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by

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ABSTRACT

Did Market Quality change with the introduction
of Leveraged ETF's

by

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Leveraged and Inverse Leveraged ETFs were introduced in the summer of 2006 and have been becoming popular ever since. They became extremely popular during the financial crisis of 2008 and that made them the obvious scapegoat taking the blame for the increase in volatility during that period. This paper examines how the S & P 500 market quality defined in terms of liquidity, volatility and efficiency was affected after the introduction of 2x and 3x leveraged and inverse leveraged ETFs. I find that after the introduction of the 2x leveraged and inverse leveraged ETFs, the market volatility decreased while the market liquidity and efficiency improved. After the introduction of the 3x leveraged and inverse leveraged ETFs, the market quality as a whole improved.

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INTRODUCTION

Introduced in 1993, exchange-traded funds (ETFs) value is based on a portfolio of investments, often referred to as a basket which also includes different stocks, but may also contain hard commodities, derivatives or other investments. ETFs trade throughout the day just like a stock and their value will fluctuate throughout the trading session.

Lately specific types of ETFs, Leveraged and inverse ETFs, were introduced to make the life of an ordinary investor less complex. Leveraged ETFs aim to provide a multiple of returns on a given index. Leveraged ETFs provide another tool for investors to access leverage in the financial markets because purchasing an ETF is as simple as issuing a buy order through your trading account, it is a much simpler process for most than using options, futures, and margin. The main problem with Leveraged ETFs is that not everyone fully understands how they really work. Leveraged ETFs often have multiples like 2x (Ultra) or 3x (UltraPro) in their names, which means the ETF aims to deliver two or three times the return on its stated index.

A Leveraged ETF (LETF) does not amplify the annual returns of an index but it follows the daily changes. For example, let's examine a leveraged fund with a 2:1 ratio. This means that each dollar of investor capital used is matched with an additional dollar of invested debt. If one day the underlying index returns 1%, the fund will theoretically return 2%. The 2% return is theoretical, as management fees and transaction costs diminish the full effects of leverage.

Investors use LETFs to hedge their portfolios against upward or downward movements in the market because they feel that index or commodity will either do well or poorly in the short term. Due to their structure, leveraged ETFs conduct most of their trading during that last hour because they need to rebalance by day's end, whereas traditional ETFs buy and sell stocks throughout the day and don't do a rebalance daily. Leveraged ETFs are riskier than traditional ETFs, using derivatives or swap contracts, and taking advantage of put (the right to sell) and call (the right to buy) options, rather than trading the underlying stocks.

As a result of the financial crisis of 2008, there was a huge surge in the popularity of LETFs in late 2008. In mid-October 2011, the Senate held a hearing to determine whether these Leveraged ETFs were the main cause for market volatility. The rebalance moves in the same direction as the market does and creates additional pressure at market close and the paper[1] from the US Federal Reserve asserts it is plausible that, during periods of high volatility, their impact in response to a large market move could reach a tipping point for a chain reaction of events that could trigger another market crash. But nothing of that sort has happened yet with LETFs being the cause.

There has also been counter arguments that state that these ETFs only account for a small portion of the overall market and so any claims that they drive up volatility should be dismissed since no concrete evidence has shown that LETFs are the root cause of market volatility. In the event that trading in LETFs does lead to less liquidity, excessive volatility, and inefficiently priced shares, then policy makers need to take a look at the impact of such financial innovations and re-think whether the externalities they impose outweigh the benefits to their investors.

In this paper, I focus on the dates that the 2x Leveraged ETFs, 2x Inverse Leveraged ETFs, 3x Leveraged and Inverse Leveraged ETFs were introduced and conduct regression analysis on a year prior and after these dates. I split the market quality into Liquidity defined by Spread and Illiquidity, Volatility defined by Price and Garch Volatility, and Efficiency defined by the Price Delay variables. All these variables have been explained in the Data section of this paper.

[1] Tugkan Tuzun, 2013. Are Leveraged and Inverse ETFs the New Portfolio Insurers? Federal Reserve Board 2013-48.

I find that in the case of the period after the introduction of the 2x Leveraged and Inverse Leveraged ETFs, even though the latter was introduced roughly 3 weeks later, both price and garch volatility had decreased while the spread and illiquidity had gone up. Informational efficiency given by the component price delay is not statistically significant, which goes to show that the efficiency did not change or remains pretty much the same. So, contrary to popular belief's that there has been an increase in the volatility after the introduction of the leveraged ETFs, I find that is not the case. Since liquidity and informational efficiency are important components of market quality, my findings suggest that the underlying stocks had become less liquid with no change in efficiency. But, we have to bear in mind that LETFs have gone a long way since they were introduced in 2006 and 3 years later in 2009, 3x LETFs were introduced. So, for the period after they were introduced, I find that liquidity, volatility, and efficiency has all improved which suggests that the market has become more liquid, less volatile and more efficient thereby improving market quality.

DATA

For my analysis, I obtain the daily stock information from Center for Research on Security Prices(CRSP) of all the stocks in the S&P 500 for 2 years, one year prior to June 21, 2006 and one year after the same date for the 2x Leveraged ETFs. For the 2x Inverse Leveraged ETFs, I got the daily stock information for all the same stocks one year prior to July 13, 2006 and one year after the same date. For the 3x Leveraged and Inverse Leveraged ETFs, the daily stock information was picked for one year prior to June 25, 2009 and one year after. So, two different datasets are used and each one has around approximately 250,000 observations. The following variables are the ones chosen to be used in the model.

Spread - The spread that I use is called the proportional spread. The proportional spread is used to give an idea of the average round-trip transaction compensation to dealers. The proportional spread is higher as liquidity decreases to compensate the dealer for the additional risk of creating a market in an illiquid security. The proportional spread is calculated as the difference between closing ask and bid prices divided by the average price of the bid and ask.

$$Spread = \frac{(Ask - Bid)}{(Ask + Bid)/2}$$

Illiquidity - The more illiquid a stock is, the more difficult it is to sell it on the market without taking a substantial loss to its value. Amihud(2002) calculates the illiquidity as the ratio of the absolute returns and the volume of shares traded.

$$Illiquidity = \frac{abs(RET)}{VOL} * 100000$$

Price Volatility - is the degree of variation in the stock price in both directions. It is given by

$$PriceVolatility = \frac{(ASKHI - BIDLO)}{(ASKHI)}$$

where ASKHI is the highest trading price during the day and BIDLO is the lowest trading price during the day.

Garch Volatility - The Generalized Auto-Regressive Conditional Heteroscedastic (GARCH 1,1) estimate of volatility incorporates a technique called mean reversion. Mean reversion is the process of limiting the influence of larger fluctuations that could have significant effects on the mean. This results in volatility estimates that pull variance closer to the long-run average. The technical term for this limiting influence is persistence. This technique effectively produces more realistic estimates of volatility than any other method. The Garch(1,1) model can be written as follows:

$$\sigma_t^2 = \gamma V_L + \alpha U_{t-1}^2 + \beta \sigma_{t-1}^2$$

Taking the square root will give me the long-run standard deviation(Garch Volatility) from the GARCH(1,1) model.

Price Delay - is a measure that captures the average delay with which a firm's stock price responds to information. Hou and Moskowitz(2005) calculated the price delay using 2 regressions. For the first regression, weekly stock returns are regressed on market returns and for the second regression weekly stock returns are regressed on market returns as well as lagged returns for the previous 4 weeks.

Restricted Model is

$$R_{i,t} = \alpha + \beta_1 R_{m,t} + \varepsilon_{i,t}$$

Un-restricted Model is

$$R_{i,t} = \alpha + \beta_1 R_{m,t} + \beta_2 R_{m,t-1} + \beta_3 R_{m,t-2} + \beta_4 R_{m,t-3} + \beta_5 R_{m,t-4} + \varepsilon_{i,t}$$

The R^2 is taken from both the models and the Price Delay is calculated as follows:

$$Delay = \frac{R_U^2 - R_R^2}{R_U^2}$$

Market Cap - The total dollar market value of all of a company's outstanding shares.

Price - is the Firm's closing stock price for the day.

Return - is the change in the total value of an investment in a common stock over some period of time per dollar of initial investment. RET(I) is the return for a sale on day I.

Turnover - The number of shares of stock sold on the market and is given by the ratio of the volume of shares traded and the number of total shares outstanding.

$$Turnover = \frac{VOL}{SHROUT} * 100$$

After - is a dummy variable that is equal to 1 for the post introduction period and 0 for all the dates prior to June 21,2006 and June 25,2009.

From Table 1, Panel A provides the summary statistics for the data used for the 1 year before and after the introductory date of 2x Leveraged and Inverse Leveraged ETFs. The mean estimate for spread is 0.00104 which indicates high liquidity, the mean for illiquidity is 0.02192 while the price delay mean is 0.21992. The mean for the price volatility and garch volatility are very close at 0.01975 and 0.01513 respectively.

Panel A also shows that the average price is $46.44 and the market capitalization of nearly $24.17 billion. Mean turnover is 0.85 which suggests that all shares outstanding turn over about 0.85 times daily and the mean holding period return of 0.01069.

Panel B provides the summary statistics for the data used for the 1 year before and after the introductory date of 3x Leveraged and Inverse Leveraged ETFs. The mean estimate for spread is 0.00147 which indicates high liquidity but not as high compared to Panel A, the mean for illiquidity is 0.0349 which tells us that stocks were less liquid compared to Panel A, while the price delay mean is 0.0734 which indicates that informational efficiency was better around 2009. The mean for the price volatility and garch volatility are at 0.04191 and 0.03273 respectively. Panel B also shows that the average price is $37.64 which is a lot lower than in Panel A and the market capitalization of nearly $18.34 billion is also lower mainly due to the financial crisis. Mean turnover is 1.63 which suggests that all shares outstanding turn over about 1.63 times daily and the mean holding period return is 0.02444. We can also notice that the Spread has a negative minimum for both Panel A and Panel B. This is defined as a cross market condition and it mainly occurs with volatile and high volume trading.

Table 2 reports the estimated Pearson correlated coefficients. In Panel A, Spread and illiquidity seems to be slightly positively correlated and the same goes for price and garch volatility. There seems to be pretty much no correlation between the price and spread, illiquidity, price volatility, garch volatility and delay. In Panel C, theory would suggest returns to be strongly negatively correlated with price and garch volatility but it seems like returns is highly positively correlated which is not true since when volatility increases, risk increases and returns would decrease. There seems to be a lot of non-correlation between the variables which is hard to explain and it could be due to everything being in weekly basis.

CONCEPT

A. *The Model*

The Underlying Index chosen is the S&P 500 which is based on the market capitalizations of 500 large companies who have their common stock listed in the NYSE or NASDAQ.

The components of market are Volatility, Liquidity and Efficiency. Volatility refers to the amount of uncertainty or risk about the size of changes in a security's value and is comprised of Price Volatility & Garch Volatility (Refer to page 5). Liquidity is an asset's ability to be sold without causing a significant movement in the price and with minimum loss of value and is comprised of Spread & Illiquidity (Refer to page 4).The degree to which stock prices reflect all available, relevant information is called Efficiency and it is comprised of Price Delay (Refer to page 5). The Market Quality can be written as a function of different variables as chosen and described in the data section above and how they change in the period after the introduction of the leveraged ETFs.

$$MarketQuality_{i,t} = f(X, PostIntroPeriod) \tag{3.1}$$

where X is firm variables like Market Cap, Price and Turnover as mentioned in the data section above.

B. *Hypothesis*

My null hypothesis is that the market quality did improve with the introduction of leveraged ETFs. The expectations were that it would help reduce volatility and increase liquidity but we shall see if it ends up being like that or not.

RESULTS

A. *After the introduction of 2x Leveraged ETFs*

Multivariate regressions with Spread, Illiquidity, Price volatility, Garch volatility and the Delay as the dependent variables and the natural log of the market cap, natural log of the price, turnover and the dummy variable After as the independent variable were estimated and the results are shown in Table 3. I am mainly interested in the coefficient estimate for the After variable since After = 1 focuses on the post introduction period and it will give a clear picture if the value of those variables went up or down resulting in a better or worse market quality.

In regression 1, there is an associated increase in the spread which is statistically significant by 0.4 basis points which even though is a small increase, it is still an increase. Greater spreads mean less liquid stocks, so this is not good for market liquidity. In regression 2, the associated increase in the illiquidity measure which is statistically significant only at the 5% level is almost 61 basis points after the introduction of leveraged ETFs which tells us that the stocks have become a lot more less liquid and this contributes to a negative improvement in market liquidity. Both the liquidity variables increased showing more illiquidity in the market.

Price volatility and Garch volatility are both statistically significant. From regression 3, it is interesting to see that the associated decrease in Price volatility by around 12 basis points. From regression 4, the Garch volatility also decreased by 4 basis points. So both the volatility variables decreased showing a slight improvement in the market volatility. Finally looking at Delay from regression 5, we see that it is associated with an increase by 27.5 basis points which tells us that the market wide informational efficiency decreased in the post introduction period.

I did estimate all of the regressions above using white's test for heteroskedasticity and the results very similar that there was no significant change in the coefficient estimates compared to the ones mentioned above.

i. Robustness

As a measure of Robustness, the above mentioned regressions are run with the volatility variables added as independent variables for the liquidity dependent variables and vice-versa. For the Delay regression, both the volatility and the liquidity variables were added as independent variables to see if the coefficients are robust and if there is any difference from the values estimated above.

From Table 4, in regression 1, the post introduction period is correlated with a 1.0 basis point increase in the Spread compared to the non-robust case. This does decrease market liquidity. Spread is statistically significant. In regression 2, there is an associated increase in the Illiquidity by 48 basis points which is less than the non-robust case by 13 basis points but it is not significant at all. So, there is no change in the illiquidity. so, overall market liquidity did not improve.

From regression 3, the associated price volatility decrease by 12.4 basis points is pretty much on par with the previous case and so the market volatility did improve post introduction period. From regression 4, the Garch volatility is exactly the same as before and so overall the market volatility did improve. Both Price and Garch volatility's are statistically significant.

From regression 5, The post introduction period is correlated with an increase in the Delay by almost 12 basis points but being statistically insignificant, I have failed to reject the null, therefore the delay coefficient estimate is zero. Therefore, the market efficiency does not change and is pretty much the same.

The results above suggest that even though the market volatility did improve and the informational efficiency did not change, the market liquidity because of the higher spread did not improve which leads to an overall decrease in market quality.

B. *After the introduction of 2x Inverse Leveraged ETFs*

From Table 5, the regression results are very similar to the one done above with all the variables being statistically significant in this case. In regression 1, there is an associated increase in the spread by 0.78 basis points which is not good for market liquidity. In regression 2, the associated increase in the illiquidity measure is almost 76 basis points after the introduction of leveraged ETFs which tells us that the stocks have become a lot more illiquid. Both the liquidity variables increased showing less liquidity in the market.

From regression 3, the associated decrease in Price volatility by around 13 basis points. From regression 4, the Garch volatility also decreased by 4.6 basis points. So both the volatility variables decreased showing a slight improvement in the market volatility. Finally looking at Delay from regression 5, we see that it is associated with an increase by 28 basis points which tells us that the market wide informational efficiency decreased in the post introduction period.

i. *Robustness*

From Table 6, in regression 1, the post introduction period is correlated with an almost 2 basis point increase in the Spread and this does decrease market liquidity. Spread is statistically significant whereas illiquidity is only significant at the 5% level. In regression 2, there is an associated increase in the Illiquidity by 63 basis points which is less than the non-robust case by 13 basis points, therefore, overall market liquidity did not improve.

From regression 3, the associated price volatility decrease by 13 basis points is pretty much on par with the previous case and so the market volatility did improve post introduction period. From regression 4, the Garch volatility is exactly the same as before and so overall the market volatility did improve. Both Price and Garch volatility's are statistically significant.

From regression 5, The post introduction period is correlated with an increase in the Delay by almost 11 basis points but being statistically insignificant, I have failed to reject the null, therefore the delay coefficient estimate is zero. Therefore, the market efficiency does not change and is pretty much the same.

The results above suggest that even though the market volatility and liquidity did improve, the informational efficiency did not change. But since volatility and liquidity are important components to market quality, my findings suggest that after the introduction of inverse leveraged ETFs overall market quality did improve.

C. After the introduction of 3x Leveraged and Inverse Leveraged ETFs

From Table 7, we can notice that all the variables are statistically significant. In regression 1, there is an associated decrease in the spread by 11.3 basis points which is very good for market liquidity. In regression 2, the associated decrease in the illiquidity measure is almost 78 basis points after the introduction of leveraged ETFs which tells us that the stocks have become a lot less illiquid. Both the liquidity variables decreased showing more liquidity in the market.

From regression 3, the associated decrease in Price volatility by around 246 basis points which is huge compared to the previous two cases. From regression 4, the Garch volatility also decreased by 171 basis points. So both the volatility variables decreased showing a huge improvement in the market volatility. Finally looking at Delay from regression 5, we see that it is associated with an increase by 11 basis points which tells us that the market-wide informational efficiency decreased in the post introduction period.

i. Robustness

From Table 8, in regression 1, the post introduction period is correlated with an almost 3 basis point decrease in the Spread and this does increase market liquidity. Both spread and illiquidty are statistically significant. In regression 2, there is an associated decrease in the Illiquidity by almost 250 basis points which is more than the non-robust case by 172 basis points, a huge increase which improves market liquidity.

From regression 3, the associated price volatility decrease by 240 basis points is pretty much close to the non-robust case and so the market volatility did improve post introduction period. From regression 4, the associated Garch volatility decrease by 168 basis points is also close to the non-robust case, so overall the market volatility did improve. Both Price and Garch volatility's are statistically significant. From regression 5, The post introduction period is correlated with an decrease in the Delay by almost 7 basis points and it is statistically significant at the 5% level only.

The results above suggest that market liquidity, volatility and informational efficiency did get better after the 3x Leveraged and inverse Leveraged ETFs were introduced. However, this could be due to market quality improvements as financial markets stabilized after the recent crisis. Perhaps conducting additional tests that examine the relation between my market quality measures and LETF trading volume during the post-introduction period might be a fruitful area for future research.

CONCLUSIONS

Whenever there seems to be an increase in volatility in the market, the fed's mostly blame the leveraged and inverse leveraged ETFs as the main cause due to high volumes of these ETFs being traded. Since the leveraged ETFs market is very small compared to the entire market, they cannot be the main cause for volatility.

But contrary to the Feds prediction, volatility actually decreased after 2x leveraged and inverse Leveraged ETFs were introduced. However, given that informational efficiency and liquidity are also important components of market quality, my findings suggest that underlying stocks became less liquid, less volatile with no change in efficiency. And after the introduction of the 3x Leveraged and inverse Leveraged ETFs, my findings suggest that the underlying stocks became more liquid, less volatile and more information efficient. That could also be due to the fact by 2009, investors had a better understanding of how these leveraged ETFs worked and were able to make use them more efficiently in their portfolio.

Therefore, I can conclude that the introduction of 2x Leveraged and inverse Leveraged ETFs did not improve market quality but the introduction of the 3x Leveraged and inverse Leveraged ETFs did improve the market quality.

Further research idea would be to look at individual ETF's and see how they performed on a daily basis to analyze if they did improve the quality of the market or not from a long term perspective.

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Table 1: Summary Statistics

Panel A shows the summary statistics from the data obtained between June 21, 2005 and June 21,2007. Panel B shows the summary statistics from the data obtained between June 25, 2008 and June 25,2010. From CRSP I obtain prices (price), market capitalization (Market Cap), share turnover (turnover), daily closing bidask spreads (spread) and returns (return). I estimate a GARCH(1,1) model and obtain daily estimates of volatility (Garch-volt). Illiquidity (illiquidity) is the ratio of the absolute returns and the volume of shares traded. Price Delay (delay) is a measure that captures the average delay with which a firm's stock price responds to information.

Variable	**Mean**	**Median**	**Standard Deviation**	**Minimum**	**Maximum**
	1	**2**	**3**	**4**	**5**
Panel A.					
Spread	0.0010396	0.0004607	0.039543	-0.0158550	0.3782498
Illiquidity	0.0219217	0.0003698	0.6068273	0	150.1500
Price Volatility	0.0197545	0.0169661	0.0120428	0	0.3836155
Garch Volatility	0.0151348	0.0138639	0.0061642	0.00086455	0.3152031
Price Delay	0.2199253	0.1665100	0.1908500	0.0052923	0.9923796
Market Cap	24178764	11872421	41605759	8157.240	48648919
Turnover	0.8547991	0.5906490	0.9732212	0	69.038847
Price	46.440343	42.380000	29.929909	0.520000	518.84003
Return	0.0106946	0.0075680	0.0119005	0	0.5469310
Panel B.					
Spread	0.0014716	0.0005759	0.0061845	-0.0313480	1.2553408
Illiquidity	0.0349084	0.0003970	0.6924939	0	70.815500
Price Volatility	0.0419088	0.0320584	0.0338665	0	0.9999977
Garch Volatility	0.0327349	0.0266790	0.0223611	0.0018047	0.4641155
Price Delay	0.0734261	0.0507266	0.0748996	0.0012811	0.9367487
Market Cap	18342453	7848047	33455130	3667.160	46681436
Turnover	1.6287141	1.1820626	1.8081984	0	110.72648
Price	37.641963	30.500000	39.668684	0.140000	656.00000
Return	0.0244412	0.0152160	0.0300833	0	1.0235780

Table 2: Pearson Correlation Coefficients

Panel A shows the summary statistics from the data obtained between June 21, 2005 and June 21,2007. Panel B only shows the correlation of the dummy variable After with all the other variables around July 13, 2006 since the data used is the same as Panel A . Panel C shows the summary statistics from the data obtained between June 25, 2008 and June 25,2010. From CRSP I obtain prices (price), market capitalization (MktCap), share turnover (turn), daily closing bidask spreads (spread) and returns (returns). I estimate a GARCH(1,1) model and obtain daily estimates of volatility (Garchvolt). Price Volatility(Prcvolt) is the degree of variation in the stock price. Illiquidity (illiq) is the ratio of the absolute returns and the volume of shares traded. Price Delay (delay) is a measure that captures the average delay with which a firm's stock price responds to information. After is a dummy variable that signifies the date on which the leveraged ETFs were introduced.

	Spread 1	**Illiq 2**	**Prcvolt 3**	**Garchvolt 4**	**Delay 5**	**Mktcap 6**	**Turn 7**	**Price 8**	**Returns 9**	**After 10**
Panel A.										
Spread	1.00000	0.30128	0.18786	0.18533	0.18725	-0.07354	-0.06417	-0.09189	0.07327	-0.01807
Illiq	0.30128	1.00000	-0.02558	0.03471	0.09262	-0.02049	-0.03054	-0.01732	0.03639	-0.00261
Prcvolt	0.18786	-0.02558	1.00000	0.49012	0.03552	-0.10848	0.47639	-0.11671	0.67948	-0.02760
Garchvolt	0.18533	0.03471	0.49012	1.00000	0.13506	-0.19673	0.42159	-0.14010	0.30407	-0.02314
Delay	0.18725	0.09262	0.03552	0.13506	1.00000	-0.14177	0.04219	-0.11086	0.02546	-0.00307
Mktcap	-0.07354	-0.02049	-0.10848	-0.19673	-0.14177	1.00000	-0.11255	0.13875	-0.06356	0.03076
Turn	-0.06417	-0.03054	0.47639	0.42159	0.04219	-0.11255	1.00000	0.05351	0.47340	0.07153
Price	-0.09189	-0.01732	-0.11671	-0.14010	-0.11086	0.13875	0.05351	1.00000	-0.04950	0.03921
Returns	0.07327	0.03639	0.67948	0.30407	0.02546	-0.06356	0.47340	-0.04950	1.00000	-0.02204
After	-0.01807	-0.00261	-0.02760	-0.02314	-0.00307	0.03076	0.07153	0.03921	-0.02204	1.00000
Panel B.										
After	-0.01540	-0.00172	-0.02900	-0.02644	-0.00341	0.03227	0.07758	0.04397	-0.02581	1.00000
Panel C.										
Spread	1.00000	0.26054	0.17132	0.18765	0.21534	-0.06046	-0.00875	-0.05857	0.13911	-0.11316
Illiq	0.26054	1.00000	-0.02784	0.00840	0.14224	-0.02706	-0.04417	-0.01699	0.02217	-0.00970
Prcvolt	0.17132	-0.02784	1.00000	0.70556	-0.00804	-0.13068	0.44071	-0.16232	0.72679	-0.42459
garchvolt	0.18765	0.00840	0.70556	1.00000	0.01614	-0.15603	0.38934	-0.19330	0.51471	-0.44828
delay	0.21534	0.14224	-0.00804	0.01614	1.00000	-0.08155	-0.01761	-0.01676	-0.00850	-0.00295
Mktcap	-0.06046	-0.02706	-0.13068	-0.15603	-0.08155	1.00000	-0.13350	0.20844	-0.08829	0.03721
Turn	-0.00875	-0.04417	0.44071	0.38934	-0.01761	-0.13350	1.00000	-0.07797	0.38512	-0.09533
Price	-0.05857	-0.01699	-0.16232	-0.19330	-0.01676	0.20844	-0.07797	1.00000	-0.11213	0.07191
Returns	0.13911	0.02217	0.72679	0.51471	-0.00850	-0.08829	0.38512	-0.11213	1.00000	-0.29527
After	-0.11316	-0.00970	-0.42459	-0.44828	-0.00295	0.03721	-0.09533	0.07191	-0.29527	1.00000

Table 3: Regression Analysis for 2x Leveraged ETFs

This table reports the results from estimating the following equation, $DepVar = \alpha + \beta_1 ln(Mktcap) + \beta_2 ln(Price) + \beta_3 Turn + \beta_4 After + \varepsilon$. The dependent variables are: Spread (regression 1), Illiquidity (regression 2), Pricevolt (regression 3), Garchvolt (regression 4) and Delay (regression 5). The control variables are the natural log of Market Capitalization(MktCap), natural log of Price which is the firm's closing stock price for the day, turnover is the ratio of the volume of shares traded and the number of total shares outstanding. After is a dummy variable representing the 21 June, 2006, the day of the introduction of Leveraged ETFs. P-values are reported in parentheses.

	Spread	*Illiquidity*	*Pricevolt*	*Garchvolt*	*Delay*
	1	**2**	**3**	**4**	**5**
Intercept	0.02694	1.45509	0.04035	0.04406	1.10846
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
Ln(MktCap)	-0.00103	-0.06394	-0.000529	-0.000996	-0.03646
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
Ln(Price)	-0.000467	0.01897	-0.00345	-0.00212	-0.01312
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
Turnover	-0.000394	-0.02680	0.00579	0.00252	0.00364
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
After	0.000044	0.00607	-0.00122	-0.00041153	0.00275
	(0.0057)**	(0.0198)*	(0.000)**	(0.000)**	(0.000)**

* significant at 5%; ** significant at 1%

Table 4: Measure of Robustness for 2x Leveraged ETF's

This table reports the results from estimating the following equation, $DepVar = \alpha + \beta_1 Spread + \beta_2 Illiquidity + \beta_3 Prcvolt + \beta_4 Garchvolt + \beta_5 ln(Mktcap) + \beta_6 ln(Price) + \beta_7 Turn + \beta_8 After + \varepsilon$. The dependent variables are: Spread (regression 1), Illiquidity (regression 2), Pricevolt (regression 3), Garchvolt (regression 4) and Delay (regression 5). The control variables are the natural log of Market Capitalization(MktCap), natural log of Price which is the firm's closing stock price for the day, turnover is the ratio of the volume of shares traded and the number of total shares outstanding. After is a dummy variable representing the 21 June, 2006, the day of the introduction of Leveraged ETF's. The Spread is calculated as the difference between closing ask and bid prices divided by the average price of the bid and ask. I estimate a GARCH(1,1) model and obtain daily estimates of volatility (Garchvolt). Price Volatility(Prcvolt) is the degree of variation in the stock price. Illiquidity (illiq) is the ratio of the absolute returns and the volume of shares traded. P-values are reported in parentheses.

	Spread **1**	*Illiquidity* **2**	*Prcvolt* **3**	*Garchvolt* **4**	*Delay* **5**
Intercept	0.02229	1.37836	0.02908	0.03798	0.86435
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
Spread			0.46376	0.31391	-1.17363
			(0.000)**	(0.000)**	(0.000)**
Illiquidity			-0.00108	-0.000296	1.86227
			(0.000)**	(0.000)**	(0.000)**
Prcvolt	0.06433	-2.14751			4.56777
	(0.000)**	(0.000)**			(0.000)**
Garchvolt	0.04627	3.54161			0.01593
	(0.000)**	(0.000)**			(0.000)**
Ln(MktCap)	-0.000949	-0.006117	-0.000097	-0.000789	-0.02647
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
Ln(Price)	-0.000147	0.01864	-0.00327	-0.00187	-0.01380
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
Turnover	-0.000883	-0.02313	0.00595	0.00260	0.00919
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
After	0.000141	0.00480	-0.00124	-0.000399	0.00116
	(0.000)**	(0.066)	(0.000)**	(0.000)**	(0.139)

* significant at 5%; ** significant at 1%

Table 5: Regression Analysis for 2x Inverse Leveraged ETFs

This table reports the results from estimating the following equation, $DepVar = \alpha + \beta_1 ln(Mktcap) + \beta_2 ln(Price) + \beta_3 Turn + \beta_4 After + \varepsilon$. The dependent variables are: Spread (regression 1), Illiquidity (regression 2), Pricevolt (regression 3), Garchvolt (regression 4) and Delay (regression 5). The control variables are the natural log of Market Capitalization(MktCap), natural log of Price which is the firm's closing stock price for the day, turnover is the ratio of the volume of shares traded and the number of total shares outstanding. After is a dummy variable representing the 13 July, 2006, the day of the introduction of Leveraged ETFs. P-values are reported in parentheses.

	Spread	*Illiquidity*	*Pricevolt*	*Garchvolt*	*Delay*
	1	**2**	**3**	**4**	**5**
Intercept	0.02694	1.45531	0.04029	0.04404	1.10859
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
Ln(MktCap)	-0.00103	-0.06396	-0.000528	-0.000996	-0.03647
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
Ln(Price)	-0.000468	0.01890	-0.00345	-0.00212	-0.01313
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
Turnover	-0.000395	-0.02688	0.00580	0.00252	0.00363
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
After	0.000078	0.00756	-0.00129	-0.000462	0.00282
	(0.000)**	(0.0035)**	(0.000)**	(0.000)**	(0.000)**

* significant at 5%; ** significant at 1%

Table 6: Measure of Robustness for 2x Inverse Leveraged ETFs

This table reports the results from estimating the following equation, $DepVar = \alpha + \beta_1 Spread + \beta_2 Illiquidity + \beta_3 Prcvolt + \beta_4 Garchvolt + \beta_5 ln(Mktcap) + \beta_6 ln(Price) + \beta_7 Turn + \beta_8 After + \varepsilon$. The dependent variables are: Spread (regression 1), Illiquidity (regression 2), Pricevolt (regression 3), Garchvolt (regression 4) and Delay (regression 5). The control variables are the natural log of Market Capitalization(MktCap), natural log of Price which is the firm's closing stock price for the day, turnover is the ratio of the volume of shares traded and the number of total shares outstanding. After is a dummy variable representing the 13 July, 2006, the day of the introduction of Leveraged ETFs. The Spread is calculated as the difference between closing ask and bid prices divided by the average price of the bid and ask. I estimate a GARCH(1,1) model and obtain daily estimates of volatility (Garchvolt). Price Volatility(Prcvolt) is the degree of variation in the stock price. Illiquidity (illiq) is the ratio of the absolute returns and the volume of shares traded. P-values are reported in parentheses.

	Spread **1**	*Illiquidity* **2**	*Prcvolt* **3**	*Garchvolt* **4**	*Delay* **5**
Intercept	0.02229	1.37806	0.02899	0.03795	0.86442
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
Spread			0.46516	0.31435	-1.17360
			(0.000)**	(0.000)**	(0.000)**
Illiquidity			-0.00108	-0.000296	1.86274
			(0.000)**	(0.000)**	(0.000)**
Prcvolt	0.06446	-2.14250			4.56629
	(0.000)**	(0.000)**			(0.000)**
Garchvolt	0.04645	3.54776			0.01593
	(0.000)**	(0.000)**			(0.000)**
Ln(MktCap)	-0.000949	-0.006118	-0.000095	-0.000788	-0.02647
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
Ln(Price)	-0.000148	0.01860	-0.00327	-0.00187	-0.01380
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
Turnover	-0.000886	-0.02326	0.00596	0.00260	0.00918
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
After	0.000182	0.00633	-0.00133	-0.000460	0.00111
	(0.000)**	(0.015)*	(0.000)**	(0.000)**	(0.158)

* significant at 5%; ** significant at 1%

Table 7: Regression Analysis for 3x Leveraged and Inverse Leveraged ETFs

This table reports the results from estimating the following equation, $DepVar = \alpha + \beta_1 ln(Mktcap) + \beta_2 ln(Price) + \beta_3 Turn + \beta_4 After + \varepsilon$. The dependent variables are: Spread (regression 1), Illiquidity (regression 2), Pricevolt (regression 3), Garchvolt (regression 4) and Delay (regression 5). The control variables are the natural log of Market Capitalization(MktCap), natural log of Price which is the firm's closing stock price for the day, turnover is the ratio of the volume of shares traded and the number of total shares outstanding. After is a dummy variable representing the 25 June, 2009, the day of the introduction of Leveraged ETFs. P-values are reported in parentheses.

	Spread	*Illiquidity*	*Pricevolt*	*Garchvolt*	*Delay*
	1	**2**	**3**	**4**	**5**
Intercept	0.03206	2.45744	0.09299	0.08915	0.36497
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
Ln(MktCap)	-0.00121	-0.11033	-0.000902	-0.00124	-0.0129
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
Ln(Price)	-0.00058	0.04433	-0.00887	-0.00768	0.00209
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
Turnover	-0.000247	-0.02749	0.00686	0.00366	-0.00210
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
After	-0.00113	-0.00780	-0.02459	-0.01713	0.00113
	(0.000)**	(0.005)**	(0.000)**	(0.000)**	(0.000)**

* significant at 5%; ** significant at 1%

Table 8: Measure of Robustness for 3x Leveraged and Inverse Leveraged ETFs

This table reports the results from estimating the following equation, $DepVar = \alpha + \beta_1 Spread + \beta_2 Illiquidity + \beta_3 Prcvolt + \beta_4 Garchvolt + \beta_5 ln(Mktcap) + \beta_6 ln(Price) + \beta_7 Turn + \beta_8 After + \varepsilon$. The dependent variables are: Spread (regression 1), Illiquidity (regression 2), Pricevolt (regression 3), Garchvolt (regression 4) and Delay (regression 5). The control variables are the natural log of Market Capitalization(MktCap), natural log of Price which is the firm's closing stock price for the day, turnover is the ratio of the volume of shares traded and the number of total shares outstanding. After is a dummy variable representing the 25 June, 2009, the day of the introduction of Leveraged ETFs. The Spread is calculated as the difference between closing ask and bid prices divided by the average price of the bid and ask. I estimate a GARCH(1,1) model and obtain daily estimates of volatility (Garchvolt). Price Volatility(Prcvolt) is the degree of variation in the stock price. Illiquidity (illiq) is the ratio of the absolute returns and the volume of shares traded. P-values are reported in parentheses.

	Spread	*Illiquidity*	*Prcvolt*	*Garchvolt*	*Delay*
	1	**2**	**3**	**4**	**5**
Intercept	0.02859	2.5046	0.08289	0.08189	0.28474
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
Spread			0.58162	0.32732	-0.10890
			(0.000)**	(0.000)**	(0.000)**
Illiquidity			-0.00259	-0.000776	-0.06316
			(0.000)**	(0.000)**	(0.000)**
Prcvolt	0.01802	-1.21716			1.79140
	(0.000)**	(0.000)**			(0.000)**
Garchvolt	0.02014	0.74370			0.00841
	(0.000)**	(0.000)**			(0.000)**
Ln(MktCap)	-0.00117	-0.11051	-0.000581	-0.00992	-0.00920
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
Ln(Price)	-0.00027	0.03925	-0.00837	-0.00742	0.00094
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
Turnover	-0.00044	-0.02187	0.00690	0.00370	-0.00027
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.0029)**
After	-0.00034	-0.02500	-0.02397	-0.01677	-0.00066
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.045)*

* significant at 5%; ** significant at 1%