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# Risk-Return Dynamics Using Leveraged ETF Options

Eliza Wampler

# Risk-Return Dynamics Using Leveraged ETF Options

A Thesis

Submitted for partial fulfillment for the Bachelor's Degree in Finance (University Honors Scholars Program) to the Department of Economics and Finance

College of Business and Technology, East Tennessee State University

By

Eliza Wampler

East Tennessee State University

March 2022

**Declaration by student**

I, Eliza Wampler, hereby declare that the work presented herein is original work done by me for the requirement of a degree program and has not been published or submitted elsewhere. Any literature done by others and cited within this thesis has been given due acknowledgement and is listed in the reference section.

Eliza Wampler

Place: East Tennessee State University

Date: March 30, 2022

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Dr. William Trainor

(Supervisor/Mentor)

Professor in the Department of Economics and Finance

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## Certificate

Certified that the thesis titled “Risk-Return Dynamics Using Leveraged ETF Options” submitted by Eliza Wampler in partial fulfillment for the Bachelor’s Degree in Finance (University Honors Scholar Program) is based on the investigation carried out under our guidance. The thesis part, therefore, has not been submitted for the academic award of any other university or institution.

Dr. William Trainor

(Supervisor/Mentor)

Professor in Department of Finance

## Abstract

This study uses barbell strategies on the S&P 500 and the NASDAQ 100 to explore if funds invested primarily in fixed income assets with a portion of the investment placed in in-the-money call options can participate in upside potential, while also reducing risk. This study examines call options on the underlying indexes as well as their leveraged, 2x and 3x, counterparts. The barbell strategy studied, 88% in fixed income bonds and 12% in call options, does not have a higher return than the underlying index, and adds additional risk. However, a weighted portfolio with combinations of a risk-free asset and leveraged ETF does provide a higher return on investment, with a decreased risk as compared to the underlying index.

## 1. Introduction

Modern investors are exploring new ways to invest. Exchange-traded funds (ETFs) track a collective group of securities that are bought together, instead of having investors focus on single stocks. Leveraged ETFs were introduced in 2006 and their popularity has surged in the last few years as new options have been developed and many new investors have entered the market. Leveraged ETFs are designed to increase exposure by a multiplier of double (±2x) or triple (±3x) an underlying index. By doing this, they are designed to amplify the daily returns of the underlying index. While the opportunity to earn significant returns is attractive, the risk of losing value is a concern to most investors. For that reason, investors are searching for ways to mitigate some amount of their risk. These concerns are particularly true as investors have witnessed three significant market drops in the last two decades. These three events are considered "once in a century" events: the Corona crash of 2020, the financial crisis of 2008 and 2009, and the dot com event of the early 2000s. Finding a way to minimize losses during periods such as these without compromising growth potential during strong market increases should be the goal of any investor. Holding only stocks or bonds or following some allocation mix such as the 60/40 approach has its limitations in meeting that goal.

In trying to attain a high return, investors can experience significant losses if they lack diversification or insurance on the portfolio. Insurance limits losses by creating a floor that the portfolio cannot go under, or investors can buy protective puts on the risky asset. Instead of diminishing the returns with the cost of portfolio insurance or holding protective puts, this study suggests purchasing in-the-money call options (.7 delta) on the underlying index or their leveraged ETF. By doing so, investors can get exposure to the stock market with a smaller percentage of their funds being exposed. Because of the leverage in leveraged ETFs, a 2x fund

only requires half of the money to gain the same exposure in the market as the underlying index. Scott and Watson (2013) show an optimized portfolio for a retiree is made of 85% in a risk-free asset and 15% in a 3x leveraged ETF. By blending a portfolio in this way, the investor is able to keep a majority of the money safe while only risking 15%. Because of the 3x properties of the leveraged fund, the investor gains the same exposure as if 45% were invested. For a 3x leveraged ETF, an investor need only invest 33.33% of the money to gain the same exposure as investing in the underlying index.

With this approach, an investor achieves the same upside while significantly reducing the risk because a majority of the investor's money stays in a virtually risk-free asset. This study suggests using a barbell portfolio to reduce the investor's risk. A barbell portfolio is one that puts a large portion of funds in a risk-free investment, while a small portion gets placed into a risky asset. By using a barbell portfolio, investors can reduce costs associated with rebalancing when compared to other methods that require frequent rebalancing such as portfolio insurance. This study explores various investing options using a risk-free asset and a risky asset. We consider portfolios including the iShares 7-10 Year Treasury Bond (IEF) with options on the underlying index and their leveraged ETF counterparts as well as the risk-free asset with a leveraged ETF. This study will test if these portfolios provide upside while reducing risk. This will be tested by comparing barbell strategies in both the S&P 500 and NASDAQ 100. The barbell portfolio in this study consists of 88% of available funds invested primarily in fixed income assets (bonds) with 12% available funds invested in in-the-money call options on the underlying index or their 2x and 3x leveraged counterparts.

This study finds that a barbell portfolio with a risk-free asset and in-the-money call options on the underlying index and its counterparts does not provide a higher return or a lower

risk as compared to the underlying index. However, this study does show that a weighted portfolio of SSO (50%) with IEF (50%) and UPRO (33.33%) with IEF (66.66%) produced a higher return while reducing the risk than the underlying index, SPY. The study also shows that a weighted portfolio of QLD (50%) with IEF (50%) and TQQQ (33.33%) with IEF (66.66%) returned a high rate of return on investment while reducing risk as compared to the underlying index, QQQ.

## 2. Literature Review

One way to limit exposure to investment loss is to have a blended portfolio. Historically, the 60/40 portfolio, holding 60% in stocks and 40% in bonds, has been a baseline for many investors. Investment managers touted this approach as prudent investing for decades. This 60/40 rule attempts to mitigate some of the risk of investing because the bond market is much more stable than the stock market so that holding bonds blunts the impact of losses in stocks. The rate of returns on bonds, though, is marginal at best since the Corona crash of 2020. The result is that, by holding a significant portion of their assets in bonds, investors can end up missing out on a large percentage of the significant upside in a bullish market. In addition to this loss of opportunity, with rising interest rates, the money in bonds is growing at a very slow rate. This slow rate along with other factors such as inflation further reduces the growth of investors' money, which results in a portfolio underperforming compared to the stock market.

Even with the lower returns from bonds, investors are not able to reduce the risk with this strategy. Investors should not expect similar returns to previous years if continuing to use the 60/40 portfolio unless they are willing to increase the risk. Even with the minimal returns, the minimum and value-at-risk (VaR) statistics are actually worse. The VaR measures the possibility of risk in a portfolio and shows, in this study, the values a portfolio may reach under the 95th

percentile. Therefore, a VaR shows that 5% of the time, a portfolio falls by that percent or more. Trainor (2021) suggests that 90-day and 10-year T-notes should not be expected to add any value to the 60/40 portfolio in the years moving forward and investors should move towards a 65/35 portfolio to give similar results to previous 60/40 portfolios.

Certain types of ETFs are inherently riskier than others. Leveraged ETFs are a prime example. Leveraged ETFs usually experience value decay over time stemming from the daily resets. This decay can occur even when the underlying index is providing very good returns. For that reason, many analysts view leveraged ETFs critically for most investors and caution against them.

Leveraged ETFs began to gain popularity in 2006 when listed by ProShares but had been created years before being listed. These ETFs are formulated to provide a return that is multiplied by its leverage (+/- 2x or 3x). Leveraged ETFs use swaps and futures to gain their leverage. Swaps are derivative contracts between two parties that do not occur on an exchange. Future contracts require the party to either buy or sell an asset, on an agreed upon date and at an agreed price and do occur on an exchange. They are utilized in this leveraged ETF behind the scenes by the managers of the fund. These derivative contracts give leverage to the ETF, making a leveraged ETF much easier to manage for the investor.

The constant leverage trap is a disadvantage of leveraged ETFs. When prices decrease, a short fund buys contracts and assets. However, a long fund buys contracts and assets when prices increase. To maintain its fixed leverage ratio, a leveraged ETF resets to its underlying benchmark index each day. Leveraged ETFs reset because these funds were designed based on daily performance. The return is geared toward a single, particular day. It is the rebalancing of assets that erodes the value of the daily leveraged fund unless markets follow a constant, strong trend in

a single direction. Researchers use the term “decay” to refer to the impact this erosion has on value. This aspect of leveraged ETFs means that over time a leveraged ETF can lose more of its expected value than most investors understand in trendless, volatile markets.

By way of illustration, imagine an index fund decreases by 5% and then increases by 20% the next day. An investor holding the underlying fund will have an average return of 7% over two days, while an investor holding a 2x leveraged ETF will have a return of 13% each day. This result would create an effective leverage ratio of 1.86 (13%/7%), not 2x as stated by the leveraged fund (Trainor and Baryla, 2008). In the long run while risk can be reduced somewhat, potential gains are blunted more than the casual observer would expect. Although these numbers seem close, they can quickly compound to big differences within a portfolio if the portfolio holds a leveraged ETF over long periods. Because of this effect, investors should use leveraged ETFs as short-term positions because of the volatility and compounding in the market. As seen in this example, leveraged ETFs rebalance daily to produce a return on a given day, not over an extended period. This function decreases overall returns because the compounding found in other investment products does not occur in the same way. Therefore, while the leveraged aspect of the ETF may be 2x for a given day, the effective percentage over time will be a lesser amount because of the decreases that can occur. The resulting comparison means that the return over time is less than the leveraged amount targeted even when returns are positive.

Volatility is the measure of variation in an asset. As mentioned, volatility is a risk factor for leveraged ETFs because each day is accounted for separately rather than using longer measures of time. When volatility is high, the managers of leveraged ETFs must rebalance more frequently, effectively buying and selling the same securities every day at a high cost to the portfolio owner (Avellaneda and Zhang, 2010). With low volatility in the markets over the past

decades, leveraged ETFs have been able to provide strong returns. That has occurred because of the trend of a significant number of days showing an increase; fewer days of losses serve to support those strong returns. Apparently, the Covid-19 pandemic and its resulting impacts over time that may create volatility may be an exception to this strong track record or could even be the precursor to usher in an extended period in which long-term leveraged ETF performance may be less effective.

In addition to volatility and leverage traps in the market, investors holding leveraged ETFs for a long-term will suffer from taxes and costs associated with the daily rebalancing (Cheng and Madhavan, 2009). However, an advantage that leveraged ETFs may provide is that the investor can produce the same return while only risking a portion of their funds because of the 2x or 3x properties of a leveraged ETF. Instead of risking 100% of funds in the stock market, an investor would only jeopardize 50% for a 2x leveraged ETF and 33% for a 3x leveraged ETF while still having the same exposure to the market.

This study explores a barbell strategy introduced by Brodie (2001) consisting of fixed income assets and in-the-money long-term call options. A barbell strategy is designed to protect a majority of the portfolio in fixed income assets with the rest in a risky asset. With a barbell approach, having a majority of the assets in a relatively safe security, an investor can reduce the potential risk significantly. Barbell strategies may apply to different settings, but they always rely on different asset classes that have very different risk characteristics. Because the risk-free asset acts like a floor, the strategy reduces risk, much like the constant proportional portfolio insurance (CPPI) from Black and Jones (1987). CPPI is formed by investing a portion of the funds in a risk-free asset, while the remaining available funds are invested in a risky asset. As the risky asset falls, the percentage of funds invested in that asset is rebalanced to a lower

percentage. If the value of the risky asset falls to zero, the percentage will also fall to zero, creating the floor. Since there is no money in the risky asset at that point, the investor cannot lose anymore. The "floor" created by the barbell strategy eliminates the need for portfolio insurance, such as CPPI. Costs associated with portfolio insurance have to do with rebalancing. Rebalancing involves switching between different weights of the risky and risk-free assets as the market moves to ensure all money is not lost. Without the need for portfolio insurance, a barbell strategy saves on rebalancing costs while still having protection. In addition, with a barbell strategy, the money at risk is the smaller percentage of the portfolio in the risky asset.

Heyne Leland first created option-based portfolio insurance when looking for a way to allow fearful investors to remain in the market during periods of loss. After he recruited Mark Rubinstein, the pair created the first type of portfolio insurance. They limited this insurance to volatility and caused it to expire after a set number of moves in the market. The insurance also required investors to work together to move money frequently. With the creation of index futures markets, investors could use portfolio insurance without expending the same time and energy on creating the trades. As the program adapted, it has become widespread and is a common tool in the financial markets (Leland and Rubinstein, 1976).

The option-based insurance is based on covered calls and protective puts. Investors using the covered call approach sell call options on stocks they already own and plan to hold long-term. The investor is "covered" because the stocks they must deliver if the option expires worthless are already owned by the investor. Without owning the stocks of a sold call option, the investor would be at risk for unlimited losses. Covered calls are not effective for stocks that are expected to have massive growth over a short time because the call will prevent the high returns that the stock would have made on its own. A protective put is similar as the investor also

already owns any stock that the put option is on. Buying protective puts allows the investor to sell the stock at the strike price of the option before or on expiration. The put option helps to eliminate any of the losses on a stock that loses value. The protective put acts like a floor, as described above, below which the investor cannot lose additional money even if the stock price continues to fall. Because of this floor, a protective put is often viewed as insurance. The premium paid for the protective put is similar to an insurance premium and expires when the put option does on the expiration date.

For example, you own 100 shares of SPY, at $100 each, and believe that the stock will increase in price. However, you want a method to limit losses in the scenario where the stock does not increase. You choose to buy one protective put option, which covers all 100 shares. The premium that you pay for this put option, with a specific expiration date, is $10. If SPY increases beyond $110 (stock price plus premium) then you will gain all of the upside from the stock and the put option will be "worthless." If SPY is between $100-$110, you will still lose money or break even because of the premium you paid upfront for the protective put option. In the scenario that the price falls below $100, the protective put will be exercised, and you can sell the SPY for $100, no matter what the price has fallen to. The only loss that you will incur is the premium paid for the protective put. This scenario is dependent on the time constraints before the protective put expires.

When buying call and put options, investors look at "moneyness." This is where the option's strike price is in relation to where the current market value is. The table below describes At-the-money, In-the-money, and Out-of-the-money prices for the options. In this study, we focus on In-the-money call options.

| Option Type | Call | Put |
|---|---|---|

| | | |
|---|---|---|
| At-the-money | Strike price and the current market value are the same | Strike price and the current market value are the same |
| In-the-money | Strike price is lower than the current market value | Strike price is above where the current market value is |
| Out-of-the-money | Strike price is above where the current market value is | Strike price is lower than the current market value |

Recently, studies have also shown that the use of leveraged ETFs in portfolio insurance can provide a higher return while still reducing the risk. With the use of a 2x leveraged ETF, the investor only needs to risk half of the funds that would have been invested in the risky asset. In their study, George & Trainor (2018) explain that the use of leveraged ETFs in a CPPI strategy provides a higher annual return than a CPPI without leveraged ETFs. Although portfolio insurance is effective at limiting losses, it also limits an investor's return because of the high fees associated with having the protection.

Nassim Nicholas Taleb created the term "Black Swan." Taleb (2010) defines a Black Swan event as an extremely rare, unpredictable event that has extreme consequences associated with it. The term has been employed in finance to apply to unpredictable significant downsides in the market. It is this type of event that investors and advisors want to protect against. Trainor (2019) outlines a barbell strategy portfolio (B-S portfolio) which serves as a replacement for costly portfolio insurance as an option to provide investors with some protection.

The barbell portfolio is set up with in-the-money long-term call options and a standard investment-grade bond fund. The costs for the barbell portfolio are different from traditional portfolio insurance because there are only two periods of rebalancing per year. As noted, with traditional portfolio insurance, rebalancing occurs frequently. The barbell strategy purchases call

options at a .7 delta with smaller time premiums. In addition, by selling before expiration, some of the premiums may be reclaimed. This study uses the principles of a barbell portfolio while exploring in-the-money call options on leveraged ETFs, instead of focusing on the underlying index.

## 3. Methodology

This study explores various investing strategies using risk-free and risky assets. The portfolios have combinations of IEF and leveraged ETFs or options on the underlying index and its leveraged counterpart. We examine whether utilizing a barbell strategy can mitigate downside risk. This strategy places a majority of assets in relatively safe investments and a smaller percentage in riskier investments, here leveraged ETFs. This study utilizes the review of empirical data from actual assets and their performance over the period studied. This study does not attempt to use simulations to inform theoretical results involving market performance prior to 2010.

This study uses data from the S&P 500 and NASDAQ 100 on their underlying index and leveraged ETFs. The following asset classes and ETFs are used as proxies: SPY, SSO, UPRO, QQQ, QLD, and TQQQ. Returns for all ETFs include reinvested dividends. The options are all on the underlying ETFs. For the bond rate, the bonds are proxied by IEF. Greater or lesser allocations for call options could be substituted without difficulty to track with actual investor risk profiles. Increasing the percentage of options increases the possibility of loss since options could expire worthless, which does not support the goal of reducing loss. Reducing options limits upside participation in market increases. Thus, a balance must be struck in applying the barbell strategy. While some in the industry suggest an 85/15 allocation (Scott and Watson, 2013) and some more recent studies have employed a 90/10 allocation (Trainor, 2019), we chose the 88/12

allocation to balance these considerations. However, individual investors could apply a different percentage allocation to match risk tolerance. This allocation is fairly conservative, but the risk-averse portion of the portfolio can be put at risk by rising interest rates.

**Table 1. S&P 500 Leveraged ETFs and Data Range**

Table 1 shows SPY and its leveraged counterparts that follow the S&P 500 and the date range this study uses.

| | **SPY** | **SSO** | **UPRO** |
|---|---|---|---|
| **Leverage** | Tracks S&P 500 | 2x | 3x |
| **Data Range** | January 2005 to September 2021 | October 2007 to September 2021 | July 2009 to September 2021 |

**Table 2. NASDAQ 100 Leveraged ETFs and Data Range**

Table 2 shows QQQ and its leveraged counterparts that follow the NASDAQ 100 and the date range this study uses.

| | **QQQ** | **QLD** | **TQQQ** |
|---|---|---|---|
| **Leverage** | Tracks NASDAQ 100 | 2x | 3x |
| **Data Range** | February 2002 to September 2021 | November 2007 to September 2021 | March 2010 to September 2021 |

After the collection of call-option data, we refined the comparison period to run from August 2010 to September 2021, except QQQ and TQQQ data started in March 2011. All of the statistics on these indexes, including the return, standard deviation, minimum, and maximum, as well as ETF returns including their dividends were obtained from the Center for Research in Security Prices (CRSP) database.

We obtained option prices from DeltaNeutral information. Our assumption is that options are purchased at the ask price. Options are sold when rebalanced at the bid price. This study uses

a barbell strategy consisting of 88% in bonds and 12% in call options, although the percentages are estimated as the rebalancing created a variation in the exact percentages. We review data to determine how the accounts increased and decreased over the defined period. We run each index alone and as part of a barbell portfolio to calculate the average return and standard deviations.

We give initial consideration to rebalancing once, twice, or four times annually by pulling 90-, 180-, and 365-day options. Ultimately, we decided to use at least six-month call options. These options sell approximately 20 or more days before maturity to avoid time decay. By employing that strategy, the study does not need to address or deal with potential tax implications that would apply at the one-year mark. That means this study does not consider the difference between short-term capital gains rates or the more favorable long-term capital gains rate for assets held for more than one year.

For the first set of data, the study considers options at a 0.5 delta for robustness. Thereafter, consideration is only given to the purchase of six-month call options, at a 0.7 delta, to be sold before expiration to avoid time decay. These options are chosen based on a 0.7 delta to reduce the time premium as a percentage of the value when bought, as mentioned above. A delta of 0.7 is often less than ten percent in-the-money; however, that percentage will vary depending on the implied volatility of the option.

Once we pull all of the data, averages, standard deviation, minimum, maximum, and VaR are calculated for each index and each portfolio mix. An 88/12 portfolio is studied with the 12% invested in options on the underlying index or for each of its leveraged counterparts. Next, consideration is given to a 50/50 portfolio of SSO and IEF as well as a 33.33/66.66 portfolio of UPRO and IEF. Finally, a traditional 60/40 portfolio is also calculated using this set of data.

The study compares the results from each index and their leveraged counterparts with a barbell strategy portfolio of each index and their leveraged counterparts alone and in other portfolios to examine the difference in return and potential downside.

**4. Results**

At the beginning of the study, we expected that purchasing options for leveraged ETFs in a barbell strategy would result in some level of protection to insulate investments from loss in a market downturn while providing a greater upside in comparison to an option on the underlying ETF. As noted above, volatility will impact the expected returns of leveraged ETFs by reducing them over time. Still, we assumed that using options in conjunction with leveraged ETFs would act as a significant buffer to limit losses or act as a supplement to increase returns in a robust market.

The findings of the study are not consistent with those expectations. Rather than finding a marked level of protection or increased returns from employing this strategy, the study displays the use of options on leveraged ETFs in a barbell strategy for the period studied is not significantly different than the underlying index. Of note, though, leveraged ETFs on their own, without options, are shown to be beneficial as compared to the index.

Annual returns are calculated from August 2010 to September 2021 for IEF, SPY, SSO, UPRO, QQQ, and QLD as seen in Table 3. Annual returns are calculated from March 2011 to September 2021 for TQQQ as seen in Table 3. Table 4 shows the 88/12 Barbell Strategy returns and statistics for all of the ETF and leveraged ETFs.

**Table 3. Return Statistics for ETFs.**

ETF statistics measuring risk and rolling annual returns from August 2010 (March 2011 for TQQQ) to September 2021.

| | IEF | SPY | SSO | UPRO | QQQ | QLD | TQQQ |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Average** | **4.25%** | **14.99%** | **27.20%** | **39.25%** | **21.55%** | **41.15%** | **60.37%** |
| **St. Dev.** | **6.53%** | **10.44%** | **24.73%** | **43.52%** | **13.92%** | **31.35%** | **52.29%** |
| **Minimum** | **-6.90%** | **-6.93%** | **-24.06%** | **-43.64%** | **-4.46%** | **-13.43%** | **-23.94%** |
| **Maximum** | **17.76%** | **56.23%** | **130.52%** | **227.16%** | **68.65%** | **161.64%** | **283.12%** |
| **VaR** | **-5.37%** | **0.12%** | **-5.25%** | **-14.09%** | **1.85%** | **-2.59%** | **-12.27%** |

**Table 4. Return Statistics for 88/12 Barbell Strategy.**
Statistics measuring risk and rolling annual returns from August 2010 (March 2011 for TQQQ) to September 2021 using a barbell strategy with the securities in Table 1.

| | | **B-S SPY** | **B-S SSO** | **B-S UPRO** | **B-S QQQ** | **B-S QLD** | **B-S TQQQ** |
|---|---|---|---|---|---|---|---|
| **Average** | | **13.30%** | **11.00%** | **13.19%** | **19.42%** | **18.46%** | **20.39%** |
| **St. Dev.** | | **9.29%** | **10.19%** | **12.56%** | **13.22%** | **14.75%** | **17.60%** |
| **Minimum** | | **-11.40%** | **-13.47%** | **-15.93%** | **-5.87%** | **-7.42%** | **-11.68%** |
| **Maximum** | | **36.53%** | **40.03%** | **44.33%** | **52.59%** | **57.31%** | **61.45%** |
| **VaR** | | **-4.81%** | **-5.89%** | **-8.03%** | **-0.40%** | **-3.51%** | **-6.43%** |

While the barbell strategy still proves to mitigate risk during the participation in upside potential, the options on the leveraged ETF add no value. The average return for a barbell strategy on B-S SPY is 13.30%, while the average return for B-S SSO is 11% and the B-S UPRO is 13.19%. These returns are compared to a 14.99% return from SPY alone. The average return is actually slightly reduced when adding in the options on the underlying index and the leveraged

ETFs. This outcome is a bit surprising since the leveraged ETFs on their own showed significantly higher returns at 27.20% for SSO and 39.25% for UPRO as compared to the 14.99% of SPY. In addition to lower returns, the minimum is shown to decrease further from -6.93% from SPY, instead of showing improvement. The B-S SPY had a minimum of -11.40% while B-S SSO and B-S UPRO had a minimum of -13.47% and -15.93%, respectively. In addition to the minimum, the VaR is also reduced from -4.81% for B-S SPY down to -5.98% and -8.03% for B-S SSO and B-S UPRO.

The same type of result is seen with the NASDAQ 100 ETFs and leveraged ETFs using the 88/12 Barbell Strategy. The average for B-S QQQ is 19.42%, while the average return for B-S QLD is 18.46% and B-S TQQQ is 20.39%. The average return is reduced by almost one percent for B-S QLD but increased by almost a percent for B-S TQQQ, when compared to the B-S SPY. However, QLD and TQQQ showed significantly higher returns on their own at 41.50% for QLD and 60.37% for TQQQ. This is compared to a 21.55% return from QQQ during this time frame. In addition to reduced returns, the minimum is also shown to decrease further in the barbell strategies with leveraged ETF. The B-S QQQ has a minimum of -5.87% while B-S QLD and B-S TQQQ has a minimum of -7.42% and -11.68%, respectively. The VaR is also reduced from -0.40% for B-S QQQ down to -3.51% and -6.43% for the B-S QLD and B-S TQQQ. These statistics are inconsistent with this study's goal of diminishing risks, while participating in upside movement.

The study finds that options on leveraged ETFs add no value, and even have the potential for more loss. The options on leveraged ETFs seem to add risk in the barbell strategy, while not adding any of their upsides. While the underlying index has similar returns as the leveraged ETF options, those products would not be subject to enhanced losses in a period of decline or

increased volatility that leveraged ETFs might experience. Therefore, the study cannot establish a substantial benefit that would warrant a strategy of purchasing options on leveraged ETFs in a barbell strategy.

After examining the returns from ETF barbell strategies with ETFs and leveraged ETFs, this study explores a weighted portfolio between the IEF bond and leveraged ETFs. This approach differs from the previous method because call options are not bought on the leveraged ETFs. In this scenario, IEF and SSO, IEF and UPRO, IEF and QLD, and IEF and TQQQ are calculated. Because leveraged ETFs are used, there are different weights assigned to each model depending on the leverage. For the 2x leveraged ETFs, SSO and QLD, 50% of available funds are invested into the leveraged ETF and 50% into the IEF. For the 3x leveraged ETF, UPRO and TTTQ, only 33.33% is invested in the leveraged ETF while the remaining 66.66% is invested in IEF. This method assumes rebalancing every month. These results seemingly provide higher returns while also reducing potential downside more than the barbell portfolio with options on the leveraged ETFs, as seen in Table 5.

**Table 5. Return Statistics for Leveraged ETF and IEF portfolios.**
Statistics measuring risk and rolling annual returns from August 2010 (March 2011 for TQQQ) to September 2021 using a 50/50 portfolio for 2x leveraged ETFs and a 66.66/33.33 portfolio for 3x leveraged ETFs with the securities in Table 1 and 2.

| | B-S SSO | B-S UPRO | B-S QLD | B-S TQQQ | IEF & SSO | IEF & UPRO | IEF & QLD | IEF & TQQQ |
|---|---|---|---|---|---|---|---|---|
| **Average** | **11.00%** | **13.19%** | **18.46%** | **20.39%** | **15.68%** | **15.82%** | **22.12%** | **42.32%** |
| **St. Dev.** | **10.19%** | **12.56%** | **14.75%** | **17.60%** | **9.32%** | **9.09%** | **12.94%** | **29.67%** |
| **Minimum** | **-13.47%** | **-15.93%** | **-7.42%** | **-11.68%** | **-6.32%** | **-6.60%** | **-3.55%** | **-12.25%** |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Maximum** | **40.03%** | **44.33%** | **57.31%** | **61.45%** | **49.50%** | **46.50%** | **60.70%** | **150.30%** |
| **VaR** | **-5.89%** | **-8.03%** | **-3.51%** | **-6.43%** | **.90%** | **1.06%** | **3.68%** | **.87%** |

As seen in Table 5, each combination of the leveraged ETF with the IEF provides a higher average than the 88/12 barbell strategy. The standard deviation is also lowered for the majority of portfolios, all except IEF and TQQQ. The minimum also improves with the weighted portfolios of SSO, UPRO, and QLD. The minimum for the TQQQ and IEF portfolio is slightly lower than with the barbell strategy. The maximum is higher for all of the weighted portfolios in comparison to the barbell strategies. Finally, the VaR also improves for each portfolio. Each VaR for the weighted portfolios is positive, while the barbell strategies all have a negative VaR. This is an important statistic as we are trying to minimize downside risk. However, it is important to note that QQQ had a higher-than-normal average during the time period used in this study.

**Table 6. Return Statistics for a 60/40 portfolio.**

Statistics measuring risk and rolling annual returns from August 2010 to September 2021 using a 60/40 portfolio with SPY/IEF and QQQ/IEF in comparison to the barbell strategies using options on leveraged ETF.

| | **B-S SSO** | **B-S UPRO** | **B-S QLD** | **B-S TQQQ** | **60/40 SPY** | **60/40 QQQ** |
|---|---|---|---|---|---|---|
| **Average** | **11.00%** | **13.19%** | **18.46%** | **20.39%** | **10.62%** | **14.40%** |
| **St. Dev.** | **10.19%** | **12.56%** | **14.75%** | **17.60%** | **5.12%** | **7.62%** |
| **Minimum** | **-13.47%** | **-15.93%** | **-7.42%** | **-11.68%** | **-2.38%** | **-0.71%** |
| **Maximum** | **40.03%** | **44.33%** | **57.31%** | **61.45%** | **27.72%** | **37.17%** |

| | | | | | | |
|---|---|---|---|---|---|---|
| **VaR** | **-5.89%** | **-8.03%** | **-3.51%** | **-6.43%** | **2.08%** | **3.51%** |

As seen in Table 6, the 60/40 portfolio for the S&P 500 does not outperform the barbell strategies utilizing leveraged ETF tracking the S&P 500. The 60/40 portfolio for the NASDAQ 100 also does not outperform the barbell strategies utilizing leveraged ETFs tracking the NASDAQ 100. However, the rolling annual standard deviation is significantly lower for the 60/40 portfolio. Although the barbell strategies outperform, the investor is exposed to higher volatility. For risk-averse or short-term investors, a barbell strategy with leveraged ETFs provides too much risk, without a substantial reward. We find that the minimum for both 60/40 portfolios is much lower than the barbell strategies. The maximum is also lower than the barbell strategies. An investor with a 60/40 portfolio would miss out on maximizing gains, assuming he or she could time the market. The VaR for both 60/40 portfolios is positive, while all of the barbell strategies are negative. This is an important finding as our goal is to minimize downside risk while participating in the market upside.

**Table 7. Return Statistics for Barbell Portfolios During the Corona Crash.**
Statistics measuring risk from January 31, 2020 to April 30, 2020 using a barbell portfolio.

| | SPY | B-S SPY | B-S SSO | B-S UPRO | QQQ | B-S QQQ | B-S QLD | B-S TQQQ |
|---|---|---|---|---|---|---|---|---|
| **Average** | **-1.95%** | **-0.18%** | **-1.11%** | **-2.11%** | **1.16%** | **2.70%** | **1.92%** | **0.37%** |
| **St. Dev** | **11.04%** | **4.58%** | **4.50%** | **5.23%** | **10.30%** | **5.43%** | **6.52%** | **7.67%** |
| **Minimum** | **-12.52%** | **-4.85%** | **-6.01%** | **-8.14%** | **-7.31%** | **-2.31%** | **-4.16%** | **-6.27%** |
| **Maximum** | **12.70%** | **4.57%** | **2.86%** | **2.81%** | **14.97%** | **8.43%** | **8.37%** | **7.85%** |
| **VaR** | **-11.83%** | **-4.61%** | **-5.69%** | **-7.64%** | **-7.12%** | **-2.19%** | **-4.02%** | **-6.26%** |

Table 7 shows how the barbell portfolios perform during the Corona Crash in 2020. This table shows the monthly returns from January 31, 2020 to April 30, 2020. The averages for the B-S SPY and B-S SSO outperform SPY. SPY returns -1.95% while B–S SPY and B-S SSO returns -0.18% and -1.11%, respectively. In addition to this, the standard deviations, minimums, and VaR are all improved for the B-S SPY and B-S SSO. Each statistic proves to be the best for the B-S SPY portfolio. The B-S UPRO portfolio does not outperform SPY's average. However, the B-S UPRO portfolio does have a better standard deviation, minimum, and VaR.

Table 7 shows similar findings for the portfolios that track the NASDAQ 100. The averages for the B-S QQQ and B-S QLD outperform QQQ. QQQ returns 1.16% while B–S QQQ and B-S QLD returns 2.70% and 1.92%, respectively. Like the portfolios that track the S & P 500, B-S QQQ and B-S QLD have improved standard deviations, minimums, and VaR. Again, the barbell portfolio with the underlying index shows the best results. The B-S TQQQ does not perform as well as any of the other portfolios that track the NASDAQ.

**Table 8. Return Statistics for Weighted Portfolios During the Corona Crash.**
Statistics measuring monthly returns from January 31, 2020 to April 30, 2020 using weighted portfolio in comparison to the barbell strategies using options on leveraged ETF.

| | B-S SPY | B-S SSO | B-S UPRO | B-S QQQ | B-S QLD | B-S TQQQ | SSO &IEF | UPRO &IEF | QLD &IEF | TQQQ &IEF |
|---|---|---|---|---|---|---|---|---|---|---|
| **Average** | **-0.18%** | **-1.11%** | **-2.11%** | **2.70%** | **1.92%** | **0.37%** | **-1.14%** | **-0.97%** | **1.84%** | **1.21%** |
| **St. Dev** | **4.58%** | **4.50%** | **5.23%** | **5.43%** | **6.52%** | **7.67%** | **11.08%** | **11.06%** | **10.70%** | **23.79%** |
| **Minimum** | **-4.85%** | **-6.01%** | **-8.14%** | **-2.31%** | **-4.16%** | **-6.27%** | **-12.92%** | **-13.23%** | **-8.58%** | **-23.56%** |
| **Maximum** | **4.57%** | **2.86%** | **2.81%** | **8.43%** | **8.37%** | **7.85%** | **12.84%** | **12.60%** | **15.54%** | **31.37%** |
| **VaR** | **-4.61%** | **-5.69%** | **-7.64%** | **-2.19%** | **-4.02%** | **-6.26%** | **-11.92%** | **-12.08%** | **-7.95%** | **-21.59%** |

Table 8 shows the comparison of the weighted portfolios to the barbell portfolios from January 31, 2020 to April 30, 2020. This table allows investors to see which portfolio would help minimize losses during a market crash. The barbell strategy tracking the S & P 500 (B-S SPY) outperforms both of the weighted portfolio's averages for the S & P 500. The barbell portfolio also has a better standard deviation, minimum, and VaR than the weighted portfolios of SSO and UPRO.

For the NASDAQ 100, the B-S QQQ and B-S QLD outperform both of the weighted portfolios for QLD and TQQQ. However, the barbell strategy with the underlying index, B-S QQQ has the highest return of all of the barbell portfolios and weighted portfolios. B-S QQQ also has the best standard deviation, minimum, and VaR of the portfolios tracking the NASDAQ 100.

**5. Conclusion/Discussion**

Since their creation, ETFs have been marked by innovation as they have been used to open more unique and tailored investment approaches than other investment vehicles. A new wave of investors has entered the market, many of whom rely on ETFs or models utilizing ETFs. Because of their flexibility and range, ETFs will continue to be attractive vehicles for investing. ETFs are used for speculation, price increases, income generation, and to hedge risk in a portfolio. There will continue to be novel and more unique ETFs introduced in the future with their uses employed in conjunction with other funds. While innovation is generally a good thing for investors, not all ETFs—or uses of ETFs—will find success. Because of the operation of ETFs, investors should investigate their operations and consider how to employ them in light of individual goals.

The study finds that options on leveraged ETFs do not add value over time. Options on the underlying index seem to do just as well as options on leveraged ETFs. Therefore, the study cannot establish a benefit that would warrant a strategy of purchasing options on leveraged ETFs in a barbell strategy over the period studied. We found that if the market performed well, the options did really well. However, in a bearish market, the options on the leveraged ETF did not help to minimize losses.

Overall, the options on the leveraged ETFs are too expensive to warrant the buy. This study attempts to provide protection against a bearish market, while participating in upward movement. However, when leveraged ETFs are exposed to a bearish market, the high volatility results in high rebalancing costs. The high costs of rebalancing paired with the leveraged losses result in lower returns. The leveraged positive returns cannot make up for the downside losses in addition to the increased costs.

However, the results from the Corona Crash show that the barbell strategies are effective in minimizing risk in "once in a century events" over a short period. Although they did not warrant use over the past ten years in a positive trending market, they could be useful in a market crash. It is of note that the weighted portfolio still outperformed the barbell strategies over the whole period studied, which included the Corona Crash. However, the barbell strategy with the underlying index did perform better than the underlying index alone during a market crash.

Through examination of barbell strategies, weighted portfolios, and the classic 60/40 portfolio, we determine that the weighted portfolios provide the best investment opportunity over time.

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