Leveraged ETFs Performance During Financial Crisis

Based on the North American Market

by

Shuvojit Paul

A research project submitted in partial fulfillment of the requirements

for the degree of Master of Finance Master of Finance

Saint Mary's University

Approved: Dr. Collin Dodds

Faculty Advisor

Approved: Dr. Francis Boabang

MFin Director

September 05, 2013

Acknowledgement

I would like to express my gratitude to my supervisor, Dr. J Colin Dodds, who gave me valuable insight and support towards the completion of this project. I would also like to thank Dr Francis Boabang and all the professors in the Master of Finance Program for their professional advice and support.

I would like to express my gratitude to my parents for all the support they provided me. And finally I want to thanks all my friends for always being with me in my both good and bad times.

Abstract

Leveraged ETFs Performance During Financial Crisis
Based on the North American Market

by

Shuvojit Paul

This paper seeks to evaluate the performance of Leveraged ETFs during the financial crisis. The paper is based on the performance analysis of three 2x bull and 2x bear Exchange Traded Fund respectively traded in the US and Canada. Leveraged ETFs have received much press coverage lately because of their performance related issues. Most of the discussion related to the leveraged ETFs has been focused towards the compounding effect, when funds are held for more than one day.

In this paper I have desegregated the effect of compounding and that of i) the management of the fund and ii) the trading premiums/discounts, all of which affect investors' returns. The former (i) is influenced by the effectiveness of the manager's replication strategy and the cost of leverage. The latter (ii) reflects liquidity and the efficiency of the market. I find that tracking errors were not caused by the effects of compounding alone. Depending on the fund, the impact of management factors can outweigh the impact of compounding, and substantial premiums/discounts caused by reduced liquidity during the financial crisis further distorted performance.

September 05, 2013

Table of Contents

Chapter 1: Introduction

"Buy index funds and ETFs. That might not seem like enough action to a 25-year-old, but it's the smartest thing to do." - Charles R. Schwab, founder and former CEO of the Charles Schwab Corporation

Exchange Traded Funds (hereafter ETFs) are one the recent developments that occurred in the financial world and they have gained popularity among the big institutional investors in the last decades. The idea of mimicking the whole index has been generated by the invention of mutual funds. But the ETFs create a different dimension by including characteristics such as liquidity and the ability to trade like normal stocks in the exchange compared to the characteristics of mutual funds.

The main idea behind the development of ETFs was to trade an entire portfolio in a single transaction. In the late 1970s and early 1980s, when program trading made it possible to trade bundles of different stocks, ETFs got their first development and breakthroughs. Subsequently, futures products on whole indices (e.g. S&P 500 Index) were launched until the regulatory bodies (i.e. CFTC) claimed that these products should not trade on a stock exchange. Leveraged ETFs are one of the few ETFs products that have gained much of investors' attention and have performed better than most of its class of products during the financial crisis.

The objective of this paper is to highlight the performance of only leveraged ETFs during the financial crisis and breaking down the performance measure in order to provide more in depth knowledge of its better performances during the financial turn moil in 2008 to 2009.

1.1 Background

The 2007/2008 financial crisis that culminated in the bankruptcy of Lehman Brothers, a US investment bank, has had pronounced repercussions in almost all areas of financial markets. While the crisis was started from mortgage backed securities initially and later spread towards the credit markets in general, later almost all asset classes were affected. In short the financial world suffered from the catastrophe which has not seen since the 1930's. Arnott and West (2008) have reported that all of the asset classes were badly affected in September 2008. The downturn of the financial crisis has been observed in developed and emerging equity markets, corporate bond markets, real estate, commodities and hedge funds as they have endured significant losses during that tenure. Asset under management (AUM) have diminished as well due to the decline of asset prices across all the asset class and a significant amount of withdrawals by the hedge fund and mutual fund investors during the last quarter of 2008 (IMF, 2008) have led to a further decline of the total AUM during that year.

Surprisingly exchange traded funds (ETFs) were one of the few financial products that stood out by not being hit as hard as other asset classes during the

financial crisis. They gained popularity in large number thereafter. For instance, European mutual funds suffered outflows of USD 570 billion over the course of 2008. ETFs, by contrast, collected USD 74 billion (Fuhr, 2009). In 2012 ETFs had a record high net share issuance (including reinvested dividends) of $185 billion strengthening the fact the investors demand for ETFs has increased compared to the past years (ICI Fact Book, 2013). During the recent financial crisis, ETFs have performed better than any other indexing product such as traditional mutual funds. However, in this paper the main focus is to highlight the performance during the financial crisis of a relatively new type of ETFs which is leveraged ETFs.

There are two main varieties of leveraged ETFs; those that magnify an index's return (ultra or bull ETFs), and those that track or magnify its inverse (bear ETFs). Approximately 13 percent of the ETFs traded in the U.S. are of the leveraged variety, and they account for 26 percent of the ETF trading volume. In Canada, the comparable numbers are 26 percent and a striking 61 percent, respectively (Shum, 2011).These numbers continue to grow, and are testimony to the popularity of these funds, considering the first leveraged ETF was only introduced in June 2006. However, exactly because they are relatively new investment vehicles, little academic research has focused on the performance of these funds especially after the recent financial crisis in comparison with the academic research available for index funds such as open end mutual funds.

1.2 Statement of the Problem

ETFs performance evaluation during the financial crisis is scarce and there has been little research undertaken which identifies the reasons behind the recent positive performance of the ETFs in the slow economic environment where every business sectors were affected due to the financial distress. Credit market, bond markets and housing market have seen the lowest return and downturn ever in recent history and the capital market dried up (e.g. DJIA and S&P indices hit record lows) during 2008. But the new innovation (ETFs) of the modern finance has stood out among them and retained healthy returns and ETFs such as leveraged and inverse ETFs have been at the centre of attraction among the institutional and as well as the major portion of the investors.

As mentioned earlier, Leveraged ETFs have gained huge popularity and attention from the press coverage mainly due to the issues related with their performance. Renowned managers have centralized their focus about investor's attention on the impact of compounding especially when funds are held for more than one day. But then again the main question raises is why Leveraged ETFs have performed better when every single big sector and industry was affected badly due to the financial crisis.

In the investment literature "tracking error" is the best measure to highlight ETFs performances which defines leveraged ETFs average deviation from its target return as well as the volatility of the deviation. We can break down the fund

performances into three components which an ETF investor may look into. These are as follows:

1. The impact of compounding if the holding period is longer than one day
2. The cost associated with management of the fund to achieve its investment objective and its effectiveness
3. The impact of trading discount/premium from its Net Asset Value (NAV) due to the efficiency of the leveraged ETF market

In order to shed light on the performance of the leveraged ETFs, I have selected a group of North American based leveraged ETFs which are based on the S&P/TSX 60, S&P 500 and S&P/TSX Global Gold indices.

1.3 Purpose of Study

The financial crisis had many implications for financial markets and investors. The two most important problems in exchange traded funds and other indexing products which arose during the recent financial crisis were the liquidity constraint and increased counterparty risk. The high volatility and uncertainty in financial market resulted in a sharp decrease in liquidity in many traded assets. ETFs have seen large pricing differences with respect to their net asset value (NAV) as a consequence of a lack of liquidity of their underlying assets. Illiquidity of underlying assets has created problems for other types of indexing financial products, such as traditional mutual funds and some of them were closed temporarily during the financial crisis.

Counterparty risk is another type of risk that the financial market has observed during the financial crisis in 2007-2008. Counterparty risk is especially a problem for non-traded derivate instruments, such as swaps. As a consequence, the financial crisis can be expected to have a strong impact on the perceived risk of OTC instruments, such as total return swaps. Recently, market participants increasingly became aware of the risk associated with their counterparty positions after the failure of Lehman Brothers on September 15, 2008 which was a leading provider of derivative products at that time.

However, Leveraged ETFs are still the most preferred indexing instruments when it comes to a comparison between ETFs and other financial products that allow for trading baskets of assets. This is according to large institutional and wide spread investors. Leveraged ETFs are different in terms of how they operate than any other indexing product. For instance, leveraged ETFs aim to track daily returns instead of tracking the price of an underlying index at a higher frequency (e.g., 15-minute intervals, 30 minutes interval). Third party structured product specialist or mangers specialized in leveraged ETFs are employed to magnify the return of the fund by two time or three times than the funds return or its inverse by the same magnitude. Fund rebalancing is done once a day and its NAV is made available to authorized parties at the end of the each trading day.

One of the best features of leveraged ETFs is that it allows investors to increase their market exposure or to hedge without a margin account and without any prior knowledge or expertise in leveraging or derivatives. The reason for this is that they maintained by professional and expert managers or third parties and thus its one of the attraction of this indexing product to investors. Moreover, it limits the losses of the value of the investor's wealth through inverse leveraged ETFs. In short, it hedges the exposure of losses that could occur through inverse leveraged ETFs (i.e. limit loss transaction). They may also serve as a substitute for short selling when the underlying assets are difficult and very expensive to borrow (Avellaneda, 2010). Regardless of its investors attracting capacity and glittering customized features, leveraged ETFs performance has been put into question in recent times. SEC, FINRA and IIIROC have all issued investor alerts over leveraged ETFs.

Many articles have been published recently from the CFA Institute and in various newspapers covering the issues related to leveraged ETFs and criticizing their performances. Financial advisors have also kept them away from their clients and removing their focus to other sorts of indexing product. As mentioned earlier during the time of 2008 – 2010 leveraged ETFs performed better than most of the other indexing products. So I took this opportunity to study this fund type and analyze their performance during that tenure, also focusing on the risk associated with it such as liquidity and counterparty risk like any other indexing product.

The main objective of this paper is to highlight the performance of the leveraged ETFs during the financial crisis. While there is a lacking of research in this field of finance; however the current innovation and development of this field have gained the attention of many scholars who have contributed their thoughts in the structure, mechanism and regulatory aspect of ETFs. More detailed research and analysis are expected to emerge as the global economy is looking to get stronger and ETFs are expected to play a central role. However Shum (2011) from the Schulich Business School of York University has focused on the performance of the leveraged ETFs during the financial crisis, mainly focusing on the global and American funds. Thus I gained my personal interest to study this field of finance by taking the similar idea and attributes of her paper but studying it across only on North American leveraged ETFs.

1.4 Justification of Study

Although exchange-traded funds have existed for almost two decades, they have only recently drawn the attention of the research community. Cherry (2004), Engle and Sarkar (2006), Kayali (2007) and Madura and Ngo (2008) investigate the differences between ETF prices and their NAV. This paper is also related to the growing academic analysis of the financial crisis 2007/2008. Mizen (2008), Reinhard and Rogoff (2008), Shiller (2008), and Blanchard (2009) provide, for example, a detailed background of the financial crisis, Brunnermeier (2008) and

Allen and Carletti (2008) investigate more closely the liquidity problems originating from the crisis, and Gorton (2008) looks at the complex role of derivatives in the crisis.

An excellent overview is provided by Deville (2007). The first influential papers on ETFs include Gastineau (2001) on early developments of ETFs, and Poterba and Shoven (2002) on ETF taxation. The only paper that investigates and analyzes the performance of ETFs during crises caused by market interruptions and trade suspensions of key ETF constituents is written by Tucker and Sanchez-Marin (2003). To my knowledge, there is very little academic literature that examines the impact of the financial crisis on the exchange-traded fund market and evaluates its performance during that time. My research provides insights on the performance of leveraged ETFs from an investor's perspective during the financial crisis to contribute to the literature of leveraged ETFs. In order to do so, I have decided to decompose the performance into three broad categories; discount/premium affect from its NAV, management expense affect on its performance and the compounding affect.

Moreover in 2009, more than 84% of all participating institutional investors have been investing in equity ETFs, up from 75% in 2008. Similarly, investment in government bond ETFs gained popularity during the financial crisis. In contrast, the financial crisis imposes severe challenges for ETFs in alternative asset classes, especially in the case of hedge fund ETFs, where both usage and

satisfaction levels have dropped sharply within the last 12 months. A significant segment of the ETF market is made up of leveraged funds. As a result I chose to study and investigate this new phenomenon of the financial development to understand their dynamics and performance during the financial crisis.

1.5 Organization of Study

This study is broken down into five distinct chapters: The current chapter has provided a brief review of the research topic and the purpose of the study; Chapter 2 provides a review of the current literature and the subsequent foundation on which this study is built upon; Chapter 3 provides the methodology utilized for this study and Chapter 4 the empirical results and analysis. Finally Chapter 5 will provide a summary of the study and a conclusion.

Chapter 3 will provide a detailed structure of the research which will consist of the reason behind selecting the time period which is from year 2005 to 2010. Moreover, the data will be used to analyze the performance of the ETFs will be retrieved from the public and open internet sources such as Google and Yahoo finance. In addition I will be using ETF database, Morningstar database and Market watch database.

In brief the best way to measure ETFs performance is to measure the tracking error volatility and yearly return in comparison with the benchmark. The most efficient criteria to measure ETFs performance would be the following:

i. Performance relative to the benchmark

ii. Liquidity spread (which measures the size issues)

iii. Tracking error volatility (for actively managed funds)

In an idealistic situation the best performance of an index fund would include the following:

1. Maximizing the outperformance vs the benchmark
2. with a minimal liquidity spread (cost) and
3. the lowest Tracking Error

In this paper I would report which are the ETFs that have successfully followed the above criteria and provided a superior performance. The model to evaluate these performance would to be run an regression with a benchmark (Market Index return) being the independent variable and the ETFs return being the dependent variable to find out the beta coefficient. The correlation coefficient is also a decisive factor to find out the co movement of the ETFs and the market index and thus the R-square of the regression.

To analyze the performance of leveraged ETFs, firstly I have started by providing an overview of the performance of the sample of leveraged ETFs over different holding periods, focusing on their alphas and betas, for the period January 1, 2008 to December 31, 2009 which will be described in chapter 4. The time period is the period that is at the heart of the recent financial crisis era. Moreover the alphas and betas have to have statistical significance over the performance and

thus estimated alphas from the sample that are needed to be close to zero and estimated betas close to 2 for bull ETFs and -2 for bear ETFS. This is because I am analyzing the performance of leveraged ETFs with 2x return than its index or the inverse. Alphas close to zero and betas close to 2 (Bull) and -2 (bear) are statistically significant to conclude that the leveraged ETFs have performed well. Regression analysis will be used to estimate the alphas and the betas by regressing the returns of the leveraged ETFs against the return of its underlying index.

The fund generates returns based on the market prices which investors receive, but in general the returns are based on three broad influential factors that I have underscored before and those are the compounding factors, management and the trading premium/discount factors. Since my sample period covers the time period of the financial crisis, analyzing the performance would provide a good edge to understand the how returns of leveraged ETFs were generated during the financial crisis.

Secondly, I would analyze the deviation of the return from its target return by decomposing each type of leveraged ETFs that I have taken into consideration namely S&P/TSX 60, S&P 500, and S&P/TSX Global Gold Index. Finally, I would analyze the bid-ask spread to stress the market liquidity issues which are widely used by many as a good measurement of liquidity and analyze the intra-day

trading patterns of leveraged ETFs which is proposed by Shum (2011) to analyze the differences of returns between bull and bear leveraged ETFs.

In my studies I found that bear ETFs deviate from their target return much more quickly than that of the bull ETFs as the holding periods extends. From the popular beliefs it is expected that the tracking error (volatility) due to premium/discount trading is high during the financial crisis and the alphas could be mostly negative and can be very large when the holding period varies from small to large number of days respectively, i.e. when the holding period is changed from 1 week holding period to one year holding period respectively.

In this paper I have used the leveraged ETFs that are designed to produce twice the return of the underlying index as “2x bulls” and those designed to produce twice the inverse of the return of the underlying index as “2x bears”. There are leveraged ETFs available which seek 3x bulls or bears but my focus in this paper is only on the 2x bulls and bears variety. the target returns objective are basically set in daily return i.e. the 2x bulls or bears are the target return of a fund on daily basis. Thus there is a compounding affect and the return generated over periods rather than one day will likely differ in amount and possibly direction from the target return for the same period of time. Proshares is an example of fund that replicates twice the return or the inverse of the underlying index for a single day only.

Chapter 2: Literature Review

After the introduction in 1993, Exchange-traded funds (ETFs) have been steadily increasing in popularity and more and more institutional investors are being actively involved in this type of financial product. These investment vehicles can be used to help diversify a portfolio at a low cost or to make tactical investment moves. A good portion of the ETF market is made up of leveraged ETF funds that seek to provide a multiple of the returns on a given index. Leveraged ETFs require the use of financial engineering techniques, including the use of equity swaps, derivatives and rebalancing, and re-indexing to achieve the desired return. There are also many inverse ETFs that aim to go up when the market goes down, and vice versa.

ProShares first introduced the first wave of leveraged ETFs in 2006 named as "Ultra ProShares". It was designed to double (2x) the daily performance of the underlying indexes they track. For example, the ProShares Ultra Dow 30 ETF (DDM) is structured to gain 2% when the Dow Jones Industrial Average gains 1%. Consequently, DDM will lose 2% if the Dow loses 1%.

For leveraged ETFs rebalancing and re-indexing is often considered to be a decisive issue due to its considerable costs when markets are volatile. The rebalancing problem is that the fund manager incurs trading losses and transaction cost because he needs to buy when the index goes up and sell when the index goes down in order to maintain a fixed leverage ratio. The re-indexing

problem of leveraged ETFs arises from the volatility of the underlying index which is often termed as an arithmetic problem by many scholars.

Leveraged ETFS like any other ETFs, generally provide the easy diversification, low expense ratios, and tax efficiency of index funds, while still maintaining all the features of ordinary stock, such as limit orders, short selling, and options. As ETFs can be economically acquired, held, and disposed of, they used as a long-term investment by some investors for asset allocation purposes. On the other hand some investors just follow market timing investment strategies by frequently trading ETF shares.

2.1 Mutual Fund Vs ETFs/leveraged ETFs

It is useful to understand the distinction between mutual funds and exchange traded fund and particularly leveraged exchange traded funds. Like any other ETFs, leveraged ETFs trade on the exchange thus they are subject to brokerage commission in each transaction. Brokerage commission is generally a matter of the type of plan chosen by the customer/investors. For example, a typical flat fee schedule from an online brokerage firm in the United States ranges from $10 to $20 whereas it can be as low as $0 with discount brokers. As a result of the commission charged by the broker, the invested capital has a great bearing, i.e. someone with $100 investment capital will lose significant percentage of capital right way rather than the investor with $1,000,000 of investment capital to whom the brokerage commission is a negligible amount. Contrary to leveraged ETF or

general ETF, mutual funds are obtained directly from the fund company itself. This brokerage fees creates a huge distinction between mutual fund and leveraged ETF because the leveraged ETF become very competitive when low or no cost transactions are available.

ETFs have a lower expense ratio than comparable mutual funds. Not only does an ETF have lower shareholder-related expenses but also ETFs do not need to maintain a cash reserve for redemption as they do not have to invest cash contributions or fund cash redemptions. This is similar to a closed end mutual fund. Moreover, mutual funds can charge 1% to 3% in general or more index fund expense ratios whereas it is as low as 0.1% to 1% range. However, over the long term there could be a significant difference when these transaction costs are included and compound.

The cost difference is more evident when compared with mutual funds that charge a front-end or back-end load as ETFs do not have loads at all. The redemption fee and short-term trading fees are examples of other fees associated with mutual funds that do not exist with ETFs. Traders should be cautious if they plan to trade inverse and leveraged ETFs for short periods of time. Close attention should be paid to transaction costs and daily performance rates as the potential combined compound loss can sometimes go unrecognized and offset potential gains over a longer period of time.

The advantages of the leveraged ETFs are:

- They offer an easy and inexpensive way to use leverage without using options or margin.
- They are available in retirement accounts.
- A good trading tool for short-term traders or investors with a short-term investment horizon.

The disadvantages associated with leveraged ETFs include:

- The long term inaccuracy that can be resulted due to the impact of negative compounding can.
- Very low level of liquidity as scholars argue that many leveraged ETFs trade only on an average of few thousand shares per day.
- Investors' knowledge about leveraged ETF is another disadvantage that hinders investors participation in this indexing product.

Overall, leveraged ETFs are a useful new vehicle for the right strategy and for an investor who performs his or her due diligence.

2.2 Scope of Literature Review

It is important to mention to reaffirm that leveraged ETFs are very new in the financial world and not too many researchers have focused on this side of finance. However with growing popularity in the investment world, leveraged ETFs are becoming one of the 'hot' prospects to talk about by many scholars and researchers and present their share of idea about this indexing product.

There are bundles of research papers being published every year on indexing products such as mutual funds and very few on exchange traded funds (ETFs). But due to the short span of history till today, leveraged ETFs are just in the beginning phase of successful life since 2006. Thus its keeps the door open for many issues to be raised, discussed, developed and changed regarding leveraged ETFs. This could be the beginning of many research papers to be published in the coming years. However, big institutions which cover a big portion of the investors who invest on leveraged ETFs have contributed to the literature of this product, but mainly focusing on their product features and attracting target customers/investors. In addition, few have also focused on different indexing techniques that could apply to create financial products like leveraged ETFs.

In one of the recent studies regarding leveraged ETFs the impact of compounding has been raised (Avellaneda and Zhang, 2009). Cheng and Madhaven (2009), Lu, et al (2009), and Hill and Foster (2009) have all contributed their ideas on the similar issues regarding leveraged ETFs. However at this time, there are no significant contributions in the literature of leveraged ETFs.

Chapter 3: Research Methodology

3.1 Types of exchange traded funds used and their Underlying Indexes

In this paper, as mentioned earlier I have only used the leveraged ETFs that are designed to provide twice the return of the underlying index which we refer as '2x bulls". On the other hand there are funds which provide return inverse of twice the return of the underlying index which we call "2x bears". There are also other types exists in the market such 3x variety which intend to provide a return three times of the return of the underlying index. However these 3x variety of leveraged ETFs are fairly new.

In this paper I have used leveraged ETFs which are based on equity indices. One of them is the based on the Canadian blue chips namely S&P/TSX 60 and it is mainly comprised of 60 of the largest (by market capitalization) and most liquid securities listed on the TSX. The index is selected by S&P using its industrial classifications and guidelines for evaluating issuer capitalization, liquidity and fundamentals. The next index consists of securities of global gold sectors issuers listed on the TSX, NYSE, NASDAQ and AMEX and it is known as S&P/TSX Global Gold index. Both of these indexes are managed by BetaPro in Canada which is by far one of the largest ETF product provider specialized on different industries and geographical location based on different investment needs.

Last but not the least; I have used the US blue chips S&P500 which is managed by ProShare in the US. It is probably the best known index for most of the active

managers who use it as a benchmark. According to S&P, the total assets invested in products indexed to the S&P 500 are nearly about $1 trillion and the figure has increased dramatically as more and more investors have adapted indexing as a investment strategy like mutual funds and exchange traded funds. ETFs account for a growing portion of assets indexed directly to the S&P 500, with the three U.S. listed products seeking to replicate the index maintaining total assets just worth of $135 billion. That figure represents more than 10% of total ETF assets around the world which confirms the importance of S&P 500 exposure as an indexing investment strategy.

3.2 Tickers

The HXU (2x Bull) and the HXD (2x bear) are the tickers that are used for leveraged ETFs which seek daily investment results equal to 200% the daily performance, or inverse daily performance, of the S&P/TSX60 Index before fees and expenses. Both of these funds are managed by Beta Pro.

The HGU (2x Bull) and the HGD (2x bear) are the tickers also managed by BetaPro based on the S&P/TSX Global Gold index. It also seeks daily investment results equal to +/- 200% the daily performance.

The third type of leveraged ETFs have been used which are based on the S&P 500 2x bull and bear and the tickers for these funds are SSO and SDS respectively managed by ProShare from the US.

3.3 Data

Data were collected from Bloomberg and Yahoo finance and the data regarding the NAV of the leveraged ETFs are gathered from BetaPro and ProShares. It is also useful to mention that some index returns are tracked directly from the open source such as Google finance and Yahoo finance. But the majority of the data were gathered from organized data sources like BetaPro and Bloomberg. The NAVs are adjusted to give the exact replication in case of splits or consolidations that might have taken place during my sample period of January 01, 2008 to December 31, 2009. Any dividend distribution or any distributed capital gains are also adjusted accordingly in order to calculate the daily change in the NAV.

3.4 Calculating the net returns and its deviation from the target return

Evaluating ETFs performance has to be broken down into the categories and one of the steps is to find the compounding affect of daily target return over the holding period. Companies that manage exchange traded funds set up target returns on a daily basis, thus it has a compounding effect over the holding period. The compounding affect on cumulative return is a fact that cannot be changed. In order to estimate the compounding affect cumulative return over two days holding period will have a net return on the underlying index like the following

$$(1 + R_t)(1 + R_{t+1}) - 1 = R_t + R_{t+1} + R_t.R_{t+1} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3.1)$$

Now the fund with a target return of “2x bulls” will have a net cumulative return like the following

$$(1 + 2R_t)(1 + 2R_{t+1}) - 1 = 2(R_t + R_{t+1} + R_t.R_{t+1}) + 2.R_t.R_{t+1} \quad \ldots\ldots\ldots\ldots (3.2)$$

From equation (3.1) and (3.2) it is clearly understood that the deviation due to compounding with a perfect replication i.e. the deviation of perfect replication of the index with ‘2x bulls” type would be (2) – 2 x (1) = $2.R_t.R_{t+1}$. Similarly for a 2x bear leveraged ETF would have the net return over a 2 day holding period like the following

$$(1 - 2R_t)(1 - 2R_{t+1}) - 1 = -2(R_t + R_{t+1} + R_t.R_{t+1}) + 6.R_t.R_{t+1} \quad \ldots\ldots\ldots\ldots (3.3)$$

The deviation due to compounding is $6.R_t.R_{t+1}$ for the 2x bear leveraged ETF assuming that the fund has been perfectly replicated of the underlying index. It is very important to realize that the coefficient attached with the returns of the 2x bear ETF is larger than that of the 2x bull ETFs. Mathematically the 2x bear ETF return deviation is three times bigger than the deviation of the return of 2x bulls ETFs. The daily returns would be positive in case of any momentum affect (positive or negative) in daily returns. If the underlying index is trending up, then a 2x bull ETF will generate higher returns than otherwise and a 2x bear ETF will generate a smaller loss than otherwise (Shum, 2011). Moreover a negative autocorrelation between returns in day t and the day t+1 or vice versa would result in a negative deviation. Therefore both the 2x bulls and 2x bears will generate a negative return even if the underlying index breaks even. But in such a case the 2x bears will be three times larger than the 2x bulls due to its compounding affect on net return of $6.R_t.R_{t+1}$ which is 3 times larger than the

compounding affect of net return generated by 2x bulls which is $2.R_t.R_{t+1}$ over the underlying index.

Any residual deviations of return in the actual leveraged ETF from the market returns are likely because of the management style and to the existence of trading premiums/discounts. Firstly, it is not often as easy task for the management to be able to consistently track the target return with perfection because risk such as credit and liquidity risk, counterparty risk, currency risk and so on are also involved in the process which managers need to deal with. Moreover, the fees and expenses are also the factors that should be taken into consideration. Secondly, temporary loss in the market efficiency may cause the leveraged ETF market price to deviate from its net asset value (NAV) which we have observed during the recent financial crisis and liquidity problem in 2008. In such a case the cost of rebalancing the leveraged ETF become more expensive as it requires rebalancing on a daily basis.

3.5 Decomposing the Return Deviation

There are several factors that affect the daily return to deviate from the target return. For instance management of the ETF, trading discount/premium from its NAV. But the deviation can be caused by market liquidity, market efficiency of the ETF and derivative market, cost of leverage rather than just management fees or brokerage fees alone. As we have seen from the previous section, the beta

estimates can deviate from a range of 2 to -2 thus market price prices can differ significantly. The returns over the long holding period would be affected by these factors if they are not random noise or happen to by just chance and cancel each other out. To determine the relative importance of the compounding return and the management factors, I have divided the deviation of the leveraged ETFs from its target return.

The decomposition can be done by considering again a 2 day holding period. For a 2x bulls ETF the deviation on day t due to compounding, D_{CP_t}, can be written as:

$$D_{CP_t} = [(1+2R_t)(1 + 2R_{t-1}) - 1] - 2[(1 + R_t)(1 + R_{t-1}) - 1] \quad \text{..... (3.4)}$$

where, R_t is the underlying index return.

The deviations due to management factors, D_{M_t}, are therefore the residual difference:

$$D_{M_t} = [(1+R_{Bull,NAV,t})(1 + R_{Bull,\ NAV,t-1}) - 1] - [(1 + 2R_t)(1 + 2R_{t-1}) - 1] \quad \text{..... (3.5)}$$

where $R_{Bull,\ NAV,t}$ is the return of the 2x bull ETF's NAV. NAV have been used here instead of market price due to the fact that managers rebalances the portfolio to the fund NAV, but not to the market price. Thus we can also conclude that the standard deviation of D_{M_t}, $\sigma(D_{M_t})$, is ultimately the tracking error due to management.

From Equation (3.4) and (3.5), the net return of holding the 2x bull ETF for 2 days regardless of any trading premium/discount is

$\{(1 + R_{Bull,NAV,t})(1 + R_{Bull,NAV,t-1}) - 1\} = 2[(1+r_t)(1 + r_{t-1}) - 1] + D_{CPt} + D_{Mt}$ …….(3.6)

For 2x bear ETFs. “2” in Equation (3.4) and (3.6) would be replaced by “2”.

The premium, P_t the equation would be as follows:

$$P_t = ET\ F_t - NAV_t \quad \text{.....} \quad (3.7)$$

where, ETF_t is the end-of-day market price and NAV_t is the end-of-day NAV of the leveraged ETF on day t. The leveraged ETF is trading at a discount if the sign of Equation (3.7) is negative.

3.6 Tracking Error

Tracking error is a measure of how closely a portfolio follows the index to which it is benchmarked. The best measure is the root mean square of the difference between the portfolio and index returns. If tracking error is measured historically, it is called 'realized' or 'ex post' tracking error. If a model is used to predict tracking error, it is called 'ex ante' tracking error. Ex-post tracking error is more useful for reporting performance, whereas ex-ante tracking error is generally used by portfolio managers to control risk. In this paper I use the Ex-Post tracking error as my paper tracks the performance of ETFs during the financial crisis and more precisely the period between 2005 -2010.

The ex-post tracking error formula is the root mean square (RMS) of the active returns

$$TE = \omega = \sqrt{\mathrm{E}[(r_p - r_b)^2]} \quad \text{……} \quad (3.8)$$

Where, rp − rb is the active return, i.e., the difference between the portfolio return and the benchmark return.

Nevertheless it is commonly calculated as the standard deviation of the active returns:

$$TE = \omega = \sqrt{\mathrm{Var}(r_p - r_b)} = \sqrt{E[(r_p - r_b)^2] - (E[r_p - r_b])^2} \quad \ldots (3.9)$$

which in case of large portfolio deviations would lessen *TE* significantly and mislead its original meaning.

Tracking error is often cited as one of the most important considerations when selecting an ETF. It measures the quality of index replication, i.e. how well a fund manager replicates the performance of a specific index. Investors typically expect their ETF to adhere tightly to an index. Thus tracking error measurement of ETFs is the central body of this paper to evaluate its performance during the period 2005 – 2010.

It is important to realize that the calculation of tracking error can result in different values depending on a variety of factors which include, but are not limited to:

- The frequency of observations, i.e. whether daily, weekly or monthly data is used
- The day chosen as the starting point for the calculation. For example, when weekly data are used, i.e. whether weekly returns are calculated from Friday to Friday, Monday to Monday, etc., or also whether weekly average data are used

- The time period, i.e. whether tracking error is calculated over one, three or five years, or longer

3.7 The regression and the statistical analysis

In the regression analysis the ETF returns are calculated using the market prices obtained from the data source mentioned earlier. The market price allows us to analyze the ETFs performance from the investor's perspective even though it is very common to see manager rebalancing the portfolio with respect to NAV of the funds they are managing. Any difference between the underlying index and NAV will result in premium/discount which the fund is trading and the investors will compensate or receive the return according to the market price. It is very important to understand that estimating the betas and alphas over the different holding periods of the selected funds will enhance our knowledge about the performance of those funds. Thus the regression analysis will help us to identify three key issues about the ETF performances and those are the following

i) Betas:

It will allow us to test whether the beta coefficients are aligned with the promised/target parameter i.e. for a 2x bull leveraged ETFs, it is expected to have a beta coefficient of +2 and for 2x bears it is expected to have a beta coefficient of -2. But the estimated beta coefficient from the sample will allow us

to see if it deviates from the promised (2 for 2x bull and -2 for 2x bears) beta coefficient and the magnitude of that deviation.

ii) Alphas:

We can also test whether the alphas or “the intercept” of the fund are statistically and economically different from zero.

iii) Coefficient of Determination (R-Square):

It is important for us to identify whether the coefficient of determination or the R-square is statistically significant enough and whether the variation of the underlying index explains the variation of returns of the leveraged exchange traded fund which can be indicated by high R-Square.

Hypothesis:

In order for organized analysis and simplicity I would emphasize and highlight my null (Ho) and alternative (Ha) hypothesis for each type of leveraged ETF and the results will be discussed in the next chapter. As we want to measure the Alpha and the Betas of the exchange traded fund to measure how close it comes to promised or targeted return, thus for each type of fund that I have examined here are the hypothesis

Type of Fund	Alpha	Beta
2x Bull (HXU, HGU, SSO)	Ho = 0 Ha ≠ 0	Ho = 2 Ha ≠ 2
2x Bear (HXD, HGD, SDS)	Ho = 0 Ha ≠ 0	Ho = - 2 Ha ≠ - 2

One of the key things for the regression analysis was to choose different holding periods for the selected funds. I have considered the one and two days. One week (5 trading days), three months (63 trading days) and one year (252 trading days) were chosen for the investment horizon for the performance analysis of the leveraged exchange traded funds. The selection of the investment horizon also brings up a new challenge that is the possibility of potential bias due to the creation of overlapping samples of data. For instance one day and two days return will overlap in a one week holding period returns. Thus to overcome this problem I have utilized Newey-West (1987) standard error to report t statistics. It is often used to correct the effects of correlation in the error terms in regressions applied to time series data.

Chapter 4: Results

I begin with the analysis by providing a brief overview about the performance of the each leveraged ETFs that I have chosen for this paper. First of all, I assess the overall performance of the S&P/TSX 60 2x Bull (ticker: HXU) and 2x bear (ticker: HXD) ETFs and then moving on to the other ETFs like HGU, HGD, SSO and SDS respectively. Appendix A contains the summary statistics, regression analysis and mean deviation from target return.

4.1 Performance overview

HXU and HXD ETFs

Due to the recent market fallout in 2008 we have observed huge negative returns of the S&P/TSX 60 index which resulted in a larger mean of HXD than that of HXU over the sample period of 2008 to 2009. HXD has a positive skewness while the HXU reports a negative skewness and the standard deviation of both ETFs are almost close to each other and almost twice the size of the underlying index in magnitude. As mentioned earlier, the null hypothesis for the betas of 2x bull ETFs are Ho = 2 and for 2x bear ETFs are Ho = -2 and for the alphas Ho = 0. With a holding period of 1-month and 3-month, the betas in Table A-1 report a figure close to 2 for HXU (1.9673 and 1.9324 for 1-month and 3-month respectively) and the null hypothesis cannot be rejected, whereas the HXD ETFs has shown larger deviation over 1-year holding period and resulted in estimated beta coefficient of -1.2234 (see Table A-1). For HXD the null hypothesis cannot be rejected for 1 week and 1 month holding period which is also closest to 2.

Estimating the alphas of these ETFs gives us a clearer idea about its performance as its measures the return of the ETF when their underlying index has zero return across different holding periods. For instance, a 1 year holding period, investors would lose 22% of their investment even when the S&P/TSX 60 has a return of 0% in HXD. However its much smaller across other holding periods, both in HXD and HXU ETFs.

HGU and HGD

For the 2x bull gold ETF (Ticker: HGU), the estimated beta can be rejected for only 1 month and 1 year holding period however, it is rejected for all holding periods for 2x bear Gold ETF (Ticker: HGD). The 2x bear gold ETF has a very small beta (0.0959) coefficient during the 1 year holding period and the estimated alpha (-0.8412) is quite huge representing that the investors will lose 84%, even if the changes return of the index has a return of 0% which is quite surprising. In such a case the gold index has to drop by quite a large margin to provide the break-even to the investors for their invested capital.

SSO and SDS

The beta estimates of the SSO are closest to target of 2 for the 1 month and 3 month holding periods whereas for the SDS, the estimated betas are close to target of -2 for 1 week and 1 month holding period. Both of the ETF show

volatility twice the size of their underlying index of S&P 500 and equally leptokurtic in nature. The SDS alpha estimates are also the smallest in a 1 year time period investment horizon.

4.2 Analysis of Tracking Error

In this section I am going to summarize the compounding $\sigma(D_{CPt})$ and management $\sigma(D_{Mt})$ tracking errors which are basically the standard deviations that I have discussed in Chapter 3. Both tracking errors due to compounding $\sigma(D_{CPt})$ and tracking errors due to management $\sigma(D_{Mt})$ increase along with the length of the holding period. However all the ETF have provided a larger tracking error due to compounding from over the sample period, except SDS. Thus we can clearly conclude that compounding is the not main factor to deviate the daily return from the target return for SDS ETF, but management is as it contributes more deviation (tracking error) than compounding factor. Both of the leveraged ETFs HXU and HXD have a negative mean deviation due to compounding across different holding periods. However the mean deviation due to management could be either positive or negative. For HXU the management factors had a bigger impact whereas the compounding factors have more influence over HXD over the one year holding period.

Among the gold leveraged ETFs, HGD has a positive mean deviation for all of the holding periods. Investors who invested in 2x bear gold ETFs suffered from smaller loss during the bull gold market which is mostly due to management

factors rather than compounding factors. In 2008 the drag due to compounding was large for HGD as the mean deviations were all negative for HGD. Moreover the correlation coefficient was small between the mean deviation due to management factors and compounding factors. For leveraged ETFs, SSO and SDS, the results are similar to other ETFs presented here. Much of the deviation of the target return came from the management factors rather than the compounding factors.

One of the major impacts due to the financial crisis was the problem of liquidity in the market. From my results I found that during 2008, there was increased volatility in premium (P_t). Given the financial turmoil and uncertainty at the time, trading premiums/discounts might have been influenced by market sentiment, similar to the case of closed-end mutual fund discounts (Lee, et al (1991)), and by the drying up of liquidity which caused larger bid-ask spreads.

4.3 Intraday Dynamics

To corroborate the claim that reduced liquidity caused the increase in premium/discount volatility during the financial crisis, I examine the market microstructure of the leveraged ETFs during the crisis period. To be specific, I study the impact of the crisis on the leveraged ETFs' intraday trading patterns. The three intraday variables that I focus on are: Share price volatility (as measured by the standard deviation of transaction prices), trading volume, and the bid-ask spread. To investigate how share price volatility changes throughout

the trading day, I need to estimate it within a fixed time interval. I followed the 15 minute interval as my intraday period in this paper, and construct my variables of interest for each 15-minute interval. Each trading day consists of 26 15-minute intervals starting at 9:30-9:44, and ending at 15:45-15:59.

Due to the large volume of intraday data, studies in this literature typically employ a sample period of one year. In order to explore the impact of the financial crisis on the market microstructure of the leveraged ETFs, I focus on the year 2008. In particular, I divide the intraday data into two subsamples: January 1 to September 14, and September 15 to December 31. The significance of September 15, 2008 is of course the fall of Lehman Brothers, which is widely regarded as the pivotal point of the financial crisis, and the start of the precipitous slide of the global stock market. Due to the lack of access to Canadian intraday data, the two TSX-traded leveraged ETFs are excluded from this analysis.

Overall, for all three intraday variables, they display an approximately U-shape pattern that is found in NYSE-traded stocks and international ETFs (Shum, 2010). The financial crisis has a much bigger impact on the mean intraday share price volatility of the 2x bear ETFs than the 2x bull ETFs showed in Figure A-2 (Panel A). See the Appendix A for the 2x bear ETFs (SDS), the jump in mean volatility is substantial and statistically significant. For the 2x bull ETFs (SSO), however, the slight increases in the middle of the trading day are not statistically significant. That said, both types of ETFs have in common that during the

financial crisis, mean volatility showed a more decisive U-shape pattern, meaning that volatility was the highest at market open and at close.

Panel B in Figure A-2 shows the mean intraday trading volume pattern and the impact of the financial crisis during the regular trading hours. Trading volume was higher across the board, and the differences were significant at the five percent level, except for five 15-minute periods (indicated by the grey bars in the diagram). Interestingly, even though the financial crisis increased the mean intraday share price volatility of the two 2x bull ETFs in a relatively moderate fashion, the impact it had on their mean intraday trading volume is by comparison much more prominent. In other words, a surge in trading volume does not necessarily increase share price volatility.

Panel C in Figure A-2 shows that the mean intraday bid-ask spread pattern before and after the start of the financial crisis. The spread variable is a percentage, and is defined as (Ask-Bid)/Bid * 100%, where Ask and Bid are the average bid and average ask prices over each 15-minute interval on a given trading day. The bid-ask spread is a widely recognized measure of market liquidity, and the larger the spread, the higher the indirect cost of trading for investors. Panel C indicates that prior to the financial crisis, the mean spread was the highest within the first 15 minutes of the highest was between 10:00 and 10:14.

This is the typical pattern observed elsewhere in the stock market. Brock and Kleidon (1992) provides a market power model that explains the simultaneous observation of high trading volume and large bid-ask spreads at market open. They argue that because trading is halted after 4pm, there is an inelastic transaction demand when the market re-opens. Market makers take advantage of this knowledge, and widen the spread. After September 15, 2008, the spreads increased significantly for the rest of the year.

Chapter 5: Conclusion

The popularity of Leveraged ETFs has been astonishing over the last half decades and quickly become the most popular tools for investors who want to hedge their positions. The market of leveraged ETF has reported a steady growth since their introduction in mid 2006 and they reached to the all time high in recent times. However, leveraged ETFs have dealt with some criticism as well such as the investors complaining that the returns were different from their target or expected returns in recent years. Moreover, some brokers in the U.S. have banned their advisors from recommending these products and regulators are calling for better investor education and knowledge regarding these products.

The primary goal of this paper was to study the performance of a sample of equity leveraged ETFs. I have disentangled different components of a fund's returns in order to evaluate the performance, from an investor's perspective. A secondary objective was to examine the impact of the recent financial crisis on the performance and the market microstructure of these funds.

To recap, a leveraged ETF is designed to replicate twice (or thrice) the daily return of its underlying index. If the fund is held for more than one day, then its compounded return will deviate from that of the underlying index, creating tracking errors. However, deviations from target return can also be caused by

management factors, including the manager's ability to deliver the promised returns, expenses, margin costs, counterparty risk (e.g., in the case of swap contracts), currency risk (in the case of foreign indices), and so on. In addition, deviations can also result from trading premiums/discounts. There is a tendency for leveraged ETF managers and the media to blame poor performance on the effects of compounding, and the other two types of deviations have received little attention. In this paper, I attempted to shed light on this issue. I decomposed the returns of a leveraged ETF to investors into these three "buckets", and study the relative importance of each, focusing on the periods before, during, and after the financial crisis.

To summarize the results, I found empirical supports that bear ETFs deviate from their target return much more quickly than their bull counterparts as the holding period lengthens. Contrary to popular belief though, returns to leveraged ETFs can deviate from their target even if investors rebalance on a daily basis. For example, in the case of the EAFE and EM 2x bear ETFs, their respective underlying indices explained only 36 to 40 percent of the variations in their daily returns during the sample period. A likely explanation is the nonsynchronicity in the trading between the ETFs and their respective underlying indices. That said, the impact of nonsynchronicity seems to average out over a week (five trading days), as the explanatory power improves to 70 percent.

In terms of the alphas, which represent the return accrued to investors if the underlying index had a zero percent return, they are all negative, and they typically become statistically significantly different from zero starting at the 1-week holding period. Some alphas can be alarmingly large, particularly when the funds are held for a year.

When I decompose the deviations of the leveraged ETFs from their target return, I found that the tracking error due to management factors can be greater than that due to compounding for certain ETFs. In addition, the mean deviations due to compounding and to management factors in a given year can be positive or negative.

In terms of the time series relationship between the two types of deviations, the correlation coefficients tend to be small or negative overall, suggesting that the two are likely driven by different forces, and do not reinforce each other in dragging down or pulling up the returns of the leveraged ETFs. For most of the funds in the study, the mean deviations due to compounding were the biggest in 2008, the year of the financial crisis. There was a noticeable jump in trading premiums/discounts during the financial crisis, both in terms of magnitude and volatility, likely due to a temporary loss of liquidity and market efficiency over that period.

Last but not least, I find that the financial crisis had an asymmetric impact on the bull versus the bear ETFs' intraday trading patterns. It had a much bigger effect on the intraday share price volatility of the bear ETFs than the bull ETFs, even though the latter experienced a much greater surge in trading volume during the crisis. In terms of the intraday average bid—ask spreads, the results show that most of the leveraged ETFs suffered a significant reduction in liquidity during the financial crisis, explaining the jump in trading premiums/discounts in that period.

In conclusion, because of the unprecedented volatility and the drying up of liquidity in the fall of 2008, the performance of some of the leveraged ETFs studied in this paper was severely impacted. Going forward and barring another major financial crisis, the deviations from target return (for different holding periods) shown in this paper may represent the upper bound. And the trading premiums/discounts, which were shown to be highly volatile during the financial crisis, should return to normalcy.

References

Avellaneda, M and S Zhang. 2009. “Path-Dependence of Leveraged ETF Returns.” Working Paper, Courant Institute of Mathematical Sciences, New York University.

Allen, F. and E. Carletti (2008): The role of liquidity in financial Crises. University of Pennsylvania, working paper.

Agapova, A., 2009, "Innovations in Financial Products: Conventional Mutual Index Funds versus Exchange Traded Funds", *Journal of Financial Markets*, forthcoming.

Brunnermeier, M.K. (2008): Deciphering the Liquidity and Credit Crunch 2007-08. Journal of Economic Perspectives. 23(1), 77–100.

Blitz, D., Huij, J. and Swinkels, L., 2009, "Dividend Withholding Taxes and the Performance of European Index Funds and ETFs", Available at SSRN: http://ssrn.com/abstract=1438484

Brooks, C., 2005, “Introductory econometrics for finance”, Cambridge (UK): Cambridge University Press.

Brock, W. A. and A. W Kleidon. 1992. "Periodic Market Closure and Trading Volume: A Model of Intraday Bids and Asks." Journal of Economic Dynamics and Control, vol.16, pp.451-489.

Bernstein, P.J., 2002, "A primer on exchange-traded funds", *Journal of Accountancy*, pp. 38-41.

BlackRock, 2009, “ETF Landscape – Industry Preview Year End 2009”, available at iShares: http://nl.ishares.com/en/pc/about/etf-landscape

Blake, C.R., Elton, E.J. and Gruber, M.J., 1993, "The Performance of Bond Mutual Funds", *Journal of Business* 66, pp. 371-403.

Blitz, D., Huij, J. and Swinkels, L., 2009, "Dividend Withholding Taxes and the Performance of European Index Funds and ETFs", Available at SSRN: http://ssrn.com/abstract=1438484

Brooks, C., 2005, “Introductory econometrics for finance”, Cambridge (UK): Cambridge University Press.

Barclays Global Investors, 2009, “ETF Landscape – Industry Review October 2009”, available at iShares: http://nl.ishares.com/en/pc/about/etf-landscape

Chan, Kalok, Y. P. Chung, and Herb Johnson. 1995. "The Intraday Behaviour of Bid-Ask Spreads for NYSE Stocks and CBOE Options." Journal of Quantitative and Financial Analysis, September, 329-46.

Cheng, M. and A. Madhaven. 2009. "The Dynamics of Leveraged and Inverse Exchange Traded Funds." Journal of Investment Management, vol.7-4.

Cherry, J. (2004): The Limits of Arbitrage: Evidence from Exchange-Traded Funds. University of California, Berkeley, Working Paper.

Dellva, W.L., 2001, "Exchange-Traded Funds Not for Everyone", *Journal of Financial Planning* 14, pp. 110-24.

Deville, L. (2007): Exchange Traded Funds: History, Trading and Research, Handbook of Financial Engineering, C. Zopounidis, M. Doumpos, and P. Pardalos (eds.), Springer

Elton, E J., M. J. Gruber, George Comer, and Kai Li. 2002. "Spiders: Where are the Bugs?" Journal of Derivatives (Summer), 27-45.

Engle, R and D Sarkar. 2006. "Premiums-Discounts and Exchange Traded Funds" Journal of Derivatives (Fall), vol.13-4: pp. 27-45.

Fleming, M J. and E M. Romolona. 1999. "Price Formation and Liquidity in the U.S. Treasury Market: The Response to Public Information." Journal of Finance, vol.54-5, pp.1901-15.

Gastineau, G.L., 2002, "Chapter 22: Exchange-Traded Funds and Their Competitors", In Frank J. Fabozzi (Ed.), Handbook of Financial Instruments, pp. 531 - 554. Hoboken (NJ): John Wiley & Sons.

Gastineau, G. (2001): Exchange-traded funds: An Introduction. Journal of Portfolio Management 27(3), 88-93

Gorton, G. (2008): The panic of 2007. Yale School of Management and NBER, Working Paper. International Monetary Fund (2008): Global Financial Stability Report, October

Hill, J and G Foster. 2009. "Understanding Returns of Leveraged and Inverse Funds: Examining performance over periods longer than one day." ProFund Advisors LLC White Paper, July 14.

Hill, J and G Foster. 2009. "Understanding Returns of Leveraged and Inverse Funds: Examining performance over periods longer than one day." ProFund Advisors LLC White Paper, July 14.

Kleidon, A. W. and I M. Werner. 1996. "U.K. and U.S. Trading of British Cross-Listed Stocks: An Intraday Analysis of Market Integration." Review of Financial Studies, vol.9-2: 619-64.

Kayali, M.M. (2007): Pricing Efficiency of Exchange Traded Funds in Turkey: Early Evidence from the Dow Jones Istanbul 20. International Research Journal of Finance and Economics 10, 14-23.

Lee, Charles, Andrei Shleifer, and Richard Thaler. "Investor Sentiment and the Closed-End Fund Puzzle." Journal of Finance, vol.46-1, pp.75-109.

Lu, L, J J Wang, and Ge Zhang. 2009. "Long Term Performance of Leveraged ETFs." Available at SSRN: http://ssrn.com/abstract=1344133.

Madura, J. and T. Ngo (2008): Pricing Behavior of Exchange-Traded Funds. Journal of Economics and Finance 32(1), 1-23.

Mizen, P. (2008): The Credit Crunch of 2007-2008: A discussion of the Background, Market Reactions and Responses. Federal Reserve Bank of St. Louis Review 90(5), pp. 531-67.

McInish T. H., and R.A. Wood. 1992. "An Analysis of Intraday Pattern in Bid/Ask Spreads for NYSE Stocks." Journal of Finance, vol.47, pp.345-74.

Newey, W. K. and K. D. West. 1987. "A Simple, Positive Semi-definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix." Econometrica, vol. 55(3), pp.703—708.

Poterba, J.M. and J.B. Shoven (2002): Exchange-Traded Funds: A New Investment Opportunity for Taxable Investors. American Economic Review 92(2), 422-427.

Reinhart, C.M. and K.S. Rogoff (2008): It the 2007 U.S. Sub-Prime Financial Crisis So Different? An International Historical Comparison. NBER working paper 13761.

Shiller, R.J. (2008): The Subprime Solution: How Today's Global Financial Crisis Happened, and What to Do About it. Princeton University Press, New Jersey, USA.

Shum, P. 2010. ""How Passive are International ETFs? A Study of Their Intraday Behaviour" Journal of Index Investing, Vol.1-4, pp.74-84.

Sullivan, R. 2009. "The Pitfalls of Leveraged and Inverse ETFs." CFA Magazine, May/June 2009: 12.

Tucker, J. and P. Sanchez-Marin (2003): Stress Testing ETFs: Will they deliver in Times of Crisis? Institutional investor Guides: ETF and indexing 2, 76-80.

Appendix A

Table A-1: S&P/TSX60, HXU (2x Bull), and HXD (2x Bear)
January 1, 2008 - December 31, 2009

Section A: Summary statistics of the daily returns based on Market Prices

Ticker	Mean	Std Dev	Skewness	Kurtosis	Max	Min
HXU	-0.0002	0.0421	-0.4099	2.2705	0.1476	-0.1860
HXD	0.0000	0.0429	0.3028	2.5164	0.1967	-0.1702
S&P/TSX60	-0.0001	0.0223	-0.2778	3.4393	0.1033	-0.0979

Section B: Regression Analysis Using Returns Based on Market Prices

		Intercept	TSX60	Adjusted R2	
1 day holding period Returns					
HXU		-0.0003	1.8341	0.9675	
		(1.36)	(4.21)		
HXD		0.0000	-1.8614	0.9683	
		(0.12)	(4.37)		
2 day Holding Period Returns					
HXU		-0.0006	1.8998	0.9794	
		(1.99)	(3.91)		
HXD		-0.0002	-1.9169	0.9776	
		(0.89)	2.9892		
1 week Holding Period Returns					
HXU		-0.0014	1.9436	0.9882	
		(2.93)	(2.98)		
HXD		-0.0013	-1.9835	0.9737	
		(1.69)	0.687		
1 Month Holding Period Returns					
HXU		-0.0062	1.9673	0.9907	
		(5.09)	(0.68)		
HXD		-0.011	-1.9311	0.9505	
		(3.56)	1.90		
3 Month Holding Period Returns					
HXU		-0.0098	1.9324	0.9878	
		(3.14)	(1.25)		
HXD		-0.0226	-1.7862	0.9117	
		(2.77)	2.921		
1 year Holding Period Returns					
HXU		-0.0899	1.8413	0.9797	
		(8.03)	(3.72)		
HXD		-0.2212	-1.2234	0.8223	
		(12.68)	8.4626		

Table A-2: S&P/TSX60, HGU (2x Bull), and HGD (2x Bear)
January 1, 2008 - December 31, 2009

Section A: Summary statistics of the daily returns based on Market Prices

Ticker	Mean	Std Dev	Skewness	Kurtosis	Max	Min
HGU	0.0010	0.0736	0.9108	6.0041	0.5010	-0.2461
HGD	-0.0019	0.0750	-0.9585	7.4245	0.2846	-0.5414
S&P/TSX60	0.0008	0.0403	0.7928	6.4977	0.2776	-0.1624

Section B: Regression Analysis Using Returns Based on Market Prices

		Intercept	TSX60	Adjusted R2	
1 day holding period Returns					
HGU		-0.0005	1.7997	0.9702	
		(1.36)	(7.21)		
HGD		-0.0004	-1.8392	0.9771	
		(1.35)	7.66		
2 day Holding Period Returns					
HGU		-0.001	1.8771	0.9833	
		(1.98)	(7.27)		
HGD		-0.0013	-1.8974	0.9763	
		(2.27)	3.7985		
1 week Holding Period Returns					
HGU		-0.0028	1.9328	0.9862	
		(2.81)	(2.82)		
HGD		-0.0054	-1.9124	0.9582	
		(2.84)	2.1215		
1 Month Holding Period Returns					
HGU		-0.0173	1.9519	0.9807	
		(5.43)	(1.01)		
HGD		-0.0476	-1.6483	0.8376	
		(4.88)	3.62		
3 Month Holding Period Returns					
HGU		-0.0659	1.8758	0.9454	
		(7.49)	(2.02)		
HGD		-0.1589	-1.2883	0.6366	
		(7.86)	7.2269		
1 year Holding Period Returns					
HGU		-0.4286	1.9152	0.9454	
		(29.41)	(1.09)		
HGD		-0.8247	-0.0959	0.2101	
		(117.42)	140.01		

Table A-3

Mean Deviations from Target Return Based on NAVs
S&P/TSX60, HXU (2x Bull), and HXD (2x Bear)
January 9, 2007 - December 31, 2009

Panel A: Mean NAV return of HXU, mean deviation due to compounding as a percentage of (the absolute value of) mean return, and mean deviation due to the management process (including fees, the manager's ability to meet the investment objective) as a percentage of (the absolute value of) mean return.

	Mean HXU NAV Returns					Due to Compounding				Due to Management				
	3-month	1-month	1-week	2-day	1-day	3-month	1-month	1-week	2-day	3-month	1-month	1-week	2-day	1-day
2007	0.04703	0.01356	0.00424	0.00193	0.00097	-7.19%	-4.42%	-1.09%	-1.17%	-34.66%	-38.44%	-28.99%	-25.43%	-25.39%
2008	-0.14773	-0.06933	-0.01603	-0.00557	-0.00251	6.07%	-6.19%	-6.55%	-3.76%	-7.71%	-5.67%	-6.06%	-7.00%	-7.80%
2009	0.11395	0.0532	0.01338	0.00488	0.00241	-12.31%	-4.20%	-0.75%	-0.59%	-6.30%	-4.16%	-3.63%	-3.94%	-3.97%
2007-09	0.00069	-0.00116	0.00053	0.00042	0.00029	-405.27%	-208.81%	-75.69%	-20.90%	-1621.03%	-321.02%	-168.28%	-85.58%	-60.80%

Panel B: Mean NAV return of HXD, mean deviation due to compounding as a percentage of (the absolute value of) mean return, and mean deviation due to the management process (including fees, the manager's ability to meet the investment objective) as a percentage of (the absolute value of) mean return.

	Mean HXD NAV Returns					Due to Compounding				Due to Management				
	3-month	1-month	1-week	2-day	1-day	3-month	1-month	1-week	2-day	3-month	1-month	1-week	2-day	1-day
2007	-0.04845	-0.01177	-0.00339	-0.0016	-0.00076	-18.30%	-15.28%	-4.12%	-4.23%	56.02%	79.87%	67.12%	56.92%	60.42%
2008	0.14749	0.04626	0.01214	0.00491	0.0026	-14.27%	-46.71%	-27.48%	-12.76%	15.75%	14.60%	12.05%	11.67%	11.03%
2009	-0.17647	-0.06359	-0.0144	-0.00525	-0.00254	-23.14%	-8.41%	-1.97%	-1.66%	-0.28%	-0.93%	-1.05%	-1.22%	-1.28%
2007-09	-0.0241	-0.00978	-0.0019	-0.00065	-0.00024	-103.87%	-100.36%	-66.27%	-40.08%	64.63%	51.48%	62.06%	72.08%	99.52%

Panel C: Correlation between deviations due to compounding and deviations due to management factors.

	HXU			
	3-month	1-month	1-week	2-day
2007	-0.47055	-0.14633	0.02395	0.04416
2008	0.69939	-0.05526	-0.0448	-0.03951
2009	-0.51255	0.03038	-0.21289	-0.05025
2007-09	0.05154	-0.06473	-0.01223	-0.01637

	HXD			
	3-month	1-month	1-week	2-day
2007	-0.9086	-0.10702	-0.03554	-0.08769
2008	0.21941	0.52175	0.15455	0.02964
2009	-0.72139	-0.18228	0.03747	-0.167
2007-09	0.0821	0.08421	0.03361	0.00105

Table A-4

Mean Deviations from Target Return Based on NAVs
S&P/TSX Global Gold, HGU (2x Bull), and HGD (2x Bear)
July 1, 2007 - December 31, 2009

Panel A: Mean NAV return of HGU, mean deviation due to compounding as a percentage of (the absolute value of) mean return, and mean deviation due to the management process (including fees, the manager's ability to meet the investment objective) as a percentage of (the absolute value of) mean return.

	Mean HGU NAV Returns					Due to Compounding				Due to Management				
	3-month	1-month	1-week	2-day	1-day	3-month	1-month	1-week	2-day	3-month	1-month	1-week	2-day	1-day
2007	0.16739	0.02409	0.00775	0.00424	0.00229	-9.50%	-12.48%	-5.27%	-4.12%	-11.94%	-24.02%	-17.34%	-12.59%	-11.68%
2008	-0.17398	-0.01262	0.0064	0.00352	0.0023	-29.38%	-145.22%	-30.71%	-12.00%	-6.25%	-18.77%	-12.40%	-9.04%	-6.94%
2009	0.19351	0.04122	0.00659	0.0026	0.00135	-34.49%	-26.26%	-17.67%	-5.79%	-2.13%	-5.73%	-7.67%	-7.76%	-7.45%
2007-09	0.02674	0.01593	0.00674	0.00329	0.00192	-202.71%	-79.10%	-19.93%	-8.04%	-33.21%	-18.52%	-11.63%	-9.53%	-8.20%

Panel B: Mean NAV return of HGD, mean deviations due to compounding as a percentage of (the absolute value of) mean return, and mean deviation due to the management process (including fees, the manager's ability to meet the investment objective) as a percentage of (the absolute value of) mean return.

	Mean HGD NAV Returns					Due to Compounding				Due to Management				
	3-month	1-month	1-week	2-day	1-day	3-month	1-month	1-week	2-day	3-month	1-month	1-week	2-day	1-day
2007	-0.20451	-0.03246	-0.00834	-0.0045	-0.00206	-12.47%	-28.93%	-14.92%	-11.64%	11.87%	30.23%	28.89%	21.55%	23.77%
2008	-0.08199	-0.0597	-0.01378	-0.00469	-0.00202	-259.50%	-98.19%	-48.25%	-26.97%	22.92%	11.72%	14.73%	17.67%	21.56%
2009	-0.32148	-0.08348	-0.01199	-0.00347	-0.00149	-17.73%	-34.10%	-29.77%	-13.02%	-0.03%	-0.72%	-1.31%	-1.82%	-2.13%
2007-09	-0.20183	-0.06486	-0.01201	-0.00417	-0.00181	-60.95%	-58.15%	-36.36%	-19.06%	5.45%	6.68%	10.17%	11.99%	14.30%

Panel C: Correlation between deviations due to compounding and deviations due to management factors.

	HGU					HGD			
	3-month	1-month	1-week	2-day		3-month	1-month	1-week	2-day
2007	-0.80056	-0.4969	-0.24152	0.05936	2007	-0.92764	-0.13215	0.1718	0.00522
2008	-0.41364	-0.08756	-0.17801	-0.15537	2008	0.50552	0.12084	-0.17497	-0.21889
2009	-0.19544	0.17225	0.22421	0.06214	2009	0.17187	-0.29724	-0.04982	-0.04144
2007-09	-0.34770	-0.11244	-0.16931	-0.13993	2007-09	-0.03449	-0.00339	-0.16057	-0.20492

Table A-5

Mean Deviations from Target Return Based on NAVs
S&P 500, SSO (2x Bull), and SDS (2x Bear)
July 14, 2006 - December 31, 2009

Panel A: Mean NAV return of SSO, mean deviation due to compounding as a percentage of (the absolute value of) mean return, and mean deviation due to the management process (including fees, the manager's ability to meet the investment objective) as a percentage of (the absolute value of) mean return.

	Mean SSO NAV Returns					Due to Compounding				Due to Management				
	3-month	1-month	1-week	2-day	1-day	3-month	1-month	1-week	2-day	3-month	1-month	1-week	2-day	1-day
2006	0.17954	0.0543	0.01284	0.00516	0.00247	3.13%	0.45%	-0.16%	0.05%	1.89%	1.46%	1.90%	1.99%	1.61%
2007	0.03046	0.00585	0.00157	0.00053	0.0003	-11.29%	-14.62%	-8.37%	-6.59%	-47.04%	-84.99%	-75.56%	-88.55%	-78.05%
2008	-0.21736	-0.08316	-0.01985	-0.00689	-0.00315	1.39%	-5.72%	-6.53%	-2.99%	-4.74%	-4.54%	-4.55%	-5.02%	-5.27%
2009	0.10713	0.04561	0.01161	0.00427	0.00210	-9.39%	-2.79%	-1.11%	-1.49%	-4.30%	-2.70%	-2.24%	-2.53%	-2.59%
2006-09	-0.01268	-0.00323	-0.00028	0.00008	0.00011	-22.52%	-62.25%	-165.08%	-104.15%	-69.67%	-88.36%	-234.86%	-304.79%	-111.14%

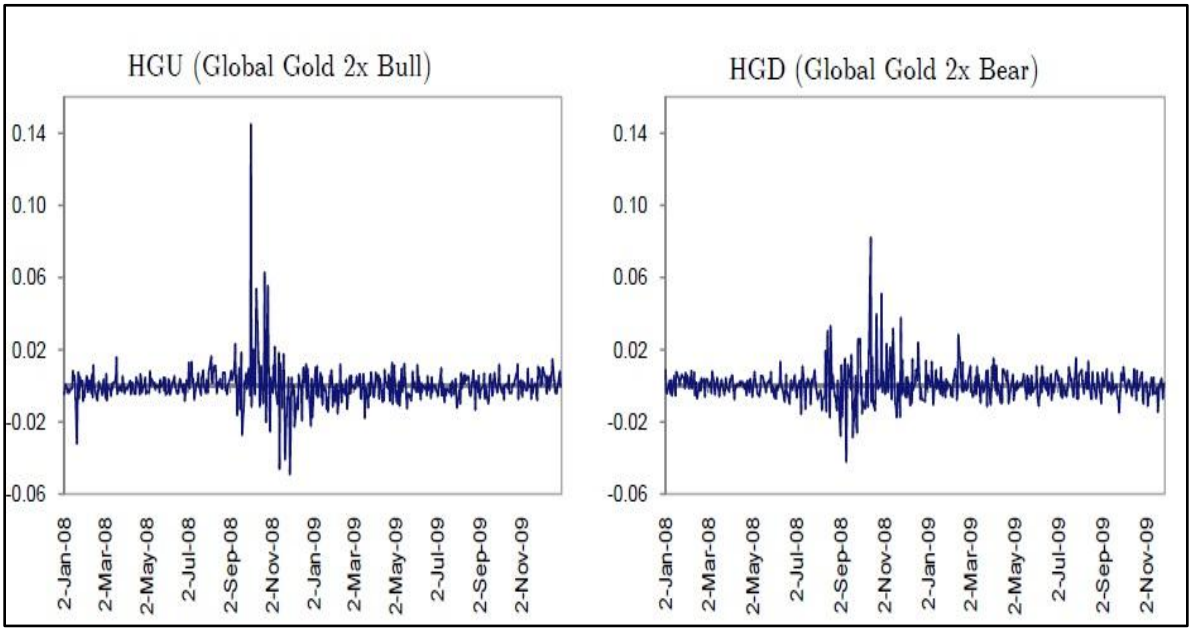
Panel B: Mean NAV return of SDS, mean deviation due to compounding as a percentage of (the absolute value of) mean return, and mean deviation due to the management process (including fees, the manager's ability to meet the investment objective) as a percentage of (the absolute value of) mean return.

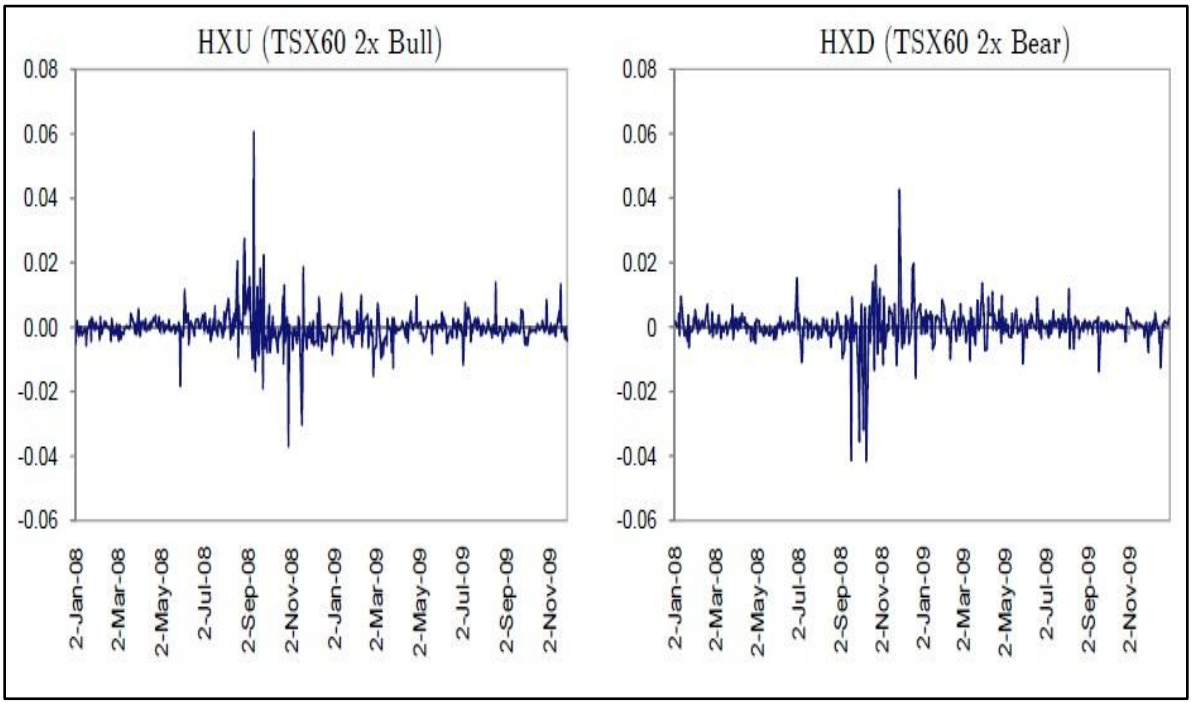
	Mean SDS NAV Returns					Due to Compounding				Due to Management				
	3-month	1-month	1-week	2-day	1-day	3-month	1-month	1-week	2-day	3-month	1-month	1-week	2-day	1-day
2006	0.25123	0.07504	0.01809	0.00728	0.00348	6.35%	1.06%	-0.33%	0.11%	161.53%	169.92%	170.08%	169.32%	169.65%
2007	0.04772	0.01072	0.00277	0.00100	0.00055	-20.48%	-24.78%	-14.18%	-10.48%	221.55%	233.75%	218.18%	213.91%	195.55%
2008	-0.22057	0.0214	0.06598	0.03094	0.01678	-19.87%	-105.38%	-6.06%	-1.95%	-175.38%	-143.36%	79.30%	81.47%	82.20%
2009	0.88560	0.21964	-0.01253	-0.00469	-0.00219	-4.11%	-1.48%	-3.18%	-4.06%	117.86%	123.39%	-1.03%	-1.15%	-1.27%
2006-09	0.23819	0.08291	0.01873	0.00888	0.00485	-11.28%	-10.05%	-7.47%	-2.92%	110.86%	112.02%	111.89%	107.68%	104.88%

Panel C: Correlation between deviations due to compounding and deviations due to management factors.

	SSO					SDS			
	3-month	1-month	1-week	2-day		3-month	1-month	1-week	2-day
2006	0.97176	0.88752	0.48242	0.19984	2006	0.99214	0.92654	0.49305	0.2003
2007	0.77285	0.32758	-0.02506	0.18421	2007	0.78551	0.36601	-0.02912	0.17415
2008	0.28504	-0.07095	-0.04364	-0.07746	2008	-0.00001	-0.08383	-0.0344	-0.0181
2009	0.81026	0.1724	0.14812	-0.06646	2009	-0.46437	-0.15502	-0.16463	-0.13883
2006-09	0.22389	0.07831	0.02061	-0.01236	2006-09	-0.30232	-0.05669	-0.04071	-0.01663

Figure A-1


HGU (Global Gold 2x Bull)
HGD (Global Gold 2x Bear)
0.14
0.10
0.06
0.02
-0.02
-0.06
2-Jan-08
2-Mar-08
2-May-08
2-Jul-08
2-Sep-08
2-Nov-08
2-Jan-09
2-Mar-09
2-May-09
2-Jul-09
2-Sep-09
2-Nov-09


HXU (TSX60 2x Bull)
HXD (TSX60 2x Bear)
0.08
0.06
0.04
0.02
0.00
0
-0.02
-0.04
-0.06
2-Jan-08
2-Mar-08
2-May-08
2-Jul-08
2-Sep-08
2-Nov-08
2-Jan-09
2-Mar-09
2-May-09
2-Jul-09
2-Sep-09
2-Nov-09

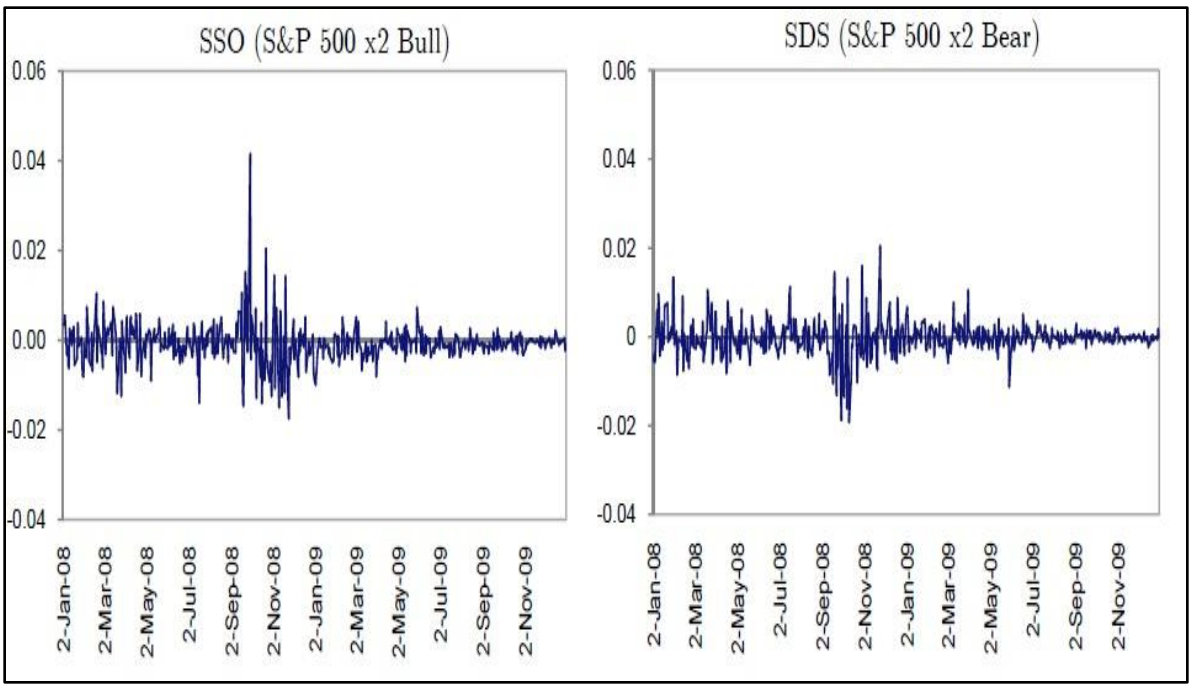
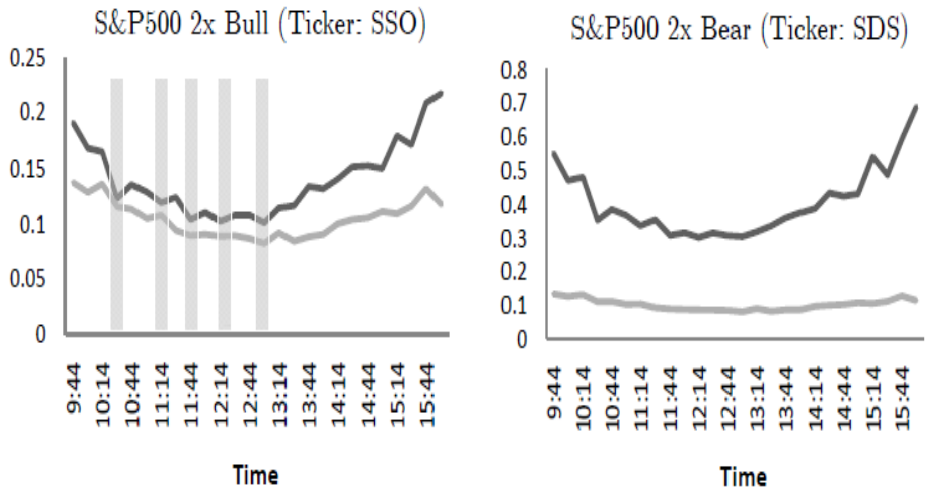
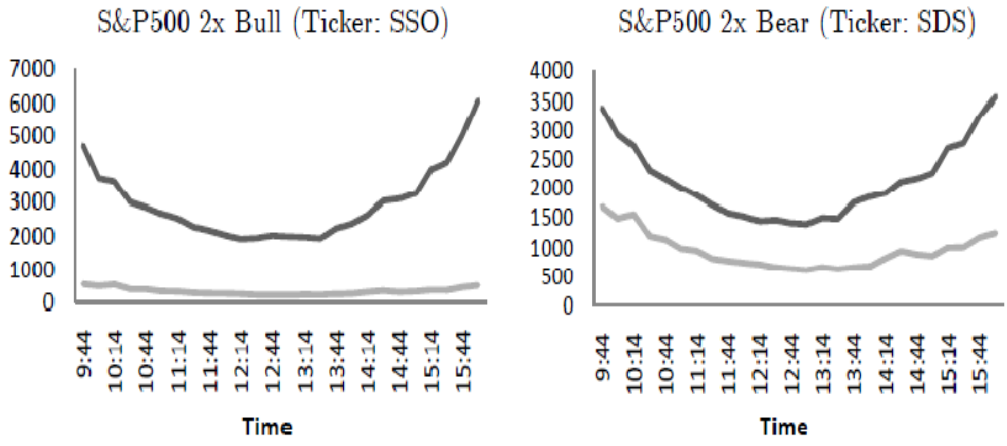

SSO (S&P 500 x2 Bull)
0.06
0.04
0.02
0.00
-0.02
-0.04
2-Jan-08
2-Mar-08
2-May-08
2-Jul-08
2-Sep-08
2-Nov-08
2-Jan-09
2-Mar-09
2-May-09
2-Jul-09
2-Sep-09
2-Nov-09
SDS (S&P 500 x2 Bear)
0.06
0.04
0.02
0
-0.02
-0.04
2-Jan-08
2-Mar-08
2-May-08
2-Jul-08
2-Sep-08
2-Nov-08
2-Jan-09
2-Mar-09
2-May-09
2-Jul-09
2-Sep-09
2-Nov-09

Figure A-2

Panel A: Mean Share Price Standard Deviation
Black line: September 15 to December 31, 2008; Grey line: January 1 to September 14, 2008. Grey bars indicate time intervals when the difference in mean is statistically insignificant at five percent.



Panel B: Mean Trading Volume in thousands
Black line: September 15 to December 31, 2008; Grey line: January 1 to September 14, 2008. Grey bars indicate time intervals when the difference in mean is statistically insignificant at five percent.



Panel C: Mean Percentage Bid-Ask Spread (%)

Black line: September 15 to December 31, 2008; Grey line: January 1 to September 14, 2008. Grey bars indicate time intervals when the difference in mean is statistically insignificant at five percent.