). Accordingly, equity tranches were extremely difficult to sell to investors and banks were usually forced to retain them on their balance sheets, resulting in a high concentration of toxic debt. After the housing bubble burst, many of these asset backed securities either defaulted outright or were significantly downgraded.

The collapse of the housing market also had negative repercussions on the Repo market as lenders in the Repo market were alarmed at the aforementioned events, creating a shortage of funding in the market. Lenders demanded higher haircuts (" the percentage difference between an asset's market value and the amount that can be used as collateral for a loan" <sup>[4]</sup> ) to account for the declining value of collateral that was put up. Borrowers in the Repo market were forced to either put up more collateral to compensate for this (often they were unable to do so) or to simply borrow less. Many hedge funds (who obtained leverage through Repo markets) were

forced to either deleverage from many of their positions or use their own capital instead.

2.) a.) Suggest an explanation for the events that occurred in August 2007. How can these events be reconciled with the idea that hedge funds can really generate a positive alpha?

Several hypotheses that enjoy considerable support amongst the academic community and the popular press have been proposed to explain the 7-9 August 2008 Quant Meltdown. Below is a summary of some of the explanations that have been put forward that we consider relevant.

### The Unwind Hypothesis

In their 2007 paper titled “ What Happened To The Quants In August 2007?”, Khandani and Lo <sup>[5]</sup> computed the average returns and Sharpe ratios for the Contrarian Strategy from 1995-2005 and reported that it had decreased dramatically (the average returns over all stocks declined from 1.38% to 0.13% whilst the Sharpe ratio declined from 53.87 to 2.79). Had other strategies employed by quantitative funds experienced similar declines in their respective returns and Sharpe Ratios, then to obtain the same level of expected returns, quant funds were required to employ considerable leverage. Sudhir Chhikara, head of quantitative strategies at Stark Investments observed that average leverage employed in the contrarian strategy had increased by a factor of at least 2 between August 2005 and August 2007 <sup>[2]</sup>. Chhikara also estimated that the gross leverage employed by quantitative funds ranged from 4 to 64 times <sup>[2]</sup>. However, increasing

leverage also made quantitative strategies more exposed to volatility risk and increased the liquidity risk. This particular form of liquidity risk, known as “funding liquidity risk”, that forced funds to use their own capital and potentially deleverage, is best exemplified by the Unwind Hypothesis chapter in Khandani and Lo’s paper <sup>[5]</sup>.

The Unwind Hypothesis <sup>[5]</sup> determines that initial losses in the Quant Meltdown can be ascribed to the liquidation of a single equity market neutral portfolio (a forced liquidation to obtain cash and increase liquidity). This forced liquidation triggered a price ripple effect (so called “unwinding behaviour”) that resulted in other quant funds experiencing losses of a similar magnitude. This in turn encouraged other quantitative funds to deleverage which triggered more price impacts leading to further losses and greater deleveraging in a downward spiral. The unwinding of large numbers of quantitative funds’ positions concurrently triggered substantial losses in August 2007.

### Commonality

It is generally accepted amongst the academic community that quantitative fund managers’ holdings were highly correlated with one another. Cliff Asness <sup>[6]</sup> notes in a letter to AQR investors in 2007 that fund managers employed similar strategies and portfolio construction methods. In which case, the strategies, which were based on the same historical data and similar technical signals, would have resulted in a large number of funds chasing the same investment opportunities, dramatically increasing the level of competition and simultaneously reducing returns. In addition, the level of

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competition was increased through the use of standardised factor risk models further reducing the number of prospective investments and leaving the exit window overcrowded when funds wished to exit their positions.

Ibbotson, Chen and Zhu note in their 2011 paper, “ The ABCs of Hedge Funds: Alphas, Betas & Costs” <sup>[7]</sup> that hedge funds retained a positive alpha from 1995 to 2009 even after accounting for so called dead funds. At the time of the paper, hedge funds still retained positive alpha albeit lower and less statistically significant. However, as with quantitative fund managers, hedge funds’ holdings were highly correlated with one another which would have triggered a liquidity spiral.

Hedge funds typically undertake strategies that yield low alpha most of the time but then experience considerable losses. Similarly, quantitative funds will achieve a small positive alpha for a long period of time, but will then incur significant losses. This belief is substantiated by the findings of Diez de los Rios and Rene Garcia <sup>[8]</sup> who observed negative skewness in the distribution of hedge fund returns and low adjusted R squared values obtained from attempts to regress hedge fund returns onto the Capital Asset Pricing Model (CAPM). Rene Stulz, <sup>[9]</sup> likens hedge funds to an insurance company that receives a steady stream of income in the majority of situations with no corresponding outflows, however in the event of a crisis it could experience heavy losses.

2.) b.) In the article published on the Journal of Finance in 2001, Mitchell and Pulvino highlight the difficulty to evaluate the performance of risk-arbitrage strategies (such as merger arbitrage) and argue that: “ risk-  
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arbitrage returns are positively correlated with market returns in severely depreciating markets but uncorrelated with market returns in flat and appreciating markets". What is the implication of their results for the statistical approach that a fund-of-fund should use to evaluate the performance of a hedge fund? Is it sensible to use the CAPM-based alpha to establish and rank the performance of different hedge funds?

A fund of funds hedge fund is a hedge fund that invests solely in other hedge funds. Investors of fund of funds not only have to pay a fee to the hedge fund that ultimately invests their capital, but also to the fund of funds that acts as a middle man. As a consequence, fund of funds investors will demand a larger and more statistically significant alpha to compensate for the higher fees that they incur.

As Diez de los Rios and Rene Garcia <sup>[8]</sup> noted, the negative skewness in the distribution of hedge fund returns, and the low adjusted R squared values obtained from regressing hedge fund returns onto the CAPM model imply that the CAPM is unsuitable to model hedge fund returns on. Further highlighting the CAPM's unsuitability is as per Mitchell and Pulvino's statement that a risk arbitrage strategy is difficult to properly evaluate as the returns from a strategy are positively correlated with market returns in a bear market but are uncorrelated elsewhere. Therefore when evaluating the performance of a hedge fund that carries out risk arbitrage, we should also consider this. There are no such terms in the CAPM. Therefore it should not be used to establish and rank the performance of different hedge funds. In addition Mitchell and Pulvino noted in their 2001 paper " Characteristics of

Risk and Return in Risk Arbitrage” <sup>[10]</sup> that the CAPM was only suitable if the returns were approximately linear.

Instead, an alternative risk factor model should be used to establish and rank the performance of hedge funds. One proposed model is the Seven Factor model developed by William Fung and David Hsieh <sup>[11]</sup> :

$$R_p = \alpha + \beta_1 R_M + \beta_2 \max(R_M - k_1, 0) + \beta_3 \max(R_M - k_2, 0) + \beta_4 \max(R_M - k_3, 0) + \varepsilon$$

Fung and Hsieh’s The Seven Factor Model is more complex than the standard CAPM and includes option strategies to evaluate performance <sup>[11]</sup> . They argued that the additional terms were better able to account for the tail risk (the tail risk is a form portfolio risk in which an investment shifts by at least 3 standard deviations from its current price) of a typical hedge fund than the CAPM <sup>[11]</sup> . The authors <sup>[11]</sup> also note that Seven Factor Model accounts for nonlinear and time varying characteristics such as the changes in correlation between risk arbitrage returns and market returns over time.

When evaluating the performance of a hedge fund we must also ensure that we eliminate any form of bias such as survivorship and size bias that may cause our alpha values to become statistically insignificant and lead us to draw misleading inferences.

2.) c.) August 2007 was not the only period when hedge funds suffered heavy losses. After Lehman’s default, many hedge funds reported large negative losses and were forced to close. In a second article, Mitchell and

Pulvino (2013) [see article in folder] highlighted the intrinsic fragility of the capital structure of a relative-value hedge funds. They say: “ The imminent failure of large Wall Street prime brokerage firms during the 2008 financial crisis caused a sudden and dramatic decrease in the amount of financial leverage afforded hedge funds. This decrease in financing resulted from the ex post asymmetrical payoff to rehypothecation lenders – the ultimate providers of financing, through prime brokers, to hedge funds. Seemingly long-term debt capital became short-term capital creating a large mismatch in the duration of arbitrage opportunities on the left-hand side of arbitrageurs’ balance sheet and liabilities on the right-hand side. A primary consequence of this withdrawal of financing was the inability of hedge funds involved in relative-value trades to maintain prices of substantially similar assets at substantially similar prices.” Explain the previous statement. Why mutual funds are not exposed to the same problem? What is the difference between hedge funds and mutual funds.

Mitchell and Pulvino’s statement highlights three issues that hedge funds faced during the 2008 financial crisis. Firstly, prime brokers had significant influence over hedge funds’ ability to employ leverage and could decrease it at any point in time without warning. This exposed an underlying vulnerability in the capital structure of a hedge fund as without sufficient funding a hedge fund is unable to operate. Secondly, the main source of funding for hedge funds ultimately came from rehypothecation lenders, who suffered heavily during the crisis. Thirdly, due to insufficient funding hedge funds were unable to partake in relative value trades during the crisis.

Mutual funds however, did not face these issues as they tend to raise capital from the open market as opposed to hedge funds that typically raise debt issued by a prime broker. Therefore mutual funds are not subject to the same counterparty risk that hedge funds are. Mutual funds also do not employ the same level of leverage that hedge funds do (they tend to be long only and tend not to invest in arbitrage opportunities). Furthermore mutual funds suffer constraints on the level of leverage that they can employ unlike hedge funds. Mutual funds also diversify their holdings to a much greater extent than hedge funds and are therefore less exposed to idiosyncratic risk, mutual funds trading strategies are also far less aggressive (though hedge funds are actually less volatile than mutual funds).

Additional differences between hedge funds and mutual funds are that mutual funds are defined as companies, more specifically as investment trusts, whilst hedge funds are defined as private partnerships. Mutual funds are subject to strict regulation (notably to protect investors) and must register with the appropriate government agency and issue periodic reports, however hedge funds are either under no such obligation and are subject to less stringent regulations.

## **References**

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