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How Investors Relate Portfolio Returns to Investment Performance Using Financial Options

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Abstract

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MBA, University of St. Thomas, 2006

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Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

This quantitative study addressed the absence of a simple investment model for private investors by analyzing the relationship between the portfolio returns and the investment performance using financial options. The purpose was to determine whether the financial options added to a portfolio can positively influence an investor's portfolio performance when diversified properly. Modern portfolio theory and option pricing theory were tested to relate portfolio returns to the investment performance using financial options for individual investors in the United States. Secondary data from Yahoo Finance, New York Stock Exchange, Chicago Board of Options Exchange, and TD Ameritrade were used to perform correlation and regression analysis. A stratified sample was taken from the January 1, 2008, to December 31, 2010, timeframe and consisted of 33 set of portfolios containing stocks in the S&P 500 Index with financial options. The results are interpreted using key parameter estimates such as correlation coefficient, standard deviation, variance, and confidence interval with the alpha of 0.05. Results showed no significant correlation between portfolio return on a stock only portfolio and the investment performance on a portfolio containing stocks and financial options due to fast-changing market conditions, an additional cost of option premiums, and time decay of financial options. The implication for a positive social change was the simplified explanation of leveraging financial options in managing an investment portfolio while being mindful of associated costs. It could be used as a training resource to educate individual investors to make better investment choices.

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Chapter 1: Introduction to the Study

Wealth management firms offer a broad range of services to their clients, including investment consulting, active asset management, estate planning, and other financial services (Beaverstock et al., 2013). Handling the investment of high net worth investors has traditionally differed from institutional investing for several reasons. First, most individual investors have insufficient time and experience to deal with sophisticated investment strategies. Second, some high net worth investors may be interested only in a buy-and-hold strategy, around which their investment policy statement is written. Investors' inability to provide a downside protection for their portfolios in volatile market conditions revealed why this study was necessary. Specifically, I tested (a) whether a correlation exists between the stock return and return on financial options such as call and put options on the same underlying stock, and (b) whether a relationship exists between investment performance and investor's returns on stocks and financial options. The implication for a positive social change was the simplified explanation of leveraging financial options in managing an investment portfolio while being mindful of associated costs. It could be used as a training resource to educate individual investors to make better investment choices.

The major sections of this chapter include an overview of Markowitz's (1991) modern portfolio theory (MPT), option pricing theory, and wealth management industry as a whole. In the problem statement section, I summarize the gaps in the literature related to individual wealth management and the added benefits to individual investors from hedging strategies employing financial options. In the purpose of the study section,

I explain why I used regression and correlation statistical analysis to test Markowitz's theory, which relates the returns of stocks and financial options to portfolio performance. Specifically, I examined whether the financial options added to the portfolio positively influence an investor's overall performance when diversified properly.

Chapter 1 also includes research questions and hypotheses along with the use of secondary data from Yahoo Finance, New York Stock Exchange, and CBOE to perform correlation and regression analysis. The specific population of the study was taken from the January 1, 2008, to December 31, 2010, timeframe and consisted of 33 set of portfolios containing stocks in the S&P 500 Index and that had financial options for the same time periods. Because there are 11 sectors in the S&P 500 index, selecting three companies per sector resulted in 33 companies. Finally, Chapter 1 includes separate sections for the list of definitions, assumptions, limitations, and the significance of the study.

Background of the Study

The scope of this research was active portfolio management. As mentioned earlier, managing the wealth of high net worth clients differs from managing an institutional investor because many individual investors lack the time or experience required to manage alternative investment approaches. Passive high net worth clients might be interested only in a traditional buy-and-hold strategy. As a result of variability in the equity and fixed income securities markets, institutional investors use certain alternative strategies, such as hedge funds or pension funds, which might benefit individual investors as well. Two alternative strategies used by multibillion intuitional

investment firms are investing in commodities and financial derivatives. In this study, I examined financial derivatives, such as financial options.

Although researchers have provided ample scholarship on the wealth management industry for large firms, the literature on individual wealth management is somewhat thin. Markowitz (1991) received a Nobel Prize for his 1952 work on portfolio selection. Black and Scholes (1973) developed the option pricing model, which provided opportunities to hedge against financial risks. The Black-Scholes's option pricing model was a breakthrough in finance for the valuation of assets with embedded features such as warrants. Hull (2005) discussed how financial options could be used as a source of building and protecting the wealth. Jennings et al. (2011) examined trends in possible investment strategies in private wealth management. Mileff et al. (2012) noted several alternative investments to optimize individual investors' returns, whereas Geambaşu et al. (2013) studied risk measurement in postmodern portfolio theory and criticized MPT for some of its shortcomings. Cochrane (2014) examined a mean-variance benchmark from an intertemporal portfolio theory standpoint. Thus, opinions vary on the validity of the MPT, the practical implications to optimize portfolio performance is more relevant than ever due because of the failure in the buy-and-hold strategy accompanied by increased trading volumes in options.

Problem Statement

It was important to evaluate if a potential stock option and the portfolio are good fits for each other to provide investors some protection during volatile market conditions (Markowitz, 2014). Hull (2005) discussed how financial derivatives can be utilized as a

source of building and protecting the wealth. Investors witnessed how the market crisis of 2008 dragged the economy into a recession and wiped out more than 50% of investors' wealth globally, accounting for $34.4 trillion in losses (Roosevelt Institute, n.d.). The general management problem was that individual investors are unable to assess if a possible stock option might provide a downside protection for a portfolio in volatile market conditions. The specific management problem was the absence of a simple investment model for private investors in the United States to maximize their wealth by analyzing the relationship between the portfolio returns and the investment performance using financial options.

Purpose of the Study

The purpose of this quantitative quasi-experimental study utilizing a regression and correlation statistical analysis was to test the MPT and option pricing theory that relate portfolio returns to investment performance using financial options for individual U.S. investors. The investors' portfolio returns consists of stock returns. Two independent variables of the study were stock returns and financial options returns. These variables were defined as monthly returns as published by the Yahoo Finance and NYSE for stocks, and the Chicago Board of Options Exchange for options. The dependent variable, investment performance, was a change in portfolio value during the investment period. The specific population of the study was a subset of the S&P 500 index consisting of 33 stocks, three stocks from each of 11 sectors, that have tradable financial options, including both call and put options, and actively traded in the stock market from January 1, 2008, to December 31, 2010. The implication for a positive social change was the

simplified explanation of leveraging financial options in managing an investment portfolio while being mindful of associated costs. It could be used as a training resource to educate individual investors to make better investment choices.

Research Questions and Hypotheses

In this quantitative quasi-experimental method, I conducted a regression and correlation statistical analysis to test MPT and option pricing theory that relate portfolio returns to investment performance using financial options for individual U.S. investors. The specific population of the study was a subset of the S&P 500 index consisting of 33 stocks, three stocks from each of 11 sectors, that have tradable financial options, including both call and put options, and actively traded in the stock market from the January 1, 2008, to December 31, 2010, timeframe. One of the key assumptions of the study was that financial options must be traded on the underlying stock to hedge the portfolio. Options are exhausting assets and die away at expiration. As such, returns on stocks and options are measured for the same time subperiods over the sample time period. For instance, if an option on Coca-Cola stock purchased on January 1, 2008, had an expiration date of June 20, 2008, then I paired it with the Coca-Cola's stock performance between those dates.

Central Research Question

How can U.S. investors relate portfolio returns to the investment performance using financial options? Two subquestions with their corresponding hypotheses were examined in this quantitative quasi-experimental study utilizing a regression and

correlation design. (See below for the operational definitions of the terms used in these questions.)

Subquestion 1

What is the correlation between the stock return and return on financial options such as call and put options on the same underlying stock?

Null Hypothesis $H_0 1$

There is no correlation between the stock return and return on financial options such as call and put options on the same underlying stock.

Alternative Hypothesis $H_a 1$

There is a correlation between the stock return and return on financial options such as call and put options on the same underlying stock.

Research Subquestion 2

What is the correlation between portfolio return on a stock portfolio containing no financial options and the investment performance on a portfolio consisting of stock returns and return on financial options including call and put options?

Null Hypothesis $H_0 2$

There is no correlation between portfolio return on a stock portfolio containing no financial options and the investment performance on a portfolio consisting of stock returns and return on financial options including call and put options.

Alternative Hypothesis H_a2

There is a correlation between portfolio return on a stock portfolio containing no financial options and the investment performance on a portfolio consisting of stock returns and return on financial options including call and put options.

Theoretical Foundation

Markowitz's (1991) MPT was the primary theoretical framework for the study. In 1952, in his dissertation, Markowitz laid the foundation for the investment theory now known as MPT. The general assumption of MPT investors desire to maximize the return for a given level of risk. The investor who follows such behavior of optimal return is a rational investor (Markowitz, 2014). To simplify the MPT, Markowitz calculated the expected rate of return and expected risk and showed how investors could optimize their portfolios by diversifying their securities. The diversification minimizes the total risk of the investment portfolio, and Markowitz demonstrated how to do it efficiently (Reilly & Brown, 2006). The correlation of securities became an important measure of diversification.

Black-Scholes's (1973) option pricing theory is a supporting framework for analyzing the benefits of options. The basic notion of Black-Scholes's option pricing model is that an investor can set up a riskless portfolio by purchasing the stock and financial options. For example, in a short term, the price of a call option correlates perfectly with the underlying stock, while the price of the put option is perfectly negatively correlated with the underlying stock (Hull, 2005). Thus, these two theories served as the theoretical framework for analyzing the investor's ability to hedge.

Nature of the Study

In this quantitative quasi-experimental research, I tested MPT and option pricing theory, which relate the investor portfolio returns without financial options to the investment performance using financial options. Two independent variables were stock returns and financial options returns. For stocks, I defined these variables as monthly returns as published by the Yahoo Finance and NYSE, and for options the Chicago Board of Options Exchange. The dependent variable, investment performance, was the change in portfolio value during the investment period. A regression and correlation analysis was employed to test the research hypotheses and to evaluate if a potential stock option and the portfolio could provide American investors with protection from significant losses and opportunities for potential growth. The research was intended to pinpoint the amount of growth and stability that could be achieved using financial options.

An example of possible strategies to examine the benefits of options when used as a hedging instrument is the regression and correlation analysis. In this study, I utilized secondary data from three independent sources to address the research questions and to conduct a regression and correlation analysis.

1. The Yahoo Finance stores historical data on securities that are part of the Dow Jones Industrial Average, S&P 500, and the NASDAQ.
2. The New York Stock Exchange (NYSE) also stores historical data on securities that are part of the Dow Jones Industrial Average, S&P 500, and the NASDAQ. The NYSE is also a physical stock market.

3. The Chicago Board of Options Exchange (CBOE) offers several services for retrieving historical data on prices of financial options. TD Ameritrade's Think or Swim platform served as an access point.

I used the online versions of the NYSE, Yahoo Finance, and TD Ameritrade's Think or Swim platform to collect data. TD Ameritrade's Think or Swim platform is available free of charge. Frankfort-Nachmias and Nachmias (2008) noted three reasons for using secondary data: conceptual-substantive factors, methodical reasons, and costs. The study relied on secondary data because of the nature of this research and costs associated with performing the test using real money. Primary data would cost more than $1 million to test the research hypotheses. Second, collecting primary data over an extended period on both stocks and options invested is time prohibitive. I used secondary data collected over an extended period by reliable sources to obtain the effects of longitudinal studies. The research questions were best answered by back-testing the secondary data.

Definitions

Financial options: An options contract that gives the option holder the right to buy or sell the underlying asset by a certain date in the future for a pre-agreed price (Hull, 2005).

High net worth investors: An investor who have enough funds to buy several securities and implement sound investment strategies to take advantage of the diversification.

Investor portfolio returns: Stock returns and options returns. The independent variables *stock returns* and *options returns* are defined as monthly returns as published by Yahoo Finance, NYSE, and Chicago Board of Options Exchange.

Investment performance: A change in portfolio value during the investment period. It was the dependent variable of the study.

Secondary data: Existing data collected by a third party. The secondary date for this research were taken from Yahoo Finance, NYSE, and TD Ameritrade.

Rate of return: A net change in the value of the security divided by the beginning value of the security as shown in Formula 1. I denoted the return with the letter *R*. To be statistically correct, it is the rate of return, which I simplified and called return.

Formula 1. Return (R) $= \frac{[(\text{Ending Value} - \text{Beginning Value}) + \text{Dividends for the period}]}{\text{Beginning Value}}$

- Ending Value is the closing price of the security for the year N.
- Beginning Value is the closing price at the end of the previous year (N–1) or at the beginning of the current year.
- Dividends for the year = all dividends paid during the year N = all cash flows.

Expected Return: The expected return of the portfolio is the weighted average of expected returns for individual securities in the portfolio (Markowitz, 1991) and denoted with R_{port}. The weight of each security is the dollar amount invested in each security as a percentage of total portfolio value. As an example, a portfolio value is $100,000 and consists of stock S and Bond B. The amount invested in Stock S is $60,000 while portion invested in Bond B is $40,000. Therefore, the weight of Stock S in this security portfolio is 60% or 0.6 while Bond B's weight is 40% or 0.4. I denoted the weight with letter *w*.

Mean of return: The mean is a simple average of all values in the pool whether this pool is population or sample. For this discussion, I denoted mean with Greek letter μ.

Formula 2. $Mean = \mu = \frac{\sum_{i}^{n} R_i}{n}$

Standard deviation: Markowitz (1991) defined the standard deviation as the square root of the average squared deviations from the mean. In other words, standard deviation measures the dispersion of returns around the expected rates of return. Therefore, the greater the variation from the mean, the greater is the standard deviation. The big variations or deviation from the expected rate of return (μ), indicates greater risk and uncertainty (Reilly & Brown, 2006). Standard deviation is calculated based on the Formula 3 and denoted with Greek letter sigma σ. Mathematically, the standard deviation is the square root of the variance. See calculation of variance.

Formula 3. $Standard\ deviation = \sigma = \sqrt{\sum_{i}^{n} (R_i - E(R_i)]^2 * P_i}$

wherein P_i in Formula 3 is the probability of the possible return R_i.

Markowitz (1991) made it clear that standard deviation of the portfolio is not equal to the standard deviations of the securities in the portfolio. While portfolio standard deviation depends on the standard deviation of individual securities in the portfolio, it also depends on the correlation between securities and the weight of each security within the portfolio.

Variance: The variance is calculated using Formula 4 and denoted with the Greek letter σ^2. As I noted earlier, the only mathematical difference between variance and standard deviation is that standard deviation is the square root of the variance.

Formula 4. *Variance* = $\sigma^2 = \sum_{i}^{n} (R_i - E(R_i)]^2 * P_i$

See Appendix A, Table A3, for numerical examples. What is shown in Column D in Table A3 of Appendix A is also known as sum of squares, or SS, in statistics textbooks when calculating an ANOVA.

Covariance: Covariance is the degree to which two variables move together relative to their individual mean values over time (Reilly & Brown, 2006). A positive covariance indicates that the returns for two securities move in the same direction relative to their individual means. Conversely, a negative covariance is a sign of returns for two securities moving in the different directions relative to their individual means. Formula 5 defines the covariance.

Formula 5. Covariance = $Cov_{ij} = E[((R_i - E(R_i)) * (R_j - E(R_j))]$

See Appendix A, Table A4, for numerical examples.

Correlation coefficient: When the covariance is divided by the product of individual security standard deviations, the correlation coefficient is obtained. It measures the strength of the relationship between variables. See Formula 6.

Formula 6. *Correlation coefficient* $\rho_{ij} = \frac{Cov_{ij}}{\sigma_i * \sigma_j}$;

The correlation coefficient is denoted by Greek letter ρ. The correlation coefficient ranges from –1 to +1. A correlation coefficient of –1 means there is perfect negative correlation between variables, and variables move in the opposite direction of one another. A correlation coefficient of 0 means there is no correlation between the variables. Finally, a correlation coefficient of +1 means perfect correlation between the variables and they move in the same direction.

Standard deviation of portfolio: The standard deviation of the portfolio depends on the standard deviation of individual securities and the covariance between the rates of return for all pair combinations of assets in the portfolio. Therefore, optimal portfolio is the mix of securities that have an acceptable risk and return features along with low or negative correlation. International stocks and bonds have a negative or low correlation with the U.S. securities (Reilly & Brown, 2006). The inclusion of international securities in the U.S. portfolio will provide the benefit of diversification by lowering the risk or increasing the return of the portfolio. Standard deviation and variance of portfolio consisting of two assets are shown in Formulas 7 and 8.

Formula 7. *Standard deviation of portfolio* = $\sigma = \sqrt{w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2w_1w_2Cov_{1,2}}$

Formula 8. *Variance of portfolio* = $\sigma^2 = w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2w_1w_2Cov_{1,2}$

Assumptions

Individual private investors who are not high net worth investors may not have enough funds to perform the diversification on their own. While targeted retirement funds might be helpful in this regard, such as Vanguard Target Retirement Fund 2040, they are

all based on buy-and-hold strategy. One of the key assumptions of this study is that the traditional buy-and-hold strategy may not have downside protection. For instance, the market crisis of 2008 wiped out more than 50% of investors' wealth globally, accounting for $34.4 trillion in losses, an amount greater than the combined GDPs of the United States, European Union, and Japan in 2008 (Roosevelt Institute, n.d.). Another vital assumption of the study was that financial options must be traded on the underlying stock to hedge the portfolio.

Scope and Delimitations

The topic of this study was individuals' wealth management utilizing financial options. The specific population of the study was taken from the January 1, 2008, to December 31, 2010, timeframe and comprised 33 set of portfolios containing stocks in the S&P 500 Index and that had financial options. Financial options included both call options and put options. One of the fundamental assumptions of the study was that financial options must be tradable on the underlying stock. The secondary data on S&P 500 were collected over an extended period. With the correlation research design, I simulated the effects of longitudinal studies. This feature of secondary data strengthens the internal validity. To address the research problem, I developed a simple investment model for private investors in the United States to maximize their wealth by analyzing the relationship between the portfolio returns and the investment performance using financial options.

Limitations

Frankfort-Nachmias and Nachmias (2008) noted three limitations to using secondary data: the gap between the purpose of the secondary data collection and the purpose of the researcher, the access to the secondary data, and insufficient information about how the secondary data were collected. Given that the performance of the financial market is measured by multiple independent sources, those three limitations posed no problem for the research. The lone limitation was how market anomalies would impact the testing—for example, so-called Black Monday in the NYSE, massive sell-off during the 2008 crisis, and massive selloffs in July and August of 2015 in fear of China's economic collapse. Such anomalies do not allow proper correlation analysis because such panicky events overshadow the future outlook.

Collecting reliable secondary data over an extended period provides the effects of longitudinal studies and strengthens the internal validity. The actual historical data on stock and options performance are accurate and reliable; thus, replication and generalizability of the findings is possible because of the sample size and its representativeness (Frankfort-Nachmias & Nachmias, 2008), strengthening the external validity of my research. Reducing my bias as a researcher was important. Using statistical tools and having another scholar review my work helped offset researcher bias and served as preventive measures for ethical considerations.

The study has two limitations. The first limitation is the generalization of the finding to the stocks that do not have options trading on the underlying. Second, because

past market or security performance is not an indication of future performance, certain aspects of the findings may not be generalizable to future market conditions.

Significance of the Study

The lack of a simple portfolio building model for individual investors to maximize their wealth by examining the relationship between stock returns, returns on financial options, and investment performance is indicative of a gap in the wealth management field. The study was the first examination of hedging strategies to offset certain market downsides for individual investors and to fill the gap identified in the literature review.

This study contributes to the existing body of knowledge by coupling it with a management application to individuals and organizational managers as a possible social good. The findings may serve as a guide for professionals providing wealth management services to individuals seeking to hedge against some of the portfolio downside risks. The implication for a positive social change was the simplified explanation of leveraging financial options in managing an investment portfolio while being mindful of associated costs. It could be used as a training resource to educate individual investors to make better investment choices.

Summary

In this study, I examined if there are added benefits to individual investors from hedging strategies employing financial options. The purpose of this regression and correlation quasi-experimental study was to test Markowitz's (1991) MPT, which related the returns of stocks and financial options to portfolio performance. I tested whether

financial options added to the portfolio influence an investor's portfolio performance positively when diversified properly. I used secondary data from Yahoo Finance, the NYSE, and CBOE (TD Ameritrade) to perform a correlation and regression analysis.

Chapter 2 is an in-depth examination of the relevance of MPT, and it includes the literature review as an analysis of recent peer-reviewed scholarship related to investment strategies and wealth management. Also, the inclusion of (Black-Scholes's options pricing theory, or BSOP, supports the relevance of portfolio diversification. The literature review provides the theoretical framework for this research. It combines the current thinking that closely aligned with Markowitz's MPT. The literature review covers two major themes that may influence the investment management. In the first theme, I discuss the portfolio diversification and asset allocation. In the second theme, I examine qualitative aspects of MPT, including views contrary to MPT.

Chapter 3 includes details of the research method. I provide the recommended research design, rationale, and methodology by explaining the target population, sampling strategy, instrumentation, and data analysis. Next, I discuss potential threats to external, internal, and construct validity, and the credibility of research including future replications of the study. Finally, ethical considerations related to the study and preventive measures will be discussed. In Chapter 4, I reveal the findings and answer the research questions. Chapter 5 includes a discussion, conclusions, and recommendations.

Chapter 2: Literature Review

The general management problem was the individual investor's inability to assess whether a possible stock option could provide a downside protection for a portfolio in volatile market conditions. The specific management problem was the absence of a simple investment model for private investors in the United States in which the relationship is analyzed between portfolio returns and the investment performance using financial options. The purpose of this quantitative quasi-experimental study, using a regression and correlation design, was to test the theories of the modern portfolio and option pricing that relate portfolio returns to the investment performance using financial options for individual investors in the United States.

This literature review focuses on investments and wealth management. I synthesize relevant current scholarship and identifies gaps in knowledge on the implications of investment and finance within the context of wealth management. Markowitz's (1991, 2014) modern portfolio theory (MPT) provides a theoretical framework.

Literature Search Strategy

Two Walden University Library databases were searched to locate relevant articles: Business Source Complete and ABI/INFORM Complete. Google Scholar was used to extract the actual articles. The search covered the following key terms and combinations: *modern portfolio theory, wealth management, stock return, options return, options pricing, asset allocation,* and *portfolio diversification*. Only peer-reviewed articles from 2012 to 2016 were considered. The original works of Markowitz (1991) on

modern portfolio fall outside of this timeframe because they serve as a theoretical framework for the study.

Theoretical Foundation

Markowitz's (1991, 2014) MPT provided the main theoretical framework for this research. Black-Scholes's options pricing theory (BSOP) is an additional supporting framework to analyze the benefits of options. In this quantitative quasi-experimental study, I employed a regression and correlation design to test the MPT and option pricing theory that relate the investor portfolio returns to the investment performance using options. This quantitative analysis was expected to pinpoint the potential amount of growth and protection that maybe achieved using options for high net worth investors in the United States.

In 1952 Markowitz (1991) founded MPT by using portfolio selection; he later received a Nobel Prize for his work. The MPT assumes that rational investors prefer a higher return and a lower risk when assessing the impact of risk and return on the portfolio performance (Markowitz, 2014). Moreover, the MPT assumes that the risk can be minimized by selecting portfolios that negatively correlated with each other. Black and Scholes (1973) created the option pricing model, which provided opportunities to hedge against financial risks. Black-Scholes's BSOP was a breakthrough in finance for the valuation of assets with embedded features. Hull (2005) elaborated how financial derivatives could be a source of building and protecting wealth. Mileff et al. (2012) listed several alternative investments to optimize individual investor's return.

Arugaslan and Samant (2012) closed the gap between investment theory and practice in the stock markets in Africa and the Middle East by evaluating the performance of American depositary receipts ADRs using statistical measures grounded in MPT. Dunham (2012) examined whether a chief executive officer's (CEO's) composition of firm stocks between restricted and unrestricted shares affects the level of risk undertaken by the firm that the CEO managed. Dunham applied MPT to examine the ability of executives to diversify their significant holdings of their firm's stock if the opportunity was available. Dunham combined two theories as a framework: MPT to explain diversification; BSOP to determine the values of options and stock awards. Similar to Dunham, in the study I combined MPT and BSOP to find out the benefits of the options as a risk mitigation. Geambaşu et al. (2013) studied the differences between the methods of measuring risk in the postmodern and MPT, from both a theoretical and empirical perspective. Geambaşu et al. concluded that the postmodern portfolio theory produced better empirical results sustained by the theoretical approach. The authors' work was integral to this research as an alternative perspective to the theoretical framework. In summary, MPT and BSOP were sound theoretical frameworks to study the relationship between the investor portfolio returns and the investment performance using options.

Modern Portfolio Theory

Markowitz's (1991) MPT is based on the following assumptions:

1. Investment alternatives are represented by the probability distribution of expected returns over a certain holding period. The normal distribution is one of the key assumptions.

2. Rational investors maximize one-period expected value; investors' utility curves are subject to diminishing marginal utility of wealth. In other words, investors receive less value and satisfaction as their wealth increases over time.
3. The risk of the portfolio is measured based on the variability of expected return. That is, investors view the variability of the return as a risk. A rational investor prefers consistency and reliability over variability of returns. Also, investors would like to get compensated for that variability because they are assuming the risk of return: the higher the variability, the higher the risk. Therefore, investors require higher returns. This notion is known as a positive relationship between risk and return. The statistical term for the variability of return is *expected variance* or *standard deviation from the mean*.
4. Because of the above assumption, investors make decisions based on expected return and expected risk. Consequently, a rational investor's utility curve is a function of these two variables, expected return and variance.
5. A rational investor would prefer a higher return over a lower return for the given risk level. Alternatively, for a given return, investors choose lower risk over higher risk.

Markowitz measured expected risk as variance. Thus, the bigger the deviation from the mean, the greater the risk. Therefore, a higher standard deviation of risk indicates more uncertainty about the possibility of the rate of return. When diversifying

the portfolio, the investor would like to add securities with negative correlation with each other because the negative covariance offsets the individual security's variance. It is possible to create a risk-free portfolio by targeting portfolios that have perfect negative correlation when they have equal weights and equal standard deviations. If two securities with perfect negative correlation are combined, it can maximize the benefit of diversification by eliminating the risk of the portfolio completely (Reilly & Brown, 2006). Markowitz demonstrated that the expected rate of return of a portfolio was the weighted average of the expected return for the individual securities in that portfolio.

Definition of Modern Portfolio Theory

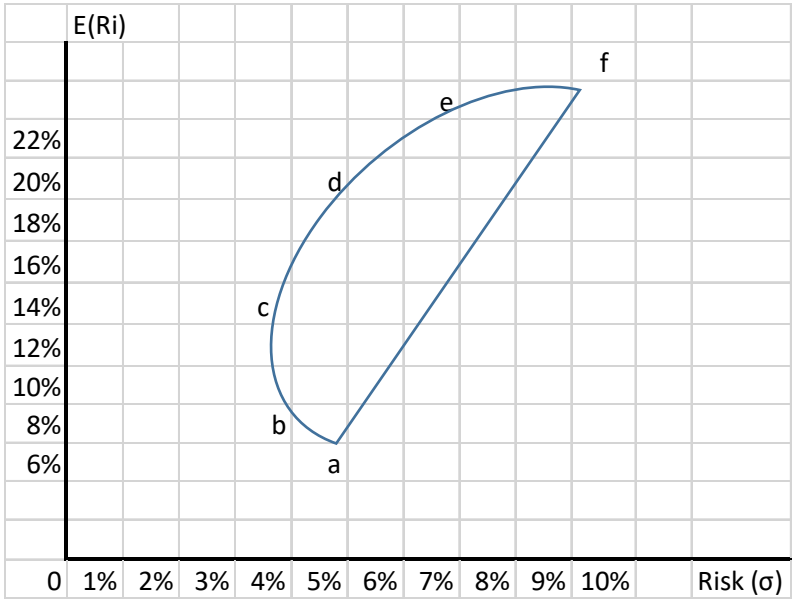
The MPT is addresses the selection of the portfolio. While the explanation and notion of MPT are about correlation and selection of securities with low or negative correlation but, instead, the selection of the portfolio. The correlation that Markowitz discussed was about the correlation of the security with the portfolio.

The importance of Markowitz's ideas to investment fields has been crucial. It changed how people select portfolio of assets and diversify their portfolios. By using expected return in vertical axis and risk (standard deviation) on the horizontal axis, Markowitz (1991) demonstrated the benefit of diversification. The following hypothetical example, informed by Reilly and Brown (2006), explains the essence of diversification.

The essence of diversification is shown in Figure 1. While units of return and risk are not the same as presented by Markowitz (1991) or Reilly and Brown (2006), this view gives a better explanation of the risk and return relationship. The asset *a* has the lowest risk and the lowest return.

Figure 1

Portfolio Diversification



Based on text material in *Investment Analysis and Portfolio Management* by F. K. Reilly and K. C. Brown, K. C., 2006. Thomson South-Western.

The asset *f* has the highest return and highest risk. Assets *b, c, d,* and *e* reside on a curve that have zero correlation with assets *a* and *f*. Therefore, by adding assets with zero correlation, we can reduce the risk and diversify our portfolio. A rational investor would prefer portfolio allocation *d* over *a* because for the same level of risk, portfolio *d* provides a higher return.

Black-Scholes's Option Pricing Theory

In a similar manner, the BSOP has its own assumptions:

1. Stock prices behave in accordance with lognormal distribution with expected return and risk being constant. The risk and return definitions are the same as in the MPT.
2. There are no transaction costs or taxes when an investor engages in options strategies. Although this assumption is simplified for the model, there are transaction costs and taxes in real life.
3. There are no dividends in the underlying stock during the life of the option. This is a realistic assumption because not all stocks pay dividends, and options can be purchased with the expiration date falling outside of the dividend period.
4. No arbitrage opportunities exist during the option expiration period.
5. Underlying stock is traded on the exchange every day.
6. Investors can borrow and lend at the same risk-free rate.
7. The short-term interest rate is constant. This assumption was validated from 2008–2015 when the Federal Reserve maintained constant near zero interest rates.

In sum, the MPT and BSOP served as the theoretical framework to analyze investors' ability to hedge.

Literature Review Related to Key Variables

This literature review combines the current research on Markowitz's (1991) MPT. I will discuss the literature on investment within the context of MPT. In his 1952 dissertation, Markowitz, who received a Nobel Prize for his work in this field, laid the

foundation for MPT. The primary premise of MPT is that an investor would like to maximize his or her return for a given level of risk. Alternatively, for a given level of return, the investor wants to minimize the risk, which is referred as a risk aversion. The investor who follows this behavior of optimal return is a rational investor (Markowitz, 2014). Markowitz computed the required rate of return and expected risk and presented how investors could optimize their portfolios by diversifying their securities. Accordingly, correlation of securities became a key measure of diversification. MPT addresses the selection of the portfolio, the portfolio diversification, and the asset allocation. While the explanations and notions of MPT refer to correlation and selection of securities with low or negative correlation, Markowitz argued his theory does not address the selection of securities but the selection of the portfolio. The correlation that Markowitz discussed was the correlation of the security with the portfolio.

Portfolio Diversification

MPT is focuses on the selection of the portfolio, the portfolio diversification, and the asset allocation. This literature review combines the current thinking that closely aligns with Markowitz's (1991) MPT and Sharpe's (2000, 2007) capital asset pricing model (CAPM), which is also based on MPT. (See Appendix B for a detailed discussion of the link between MPT and CAPM.) As mentioned in previous sections, the general assumptions of MPT are that an investor would like to maximize his or her return for given level of risk. The investor who follows this behavior of optimal return is a rational investor (Markowitz, 2014).

Livingston (2013) found an easier way to teach MPT and CAPM. Livingston argued that once the researchers know the logic behind MPT and CAPM, it would be easier to understand the implications of these theories. This article is a valuable research for students studying MPT and CAPM. It bridges the gap in the existing literature because it simplifies Markowitz's mathematical models into Excel. This narrative research was appropriate for describing these complex theories. I found no limitations in the article. Article generalizable and the research are replicable. The author controlled for researcher bias by substantiating explanations with evidence.

Miccolis and Goodman (2012) discussed adjustments needed to improve MPT's relevance after the financial crisis of 2008 exposed some of the weaknesses or oversimplifications of the MPT. First, Miccolis and Goodman emphasized separating the market environment to steady and turbulent environments to assess the market conditions better. Second, the authors recommended adding shortfall probability and conditional risk as additional measurements of risk. Third, the authors defined multidimensional copula dependence of the correlation rather than one-dimensional relationship. Finally, Miccolis and Goodman claimed that these modifications to the MPT would allow more realistic financial and investment planning. Because Miccolis and Goodman discussed the amendment to the MPT, it is safe to state that their theoretical framework was MPT. The research method used in this study is quantitative method employing regression analysis, similar to Markowitz himself in 1952. The difference was the modifications Miccolis and Goodman decided were necessary for the post–2008 crisis.

Furthermore, Miccolis and Goodman (2012), a pair of industry practitioners, communicated clearly and fully by putting their assumptions and clarifications up front. The quantitative research method was appropriate and adequate for this study because it showed the link between the original MPT and the modifications needed to reflect the current market and economic conditions in the investment field. Miccolis and Goodman called out their research questions and framed them significantly. Miccolis and Goodman emphasized that Markowitz (1952) simplified the MPT to make the math easier to comprehend and warned his audience to be cautious of the drawbacks. According to Miccolis and Goodman, the investment industry took MPT as the way of implementing diversification since complex and more sophisticated approach was not simply achievable. However, with contemporary technological advancements, the sophisticated version of the MPT should be viewed as more complex market conditions. Therefore, Miccolis and Goodman made an original contribution to the existing body of knowledge by resurfacing the forgotten or hidden issues of portfolio diversification. MPT was the correct theoretical framework for this study.

Peylo (2012) used the MPT as the theoretical base and emphasized the importance of socially responsible investing by developing a methodological approach to analyze and compare both traditional investing and socially responsible investing. Peylo argued that socially responsible investing has no extra cost to the investor and has no superior return; however, it is the right thing to do to save the planet and the environment. Peylo focused on the German stock market when implementing sustainability-related investment. Peylo quantified the qualitative parameter such as social responsibility by using all stocks in

German stock market index DAX, which consisted of 30 large cap companies. Peylo collected the data for the period from September 2003 through June 2010. The author used another pre-existing secondary source data for socially responsible investing (SRI) rating published by rating agency Sustainalytics. Peylo computed the risk and return values from daily closing prices of all DAX stocks by taking it from the database of the University of Karlsruhe, Germany. Peylo proposed to identify socially responsible companies and from that list to select the stocks of firms that meet the portfolio optimization criteria that MPT sets forward. Another approach Peylo proposed was using SRI as optimization criteria from the portfolio that already meets MPT guidance. The study was quantitative and based on mathematical formulas to derive the optimal portfolio selection. Peylo developed optimization algorithm using visual basic for applications. The author concluded that sustainability-driven stocks provide better diversification since they contribute to the reduction of portfolio risk. Peylo rejected the claims that SRI would have lower returns by applying mathematical formulas ad testing in the hypothetical portfolio cases. SRI also relates to Popper's (2002) refutation idea. Peylo refuted the idea of SRI having lower return and did not find the claims to be substantial. Therefore, it informed my research from refutation perspective.

Peylo (2012) listed several of the limitations of the model. One was model inaccuracy if more than one day of shortfall occurs in a 10-day period. The researcher defined the shortfall as a return being lower than the value at risk limit. Another limitation of the article was specificity to Germany. If other researchers want to apply it to another country, they must find SRI rating agencies and a similar mix of a diversified

portfolio that contain sustainability ratings. Overall, the results can be generalized to German market because it included the entire stocks in DAX. Caution must be exercised when implementing this method to broader and smaller cap stocks. While I understood the intentions and the findings, it was difficult to follow the formulas and calculations. The original contribution of the study was a demystification of SRI having a lower return than a traditional diversified portfolio.

Morison et al. (2013) studied the trend in the ultra-high net worth individuals (UHNWI) who are defined to have at least $30 million. The authors found that this group of individuals grew roughly from 75,000 to 187,000 over the preceding 2 decades; their wealth increased from $6.7 trillion to almost $25.8 trillion in the same period. Morison et al. (2013) concluded that this trend would continue into the next decade. The research method of this article was quantitative since author used descriptive statistics to summarize the trends. Interestingly, UHNWI accounts only for 0.003% of world population but holds 37% of the global GDP as of 2012. Morison et al. revealed how disproportioned the wealth distribution among people. The authors did not define or describe the theoretical framework for their study. The article was well written and contributed to the existing body of knowledge in wealth management by revealing the trend and market for wealth management firms. Because Morison et al. did not define the theoretical framework for their study, I classified the study as a conceptual framework for analyzing trending of UHNWI. Morison et al. communicated clearly and thoroughly to deliver their findings. Because the entire population of the UHNWI is 187,000 people and accounts only for 0.003% of the planet's population, these individuals can improve

the greater population's lives, given that they hold 37% of the wealth. The results of the study justify the authors' conclusions. Because the authors considered multiple countries and regions, the study took into account cultural and social differences even among UHNWI.

In the same fashion as above researchers, Scherer (2013) performed quantitative analysis of portfolio diversification to find the number of assets needed to diversify the portfolio. Scherer used MPT as a theoretical framework for the study. The author carried out this research based on hypothesis testing and using OLS regression analysis. By using mathematical formula and testing in regression analysis, Scherer found an optimal number of equally weighted assets needed to diversify the investment portfolio accounting for the frictional cost of diversification. By frictional cost, the author refers to the cost of further diversification. Scherer framed the research questions and hypothesis well and significant. The researcher made a contribution to the existing body of knowledge by adding the frictional cost of diversification. The research is based on a thorough review of the previous literature and expanding the work of other authors who created the portfolio diversification formulas. MPT theory was an appropriate theoretical framework for this study. Additionally, quantitative research method and OLS data analysis were adequate for this study. Because the author used funds of hedge funds, there are enough assets and funds to categorize the sample size to be sufficient. The derived formulas and regression model are replicable and generalizable to other population sizes. The limitations of the study are subjective determinants of individual investor's risk aversion level. Therefore, investors and financial advisors are warned to

use this model with caution since each person has a different degree of risk aversion. Finally, the amount of the asset under management has a significant influence on the frictional cost of diversification.

Dunham (2012) used MPT as the theoretical framework to study the firm's risk, return, and the diversification of a CEO's risk. Dunham examined the ability of executives to diversify their significant holdings of their firm's stock if the opportunity was available. The key question of the study was whether the composition of a CEO's portfolio of firm stock between restricted and unrestricted shares was related to the level of risk undertaken by the firm. Dunham found a negative and statistically significant relationship between firm risk and the proportion of CEO total unrestricted shareholdings. Dunham (2012) suggested that managerial hedging is more prevalent than in previous years because more innovative hedging instruments have become available to corporate executives. Executives use their unrestricted shares in hedging transactions while their restricted shares are not used (Dunham, 2012). The reference list included 28 scholarly articles to provide evidence to support the research problem, although only five of the 28 references were within 5 years of the article's publication date. Nonetheless, the author chose sources judiciously to perform evidence-based research. Dunham related his research to the existing body of knowledge well and made an original contribution by showing the relationships of a CEO's performance and risk mitigation of the firm. The researcher communicated clearly in a nonbiased literature review. As such, the research questions were logical extensions of the literature and existing body of knowledge.

Arugaslan and Samant (2012) bridged the gap between investment theory and practice in the stock markets in Africa and the Middle East. The purpose of the study was to provide empirical documentation to global investors who wished to participate in African and Middle Eastern stock markets using ADRs as the investment vehicle. In the first section of the article, Arugaslan and Samant studied the nature of ADRs, including their structure, sponsorship status, industry classification, and listing. In the second section, the researchers assessed the performance of these ADRs using statistical measures grounded in MPT. The quasi-experimental study used secondary data to perform a *t* test to compare returns. The authors adjusted the returns for the degree of total risk and systematic risk inherent in each ADR. They next ranked the securities based on risk-adjusted performance. Arugaslan and Samant used two evaluation metrics, the Modigliani and Sortino measures, to rank the securities. They obtained monthly return data for the 3-year period from January 2008 through December 2010 from the Center for Research in Security Prices (CRSP). The Morgan Stanley Capital International EAFE Index was used to evaluate the risk-adjusted performance of African and Middle Eastern ADRs. As a result of the study, Arugaslan and Samant created tables based on the risk of returns. The managerial and practical implication of this study is the ease of selection of the ADRs based on the investor's risk and return appetite.

Geambaşu et al. (2013) compared MPT to postmodern portfolio theory (PMPT) as a measurement of risk. Geambaşu et al. highlighted the differences between the methods of measuring risk in the post-modern and MPT, from both a theoretical and empirical perspective. Standard deviation represents a widely used measurement of risk; however,

the authors questioned the accuracy of standard deviation because it does not reflect investors' behavior and expectations. Geambaşu et al. viewed the downside risk as a better answer to the real investment process, including investor expectation and the non-normal distributed return rates. The authors argued that if PMPT were employed, the investor could distinguish between the real risk of obtaining returns lower than required return and the premium of obtaining higher returns than expected. Similar to the other two studies, secondary data were used from 40 companies from the Bucharest Stock Exchange over a period of 7 years, between 2005 and 2012. Geambaşu et al. found that the PMPT produced better empirical results sustained by the theoretical approach.

Bilgin and Basti (2014) tested both the unconditional and conditional CAPM in the Istanbul Stock Exchange (ISE) during 2003 and 2011. The authors excluded the unconditional CAPM from the study. Bilgin and Basti found a statistically significant relationship during some periods as a result of the conditional CAPM test. The authors warned that this conditional connection does not show a positive risk-return tradeoff since the risk-return relationship in up and down markets is not symmetric. Therefore, authors concluded that CAPM may not be suitable as asset pricing model in Istanbul. The authors made an original contribution by providing empirical evidence for the applicability of conditional and unconditional CAPM models for the ISE. Using CAPM as the theoretical framework for this study was appropriate. Although the CAPM and MPT are two different theories, CAPM is based on an extension of MPT, such as applying the concept of risk-free rate. Therefore, CAPM was a relevant investment theory.

Tarnóczi and Kulcsár (2013) explored efficient portfolio alternatives part of performance ratios based on CAPM, MPT, and Sharpe ratio employing value at risk. Specifically, the authors examined the MPT as a theoretical framework by performing a comparative analysis of risks and returns of portfolios consisting primarily of Hungarian (BUX) and Romanian (BET) stock indices. Tarnóczi and Kulcsár investigated daily closing prices during a 6-month period. The authors employed a statistical analysis to derive their conclusions; therefore, their study fell under quantitative methods of research design. The researchers found that Romanian portfolio had a higher risk and lower volatility to achieve greater performance than Hungarian portfolio. Combining various theoretical foundations was justified by the study because, in the investment field, CAPM, MPT, and Sharpe ratio complement each other.

In my dissertation research, I combined MPT with BSOP to have a more comprehensive theoretical framework, a combination of theoretical frameworks allowable for such studies. The quantitative research method used by the authors was adequate and suitable for this study. Tarnóczi and Kulcsár (2013) reviewed 21 other scholarly works upon which to base their knowledge. Their article made an original contribution to the existing body of knowledge by applying the theoretical framework to the international markets such as Budapest and Bucharest stock exchanges. Overall, the article as well written and researched. Tarnóczi and Kulcsár framed important research questions. The researchers defined the variables and the theoretical frameworks; thus, it was easy to follow the authors' lines of thought. The use of secondary source data was justified and the 6-month period was reasonable to make inference because of the number

of socks and data points available in each stock exchange is quite large and equates to 120 to 130 data points per each stock selected in each stock exchange.

Bilinski and Lyssimachou (2014) tested the risk interpretation of the CAPM's beta by examining if high-beta stocks experience either very high or very low returns compared to low-beta stocks. Although subject to debate, the researchers found that beta was a good predictor of large positive and negative swings and a valid empirical risk. Bilinski and Lyssimachou framed the research questions and hypotheses well. The authors made an original contribution by providing empirical evidence of CAPM's application. The theoretical framework of CAPM was appropriate for this study because the authors were analyzing whether the beta was a good predictor of risk. Bilinski and Lyssimachou listed their assumptions and data collection process precisely. One limitation of this article is its divided audience. That is, most researchers are not convinced that single beta can be the estimator of risk, while others use unconditional CAPM in the U.S. markets as a result of its simplicity. Finally, practicing managers should be aware of limitations of beta.

Cochrane (2014) also employed CAPM as the theoretical framework in the author's examination of long-term portfolio problems and appropriate balance between earnings and investment return. Asset return dynamics were discussed, along with dynamic trading, and nonmarket wealth, including salaries, real estate, and business ownership. Cochrane argued that markets are incomplete, and investors may not be able to hedge completely their noninvestment income. One area Cochrane concentrated on

was the optimal stream of payoffs instead of portfolio returns. Cochrane used mean-variance characterization and CAPM equilibrium pricing.

From a methodological standpoint, Livingston (2013) used Excel functionalities to show how to build efficient frontier and a securities market line. Livingston concluded that if students were exposed to the techniques of building efficient portfolios using Excel matrix multiplication functions, students would understand the portfolio theory better than just reading the textbooks. Both Dunham (2012) and Arugaslan and Samant (2012) performed quasi-experimental studies analyzing secondary data from the Center for Research in Security Prices (CRSP). Dunham used Standard and Poor's Execucomp database for the period of 1993–2005, while Arugaslan and Samant obtained monthly return data for the 3-year period January 2008 through December 2010. Dunham's final sample comprised 3,401 CEO observations on 782 firms. Such large sample sizes represent the larger population. Geambasu et al. employed statistical and mathematical procedures to test hypotheses. They employed analyses similar to ANOVA, even though they did not specify the statistical analysis. From the mathematical viewpoint, they used derivative terms to solve the variances and standard deviation.

Bilgin and Basti (2014) constructed betas of 18 portfolios by averaging the betas of the individual stocks they contain. They next used logistic regression analyses to test hypotheses. These 18 portfolios accounted for 60% to 71% of total stocks; as such, the sample size was bigger than needed. Given this research was unique to the ISE; the results could be different in other locations. However, the findings were consistent with the existing literature.

Bilinski and Lyssimachou (2014) used logistic regression to validate their hypotheses. The authors processed enormous data. The sample was the entire population of companies listed in the stock market from January 1975 through December 2005 that met the selection criteria. The final sample contained 1,015,320 firm-month observations. This sample size and cross-sectional observations were too large; if another researcher wished to replicate this finding, it would be time-consuming to validate or duplicate the results.

Qualitative Aspects of MPT

Although the theoretical focus of this study was MPT and diversification, other authors have disputed Markowitz's (1991) rational investor definition and argued against MPT. International trade between countries has enabled investors to be exposed to the global markets outside the United States. Lydenberg (2014) evaluated the power of fiduciary obligation of money managers from a legal and economic viewpoint. In this narrative qualitative article, the researcher distinguished the difference between reasonable and rational behavior. Lydenberg argued that reasonable behavior was the legal side of the fiduciary duty where a reasonable person would behave to protect the interest of others. On the other hand, rational behavior of the fiduciary responsibility refers to self-interest rather than the interest of others. Therefore, Lydenberg called it conflicting behaviors within the fiduciary obligation. Lydenberg suggested that MPT is to blame for the rational behavior of investors at the cost of others. Specifically, Lydenberg argued that the benefit of investment and fiduciary obligation must be balanced between the current generation and future generation if the reasonable, prudent, and intelligent

person rather than a rational individual is managing the investment. The author criticized MPT by blaming the rational investors for not being reasonable. Lydenberg concluded that to be a reasonable and prudent investor, fiduciaries must pay attention to the real-world implications of their investment behavior.

Jennings et al. (2011) examined the peculiarities and complexities of private wealth management practice. The study was narrative and exploratory in its approach; therefore, the research method was qualitative. Although Jennings et al. did not explicitly state the theoretical framework, it can be inferred that it was in alignment with MPT. Jennings et al. listed seven fields that private wealth management must be capable of, such as investment management, tax advice, personal financial planning, estate planning and will, behavioral finance, risk management such as insurance, annuities, and technical expertise. Another difference of individual investing from the institutional investing that Jennings et al. mentioned was the strategic asset allocation and investment policy because individual investors compare after-tax risk and return. Jennings et al. emphasized the distinguishing characteristics of wealth management firms are asset allocation and asset location. The definition of asset allocation might be well known while asset location refers to where to put assets such in taxable accounts or tax-advantaged accounts. Jennings et al. reviewed more than 100 studies to support their findings of the research. The authors found the gap in the existing literature and by summarizing and guiding the reader through complexities and differences of private wealth management practice. A qualitative research method was appropriate and justified for their study. While Popper (2002) did not accept the qualitative inductive method of research as a scientific

approach, Jennings et al. was one example of where knowledge can be built and expanded by the inductive approach. Therefore, both qualitative and quantitative methods of acquiring knowledge can be relevant.

Likewise, Kitces (2013) employed the qualitative method and based his article on interviewing three expert financial advisors. Kitces interviewed Mebane Faber, Jerry Miccolis, and Ken Solow on advantages and drawbacks of dynamic asset allocation, which is also known as tactical asset allocation. Kitces obtained answers and insights from above financial advisors and provided in concise and easy to read format. Kitces framed his questions well, and they followed from the generic to more detail as the interview progressed. This article is an excellent example of how qualitative research method can be used to analyze a quantitative field such as investment. Because tactical allocation is in a transition phase, Kitces made an original contribution by providing insights from the practicing advisors. The theoretical framework of MPT was adequate and appropriate for this discussion. Kitces communicated clearly and thoroughly to address problems of tactical asset allocation. The author controlled researcher bias pretty well even though it was a qualitative study and provided conclusions in the form of advice from the experts. The conclusions were generalizable. Among its limitations were its applicability by all advisors or investors, given that some may not understand the complexity and dynamic nature of tactical asset allocation.

Mangram (2013) used Microsoft Excel to show the complex statistical formulas so that the reader can focus on the importance of MPT. Mangram summarized the key concepts of MPT, fundamental assumptions, and how they can be simplified. Mangram

employed qualitative method since the nature of his study was narrative, and he used no statistical analysis. However, as an example of qualitative research article on quantitative theory and work of Markowitz's MPT, his method of delivering the knowledge was powerful and fascinating. He concluded that MPT would continue being a critical theory in the field of investment in spite of its challenging assumptions. Mangram's original contribution was providing the literature review of the existing knowledge and linking them to create new knowledge. The article provided additional evidence against Popper's (2002) claim that knowledge cannot be classified as scientific if it is obtained through the inductive method.

From a practical implication standpoint, most of these researchers used secondary data and regression analysis. Bilgin and Basti (2014) showed that one model may work in one country but not in another country for social, cultural, economic, and political reasons. The implications of the findings were relevant to my study. Kitces's (2013) article was also relevant because I used MPT with some level of active investing. As the researcher, I benefited from Kitces because the study informed my research of continues asset allocation and looking for alternative investment strategies. I proposed alternative active investment strategies and test them to examine if they work. As buy-and-hold strategies failed in recent years, wealth management professionals must look for other sound strategies to minimize the downside risk even if they limit the upside potential of the portfolio.

Summary and Conclusions

In summary, the literature review provided the theoretical framework for this research. It combined the current thinking that closely aligned with Markowitz's MPT. I organized the literature review around two major themes that may influence investment management. First, I discussed portfolio diversification and asset allocation. In the second theme, I discussed qualitative aspects of MPT including views contrary to MPT. The general assumptions of MPT are that investors would like to maximize their return for a given level of risk. Alternatively, for a given level of return, the investor wants to minimize the risk, which is referred as a risk aversion. The review showed that other researchers have successfully used secondary data and regression analysis in similar studies. This literature review served as a starting point and groundwork for the study. The study was the first examination of hedging strategies to offset certain market downsides for individual investors and to fill the gap identified in the literature review.

In Chapter 3, I cover in detail the research methodology, design, data analysis, and rationale. I provide the recommended research design and methodology by explaining the target population, sampling strategy, instrumentation, and data analysis. Next, I discuss potential threats to external, internal, and construct validity, and the credibility of research including future replications of the study. Finally, ethical considerations related to the study and preventive measures are discussed.

Chapter 3: Research Method

The purpose of this quantitative quasi-experimental study was to test the MPT and option pricing theory that relate portfolio returns to investment performance using financial options for individual U.S. investors. The design was a regression and correlation statistical analysis. The investors' portfolio returns consisted of stock returns and financial options returns. Two independent variables of the study were stock returns and financial options returns, defined as monthly returns as published by the Yahoo Finance and NYSE for stocks, and the Chicago Board of Options Exchange for options. I defined the dependent variable, investment performance, as a change in portfolio value during the investment period. The specific population of the study was a subset of the S&P 500 index consisting of 33 stocks, three stocks from each of 11 sectors, that have tradable financial options, including both call and put options, and actively traded in the stock market from January 1, 2008, to December 31, 2010. The implication for a positive social change was the simplified explanation of leveraging financial options in managing an investment portfolio while being mindful of associated costs. It could be used as a training resource to educate individual investors to make better investment choices.

In this chapter, I provide the research design and methodology by explaining the target population, sampling strategy, instrumentation, and data analysis. Next, I discuss potential threats to external, internal, and construct validity, and the credibility of research including future replications of the study. Finally, I discuss ethical considerations related to the study and preventive measures.

Quantitative Methods

A quantitative method is deductive and explains the relationships between independent variable and dependent variable. The deduction is a regressive method where existing general theory is applied or examined on a particular issue (Lewis-Beck et al., 2004). The two primary strategies primarily used in a quantitative study are experimental and nonexperimental designs. Frankfort-Nachmias and Nachmias (2008) further expanded nonexperimental designs into cross-sectional and quasi-experimental studies.

An experimental design is the strongest form of research on internal validity but suffers from weakness on external validity. On the contrary, cross-sectional and quasi-experimental designs are robust on external validity but weak on internal validity. The weakness of cross-sectional and quasi-experimental designs can be mitigated by statistical data analysis techniques as a method of control of extrinsic and intrinsic factors (Frankfort-Nachmias & Nachmias, 2008). The pre-experimental design is weak on both internal and external validity, which I now further discuss.

Experimental Design

The strength of an experimental design is a researcher's ability to control variables of the study improving internal validity, such as a causal relationship. Consequently, a researcher can control the timing and process of the intervention of the independent variable to identify the direction of the causation (Frankfort-Nachmias & Nachmias, 2008). One of the limitations of the experimental design is the researcher's inability to reproduce the real-life cases resulting in weak external validity (Frankfort-Nachmias & Nachmias, 2008). Another weakness of this model is self-selected

participants. Because participants may not be representative of the entire population, the generalizability of the findings is limited.

Cross-Sectional and Quasi-Experimental Designs

The strength of these designs is external validity because they allow researchers to conduct studies in the natural settings of the phenomenon. Additionally, these methods do not require the random assignment of individual cases to experimental and control groups (Frankfort-Nachmias & Nachmias, 2008). Weaknesses of cross-sectional and quasi-experimental designs reside in inadequate control over independent variable resulting in uncertain inferences and direction of causation (Frankfort-Nachmias & Nachmias, 2008). Because of this weakness, a researcher cannot guarantee reverse causation in certain cases such as dependable variable influencing the independent variable.

Pre-Experimental Designs

The strength of this design is applicability to cases where other designs do not lend themselves; however, the pre-experimental design is the weakest design because it suffers from both internal and external validity (Frankfort-Nachmias & Nachmias, 2008). Therefore, researchers should try other designs to draw scientific conclusions on causation while strengthening the internal and external validity and controlling independent variables.

Qualitative Methods

A qualitative method is inductive and designed to study behaviors, statements, attitudes, observations, gender, race, and culture (Lewis-Beck et al., 2004). Induction is a progressive method of creating a theory from data by analyzing specific issues related to

smaller topic or problem and generalizing it to the point that it becomes a theory applicable to the greater population (Lewis-Beck et al., 2004). A qualitative approach employs one of the five strategies: narrative research, phenomenology, ethnography, case study, and grounded theory.

Lewis-Beck et al. (2004) provided foundational differences in five approaches and classified them by focus, research problem, and the unit of analysis, among others. For instance, narrative research focuses on reporting the biography of an individual while phenomenology concentrates on the common meaning of lived experiences for multiple participants. Data collection and analysis for the five approaches depends on the number of sources and type of analysis chosen. As an example, a case study uses multiple sources including interviews, observations, and documents while grounded theory primarily uses interviews to collect the data (Lewis-Beck et al., 2004). The intent is also different for the five approaches. As an illustration, the purpose of grounded theory is to create a new theory while the other four mainly describe or explore a phenomenon. The reporting structure and the format of five approaches are also distinctively different. The grounded theory, phenomenology, and case study approaches are more structured with systematic procedures than ethnography or narrative research (Lewis-Beck et al., 2004). Therefore, the research design and approach must be selected based on the questions or problems the researcher is trying to answer. I will briefly analyze each of the five approaches.

Ethnography

The ethnographic researcher seeks to understand shared values, attitudes, beliefs of a group in a natural setting of the participants over extended time by using

observations and interviews (Lewis-Beck, Bryman, and Liao, 2004). In ethnography, the theory is used as a foundational framework to explain behavior and attitudes of participants who share common beliefs or values. It is used to analyze the common themes. The theory is also used as a lens to explain the observations the researchers notice through the lens of participants. Lewis-Beck et al. (2004) referred to the theory as an overall orienting lens for the study because it directs how scientists position themselves concerning the topic. The theory is also used to show different perspectives and aspects of the central phenomenon.

Grounded Theory

A researcher who undertakes a grounded theory approach seeks to generate and discover a theory inductively based on the participants' views and compare multiple groups that share common processes (Lewis-Beck et al., 2004). In other words, as its name indicates, the theory is grounded in the viewpoint of the participants who share similar actions but may be physically located in different places. In a ground theory approach, a theory is the result of successfully carried out a qualitative approach that is grounded in the perspectives of participants.

Case Studies

Case studies are used to explore the detailed account of events, processes, or behaviors of one or more individuals (Moses & Knutsen, 2012). Case studies might take place in two different companies in two distinct countries or could be held in two separate departments from the same company in the same location. The case studies are delimited by time. In the case study approach, a theory could be the outcome of the

researchers' interpretations and observations to generalize pattern or theory. That is because social scientists explore real cases of events, processes, and behaviors.

Phenomenology

In a phenomenological study, participants tell about actual lived experiences to identify the essential structures of a phenomenon (Lewis-Beck et al., 2004). Unlike the other five approaches, phenomenology uses a conceptual framework rather than a particular theory as a starting point (Lewis-Beck et al., 2004). There may not be a theory to guide every step of the way in phenomenology. The theoretical framework is at one end of the continuum of inquiry where much is known, while the conceptual framework is on the other side of the continuum where little is known (Laureate Education, 2010). When scientists employ phenomenology as a qualitative approach, they contribute to their field by making the phenomenon more widely known, which contributes to the generalization of the concepts to the extent that it may become a theory.

Narrative Research

Narrative research is focused on reporting the live stories of individual or individuals as told by participants in chronological order (Lewis-Beck et al., 2004). Some of the examples of the narrative research are a biographical study, life stories, and the story of an individual's life. According to Patton (2015), narrative research employs a broad range of social theories such as a practice theory. Consequently, the role of practice theory is important because it structures how the researcher reports the live stories of individual or individuals in chronological order. In addition to theory, narrative research requires extensive use of conceptual frameworks in organizing and collecting the data

(Patton, 2015). As a result, theory guides the narrative study because it is a biographical study and the story of individual's life.

Mixed Methods

Reynolds (2007) referred to mixed methods as a composite approach because mixed methods research includes both quantitative and qualitative characteristics by utilizing deductive or inductive research methodologies. There are three concurrent and three sequential strategies in mixed methods. The four factors of mixed methods are timing, weighing, mixing, and theorizing (Lewis-Beck et al., 2004). The primary factor that determines the weight of the split between quantitative and qualitative approaches is the timing.

Usage, Strength, and Limitations of Research Methods

The strength of the quantitative method is its objectivity. A straightforward statistical calculation to test existing theory is the second strength. There are limitations of the quantitative approach. First, it only predicts or explains the relationship between variables. Second, it cannot study non-numerical variables such as gender, social class or culture without converting them into numerical values. Third, it cannot explore the phenomena, and it does not generate new theory. Fourth, it also has limitations on the rigid structure of reporting the findings.

One strength of qualitative approach is the flexibility of presentation format. The second strength resides in studying non-numerical variables in social sciences. Next, it takes place in the natural setting of participants. Conversely, one weakness of this method

is the subjectivity of the approach. Researcher bias is an inherent weakness. Finally, it cannot be used to examine numerical data.

The strength of the mixed methods is that a researcher can gain perspective by analyzing both qualitative and quantitative data. Second, some events cannot be studied using only one research method. The final strength of the mixed method is triangulating data sources, which cancels the biases inherent in a single method (Lewis-Beck et al., 2004). However, mixed methods have limitations as well. One of them is the complexity of mixed methods research. The sequential design studies take a significant amount of time to complete data collection and analysis because the quantitative and qualitative phases are conducted separately (Lewis-Beck et al., 2004). Next, the researcher must have expertise in both qualitative and quantitative studies. In the following section, I will discuss the research design and my rationale for selecting it.

Research Design and Rationale

This study was quantitative quasi-experimental research in which I used a regression and correlation analysis. The independent variables, stock return and options return, were defined as monthly returns as published by Yahoo Finance, the NYSE, and the Chicago Board of Options Exchange. The dependent variable, investment performance, was defined as a change in portfolio value during the investment period. To validate the existence of a relationship between the dependent and independent variables, I performed a correlation analysis in which I compared performance of the portfolio with and without the use of options as a risk reduction instrument. Campbell and Stanley (1963) suggested that the closer the relationship amongst dependent and independent

variables, the higher the correlation because correlation measures the strength of the relationship. The mere existence of a correlation does not necessarily mean there is causation; however, if there is causation, then there is a correlation between variables (Campbell & Stanley, 1963). The proof of causality consists of demonstrating covariation, elimination of false relations, and forming time-order of the occurrences (Frankfort-Nachmias & Nachmias, 2008). Therefore, regression and correlation analysis was appropriate for this study because I predicted that the options would influence the portfolio performance.

Because I needed to examine statistical relationship among variables, I performed ANOVA, bivariate correlation, and standard multiple regression to test the research hypotheses. I used SPSS to generate statistical analyses and facilitate the interpretations of Pearson correlation and regression modeling amongst variables.

The rational investor would like to reduce the correlation between securities to increase total return of the portfolio (Markowitz, 1991). For that reason, Markowitz's initial portfolio selection was a groundbreaking phenomenon in 1952. Because my study was designed to compare performance of the portfolio with and without an option, the regression and correlation design was the appropriate approach. The option was an experimental variable to which the subject portfolio was exposed. Consequently, in this regression and correlation design, I tested the reduction of risk associated with adding options.

As a caveat, Markowitz's (1991) theory favors a low or negative correlation amongst securities. However, I measured an increase in a total portfolio return or

reduction in the total portfolio risk as the result of adding options. That is, I added the type of option that negatively correlates with securities in the portfolio but positively correlates with the total return of the portfolio. For that reason, I selected regression and correlation design to conduct this research.

Methodology

Population

The specific population of the study was a subset of the S&P 500 Index taken from January 1, 2008, to December 31, 2010. The stocks had tradable financial options including both call and put options. The specific population comprised 33 companies and included all 11 sectors of S&P 500 to best represent the entire S&P 500 Index. S&P 500 Index sectors include consumer discretionary, consumer staples, energy, financials, healthcare, industrials, information technology, materials, real estate, telecommunication services, and utilities.

Sampling and Sampling Procedures

A researcher must consider various sampling designs because sampling strategy can strengthen or weaken the quantitative research study. Because the secondary data included the full population of S&P 500 stocks and options, a single-stage sampling was appropriate. The study involved stratification of the population before initiating random sampling. Stratification is the process of ensuring accurate characteristics of the population, such as industry and sector proportions that are represented in the sample (Frankfort-Nachmias & Nachmias, 2008). Finally, I selected stocks using a random sampling strategy. In random sampling, each selection from the population has the same

chance of being chosen (Bowerman & O'Connell, 2003). The strength of the stratified random sampling is its representativeness of the entire population of the stock market. It increases the accuracy of estimating because the sample represents the population adequately (Frankfort-Nachmias & Nachmias, 2008). Therefore, I selected stratified random sampling as a method that would allow making statistical inferences about the population parameters and enable generalizability to the entire S&P 500 Index.

Sampling Strategy

Typically, researchers test the sample size and generalize to the larger population because of cost and time effectiveness of sample testing. Nonprobability sampling strategies would not have been appropriate for this research because the sample unit of the stock market had to be included in the sample. In nonprobability sampling, there is no assurance of each unit of the population having some chance of being included in the sample (Frankfort-Nachmias & Nachmias, 2008).

Probability sampling strategies assure that all units of the population have some chance of being selected. Frankfort-Nachmias and Nachmias (2008) listed the four most common probability sample designs: simple random sampling, systematic sampling, stratified sampling, and cluster sampling. Within probability sampling, a systematic sampling and cluster sampling would not have work for this research. The systematic sampling was not suitable because I would have omitted industry or sector of the S&P 500 stocks. Cluster sampling was inappropriate because it would have complicated the sampling by performing it in multiple stages.

The sample generated from stratified random sampling is a representative sample from the population enabling the generalization to a larger population (Frankfort-Nachmias & Nachmias, 2008). Equally importantly, stratified random sampling reduces the cost of collecting the data and conducting the research. Because the sample was a subset of the population and representative of the entire S&P 500 stocks, the findings are generalizable to the entire stock market. Therefore, stratified random sampling was appropriate because the population was fairly represented in its true composition.

Sample Size and Power Analysis

When deciding on sample size, three important factors are statistical power, alpha, and the effect size. According to Burkholder (n.d.), the acceptable value for power is 0.80, for alpha is 0.05. In the regression analysis, R^2 is the effect size of the model, and it is the coefficient of determination. Field (2013) using Cohen's methodology and defined these ranges for R^2 values: 0.02 as a small effect, 0.13 as a medium effect, and above 0.26 as a large effect. G*Power 3.1 software uses 0.35 as a large effect for the linear regression model. Field (2013) emphasized that sample size does not have to be big for medium to large effects regardless of how many predictors the researcher has. I ran G*Power software, and it calculated the sample size of 32 to be adequate at the alpha of 0.05, the power of 0.80, and with a large effect size of 0.35 (Faul et al., 2007). Because there are 11 sectors in S&P 500 index, selecting three companies per sector resulted in 33 companies. I collected the data on stocks of 33 companies that had tradable financial options, including both call and put options, and actively traded in the stock market from January 1, 2008 to December 31, 2010.

Procedures for Recruitment, Participation, and Data Collection

Because in this research I used secondary data, I had no recruitment of participants or data collection of primary data. Instead, I used archival data from Yahoo Finance, NYSE, and CBOE, and TD Ameritrade's Think or Swim platform. Frankfort-Nachmias and Nachmias (2008) noted three reasons for using secondary data: conceptual-substantive factors, methodical reasons, and costs. Secondary data were appropriate because I would have needed to have invested at least $1 million as the alternative method. Moreover, I would need to collect the primary data over an extended period on both stocks and options I invested. Instead, I used secondary data collected over an extended period and a correlation research design to obtain the effects of longitudinal studies. This feature of secondary data strengthened the internal validity. Because the actual historical data on stock and options performance are accurate and reliable, I left an opportunity for replication and generalizability of the findings because of sample size and its representativeness (Frankfort-Nachmias & Nachmias, 2008). That strengthened the external validity of the research.

On the other hand, secondary data use has limitations: the gap between the purpose of the secondary data collection and the purpose by the researcher, the access to the secondary data, and insufficient information about how the secondary data collected (Frankfort-Nachmias & Nachmias, 2008). Given that the performance of the financial market is measured by multiple independent sources, those three limitations posed no problem for this research. Nevertheless, as noted earlier, market anomalies can impact the hypothesis testing—for example, Black Monday in the NYSE, the massive selloff during

the 2008 crisis, or massive selloffs in July and August of 2015 in fear of China's economic collapse. These kinds of anomalies do not allow proper correlation analysis because such panicky events overshadow the future outlook.

Instrumentation and Operationalization of Constructs

I used SPSS as a reliable analytical instrument. Reliability measures variable errors of the measurement and refers to the consistency of the instrument (Frankfort-Nachmias & Nachmias, 2008). In other words, reliability is the dependability of the instrument. If a researcher can obtain the same or similar results by using the measurement multiple times, then the instrument is reliable. Reliability and validity are similar because they both indicate the sources of measurement error. They differ because validity is an aspect of measurement that addresses whether researchers are measuring what they think they are evaluating, while reliability measures variable errors of the measurement (Frankfort-Nachmias & Nachmias, 2008). Therefore, they are both essential and integral part of research validation.

As noted in Chapter 1, the four constructs were operationally defined as follows:

Financial options: An options contract that gives the option holder the right to buy or sell the underlying asset by a certain date in the future for a pre-agreed price (Hull, 2005).

High net worth investors: Investors who have enough funds to buy several securities and implement sound investment strategies to take advantage of the diversification.

Investor portfolio returns: Stock returns and options returns. I defined the independent variables *stock returns* and *options returns* as monthly returns as published by Yahoo Finance, NYSE, and Chicago Board of Options Exchange.

Investment performance: A change in a portfolio value between the beginning and the end of the investment period. It was the dependent variable of the study.

Data Analysis Plan

The strength of the quantitative method is its objective, straightforward statistical calculations using SPSS to test an existing theory. The research method was quantitative with a quasi-experimental design using regression and correlation. The results were interpreted using key parameter estimates, including correlation coefficient, standard deviation, variance, and confidence interval with the alpha of 0.05.

Because I compared the performance of the portfolio with and without an option, the regression and correlation design was an appropriate approach. The option is an experimental variable that the subject portfolio were exposed to. Consequently, regression and correlation design tested the reduction of risk associated with adding options. In the research, I measured an increase in a total portfolio return or reduction in the total portfolio risk as the result of adding options. In addition to using regression analysis, I included descriptive statistics for the research variables and used ANOVA for quantitative analysis as an appropriate test.

The specific population of the study was based on the January 1, 2008, to December 31, 2010, timeframe and comprised 33 sets of portfolios containing stocks that were in the S&P 500 Index and had financial options. Financial options include both call

options and put options. One of the main assumptions of the study was that financial options must be traded on the underlying stock to hedge the portfolio.

Statistical Assumptions

Analysis of Variance

ANOVA compares two or more sample means. According to Field (2013), the underlying assumptions of one-way ANOVA are that (a) the populations are normal, (b) observations must be independent, and (c) homogeneity of variance.

Correlation Analysis

Campbell and Stanley (1963) suggested that the closer the relationship amongst dependent and independent variables, the higher the correlation because correlation measures the strength of the relationship. According to Green and Salkind (2014), a bivariate correlation analysis has the following assumptions: (a) the relationship between X and Y is linear and normally distributed, (b) the cases represent a random sample from the population, and (c) scores on variables for one case are independent of scores of other cases.

Regression Analysis

Linear multiple regression was used for the study. The regression is the basic or starting point of general linear models. According to Filed (2013), the purpose of performing regression is to develop the equation that is used to predict the best fit line for the given dataset when one or more variables are used to predict the outcome. The advantage of multiple regression is its strengthening the causal inferences through the addition of multiple predictors (Field, 2013). There are several assumptions of multiple

regression: (a) linearity of the model, (b) independence of errors, (c) no outliers, (d) variables are continuous, (e) no missing data, (f) population is normally distributed including errors, (g) homogeneity of regression and homogeneity of variance (i.e., homoscedasticity), and (h) no perfect multicollinearity between variables (Field, 2013; Laureate Education, 2009). Field (2013) proposed using Cohen's methodology and defined ranges for R^2 values: 0.02 as a small effect, 0.13 as a medium effect, and above 0.26 as a large effect. The homogeneity of regression can be violated by outliers. If homogeneity of regression is violated, we need to remove that outlier variable from the analysis.

Frankfort-Nachmias and Nachmias (2008) noted four limitations of the quantitative approach. First, it only predicts or explains the relationship between variables. Second, it cannot study non-numerical variables such as gender, social class, or culture without converting them into numerical values. Third, it cannot explore the phenomena, and it does not generate new theory. Fourth, it also has limitations on the rigid structure of reporting the findings.

Research Questions and Hypotheses

Central Research Question

How can U.S. investors relate portfolio returns to the investment performance using financial options? Two subquestions with their corresponding hypotheses were examined in this quantitative quasi-experimental study utilizing a regression and correlation design. (See below for the operational definitions of the terms used in these questions.)

Subquestion 1

What is the correlation between the stock return and return on financial options such as call and put options on the same underlying stock?

Null Hypothesis $H_0 1$

There is no correlation between the stock return and return on financial options such as call and put options on the same underlying stock.

Alternative Hypothesis $H_a 1$

There is a correlation between the stock return and return on financial options such as call and put options on the same underlying stock.

Research Subquestion 2

What is the correlation between portfolio return on a stock portfolio containing no financial options and the investment performance on a portfolio consisting of stock returns and return on financial options including call and put options?

Null Hypothesis $H_0 2$

There is no correlation between portfolio return on a stock portfolio containing no financial options and the investment performance on a portfolio consisting of stock returns and return on financial options including call and put options.

Alternative Hypothesis $H_a 2$

There is a correlation between portfolio return on a stock portfolio containing no financial options and the investment performance on a portfolio consisting of stock returns and return on financial options including call and put options.

Threats to Validity

Internal and external threats to validity and construct validity threaten a researcher's ability to draw the correct conclusions. Moses and Knutsen (2012) defined *internal validity* as internal procedures of the experiment or the study while *external validity* covers the experiment or study and its relationship to the outside world. Therefore, internal validity is internal control of the experiment or simply control of the variables. External validity is generalizability of the findings. Campbell and Stanley (1963) summarized eight threats to internal validity: selection, history, maturation, mortality, instrumentation, testing, regression artifacts, and interaction with a selection. The threat to external validity, which is generalizability, includes study settings, the timing of the study, and the interaction of selection with treatment (Frankfort-Nachmias & Nachmias, 2008). For that reason, the research sample must be representative of the population to address the threats to external validity.

To ensure credibility, quality, validity, and reliability of the data, a researcher may use strategies such as member checking, rich descriptions, explaining researcher's bias, negative information, audit trail, referential adequacy, peer debriefing, and hiring an external auditor (Grinnell, 2009). When conducting research, the researcher must identify threats to validity such as selection, maturation, additive and interactive effects of threats to validity. Random selection from the pool of all participants or data points helps mitigate the selection threats. Shortening the time of the study and the survey can reduce the maturation effects. Additive and interactive effects of threats to validity can be mitigated by sticking to the research plan timeline and completing it on time.

External Validity

A researcher must balance internal validity and external validity. The interaction of setting and the experiment does not depend on the environment of the study. The interaction of selection and treatment may pose some threats because the findings cannot be generalized to the stocks that do not have options trading on the underlying. As such, the results cannot be generalized to the out-of-scope stocks to mitigate the selection threat.

Threats to external validity result from the researcher's incorrect interpretations from sample data to the past or future conditions (Frankfort-Nachmias & Nachmias, 2008). The main threat to the external validity of the research is the interaction of history and experiment. Such is the case in the investment field. Therefore, the Security and Exchange Commission (SEC) of the United States requires mutual funds, investment firms, and wealth management firms to disclose that the past performance is not an indicator of future results (U.S. SEC, 2010). My research had a similar disclaimer to mitigate the historical threat to external validity. I employed a quasi-experimental quantitative design method to reduce the overall threats to the external validity. Quasi-experimental designs are robust on external validity, but they are weak on internal validity. The weakness of quasi-experimental designs is mitigated by statistical data analysis techniques as a method of control of extrinsic and intrinsic factors (Frankfort-Nachmias & Nachmias, 2008). Because the actual historical data on stock and options performance are accurate and reliable, the data provided opportunities for replication and generalizability of the findings, given the sample size and its representativeness

(Frankfort-Nachmias & Nachmias, 2008). This feature of the secondary data strengthened the external validity of the research.

Internal Validity

The secondary data on S&P 500 represented an extended period. With the correlation research design, the research would obtain the effects of longitudinal studies. This feature of secondary data strengthened the internal validity. No threats resulted from history, maturation, experimental mortality, selection-maturation interaction, and diffusion of treatment as data had already been gathered by reliable third parties. There could have been threats from the selection, but I used a stratified random sampling to select companies randomly to reduce the selection threat.

Construct Validity

If the researcher employs insufficient definitions, measurement of variables, or statistical assumptions, a study may suffer from threats to construct validity (Frankfort-Nachmias & Nachmias, 2008). As noted earlier, while the secondary data strengthen the external and internal validity, there are three limitations of secondary data: the gap between the purpose of the secondary data collection and the use by the researcher, the access to the secondary data, and insufficient information about how the secondary data collected (Frankfort-Nachmias & Nachmias, 2008). Given that the performance of the financial market is measured by multiple independent sources, those three limitations posed no problem for the research. The only limitation was the previously mentioned effects of market anomalies. Finally, inaccurate inferences from the data may pose a threat to statistical conclusion validity and sampling validity (Frankfort-Nachmias &

Nachmias, 2008). The research includes acceptable statistical power 0.8 to mitigate statistical conclusion validity and construct validity.

Credibility

Credibility is established by repetition, validation, verification, confirmation, and peer-review by the scientists or scientific community who are viewed as experts in the field (Grinner, 2009; Popper, 2002). The scientific community expects the repeatability and continuity of the scientific knowledge. Grinnell (2009) defined the repeatability as repeating of the event took place in the past. Therefore, "what occurred in the past should be repeatable in the future" (Grinnell, 2009, p. 62). This definition demonstrates the difference between scientific community and investment community. Banks, investment firms, and financial advisors commonly advise that past performance is not an indication of the future performance. The investment community reminds consumers that nobody can predict the future. The scientific community is concerned about the repeatability of the processes, methodologies, and results that led to the discovery. If Scientist A is the founder of the discovery, then Scientists B and C must be able to replicate the phenomenon or event to find the results to be credible scientific discovery. Consequently, discoveries would be deemed credible if they are repeatable by another scientist, continuous with the previous scientific knowledge, and verifiable by other scientists (Grinnell, 2009). Grinnell's repeatability and verifiability are similar to Popper's (2002) refutability and falsification. When discovery can stand up to these stringent tests, it is credible.

The credibility process includes researchers themselves since they must make their research finding, notes, and methodology available to others. Credibility can be enhanced by publishing the findings and having a study reviewed by editors and peer reviewers (Grinnell, 2009, that is, the peer review process. Other researchers in the same or similar field with similar backgrounds can examine and analyze the research findings critically. This review process contributes to the affirmation or rejection of the findings. In either case, the knowledge is created because of the interaction amongst scientists due to social construction (Grinnell, 2009). Once it is published and made available to the broader research community, another scientist may cite the results or pinpoint flaws in the data or design. As a researcher, I welcome peer review by others and, through the publication of this study, offer my findings, notes and methodologies available to others who wish to repeat this study.

Ethical Procedures

My role as a researcher was to identify 33 companies from the S&P 500 Index from January 1, 2008, to December 31, 2010, that met the research criteria. I used stratified random sampling to select participants from the target population. IRB approval was required even though I used secondary data and involved no interaction with human beings. Second, reducing researcher bias is important. Using statistical tools and having my dissertation committee review my work helped mitigate any researcher bias and served as preventive measures for ethical considerations.

Summary

Chapter 3 included details of the research method. I discussed the recommended research design, rationale, and methodology by explaining the target population, sampling strategy, instrumentation, and data analysis. Stratified sampling strategy was the appropriate approach for the study. The recommended sample size for the study was 33, divided amongst 11 sectors of S&P 500 Index. Data were collected from the January 1, 2008 to December 31, 2010, timeframe. I discussed potential threats to external, internal, and construct validity, and the credibility of research including future replications of the study. Finally, I discussed ethical considerations related to the research and preventive measures. The results of the study are presented in Chapter 4 with comprehensive detail on descriptive statistics and statistical analysis. Chapter 5 is a summary of the research, including analysis, interpretations of the potential findings, and an overview of the limitations of the study. Chapter 5 also includes recommendations for future research and positive social change implications of this research.

Chapter 4: Results

The purpose of this quantitative quasi-experimental study utilizing a regression and correlation statistical analysis was to test the MPT and option pricing theory that relate portfolio returns to investment performance using financial options for individual U.S. investors. The investors' portfolio returns consisted of stock returns and financial options returns. Two independent variables of the study were stock returns and financial options returns. The dependent variable, investment performance, was a change in portfolio value during the investment period. Employing modern portfolio and Black-Scholes option pricing theories, I studied whether U.S. investors could relate portfolio returns to the investment performance using financial options. I examined (a) whether a correlation exist between the stock return and return on financial options such as call and put options on the same underlying stock, and (b) whether a correlation between portfolio return on a stock portfolio containing no financial options and the investment performance on a portfolio consisting of stock returns and return on financial options including call and put options.

In Chapter 4, I provide the findings, which indicate several relationships between portfolio returns, investment performance, stock return, and return on financial options. I present the results of the study with comprehensive detail on descriptive statistics and statistical analysis that show representativeness and heterogeneity of the sample. In descriptive statistics, I report measures of central tendency and distribution characteristics specific to the stock return and financial options return. I also present the results of the statistical analyses I used to test the two hypotheses: (a) ANOVA and bivariate

correlation used to determine whether relationships existed between the stock return and return on financial options, and (b) standard multiple regression employed to identify whether a portfolio consisting of stock returns and return on financial options predicted investment performance.

Data Collection

I divided this section into several subsections to describe the timeframe for data collection as well as actual recruitment and response rates. I present discrepancies in data collection from the plan presented in Chapter 3. I report baseline descriptive and demographic characteristics of the sample and described how representative the sample is of the population of interest or how proportional it is to the larger population if nonprobability sampling is used (external validity).

Time Frame and Data Cleaning

The specific population of the study was obtained from the January 1, 2008, to December 31, 2010, timeframe and consisted of 33 set of portfolios containing stocks that were in the S&P 500 Index and had financial options. Financial options include both call options and put options. I used Yahoo Finance and TD Ameritrade to collect and validate the data. I also utilized NYSE archival data.

When I downloaded the S&P 500 Index component companies, there were 505 companies. While the index is called S&P 500, the index contained 505 stocks[1] as of April 27, 2017, because it included two share classes from five of its components. Because my research period covered January 1, 2008, to December 31, 2010, I excluded

[1] A list of the 505 stocks is available upon request.

any stocks added to the index after 2010. That left me with 380 stocks as my population size, or 75% of the entire S&P 500 stocks.

Based on the discussion of power analysis for sample size previously mentioned in Chapter 33, my targeted total sample size was 33. Because 380 of the stocks were usable, I stratified the 380 among market sectors and randomly selected 33 samples. That translated to 8.68% of the population being sampled.

Stratification and Random Sampling

I used the random.org website as a random number generator to draw my sample size of 33. First, I sorted the entire 380 stocks by industry to stratify the data. Once the data were sorted and stratified, I inserted a column to order stocks from 1 through 380. (See Appendixes C1 and C2 for an example of the random number generator.)

As one example, the consumer discretionary sector had 56 stocks. The random number generator created three numbers that fell between values of 1 and 56, as shown in in Table 1. The random table generator for those 56 provided the Number 25 (Target Corp.), 17 (Scripps Networks), and 40 (Expedia). However, Scripps Networks had only partial data within the time period of this study and was therefore replaced with the Number 4 (Goodyear Tire).

Table 1

Stratification of the Population by Market Sector

Range	No. of securities	Market sector	Random numbers corresponding to stocks		
1–56	56	Consumer Discretionary	25	40	4
57–88	32	Consumer Staples	63	73	68
89–116	28	Energy	89	105	92
117–173	57	Financials	126	137	132
174–214	41	Health Care	183	210	181
215–262	48	Industrials	249	255	247
263–313	51	Information Technology	292	309	283
314–334	21	Materials	327	321	315
335–351	17	Real Estate	350	351	344
352–354	3	Telecommunication Services	352	353	354
355–380	26	Utilities	371	367	355

Descriptive Statistics

I collected monthly historical data for all 33 stocks in my sample, or 1,188 data points in the stock and corresponding data points in financial options to analyze. (See Table 2.) With a sample size of 33, the standard deviation was 13,688.33.

Table 2

Descriptive Statistics

	N	Min.	Max.	Mean	*SD*
PortfolioReturn	33	-25060	36849	3507.69	13688.33
Valid *N* (listwise)	33				

Once I converted those selected random numbers using the order of the stocks listed by sector, I had the full list of 33 stocks and their ticker symbol. Then, I verified

securities via TD Ameritrade whether they had financial options. I compiled my sample as shown in Tables 3 and Appendix D.

Table 3

Random Generated Numbers and Associated Stocks

Sector	Random numbers	Stocks
Consumer Staples	63	CVS
	73	Campbell Soup
	68	Clorox
Energy	89	Devon Energy
	105	ConocoPhillips
	92	Chevron
Financials	126	State Street
	137	International Exchange
	132	Citigroup
Health care	183	Express Scripts
	210	Allergan
	181	AmerisourceBergen
Industrials	249	Honeywell
	255	Illinois Tool Works
	247	3M
Information technology	292	Salesforce
	309	Red Hat
	283	ADP
Materials	327	Avery Dennison
	321	FMC
	330	Dow Chemical
Real estate	350	Public Storage
	351	Weyerhaeuser
	344	Apartment Investment & Management

Sector	Random numbers	Stocks
Telecommunications[1]	352	ATT
	353	CenturyLink
	354	Verizon
Utilities	371	CMS Energy
	367	AES Corp
	355	SCANA

[1]Telecomunications had only three stocks with orders. Because I had a stratification limit of three stocks per sector, I selected all three.

Study Results

Central Research Question

How can U.S. investors relate portfolio returns to the investment performance using financial options? Two subquestions with their corresponding hypotheses were examined in this quantitative quasi-experimental study utilizing a regression and correlation design. (See below for the operational definitions of the terms used in these questions.)

Subquestion 1

What is the correlation between the stock return and return on financial options such as call and put options on the same underlying stock?

Null Hypothesis $H_0 1$

There is no correlation between the stock return and return on financial options such as call and put options on the same underlying stock.

Alternative Hypothesis $H_a 1$

There is a correlation between the stock return and return on financial options such as call and put options on the same underlying stock.

Research Subquestion 2

What is the correlation between portfolio return on a stock portfolio containing no financial options and the investment performance on a portfolio consisting of stock returns and return on financial options including call and put options?

Null Hypothesis $H_0 2$

There is no correlation between portfolio return on a stock portfolio containing no financial options and the investment performance on a portfolio consisting of stock returns and return on financial options including call and put options.

Alternative Hypothesis $H_a 2$

There is a correlation between portfolio return on a stock portfolio containing no financial options and the investment performance on a portfolio consisting of stock returns and return on financial options including call and put options.

In answering whether there is a correlation between the stock return and return on financial options such as call and put options on the same underlying stock, I failed to reject null hypothesis $H_0 1$. There was no significant correlation between the stock return and return on financial options such as call and put options on the same underlying stock. As I will discuss in Chapter 5, the result could be explained by fast-changing market condition, additional cost of option premiums, and time decay of financial options.

Similarly, I failed to reject the second null hypothesis. There was no significant correlation between portfolio return on a stock portfolio containing no financial options and the investment performance on a portfolio consisting of stock returns and return on financial options including call and put options. As I will discuss in Chapter 5, this may

be explained by added costs to the portfolio, which offset the short-term protection provided by options.

Summary

In Chapter 4, I provided the findings, which indicated the relationships between portfolio returns, investment performance, stock return, and return on financial options. In Chapter 5, I discuss the conclusions and recommendations with explanations why study results were different than what was expected based on the theories that served as a framework for this study.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this quantitative quasi-experimental study was to test the MPT and option pricing theory that relate portfolio returns to investment performance using financial options for individual U.S. investors. An investors' portfolio returns consists of stock returns. Two independent variables of the study were stock returns and financial options returns. Key findings of this study were not supported by the MPT and option pricing model as hypothesized.

Interpretation of Findings

There was no significant correlation between the stock return and return on financial options such as call and put options on the same underlying stock due to fast-changing market conditions, an additional cost of option premiums, and time decay of financial options. Similarly, there was no significant correlation between portfolio return on a stock portfolio containing no financial options and the investment performance on a portfolio consisting of stock returns and the return on financial options, including call and put options. Added costs of premiums to the portfolio offset the short-term protection provided by financial options. Investors can keep stocks in the portfolio for a more extended period under the buy-and-hold strategy. As long as the company does not go bankrupt, the stock of the company might recover from the ups and downs of the stock market in the long run. However, financial options have limited lives, and time decay does not allow investors to protect and match the portfolio's duration unless it is performed for a short period, such as weeks versus years.

Limitations of the Study

Because I took a portfolio approach and assumed that investors are rational, this study has limited generalizability. An investor might take only one stock and protect it for a short period. However, that is not sustainable protection, and the cost of protection outweighs the investment losses as the price of the financial options increases rapidly in uncertain markets.

Recommendations

I have several recommendations for further research grounded in the strengths and limitations of the current study as well as the literature reviewed in Chapter 2. The sample size should be smaller because an individual investor does not have 30 stocks in his or her portfolio or the time to manage it. Therefore, I recommended that a maximum of five stocks with 20% weight in each stock should be analyzed for further research with a much shorter timeframe, such as 3 months. To diversify and reduce the added costs from premiums from financial options, I recommend rotating which security is being protected.

Implications for Positive Social Change

The implication for a positive social change was the simplified explanation of leveraging financial options in managing an investment portfolio while being mindful of associated costs and fast-changing market conditions. It could be used as a training resource to educate individual investors to make better investment choices.

Conclusions

The theories of the modern portfolio and option pricing model were useful as a framework in this study to analyze the relationship of portfolio returns to the investment performance using financial options for individual investors in the United States. There was no significant correlation between the stock return and return on financial options such as call and put options on the same underlying stock due to fast-changing market conditions, an additional cost of option premiums, and time decay of financial options. Similarly, there was no significant correlation between portfolio return on a stock portfolio containing no financial options and the investment performance on a portfolio consisting of stock returns and return on financial options, including call and put options. It can also be explained by added costs of premiums to the portfolio, which offset the short-term protection provided by financial options. The stock of the company might recover from the market fluctuations in the long run. However, financial options have limited lives, and the time decay does not allow investors to protect and match the portfolio's duration unless it is performed for a short period, such as weeks versus years. In conclusion, the advantages of financial options are short term while the portfolio objective is usually a long-term focused. Therefore, the findings of this study were inconclusive regarding the long-term protection of financial options.

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Appendix A: Numerical Examples for Formulas

Table A1

Calculation of Portfolio Return

Securities	Investments amount	Weights (w_i)	Returns (R_i)	Expected portfolio return $E(R_{port})=(w_i * R_i)$	Return amount
Bond B	$ 3,000	30%	10%	3.0%	$ 300
Stock 1	$ 1,000	10%	20%	2.0%	$ 200
Stock 2	$ 3,000	30%	15%	4.5%	$ 450
Stock 3	$ 1,000	10%	30%	3.0%	$ 300
Stock 4	$ 2,000	20%	25%	5.0%	$ 500
Portfolio	$ 10,000	100%	100%	17.5%	$1,750

Table A2

Calculation of Mean

Date	Monthly returns of securities	
	Stock S	Bond B
Jan–14	5.00	1.00
Feb–14	5.00	2.00
Mar–14	8.00	1.50
Apr–14	6.00	1.00
May–14	3.00	0.50
Jun–14	–1.00	–1.00
Jul–14	0.50	0.50
Aug–14	–3.00	–1.00
Sep–14	8.00	2.00
Oct–14	7.00	2.00
Nov–14	8.00	2.00
Dec–14	8.00	2.00
Mean	4.54	1.04

Table A3

Variance and Standard Deviation

Rates of Return (Ri)	Expected Return E(Ri)	Ri-E(Ri)	$[Ri-E(Ri)]^2$	Pi	$[Ri-E(Ri)]^2 * Pi$
A	B	C = A-B	$D = C^2$	E	F = D*E
9%	11%	–2%	0.040%	35%	0.014%
10%	11%	–1%	0.010%	30%	0.003%
13%	11%	2%	0.040%	20%	0.008%
15%	11%	4%	0.160%	15%	0.024%

Note. Variance = 0.049%; *SD* = 2.214%

Table A4

Calculation of Covariance and Correlation Coefficient

Date	Monthly Return of Securities		Stock S	Bond	Stock S x Bond B	Stock S	Bond
	Stock S	Bond B	R_i-Mu_i	R_j-Mu_j	(R_i-Mu_i) x (R_j-Mu_j)	(R_i-Mu_i)^2	(R_j-Mu_j)^2
Jan–14	5.00	1.00	0.46	(0.04)	-0.02	0.21	0.00
Feb–14	5.00	2.00	0.46	0.96	0.44	0.21	0.92
Mar–14	8.00	1.50	3.46	0.46	1.59	11.96	0.21
Apr–14	6.00	1.00	1.46	(0.04)	-0.06	2.13	0.00
May–14	3.00	0.50	(1.54)	(0.54)	0.84	2.38	0.29
Jun–14	(1.00)	(1.00)	(5.54)	(2.04)	11.31	30.71	4.17
Jul–14	0.50	0.50	(4.04)	(0.54)	2.19	16.34	0.29
Aug–14	(3.00)	(1.00)	(7.54)	(2.04)	15.40	56.88	4.17
Sep–14	8.00	2.00	3.46	0.96	3.31	11.96	0.92
Oct–14	7.00	2.00	2.46	0.96	2.36	6.04	0.92
Nov–14	8.00	2.00	3.46	0.96	3.31	11.96	0.92
Dec–14	8.00	2.00	3.46	0.96	3.31	11.96	0.92
Mean	4.54	1.04		Sum	43.98	162.73	13.73

Note. Cov_{ij} = 43.98/12=3.66; σ^2 stock= 162.73/12 = 13.56; σ stock= $\sqrt{}$ 13.56=3.68; σ^2 bond = 13.73/12 = 1.14; σ bond = $\sqrt{}$ 1.14 = 1.07. Based on Formula 6 and using results from Table A4 leads to a correlation coefficient as 0.93

$$\rho = \frac{Cov_{ij}}{\sigma_{stock} * \sigma_{bond}} = \frac{3.66}{3.68 * 1.07} = 0.93.$$

Appendix B: Link Between MPT and CAPM

After Markowitz introduced his modern portfolio theory in 1952 using asset allocation and portfolio selection, two theories evolved from MPT. The first theory was capital markets theory (CAPM) and the second was arbitrage pricing theory. I will discuss only CAPM in detail in this appendix. CAPM introduces the risk free assets as treasury bills with its risk-free rates into Markowitz's MPT. That led to a major change in the investment field. It simplified several of the Markowitz formulas and derived the famous CAPM. Most of the CAPM assumptions were the same as in MPT. Sharpe (2000) also introduced CAPM assumptions as follows:

1. All investors are efficient and rational investors, and they target Markowitz's efficient frontier.
2. Because Sharpe introduced the risk-free rate, investors can borrow and lend money at the risk-free rate. His assumption was realistic because anyone can buy T-bills and lend money to the U.S. government by doing so. Borrowing at those rates is normally more difficult but is doable. Therefore, this assumption is needed.
3. Investors' expectations are represented by the identical probability distribution of expected future returns over the same holding period. In other words, all investors have the same expectations about the future rates of return and have the same holding periods. The normal distribution is one of the key assumptions in CMT as it was in MPT. Generally, older investors have shorter holding periods because they are closer to their retirement age than younger

investors, who are more risk tolerant and have longer holding periods. For instance, Vanguard 2040 target retirement fund also assumes that people who will buy their funds have their same risk, return, and holding period.

4. Investors can invest in fractions and not only in whole units of investable assets. The original term was “infinitely divisible,” but to make more sense of this assumption, I used the term “fractions” to relate this to ETF or mutual fund purchases. Because individual stocks can be sold in fractions in employee stock purchase plans, I assumed that indefinitely divisible term was reasonable. This assumption allowed me to use continuous curves.
5. There are no taxes or transactional costs. While in real word we need to pay taxes to the government and transaction costs to brokers, this is a reasonable assumption because pension funds, municipal bonds, and a few other assets are not taxed. Discounted online brokers such as Ameritrade charge fixed fee of $9.99 and Scottrade charges $7 (Ameritrade, 2015, Scottrade, 2015). If I buy or sell a large amount of investments, the transaction costs are immaterial.
6. There is no inflation or any change in inflation rate is fully expected. This is a reasonable assumption. After 2008 financial crisis, the rate of inflation was flat, and any change in inflation was fully expected as the Federal Reserve kept interest rates at or near 0% for straight 7 years. This assumption can be modified if needed.

7. I also assumed that capital markets are in equilibriums. In other words, there is no shortage of assets or funds and all assets are priced in line with their risk characteristics.

Given these basic assumptions, I will now further analyze the CAPM. As mentioned earlier, one of Sharpe's contributions was introduction of a risk-free asset into a Markowitz portfolio. I provided example of the risk free asset such as a U.S. Treasury bill. It is risk free because it is backed by credibility and full faith of the U.S. government. The interesting part about the risk-free assets is that it has zero risk, zero variance, and zero standard deviation. These features of the risk-free assets simplify several of the formulas was covered in MPT. I will apply these features mathematically to Formulas 3, 4 and 5 that I covered in the MPT section.

Formula 3. $Standard\ Deviation = \sigma = \sqrt{\sum_{i}^{n} (R_i - E(R_i)]^2 * P_i}$

Because the U.S. government guarantees the return, the return on the risk-free assets is equal to the expected return. In other words, R- E(R) = 0. Therefore, standard deviation on Formula 3 becomes equal to 0. If the standard deviation is zero, then, the square of zero is also 0. Therefore, the variance is also zero.

Formula 4. $Variance = \sigma^2 = \sum_{i}^{n} (R_i - E(R_i)]^2 * P_i$

Now, if we extend the concept to the covariance of the risk-free asset (RFA) and risky asset j, let's recall the formula 5.

Formula 5. Covariance = $Cov_{ij} = E[((R_i - E(R_i)) * (R_j - E(R_j))]$

If we denote Cov of the risk-free asset and the security j as $Cov_{RFA,J}$ then formula 5 would look like as follows:

Formula 5 for RFA. Covariance = $Cov_{RFA,J} = E[((R_{RFA} - E(R_{RFA})) * (R_j - E(R_j))]$

Formula 3 shows that R_{RFA}- $E(R_{RFA}) = 0$, which would lead to COV of the risk-free asset and any other security to be zero. If Cov of RFA is zero, then the correlation of the risk- free asset and risky security must be zero also. Let's recall Formula 6.

Formula 6. *Correlation coefficient* $\rho_{ij} = \frac{Cov_{ij}}{\sigma_i * \sigma_j}$;

Sharpe (2000) applied this mathematical solution to MPT, and Reilly and Brown (2006) presented Sharpe's solutions in a concise and easy-to-understand manner as I reproduced above. Applying the features of the risk-free asset to the portfolio of risky assets. Is enlightening. Formulas 7 and 8 from MPT section were as follows".

Formula 7. *Standard Deviation of Portfolio* = $\sigma = \sqrt{w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2w_1w_2Cov_{1,2}}$

Formula 8. *Variance of Portfolio* = $\sigma^2 = w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2w_1w_2Cov_{1,2}$

If one replaces one of the risky assets in two asset portfolio with RFA, note the change.

Formula 8a. *Variance of Portfolio with RFA*=

$$\sigma^2_{port} = w^2_{RFA}\sigma^2_{RFA} + w^2_2\sigma^2_2 + 2w_{RFA}w_2Cov_{RFA,2}$$

From earlier solutions, variance of RFA is zero and covariance of RFA with any other asset is also zero. Thus, of the portfolio becomes simply the weight of the risky security in terms of total portfolio multiplied by the variance of the risky security.

Formula 9. *Variance of Portfolio with RFA* = $\sigma^2_{port} = w^2_i \sigma^2_i$

Formula 10. *Standard Deviation of Portfolio with RFA*= $\sigma_{port} = \sqrt{w_i^2 \sigma_i^2}$

Numerical examples follow. Assume the risk-free rate on T-bills is 2%, the standard deviation of Stock A is 5% and the portfolio is comprised of 50% T-bills and 50% Stock A. Based on Formula 10, σ^2=0.5*(5%)^2 = 12.5%. In other words, adding a T-bill to a portfolio of Stock A reduces the variance by half. The standard of the portfolio is the square root of 12.5%, which is 3.54%

The Security Market Line (SML)

Next, market risk, the securities risk, and the risk-free rate can be brought into one equation. In other words, consider these three rates together. To do this, I rearrange Formula 6 to solve for covariance.

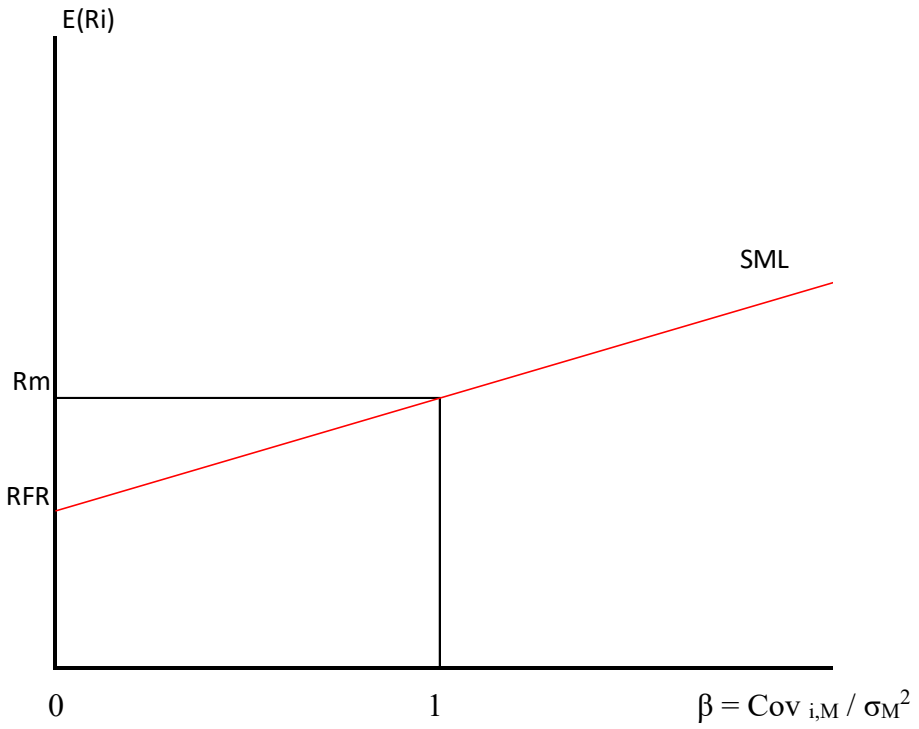
Formula 11. *Covariance* = $Cov_{ij} = \rho_{ij} * \sigma_i * \sigma_j$;

Where ρ is correlation coefficient, σ_i and σ_j are standard deviations of security i and security j. Sharpe (2000) simplified the formula 10 by assuming security I and security J are one of the same. If $\sigma_i = \sigma_j$, then the correlation of the security with itself is perfect correlation and equals to 1, and $\sigma_i * \sigma_j = \sigma_i^2$ or the variance of the security. Therefore, formula 10 simples to $Cov_{i,j} = \sigma_i^2$. Sharpe (2000) used the market portfolio as an example. Sharpe's contribution was to define the ratio of covariance of the security with the market and market variance as a standardized measure of systematic risk also known as beta or β. In other words,

$\beta = Cov_{i,M} / \sigma_M^2$. Sharpe depicted this relationship as shown in Figure 2.

Figure B1

Security Market Line With Normalized Beta



Note. Author's figure based on Reilly and Brown (2006) and Sharpe (2000).

The SML line in Figure B1 shows a straight regression line (y = a + bx + e). In Sharpe's model, it can be written as required or expected rate of return being equal to RFR (intercept) plus market risk premium multiplied by systematic risk (Sharpe, 2007). The mathematical equation is given in Formula 12, and it is known as CAPM.

Formula 12. $CAPM = E(R_i) = RFR + \beta * (R_m - RFR)$.

$(R_m - RFR)$ is known as market risk premium (Reilly & Brown, 2006). R_m is the return on market portfolio.

To illustrate CAPM calculation, if one assumes the RFR is still 2% from the earlier example and that there are two stocks Stock A with β_A of 1.50 and Stock B with β_B of 0.50, then the market portfolio of the S&P 500 has the return of 10%. Using Formula 12, the following equation results:

$E(R_A) = 2 + 1.5*(10 - 2) = 2 + 12 = 14\%$.

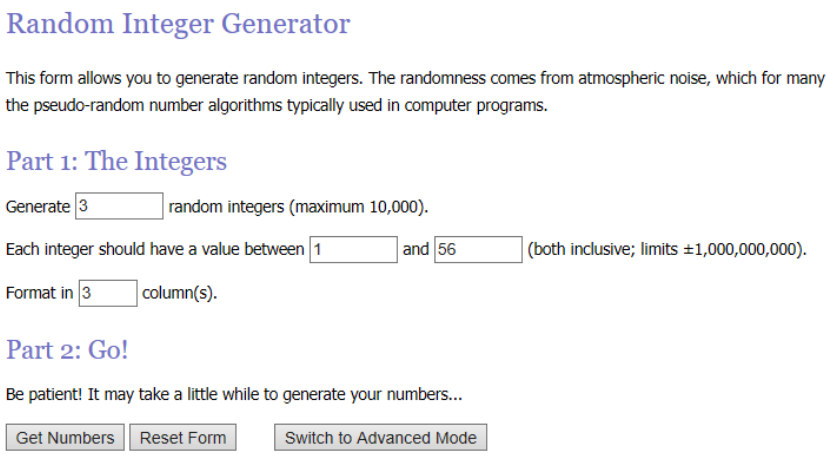
$E(R_B) = 2 + 0.5*(10 - 2) = 2 + 4 = 6\%$.

With this method, I derived the CAPM model by applying the risk-free rate to Markowitz's modern portfolio concept. Sharpe's CAPM model is widely used by investors and corporate managers alike.

Appendix C: Sample Random Integer Generator Result

Figure C1

Sample Random Integer Generator



The results of random sampling are shown in Figure C1 for the Consumer Discretionary sector.

Figure C2

Sample Random Integer Generator Result

Appendix D: List of Stocks in the Final Sample ($N = 33$)

Order no.	Ticker symbol	Security	Market sector	Trade options	Weeklys
4	GT	Goodyear Tire & Rubber	Consumer Discretionary	Yes	Yes
25	TGT	Target Corp.	Consumer Discretionary	Yes	Yes
40	EXPE	Expedia Inc.	Consumer Discretionary	Yes	Yes
63	CVS	CVS Health	Consumer Staples	Yes	Yes
68	CLX	The Clorox Company	Consumer Staples	Yes	No
73	CPB	Campbell Soup	Consumer Staples	Yes	No
89	DVN	Devon Energy Corp.	Energy	Yes	Yes
92	CVX	Chevron Corp.	Energy	Yes	Yes
105	COP	ConocoPhillips	Energy	Yes	Yes
126	STT	State Street Corp.	Financials	Yes	No
132	C	Citigroup Inc.	Financials	Yes	Yes
137	ICE	Intercontinental Exchange	Financials	Yes	No
181	ABC	AmerisourceBergen Corp	Health Care	Yes	Yes
183	ESRX	Express Scripts	Health Care	Yes	Yes
210	AGN	Allergan, Plc	Health Care	Yes	Yes
247	MMM	3M Company	Industrials	Yes	Yes
249	HON	Honeywell Int'l Inc.	Industrials	Yes	No
255	ITW	Illinois Tool Works	Industrials	Yes	No
283	ADP	Automatic Data Processing	IT	Yes	No
292	CRM	Salesforce.com	IT	Yes	Yes
309	RHT	Red Hat Inc.	IT	Yes	Yes
315	DOW	Dow Chemical	Materials	Yes	Yes
321	FMC	FMC Corporation	Materials	Yes	No
327	AVY	Avery Dennison Corp	Materials	Yes	No

Order no.	Ticker symbol	Security	Market sector	Trade options	Weeklys
344	AIV	Apartment Investment & Management	Real Estate	Yes	No
350	PSA	Public Storage	Real Estate	Yes	No
351	WY	Weyerhaeuser Corp.	Real Estate	Yes	Yes
352	T	AT&T Inc	Telecom Services	Yes	Yes
353	CTL	CenturyLink Inc	Telecom Services	Yes	No
354	VZ	Verizon Communications	Telecom Services	Yes	Yes
355	SCG	SCANA Corp	Utilities	Yes	No
367	AES	AES Corp	Utilities	Yes	No
371	CMS	CMS Energy	Utilities	Yes	No