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# Investigating the Persistence of Hedge Fund returns Over the period of 1998 to 2005

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## I. Introduction

Typically, Hedge funds are special investment vehicles that pool investors' capital together to generate high returns. Legally, hedge funds are most often set up as a private investment partnership that are open to a limited number of investors and require a very large initial minimum investment. Investments in hedge funds are illiquid as they often require investors to keep their money in the fund for at least one year. As a result of the requirements to invest in a hedge fund, they are not available to the average investor. Hedge funds are similar to mutual funds in that investments are pooled and professionally managed, but differ in that the fund has far more flexibility in its investment strategies. As a result, hedge funds are much less regulated than other investments such as mutual funds. The loose regulation of hedge funds allows the investment vehicle to use other tools to generate high returns for the investors.

These aggressively managed portfolios employ several different strategies in order to meet the end goal of reaching high returns. Hedge fund strategies have proven to show good returns, in addition to enhancing the risk return profile of a generic portfolio of traditional assets. These returns suggest that hedge funds do play a beneficial role within a traditional portfolio. Characteristics of hedge funds are that they usually create high returns in relation to other asset classes, provide a measure of downside protection in a period of volatility, and a general lack of correlation with equity and fixed income markets.

Examined on a granular level, the hedge fund industry consists of a variety of investment strategies and styles. These strategies typically move in and out favor depending on the current economic conditions, strategy specific factors, and the supply and demand conditions over time. The further enhancement of portfolio returns can be realized by an individual by choosing a hedge fund that uses the correct strategies during certain market conditions.

Identifying a hedge fund's strategy is an important process to determine if the fund is the right fit for the investor. Therefore, it is significant to understand the differences between the various hedge funds. The investment returns, volatility, and risk vary enormously among the different hedge fund strategies. Some strategies which are not correlated to equity markets are able to deliver consistent returns with extremely low risk of loss, while others may be as or more volatile than mutual funds. For example, a strategy that uses mostly fixed income instruments to produce returns will not be correlated with the equity markets. Another strategy that may not be correlated to equity markets is emerging markets, because of the lack of efficiency present in these markets. A successful investment can be achieved if one is able to identify the appropriate strategy for the risk return profile.

The persistence of a hedge fund strategy must be measured in order to determine which strategies can continually produce high returns over a period of time. It is important to measure the persistence of each strategy, because a strategy may be able to produce a substantial amount of return for one year, but due to the risky nature of hedge funds, the fund may produce a return that is not comparable for the following year. For example, a funds average return may beat the market for one period, but in the following period decline. Although the hedge fund and the strategy which is employed create wealth in the first period, it may be destroyed in the second. Being able to determine the persistence of a hedge fund's strategy will allow an individual to achieve the maximum amount of success in their investment. In conclusion, thirteen strategies will be tested for persistence to determine which strategies can continually create higher than average returns.

## II. Literature Review

Hedge funds are usually evaluated based on their historical performance. Good historical performance is almost always followed by a growth in assets under management. The idea that hedge funds typically create high returns year over year leads one to believe that hedge funds are also persistent (De Souza and Gokca 2004). De Souza and Gokca tested whether or not these hedge funds' returns, standard deviations, and Sharpe Ratios display any persistence.

The authors determined persistence of individual funds within their strategy by dividing the time frame into two sub-periods. The first sub-period extended from Jan 1997- December 1999, and the second sub-period extended from January 2000 to December 2002. To determine whether or not the fund displayed persistence, the authors calculated the average return, Sharpe Ratio, and standard deviation within in each period, for each fund within a strategy. A fund was labeled a winner or loser for a given period if the measure, whether it be Sharpe ratio, standard deviation, or mean returns were greater than the median of all funds in that strategy. Persistence exists if the fund is a winner in both the first sub-period and second sub-period, or a loser in both sub periods. After the fund is determined to be a winner or loser, the author's use a cross-product ratio that enables them to formally test the hypothesis. If the strategy produces a Z score above 1.96 it is significant. A Z-score of 1.96 is used because to determine if the strategy is significant, the authors use a 5% confidence level. In the case of this study, none of the funds were persistent in the Sharpe Ratio or measure of returns, only in volatility. De Souza and Gocka's work in developing a way to formally test a hypothesis on persistence is important because the same methods will be used in this paper.

Hedge funds today do not only perform according to how well the manager can manage his the equity within his portfolio. Hedge funds' returns also differ according to the different styles or strategies that the hedge funds use (Brown & Goetzmann 2001). After studying a large database of monthly returns of hedge fund strategies, Brown and Goetzmann 2001 are able to determine the effect of returns on different hedge fund strategies. By using a quantitative systematic approach, Brown and Goetzmann 2001 find that the differences in investment styles are the main contributor to volatility in performance. Furthermore, the differences in style account for significant differences in risk taking by fund managers. It is significant for investors to be able to choose the correct appropriate style and style management to make a successful investment in a hedge fund. This paper will not only identify the different styles and strategies of hedge fund's returns, but will

also determine if these strategies can continually produce substantial returns over a certain time period.

A second way of determine persistence was used by Edwards. Using a six factor alphas as a measure of performance, and analyzing persistence over one and two year horizons has found evidence of both winners and losers over time (Edwards 2001). Using metrics such as alphas have determined not only hedge funds can produce positive alphas, but managers who produce positive alphas, also are persistent (Edwards 2001). These findings have also been able to conclude that hedge funds that pay managers with higher incentive fees also have higher excess returns and are consistent with the view that fund manager skill may be a partial explanation for the positive excess returns (Edwards 2001). It is important to note whether it is the hedge fund managers producing the returns or the strategies they use. By analyzing the data of returns year over year, I will be able to determine if strategies can not only create excess returns, but also persistence.

Hedge funds are considered skill-based investment strategies, primarily because many hedge fund managers do not explicitly attempt to track a particular index (Gupta 2003). The ability to use these strategies gives managers greater flexibility in following a trading style and the execution of that style, this offers a greater probability of obtaining returns due to their unique skills or strategies. When evaluating hedge funds it is important to consider their absolute returns, rather than their return to a benchmark (Gupta 2003). It is important to realize however, that the fact hedge funds do not emphasize benchmark tracking does not mean that the return from a hedge fund is based solely on manager skill. Hedge fund managers who manage a particular investment strategy can track that investment strategy or risk return opportunity (Gupta 2003). Studies have shown that the returns to certain hedge fund strategies are driven largely by

market factors, such as changes in credit spreads or market volatility (Fung and Hsieh 1997). Because it is not ideal to relate hedge fund returns to a bench mark, it is appropriate to evaluate hedge fund strategies and compare each strategy to one another. It is ideal to use the returns of different strategies as a measure of whether or not a strategy is successful, or persistent.

Although, testing done by De Souza et al. 2004 determines that persistence does not exist within individual funds Agarwarl and Naik uses a multi-period framework to determine if persistence exists. Unlike the existing literature, Agarwarl et al, examines the degrees of persistence at different return horizons, an issue that has been investigated to some extent by mutual funds literature (Agarwarl et al). Their findings acknowledge the existence of persistence at the quarterly, but not at the annual return horizon among hedge funds. It is well known that different hedge fund strategies involve significantly different risk-return tradeoffs. Therefore, it may not be prudent to compare the performance of a hedge fund manager following a given strategy with another manager following a different (Agarwal et al 2000). As a result, Agarwal and Naik examine persistence among the strategies in this paper using both parametric and non parametric tests. Unlike De Souza et al 2004, Agarwal et al. determined that there was a degree of persistence within strategies for short periods of times, but there was no difference between directional and non-directional funds strategies. Similar to Agarwal et al. work, this paper investigates the persistence of the different strategies returns, but for a longer period of time using semi-annual returns of each year from 1998- 2005 as a basis for conducting testing.

Examining how strategies returns differ will enable investors to understand how volatile and correlated different strategies are to each other. It is well documented that the correlation of hedge fund indices to equity market direction has increased over the past four years (Ludvigsen 2007). This is not surprising, given the flexible mandates of many managers. Most managers

allow themselves the freedom to increase net long exposure during a bull market and to decrease it in a bear phase. Since March 2003 many managers of equity-linked strategies have increased net long exposure. Some have skill in identifying trends and have positioned accordingly; others have simply learned that it is easier to make money from the long side and have thrown in the towel on maintaining a significant short book (Ludvigsen 2007). Over the past three years the correlation has averaged 0.71. As a result, funds of funds are not benefiting from strategy diversification. The investigation, of which strategies are persistent in creating positive returns, will enable the investor to enhance their portfolio. By looking at persistence, over a several year period one will be able to assess what strategies will be able to continually outperform the market, and will not be correlated to the modest returns of other benchmarks.

There has been a substantial amount of literature on the returns of hedge funds and the positive returns of alpha among strategies. It has been proven that over a period from 1995 to 2004 alpha's have significantly been decreasing (Naik et al 2007). Naik et al, have identified that four out of eight strategies alpha's have declined within the decade of 1995- 2004. Although this paper will not consider the persistence of alpha, the returns of each strategy will be considered from 1998-2005, to determine which strategies are superior to the others.

As discussed in previous literature, currently available indices or benchmarks that rely on manager and peer group averages do not necessarily provide a sufficiently accurate picture of the industry or strategy sector performance due to various well-known biases ( Lars 2005). At the same time, the demand and necessity of hedge fund indices for the purpose of measuring manager performance, classifying investment styles, and generally creating a higher degree of transparency is high and increasing. The increasing demand to understand how hedge funds produce high returns is a result of whether it is the manager or the strategy used, or both. In

previous literature (De Souza et al), it has been shown that managers' returns vary greatly within the same strategies. Analyzing the strategies of hedge funds will produce a result that can create more transparency among hedge funds in determining how these investment vehicles are able to produce high returns.

Investigating the varying returns and persistence of several different strategies within hedge funds is significant for investors because by choosing the hedge funds with the correct strategies one will be able to a superior funds of funds portfolio. It is possible to construct portfolios of Non-Directional and Directional hedge funds that outperform the best Fund of Funds in the HFR database, in terms of Sharpe Ratio (Gregoriou et al. 2007). Furthermore, this serves as evidence that choosing a strategy that demonstrates persistence may also be able to accomplish this.

Many different literatures have discussed whether or not hedge fund strategies are persistent or deliver excess returns. It has been proven that during both bull and bear markets hedge fund persistence exists mostly among medium performers (Capocci 2005). Because persistency has been demonstrated among different hedge funds and different hedge fund managers, it is important to determine which strategies will also demonstrate persistency. This paper will investigate which strategies demonstrate persistence from 1998- 2005.

### III. Hypothesis

There has been a great amount of research done on the persistence of hedge fund strategies. Although it appears that most strategies are successful in generating high returns over the past years, it is important to assess if these same funds continually produce high returns. This

paper tests whether or not hedge funds demonstrate persistence. If so, do different strategies demonstrate persistence, while others do not?

#### IV. Data Analysis

The data is taken from University at Albany School of Business, which was provided by the CIIM. The database provided 2,050 hedge funds with monthly data available from 1998 to 2005. Since hedge funds follow a variety of strategies, it is customary to classify the hedge funds in a number of categories, depending on the main strategy followed (Kat and Menexe 2003). In line with the CIIM database hedge funds strategies are classified into categories of Equity Long/Short, convertible arbitrage, distressed securities, emerging markets, event driven multi-strategy, fixed income, fixed income mortgage backed securities, fixed income arbitrage, global macro, merger arbitrage, relative value multi-strategy, equity long only, and equity market neutral.

The data shows that the mean returns of each individual strategy with the exception of Merger Arbitrage produce a high return. This serves as evidence that the hedge fund strategies that are used produce a substantial amount of return over the time period from 1998- 2005. Table one below ranks the annualized mean returns of each strategy from one to thirteen, during the period 1998 to 2005. Table 1 demonstrates that the highest average annualized return of a strategy is equity long strategy, with a return of 22%, while merger arbitrage was the worst strategy with a negative 14 percent mean return. The annualized mean returns of these strategies are consistent with annualized mean returns demonstrated in previous literature.

### Annualized Mean Returns of strategies from 1998-2005

| Rank | Strategy                      | Mean  |
|------|-------------------------------|-------|
| 1    | Equity Long Only              | 0.22  |
| 2    | Distressed Securities         | 0.20  |
| 3    | Event Driven Multi Strategy   | 0.20  |
| 4    | Fixed Income                  | 0.19  |
| 5    | Equity Long/Short             | 0.19  |
| 6    | Emerging Markets              | 0.18  |
| 7    | Relative Value Multi Strategy | 0.17  |
| 8    | Convertible Arbitrage         | 0.16  |
| 9    | Fixed Income - MBS            | 0.16  |
| 10   | Equity market Neutral         | 0.15  |
| 11   | Fixed Income - Arbitrage      | 0.14  |
| 12   | Global macro                  | 0.11  |
| 13   | Merger Arbitrage              | -0.14 |

**(Table 1)**

The mean returns for each strategy is a good measure of how well each strategy performs, but it does not take into account any risk associated with the strategy. Therefore, the Sharpe Ratio was used to determine which strategies produce the best risk adjusted returns. The Sharpe Ratio is an important factor to discuss because it will enable the investor to choose a strategy appropriate to their risk appetite. The Sharpe Ratio of each strategy's returns is generated by calculating the difference between each strategy's mean annualized returns and the risk free rate of 3.11%, divided by the annualized standard deviation of each strategy. The risk free rate is based on the 30- year treasury yield rate for December 5, 2008. Table two ranks the annualized Sharpe Ratio for the entire strategy from one to thirteen. The Relative Value Multi Strategy produces the highest risk adjusted returns, generating 22%. While merger arbitrage, displays a

negative 25% return. The Shape Ratios of the strategies are also consistent with previous literature, that hedge funds are able to produce high risk-adjusted returns. The risk adjusted returns demonstrate that although some returns in Table 1 are greater than their peers, this is not the case when the Sharpe Ratio is applied. The equity long strategy drops from the top position to the number 8 position because of an 8 percent decrease. In addition, emerging market's returns decrease by 8 percent, demonstrating that the strategy is very risky and volatile. This is significant because it demonstrates that emerging markets, although able to generate high returns in some years, it is a very risky strategy that could also produce negative returns. When returns are adjusted for risk, the returns can differ according to Table 2. Therefore, it is imperative that each fund be evaluated on persistence, rather than the Sharpe Ratio and mean returns alone.

**Annualized Sharpe Ratio of strategies from 1998-2005**

| Rank | Strategy                      | Sharpe Ratio |
|------|-------------------------------|--------------|
| 1    | Relative Value Multi Strategy | 0.22         |
| 2    | Fixed Income - MBS            | 0.17         |
| 3    | Event Driven Multi Strategy   | 0.17         |
| 4    | Equity market Neutral         | 0.16         |
| 5    | Distressed Securities         | 0.16         |
| 6    | Fixed Income                  | 0.15         |
| 7    | Convertible Arbitrage         | 0.14         |
| 8    | Equity Long Only              | 0.14         |
| 9    | Equity Long/Short             | 0.13         |
| 10   | Fixed Income - Arbitrage      | 0.12         |
| 11   | Emerging Markets              | 0.10         |
| 12   | Global macro                  | 0.07         |
| 13   | Merger Arbitrage              | -0.25        |

( Table 2)

## V. Empirical Testing

To test for persistence, all strategies mean monthly returns and annualized Sharpe Ratios were calculated. To determine which hedge fund strategies demonstrate persistence, eight years

of data were sorted into two equal sub-periods. The first sub-period is from January 31, 1998 to December 31 2001, while the second period is from January 31 2002 to December 31, 2005.

The first test used to determine if persistence exists among hedge funds during this time period was to use the mean returns of each individual fund. In each sub-period the mean return was calculated for each fund, both sub-period one and sub-period two. Once the mean return was calculated for each fund in both sub-period one and sub-period two, the median value for all mean returns for that sub-period was generated. To evaluate the persistence of funds it is essential to calculate the median value for all funds, because if a fund's mean is higher or lower than the median of all funds in the strategy, it will be labeled either a winner or loser. If a fund is determined to be a winner in the first sub-period, the notation W1 is used. If the fund is a loser in the first sub-period, the notation L1 is used. This notation is also used for the evaluation of winners and losers in the second sub-period; where W2 represents a winner in sub-period 2, and L2 represents a loser in sub-period two.

The number of winners and losers in each period is calculated to determine the persistence of each strategy's mean returns. Persistence is present when a fund is deemed a winner in both sub-periods and a loser in both sub-periods. To formally test the persistence of each strategy a cross product ratio is used. Two time winners are denoted as W1W2 and two time losers as L1L2, while mixed results are labeled W1L2 and L1W2. The CPR is calculated as  $CPR = \frac{W1W2 * L1L2}{W1L2 * L1W2}$ . This ratio shows the number of funds that are persistent compared to those that are not. When a strategy's CPR equals 1, the null hypothesis of no persistence exists (Kat and Menexe 2003). The significance of the CPR is then tested using Z-Scores. The Z-Score is calculated by taking the natural log of the CPR divided by the standard error. The standard error equals the square root of  $(1/W1) + (1/L2) + (1/W2) + (1/L1)$ . If the Z-

Score is above 1.96, the CPR is considered significant. The Z-Score of 1.96 is used because it represents a 5% confidence level where the null hypothesis of no persistence is rejected.

Table three displays the persistence of thirteen strategies using the mean returns from the period of 1998-2005, using the cross product ratio and Z-Scores. W1W2 represents the number of funds within each strategy that is a winner in both sub-periods. L1L2 demonstrates funds within each strategy that are losers in both sub-periods, while W1L2 and L1W2 represent mixed results. To calculate CPR, the values for each strategy within the column of W1W2 are multiplied by the values of the L1L2 column. The product of the values in columns W1W2 and L1L2 is then divided by the product of the values in the mixed results columns, W1L2, L1W2 (Table 3).

#### **Persistence of Mean Returns using CPR and Z Scores**

| Mean Returns                  |      |      |      |      |      |         |
|-------------------------------|------|------|------|------|------|---------|
| Strategy                      | W1W2 | W1L2 | L1W2 | L1L2 | CPR  | Z Score |
| Equity Long/Short             | 121  | 197  | 79   | 164  | 1.28 | 2.69    |
| Convertible Arbitrage         | 8    | 14   | 15   | 10   | 0.86 | -0.53   |
| Distressed Securities         | 15   | 15   | 4    | 10   | 2.50 | 2.89    |
| Emerging Markets              | 45   | 45   | 16   | 27   | 1.69 | 2.82    |
| Event Driven Multi-Strategy   | 20   | 20   | 16   | 22   | 1.38 | 1.14    |
| Fixed Income                  | 7    | 7    | 3    | 8    | 2.67 | 2.29    |
| Fixed Income- MBS             | 9    | 12   | 17   | 18   | 0.79 | -0.61   |
| Fixed Income Arbitrage        | 21   | 17   | 6    | 11   | 2.26 | 2.83    |
| Global Macro                  | 44   | 5    | 17   | 6    | 3.11 | 5.73    |
| Merger Arbitrage              | 25   | 12   | 25   | 12   | 1    | 0.00    |
| Relative Value Multi Strategy | 8    | 11   | 6    | 11   | 1.33 | 0.73    |
| Equity Long Only              | 4    | 7    | 3    | 6    | 1.14 | 1.09    |
| Equity Market Neutral         | 27   | 28   | 18   | 28   | 1.50 | 1.75    |

( Table 3 )

Contrary to previous literature, persistence in mean returns is demonstrated in six out of the thirteen strategies. In Table 3, persistence exists in the equity long/short strategy, distressed securities, emerging markets, fixed income, fixed income arbitrage, and the global macro strategies. Strategies that exhibit

persistence are highlighted in blue, while strategies that represent the null hypothesis of no persistence are highlighted in yellow. In the equity long/short strategy, a total of 561 funds with data from 1998- 2005 were tested to determine persistence. The Equity Long/Short strategy displays persistence because a CPR of 1.28 and significant Z-Score of 2.69. A CPR of 1.28 is well above 1 which rejects the null hypothesis of no persistence. Also, with a Z-Score greater than 1.96 the results are considered significant at the 5% confidence level. Persistence was tested on funds in the distressed securities strategy. The distressed securities strategy also displays persistence with a CPR of 2.5 and a significant Z-Score of 2.89. The emerging markets strategy persistence is tested on 184 funds, persistence is present with a CPR of 1.69 and significant Z-Score of 2.82. The fixed income strategy persistence was tested on 26 funds, this data produced persistence with a CPR of 2.67 and a Z-Score of 2.29. A total of 56 funds were tested in the fixed income arbitrage strategy, the CPR 2.26 of and Z-Score of 2.83 demonstrate persistence. The global macro strategy demonstrates persistence with a CPR of 3.11 and Z-Score of 5.73, a total of 70 funds were tested in this strategy. The demonstration of persistence in these strategies show that depending on the strategy, a fund manager may or may not be able to continually produce high returns.

It is also essential to determine if risk adjusted returns for hedge funds demonstrate persistence. To test the hypothesis if persistence exists for risk-adjusted returns the Sharpe Ratio is used. To determine if persistence exists among hedge funds the Sharpe Ratio is calculated in each sub-period. The Sharpe Ratio is calculated by taking the difference of each funds annualized mean return within a strategy and dividing by the risk free rate of 3.11%. Once the Sharpe Ratio was calculated for each fund in both sub-period one and sub-period two, the median value for all Sharpe Ratios for that sub-period was generated. If the fund's Sharpe Ratio is higher than the median it is labeled as a winner, if it is less, it is labeled as a loser. If a fund is a winner in the first sub-period, the notation W1 is used, if the fund is a loser in the first sub-period the notation L1 is used. This notation is also used for the evaluation of winners and losers in the second sub-

period; where W2 represents a winner in sub-period 2, and L2 represents a loser in sub-period two.

Table four displays the persistence of each hedge fund strategy's Sharpe Ratio during the period from 1998-2005, using the cross product ratio and Z-Scores. W1W2 represents the number of funds within each strategy that are winners in both sub-periods. L1L2 demonstrates funds within each strategy that are losers in both sub-periods, while W1L2 and L1W2 represents mixed results. To calculate CPR, the values for each strategy within the column of W1W2 are multiplied by the values of the L1L2 column. The product of the values in columns W1W2 and L1L2 is then divided by the product of the values in the mixed results columns, W1L2, L1W2 (Table 4). Also, to ensure a valid comparison between both Table 3 and Table 4, the same amount of funds were used in the calculation within each strategy.

#### **The Persistence of Hedge Fund Strategies Measured by Sharpe Ratio**

| Sharpe Ratio Returns          |      |      |      |      |      |         |
|-------------------------------|------|------|------|------|------|---------|
| Strategy                      | W1W2 | W1L2 | L1W2 | L1L2 | CPR  | Z Score |
| Equity Long/Short             | 177  | 192  | 95   | 171  | 1.66 | 5.68    |
| Convertible Arbitrage         | 35   | 21   | 14   | 24   | 2.86 | 4.31    |
| Distressed Securities         | 17   | 15   | 3    | 8    | 3.02 | 3.49    |
| Emerging Markets              | 40   | 52   | 40   | 52   | 1.00 | 0.00    |
| Event Driven Multi-Strategy   | 19   | 19   | 14   | 24   | 1.71 | 1.92    |
| Fixed Income                  | 5    | 10   | 4    | 7    | 0.88 | -0.31   |
| Fixed Income- MBS             | 8    | 12   | 9    | 9    | 0.67 | -1.01   |
| Fixed Income Arbitrage        | 18   | 19   | 9    | 10   | 1.05 | 0.18    |
| Global Macro                  | 26   | 21   | 9    | 14   | 1.93 | 2.59    |
| Merger Arbitrage              | 22   | 17   | 9    | 21   | 3.02 | 3.70    |
| Relative Value Multi Strategy | 7    | 12   | 6    | 11   | 1.1  | 0.2     |
| Equity Long Only              | 5    | 7    | 1    | 7    | 5.0  | 3.9     |
| Equity Market Neutral         | 20   | 34   | 22   | 23   | 0.61 | -2.08   |

**(Table 4)**

Table 4 demonstrates that persistence also exists in hedge funds when the Sharpe Ratio is used. Six out of thirteen strategies demonstrate persistence, which are labeled in blue. These strategies include equity long/short, convertible arbitrage, distressed securities, global macro,

merger arbitrage, and equity long only. The equity long/short strategy demonstrates persistence in both mean returns (Table 3) and in Sharpe Ratio (Table 4). The equity long/short demonstrates persistence once again with a CPR of 1.66, and a Z-Score of 5.6. The strategy demonstrates even more persistence in Sharpe Ratio (Table 4) than in mean returns (Table 3). When convertible arbitrage strategy is tested for persistence, the null hypothesis is also rejected because the CPR is 2.86, while the Z-Score is 4.31. It is an interesting observation that when the Sharpe Ratio is used persistence is present (Table 4), while using the mean returns of convertible arbitrage (Table 3) does not demonstrate persistence. Distressed securities demonstrate persistence when tested using the Sharpe Ratio. Table 4 displays a CPR of 3.02 for the distressed security strategy, and a Z-Score of 3.49. When the global macro strategy is tested for persistence using the Sharpe Ratio the null hypothesis is rejected again. Although the null hypothesis is rejected again, the CPR is 1.93 and Z-Score is 2.59, less than the findings in Table 3. Another strategy that demonstrates persistence using the Sharpe Ratio is merger arbitrage. A noticeable change when this strategy is adjusted for risk is that there is a significantly lower amount of mixed results in column L1W2 of Table 4, than in column L1W2 of Table 3. This generates a CPR of 3.02, and a significant Z-Score of 3.7. The results of the equity long only strategy (Table 4) show a significant change in CPR when using Sharpe Ratio, when compared to Table 3. The CPR is 5.0 for the equity long strategy (Table 4), while the Z-Score is 3.9. The CPR of this strategy is persistent when the returns are adjusted for risk. In conclusion, formally testing the persistence of Sharpe Ratios using the CPR, serves as evidence that hedge funds can continually generate good returns over a period of time.

## VI. Conclusions

After formally testing the persistence of several hedge fund strategies the results prove that persistence does exist in hedge funds, for both their mean monthly returns, and Sharpe Ratio. The presence of persistence in each strategy is likely due to the nature of the strategy, and not the managers of funds employing each strategy. For example, persistence is demonstrated in the distressed securities in both the strategy's Sharpe Ratio and mean returns. This is most likely due to the investment of capital in this type of securities. The nature of distressed securities is the instrument will either default or will experience growth from its current position. It is more likely than not that either of these situations will occur, rather than continually rise and suddenly decline. The equity long/short strategy also demonstrated persistence in both the Sharpe Ratio and mean returns. Typically, the equity long/short strategy involves purchasing securities that will have an upside, while selling securities that have the potential to decrease in value. A fund manager attempts to reduce volatility by either diversifying or hedging positions, using shorts, across individual regions, industries, and sectors. The nature of using shorts to hedge against risk decreases volatility, making mixed results of W1L2 and L1W2, less likely. Convertible arbitrage demonstrates persistence when the strategy's Sharpe Ratio is used. Convertible arbitrage involves the simultaneous purchase of convertible securities and the short sale of the same issuer's common stock. The premise of the strategy is that the convertible is sometimes priced inefficiently relative to the underlying stock. Being able to identify arbitrage opportunities creates persistence for only the Sharpe Ratio because the risk of the asset can be identified to a certain degree. Therefore, a manager that uses this strategy and correctly identifies arbitrage

opportunities will continually produce high or low returns. Emerging markets demonstrates persistence in only mean returns. This is because over the period of 1998 to 2005 emerging markets investments were considered to be on a steady upward incline. Emerging markets strategy invests in developing nations such as China, India, Brazil, and Russia. The strategy will produce either high or low returns depending on which investments the manager made within these developing nations. When the persistence of emerging markets is tested using the Sharpe Ratio the null hypothesis is true because risk is taken into consideration. When the returns are adjusted for risk, the Sharpe Ratio exposes the volatility of this strategy, where it is more likely to have mixed results. Fixed income and fixed income arbitrage strategies demonstrate persistence when their mean returns are tested. These strategy's returns continually generate constant returns with out calculating risk. When the Sharpe Ratio of fixed income strategies are tested the null hypothesis is true because it takes into account the possibility of interest rate risk. If the fixed income strategies securities are exposed to interest rate risk, there will more likely be mixed results. The nature of the global macro strategy causes persistence. Global macro strategy invests in interest rate trends, and the flow of funds of funds on a broad world scale. This explains why there is persistence because if a trend is followed there will be either upward or downward movement, creating returns that will continue in either direction. Merger arbitrage strategy buys and sells stocks of two companies that are merging, creating very minimal risk. The very nature of the strategy creates persistence when the strategy's Sharpe Ratio is calculated. Equity long only strategies demonstrate persistence when evaluated by the Sharpe Ratio. The nature of the equity long strategy is to invest in stable companies that have strong comparables. For example, investing in a long only position in a company like McDonalds will have constant

growth. The nature of this strategy causes persistence in the Sharpe Ratio because the small amount of risk that the equity long only strategy employs.

It is imperative to evaluate the persistence of a fund and the strategy that is used. It is not in the best interest of investors to evaluate hedge funds solely based on their average returns or Sharpe ratios for one period of time. In conclusion, persistence is present in hedge funds, and the strategies that they employ. By choosing a strategy that is proven to demonstrate persistence will allow an investor to succeed in receiving high returns on a constant basis.