

SHOULD INVESTORS PREFER CANADIAN HEDGE FUNDS OR STOCKS?

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Abstract

Brulhart and Klein (2006) found the true magnitude of extreme returns from hedge fund indices is less than what has been popularly believed and investors should not be afraid of investing in hedge funds. This paper updates Brulhart and Klein (2006) by comparing the magnitude of extreme returns from Tremont, HFRI hedge fund indices with stock indices. It also compares the magnitude of extreme returns from Canadian hedge fund indices with stock indices. We found that the results from Brulhart and Klein (2006) still hold even for the updated US data. However, the results do not hold for the Canadian hedge fund indices. The magnitude of extreme returns from Canadian hedge fund indices is lower than the magnitude of extreme returns from TSX composite, Nasdaq, Tremont and HFRI hedge fund indices, but it is higher than the S&P 500. We believe that is because the composition of the Canadian hedge fund industry is different from the US hedge fund industry. Equity long/short is the most popular hedge fund strategy in Canada, so the Canadian hedge fund industry overall is more similar to the US equity long/short strategy.

Keywords: Hedge Funds, Third Moment, Fourth Moment, Modified VaR

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Section.1 Introduction

Many investors perceive that investing in hedge funds is very risky, because they often read bad news relating to hedge funds in the newspapers. For example, two hedge funds run by Bear Stearns Cos collapsed in July 2007. Those two funds were leveraged heavily and invested in collateralized debt obligations (CDOs) backed by sub-prime mortgages. One of the larger funds lost more than a quarter of its capital in the first quarter of 2007. A hedge fund ran by UBS AG lost \$150 million in the first quarter of 2007 because of the difficulty in sub-prime mortgage sector. Goldman Sachs's global equity opportunities fund lost more than 30% of its value in the second week of August of 2007. This kind of news appears on the headlines once in a while, from the collapse of Barings banks in 1995, the collapse of LTCM in 1998 to the collapse of Amaranth Advisor LLC in 2006. Because of the large magnitude of the losses experienced by those funds, investors only read bad news and they never see any good news coming from hedge funds. Because of this, investors generally perceive hedge funds as dangerous instruments and investing in hedge fund as more risky than investing in stock markets. Is this true? According to the article from Wall Street Journal, the HFRI weighted composite index, which tracks more than 2,000 hedge funds, gained 0.49% while the S&P 500 experienced 3.2% loss in July 2007 and is up roughly 8% in 2007 through July, beating the S&P index of major stocks. However this kind of news seldom gains investors' attention, because the news was hidden in one of the paragraphs in the article.

Academic researchers, for example, Brooks and Kat (2002), Agarwal and Naik (2004) and Malkiel and Saha (2005) argue that hedge fund returns have more negative skew and higher kurtosis than returns from stock markets. Brulhart and Klein (2006) took different

approaches to examine hedge fund returns and they found out that the true magnitude of hedge funds' extreme returns is lower than stock indices.

In this paper, we update the Brulhart and Klein (2006) by comparing the magnitude of extreme returns from Tremont, HFRI hedge fund indices with stock indices. We also compare the magnitude of extreme returns from Canadian hedge fund indices with stock indices. Brulhart and Klein (2006) analyzed the magnitude of extreme returns by comparing the skew, kurtosis, third moment, fourth moment and the recovery time for the maximum drawdown between hedge fund indices and stock indices and they found that the true magnitude of extreme returns from hedge fund indices is less than what has been popularly believed. They also found that investors should prefer hedge funds than stock indices by applying a decision rule based on stochastic dominance¹. In our paper, we analyze the magnitude of extreme returns by looking at the skew, kurtosis, third moment, fourth moment and the modified VaR. We also apply the Brulhart and Klein decision rule to the Canadian hedge fund indices.

The finding from the analysis of most up to date returns from Tremont, HFRI hedge fund indices, S&P 500 and Nasdaq indices is consistent with the result from Brulhart and Klein (2006) that the true magnitude of extreme returns is lower for hedge fund indices as compared to equity indices. We also found that returns from Canadian hedge fund indices are more extreme than the returns from Tremont and HFRI hedge fund indices and S&P 500 and less extreme than TSX composite and Nasdaq. Among all the Canadian hedge

¹ The decision rule is developed by Brulhart and Klein (2006) and it shows that by equaling the fourth moment of portfolio B and portfolio A through borrowing or lending at the risk free rate, investors prefer portfolio B than portfolio A if the portfolio B has smaller negative third moment, smaller standard deviation and higher mean than the portfolio A does.

fund indices and stock indices, Canadian Fund of funds has smallest magnitude of extreme returns and its return is more normally distributed. By applying the decision rule, we can not conclude anything for the Canadian hedge fund indices.

The paper is organized as follows. Section 2 describes various hedge fund strategies and the history and characteristics of Canadian hedge fund industry. Section 3 reviews the findings from various papers regarding the risks of investing in and the bias of hedge fund indices. Section 4 is the analysis of the returns from various hedge fund indices and from stock indices by using different measures. Section 5 analyzes the magnitude of extreme returns for hedge fund indices and stock indices by calculating the modified VaR. Section 6 applies the decision rule to find out should investor prefer Canadian hedge fund indices or stock indices and section 7 is the discussion of results and the conclusion.

Section.2 Descriptions of Hedge Fund Strategies and Canadian Hedge Fund Industry

Hedge funds have received considerable attention as alternative investments. Philips (2006) presents the characteristics of hedge fund strategies available to investors. The common hedge fund strategies can be divided into two broad categories: Non-directional and Opportunistic. Non-directional strategies tend to neutralize a majority of market risk, largely assuming only idiosyncratic risks which are inherent to individual securities. Opportunistic strategies tend to remain exposed to a degree of market risk in addition to idiosyncratic risks.

Non-directional strategies descriptions

Equity market neutral: Hedge funds employ individual stock-selection strategies to

identify small but statistically significant return opportunities. The portfolio is divided exactly into 50/50, 50% for the long position and the other half for the short position. Fund managers use quantitative risk control to minimize systematic risk and balance long and short positions. Imperfect hedges may result from poor stock selection or from the impact of selection uncertainty.

Convertible arbitrage: Hedge funds involve the simultaneous purchase of convertible securities (often bonds) and short sale of the underlying common stocks to exploit perceived market inefficiency. This strategy has attracted a large number of market participants, creating intense competition and reducing the effectiveness of the strategy. The portfolio neutralizes most risk factors outside of the bond's credit risk, earning coupon interest income and short rebates rather than trading on option volatility.

Fixed income arbitrage: Hedge funds employ strategies to discover and exploit relative mispricing among related fixed income securities. Strategies typically focus on mispricing relative to a single risk factor—duration, convexity, or yield curve changes—increasing risk control by neutralizing residual factors. Unanticipated changes in a yield spread can result in losses even on basic trades, such as trading futures against cash, if the securities are marked to market before adjustments are made.

Opportunistic strategies descriptions

Long/short equity: Hedge funds take independent long and short stock positions, typically using various quantitative models to rank stocks, then buying top-tier stocks and shorting those in the bottom tier, seeking to “double alpha.” Portfolios often are net long or net short with systematic risk exposure and bets on size, industry, sector, and/or country risk

factors.

Emerging markets: Hedge funds invest in emerging-market currencies, equity and fixed income securities with the goal of exploiting market inefficiencies considered to occur more frequently and to yield larger returns. Managers face unique risks in undeveloped markets that are typically characterized by limited information, lack of regulations, and instability.

Dedicated short bias: Hedge funds sell borrowed securities, hoping to repurchase later at a lower price and return them to the lender. Short selling earns a profit if prices fall. Interest is also received on the cash proceeds from the short sale. Portfolio is typically exposed to industry, sector, and company-specific risk factors, as well as the risk that the market will appreciate.

Global macro: Hedge funds take leveraged positions in financial derivatives, on the basis of forecasts about the interest rate trends, movements in the general flow of funds, political changes, government policies and other broad systemic factors.

Managed futures: Hedge funds rely on technical or fundamental trend-following models to invest in currencies, interest rate, index, and commodities global options and futures. Risks include unanticipated commodity shocks, incorrect forecasts, and poor trade timing or positioning.

Event driven: Hedge funds profit on firm events such as acquisitions, mergers, tender and/or exchange offers, capital structure change, the sale of entire assets or business lines, and entry into or exit from new markets. Returns tend to be highly dependent on a

manager's ability to spot these opportunities. The strategy does not hedge against factors such as a weak merger environment or the risk that deals are not completed.

Canadian Hedge Fund Industry

The hedge fund market in Canada is relatively small in comparison with the global hedge fund market. According to the survey done by NBCN Prime Brokerage Services, 30% of the Canadian hedge funds have between \$10 and \$49 million USD in assets and only 4% have assets exceeding \$5 billion. On the global scene, 21% manage assets over \$5 billion, but only 10% have assets between \$10 million and \$49 million². Before 1995, there were less than 15 funds in Canada. The growth of the hedge fund industry in Canada was very slow between 1995 and the first half of 2000. Since the stock market did not perform well in the second half of 2000, Canadian investors looked for alternative opportunities to invest their money. To invest in hedge funds has become more popular since the second half of 2000 in Canada and the boom continues today. At the beginning of 2000, there were only 20 hedge funds managing \$1.5 billion assets. However, by May 2002, there were about 180 hedge funds managing \$5 billion assets in Canada. According to the statistics from KCS Fund Strategies Inc., as of June, 2007, there are about 70+ managers in Canada managing approximately \$60 billion asset and 8,000 managers managing \$1.5 trillion globally.

Even there are no any publications discussing the characteristics of the Canadian hedge fund industry, there are a few industry surveys and articles discussing the Canadian hedge fund industry. The survey done by NBCN Prime Brokerage Services covers 35 hedge

² Pushpa Sathish, Staff Writer, http://www.hedgefundreader.com/2007/01/canadas_hedge_f.html, Jan 24, 2007.

fund managers in Canada and it reveals the fact that Long/Short equity is the largest strategy used by Canadian managers. This result is consistent with the result presented by Ostoich and McGovern (2005), “The most common investment strategy for Canadian hedge funds is the equity long/short strategy.” In the same article, Ostoich and McGovern (2005) pointed out that market neutral strategy is another common strategy used by Canadian hedge fund managers. The same results can be found in the latest statistics presented by KCS Fund Strategies Inc. Within the Scotia HF Index, totaling 42 funds, 58% of the assets are managed under the equity long/short strategy and 12% of the assets are managed under the market neutral strategy³.

Section.3 Literature Review

There are a number of published articles about hedge funds. Some of those papers discuss the magnitude of extreme returns of hedge funds and some discuss the biases in the reported return of hedge funds.

3.1 High moments and extreme returns

Some scholars and hedge fund managers suspect that extreme values and non-normality of hedge fund returns would be problematic when using portfolio tools designed in a mean-variance setting. Brooks and Kat (2002) demonstrate that there is high potential for substantial losses for the negative skew and high kurtosis of hedge fund return distributions. They point out the Sharpe ratio overestimates the true risk-return performance of hedge funds. High Sharpe ratio tends to go with negative skew and high kurtosis. High mean and low standard deviation from hedge fund indices is no free lunch.

³ KCS Fund Strategies Inc. Perspectives on Hedge Fund Investing, June, 2007.

Thus, mean-variance portfolio analysis over-allocates the weights on hedge funds and overestimates the attainable benefits.

Brulhart and Klein (2006) shows evidence against this point of view and find the skew and kurtosis in hedge fund returns do not necessarily imply that investors are exposed to undue risks. They develop a decision rule which takes the higher moments into account and employ the rule on historical returns for hedge fund indices and other traditional indices, S&P 500 and Nasdaq stock market indices. Their results conclude that the investors should prefer hedge fund indices to equity indices. The hedge fund indices do not have extreme returns that are as severe as returns from equity indices; hedge funds tend to have shorter recovery times; so hedge funds are not problematic per se for investors. As mentioned in their paper, the standard measures of skew and kurtosis are not suitable to provide reliable insights from the risk of extreme returns in hedge fund indices. Through their studies on the higher moments, un-scaled third and fourth moments provide the evidence that risk of extreme returns is more prevalent for equity indices. Throughout the comprehensive analyses on the returns from hedge fund and stock indices in Brulhart and Klein (2006), they present some implications for investors. First, there are evidences to support that the extreme returns from hedge fund indices are smaller than those on equity indices and are not as problematic as for equities. Second, funds of hedge funds employing leverage to a diversified basket of hedge funds may provide a distribution of returns that is preferable to the distribution of equity index returns. Third, investors should use scaled measures of higher moments since standard measures may cause incorrect evaluation of risk. Fourth, the mean-variance portfolio tool,

which may not be efficient for risk analysis because of higher moments, can also play an important role for decision making.

As mentioned in Agarwal and Naik (2002), hedge fund payoffs are non-linear and asymmetric with significant negative tail risk. Thus, for investor analysis, hedge funds construction should explicitly account for tail risk in down market conditions. Some financial institutions and fund managers use VaR to address the tail risk for hedge funds returns. Nevertheless, researchers like Artzner et al (1999) and Agarwal and Naik (2002) proposed the use of Conditional VaR. CVaR corresponds to the expected loss conditional on the losses being greater than or equal to the VaR. VaR has a limitation that it only concentrates on the frequency of extreme events but CVaR can focus both on frequency and size of losses in case of extreme events. Besides VaR and CVaR, Favre and Galeano (2002) suggested the use of Modified VaR is a better way to measure the extreme events, because the Modified VaR takes the third and fourth moments into account.

Malkiel and Saha (2005) claim that: hedge funds are far riskier and provide much lower returns than are commonly supposed. Their findings show that the cross-sectional standard deviation of hedge fund returns is higher than that of the case for the mutual fund universe. Hedge fund indices have substantial survivorship bias and backfilled bias as well. By correcting these biases they find hedge funds have lower returns and are riskier than are commonly supposed. They wonder whether the substantial flow of funds into the hedge fund industry will tend to reduce returns significantly in the future.

3.2 Biases in the Reported Returns of Hedge Funds

Hedge fund indices have various biases and all those biases are worth of noting in the indices. In Liang (2003), he clearly pointed out that performance measurement based on an inaccurate database is biased in all cases. Gehin (2004) summarizes four kinds of biases: survivorship bias, backfill bias, selection bias and stale price bias.

Among these biases, survivorship is the most significant one with bigger effect and commonly exists in performance measurement. If the database only contains the information on 'surviving funds' and the database vendor stops reporting the defunct funds information, we can say there is survivorship bias. Generally good performing funds dropped out of the index generate a downward bias while bad performing funds dropped out of the index generate an upward bias. Gehin (2004) points out that the higher the covariance, monthly returns, average assets under management, age of the funds and etc., the longer the survival times. In the paper of Amin and Kat (2003), with the data over the period 1994-2001, they find survivorship bias in hedge fund data is quite modest that the difference between surviving and defunct funds is very small. The result concentrating on survivors only overestimates the average hedge fund return around 2% per annum. However, for small, young and leveraged funds the bias can be as high as 4-6%. Survivorship biases estimated by Brown and Goetzmann (1995), Liang (2000) and Fung and Hsieh (1999) are range from 0.6% to 3.6% per annum for various hedge fund types. Meanwhile, Amin and Kat (2003) study the survivorship bias in higher moments. They find a downward bias in the standard deviation, an upward bias in the skew and a downward bias in the kurtosis. Without any corrections, this can make the investors have incorrect analysis and overestimate the benefits of hedge funds.

In addition, backfill bias also appears in hedge funds. It is caused by adding a hedge fund that earlier good returns are backfilled between the inception date of the fund and the date it enters the database. The bias is evaluated by the difference between the return of an adjusted observable portfolio and the return of a non-adjusted observable portfolio. The backfill bias is 1.4% calculated by Fung and Hsieh (2000) for the TASS database over the period 1994-1998. Malkiel and Saha (2005) calculate the backfilled return's average is more than 5% higher than the contemporaneously reported returns with the TASS database over 1994-2003. With different methods of eliminating individual incubation period fund by fund, Posthuma and van der Sluis (2003) find 4.35%, 7.24 and 10.13% per year backfill bias in three different scenarios. Malkiel and Saha (2005) conclude that the use of backfill returns to judge the effectiveness of hedge fund management significantly biases the returns upwards.

With the example of Long-Term Capital Management lost 92 percent of its capital between October 1997 and October 1998, Malkiel and Saha (2005) mention another kind of biases, End – of – Life Reporting bias that hedge funds would stop reporting their results during the last several months of their lives. It is noted that even the adjusted return data are likely to be upward biased. Posthuma and van der Sluis (2003) evaluate the End – of – Life Reporting bias by assuming the hedge fund has a negative return in the month after it stopped reporting. They employ the method of adjustment can improve the accuracy of hedge fund indices. Their average industry hedge fund return would be decreased by over 6% per annum if the non-reported last month return was negative 50% for funds leaving the database. Nevertheless, some authors do not accept this method

since some funds stopped reporting not because they failed but because they did not want to attract new funds.

The evidence of biases from the reported returns is not clear and can not be fixed. Because of this reason, Brulhart and Klein (2006) and our paper use the raw data to analyze the magnitude of extreme returns from hedge funds and the raw data is treated with caution.

Section.4 Analyses of Hedge Fund and Stock Indices

4.1 Description of the Data

In section 4, we mainly focus on updating the data for Brulhart and Klein (2006) and adding the new data from Canadian hedge fund indices to check whether the most recent Tremont/HFRI hedge fund indices performance and the Canadian hedge fund indices performance are consistent with the findings in Brulhart and Klein (2006). There are two sets of data used in Brulhart and Klein (2006) for hedge fund performance. One is the monthly return on the CSFB/Tremont hedge fund indices from January 1994 to August 2005 and is available from the website www.hedgeindex.com. The second set of data is the monthly return on HFRI hedge fund indices from January 1990 to August 2005 and is available from the website www.hedgefundresearch.com. The stock indices they used for comparison are the S&P 500 and the Nasdaq. In this paper, we update those two sets of hedge fund data, the CSFB/Tremont hedge fund indices and the HFRI hedge fund indices to June 2007. For Canadian hedge fund indices, we analyze CHW Canadian hedge fund indices from January 2005 to June 2007 and SC Canadian hedge fund performance

indices from January 2005 to June 2007⁴. Those two sets of data are from www.canadianhedgewatch.com and www.scmonline.com respectively. For the comparison purpose, we obtain returns on S&P 500 total return from www.standardandpoors.com and Nasdaq from Finance.yahoo.com and TSX composite index from Finance.yahoo.ca.

The returns for all of the hedge fund indices are net of fees. The fund of funds index includes the additional fees charged by a diversified fund of hedge funds, since the management fees for fund of funds include part of the management fees charged by the underlying funds.

4.2 Summary Statistics

We calculate the mean, standard deviation, skew, kurtosis and Jarque-Bera statistics for returns that include most recent returns up to June 2007, from all the stock indices and hedge fund indices and then we compare the results with the findings in Brulhart and Klein (2006). In table 1, we present the results for the updated periods for the S&P 500 total return index, Nasdaq, the Credit Suisse/Tremont and the HFRI hedge fund indices. We found that by including the most recent returns for hedge fund indices, the results are pretty much the same as the results from the original periods (Please refer to Brulhart and Klein (2006) Table 2 for the results from original periods). The mean returns for hedge fund indices are generally lower than the returns from stock indices; the standard deviations for hedge fund indices are lower than the equity indices (with the exception of HFRI emerging market); hedge fund indices have higher kurtosis than the equity indices

⁴ The historical data for both sets of Canadian hedge fund indices are only available from January 2005 to June 2007.

do in most cases (with the exception of the market neutral, the Tremont futures, the HFRI equity non-hedged strategies and the HFRI macro index); the results for the skew are not very clear. Some of the hedge fund indices' returns have more negative skew than returns from stock indices, for example, weighted composite, convertible arbitrage, distressed, and emerging markets etc, but some of them show less negative skew than stock indices or even show positive skew, for example, market neutral, macro, short selling and managed futures.

By looking at the Jarque-Bera (J-B) statistics which are based on the skew and the kurtosis, most of the hedge fund indices have values higher than 5.99 and some of them even have values higher than 9.21. Based on the J-B statistics, we know most of the hedge fund returns are not normal, since for the J-B statistics, any value over 5.99 (at a 5% level) or 9.21 (at a 1% level) indicates the normality hypothesis can be rejected.

Generally speaking, the results calculated from updated data show that hedge fund returns have more negative skew, greater kurtosis and are not normally distributed. Those results are consistent with the findings in Brulhart and Klein (2006) and some other previous published papers, for example, Brooks and Kat (2002), Agarwal and Naik (2004) and Malkiel and Saha (2005).

After analyzed the returns on Tremont and HFRI hedge fund indices, we will look at the performance of Canadian hedge fund indices in this section. Table 2 presents the results for returns on CHW Canadian hedge fund indices, SC Canadian hedge fund performance indices, TSX composite, Nasdaq and S&P 500 total return for January 2005 to June 2007. The table tells us that all the returns for Canadian hedge fund indices (with the exception

of the fund of funds) have smaller kurtosis and less negative skew compared to TSX composite. Returns on all Canadian hedge fund indices have greater kurtosis than S&P 500 and Nasdaq and CHW composite and equity hedged indices have more negative skew than S&P 500 and Nasdaq. The CHW fund of funds, as expected for most of the fund of funds, has a lower standard deviation and a more positive skew than stock indices and a kurtosis close to 3.

In Table 2, we also compare the Canadian hedge fund indices (with the exception of fund of funds) with Tremont and HFRI hedge fund indices for January 2005 to June 2007. We found that the returns for Canadian hedge fund indices generally have higher mean, higher standard deviation, lower negative skew and smaller kurtosis than the Tremont and HFRI hedge fund indices (with few exceptions).

Since the Jarque-Beta statistics for most of the hedge fund indices are less than 5.99 (at a 5% level), we can not reject a hypothesis of normality for this particular period from January 2005 to June 2007. We think this result is reasonable. When we look at the financial market from January 2005 to June 2007, there were not too many surprises in this period, except the sub-prime mortgage problem in US. However, the most serious damages on the global financial market caused by sub-prime mortgage happened after mid July 2007, so it did not bring too many surprises to the markets before July 2007.

When we looking at all those results from Table 1 and 2, if the magnitude of extreme returns solely depends on the skew and the kurtosis, we can conclude the following:

1. Returns on Tremont and HFRI hedge fund indices are more extreme than stock indices.

2. In general (with three exceptions in the comparison of the skew), Canadian hedge fund indices except fund of funds have more extreme returns than Nasdaq and S&P 500 indices due to the more negative skew and higher kurtosis.
3. Among all the Canadian hedge fund indices and stock indices, Canadian Fund of funds has smallest magnitude of extreme returns and its return is more normally distributed.
4. Returns on Canadian hedge fund indices are less extreme than the returns on Tremont and HFRI hedge fund indices due to the lower negative skew and smaller kurtosis.
5. Returns on Canadian hedge fund indices are less extreme than TSX composite due to the smaller negative skew and smaller kurtosis (with the exception of the fund of funds).

However, as mentioned in Brulhart and Klein (2006), there are two reasons that greater kurtosis or excess negative skew may not represent the magnitude of extreme returns. First they pointed out that in Kaplansky (1945), Kaplansky presented four examples showing that a distribution which has higher kurtosis than a normal can have smaller corresponding area in the left hand tail than a normal and a distribution which has less kurtosis than a normal can have a greater corresponding area in the left hand tail. The second reason is the formulae used to calculate the skew and kurtosis showing that the high value of skew and kurtosis can be caused by either the denominator (or standard deviation) or the numerator (or the 3rd moment for skew and the 4th moment for the kurtosis) of the formula. If the high values of skew and kurtosis are caused by the

denominator which is the smaller standard deviation, this means that the high negative skew and positive kurtosis can not represent the extreme returns of hedge fund indices.

Based on those two reasons above, we can not draw the conclusions so early. For example, for conclusion (4), we can not conclude that the returns on Canadian hedge fund indices are less extreme than the returns on the Tremont and HFRI hedge fund indices simply by looking at the skew and the kurtosis, because the lower negative skew and smaller kurtosis for the Canadian hedge fund indices may be caused by the greater value in standard deviation which is the denominator in the skew and kurtosis formula. The same argument can be applied to conclusion (1) that the returns on Tremont and HFRI hedge fund indices are more extreme than stock indices, because the more negative skew and greater kurtosis for the returns on those two hedge fund indices may be caused by the small standard deviation.

In order to get a clear insight on which returns have more extreme returns, we employ the measure that Brulhart and Klein (2006) used. We need to look at the un-scaled third and fourth moments, because these two moments correspond to the third and fourth term in a Taylor series expansion of an investor's utility function. With this method, we can find out that the more extreme returns are caused directly by the third and fourth moments or caused by smaller standard deviation.

Table 3 shows the moments for the updated returns on Tremont and HFRI hedge funds and on stock indices and Table 5 shows the moments for Canadian hedge fund indices, Tremont and HFRI hedge fund indices from January 2005 to June 2007. In Table 3, we can see that the third moments for the returns on the Tremont and HFRI hedge funds

indices are smaller than the third moments on the returns on stock indices with only two exceptions, the emerging market and the equity non-hedge indices. The same result can be found for the fourth moment. The fourth moment for the returns on these hedge fund indices are smaller than the fourth moments on the returns on stock indices with only two exceptions, the short bias and the emerging markets. We know that the returns on the investments in emerging markets are generally more volatile than in developed market, so the exception on the emerging markets strategy is quite reasonable.

In Table 4, we found that the third moments for the returns on CHW composite, equity and SC equal weighted indices are more negative than the third moments on those Tremont and HFRI indices with very few exceptions, emerging market, non-hedge, long/short and futures. The fourth moments for Canadian indices except the fund of funds index are larger than the fourth moments for most of the Tremont and HFRI indices (with the exceptions of non-hedge, short bias, emerging market and futures). In Table 4, we also found that the returns from CHW fund of funds index has the greatest positive third moment (with the exception of Nasdaq) and has the smallest fourth moment among all the Canadian hedge fund and stock indices. From Table 4, we further confirm conclusion (5) is correct because of the higher fourth moment (with the exception of CHW equity hedged) and greater negative third moment in TSX composite than those in Canadian hedge fund indices, but we still can not get consistent results for conclusion (2) we have before. For example, SC equal weighted index has a greater negative third moment than stock indices' but its fourth moment is greater than S&P 500's fourth moment, smaller than the fourth moment of TSX composite and Nasdaq. Similar situation can be found for other three Canadian hedge fund indices.

Table 3 and 4 lead us to conclusions that are different from the conclusions (1) and (4) we have before. That is why Brulhart and Klein (2006) look at the third moment and the fourth moment rather than the skew and kurtosis. We also confirm the conclusion (3) and (5) we have before.

- Returns on Tremont and HFRI hedge fund indices are less extreme than stock indices because of the smaller negative third moment and smaller fourth moment.
- Returns on Canadian hedge fund indices are more extreme than the returns on Tremont and HFRI hedge fund indices due to the greater negative skew and greater kurtosis.
- Canadian Fund of funds has less extreme returns than stock indices and the return is more normally distributed.
- Returns on Canadian hedge fund indices are less extreme than TSX composite due to the smaller negative skew and smaller kurtosis (with the exception of the fund of funds).

Section.5 The Modified VaR

Brulhart and Klein (2006) also examine the recovery time from the maximum drawdown for hedge fund indices and stock indices. Since the historical data for the Canadian hedge fund indices is very limited, it is meaningless to apply another measure, the magnitude of maximum drawdown on those returns. In order to re-confirm our results above, we apply another measure, the modified VaR to find out the magnitude of the extreme returns.

The next method we use to examine the magnitude of the extreme returns is the modified VaR developed in Favre and Galeano (2002). This modified VaR is based on an

investor's wealth function and it includes the first, second, third and fourth moment in the calculation⁵. By including the third moment and fourth moment in the calculation of modified VaR, the modified VaR allows to measure the risk of portfolio with any assets that are non-normally distributed, for example, hedge funds.

When we calculate the modified VaR, we assume we invest one million US dollars in every index and the conditional VaR is based on 1% level. Results in Table 5 tell us the following:

- Based on the modified VaR, returns on Tremont and HFRI hedge fund indices are less extreme than the returns from stock indices (with the exceptions of dedicated short bias, emerging markets, managed futures and equity non-hedge)
- Returns on Canadian hedge fund indices are more extreme than the returns on Tremont and HFRI hedge fund indices due to the greater modified VaR.
- Canadian Fund of funds has a smaller magnitude of extreme return than stock indices do.
- With the exception of fund of funds, the magnitude of extreme returns from Canadian hedge fund indices is greater than the S&P 500.
- The magnitude of extreme returns from Canadian hedge fund indices is smaller than the TSX composite and Nasdaq.

⁵The formula for the modified VaR is

$$\text{VaR} = W \left[\mu - \left(z_c + \frac{1}{6}(z_c^2 - 1)S + \frac{1}{24}(z_c^3 - 3z_c)K - \frac{1}{36}(2z_c^3 - 5z_c)S^2 \right) \sigma \right]$$

, where the W is how much money invested in the risky asset, Z_c is equal to -2.33 for a 99% probability or to -1.96 for a 95% probability, S is the skew and K is the kurtosis. It is derived from Cornish-Fisher expansion.

The results from the modified VaR are the same as what we found by re-scaling moments and we can also find out that the magnitude of extreme returns from Canadian hedge fund indices is greater than S&P 500 and smaller than TSX composite and Nasdaq.

In summary, the modified VaR does confirm the results we found in the previous section. The findings from Brulhart and Klein (2006) do not hold for Canadian hedge fund indices, since the magnitude of extreme returns from Canadian hedge fund indices is greater than S&P 500.

Section.6 Should Investors Prefer Hedge Funds or Stocks?

In this sub-section, we try to answer the question, “Should Investors Prefer Hedge Funds or Stocks?” by applying the decision rule developed by Brulhart and Klein (2006). Every investor has his/her own utility function and own preference for risks. When investors make investment decisions, some investors assign more weights on the standard deviation; some investors give more weights to the third moments and some give more weights to the fourth moment. Because of different preferences on different moments, it is possible that the negative effects of the third and fourth moment from the returns might be offset by the more favorable first moment and standard deviation for investors, so we need to look at the returns from hedge funds and stocks on the risk adjusted basis in order to find out which one investors prefer.

The following approach we use to examine the magnitude of extreme returns on indices is based on the risk adjusted basis is from Brulhart and Klein (2006). What we do is to set the fourth moment equal among all the returns from indices through leverage or de-leverage by borrowing or lending at the riskless rate. Since the fourth moment is the

same among all the indices, we will only need to check the mean, standard deviation and the third moment on the indices. The definition of the decision rule can be found from Brulhart and Klein (2006).

We present the results in Table 6. We set the fourth moment from all the indices all equal to the fourth moment of the S&P 500. In this table, conclusion (3) and (5) are confirmed once again. All the third moments from Canadian hedge fund indices are less negative skew than the TSX and standard deviations are pretty much same among them. All the mean returns from Canadian hedge fund indices (with the exception of CHW composite) are higher than TSX. Based on this, we can conclude that investors should prefer Canadian hedge fund indices over TSX composite. Conclusion (3) is very noticeable under this approach. It outperforms all other indices in every risk category, the standard deviation and the third moment. For conservative investors, they should invest in fund of funds which offer them a relative low risk in all the risk categories.

However, we can not conclude anything for the Canadian hedge fund indices and S&P 500 and Nasdaq based on this approach because of the mixed results for the moments

Section.7 Discussion of Results and Conclusion

In summary, we found the following results after we employ various measures to analyze Tremont, HFRI, Canadian hedge fund indices and S&P 500, Nasdaq and TSX composite indices.

1. The magnitude of extreme returns from The Tremont and HFRI hedge fund indices is smaller than for stock indices.

2. The magnitude of extreme returns from Canadian hedge fund indices is smaller than the magnitude of extreme returns from TSX composite and Nasdaq.
3. The magnitude of extreme returns from Canadian hedge fund indices is greater than Tremont and HFRI hedge fund indices and S&P 500.
4. Among all the Canadian hedge fund indices and stock indices, Canadian Fund of funds has smallest magnitude of extreme returns and its return is more normally distributed.

We mentioned before that the most popular hedge fund strategy used by Canadian managers is the equity long/short. Based on this, we should compare the magnitude of returns from Canadian HF indices with the magnitude of returns from equity long/short strategy from Tremont and HFRI and stock indices. When we do the comparison among them, we take out the CHW fund of funds and SC equal weighted indices. By assigning the same weight to all the strategies, the results from the SC equal weighted indices will not reflect the fact that the most popular hedge fund strategy used by Canadian manager is equity long/short.

From Table 4 and Table 5, we see that in general, the long/short equity or the equity hedge strategy has greater magnitude of extreme return than other strategies. For example in Table 5, the long/short equity from Tremont and the equity hedge from HFRI have greater negative third moment and larger fourth moment than majority of strategies. The same result can be found in Table 5, the modified VaR for these two strategies are greater than the modified VaR from most of the strategies. This can explain why the magnitude of extreme returns from the Canadian HF indices is greater than S&P 500. However, when we compare the results from Table 4 and Table 5 between the Canadian hedge fund

indices with the long/short equity from Tremont and the equity hedge from HFRI, we still find that the magnitude of extreme returns from Tremont and HFRI is smaller than Canadian hedge fund indices. For example, in Table 5, the modified VaR from long/short equity from Tremont and from equity hedge from HFRI are smaller than the modified VaR from stock indices and from Canadian hedge fund indices, even though the modified VaR from those two strategies is very close to the modified VaR from S&P 500. This result is even more obvious when we only compare the CHW equity hedged index with stock indices and long/short equity from Tremont and equity hedge from HFRI. The modified VaR from CHW equity hedged index is almost the biggest among all those indices and it is far greater than the modified VaR from S&P 500, long/short equity from Tremont and equity hedge from HFRI, similar result for the third and the fourth moment.

Based on the analysis above, we suggest the reason why the results from Brulhart and Klein (2006) do not hold for Canadian hedge fund indices. One of the reasons is because in Canada, equity long/short is the most popular hedge fund strategy used by hedge fund managers and the equity long/short strategy is considered to have higher magnitude of extreme returns than most of other hedge fund strategies based on the third moment, fourth moment and the modified VaR. Another reason is that the Canadian hedge fund indices are outperformed by the US hedge fund indices even though we only compare the third moment, fourth moment and the modified VaR for the equity long/short strategy.

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Table 1

Statistical properties of equity and hedge fund indices

All calculations are based on monthly returns. The data for the US equity indices was downloaded from the Yahoo and Standard and Poors websites. The data for the Hedge Fund indices is from the Tremont and HFRI websites.

Index	Mean (%)	Standard Deviation (%)	Skew	Kurtosis	Jarque-Bera Stat
PANEL A Credit Suisse/Tremont(January 1994 to June 2007)					
US Equity Indices					
S&P 500 TR	0.960	4.067	-0.625	3.895	15.954
Nasdaq	1.025	7.382	-0.375	4.176	13.145
Credit Suisse/Tremont Hedge Fund Indices					
Hedge Fund Index	0.912	2.175	0.076	5.618	46.425
Convertible Arbitrage	0.737	1.312	-1.403	6.612	141.204
Dedicated Short Bias	-0.094	4.818	0.859	5.301	55.651
Emerging Markets	0.872	4.534	-0.728	8.187	195.894
Equity Market Neutral	0.803	0.820	0.336	3.500	4.738
Distressed	1.099	1.776	-3.001	23.515	3084.047
Event Driven Multi-Strategy	0.914	1.715	-2.506	19.950	2108.753
Risk Arbitrage	0.638	1.179	-1.179	9.658	336.782
Fixed Income Arbitrage	0.532	1.039	-3.143	20.584	2353.807
Global Macro	1.118	3.047	0.029	6.354	75.950
Long/Short Equity	1.018	2.852	0.191	7.218	121.082
Managed Futures	0.609	3.423	0.007	3.314	0.666
Multi-Strategy	0.808	1.225	-1.236	6.519	124.831
PANEL B HFRI (January 1990 to June 2007)					
US Equity Indices					
S&P 500 TR	0.950	3.984	-0.484	3.955	16.180
Nasdaq	1.080	6.971	-0.390	4.265	19.322
HFRI Hedge Fund Indices					
Fund Weighted Composite	1.121	1.908	-0.610	6.120	98.202
Fund of Funds Composite	0.817	1.566	-0.290	7.342	167.924
Convertible Arbitrage	0.808	0.989	-1.121	5.224	87.272
Distressed Securities	1.196	1.699	-0.658	9.248	356.770
Emerging Markets	1.371	4.080	-0.893	7.489	204.172
Equity Hedge	1.335	2.459	0.195	4.613	24.095
Equity Market Neutral	0.729	0.869	0.208	3.591	4.568
Equity Non-Hedge	1.336	3.930	-0.513	3.763	14.286
Event Driven	1.161	1.827	-1.313	8.045	283.025
Fixed Income	0.819	0.941	-0.243	8.553	271.864
Macro	1.205	2.306	0.401	3.804	11.271
Merger Arbitrage	0.837	1.202	-2.529	14.383	1357.665
Relative Value Arbitrage	0.953	1.001	-0.846	14.142	1111.360
Short Selling	0.254	5.796	0.180	5.007	36.358

Table 2

Statistical properties of equity and hedge fund indices (From January 2005 to June 2007)

All calculations are based on monthly returns. The data for the US and Canada equity indices was downloaded from the Yahoo and Standard and Poors websites. The data for the Hedge Fund indices is from the Tremont, HFRI, CHW and Scotia Capital websites.

Index	Mean (%)	Standard Deviation (%)	Skew	Kurtosis	Jarque-Bera Stat
US Equity Indices					
S&P 500 TR	0.897	2.077	-0.192	1.991	1.458
Nasdaq	0.657	3.457	0.035	2.397	0.460
TSX	1.413	3.006	-0.562	2.629	1.752
Canadian Hedge Fund Indices					
CHW Composite Index	0.964	2.180	-0.385	2.556	0.987
CHW Equity Hedged Index	1.425	3.065	-0.367	2.444	1.059
CHW fund of funds	0.337	1.351	0.232	2.827	0.305
SC Asset Weighted	1.443	2.717	-0.043	2.478	0.350
SC Equal Weighted	1.272	2.462	-0.172	2.616	0.332
Credit Suisse/Tremont Hedge Fund Indices					
Hedge Fund Index	0.966	1.130	-0.473	2.839	1.153
Convertible Arbitrage	0.535	1.144	-1.393	5.977	20.771
Dedicated Short Bias	0.276	3.353	0.116	2.326	0.635
Emerging Markets	1.483	2.100	-1.109	5.591	14.540
Equity Market Neutral	0.723	0.551	0.391	2.993	0.766
Distressed	1.153	0.737	-0.074	2.470	0.379
Event Driven Multi-Strategy	1.144	1.359	-0.628	5.866	12.243
Risk Arbitrage	0.526	0.788	1.122	5.884	16.687
Fixed Income Arbitrage	0.423	0.672	-0.125	3.797	0.872
Global Macro	0.983	0.968	0.205	3.600	0.660
Long/Short Equity	1.084	1.693	-0.663	2.827	2.234
Managed Futures	0.536	3.000	-0.238	1.807	2.063
Multi-Strategy	0.971	1.028	-0.411	2.474	1.189
HFRI Hedge Fund Indices					
Fund Weighted Composite	0.952	1.227	-0.556	2.956	1.550
Fund of Funds Composite	0.832	1.172	-0.759	2.958	2.879
Convertible Arbitrage	0.478	1.003	-1.282	5.413	15.502
Distressed Securities	0.994	0.794	-0.336	2.843	0.594
Emerging Markets	1.849	2.233	-0.839	3.829	4.376
Equity Hedge	0.981	1.552	-0.612	2.890	1.886
Equity Market Neutral	0.596	0.447	-0.307	2.955	0.475
Equity Non-Hedge	1.197	2.481	-0.539	2.558	1.696
Event Driven	0.990	1.199	-0.606	3.256	1.917
Fixed Income	0.560	0.392	-1.220	5.302	14.062
Macro	0.668	1.131	0.016	1.961	1.352
Merger Arbitrage	0.846	0.999	-0.557	3.968	2.723
Relative Value Arbitrage	0.800	0.668	-0.462	3.306	1.183
Short Selling	0.001	2.010	0.256	2.051	1.455

Table 3

Higher moments for equity and hedge fund indices

The skew is calculated by dividing the 3rd moment by the standard deviation³ and the kurtosis is calculated by dividing the 4th moment by the standard deviation⁴.

Index	Standard Deviation (%)	Skew	Kurtosis	Third Moment (% ³)	Fourth Moment (% ⁴)
PANEL A Credit Suisse/Tremont(January 1994 to June 2007)					
US Equity Indices					
S&P 500 TR	4.067	-0.625	3.895	-42.070	1066.007
Nasdaq	7.382	-0.375	4.176	-150.974	12401.387
Credit Suisse/Tremont Hedge Fund Indices					
Hedge Fund Index	2.175	0.076	5.618	0.780	125.706
Convertible Arbitrage	1.312	-1.403	6.612	-3.166	19.575
Dedicated Short Bias	4.818	0.859	5.301	96.034	2856.401
Emerging Markets	4.534	-0.728	8.187	-67.890	3461.045
Equity Market Neutral	0.820	0.336	3.500	0.185	1.585
Distressed	1.776	-3.001	23.515	-16.804	233.851
Event Driven Multi-Strategy	1.715	-2.506	19.950	-12.629	172.385
Risk Arbitrage	1.179	-1.179	9.658	-1.935	18.691
Fixed Income Arbitrage	1.039	-3.143	20.584	-3.529	24.020
Global Macro	3.047	0.029	6.354	0.821	547.629
Long/Short Equity	2.852	0.191	7.218	4.440	477.760
Managed Futures	3.423	0.007	3.314	0.274	454.922
Multi-Strategy	1.225	-1.236	6.519	-2.274	14.701
PANEL B HFRI (January 1990 to June 2007)					
US Equity Indices					
S&P 500 TR	3.984	-0.484	3.955	-30.611	996.842
Nasdaq	6.971	-0.390	4.265	-132.002	10077.16
HFRI Hedge Fund Indices					
Fund Weighted Composite	1.908	-0.610	6.120	-4.241	81.170
Fund of Funds Composite	1.566	-0.290	7.342	-1.113	44.171
Convertible Arbitrage	0.989	-1.121	5.224	-1.085	5.004
Distressed Securities	1.699	-0.658	9.248	-3.057	71.703
Emerging Markets	4.080	-0.893	7.489	-60.618	2074.702
Equity Hedge	2.459	0.195	4.613	2.906	168.659
Equity Market Neutral	0.869	0.208	3.591	0.137	2.048
Equity Non-Hedge	3.930	-0.513	3.763	-31.111	897.550
Event Driven	1.827	-1.313	8.045	-8.007	89.667
Fixed Income	0.941	-0.243	8.553	-0.203	6.711
Macro	2.306	0.401	3.804	4.912	107.561
Merger Arbitrage	1.202	-2.529	14.383	-4.398	30.072
Relative Value Arbitrage	1.001	-0.846	14.142	-0.849	14.200
Short Selling	5.796	0.180	5.007	34.965	5651.431

Table 4

Higher moments for equity and hedge fund indices

(From January 2005 to June 2007)

The skew is calculated by dividing the 3rd moment by the standard deviation³ and the kurtosis is calculated by dividing the 4th moment by the standard deviation⁴.

Index	Standard Deviation (%)	Skew	Kurtosis	Third Moment (% ³)	Fourth Moment (% ⁴)
US Equity Indices					
S&P 500 TR	2.077	-0.192	1.991	-1.723	37.023
Nasdaq	3.457	0.035	2.397	1.428	342.330
TSX	3.006	-0.562	2.629	-15.275	214.773
Canadian Hedge Fund Indices					
CHW Composite Index	2.180	-0.385	2.556	-3.988	57.747
CHW Equity Hedged Index	3.065	-0.367	2.444	-10.572	215.833
CHW fund of funds	1.351	0.232	2.827	0.571	9.418
SC Asset Weighted	2.717	-0.043	2.478	-0.867	135.074
SC Equal Weighted	2.462	-0.172	2.616	-2.568	96.162
Credit Suisse/Tremont Hedge Fund Indices					
Hedge Fund Index	1.130	-0.473	2.839	-0.682	4.621
Convertible Arbitrage	1.144	-1.393	5.977	-2.084	10.233
Dedicated Short Bias	3.353	0.116	2.326	4.367	293.868
Emerging Markets	2.100	-1.109	5.591	-10.262	108.665
Equity Market Neutral	0.551	0.391	2.993	0.065	0.276
Distressed	0.737	-0.074	2.470	-0.029	0.728
Event Driven Multi-Strategy	1.359	-0.628	5.866	1.577	20.011
Risk Arbitrage	0.788	1.122	5.884	0.549	2.267
Fixed Income Arbitrage	0.672	-0.125	3.797	-0.038	0.773
Global Macro	0.968	0.205	3.600	0.186	3.165
Long/Short Equity	1.693	-0.663	2.827	-3.220	23.254
Managed Futures	3.000	-0.238	1.807	-6.417	146.374
Multi-Strategy	1.028	-0.411	2.474	-0.447	2.767
HFRI Hedge Fund Indices					
Fund Weighted Composite	1.227	-0.556	2.956	-1.027	6.696
Fund of Funds Composite	1.172	-0.759	2.958	-1.222	5.590
Convertible Arbitrage	1.003	-1.282	5.413	-1.295	5.485
Distressed Securities	0.794	-0.336	2.843	-0.168	1.132
Emerging Markets	2.233	-0.839	3.829	-9.340	95.231
Equity Hedge	1.552	-0.612	2.890	-2.288	16.785
Equity Market Neutral	0.447	-0.307	2.955	-0.027	0.118
Equity Non-Hedge	2.481	-0.539	2.558	-8.223	96.845
Event Driven	1.199	-0.606	3.256	-1.045	6.736
Fixed Income	0.392	-1.220	5.302	-0.073	0.125
Macro	1.131	0.016	1.961	0.023	3.210
Merger Arbitrage	0.999	-0.557	3.968	-0.555	3.947
Relative Value Arbitrage	0.668	-0.462	3.306	-0.138	0.658
Short Selling	2.010	0.256	2.051	2.081	33.445

Table 5**Modified VaR**

The modified VaR is calculated based on the assumption that investors invest \$1 million dollars in to each index.

Index	Modified VaR(in \$)
US Equity Indices	
S&P 500 TR	69765
Nasdaq	105762
TSX	111691
Canadian Hedge Fund Indices	
CHW Composite Index	78544
CHW Equity Hedged Index	110085
CHW fund of funds	41271
SC Asset Weighted	94468
SC Equal Weighted	88134
Credit Suisse/Tremont Hedge Fund Indices	
Hedge Fund Index	46527
Convertible Arbitrage	51475
Dedicated Short Bias	96229
Emerging Markets	98829
Equity Market Neutral	22040
Distressed	33373
Event Driven Multi-Strategy	66173
Risk Arbitrage	24269
Fixed Income Arbitrage	26473
Global Macro	38988
Long/Short Equity	67053
Managed Futures	92669
Multi-Strategy	42131
HFRI Hedge Fund Indices	
Fund Weighted Composite	50258
Fund of Funds Composite	47826
Convertible Arbitrage	44195
Distressed Securities	35395
Emerging Markets	98555
Equity Hedge	61370
Equity Market Neutral	20352
Equity Non-Hedge	91864
Event Driven	50741
Fixed Income	20948
Macro	38132
Merger Arbitrage	44008
Relative Value Arbitrage	30508
Short Selling	52244

Table 6

Levering or De-levering to match fourth moments

When levering or de-levering, the riskless borrowing and lending rate is 6% annually.

Index	Leverage	Mean	Standard Deviation (%)	Third Moment (%)³
S&P 500	100.00%	0.897	2.077	-1.723
Nasdaq	57.35%	0.590	1.983	0.739
TSX	64.44%	1.088	1.937	-4.087
CHW Composite	89.48%	0.915	1.951	-2.857
CHW Equity Hedged	64.36%	1.096	1.973	-2.818
SC Asset Weighted	72.35%	1.183	1.966	-0.328
SC Equal Weighted	78.77%	1.108	1.940	-1.255
CHW Fund of Funds	140.81%	0.270	1.902	1.594