# How surprising are returns in 2008? A review of hedge fund risks

Melvyn Teo[1]

Abstract

Many investors, expecting absolute returns, were shocked by the dismal performance of various hedge fund investment strategies in 2008. In this issue of the statistical digest, I review the academic literature on hedge fund risks and conduct some simple analyses. I find that many hedge funds, even those without directional equity exposure, have payoffs that resemble those from writing put options on equity indices. A central theme is that their strategies all involve being short liquidity. Therefore, these hedge funds tend to underperform during liquidity crises, which coincide with extreme bear markets.

[1] Melvyn Teo is Associate Professor of Finance and Director, BNP Paribas Hedge Fund Centre at the Singapore Management University. I thank Qiu Yan for excellent research assistance and Narayan Naik for helpful comments and suggestions. All errors are mine. Address correspondence to Melvyn Teo, Lee Kong Chian School of Business, Singapore Management University, 50 Stamford Road, #04-01, Singapore 178899; telephone: +65-6828-0735; fax: +65-6828-0777; e-mail: melvynteo@smu.edu.sg

# I. Introduction

*"Three quarters of all hedge funds lost money in August [1998], and Long-Term did the worst of any of them. In one dreadful month, Meriwether's gang lost $1.9 billion or 45 percent of its capital..."*

*- When Genius Failed, Roger Lowenstein*

Hedge funds are often marketed as absolute return vehicles. Proponents of hedge funds argue that hedge funds shield investors from down markets and volatile conditions by hedging away market risks. Investors were thus sorely disappointed last year when many hedge funds failed to deliver positive returns. Consequently, these investors have started to redeem en masse from funds. According to several press reports,[2] hedge fund assets under management are expected to shrink dramatically and as many as 50 percent of hedge funds may perish due to insufficient funds. Some hedge funds have erected gates in an effort to stanch withdrawals and avoid asset fire sales. These events beg the question: Are hedge fund returns to be expected given the performance of the financial markets in 2008?

To address this question, I review the academic literature on hedge fund risks. I then analyze hedge fund exposure to the equity market using performance data from 1994 – 2007. The findings indicate that hedge funds vary significantly in their ability to weather economic downturns. Many hedge fund investment strategies either suffer from directional exposure to the equity market or deliver payoffs that resemble those from writing put options on equity indices. Only a few investment strategies appear truly insulated from severe market downturns. In light of these results, the underperformance of hedge funds in 2008 appears less surprising.

# II. Literature Review

Mitchell and Pulvino (2001) are among the first to study hedge fund risks by focusing on risk arbitrage or merger arbitrage. After the announcement of a merger or acquisition, the target

[2] See, for example, "Crisis on Wall Street: More Hedge Funds Expected to Succumb" *The Wall Street Journal*, 22 November 2008.

company typically trades at a discount relative to the offer price. The difference between the target's stock price and the offer price is known as the arbitrage spread. Merger arbitrage refers to an investment strategy that attempts to profit from this spread. If the merger is successful, the arbitrageur[3] captures the spread. However if the merger fails to go through, the arbitrageur incurs a loss that is usually much greater than the profits obtained if the deal succeeds.

To characterize the return and risk of merger arbitrage, Mitchell and Pulvino (2001) use a sample of 4,750 stock swap mergers, cash mergers, and cash tender offers during the 1963 – 1998 period. They replicate the returns from a merger arbitrage strategy by forming a portfolio that buys target firms in cash offers, and buys and sells target and acquirer firms, respectively, in stock mergers. They show that merger arbitrage returns are positively correlated with market returns in severely depreciating markets but uncorrelated with market returns in flat and appreciating markets. That is the market beta of merger arbitrage increases dramatically during market downturns. Hence, the returns to risk arbitrage are similar to those obtained from writing uncovered index put options. Nonetheless, they show that after accounting for the non-linear return profile and transactions costs, merger arbitrage generates excess returns of 4 percent per year. Their findings suggest that markets exhibit systematic inefficiencies in the pricing of firms involved in mergers and acquisitions.

The primary risk borne by risk arbitrageurs is that of deal failure. Typically when markets are flat or appreciating, the risk of deal failure is unrelated to market conditions. However Mitchell and Pulvino (2001) show that the probability of that a merger will fail is a decreasing function of market returns in the last two months. That is deals are more likely to fail following market downturns. They postulate therefore that risk arbitrageurs are paid a premium for providing liquidity, especially during severe economic downturns.

Independently, Fung and Hsieh (2001) use option like payoffs to model the risks of trend following hedge funds. Trend followers are typically commodity trading advisors (CTAs) who attempt to profit from trends in commodity prices using technical indicators. According to Fung and Hsieh (2001) trend followers are particularly interesting in that not only are their returns uncorrelated with the standard equity, bond, currency, and commodity indices, but

[3] Famous risk arbitrageurs include Ivan Boesky and Long-Term Capital Management.

their returns tend to exhibit option like features. They tend to be large and positive during the best and worst performing months of world equity indices.

They cite evidence by Fung and Hsieh (1997) who show that if one divided up the states of the world into five states based on the return on the MSCI equity world index, trend followers tend to outperform when the MSCI equity return is at its lowest and highest. The relationship between trend followers and the equity market is non-linear and U-shaped. Although returns of trend following funds have a low beta against equities on average, the state-dependent betas tend to be positive in up-markets and negative in down markets.

Fung and Hsieh (2001) therefore hypothesize that the simplest trend following strategy has the same payout as a structured option known as the "lookback straddle." The owner of a lookback call option has the right to buy the underlying asset at the lowest price over the life of the option. Similarly, a lookback put option allows the owner to sell at the highest price. The combination of these two options is the lookback straddle, which delivers the ex-post maximum payout of any trend following strategy. Fung and Hsieh (2001) then demonstrate empirically that lookback straddle returns resemble the returns of trend following hedge funds.

Building on this pioneering work, Fung and Hsieh (2004) propose seven factors that explain aggregate hedge fund returns. These seven factors include the excess return on the S&P 500 index, the Wilshire small cap minus large cap index return, the term spread, the credit spread, and trend following factors for bonds, currencies, and commodities. They show that their seven factor model well explains variation in aggregate hedge fund returns. In addition they find that equity long/short hedge funds tend to load positively on the S&P 500 index factor and the small cap minus large cap factor. These results are consistent with the observation that equity long/short hedge funds typically have a small positive exposure to stocks and tend to be long small stocks and short large stocks. Fung and Hsieh (2004) also find that fixed income funds on the other hand tend to load negatively on the change in the credit spread, where the credit spread is measured as the difference between the yield on Moody's Baa bonds and the yield on the 10-year constant maturity Treasury bond. The reason is that fixed income funds typically buy bonds with lower credit ratings and/or less liquidity and then

hedge the interest rate risk by shorting US Treasury bonds, which have the highest credit rating and are more liquid.

Separately, Agarwal and Naik (2004) also propose a multi-factor model to explain hedge fund risks. They find that non-linear option like payoffs are not restricted to trend followers and risk arbitrageurs, but are an integral feature of payoffs for a wide range of hedge fund strategies. In particular they observe that the payoffs on a large number of hedge fund strategies resemble those from writing a put option on the equity index. These strategies include risk arbitrage, distressed debt, convertible arbitrage, and relative value arbitrage. Consistent with the exposure of these strategies to the risks borne by sellers of equity index put options, Agarwal and Naik (2004) find that these hedge funds suffer from significant left tail risk which tends to coincide with severe market downturns.

# III Empirical Results

Motivated by the findings of the academic literature on hedge fund risks, I investigate the relationship between hedge fund investment strategy and equity market returns. I ask the question: How surprising are hedge fund returns in 2008 given the performance of the equity market last year?

As in Fung and Hsieh (1997), I divide the sample into five states based on the performance of the MSCI world equity index. Then, for each investment strategy, I plot the performance of each investment strategy over the five states.[4] For another look at hedge fund equity market exposure, I also graph a scatter plot of monthly strategy returns versus monthly MSCI world equity index returns. The goal is to test whether the pattern of returns established using past data is extrapolative and indicative of that in 2008. Hence, I focus on 1994 – 2007 returns, but also include 2008 (January – October) returns in the scatter plot for comparison.

[4] I use data from the union of Eurekahedge and HFR. The data sample extends from January 1994 to October 2008. It consists of 6220 live funds and 4997 dead funds with monthly return data. Duplicated share classes of the same fund have been removed. There are 3253 equity long/short funds, 446 multi-strategy funds, 1915 funds of funds, 72 merger arbitrage funds, 164 convertible arbitrage funds, 493 relative value funds, 724 CTAs, 1762 macro funds, and 48 short sellers in the sample.

Figures 1 – 3 illustrate the market exposure of equity long/short funds, multi-strategy funds, and fund of funds, respectively. Like Fung and Hsieh (2004), I find that equity long/short funds load positively on equity market risk. Figure 1A indicates that equity long/short funds outperform when global equity index returns are high and underperform when global equity index returns are low. The scatter plot in Figure 1B corroborates this view. It also suggests that the return pattern pre-2008 is indicative of that in 2008. It is likely that the losses suffered by equity long/short funds in 2008 are simply a by-product of their long standing exposure to the equity markets. Note that the market exposure of the equity long/short style is still significantly lower than that for the average mutual fund.

While the market exposure of equity long/short funds is not unexpected, it is probably surprising that multi-strategy funds and funds of funds also suffer from significant market exposure. See Figures 2 and 3. It must be that either funds of funds hold a preponderance of equity long/short funds and multi-strategy funds have significant exposure to equity long/short strategies, or other investment strategies also have non-trivial exposure to the equity market.

*Figure 1A. Long/Short Equity*

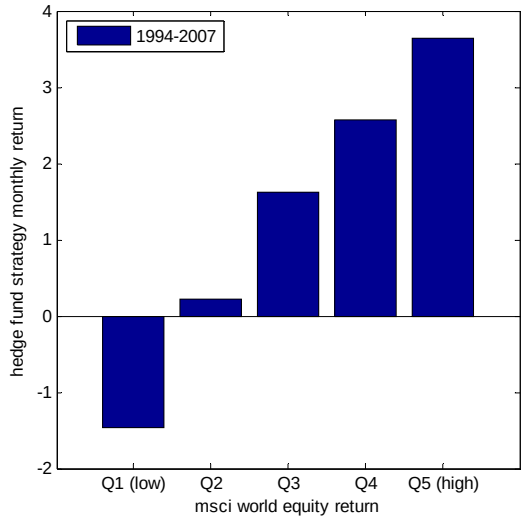



*Figure 1B. Long/Short Equity*

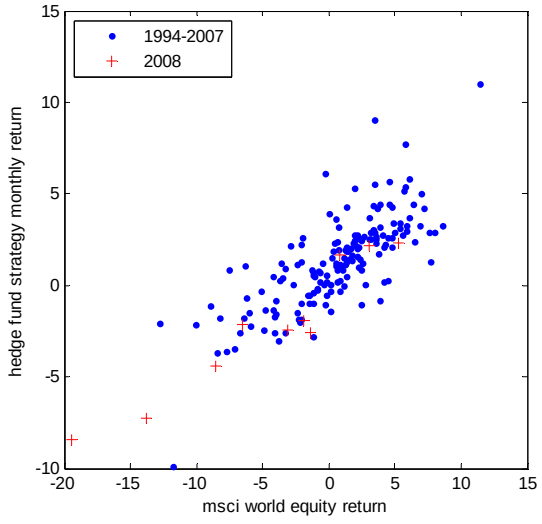


*Figure 2A. Multi-strategy*

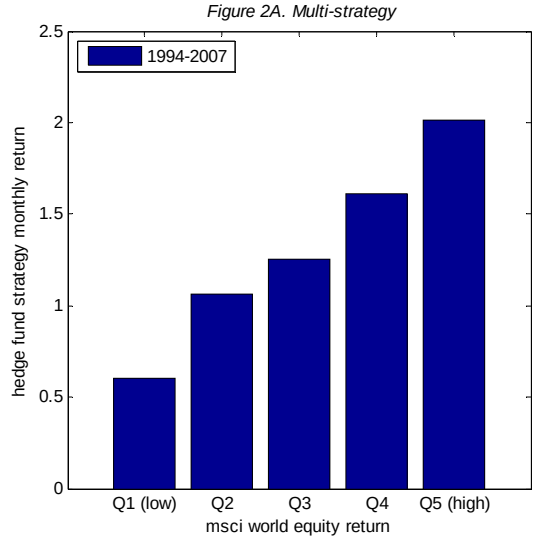



*Figure 2B. Multi-strategy*

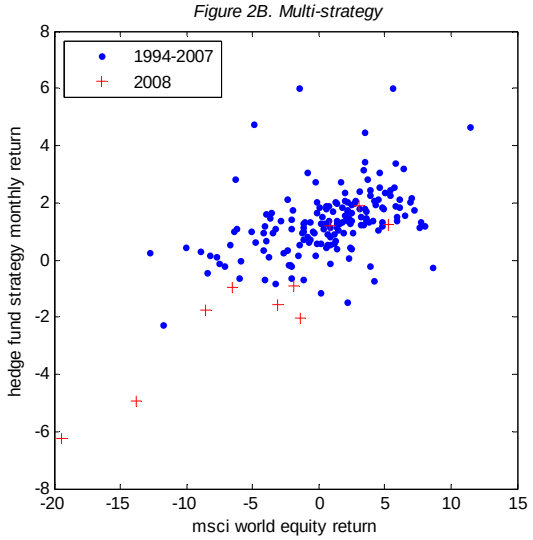



*Figure 3A. Fund of Funds*

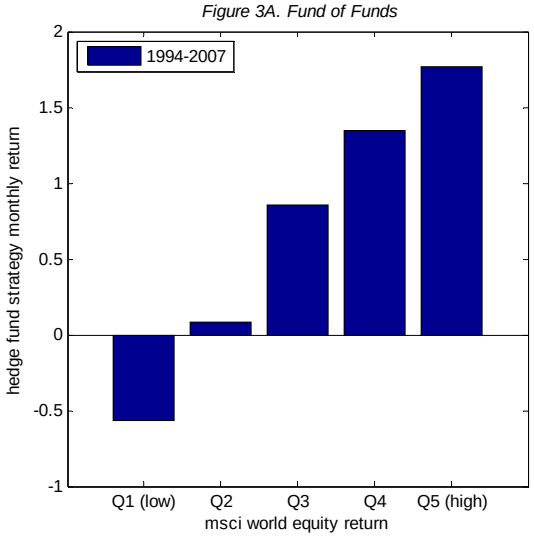
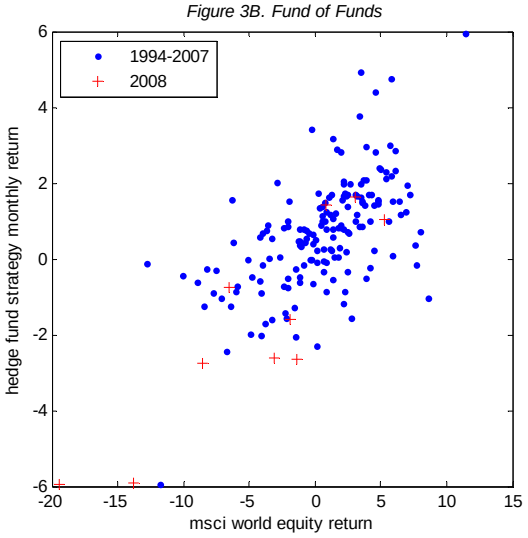



*Figure 3B. Fund of Funds*




The return patterns for merger arbitrage, convertible bond arbitrage, and relative value funds suggest that other hedge fund investment strategies are exposed to equity markets, but often in a non-linear way, as argued by Mitchell and Pulvino (2001) and Agarwal and Naik (2004). The scatter plot of points (1994 – 2007 data) in Figures 4B and 6B indicate that the payoffs for merger arbitrage[5] and relative value funds resemble those from writing a put option on the equity index.[6] The same return pattern holds for convertible bond arbitrage funds, after taking into account observations from 2008. We believe that the reason for the non-linearity is that

[5] I note from Figure 4B that October 2008 merger arbitrage returns have not been as disappointing as suggested by an option-based factor model. One view is that the massive consolidation that is occurring in the financial services industry has softened the effect of a bear market on deal risk.

[6] As it is dependent on the extreme return observations, the non-linear relationship between hedge fund strategy returns and equity returns is less evident from the bar graph.

these strategies all involve being short liquidity. For instance, merger arbitrage funds are often long small-capitalization, illiquid takeover targets and short large-capitalization, liquid acquirers. Likewise, convertible bond arbitrage often involves being long the less liquid convertible bond and being short the more liquid stock of a firm, so as to hedge against equity risk. Similarly, fixed income relative value plays typically involve being long riskier, less liquid bonds and being short safer, more liquid bonds. When there is a flight to quality, which tends to coincide with extreme downward price movements in the stock markets, spreads between risky and safe assets widen considerably and these strategies break down. A good example of this is the Russian ruble collapse of August 1998 which led to the demise of Long Term Capital Management (henceforth LTCM).

*Figure 4A. Merger arbitrage*

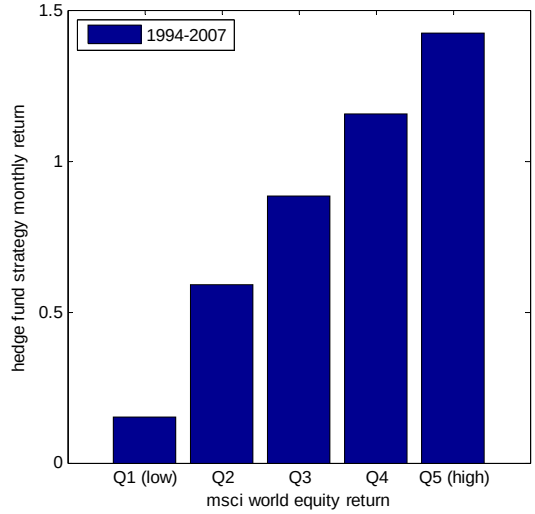



*Figure 4B. Merger arbitrage*

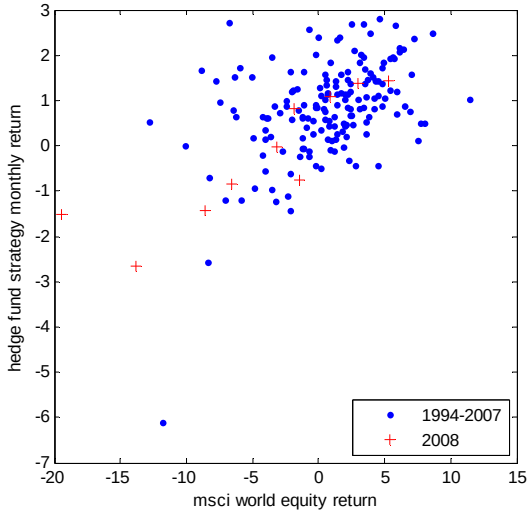



*Figure 5A. Convertible bond arbitrage*

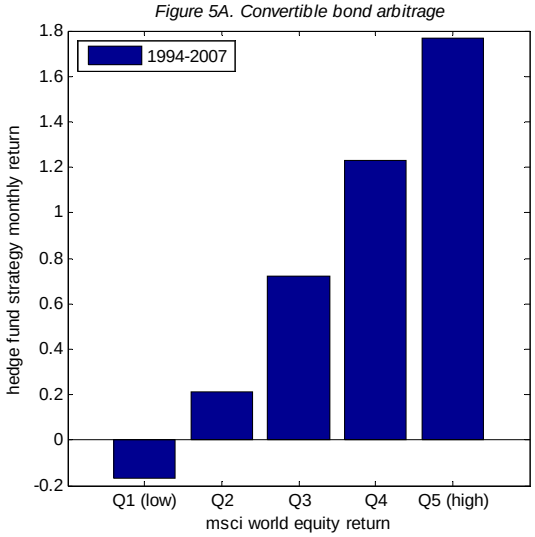



*Figure 5B. Convertible bond arbitrage*

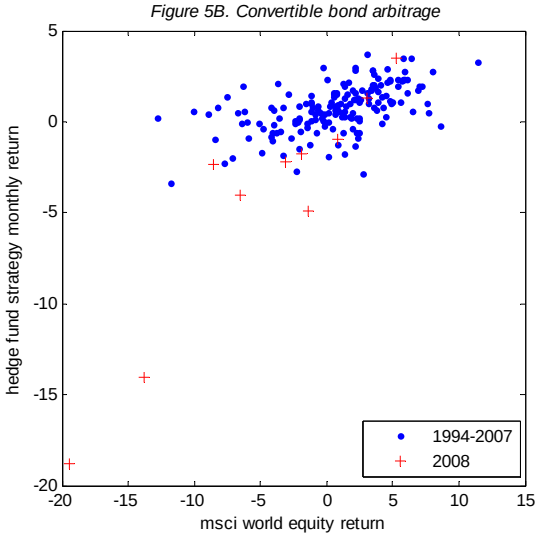


*Figure 6A. Relative value*

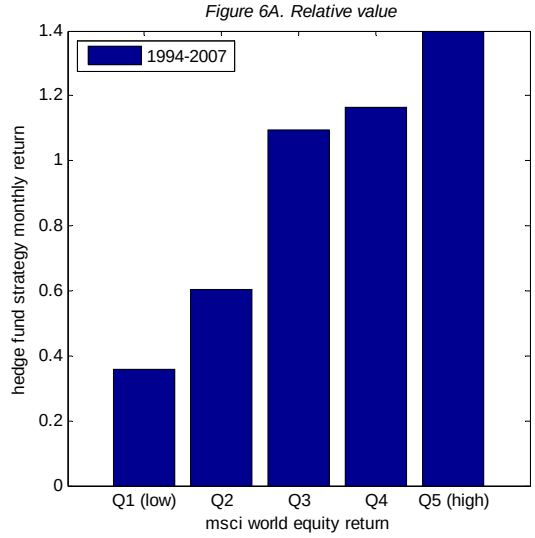
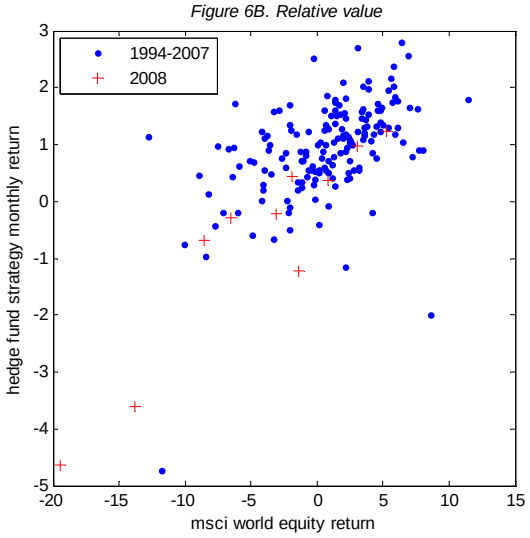



*Figure 6B. Relative value*




Not all hedge fund investment strategies suffer in bear markets however. When we redo the same analysis for CTAs, Macro funds, and Short Sellers, we find that consistent with Fung and Hsieh (1997), CTAs exhibit a U-shaped payoff structure relative to equity markets. They outperform when the MSCI world equity index delivers low returns (Q1). They also outperform when the MSCI world equity index delivers high returns (Q4 and Q5). It is not unexpected therefore that CTAs have provided investors some protection from the bear market in 2008. Short sellers also shine in down markets. It is comforting to note that, almost in direct contrast to equity long/short strategy, short selling delivers strong and negative exposure to the stock market. Macro funds however do not thrive during economic crises. This seems puzzling given that Macro funds are typically expected to outperform during volatile times. One possibility is that just like other hedge fund strategies, Macro funds are short liquidity. A classic example of a Macro play is the carry trade. It involves being long less liquid, high-yield currencies like the New Zealand Dollar and short more liquid, low-yield currencies like the Japanese yen. In a flight to quality, the carry trade unwinds swiftly as investors flee risky high-yield currencies for the safety of low-yield currencies.

*Figure 7A. CTA*

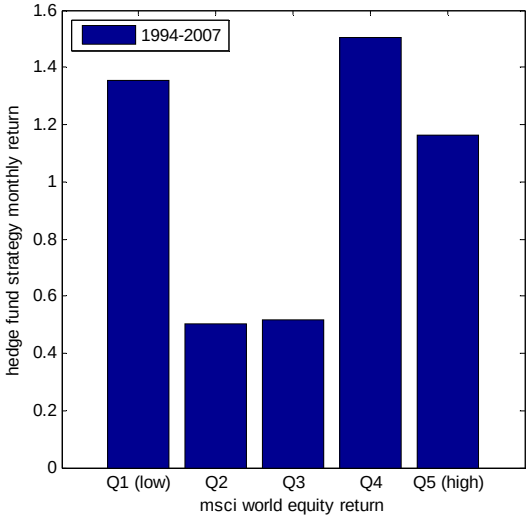



*Figure 7B. CTA*

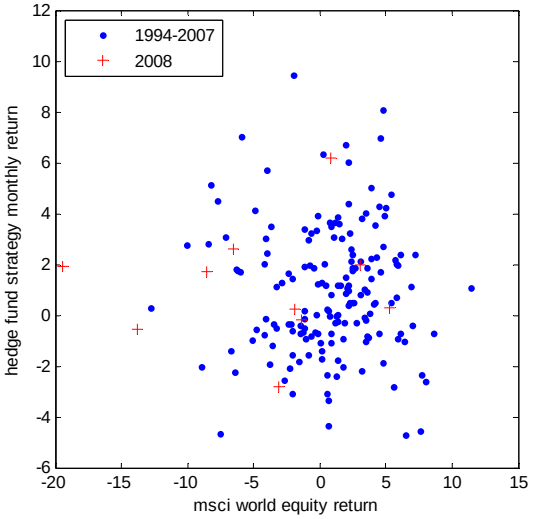



*Figure 8A. Macro*

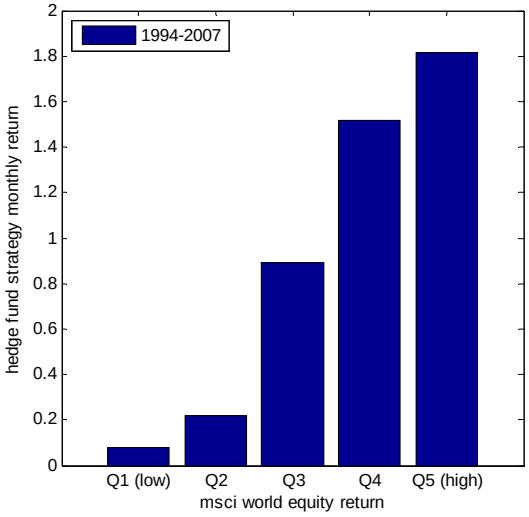



*Figure 8B. Macro*

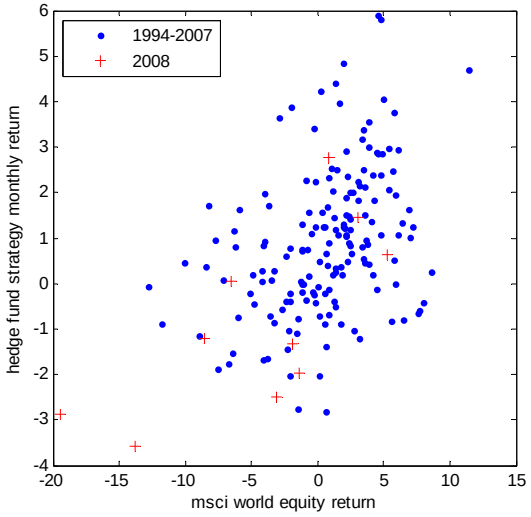



*Figure 9A. Short selling*

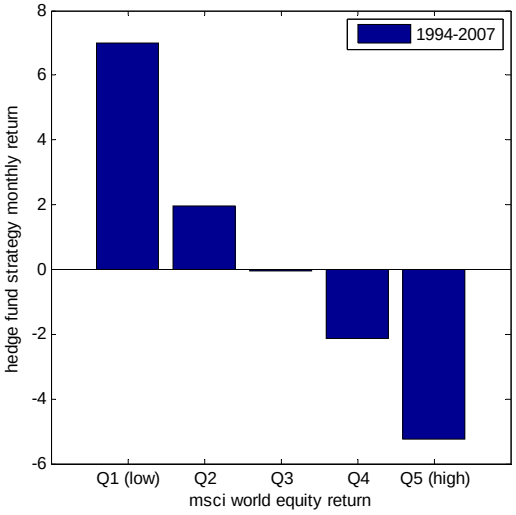
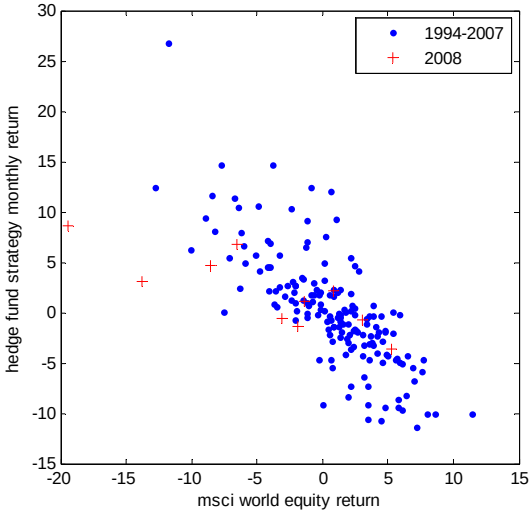



*Figure 9B. Short selling*



# IV Conclusion

The performance of the hedge fund industry in 2008 parallels that of LTCM in 1998, more than ten years ago. In the month of August 1998 alone LTCM lost 45% of its capital in the wake of the massive liquidity event triggered by the Russian ruble default. The much vaunted LTCM lost money everywhere – on its fixed income relative value spread trades, on its equity volatility trades, and on its risk arbitrage trades. Like most hedge funds today, LTCM was a supplier of liquidity in almost every one of its strategies. The academic literature has shown that a significant liquidity shock can cause different investment strategies operating in disjoint asset classes to underperform simultaneously. Unfortunately such shocks also coincide with hemorrhaging stock markets. Investors who wish to weather future financial maelstroms should take note of the non-linear relationship between hedge fund returns and the equity market.

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