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An Examination of U.S. Equity Linked Retirement Funds

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Abstract

The goal of this project is to determine whether retirement funds are being overexposed to β risk by regressing returns to major funds from three investment management groups (Fidelity, TIAA-CREF, and Vanguard) against economic systematic risk factors. These assets management firms are a few of the largest firms in the U.S. and manage trillions of dollars in assets. These large firms are assumed to be doing their jobs, but this paper will expose whether or not that is true. Eventually, this will uncover whether active managers are doing their job and whether or not management fees are justified. By doing this, we will discover how responsibly your money is being managed for the future.

Table of Contents

Table of Figures

Table of Tables

1 Introduction and Goals

The purpose of this major qualifying project is to answer the rather simple question, “Are management fees justified?” This was accomplished by collecting return data from three major asset management firms, Fidelity, TIAA-CREF, and Vanguard.

The more underlying goal is to discover whether top investment firms and their U.S. equity based retirement funds were overly exposed to various macroeconomic systematic risk factors. I compared the return rates of these systematic risk factors to the returns of nearly 50 active retirement mutual funds over a time period of about twenty years. By collecting data from two decades, I was able to factor in the market crash of 2000 and also the market crash of 2008 in to the data to examine how much stress was put on these funds during those times. In addition to collecting market crash data, included were also time of significant growth in the periods in between both crashes.

Figure 1.1 S&P 500 Relevant Range (Retrieved from Yahoo Finance)

My method of comparison method involved creating two market models to express in linear format what the returns of a particular fund would be. This involved selecting which systematic risk factors would simulate most of the market exposure risks.

1.1 International Scope

Although I only chose to examine U.S. equity linked retirement funds, this same research and method can be applied on a much larger scale to the world market. Markets are no longer segmented as they used to be trading happens on a much larger scale and trading between countries has become easier as time goes on. People often invest internationally for diversification, to spread the investment risk among foreign companies and markets; and for growth, to take advantage of emerging markets. Through companies like Fidelity, it is possible now to trade in 25 different countries and 16 different currencies all in one account through a U.S. based investment firm. However, there are additional factors that apply on an international scope such as fluctuations in currency exchange rates, significant political and social events, and legality and ethics in certain countries. That being said it is now important to recognize the global impact that this research would have on the investment community. It is also important to recognize the impact that the U.S. equity market has on the rest of the world. In 2008, the housing market collapse triggered a global recession in 2009 nicknamed the Great Recession. The credit crisis that emerged from this recession rippled throughout most of Europe. It is also possible for booms and recessions in other countries to affect the United States as well. As of late, economists are trying to decide to what extent the market crash in China will have an effect on the US market.

1.2 Multidisciplinary Scope

The nature of the stock market is one shrouded in mystery and almost a sense of aversion to its surrounding businesses and societies. Often the general populous tends to avoid topics of finance and retirement as tough issues with many grueling hours of organization. However, as the larger percentage of the United States workforce moves toward retirement, younger families begin to wonder, “How much is enough for retirement and how do I decide who is going to manage my money responsibly?” All told Fidelity manages an astounding $5,152.8 billion in assets, TIAA-CREF another $866 billion in assets, and finally Vanguard with another $3,000 billion in assets.

According to the National Institute for Retirement Security, “Even after counting households’ entire net worth—a generous measure of retirement savings—two thirds (66 percent) of working families fall short of conservative retirement savings targets for their age and income based on working until age 67. Due to a long-term trend toward income and wealth inequality that only worsened during the recent economic recovery, a large majority of the bottom half of working households cannot meet even a substantially reduced savings target.”[1]

These numbers in themselves are staggering, but this leads us to infer that it is now more important than ever to be involved in the decision making process when it comes to one’s own retirement funds. Customers of the financial service industry are no longer just financial minded people; they are teachers, professionals, and almost anyone who holds a retirement account.

[1] Rhee, Nari, PhD, and Ilana Boivie. "National Institute on Retirement - The Continuing Retirement Savings Crisis." The Continuing Retirement Savings Crisis. National Institute on Retirement Security, Mar. 2015. Web. 04 June 2016.

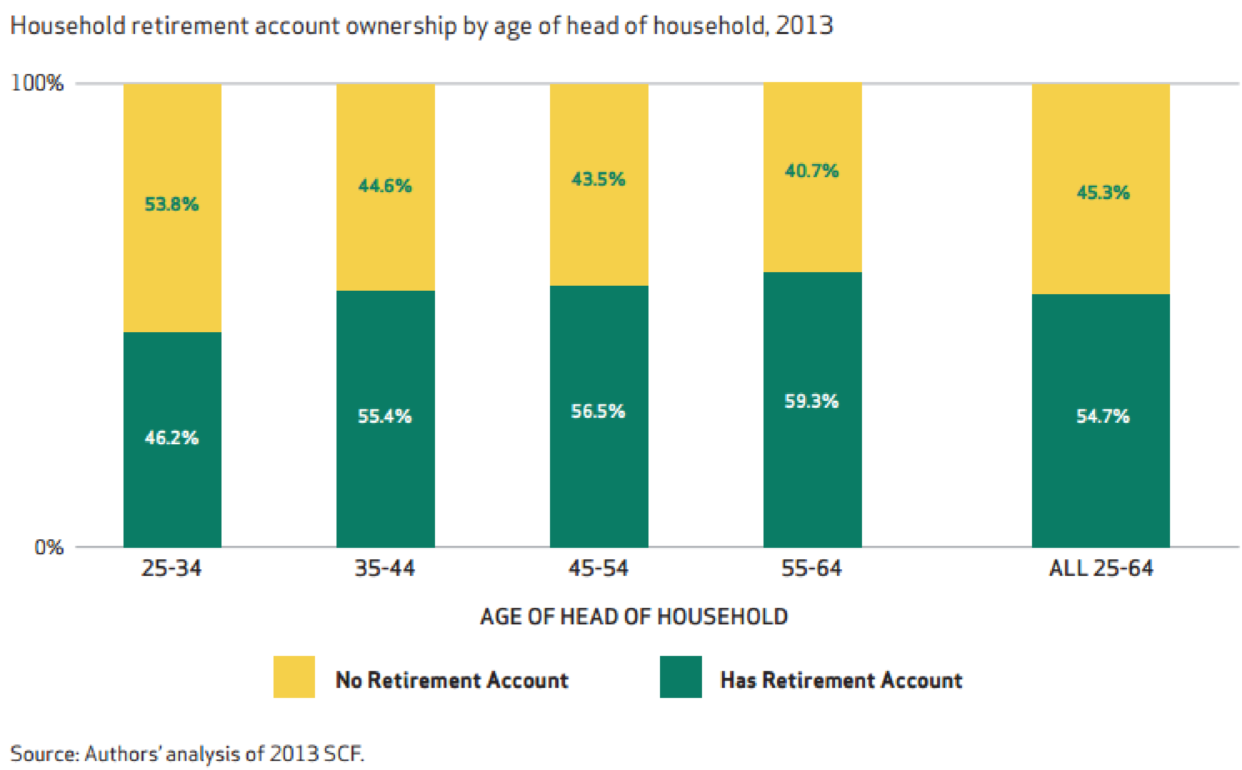

Figure 1.2 (Source NIRS)

As noted in the chart, roughly 45% of all Americans do not hold assets in a retirement account. Altogether that number among working age households totals to around 40 million people who are not properly prepared for retirement. Fidelity Investments – Boston says, "As a result of this positive behavior, the number of people who are likely to afford at least their essential expenses[1] in retirement jumped seven percentage points since 2013, from 38 to 45 percent. However, this means more than half (55 percent) are estimated to be at risk of being unprepared to completely cover essential living expenses in retirement, which includes housing, health care and food."[2] Unfortunately, Social Security will no longer suffice as a primary form of

[2] "America's Savings Rate Improves, but Fidelity Study Finds More than Half of Americans at Risk of Not Covering Essential Expenses in Retirement." America's Savings Rate Improves, but Fidelity Study Finds More than Half of Americans at Risk of Not Covering Essential Expenses in Retirement. Fidelity Investments, 07 Jan. 2016. Web. 04 June 2016.

income in retirement.

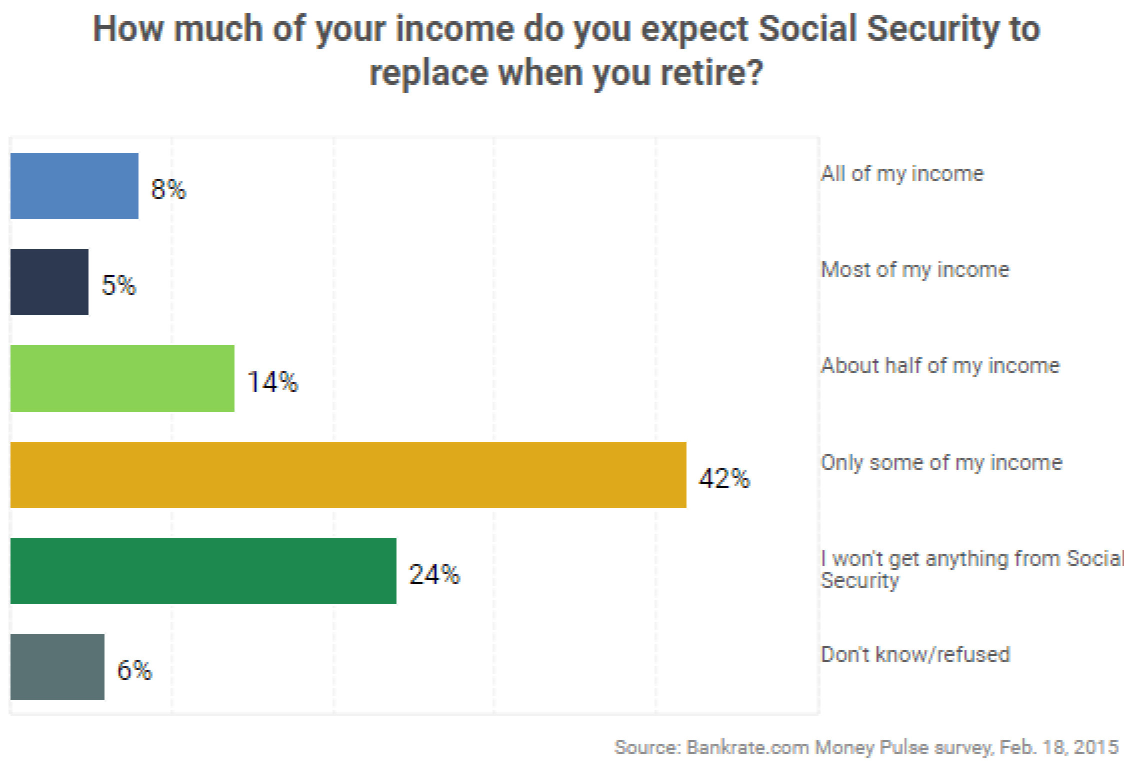

Figure 1.2 (Source Bankrate)

The independent survey by Bankrate shown above notes that there are almost 30% of people who believe that Social Security will cover up to have of their living expenses when they enter retirement. The numbers speak for themselves about how important it is to have the proper knowledge about retirement and to begin preparing early to be able to survive a significant decrease of income in retirement. That is a sizeable amount of the nation that either does not care to prepare or simply do not know how to prepare. However, this chart does not account the millions of other those with retirement account who assume their accounts are being properly managed, that is being hedged against potential risks to their portfolio.

It is important to highlight that most of literature being pumped out of Wall Street is about stocks and the companies themselves. While researching this topic, there was a notable gap in the literature that would have been able to educate the interested parties about what the responsibility of the investment firm and investment vehicle are.

1.3 Brief History of the Stock Market

Trade has always existed in society whether it be from early Neanderthal forms of bartering to simple trade of services for goods predating written history itself. However, trade of government securities first began in the 13th century. Italian banking families traded the securities of the independent city states throughout the nation and up until the formation of the country officially.

However, true capital stock and investing in corporations/companies rose in tandem with the pre-colonial and Imperial Era of world exploration. The first stock market emerged in Belgium to deal in business, government and individual debt issues. Yet, in this format there were no shares 14 of companies traded. In the 1600s, the age of Imperialism was in full swing and countries such as Britain, France, Spain, and the Netherlands were sailing to the New World and the East Indies in search of spices and other rare treasures. These massive excursions required large amounts of capital. Explorers created companies in which other could invest for a share at the final profit of the voyage. These voyages came with high amounts of risk and it was likely that the exploration party would not return. London merchants formed the first joint-stock company known as the “East India Company”. According to the company regulation, a shareholder would only be able to lose the amount of capital that he/she had invested. Additionally, the shareholders would receive dividends from the company for investing in these excursions. Economic turmoil known as the “South Sea Bubble Burst” caused reactionary legislation to be passed which outlawed stock for over one hundred years.

On May 17th, 1792, the Buttonwood Agreement was signed into effect, and thus, the New York Stock & Exchange Board was created. Twenty-four stock brokers from New York City met at 68 Wall Street to sign the agreement. At first, five securities were traded, the first of which being the Bank of New York. In 1817, the first constitution was drafted, and in 1863, the name was changed to its current form, the New York Stock Exchange, or NYSE. At the turn of the 20th century, stock trading rose rapidly, and in turn, a new building was needed to hold the large trade volume and growing interest of companies trading. With their new large, appealing building, located on 18 Broad Street, NYC, the NYSE began to really take off. In addition, technological advances only helped the growth of the stock trading history. The telegraph and the phone made trading over longer distances very feasible and accessible. In turn, stock exchanges all across the country and around the world began to take off as well. With all of the garnered interest in stocks, 15 many companies opened up and became publicly traded. The stock market became a very lucrative market, holding a lot of weight in the United States' economy, as well as the world's economy.

2 Recent Empirical Work in Retirement Funds

In this section I would like to analyze the focus of other research being done throughout the globe on retirement. If you were to open a webpage and go to your favorite third party financial news/advice provider and focus in on retirement, the content would be geared towards rethinking how you are going to spend your money in retirement, a sustainable rate of withdrawal, or identifying the "best" strategies to save for retirement. While these topics provide crucial information towards preparing oneself for retirement, it does not do a whole o help you decide based on the funds and their which asset management company may be performing optimally.

It would be comfortable for us to believe that once the money makes it to either our 401k or an IRA that the money is being managed responsibly and that the manager is delivering on whatever promises he/she made at the beginning of your relationship. The gap in education between money managers and those whose money is being managed should be fairly narrow. According to Marrick Wealth there are multiple forms of client involvement in the process of retirement investing, "Discretionary investment management is a form of investment management where trading decisions are made for clients at the portfolio manager's discretion. Under non-discretionary investment management, trades must be discussed and approved by clients before taking place."[3] The non-discretionary approach to investing lets the client have hands on approach to their own personal retirement funds. Although this does allow total freedom to choose stocks at will, it does allow some protection for the client as he/she would be personal accountable for the success of their account.

Traditionally most research is done in the equity market to make sure that one is picking the right stocks for their portfolio. There are numerous beginner, advanced, and expert level trading guides for countless stocks and strategies. However, the area of retirement funding research is a neglected area that could use some of that same expertise applied to the stock market. In this project I selected a few mutual funds to analyze their returns and gauge the performance of each asset management company. In doing this I hope to close the literature gap in holding managers responsible for the claims of returns. Performance reports ought to be a standard for the industry in evaluating what level of exposure that the funds you invest in contain.

[3] "What Is the Difference between Discretionary and Non-discretionary Investment Authority? - Marrick Wealth." Marrick Wealth. N.p., n.d. Web. 09 June 2016.

3 Nature of Sample Data

In this chapter I will discuss the funds that I decided to use in my sample data and why I chose to use them. I selected around fifty funds from three major asset management firms proportionally concentrating the amount of funds I chose based on the total number of assets that the firm managed.

3.1 Fidelity Investments

-FOCPX

This fund primarily invests in small to medium sized companies principally traded on the NASDAQ or an Over-the-Counter market. This funds also invests more than 25% of its assets in the technology sector with key holdings being Apple, Alphabet, and Microsoft. I chose this funds because of its concentration in the technology sector and its attractiveness to other investors and money managers.

-FBGRX

Fidelity's Blue Chip Growth fund invests in companies with a strong financial reputation and stable income. In addition to this, the companies need to have a market capitalization of over $1 billion. This funds seeks to target stocks with above-average growth potential based on Fidelity's research. Key holdings include Amazon, Coca Cola, and Tesla Motors. I chose this fund once again for its popularity and its representation of a growth fund.

-FDEGX

This fund is a pure growth strategy fund consisting of 107 different holdings. Fidelity targets companies who are primed for accelerated growth and revenue including dividends. The funds focuses primarily on medium-sized companies, but states that it may also invest substantially in larger or smaller companies. Key holdings include Wyndham Worldwide, Equifax, and Autozone Inc. I selected this funds for the sample because it represents a pure growth fund used for those with an aggressive growth strategy in their retirement portfolio, which is more than 50% equities.

-FLGEX

This funds is another growth fund, but this fund works off the Russell 1000 Growth Index as a benchmark. This fund primarily invests in large market capitalization companies. Key funds are Microsoft, Facebook, and Amazon. I chose this fund to represent the large cap growth fund that Fidelity uses.

-FCPGX

Fidelity's Small Cap Fund bases the companies they select for this fund on the Russell 200l or the Stand and Poor's Small Cap 600 Index. These companies are selected by Fidelity on the basis of having above-average growth potential. Key holdings are Vail Resorts, 2U Inc, and Stamps.com Inc. This fund represents the small cap growth funds that Fidelity offers.

-FCNTX

According to Fidelity Fund Research, this fund seeks capital appreciation with funds whose value they believe is not fully recognized by the public. Key stocks are Starbucks Corp, Facebook, and Berkshire Hathaway. This fund is quite interesting because it also contains some larger named stocks that are fairly recognized by the public as being blue chip such as Apple, Alphabet, and Visa. Perhaps, this is a fund that a somewhat compromised its initial strategy.

-FSMVX

This fund primarily consists of medium market capitalization companies whom Fidelity believes are undervalued in the current market in relation to other companies of the same industry. Key holdings of this fund are Discover, Allstate, and Teva Pharmaceuticals. This fund represents a long-term growth strategy with medium cap companies.

-FMEIX

This fund is a comparative index to the Russell MidCap Index, but aims to provide higher returns than the Russell index previously mentioned. Some of the keynote stocks that this fund trades are Southwest Airlines, Dollar General, and Progressive. I chose this fund based on the ratings that Morningstar gave to this fund. It was rated five stars as of the 31st of May, 2016.

-FDEQX

Fidelity's Disciplined Equity Fund is another pure growth fund that is not anchored to one market capitalization or another by selecting either growth or value stocks. The idea of the fund is to achieve capital growth with 124 different holdings. A few of the more notable holdings are Procter and gamble, Johnson & Johnson, and Pfizer Inc. I chose this fund because this would be another key fund of an aggressive growth strategy for a retirement plan.

-FLCEX

This is a comparative fund for the S&P 500, in which the fund manager selects stock that, in their opinion, can perform better than the index which they are comparing against. The S&P 500 is a market-cap weighted index with large market caps. This fund invests in Apple, Microsoft, Amazon, and Wells Fargo among others. The S&P 500 is one of the most used benchmarks for large cap funds, because of its status as an economic indicator.

-FBCVX

Fidelity's Blue Chip Value Fund seeks to invest primarily in blue chip stocks (discussed earlier) that are undervalued in comparison to the rest of their respective industries. Key holdings in this fund are Samsung, Oracle, and EMC Corp. I chose this fund because it represents the blue chip value stocks currently in the market.

-FLVEX

This is another large cap value fund, but with the Russell 1000 as a benchmark for success. Stock are selected in this fund based on a statistical model to remove emotional bias from the selection process. A few of the more notable stocks in this fund are Exxon Mobil, Procter & Gamble, and Intel. This fund is also heavily weighted in the telecommunications industry.

-FGRTX

This fund normally invests up to 80% of its assets in stocks of mega capitalization, or companies with similar market caps to the Russell Top 200 Index or the S&P 100. Mega cap stocks are those with a market cap over $100 billion. A few examples of mega cap stocks in this fund are Bank of America, Citigroup, and Apple.

-FDGFX

This fund targets equities that pay dividends or have the potential to pay dividends in the future, while investing in both growth and value stocks. A number of large corporation make up the list of holdings such as Apple, Alphabet, Microsoft, and Wells Fargo. I chose this fund because this is a consistent source of funds to reinvest for a manager and an interesting concept for a mutual fund.

-FSLVX

This fund also has quite an interesting concept as it has six fund managers that invest across numerous different sectors like financials, health, telecommunications, and utilities. However, the strategy of this fund is to invest in large cap funds that are considered undervalued by Fidelity. Some of the top holdings include Qualcomm, Wells Fargo, Chevron, and AT&T.

-FMCSX

This fund invests at least 80% of assets in companies with medium market cap while using the Russell Midcap Index or S&P MidCap 400 as benchmarks for performance. The total number of holdings for this fund is 164 with top holdings being First American Financial, Aramark, and the Boston Scientific Corp.

-FDVLX

This another fund with an interesting strategy and fund manager team. The fund currently has seven managers on it. It is similar to the aforementioned fund, but it has not limit to the diversification that it can have. Normally funds with a declared strategy invest at least 80% into their strategy. According to Fidelity this is also a “value” stock fund. It’s current holding stand at 274 with top holdings being Berkshire Hathaway, Aecom, and US Bancorp.

-FSLCX

This fund primarily invests in small market cap companies, that is, companies with a market cap of between $300 million and $2 billion according to Investopedia. This fund uses both the Russell 2000 and the S&P SmallCap 600 as benchmarks. Top holdings include

World Fuel Services, Landstar Systems, and Silgan Holdings. This fund serves to represent a general small cap fud that Fidelity offers to its customer base.

-FDSCX

This mutual fund is small market cap fund that invests in both growth and value stocks. However, this fund also has five managers and well over 200 separate holdings. Even the top 10 holdings of this fund only make up 12.13% of its total holdings. A few of the top 10 include MB Financial, WSFS Financial, and Huntington Bancshare. This fund also appears to have a high concentration in the financial services industry.

3.2 TIAA-CREF

-TIRTX

TIAA-CREF's Large Cap Growth fund seeks to invest primarily in large cap companies that the investment adviser believes present that opportunity for growth. It also seeks to invest in companies that will benefit from restructuring, reorganizations, and other favorable special situations. Key holdings include Amazon, Facebook, Alphabet, and Intuit. This fund is a solid representation of TIAA's standard Large Cap Growth fund not unlike other investment management firms.

-TRLCX

This mutual fund seeks to invest at least 80% of its assets and large cap equity securities. This fund also seeks to aria companies that the fund's investment adviser who believes to be undervalued by the market. Key holdings include Pfizer, Wells Fargo, Bank of America and General Electric. This fund it is a typical example of a large cap value fund.

-TRCVX

This fund as a comparison fund based on Russell 1000 value index and seeks to invest the least 80% of its assets in the benchmark index. This index represents a large cap value segment of the U.S. equity market. Key holdings include AT&T, Procter & Gamble, and Johnson & Johnson. This fund is an example of a large cap comparative index fund.

-TRGMX

This funds seeks to invest 80% of its assets in midcap companies. It also seeks to target companies that the funds advisor believes presents the opportunity for growth. This fund is also benchmarked by the Russell Midcap Growth Index. Key holdings include Monster Beverage, Southwest Airlines, and United Continental Holdings. This is TIAA-CREF’s midcap growth fund.

-TCMVX

This fund seeks to invest at least 80% of its assets in midcap companies. This is another midcap value fund that TIAA has, but it also benchmarks off of the Russell Midcap Value Index giving it a unique strategy. A few of the top 10 holdings of this fund are Tyson Foods, Synchrony Financial, and Hess Corp.

-TRSPX

TRSPX is TIAA-CREF’s S&P 500 Index Fund meaning this fund buys most, but not necessarily all of the stock in its benchmark index, the S&P 500. This fund allow managers to compare their own fund with the S&P 500 in order to calculate Alpha, or the returns in excess of the index fund. Key holdings of this fund are Apple, Microsoft, and Exxon Mobil.

-TRBIX

This fund seeks to invest at least 80% of its assets in small cap companies included in the Russell 2000. The Russell 2000 serves as a benchmark for the small cap segment of the U.S. equity market. This fund serves as TIAA's benchmark small cap comparison fund with key holdings being Vail Resorts, Burlington Stores, and CubeSmart.

-TRSEX

This fund primarily invests small capitalization companies with 80% of its assets being invested in companies found in the Russell 2000 Index at the time of purchase. This also means they do not necessarily have to be still considered a small cap company today, just when it was added to this funds holdings. This fund is a general small cap equity fund with no restrictions placed on sectors, growth rates, and valuations. A few of the top 10 holdings of the mutual fund are Vail Resorts, Sovran Self Storage, and EPR Properties.

-TRSCX

TIAA-CREF's Social Choice mutual fund provides investors a choice to support companies who meet certain environment, social and corporate governance (ESG) criteria that are included in this fund. It also benchmarks using the Russell 3000, an index that seeks to benchmarks itself on the entire U.S. stock market and the largest 3000 traded stocks. Key holdings of this fund are Verizon Communications, Walt Disney, and Johnson & Johnson. This is a unique fund that allows consumers to lend support to social responsible companies who are warry of their social and environmental impact.

3.3 The Vanguard Group

-VEIPX

The Vanguard Equity Income fund seeks to construct a portfolio of above-average yield dividend paying stocks. This fund emphasizes slower-growing, higher-yielding companies in order to create long term value for the consumer while adapting to volatility. Its current benchmark index is the FTSE High Dividend Yield index. Top 10 holdings include Microsoft, Wells Fargo, and JPMorgan Chase. I chose this fund because it represents a core holding of most Vanguard retirement funds.

-VDIGX

This fund seeks to invest primarily in stocks that offer current dividends, but also are considered undervalued relative to the market and show potential for long term growth. The fund manager targets companies who will likely increase their dividends over time. Current holdings consist of Nike, Costco Wholesale, and United Parcel Service. I chose this fund because it differs slightly from the previous fund in that this fund does not necessarily target the highest payout, but those funds with room for growth and dividend growth. This fund is also highly considered to be another core fund with the previous fund.

-VDEQX

Vanguard's Diversified Equity fund conceptually is quite different from any other funds that I have chosen to use for my models. The strategy of this fund is called a "fund of funds" and seeks to invest in other Vanguard Equity mutual funds rather than individual securities. It has a large range of market capitalization companies that are found its fund. A few of the funds that it invests are also funds that I have chosen for my sample such as Vanguard Mid Cap Growth and Vanguard Growth and Income.

-VQNPX

This fund seeks to invest at least 65% of its assets in companies found in the S&P 500. By using the S&P 500 index as a benchmark, managers can select a broadly diversified group of stocks that, as a whole, have similar characteristics to the S&P 500, but are expected to outperform in the index as a whole. This large blend fund is also considered another staple pf long term growth portfolio's serviced by Vanguard. Top 3 holdings consist of Apple, Microsoft, and Johnson & Johnson. These stock are expect to provide long term growth plus dividend income.

-VMGRX

Vanguard's Mid-Cap Growth fund seeks to invest at least 80% of its assets in stocks of mid cap companies. The fund advisor also selects fund that are determined to have potential for future growth. This fund uses multiple advisors to create their model for selection of these companies. Key companies of this fund are Old Dominion Freight Lines, Hilton Worldwide, and Norwegian Cruise Line Holdings. This fund represents Vanguards version of the mid-capitalization growth fund and can be compared to both Fidelity's FMCSX and TIAA's TRGMX.

-VWUSX

This fund seeks to invest at least 80% of its assets in U.S. large capitalization companies that are determined, by the fund's advisor, to have above-average earnings growth potential and reasonable share price. This fund can be compared to TIAA's TIRTX fund. I chose this fund because it represents Vanguard larger cap growth fund. A few key holdings of this fund are Alphabet, MasterCard, and Amazon.com.

-VUVLX

Vanguard’s Value Fund has a stated strategy of investing 80% of its assets in large capitalization companies whose stocks have fallen out of favor with investors and generally have lower than average earnings ratios. These are companies who are large considered to be undervalued by Vanguard’s research. This is an example of a large cap value fund that Vanguard uses in its retirement portfolios. A few of the top holdings are Bank of America, Procter & Gamble, and Exxon Mobil.

-VWNDX

The Vanguard Windsor Fund focuses on chap undervalued stocks that they believe have the potential for large growth. The fund manager looks for stocks that are considered out of favor. The two largest concentrations for sectors are financial services and consumer companies. Windsor is a separate investment strategy within the Vanguard Group that specializes in value stock with cheap prices. The top 3 holdings of this fund are American International Group, Citigroup, and Bristol-Myers Squibb Company.

-VWNFX

This fund is Vanguard’s Windsor II fund is another Windsor fund that targets large capitalization companies whose stocks have fallen out of favor with investors according to the fund’s managers. This fund offers investors a low fee large value fund to add to their portfolio. This fund, although similar in nature to VWNDX, invests has a slightly larger average market capitalization, which leads me to believe that this fund also targets mega cap companies. For example, the largest three holdings of this fund are Microsoft, JPMorgan Chase, and Medtronic.

-VCVLX

This fund seeks to invest 80% of its assets in mid-capitalization companies which the fund advisor believes to be undervalued by the market. The equities included in this fund may or may not pay dividends. This fund can be compared to TIAA-CREF's TCMVX and also Fidelity's FDVLX. The top 10 holdings of this fund include Merck & Co, TherapueticsMD, and Pioneer Natural Resources. I chose this fund because it represents the mid-cap value fund that Vanguard offer to its investors.

-VASVX

Vanguard's Selected Value fund has an overall investment strategy of pouring 80% of its assets into Mid-Cap companies whose stocks are considered value buys by Vanguard's fund managers. Although this fund is similar to the one above, it also uses the Russell Midcap Value Index as a benchmark. This fund is unique because it consistently outperforms growth funds with steady gains over a long period of time. This fund plays a supporting role in the overall makeup of a retirement portfolio. A few of the top holdings include Royal Caribbean Cruises, Stanley Black & Decker, and Hanesbrands Inc.

-VSEQX

Vanguard's Strategic Equity Fund is considered one of the top three Mid-Cap Blend funds by Morningstar. The fund seeks to invest 80% of its assets in small to mid-cap companies based on the advisors valuation of the long term returns. This fund is not strictly value or growth stocks, but may be a mix of both. This fund also uses the MSCI US Small + Mid Cap 2200 Index as a benchmark for returns. Key holdings of the fund are Expedia, Cintas Corp, and Spirit AeroSystems Holdings.

-VEXPX

Vanguard's Explorer Fund, does in fact just that, as it tunes itself toward smaller capitalization companies with potential for high growth. That being said this fund also incurs a lot of risk by targeting those companies, because a smaller company with a lower share price is much more likely to incur higher volatility than would a well-established stock. The top three holdings of this fund are Globus Medical, West Pharmaceutical Services, and Demandware. This mutual fund was selected on the basis of representing Vanguard's small-cap growth fund.

-VEVFX

Vanguard's Small Blend fund seeks to invest at least 80% of its assets in both mid and small cap companies that the fund manager determines to be undervalued by the market. This fund may contain companies that pay above average dividends. Top holdings of this fund include Ligland Pharmaceuticals, Endurance Specialty Holdings, and American Capital. I chose this fund because it represents Vanguards small blend growth fund.

-VSTCX

This fund seeks to invest 80% of its assets in small capitalization companies whom the advisor believes achieves an appropriate balance of strong growth prospects and reasonable valuation. This fund also uses a bench mark of the MSCI US Small Cap 1750 Index to gauge their returns. A few of the companies included in this fund's top 10 holdings are Charles River Laboratories, Amsurg Corp, and Aspen Technology Inc. I chose this fund to be included in the study because it is an example of Vanguard's small cap index fund.

The last three mutual funds that I included in my study are unique because they are not a blend of funds in one specific market capitalization, but they are instead chosen based on the sector that they belong to. While this would make a fund more exposed to a crash in a specific sector, I wanted to include as a viable choice for certain consumers' portfolios.

-VGENX

This fund invests at least 80% of its assets in companies who are engaged in energy related activities such as production, research, or pollution control. The fund is often considered for investors with a sizeable risk appetite as noted earlier due to the volatility of one specific sector being the larger composition of the fund. It would also be considered a specialty fund for those with a particular interest in energy related investments. There is no restriction placed on the capitalization size of the companies. The top three holdings of this fund are Exxon Mobil, Chevron, and Pioneer Natural Resources.

-VGPMX

Vanguard Precious Metals and Mining Fund seeks to invest at least 80% of its assets in companies that are currently engaged in exploration, mining, development, fabrication, processing, marketing, or distribution of metals or minerals. The term "precious metal" may be a loose definition, but the advisor has narrowed it down to Gold, Silver, or other bullion and coins. The fund may also invest directly in Gold, Silver, and other bullion and coins.

-VGHCX

This fund is Vanguard's Health Care related fund which invests primarily in health care providers and companies. There is no restriction on the market capitalization of these companies. This fund is becoming more popular with investors as the population is moving toward an elder stage of life. This fund is highly concentrated in pharmaceuticals, but is not limited to just that; it also includes equipment and technology. A few of the top 10 fund holdings are Allergan, Bristol-Myers Squibb, and UnitedHealth Group.

4 Empirical Framework

4.1 Single Factor Model

I chose to break up the regressions into two spate tests after running a few test of the mutual funds against the factors I selected. In these tests I discovered that the Wilshire 5000 was absorbing a majority of the beta risk in these regressions. This makes sense due to the fact that these mutual funds are comprised of stocks that would be found in the Wilshire 5000.

The Wilshire 5000 is important as a macro economic risk factor, because it is widely accepted as the definitive benchmark for the U.S. equity market. It also measures the performance of all U.S. equity securities with real time updated data. The index however does not actually contain 5000 equities as the name might suggest, but now carries around 4000. This factor is important because a market crash would ripple through the Wilshire and throughout the individual equities found in each mutual fund. It is also important that a fund would not essentially bottom out if the Wilshire 5000 decreased a significant amount. The figure below is the range of data for the Wilshire 5000 that I examined.

Figure 4.1 Wilshire 5000 Relevant Range (Retrieved from Yahoo Finance)

The market model for calculating the returns to funds that I created roughly equates to a linear model for this one specific economic risk factor.

$$r_i = \alpha + \beta_{\Delta Wilshire\ 5000} + \varepsilon$$

Figure 4.2 Single Factor Model

In this model α represent the returns of a fund in excess of the market index that a fund would be using as a comparison. Beta, β, in this equation represents the certain macroeconomic systematic risk factor that is being used for the specific equation, in this case the returns, Δ, to the Wilshire 5000. In addition, ε is just some random error unable to be accounted for.

4.2 Multi-Factor Model

The multi factor model that I created is comprised of the other macroeconomic systematic risk factors that I selected to create a basic level of risk estimation. The first factor that I chose is the Returns to Crude Oil. Specifically, I chose the West Texas Intermediate (WTI) as the benchmark for Crude Oil prices as it frequently serves that purpose in the U.S. Stock Market.

WTI has a more direct correlation to gasoline prices in the United States due to its light-weight and low Sulphur properties. A rise in Crude Oil would have a direct proportionate rise to the cost of gasoline and other commonly used utilities such as electric and gas. Another impact that this has is on food prices, because trucks use the gasoline to travel and ship food across the country and world, the higher the price the more of an increase on food. For the reasons I listed, Crude Oil stands as a solid leading indicator of the World and U.S. Economic climate. Below is a graph depicting the WTI Crude Oil prices from January 4th, 2000 to February 8th, 2016.

Figure 4.3 WTI Prices 1/4/2000-2/8/2016 (Retrieved from FRED Data)

The next factor that I chose to include in the multi-factor model regressions was the Effective Federal Funds Rate. The US Federal Funds Rate is the interest rate at which depository institutions such as banks and credit unions lend money to one another to satisfy the Federal Reserve requirement on reserve balances overnight. This rate directly affects the interest rate at which a depository institution will lend money to consumers. For example, a relatively low Effective Federal Funds Rate would mean the US is currently in a high inflationary period. This would mean that banks are currently not as willing to lend money to consumers effectively cutting back on lending and consumer spending and thusly shrinking the Gross Domestic Product. This factor serves as a trailing economic indicator. In the graph below the Effective Federal Funds rate is shown for the examined period of time.

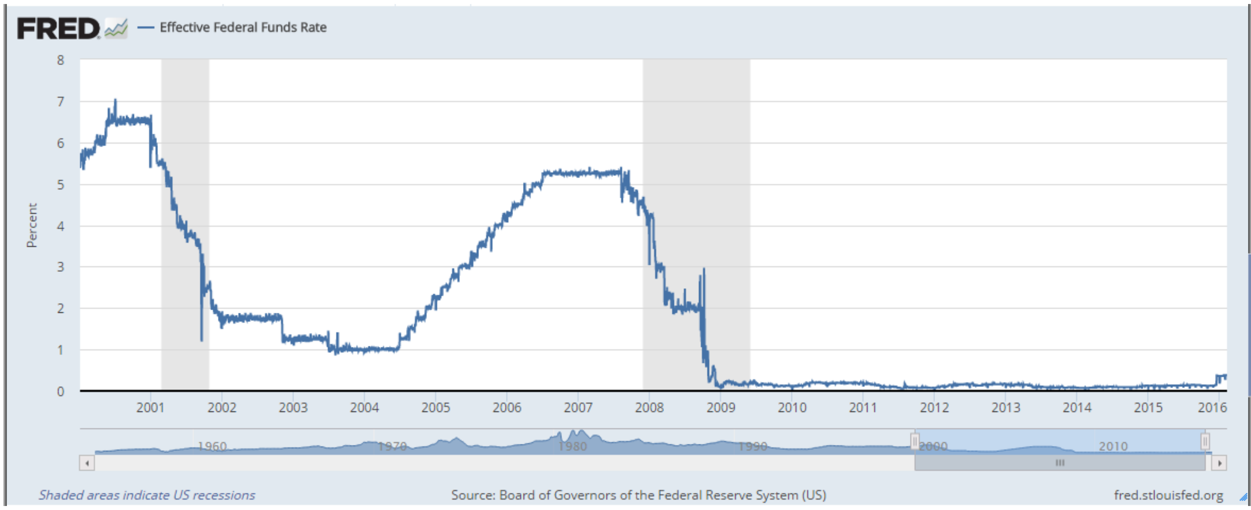

Figure 4.4 Effective Federal Funds Rate 1/4/2000-2/8/2016 (Retrieved from FRED Data)

The third factor that I chose to use in my regressions was the difference between the rates of the 10 Year Treasury Bill and the 3 Month Treasury Bill commonly known as the Yield Curve. Both the 10 Year and 3 Month bills are treasury bonds offered by the United States government as part of monetary policy in order to control the supply of money currently circulating. By doing this they can also control the inflation rate growth as well a few other key factors. This factor serves as one of the best leading economic indicators as far as predicting recessions in advance. To simplify this concept, the steepness of the curve, when calculating this difference, is an excellent predictor of a possible future recession. Exposure to this factor would allow us to see whether or not one's portfolio is susceptible to an upcoming economic recession. The graph following is the calculated Yield Curve for the dates of 1/4/2000 through 2/8/2016.

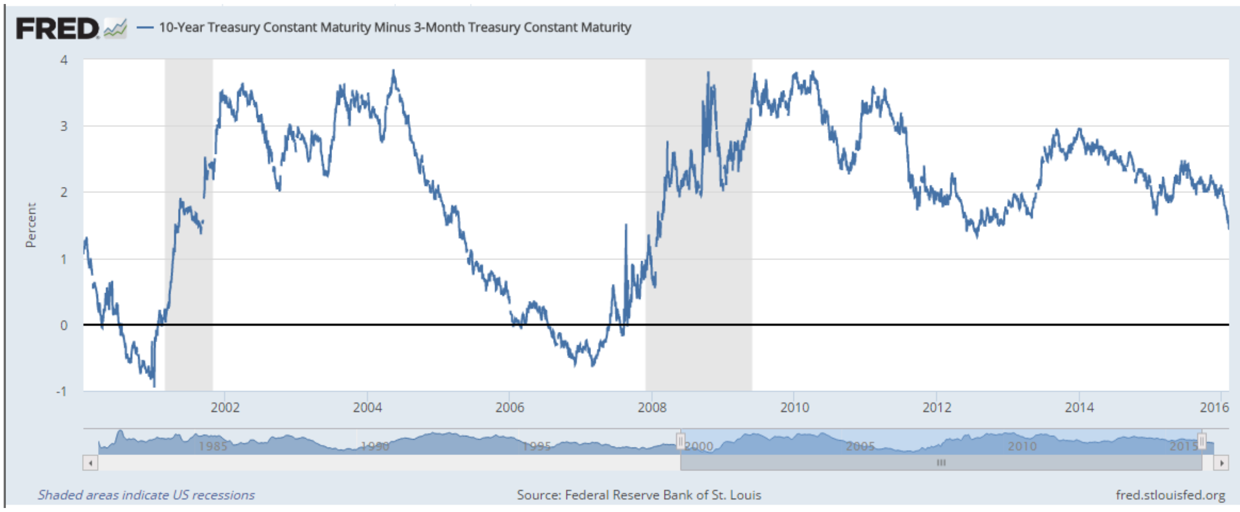

Figure 4.5 Yield Curve from 1/4/2000-2/8/2016 (Retrieved from FRED Data)

The next factor that I chose to use for the multi-factor regression was the returns of Baa-Aaa Bond Yields respectively. This rate of subtracting Aaa rated bond yields from Baa bond yields effectively denotes the costs of corporate borrowing in the United States. This rate is often referred to as the Corporate Bond Yield Spread. When the spread between Baa and Aaa grows, that signifies that the probability for defaults has increased with Baa bonds. This factor is a good indicator of economy-wide stress facing these firms. Therefore, this bond yield spread can tell us much about the economy and the length of a recession. If the rate difference remains high, then the likelihood of a continuing recession will be higher, the inverse of this statement is also true. Exposure to this factor would lead us to believe that one's retirement portfolio contains many companies whose corporate bonds fall into the Baa category and are thusly much riskier. During times of economic turmoil, these companies find it much more difficult to obtain funding through bonds. The chart below depicts the Corporate Bond Yield Spread for the relevant dates to this study.

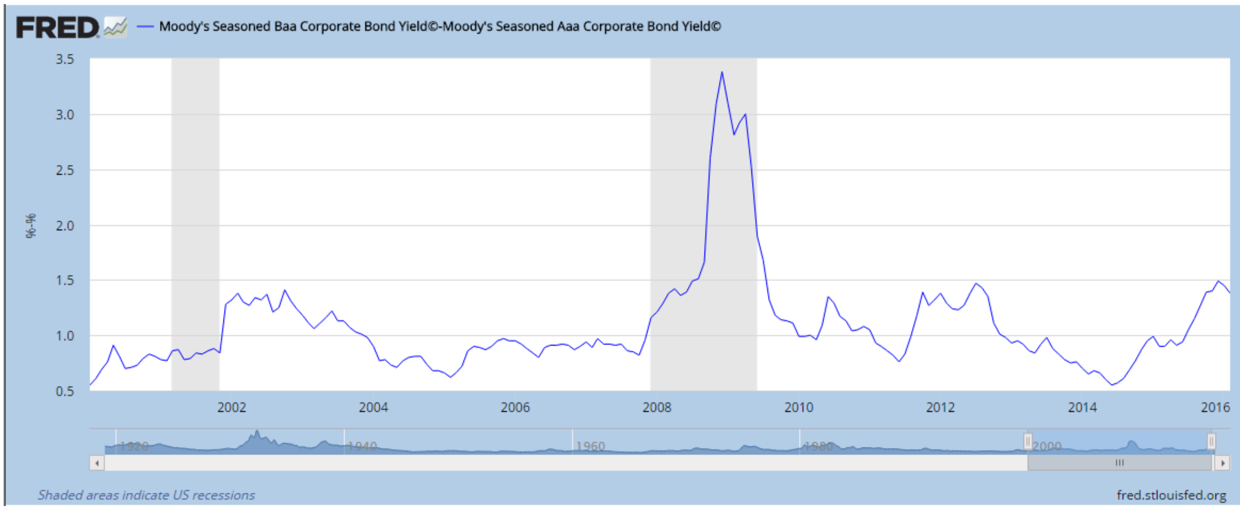

Figure 4.6 Baa-Aaa Corporate Bond Yield Spread 1/4/2000-2/8/2016 (Retrieved from FRED Data)

The final factor that I chose to regress the various retirement mutual funds against in my multi-factor model was the VIX or a measure implied volatility of the S&P 500. This is also known as the investors fear gauge, because it serves as investor’s near-term prediction of future market volatility and risk. For example, a high VIX would be due to a high level of fear in the market and a low level would be a low amount of fear. By gauging this factor we can understand whether or not investor’s fear that the market will be shifting downward. It’s important to keep track of this factor because if one’s portfolio is exposed to this factor, it means that self-fulfilling prophesies of market crashes will damage one’s portfolio significantly. Not only does this effect pricing of the S&P 500 itself, it also effects secondary markets for put/call options to stocks. As the VIX increases, call and put options increase, and the same direct correlation of the VIX goes down. The below graph shows the implied volatility of the S&P 500 for the dates of 1/4/2000 through 2/8/2016.

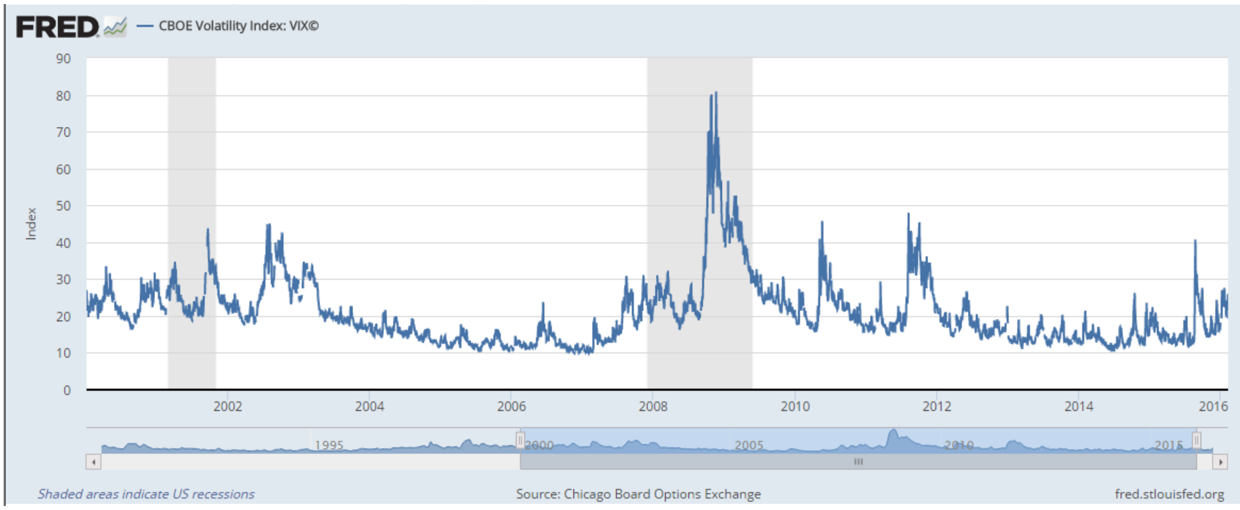

Figure 4.7 VIX 1/4/2000-2/8/2016 (Retrieved from FRED Data)

The market model below if the equation that I used to run regressions of the factors that I listed above against the returns of the various funds that I mentioned in Section 3.

$$r_i = \alpha + \beta_{\Delta Crude\ Oil} + \beta_{\Delta Effective\ Federal\ Funds\ Rate}$$

$$+\beta_{\Delta 10\ Year - 3\ Month\ Treasury\ Yield}$$

$$+\beta_{\Delta Baa - Aaa\ Corporate\ Bond\ Yield} + \beta_{\Delta VIX} + \varepsilon$$

Figure 4.8 Multi-Factor Regression Equation

In this model α represent the returns of a fund in excess of the market index that a fund would be using as a comparison. Beta, β, in this equation represents the certain macroeconomic systematic risk factor that is being used for the specific equation, in this case the returns, Δ, to Crude Oil, the Effective Federal Funds Rate, the 10 Year - 3 Month Treasury Yield, the Baa-Aaa Corporate Bond Yield, and the Returns to the VIX. In addition, ε is just some random error unable to be accounted for.

5 Empirical Findings & Socioeconomic Impact

5.1 Single Factor Model

After running the regressions of each individual fund listed in section three, I discovered what I had hypothesized to be true. In the multi factor model, the Wilshire 5000 would have soaked up a majority of the Beta risk as it contains the stocks that each mutual fund is comprised of. However, when the single factor regression was run a different story appeared. Below is a table of the collected Betas for each mutual fund.

Fund	Company	Market Model (Alpha)	Market Model (Beta)	Relative Std Dev
FOCPX	Fidelity	-0.0024	1.2027	1.336928518
FBGRX	Fidelity	-0.0032	1.0146	1.03685661
FDEGX	Fidelity	-0.0251	1.1855	1.347018224
FLGEX	Fidelity	0.0059	0.9224	1.017686191
FCPGX	Fidelity	0.0064	1.0712	1.133211251
FCNTX	Fidelity	0.0123	0.8119	0.855360427
FSMVX	Fidelity	0.0079	1.0713	1.084754911
FMEIX	Fidelity	0.0012	1.0521	1.179095
FDEQX	Fidelity	-0.0019	0.9695	0.986821622
FLCEX	Fidelity	-0.0002	0.9675	1.058747514
FVDFX	Fidelity	0.0002	1.0722	1.050061876
FBCVX	Fidelity	-0.0168	1.0667	1.074560876
FLCSX	Fidelity	-0.0063	1.0814	1.098631009
FLVEX	Fidelity	-0.008	1.0364	1.141078842
FGRTX	Fidelity	0.0012	0.9396	0.9627952
FDGFX	Fidelity	0.0031	1.038	1.068638455
FSLVX	Fidelity	-0.0047	1.0326	1.029742646
FMCSX	Fidelity	0.008	1.034	1.12132966
FCPSX	Fidelity	-0.0109	0.6792	0.703900395
FDVLX	Fidelity	0.0161	1.0035	1.073277121
FSLCX	Fidelity	0.0133	1.0218	1.116911037
FDSCX	Fidelity	0.0085	1.03	1.124103342
TIRTX	TIAA-CREF	0.0037	0.9956	1.072687602
TRLCX	TIAA-CREF	-0.0086	1.0828	1.073146252
TRCVX	TIAA-CREF	-0.0068	1.0382	1.024467998
TRGMX	TIAA-CREF	-0.001	1.0741	1.089985032

TCMVX	TIAA-CREF	0.0035	1.0552	1.041919834
TRSPX	TIAA-CREF	-0.0036	0.9866	0.960913592
TRBIX	TIAA-CREF	-0.0154	1.1773	1.234252908
TRSEX	TIAA-CREF	-0.005	1.1669	1.207980227
TRSCX	TIAA-CREF	-0.0034	1.0029	0.974768591
VEIPX	Vanguard	0.0131	0.8469	0.90078502
VDIGX	Vanguard	0.0106	0.7354	0.842969932
VDEQX	Vanguard	-0.0055	-0.0278	1.827162417
VQNPX	Vanguard	-0.002	0.9837	0.993735253
VMGRX	Vanguard	-0.0017	1.1112	1.258361645
VWUSX	Vanguard	-0.0165	1.0709	1.131387173
VUVLX	Vanguard	0.0073	0.9793	0.999185858
VWNDX	Vanguard	0.0076	0.9991	1.039601092
VWNFX	Vanguard	0.01	0.8834	0.932052174
VCVLX	Vanguard	-0.0085	1.2315	1.270048049
VASVX	Vanguard	0.0223	0.8491	0.925605102
VSEQX	Vanguard	0.0104	1.0546	1.118856768
VEXPX	Vanguard	0.0081	1.0684	1.135905769
VEVFX	Vanguard	-0.0045	1.1093	0.942327207
VSTCX	Vanguard	-0.0045	1.1575	1.264026072
VGENX	Vanguard	0.0267	0.9675	1.344538329
VGPMX	Vanguard	0.0175	0.8106	1.440495492
VGHCX	Vanguard	0.0349	0.6309	0.7723324

Table 5.1 Single Factor Model Results

As we can see here the data represents the earlier market model that I created in section four to simplify the regressions. From that data we see that the average Beta of the Vanguard retirement mutual funds is around 0.915, which is nearly 1. This means that the returns of the Wilshire 5000, are highly correlated with the returns of Vanguard's funds. The average Beta of Fidelity's funds was 1.014, which is above 1 meaning a slightly more than direct correlation in relation to the returns of the Wilshire 5000. Finally, the average Beta of TIAA-CREF's funds was 1.064 which happened to be the highest Beta of all three investment management firms. Overall, this is the outcome that I had expected to see which is why I investigated this question from the start. While there are stocks found in the Wilshire 5000, that make up most of these funds it is also important to note that most of these funds have around 100 holdings, so exposure at this level to all 5000 stocks is not the type of performance that one would like to see.

In addition to these numbers, the relative average standard deviation for Fidelity's funds was 1.073 while TIAA's was 1.076 and Vanguard's was 1.119. These deviations are rather normal for the whole range of funds listed here. This umber means that the past returns fell within one standard deviation away from the mean return of this funds. In other words, the funds returns do not vary wildly.

5.2 Multi-Factor Model

In the multi-factor I used each mutual fund that was listed in section three are regressed their returns against five factor listed in section four simultaneously to get an overall feel for what exposure each fund had. The following table is the full calculations for each fund that I tested in the multi-factor regressions.

Fund	Company	Oil	Fed Funds	10yr-3mo	Baa-Aaa	VIX
FOCPX	Fidelity	0.364	-0.0082	1.68	-0.016	-0.145
FBGRX	Fidelity	0.03895	-0.00527	1.470781	-0.01187	-0.12738
FDEGX	Fidelity	0.065101	-0.00517	1.875459	-0.02101	-0.14048
FLGEX	Fidelity	0.076446	-0.00485	0.784096	-0.03113	-0.1111
FCPGX	Fidelity	0.104829	-0.0071	1.229585	-0.03123	-0.1173
FCNTX	Fidelity	0.051482	-0.00425	0.681323	-0.01329	-0.10661
FSMVX	Fidelity	0.074067	-0.0069	1.498592	-0.02215	-0.1225
FMEIX	Fidelity	0.095684	-0.0069	1.301798	-0.04426	-0.122
FDEQX	Fidelity	0.048952	-0.00448	1.039324	-0.01429	-0.12358
FLCEX	Fidelity	0.081753	-0.00491	0.83655	-0.03297	-0.11412
FVDFX	Fidelity	0.081072	-0.00667	1.23785	-0.02535	-0.11601
FBCVX	Fidelity	0.092749	-0.00703	0.996051	-0.03223	-0.11561
FLCSX	Fidelity	0.061717	-0.00764	1.484689	-0.02382	-0.12963
FLVEX	Fidelity	0.09167	-0.00597	0.924833	-0.03502	-0.11868
FGRTX	Fidelity	0.044902	-0.00524	1.094822	-0.01695	-0.11787
FDGFX	Fidelity	0.058632	-0.00648	1.44872	-0.02231	-0.12557
FSLVX	Fidelity	0.07203	-0.00575	1.391821	-0.01788	-0.11854
FMCSX	Fidelity	0.084848	-0.0055	1.258024	-0.02481	-0.12531
FCPSX	Fidelity	0.018371	0.000114	2.050951	-0.00913	-0.05036

FDVLX	Fidelity	0.074419	-0.00746	1.392932	-0.02395	-0.121
FSLCX	Fidelity	0.061132	-0.00768	1.590326	-0.02216	-0.12473
FDSCX	Fidelity	0.080824	-0.00668	1.322647	-0.02438	-0.12568
TIRTX	TIAA-CREF	0.059292	-0.00558	1.388192	-0.01979	-0.1128
TRLCX	TIAA-CREF	0.075474	-0.00651	1.112238	-0.02629	-0.11576
TRCVX	TIAA-CREF	0.068242	-0.00584	1.299337	-0.02202	-0.11534
TRGMX	TIAA-CREF	0.078262	-0.00659	1.633432	-0.02284	-0.12323
TCMVX	TIAA-CREF	0.075964	-0.00672	1.290988	-0.03053	-0.11626
TRSPX	TIAA-CREF	0.053591	-0.00506	1.346796	-0.01852	-0.11243
TRBIX	TIAA-CREF	0.063842	-0.00767	1.894417	-0.02216	-0.1341
TRSEX	TIAA-CREF	0.062392	-0.00758	1.80833	-0.023	-0.13411
TRSCX	TIAA-CREF	0.059292	-0.00558	1.388192	-0.01979	-0.1128
VEIPX	Vanguard	0.039803	-0.00532	0.822589	-0.01091	-0.10661
VDIGX	Vanguard	0.038793	-0.00277	0.848951	-0.01574	-0.09446
VDEQX	Vanguard	-0.00909	0.001268	1.613455	0.032626	0.004693
VQNPX	Vanguard	0.040109	-0.00441	1.180154	-0.01268	-0.12268
VMGRX	Vanguard	0.049086	-0.00608	1.670038	-0.02073	-0.1344
VWUSX	Vanguard	0.028805	-0.00496	1.659565	-0.00697	-0.13333
VUVLX	Vanguard	0.049728	-0.00499	1.102199	-0.01834	-0.12043
VWNDX	Vanguard	0.053521	-0.00602	1.305526	-0.0181	-0.12473
VWNFX	Vanguard	0.05237	-0.00488	0.909194	-0.01614	-0.11143
VCVLX	Vanguard	0.107547	-0.00972	2.057346	-0.0324	-0.13419
VASVX	Vanguard	0.054008	-0.00521	1.001229	-0.01495	-0.10715
VSEQX	Vanguard	0.057096	-0.00615	1.300081	-0.01691	-0.13106
VEXPX	Vanguard	0.056668	-0.00687	1.624954	-0.01869	-0.13204
VEVFX	Vanguard	0.088549	-0.00189	3.747582	-0.00733	-0.08977
VSTCX	Vanguard	0.090825	-0.00731	1.439774	-0.03952	-0.12696
VGENX	Vanguard	0.296768	-0.00254	0.685655	-0.03911	-0.11195
VGPMX	Vanguard	0.2081	-0.00368	0.152567	-0.0702	-0.09509
VGHCX	Vanguard	0.011206	-0.00132	0.183591	-0.00325	-0.08557

Table 5.2 Multi-Factor Regressions Results

This multi factor regression came with far more hopeful results for these particular mutual funds. The highest exposure that I observed came from the 10 year minus the 3 month treasury yield across all three investment management firms; Fidelity had an average beta of 1.30, which was second overall, TIAA-CREF has an average Beta of 1.46 and finally Vanguard had an average Beta of 1.29. This kind of exposure opens the door to possibility of a future recession and the impact the self-fulfilling prophesies have on the state of the economy. Other unique observations that I notice were all three investment managed firms had relatively small negative exposure to the volatility index. The full average Beta results for each firm are as follows below.

Fidelity Avg Beta			TIAA-CREF Avg Beta			Vanguard Avg Beta	
Oil	0.082892		**Oil**	0.066261		**Oil**	0.072994
Fed Funds	-0.00591		**Fed Funds**	0.066261		**Fed Funds**	-0.0046
10yr-3mo	1.299599		**10yr-3mo**	1.462436		**10yr-3mo**	1.294692
Baa-Aaa	-0.02346		**Baa-Aaa**	-0.02277		**Baa-Aaa**	-0.0183
VIX	-0.11905		**VIX**	-0.11965		**VIX**	-0.10873

Table 5.3 Average Betas Multi Factor Model

The results found here in these regression have implications not only for those who have a financial career or are interested in this type of research. Retirement account affect all of us in one way or another. Whether we count on those funds to carry through the remaining days of our lives or we want to pass on a legacy to our children or our grandchildren. These results also have sway across different careers and walks of life. TIAA-CREF manages billions of dollars of teachers and professors assets. Fidelity and Vanguard also manage billions of dollars of assets and should likewise be examined under a careful lens.

6 Conclusion

This major qualifying project was based around a simple question: are management fees justified? In order to accurate answer that question I needed to analyze whether or not fund managers were doing their job in making sure that their funds are not overexposed to macroeconomic risk factors which would put the alpha, or returns, in jeopardy. By measuring the betas, or risk exposure, to a group of researched risk factor I would be able to determine whether or no these funds are overexposed and therefore at high risk to an economic collapse or other negative financial trends. I defined overexposed as any fund with a correlation over 1. I split the regressions tests up in to two categories, one single factor regression and another multi factor regression with the factors listed in section four.

As noted in section five, all of the funds and a collective average of each investment management firm were overexposed to the risk of a Wilshire 5000 collapse. This leads us to believe that a 1:1 ratio of decreases in the Wilshire would have the same effect on one's retirement account. The multi-factor tests though gave some promising results against the other factors I had selected with the exception of the 10 year treasury minus the 3 month treasury.

Overall, I discovered that in the multi-factor model the funds were sensitive to future market crashes and the investor sentiments that are held about future market conditions. In addition to this, the other factor that showed the most correlation to the returns of the fund were the returns of the Wilshire 5000. This means that just as the fund is sensitive to a rise in the market, it is equally sensitive to a crash. With this information I would encourage investors to question the funds that are being sold to them and perform similar research on the funds themselves to determine if this is true for single funds as well.

Although the research done in this project was quite extensive, future possibilities might include doing a more thorough regression with a few other risk factor added to the equation in order to get a fuller picture of the risk profile of the mutual funds that I selected. As noted in this article, "The stronger preference for low systematic risk in the strong market state suggests that investors are reacting to fund performance as opposed to continuity in fund systematic risk levels…This result potentially suggests that more savvy investors are able to select high Systematic Risk Management skill managers and these investors are more prone to monitor and react to the systematic risk level of the fund."[4] My goal in this project was to educate further the public about the risks involved money management and assuming that the job is always being done correctly and also to empower people to ask their own advisors: is my money being responsibly managed?

[4] Ethan Namvar, Blake Phillips, Kuntara Pukthuanthong, P. Raghavendra Rau, Do hedge funds dynamically manage systematic risk?, Journal of Banking & Finance, Volume 64, March 2016, Pages 1-15, ISSN 0378-4266, http://dx.doi.org/10.1016/j.jbankfin.2015.11.014.

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