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REPLICATING MUTUAL FUNDS USING AN ONLINE INVESTMENT PLATFORM

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ABSTRACT

Online investing has opened up capital markets to many more investors by providing lower costs, convenience, and access to incredible amounts of information. This has created a trend among investors of taking control of their own assets and investments and cutting out the middle man. However, heavily managed mutual funds with high costs continue to attract a large number of investors. This study was created to determine if the information used to create mutual funds could be taken by the average investor and invested online at a much lower cost. The online investing platform *Motif Investing* was used to create “motifs” of 30 stocks that mimicked nine top performing mutual funds using their historical holdings. It was found that the mutual funds could only be replicated to represent 40%-75% of the funds’ holdings with an outlier at 98%. The motifs ended up outperforming the mutual funds in 2013 in five cases by an average of 0.6%. In 2014 six of the motifs outperformed their mutual funds by an average of 3.90%. These findings and trends have generated many additional questions to be pursued in future research.

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Chapter 1

Introduction

Each year millions of Americans invest their money in actively managed mutual funds. These funds are overseen by financial managers who invest the money pooled from investors into stocks, bonds, and other financial instruments in attempts to create capital gains. These professional managers spend their time researching the markets in attempts to find the best investments to produce the largest gains. In exchange for their services people that invest in mutual funds pay fees that are taken out of their portion of the earnings. Some of these fees are sales loads which come in different forms either at the time of purchase, time of sale, or they can be ongoing. There are also ongoing expenses which include operating costs, management fees, distribution costs and more. All of these ongoing expenses come together to form an ongoing fee which is usually 0.5%-3.0% of the investor's return on investment. In addition to these fees most mutual funds have minimum investment quotas of a few thousand dollars required invest in the fund. Many people are willing to pay these fees and minimums because they don't trust themselves to invest their own money as effectively as possible. Others turn to mutual funds because they are convenient as the managers do all the research and figure out how to distribute the money and when to reweight the portfolio.

There is an Investopedia page dedicated to explaining mutual funds. It claims that mutual funds give investors with relatively little money the chance to invest in large portfolios that are well diversified and professionally managed. The article says that otherwise this type of portfolio "would be quite difficult (if not impossible) to create with a small amount of capital"

(Investopedia, 2015). That might have been the case in the past but in recent years there have been more options and strategies available to the individual investor than ever before. This is due to increases in technology and competition among investment companies. One online investment company called *Motif Investing* was launched in the summer of 2012 that allows investors to create their own portfolios of stocks, called motifs, with up to 30 stocks. These selected stocks can then be weighted any way the investor would like and reweighted as they choose in the future. This form of investing is very similar to what a mutual fund manager does when they choose investments, determine each investment's weight within the portfolio, and then reweight them as time passes. This online investment platform could make it possible for the individual investor to replicate a mutual fund online with less money for a fraction of the cost.

The creators of *Motif Investing* had the intention of allowing investors to create motifs based on ideas they think would be profitable. Real examples from the website include the motif "Senior Care" which invests in healthcare stocks which could be profitable as the Baby Boomers age and "Vanity Flair" which holds stocks related to the US beauty and personal care industry which has increased 3.4% in the past year. There are premade motifs available on the website that have been designed by financial experts who work for the company. These are people that know the markets well and create motifs around ideas that they think will be profitable. Members of the website can also create their own motifs using any 30 stocks or ETFs that are available on US exchanges. These motifs can be weighted and organized any way the investor wants and then published. To invest in a motif the minimum is only \$250 and each motif transaction has a \$9.95 total commission. To add additional stocks or reweight the motif in the future costs \$4.95 per stock or ETF.

This study is going to use the unique features of this website to attempt to create motifs that replicate existing actively managed mutual funds. This will be done by finding top performing mutual funds from the past and replicating them as motifs on the *Motif Investing* website. Since *Motif Investing* only allows investors to add US stocks and ETFs to their motifs the mutual funds replicated will be top performing stock funds from 2012. Their holdings as of year-end 2012 will be used to create the motif. This allows the investor to use the information that the fund manager found in their own personal motif. Once the motifs have been created based on the holdings of top mutual funds from year-end 2012 their performance for 2013 and 2014 will be calculated using historical returns. The performance of the motifs, mutual funds, and S&P 500 for these 2 years will then all be compared to see if the performance of the fund can actually be replicated this way and if the motifs can beat the S&P 500 benchmark. The costs of each investment type will also be analyzed to determine if motifs can be made to create similar returns as mutual funds for a lower cost.

If motifs are able to replicate mutual fund returns for a fraction of the cost this would be very attractive to investors, especially younger individuals who have less capital available for investing. This plan would still involve the fund managers doing the research and determining the stocks to invest in and the weights to give each stock. The study is simply using this information, which is provided in the funds' semi-annual shareholders reports, to recreate the funds online. This would be a relatively easy strategy for the average investor to imitate and would completely avoid management fees. The \$250 minimum investment for a motif is much lower than most of the minimums needed to invest in a mutual fund. The majority of funds replicated in this study had a minimum investment requirement of \$1,000-\$2,500. This

investment strategy could open up this opportunity of having a well-researched and diversified portfolio to investors with less money and little financial expertise.

Chapter 2

Literature Review

Background on Online Investing

In recent years the rapid increases in the creation and development of technology has led to increased options and capabilities in all aspects of life for humans. The world of finance and investing is not an exception. With the introduction of the internet and online investing everything has changed in the financial community. Numerous new investment methods, opportunities, and strategies have emerged. Investors are now able to invest with convenience, at a low cost, and with total control of their own assets if they choose to. Innovation is constant and new firms, platforms, and tools are being introduced at incredible rates. All of these changes have allowed investors to create and implement trading strategies on a do-it-yourself basis.

This huge explosion within the investing community can be traced back to January 23, 1975 when the Securities and Exchange Commission ruled that brokers' commissions were no longer allowed to be fixed by securities exchanges. These commission rates had been fixed since 1792 which kept the cost of investing high and limited participation to mostly the upper class (Melnick & Ofer, 1978). This new ruling inspired firms to restructure and encouraged competitive pricing. Charles Schwab saw this as an opportunity and created Schwab & Co. which became one of the world's first and largest discount brokerage firms. He was targeting investors who wanted the power to invest their own way without paying a broker or mutual fund manager (Serwer, 1999). This was when do-it-yourself investing first began to take off.

The next huge step was initiated by K. Aufhauser & Company a brokerage firm that in 1994 brought investing to the internet. The company created WealthWEB which allowed investors to place their orders online and cut out brokers (Franklin, 2013). The impact that WealthWEB would have on investors was greatly underestimated in early years. However, soon investors began to show interest in the convenience and control WealthWEB gave them. In the next few years other companies created online investing components such as Prodigy and E-Trade. By the end of 1994 there were a total of 12 existing online brokerage firms. This number grew to 140 online brokerage firms in just six years at the end of 2000 (Tobias, 2010). In the early 2000's online investing had also extended to web-enabled mobile phones allowing trades to be made using touchtone trading systems. This new technology was called mobile e-commerce (Huynh, Jessup & Umesh, 2005).

A study was performed by researchers from the National Bureau of Economic Research to see the effect that online trading technology actually has on the volume and volatility of the stock market. To measure this effect the researchers looked at the trading activity created by participants in two large corporate 401(k) plans. These plans originally only offered phone trading but expanded to internet trading in 1998. After taking into consideration external factors such as stock price volatility and overall market volume the results still showed that the internet trading option increased the trading volume of these participants by 55% in just 18 months. They also found that of the participants that made a trade online would tend to continue to use this method in the future. After participants' first online trade 88% of them would make their next trade online. Males who were younger and had higher salaries were the most likely to use the online trading option. Young participants with lower account balances began to trade more frequently online but with lower transaction sizes. Retirees were the least likely to switch from

the phone service to the online services. Overall the participants reported being very happy with the online trading option and it increased trading volume significantly (Choi, Laibson & Metrick, 2000).

Today investors have access to the markets through a variety of devices with intricate and advanced platforms. In 2014 it was estimated that 15%-20% of all retail trades were made from a mobile device (Carey, 2014). *Barron's* ranked the best online brokers of 2014 and found that all of their favorites allowed for complete customization of trades, access to a variety of analytical tools, high speed trades, and a mobile application that is as user friendly as a desktop computer trading platform. Most services now create their mobile application first and then carry it over to other platforms like the desktop (Carey, 2014).

Pros and Cons of Online Investing

Online investing offers investors numerous benefits and opportunities that were not available just a few years ago. However, these new advances do not come without risks and controversy. Overall most of the pros and cons can be categorized by two general theories. The investor-empowerment theory praises online investing as it encourages the creation of new exchanges, investment methods, after hours trading, distributes IPOs, lowers costs, and gives investors flexibility and control. The investor-excitability theory addresses the fact that online investing might give individuals too much excitement and power that they might not be ready to handle. Many investors lack financial knowledge and engage in higher trading volumes online than they would otherwise (Serwer, 1999).

There are positives and negatives to every aspect of online investing. The first and most acknowledged benefit of investing online is that an investor can have personal control over their own portfolio. Online trades can be made instantaneously without waiting on a broker. The investor can act completely on their own knowledge and instincts (Ray, 2014). The flipside of this is that brokers have lots of experience and are supposed to help investors avoid bad investments. Also it has been speculated that online investing has greatly increased the number of naïve investors that are actively trading. Three professors at Syracuse University, Ahmed, Schneible, and Stevens, did a study called “An empirical analysis of the effects of online trading on stock price and trading volume reactions to earnings announcements”. This study found that since online trading became popular stock price reaction to earnings announcements has substantially increased which decreases average prior precision. The change in the volume has also become less related to the actual price change which led the researchers to believe that interpretation of the earnings reports has changed with the introduction of online investing. The differential prior precision of investor information overall was found to decline due to the decrease in volume reaction for each unit of price change related to the announcements. The study concluded that there is a strong likelihood that the introduction of online investing has attracted an increased number of naïve investors (Ahmed, Schneible & Stevens, 2003).

The second factor that is often noted as the largest pro of online investing is the lower cost associated with investing. Even if an investor chooses to keep investing offline the creation of online investing has already saved them money as investment firms and mutual funds had to lower fees over the years to stay competitive. In general brokers and mutual fund directors often charge high fees for each transaction and then take an additional portion of the earnings. Mutual

funds can have annual fees as well. Online investment platforms are often a fraction of this price (Ray, 2014). Once again the downside of these lower costs is losing the professional expertise.

A *Wall Street Journal* article by Michael Pollock explained common investment options that are now available to the average money conscious investor. Some financial services offer flat fee portfolio creation advice which can be under \$1,000 but will have future management fees. Investors can also invest in one time advice but then are on their own if the portfolio starts performing poorly. Traditional services that involve extensive interaction with a broker to create a personalized portfolio are very expensive, usually upwards of \$2,000 for the initial advice. Afterwards there is an average annual fee that ranges from 1%-2% for portfolio management. Investing in funds can have expenses ranging from 0.25% for exchange-traded funds and index mutual funds all the way to 2% for active management. Some mutual funds have advisory services provided to those who invest in their funds but there is a high minimum for the investment. Vanguard investors that have a portfolio of less \$50,000 can get a basic plan with weighting recommendations for \$1,000. Once an investor has a portfolio of greater than \$50,000 this fee is only \$250. There are also financial advisors from other services that are available on an hourly basis at an average cost of \$300 per hour. Some discount brokerage firms now have management service options as well. Charles Schwab Corporation will create and manage a portfolio under \$250,000 for a 0.50% fee. Online options are consistently the most affordable but often the most do-it-yourself. Wealthfront.com has an application to automatically create a risk profile for its investors and then it will recommend ETFs and rebalance them based on that information. This has only a \$5,000 minimum requirement and no advisory fee. However, there is no person to person contact with this option. Betterment.com is another online site that has no minimum. For clients with portfolios worth more than \$100,000 there are free personal

consultations but there is a 0.15% annual fee. Overall Pollock found that there are many online services that offer the same options as brick and mortar firms for lower rates. However, there is often a loss of human interaction that some people, especially older generations, require (Pollock, 2012).

One online investment platform that launched on December 11, 2014 is attempting to reduce trading fees to nothing. The name of this company is Robinhood Financial and its mission is to “democratize access to the financial markets” (“Robinhood markets, inc,” 2015). This is a startup company created by two Stanford graduates that left their jobs on Wall Street to create the Robinhood mobile application. The application charges 0% commission to trade and has no minimum deposit requirement. They plan to make money through investors that choose to open margin accounts and interest from customers’ uninvested cash balances. The company has also received funding from various investors such as Google Ventures. Robinhood is a registered broker-dealer and is also a member of the Financial Industry Regulatory Authority and the Securities Investor Protection Corporation which protect investments up to \$250,000. Currently they offer most U.S. equities and exchange trade funds and are looking to expand to foreign equities, options, warrants, and more in the future. This application received so much attention that there were already over 500,000 people on the waiting list before it launched. There are still over 200,000 people waiting for access to the application as they are trying to slowly increase the number of users as to not overwhelm their infrastructure. As of now the application is only available for Apple phones and tablets. They are currently experimenting with expanding to Android products. This is still a very new company but it has received high reviews so far (“Robinhood markets, inc,” 2015). This company is the ultimate example of how online trading could reduce the cost of trading to zero. However, this idea of no-commission trading was

attempted and failed in the past by a company called Zecco which offered 10 free trades a month. Zecco ran into financial troubles within two years and had to restructure their pricing model. Later they were acquired by Tradeking (Huang, 2015). Robinhood Financial is still very new and has received a good amount of praise and speculation. It will be interesting to see how the company structure works out in the future as it could be the next big thing in investing.

Bringing investment activity to the internet also brought a new abundance of tools for financial research. There are several online websites and investment firms that provide professional advice and research for no additional charge. The difference is that the investor has to search for it instead of requesting the information directly from their hired broker as in the past. The downside of this new information availability is there is so much that an investor could easily get conflicting information, misinterpret their findings, or miss something crucial entirely. Extensive personal research also takes a lot of effort and time (Ray, 2014). However, a smart investor with some time available to dedicate to research has tons of information available to them. One very interesting study was published in *The Journal of Business Finance & Accounting* that looked into how much internet source processing effects investors' decisions. To measure this the researchers looked at the editing frequency of Dow Jones Industrial firms' pages on Wikipedia with regards to analysts' recommendations and forecasts. What they found was that the pages with more frequent edits correlated to increases in the bid-ask spread of the company's stock price following analysts' recommendations to buy. Higher editing frequencies of a page was also negatively correlated to forecast dispersions and analysts' forecast errors. The conclusion they drew from this study was that enough investors are actively depending on the internet for investment information. The information is being processed rapidly and kept up to

date even when it is a public source, such as Wikipedia, greatly reducing information asymmetry (Rubin & Rubin, 2010).

Another study published in the *Journal of Accounting Research* looked into how investors are demanding and using financial information around earnings announcements through Google searches. These researchers found that investors are relying so much on the information they find on the internet that their internet searches now impact the way capital markets respond to the earnings announcements. After observing timing and volume of internet searches of different companies surrounding their earnings announcements they found that two weeks prior to the announcement search volumes spike and continue to remain high until two weeks after the announcement. On average the volume increased by 13.2%. The more attention the firm is receiving in the news and media the higher these search volumes are. When investors start searching before the announcement is even made there is less of a change in the price and volume of the stock once the announcement is finally made. This suggests that the more investors research a company prior to their earnings announcement the information of that announcement is actually incorporated into the stock price preemptively (Drake, Roulstone & Thornock, 2012). This rise in company searches and the effect it seems to be having on the reaction of the stock price to earnings announcements shows how so many investors are seeking information independently on the internet when deciding what to invest in. It also shows how the increased availability of information due to the internet is influencing capital markets.

Mutual Funds

At year-end 2013 the U.S. mutual fund industry had \$15 trillion in assets making in the largest in the world. That year alone there were \$167 billion in net new cash flow among all types of mutual funds (2014 investment company, 2014). Mutual funds are investment vehicles that collect money from several investors and invest in in one large portfolio. There are many types of mutual funds and they are maintained by professional managers who are paid to invest the collected money in attempts to create capital gains. Different funds have different objectives where the manager is supposed to try to meet and these are described in the fund's prospectus (Investopedia, 2015).

The first mutual fund ever created was the Massachusetts Investors Trust back in 1924. This fund is still sold to this day (McWhinney, 2014). As of 2013 there were 7,707 existing mutual funds, 23,353 share classes, and 264,848,000 shareholder accounts (2014 investment company, 2014). Over the years several different kinds of mutual funds have emerged and they have become more complicated with a variety of objectives that range from very broad to super specific. In general mutual funds are divided into load and no-load funds. Load funds can come in up to seven different classes but are primarily A, B, and C. Class A shares charge a front-end load fee, class B shares have a back-end load fee, and class C shares have level-loads. Different share classes are better depending on the type of investor and the situation. If an investor is looking to hold onto a fund for a long time and save for retirement class A or B shares would work well. If they just plan to invest one lump sum then class A would be the best over time as there would be a discount on the initial load and yearly expenses would be low. Class C shares are a good option for investors that are planning to hold their investment for a short time but over a year to avoid front-end and back-end loads. Investors should evaluate their situation and goals

to pick the best class for them to avoid paying higher fees, suffering from penalties, and to maximize their return on investment (Carther, 2015).

In addition to different classes of mutual funds there are also different types of mutual funds. There are four general categories that most funds fall into which are stock funds, target date funds, bond funds, and money market funds. Stock funds invest primarily in corporate stocks and there are a few different ways this can be done. One type are income funds that focus on stocks that pay dividends. Another type of stock fund is a growth fund that try to invest in stocks that look promising for above-average gains even if they don't pay dividends. Stock funds can also be created to track certain indices, these are index funds. Finally there are sector funds that invest in stocks within a certain industry segment ("Mutual funds," 2015). Target date funds have a strategy from the beginning designed to produce certain returns by a selected date. These are often used by people trying to save for retirement. These funds have mixed portfolios that include bonds, stocks and other types of investments. Bond funds tend to hold a variety of bonds. These different bonds have unique risks and rewards which make these funds overall more risky with higher potential returns. On the other end money market funds are often lower risk because they hold short-term, high-quality investments from the government and U.S. corporations ("Mutual funds," 2015). Today there are several more complex mutual funds with objectives that range widely. An example of a popular but very risky type of mutual fund is a geared or leverage/inverse fund. This type of fund attempts to achieve the multiple of the performance of a benchmark. For example a geared fund could use a certain index as its benchmark and the goal would be to provide 2x or 3x the return of that index. Inverse geared funds would aim for -2x or -3x. These funds are used by investors that are trying to hedge another investment, are seeking magnified returns, or want a certain amount of exposure while using less cash. These funds are

constantly being rebalanced to meet their goals. These funds are super risky because losses are magnified as well as gains and they are extremely volatile (ProShares, 2012). This is just one example that demonstrates how complex some mutual fund options have become.

As the previous statistics showed mutual funds are still very popular despite the vast number of ways investors can now manage their own money. There are a few reasons why people still choose to invest in mutual funds. The biggest selling point for mutual funds is the professional management. Investors with little financial knowledge of their own might not trust themselves to invest their own money. Even if an investor knows a lot about finance they might choose to invest in a mutual fund to save time and let the professional managers stay up to date on research for them. The next strength of mutual funds is their diversification. Funds tend to span several different industry segments and companies which lowers the overall risk of the fund. Also there is the advantage of liquidity. Investors who put their money into mutual funds can redeem these shares at the current net asset value with any redemption fees ("Mutual funds," 2015).

The greatest downside to mutual funds is that they tend to charge high fees which do not necessarily translate to higher returns. Mutual funds charge two general fees which are sales loads and ongoing expenses. Sales loads are paid when the fund is first purchased. The ongoing fees are collected to cover operating costs such as distribution charges, fund management and administration, shareholder services, and any other costs to the firm. These fees tend to range from 0.5% - 3.0% depending on the fund and its management style (2014 investment company, 2014). Each fund is different and an investor must investigate the expenses of a particular firm before investing. Many times expense ratios for funds are evaluated or mutual fund cost calculators are used. As competition has increased with other mutual funds and other forms of

investing the average cost to invest in a mutual fund has declined greatly. Back in 2000 an investor in an equity fund could expect to pay an average expense ratio of 99 basis points. By 2013 the average expense ratio had declined 25% to 74 basis points (2014 investment company, 2014).

There are often hidden costs and risks that can go unnoticed or are not even available to the public. A study published in the *Financial Analysts Journal* found that expense ratios, which are often used to predict a mutual fund's return performance, often does not capture some hidden fees. The researchers in this study replicated different mutual funds' annual expenses on trading costs by looking at historical holdings, U.S. SEC filings, and securities transaction data. They estimated the cost of all transactions for the funds over a multiple year period. The results showed that the annual trading costs were similar to the expense ratio in magnitude but the aggregate trading costs showed way more variation than the expense ratio. These aggregate trading costs had strong negative correlation to the fund return performance meaning as these costs increased performance decreased. The issue is that these costs are not provided to investors while expense ratios are which did not show any consistent correlation to returns (Edelen, Evans & Kadlec, 2013). Investors must be very careful to understand all expenses and risks before investing in a mutual fund.

Motif Investing

Motif Investing is an online investment platform that was launched in June 2012 that has a very specific type of trading strategy to offer. This company allows users to completely customize portfolios of up to 30 stocks and begin investing with the minimum set at \$250. There

is an initial investment commission of \$9.95 to invest in any motif. To adjust a motif at a later date it costs \$4.95 to buy or sell a stock and to adjust the weights within a motif. The idea is that investors can create “motifs” of stocks based on ideas they think are profitable. The company also offered 120 pre-made motifs at the date of their launch for customers to invest in. These pre-made motifs are heavily researched and weighted by financial professionals. They will also continue to reweight and update these motifs as time passes. They can be bought as is or customized. An example of existing motifs created by the company include one called “Senior Care” which invests in a variety of companies related to healthcare based on the idea that as the Baby Boomers get older this will be a profitable industry ("Motif investing," 2015).

An investor using this platform can create their own motifs including up to 30 U.S. traded stocks or ETFs. The investor can weight each holding any way they want and this can be adjusted later for the additional \$4.95 fee. Any dividends are paid out by the company in cash form and are not automatically reinvested. An investor can choose to share their motif with other users and can receive \$1 royalty for every additional person that chooses to invest in their motif. This website has a social element which allows users to interact with each other. Each motif has a discussion board that allows users to share their thoughts on the investments and vote on the motifs. The motifs also have graphs that show their performance to date and other metrics such as volatility and valuations ("Motif investing," 2015).

The *Motif Investing* website and mobile application have received a lot of attention for its unique investment offering. CNBC ranked the company as #4 on their annual list of “Disruptor 50” in 2014 which features private companies that are innovative and revolutionary. The closest competitors include Betterment, Wealthfront, and Personal Capital but none of these companies offer the same investment model ("The list: Disruptor 50," 2014). The company was founded by

Hardeep Walia who was previously a manager at Microsoft. The board of directors includes big names such as Arthur Levitt Jr., previous chairman of the U.S. Securities and Exchange Commission, and Carl Stern, previous vice chairman of investment banking at Goldman Sachs and president and CEO of The Boston Consulting Group. The company currently has over \$86 million in funding from companies including JP Morgan Chase, Goldman Sachs, and Google (Nath, 2015).

Chapter 3

Methodology

In order to recreate mutual funds using the *Motif Investing* website the first step was to choose the mutual funds to replicate. Investors are seeking the highest possible returns so it is logical that they would want to replicate top performing funds. A list published by Morningstar Inc. of the top performing mutual funds from 2012 was chosen to be replicated (Appendix A). The list only included stock mutual funds and was based on total returns for the year. Each of them beat the return of the S&P 500 for 2012 which was 16%. Leveraged funds and specialized industry and sector stock funds were not included in this listing. That is beneficial for this study because those funds are often created when the managers invest borrowed money and this could not be recreated using Motif Investing. Those special funds are also re-weighted on a much more frequent basis, often daily. Finally, this list only includes funds that require an initial investment of \$10,000 or less so they are reasonable for the everyday investor. This study is to attempting to create even lower cost for the everyday investor and those with lower net worth so this is an appropriate demographic. This list included the top three performing mutual funds from the following nine categories: large-cap blend, large-cap growth, large-cap value, mid-cap blend, mid-cap growth, mid-cap value, small-cap blend, small-cap growth, and small-cap value (Associated Press, 2013).

Originally this study was only going to look at a time period of one year. However, the list of mutual funds from 2012 that was found included the exact type of funds that can be created using *Motif Investing* due to the factors previously mentioned. This allowed the study to

be done as if an investor saw the list in the beginning of 2013 and recreated the funds online immediately. The study could now include historical returns from 2013 and 2014. To begin the return of the S&P 500 was found for each of the two years. This was done to get a baseline idea of how these top performers from 2012 actually did overall during the test period.

The next step was to investigate each fund on the list to find what stocks they held at year end 2012 when the list was published. These are the stocks that would be used to attempt to recreate the mutual fund online in a motif. Only the highest weighted 30 stocks were chosen from each fund because that is the maximum number of stocks that can be held in a motif. It was very difficult to find the historical stock holdings of these mutual funds as they are constantly changing. In addition most websites, such as Yahoo Finance, only give the top 10 holdings of mutual funds currently. In the end the best source to find the stock holdings of the mutual funds was the U.S. Securities and Exchange Commission website using the EDGAR electronic data collection database (U.S. SEC, 2015). There is an option to search through all filings for mutual funds by entering the ticker into a search bar. The search can be narrowed down by looking for specific dates. For this study the search was restricted to filings from before year end 2012. The filing that consistently supplied a list of all of each mutual funds holdings was the Certified Shareholder Report (N-CSR). This report requires registered investment companies to disclose the firm's security holdings along with other information. Each company filed at slightly different times so the most recent N-CSR prior to 2012 year end was used.

In order to narrow the scope of this study only the three categories of growth stocks were replicated as motifs, the large-cap growth, mid-cap growth, and small-cap growth. The growth category was chosen because all nine of the funds that fell into these categories had their holdings listed and accessible in the EDGAR database through their N-CSR forms. Each of these

nine funds were searched for using the database and their fund holdings were pulled from their N-CSR forms and put into an excel document. The data often had to be cleaned up as it was pulled from text and transferred into cells. All titles and headers were removed as well as totals and subtotals. All that was left was the name of the stock holdings, the number of shares held, and the market value of each holding. All of the stocks were then sorted by their market values from largest to smallest. The largest holdings have the greatest weight in the mutual funds.

Once all the holdings were downloaded and sorted the 30 stocks with the greatest weight in the actual mutual funds had to be found to create the replication motif. These were not necessarily just the top 30 holding with the highest market value because some of those holdings were not actually available to be purchased through *Motif Investing* so they could not be included in the motif. This was mostly the case with stocks traded on foreign exchanges. Also any stocks of companies that had been acquired or are no longer listed since 2012 could not be included as they could not be found on the *Motif Investing* website. In order to determine which stocks could actually be used to create the motif the *Motif Investing* website was used at this point. An account was opened which only required creating a user name and password and supplying some personal information. No money was needed to open this account or create the motifs (Motif Investing, 2015).

After an account is created a personalized motif can be made by clicking on the “Build a Motif” tab from the homepage. From there a name must be selected for the new motif and there are additional options such as adding descriptions and photos which are not necessary. In this study each motif was named after the mutual fund it was mimicking with the word “replication” after it. The next step is to add stocks to this personalized motif. A search bar is available where stocks can be searched for and selected by entering the company name or ticker symbol. This is

how the stocks to be used from the actual mutual funds were selected, they had to be available on the website to be added to the motif. For one mutual fund each stock would be entered one at a time into the search bar in order starting with the stock that had the highest market value in the mutual fund. If the stock was available on the website it would pop up under the search bar and clicking on the company name would add it to the motif. To the right of the search bar there is a list that shows all the stocks that have been added to the motif. If the stock was not available on the website it was searched for on the internet to find an explanation for why *Motif Investing* would not offer it, such as being traded on a foreign exchange or no longer being listed. These stocks were noted and skipped over. This process continued until all the stocks of the mutual fund were included or the motif hit its maximum of 30 stocks.

The motif at this point is holding all the stocks it can to replicate the mutual fund but now they need to be weighted according to their weights in the original fund as of year-end 2012. By hitting the “next” button on the website the following screen allows the motif creator to organize the motif any way they want. The website automatically groups similar stocks together under headings they find applicable. An example would be “biotechnology”. If the motif creator wants they can change the segment names or reorder the stocks as they desire. For this study the organization of the stocks was irrelevant so the segments created by the website were left as provided. Hitting the “next” button again provides the user the opportunity to assign weights to all of the stocks in the motif.

To determine the weights that should be assigned to each stock in the motif the historical information from the N-CSR forms that was put into excel documents was once again used. This time only the stocks that had made it into the motif were pulled out. All of their market values were added together to find the total market value of these funds from the mutual fund. Then the

market value of each individual stock was divided by this total market value to see what weight each stock held within the group. The resulting percent was the weight that was assigned to that specific stock within the motif. To assign a weight to a stock on the website there is a slider bar that can be used or the numerical value can be typed in. Once the stock is given the weight it needs it is important to lock the stock so that the weight does not continue to change as adjustments are made to the other stock weights. The weights on *Motif Investing* can only be assigned to a tenth of a percent so occasionally the last stock or two has a tenth of a percent higher weight due to rounding errors. Once all the weights for the stocks within a motif add up to 100% they can all be locked and the “next” button can be selected.

The final stage of the motif building process allows the creator to preview the motif they just created and make any last edits. Once everything is in order the “Create & View Motif” button is used to publish the final motif. At this point the creator has the opportunity to share the motif, tracks its performance, and invest their money in the motif. The motif page shows information on the holdings of the motif such as the company names, tickers, weights, current price, market cap, etc. This information was downloaded into an excel spreadsheet and saved. For this study the only additional step taken on the website was to click on the performance tab to get a graph of what the motif’s historical returns would have been. The graph shows the return of the motif and also plots the return of the S&P 500. The time period of the graph was set to 2 years and the slider below the graph was adjusted so the graph showed returns from 2013-2014 which is the target period for this study. The graph was then saved.

Now that the motifs were created and the holdings of each motif were determined some overall information was collected and calculated for each mutual fund and its replicated motif. First the net expense ratio and minimum initial investment requirement for each mutual fund was

found using the SEC EDGAR database N-CSR report. For each motif the cost would be the same. There would be a total commission on \$9.95 per motif transaction and an additional charge of \$0.01 for the Financial Industry Regulatory Authority (FINRA) transaction fee (Motif Investing, 2015). Each of these motifs would also require a minimum of a \$250 investment to open the motif.

The total net assets held by each fund and the total market value of the stock holdings were also recorded from the N-CSR reports. The percent of the net assets made up by the stock holdings was found by dividing the total market value of stocks by the fund's net assets. Each fund was made up of over 90% stocks. Then the extent to which the motifs were able to replicate the mutual funds' holdings were calculated. This was done by finding the market value of each stock used in the motif within the mutual fund. These market values were added up to find the total fund market value of the stocks used within the motif. This number was then divided by the total market value of all stocks in the mutual fund to find the percentage of the stocks' value that is present in the replicated motif.

In order to calculate what the returns of these motifs would have been back in 2013 and 2014 historical prices were pulled using Yahoo Finance historical price searches (Yahoo Finance, 2015). The adjusted closing prices were used as these are adjusted to include any dividends or stock splits. The date range was set to retrieve monthly prices from December 12, 2012 to December 31, 2014. The returns for each motif were calculated one at a time using the same method. First all of the historical prices in this range were pulled for the stocks within the motif. The historical prices for the mutual fund that was being replicated was also pulled as well as the S&P 500. To find the returns for 2013 the adjusted closing price from December 2nd, 2013 was divided by the adjusted closing price from December 3rd, 2012 and one was subtracted:

$(\text{Price } 12/2/2013 / \text{Price } 12/3/2012) - 1$. The return was found from December to December because this is how the annual price returns of the S&P 500 are reported in financial news each year. The annual return for 2014 was found with the following equation: $(\text{Price } 12/1/2014 / \text{Price } 12/2/2013) - 1$. The two year return was calculated as follows: $(\text{Price } 12/1/2014 / \text{Price } 12/3/2012) - 1$. The returns for 2013, 2014, and the two year period were calculated for each stock in the motif, the mutual fund, and the S&P 500.

When this information was collected it was possible to calculate the motif return. The motif stock returns for 2013, 2014, and both years were collected on a new excel sheet. The weights of each stock in the motif were pulled from the data sheet downloaded from the Motif Investing website. To calculate the return of the entire motif according to the monthly returns and weights of each stock matrix multiplication was used. The vector of weights was transposed and multiplied against the monthly returns using Excel's MMULT(Matrix 1, Matrix 2) formula. The formula used was =mmult(transpose(weights),returns). This was done three times for each motif using the monthly returns from 2013, 2014, and both years combined. The result of this calculation was the historical returns for each of the motifs. These motif returns were then compared to the returns of the mutual fund it was replicating and the S&P 500.

The final step in this study was to collect all the data together and factor in the costs associated with investing in a mutual fund. This was done by comparing the returns of the mutual fund, the mutual fund minus its annual net expense ratio, the replicated motif, and the S&P 500 for 2013, 2014, and the overall two year period. All four of these return types were graphed based on time period and type of fund, large growth, mid growth, and small growth. Then one graph was made for each time period that included all nine funds. The difference between the mutual funds' performance after the net expense ratio was subtracted and the motif

returns was found for each of the nine funds for each year. The average of these differences was found to determine how the motifs performed relative to the mutual funds they were replicating on average.

Chapter 4

Data

Table 1: List of Funds Used

	Company Name	Ticker	Net Expense Ratio	Initial Investment Requirement
Large Cap	Matthew 25 Fund	MXXVX	1.25%	\$10,000
	Parnassus Fund	PARNX	0.97%	\$2,000
	Federated Kaufmann Large Cap	KLCAX	1.50%	\$1,500
Mid Cap	Kinetics Internet No Load	WWWFX	1.89%	\$2,500
	JHancock Funds2 Mid Cap	JIMSX	0.93%	-
	Harbor Mid Cap	HIMGX	1.22%	\$2,500
Small Cap	Wasatch Micro Cap Value	WAMVX	2.03%	\$2,000
	PNC Small Cap	PPCAX	1.24%	\$1,000
	Federated Kaufmann Small Cap	FKASX	1.95%	\$1,500

Above is a list of the nine funds used in this study. The mutual fund's full name is provided as well as their ticker symbol, net expense ratio, and initial investment requirement. All of the information was found using the Yahoo Finance and SEC EDGAR databases. For *Motif Investing* there is an initial investment requirement of \$250. There is one time commission charge of \$9.95 and a SEC fee of \$0.0000224 for every dollar invested and a FINRA fee that is \$0.000119 per share. The percentage expense of these fees would depend on the amount invested and how long the investment was held because these fees only occur when a motif is bought.

Table 2: Market Value of Stocks in Funds and Motifs

Ticker	Net Assets of Fund	Total Value of Stocks in Fund	% of Fund in Stocks	Value of Stocks Used in Motif	% Value Represented in Motif
MXXVX	\$128,738,941	\$117,194,789	91.03%	\$63,054,968	53.80%
PARNX	\$354,571,642	\$346,311,050	97.67%	\$340,264,050	98.25%
KLCAX	\$349,240,988	\$339,948,092	97.34%	\$249,855,901	73.50%
WWAFX	\$105,055,106	\$100,558,747	95.72%	\$76,736,180	76.31%
JIMSX	\$998,668,244	\$979,683,831	98.10%	\$423,403,109	43.22%
HIMGX	\$707,230	\$671,331	94.92%	\$293,414	43.71%
WAMVX	\$138,299,353	\$131,446,655	95.05%	\$56,359,161	42.88%
PPCAX	\$154,796,000	\$150,405,000	97.16%	\$106,443,000	70.77%
FKASX	\$759,659,350	\$754,565,551	99.33%	\$328,795,665	43.57%

The table above shows the market value of the net assets held by each fund in according to their last N-CSR shareholder report filed in 2012. These forms were found using the SEC EDGAR database. The total market value of just the common stocks is found in the third column. The percentage of fund value placed in stocks was found by dividing the total value in stocks by the net assets of the fund. The market value of stocks used to create the replicated motif was found by adding up the market value of the stocks in the mutual fund that were used to create each motif. To find the percentage of the fund that was able to be replicated in the motif the value of the stocks used in the motif was divided by the total value of stocks in the mutual fund.

Table 3: Motif Investing Download: Federated Kaufmann Large Cap Replication

Motif Details			
Name	Symbol	Segment	Weight
American International Group Inc.	AIG	Financial	5.86%
Capital One Financial Corp.	COF	Financial	3.23%
Visa Inc.	V	Financial	3.05%
JP Morgan Chase & Co.	JPM	Financial	3.03%
BlackRock Inc.	BLK	Financial	2.79%
Wells Fargo & Co.	WFC	Financial	2.74%
Gilead Sciences Inc.	GILD	Healthcare	5.56%
Actavis plc	ACT	Healthcare	3.79%
Biogen Idec Inc.	BIIB	Healthcare	3.78%
Express Scripts Holding Company	ESRX	Healthcare	3.45%
Varian Medical Systems Inc.	VAR	Healthcare	2.64%
LyondellBasell Industries NV	LYB	Basic Materials	4.24%
Schlumberger Ltd.	SLB	Basic Materials	3.27%
Valero Energy Corp.	VLO	Basic Materials	3.25%
Halliburton Co.	HAL	Basic Materials	2.78%
Cenovus Energy Inc.	CVE	Basic Materials	2.72%
Anadarko Petroleum Corp.	APC	Basic Materials	2.66%
Vantiv	VNTV	Services	3.61%
Starbucks Corp.	SBUX	Services	3.03%
Las Vegas Sands Inc.	LVS	Services	3.00%
FedEx Corp.	FDX	Services	2.59%
eBay Inc.	EBAY	Services	2.56%
NXP Semiconductors N.V.	NXPI	Technology	4.09%
Qualcomm Inc.	QCOM	Technology	3.75%
Citrix Systems Inc.	CTXS	Technology	3.17%
Salesforce.com Inc.	CRM	Technology	2.60%
Apple Inc.	AAPL	Consumer Goods	3.74%
Michael Kors Holdings Ltd. ADS	KORS	Consumer Goods	2.96%
Owens Corning	OC	Industrial Goods	3.29%
Precision Castparts Corp.	PCP	Industrial Goods	2.78%

This is a portion of the download available on Motif Investing for any motif a user creates. This is the download for the Federated Kaufmann Large Cap fund replication motif. This fund will be used to show an example of the method that was used for each of the nine funds. Information, table, and charts for each of the nine funds is available upon request. This download

was used to have a list of the stocks and their weights within the motif. This information is used in a later step to calculate the annual returns of the motif as a whole.

Table 4: Historical Prices and Calculated Returns for Federated Kaufmann Large Cap Replication, the mutual fund, and the S&P500

Date	AIG	COF	JPM	V	BLK	WFC	GILD	ACT	BIIB	ESRX		
12/1/2014	55.89	82.22	62.18	65.43	355.47	54.46	94.26	257.41	339.45	84.67		
12/2/2013	50.47	75.11	56.59	55.15	307.25	43.88	75.1	168	279.57	70.24		
12/3/2012	34.76	55.97	41.39	37.25	195.68	32.1	36.72	86	146.37	54		
2013	45.20%	34.20%	36.72%	48.05%	57.02%	36.70%	104.52%	95.35%	91.00%	30.07%		
2014	10.74%	9.47%	9.88%	18.64%	15.69%	24.11%	25.51%	53.22%	21.42%	20.54%		
2 Yr	60.79%	46.90%	50.23%	75.65%	81.66%	69.66%	156.70%	199.31%	131.91%	56.80%		
	VAR	LYB	SLB	VLO	CVE	HAL	APC	VNTV	SBUX	LVS		
12/1/2014	86.51	78.77	84.91	49.14	20.37	39.17	82.23	33.92	81.75	57.47		
12/2/2013	77.69	77.4	88.11	49.02	27.25	49.95	78.22	32.61	76.95	75.64		
12/3/2012	70.24	53.48	66.72	29.72	30.92	33.75	72.83	20.42	51.95	43.27		
2013	10.61%	44.73%	32.06%	64.94%	-11.87%	48.00%	7.40%	59.70%	48.12%	74.81%		
2014	11.35%	1.77%	-3.63%	0.24%	-25.25%	-21.58%	5.13%	4.02%	6.24%	-24.02%		
2 Yr	23.16%	47.29%	27.26%	65.34%	-34.12%	16.06%	12.91%	66.11%	57.36%	32.82%		
	FDX	EBAY	NXPI	QCOM	CTXS	CRM	AAPL	KORS	OC	PCP	KLCAX	S&P
12/1/2014	173.46	56.12	76.4	73.9	63.8	59.31	109.95	75.1	35.66	240.85	18	\$2,058.90
12/2/2013	142.89	54.87	45.93	72.27	63.25	55.19	78.19	81.19	39.83	269.13	16.09	\$1,848.36
12/3/2012	90.68	51	26.32	59.06	65.62	42.03	72.35	51.03	36.18	189.2	11.72	\$1,426.19
2013	57.58%	7.59%	74.51%	22.37%	-3.61%	31.31%	8.07%	59.10%	10.09%	42.25%	37.29%	29.60%
2014	21.39%	2.28%	66.34%	2.26%	0.87%	7.47%	40.62%	-7.50%	-10.47%	-10.51%	11.87%	11.39%
2 Yr	91.29%	10.04%	190.27%	25.13%	-2.77%	41.11%	51.97%	47.17%	-1.44%	27.30%	53.58%	44.36%

The table above shows all the stocks held in the Federated Kaufmann Large Cap replication motif. The data is divided into three sets just so it can be presented on one page. In the third set the actual mutual fund and S&P 500 are also included. The monthly historical prices were retrieved from the Yahoo Finance database for the months from 12/3/2012 – 12/1/2014. All the extra month prices are hidden besides those used to calculate the annual and two year returns. For each stock, the mutual fund, and the S&P 500 the 2013 return was calculated as follows: $(12/2/2013 \text{ Price} / 12/3/2012 \text{ Price}) - 1$. The 2014 return: $(12/1/2014 \text{ Price} / 12/2/2013 \text{ Price}) - 1$. The two year return: $(12/1/2014 \text{ Price} / 12/3/2012 \text{ Price}) - 1$.

Table 5: Calculating the Returns of the Overall Motif

	Ticker	2013	2014	Overall	Weights
	AIG	45.20%	10.74%	60.79%	5.86%
	COF	34.20%	9.47%	46.90%	3.23%
	JPM	36.72%	9.88%	50.23%	3.05%
	V	48.05%	18.64%	75.65%	3.03%
	BLK	57.02%	15.69%	81.66%	2.79%
	WFC	36.70%	24.11%	69.66%	2.74%
	GILD	104.52%	25.51%	156.70%	5.56%
	ACT	95.35%	53.22%	199.31%	3.79%
	BIIB	91.00%	21.42%	131.91%	3.78%
	ESRX	30.07%	20.54%	56.80%	3.45%
	VAR	10.61%	11.35%	23.16%	2.64%
	LYB	44.73%	1.77%	47.29%	4.24%
	SLB	32.06%	-3.63%	27.26%	3.27%
	VLO	64.94%	0.24%	65.34%	3.25%
	CVE	-11.87%	-25.25%	-34.12%	2.78%
	HAL	48.00%	-21.58%	16.06%	2.72%
	APC	7.40%	5.13%	12.91%	2.66%
	VNTV	59.70%	4.02%	66.11%	3.61%
	SBUX	48.12%	6.24%	57.36%	3.03%
	LVS	74.81%	-24.02%	32.82%	3.00%
	FDX	57.58%	21.39%	91.29%	2.59%
	EBAY	7.59%	2.28%	10.04%	2.56%
	NXPI	74.51%	66.34%	190.27%	4.09%
	QCOM	22.37%	2.26%	25.13%	3.75%
	CTXS	-3.61%	0.87%	-2.77%	3.17%
	CRM	31.31%	7.47%	41.11%	2.60%
	AAPL	8.07%	40.62%	51.97%	3.74%
	KORS	59.10%	-7.50%	47.17%	2.96%
	OC	10.09%	-10.47%	-1.44%	3.29%
	PCP	42.25%	-10.51%	27.30%	2.78%
	Motif Returns	45.02%	10.87%	63.25%	

All of the annual returns for 2013, 2014, and the two year returns were collected for all of the stocks within the motif. The weight of each stock within the motif was pulled from the *Motif Investing* download and put in the fifth column (Table 3). The motif return for 2013 was calculated using the following matrix multiplication formula:

MMULT(TRANSPOSE(weights),2013returns). This multiplies each stocks return for 2013 by its weight within the motif and then adds them all together to find the annual return for the motif. This calculation was repeated using the 2014 and two year returns to find the motif returns for those time periods as well.

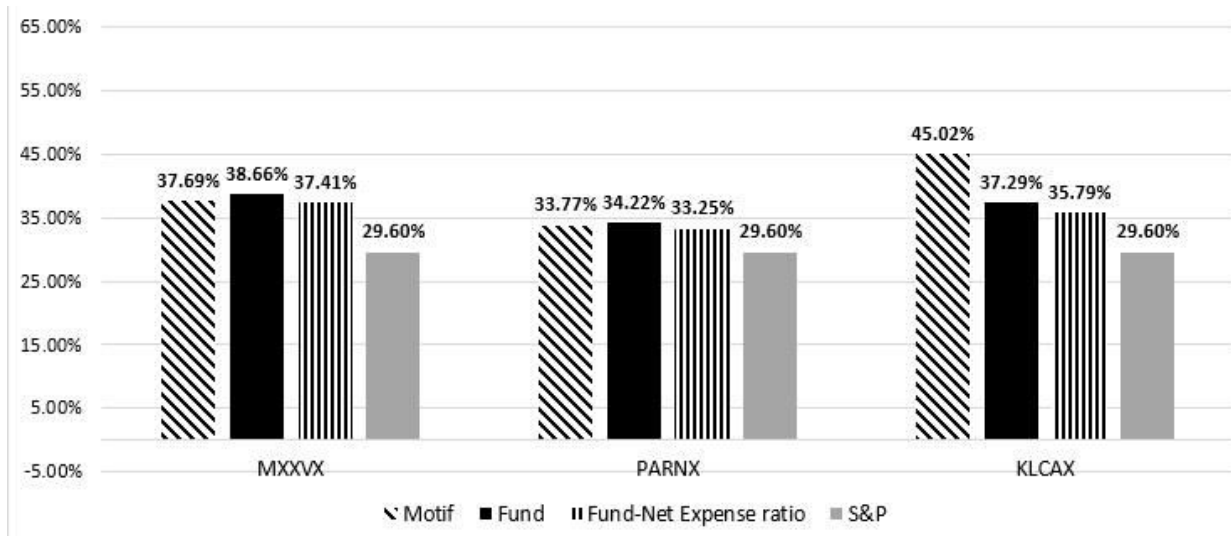
Table 6: Returns of Motif, Mutual Fund, and S&P 500

	Motif	KLCAX	KLCAX-Net Expense Ratio	S&P
2013	45.02%	37.29%	35.79%	29.60%
2014	10.87%	11.87%	10.37%	11.39%
2 Yr	63.25%	53.58%	52.08%	44.36%

This is a consolidation of the results that the study is interested in comparing. These are the returns for 2013, 2014, and the two year period for the motif, mutual fund that was replicated (Federated Kaufmann Large Cap fund), the mutual fund after expenses are considered, and the S&P 500. The returns from the motif were calculated in Table 5. The returns for the mutual fund and S&P 500 were taken directly from Table 4. The mutual fund's returns after expenses were deducted was found by taking the mutual fund's return and subtracting the net expense ratio for that fund which is found in Table 1. In this case it was found that the motif had the highest return in 2013 and over the two year period. In 2014 the mutual fund had the highest return but after expenses were taken into consideration the S&P 500 had the highest return. This process was done for each of the nine mutual funds and the raw data and calculations for each are available upon request.

Table 7: 2013 Large Cap Growth Returns

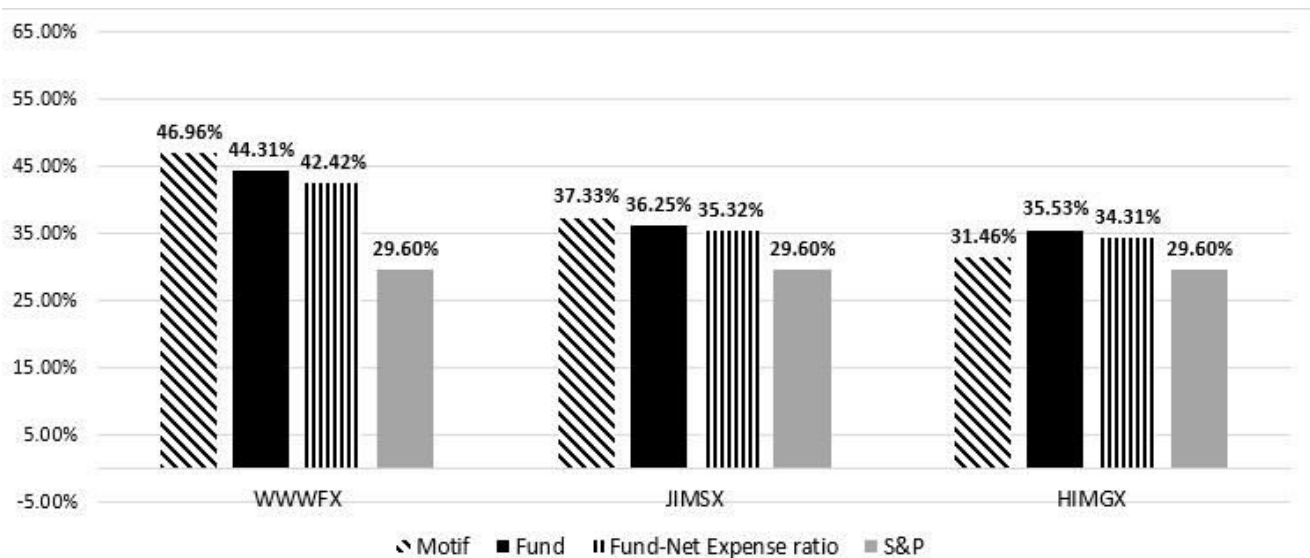
Ticker	Motif	Fund	Fund-Net Expense ratio	S&P
MXXVX	37.69%	38.66%	37.41%	29.60%
PARNX	33.77%	34.22%	33.25%	29.60%
KLCAX	45.02%	37.29%	35.79%	29.60%

Figure 1: 2013 Large Cap Growth Returns

The table and graph above show the returns of the large cap growth mutual funds in 2013 before and after expenses were considered, their replicated motifs, and the return of the S&P 500. For the Matthew 25 Fund (MXXVX) the mutual fund had the highest return at 38.66% but once the net expense ratio was subtracted the motif had the highest return at 37.69%. For the Parnassus fund (PARNX) the mutual fund also had the highest return before the net expense ratio was deducted at 34.22% then the motif was the highest performer with a 33.77% return. For the Federated Kaufmann Large Cap fund (KLCAX) the motif had the highest return at 45.02%.

Table 8: 2013 Mid Cap Growth Returns

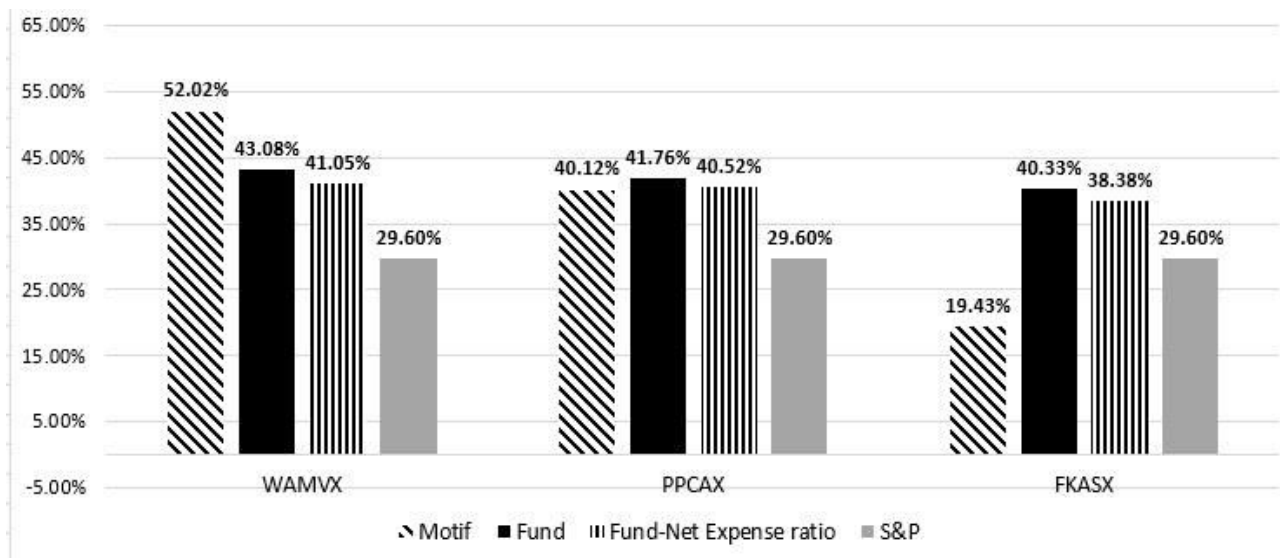
Ticker	Motif	Fund	Fund-Net Expense ratio	S&P
WWWFX	46.96%	44.31%	42.42%	29.60%
JIMSX	37.33%	36.25%	35.32%	29.60%
HIMGX	31.46%	35.53%	34.31%	29.60%

Figure 2: 2013 Mid Cap Growth Returns

The table and graph above show the returns of the mid cap growth mutual funds in 2013 before and after expenses were considered, their replicated motifs, and the return of the S&P 500. For the Kinetics Internet fund (WWWFX) and the JHancock Funds2 (JIMSX) the motifs had the highest returns at 46.96% and 37.33% respectively. The Harbor fund (HIMGX) saw the highest return for the mutual fund even after the net expense ratio was taken out at 34.31%.

Table 9: 2013 Small Cap Growth Returns

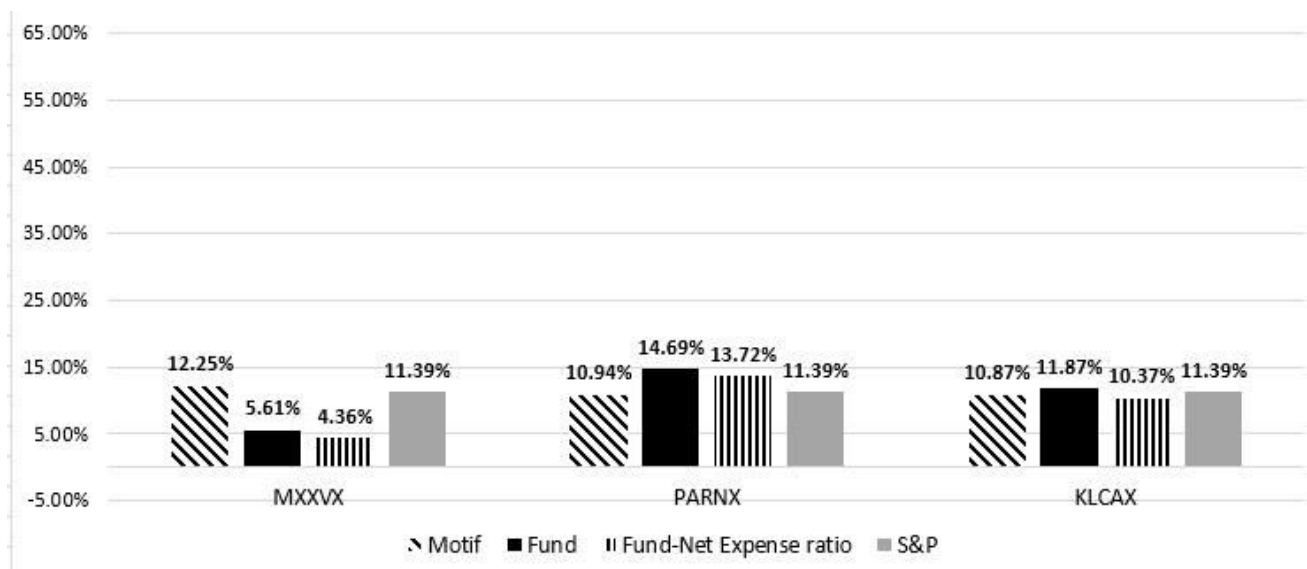
Ticker	Motif	Fund	Fund-Net Expense ratio	S&P
WAMVX	52.02%	43.08%	41.05%	29.60%
PPCAX	40.12%	41.76%	40.52%	29.60%
FKASX	19.43%	40.33%	38.38%	29.60%

Figure 3: 2013 Small Cap Growth Returns

The table and graph above show the returns of the small cap growth mutual funds in 2013 before and after expenses were considered, their replicated motifs, and the return of the S&P 500. For the Wasatch Micro fund (WAMVX) the motif had the highest annual return at 52.02%. Both the PNC fund (PPCAX) and the Federated Kaufmann Small Cap fund (FKASX) had the mutual funds perform the best even after the net expense ratios were taken out. These returns were 40.52% and 38.38% respectively.

Table 10: 2014 Large Cap Growth Returns

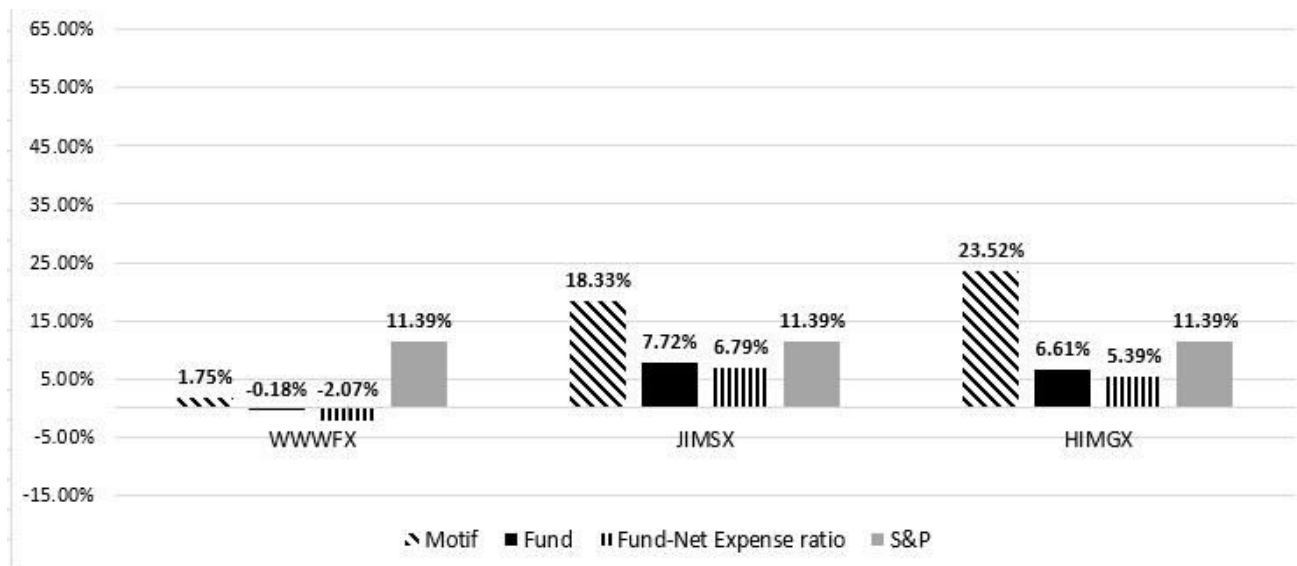
Ticker	Motif	Fund	Fund-Net Expense ratio	S&P
MXXVX	12.25%	5.61%	4.36%	11.39%
PARNX	10.94%	14.69%	13.72%	11.39%
KLCAX	10.87%	11.87%	10.37%	11.39%

Figure 4: 2014 Large Cap Growth Returns

The table and graph above show the returns of the large cap growth mutual funds in 2014 before and after expenses were considered, their replicated motifs, and the return of the S&P 500. For the Matthew 25 fund (MXXVX) the motif had the highest annual return of 12.25%. The Parnassus fund (PARNX) had its highest returns for the mutual fund even with the net expense ratio taken into account with a return of 13.72%. The Federated Kaufmann Large Cap fund (KLCAX) had the highest return for the mutual fund but after expenses the S&P 500 had the greatest return of 11.39%.

Table 11: 2014 Mid Cap Growth Returns

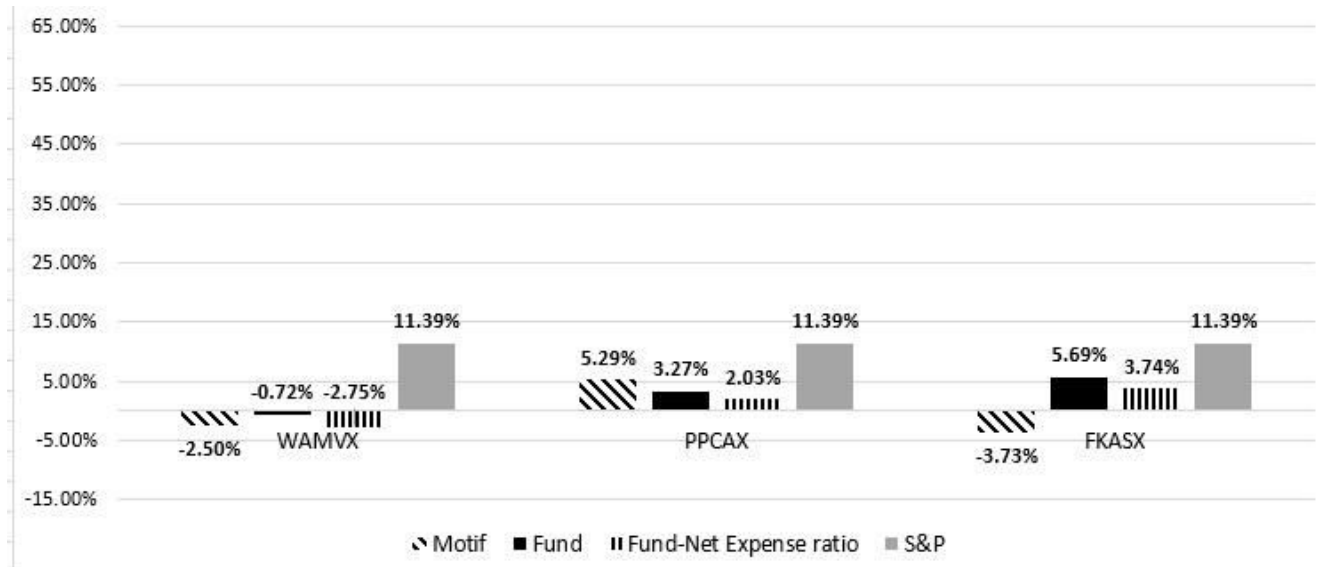
Ticker	Motif	Fund	Fund-Net Expense ratio	S&P
WWWFX	1.75%	-0.18%	-2.07%	11.39%
JIMSX	18.33%	7.72%	6.79%	11.39%
HIMGX	23.52%	6.61%	5.39%	11.39%

Figure 5: 2014 Mid Cap Growth Returns

The table and graph above show the returns of the mid cap growth mutual funds in 2014 before and after expenses were considered, their replicated motifs, and the return of the S&P 500. For the Kinetics Internet fund (WWWFX) the S&P 500 outperformed the motif and the mutual fund with a return of 11.39% for the year. The JHancock Funds2 (JIMSX) and Harbor (HIMGX) funds both had their motifs perform the best for the year with returns of 18.33% and 23.52% respectively.

Table 12: 2014 Small Cap Growth Returns

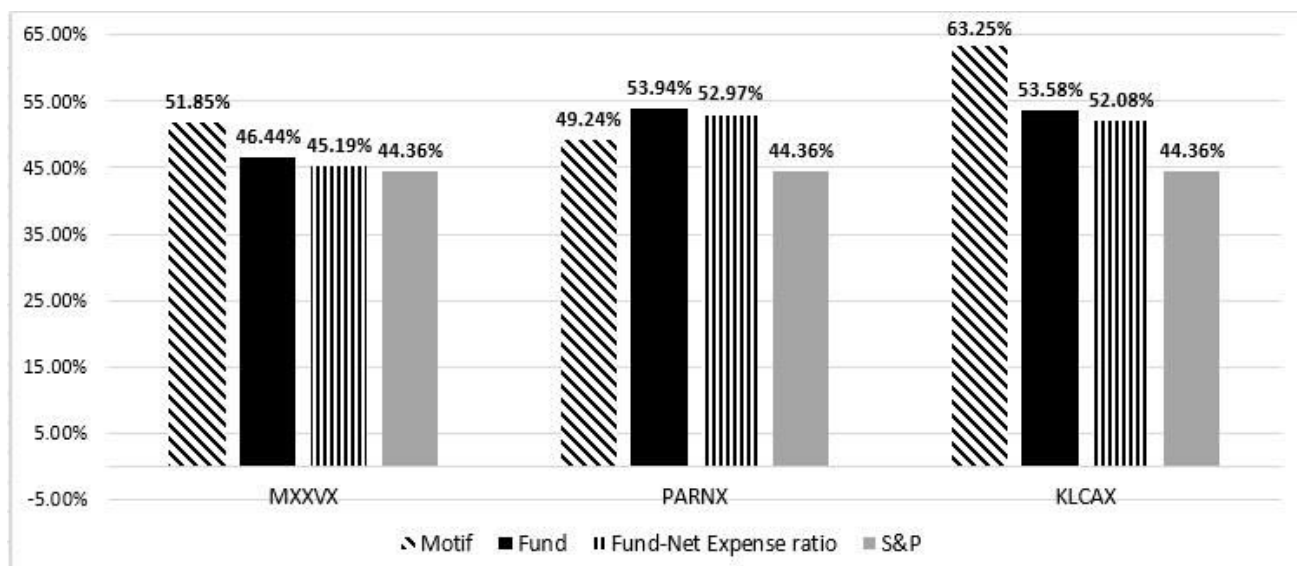
Ticker	Motif	Fund	Fund-Net Expense ratio	S&P
WAMVX	-2.50%	-0.72%	-2.75%	11.39%
PPCAX	5.29%	3.27%	2.03%	11.39%
FKASX	-3.73%	5.69%	3.74%	11.39%

Figure 6: 2014 Small Cap Growth Returns

The table and graph above show the returns of the small cap growth mutual funds in 2014 before and after expenses were considered, their replicated motifs, and the return of the S&P 500. For all three funds, the Wasatch Micro (WAMVX), PNC (PPCAX), and Federated Kaufmann Small Cap (FKASX) funds, both the motif and the mutual fund underperformed the return of the S&P 500 which was 11.39%.

Table 13: 2 Year Large Cap Growth Returns

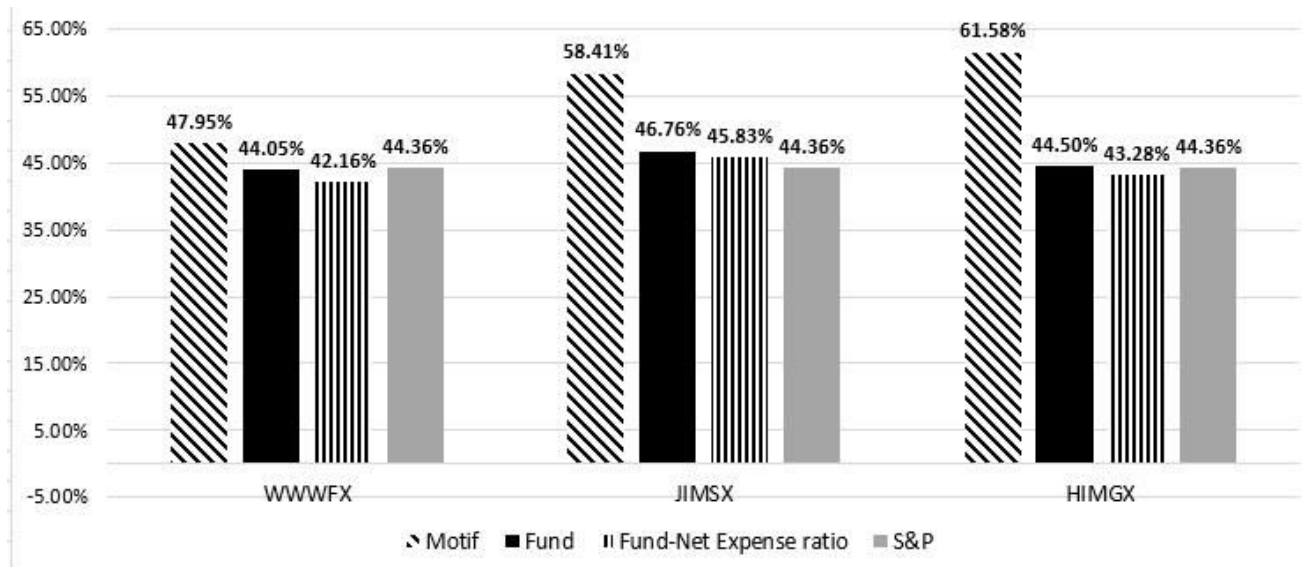
Ticker	Motif	Fund	Fund-Net Expense ratio	S&P
MXXVX	51.85%	46.44%	45.19%	44.36%
PARNX	49.24%	53.94%	52.97%	44.36%
KLCAX	63.25%	53.58%	52.08%	44.36%

Figure 7: 2 Year Large Cap Growth Returns

The table and graph above show the returns of the large cap growth mutual funds for the 2013-2014 two year period before and after expenses were considered, their replicated motifs, and the return of the S&P 500. The Matthew 25 (MXXVX) and Federated Kaufmann Large Cap (KLCAX) funds both had their motifs perform the best with two year returns of 51.85% and 63.25% respectively. The Parnassus fund (PARNX) had the highest two year return for its mutual fund even after expenses at 52.97%.

Table 14: 2 Year Mid Cap Growth Returns

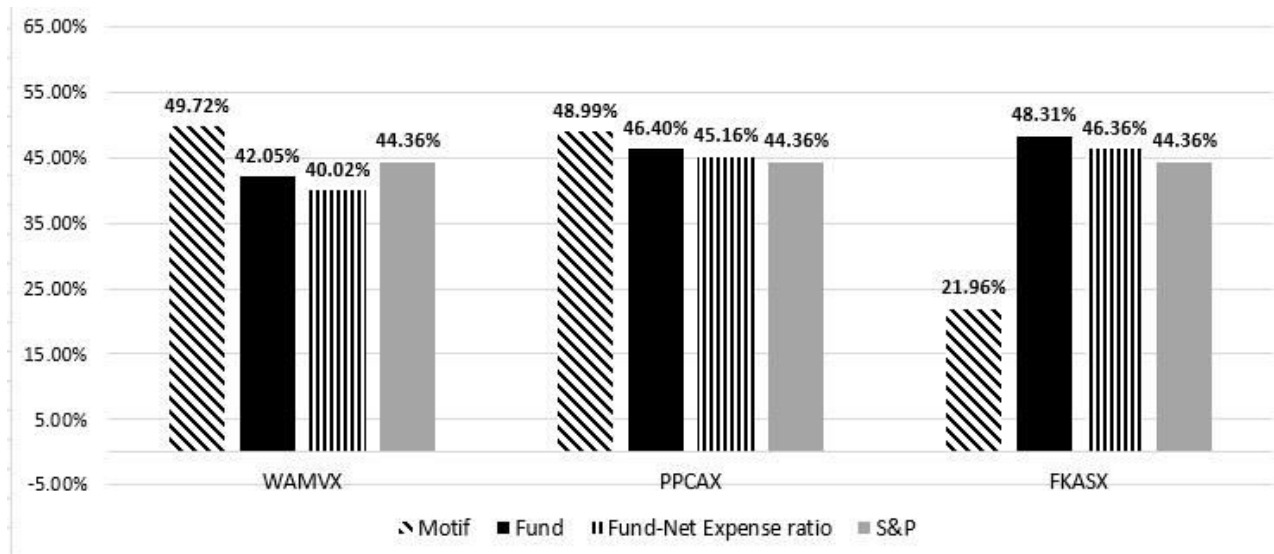
Ticker	Motif	Fund	Fund-Net Expense ratio	S&P
WWWFX	47.95%	44.05%	42.16%	44.36%
JIMSX	58.41%	46.76%	45.83%	44.36%
HIMGX	61.58%	44.50%	43.28%	44.36%

Figure 8: 2 Year Mid Cap Growth Returns

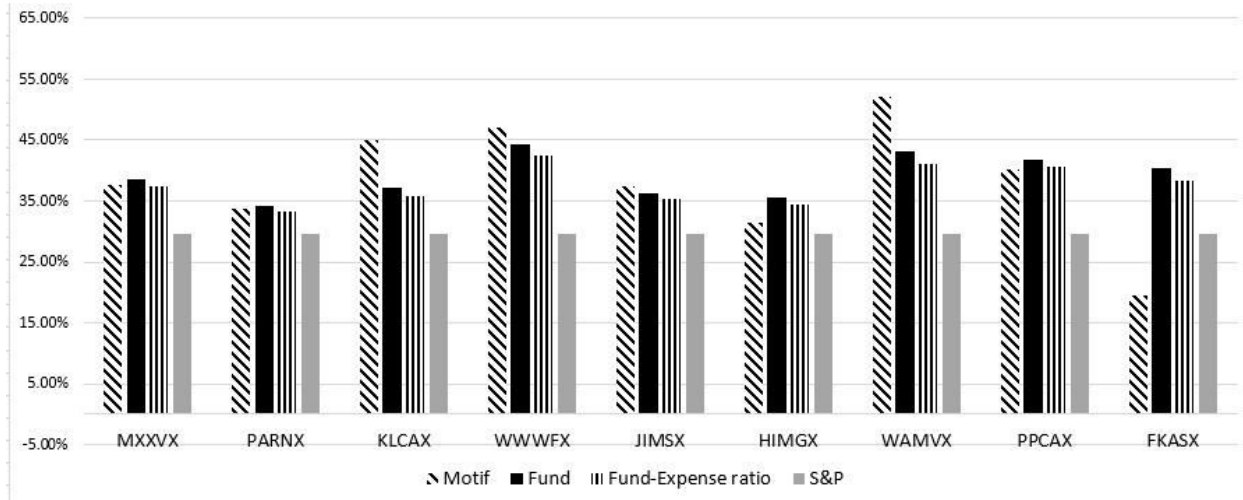
The table and graph above show the returns of the mid cap growth mutual funds for the 2013-2014 two year period before and after expenses were considered, their replicated motifs, and the return of the S&P 500. The three mid cap growth funds, Kinetics Internet (WWWFX), JHancock Funds2 (JIMSX), and Harbor (HIMGX), all had the highest two year return from their motif. The motifs had returns of 47.95%, 58.41%, and 61.58% respectively.

Table 15: 2 Year Small Cap Growth Returns

Ticker	Motif	Fund	Fund-Net Expense ratio	S&P
WAMVX	49.72%	42.05%	40.02%	44.36%
PPCAX	48.99%	46.40%	45.16%	44.36%
FKASX	21.96%	48.31%	46.36%	44.36%

Figure 9: 2 Year Small Cap Growth Returns

The table and graph above show the returns of the small cap growth mutual funds for the 2013-2014 two year period before and after expenses were considered, their replicated motifs, and the return of the S&P 500. The motifs for the Wasatch Micro (WAMVX) and PNC (PPCAX) funds had the highest returns over the two years at 49.72% and 48.99% respectively. The Federated Kaufmann Small Cap fund (FKASX) saw the largest return in its mutual fund which was 46.36% after the net expense ratio was deducted.

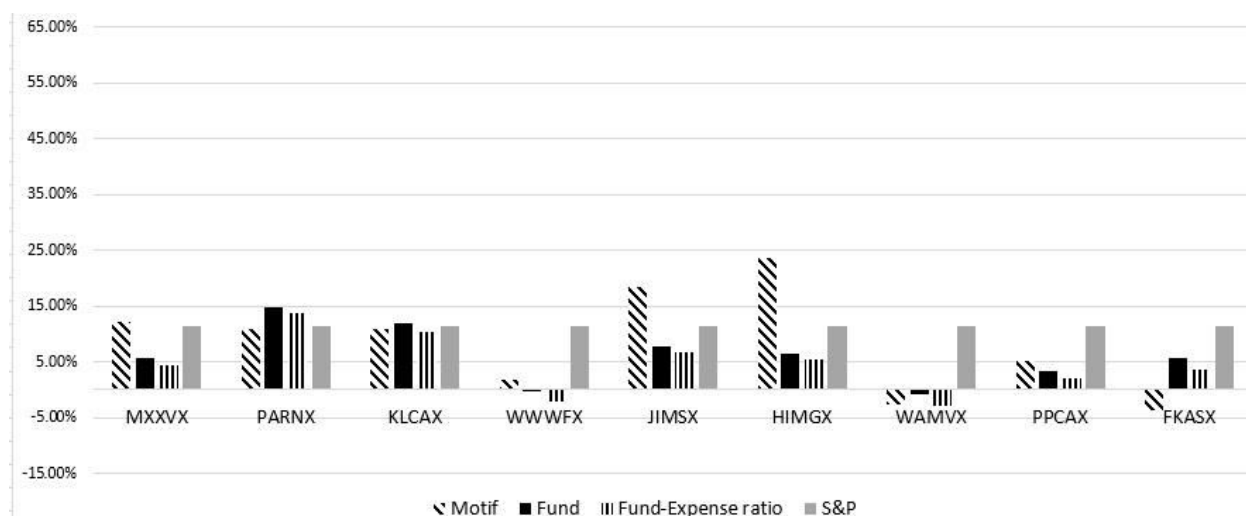
Figure 10: 2013 Returns for All Funds

The figure above gives a visual representation of the returns for all nine funds, including large, mid, and small growth, for the year 2013. For each fund the mutual fund's performance is shown both before and after the net expense ratio is subtracted, the replication motif's performance is shown, and so is the return of the S&P 500.

Table 16: 2013 Average Difference between Mutual Fund and Motif Returns

Ticker	Motif	Fund-Net Expense Ratio	Fund-Motif
MXXVX	37.69%	37.41%	-0.28%
PARNX	33.77%	33.25%	-0.52%
KLCAX	45.02%	35.79%	-9.24%
WWWFX	46.96%	42.42%	-4.54%
JIMSX	37.33%	35.32%	-2.01%
HIMGX	31.46%	34.31%	2.85%
WAMVX	52.02%	41.05%	-10.97%
PPCAX	40.12%	40.52%	0.39%
FKASX	19.43%	38.38%	18.94%
		average	-0.60%

The table above found the difference between the return of the mutual fund performance without the net expense ratio and the motif performance in 2013. The average of the nine differences was found and the motifs outperformed the mutual funds an average of 0.60%.

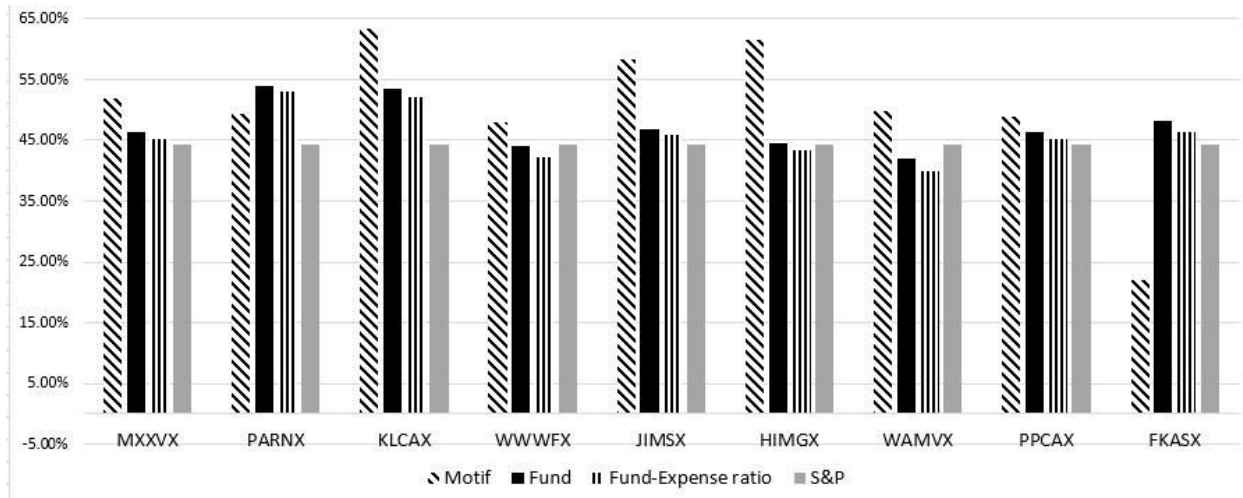
Figure 11: 2014 Returns for All Funds

The figure above gives a visual representation of the returns for all nine funds, including large, mid, and small growth, for the year 2014. For each fund the mutual fund's performance is shown both before and after the net expense ratio is subtracted, the replication motif's performance is shown, and so is the return of the S&P 500.

Table 17: 2014 Average Difference between Mutual Fund and Motif Returns

Ticker	Motif	Fund-Net	
		Expense Ratio	Fund-Motif
MXXVX	12.25%	4.36%	-7.89%
PARNX	10.94%	13.72%	2.79%
KLCAX	10.87%	10.37%	-0.50%
WWWFX	1.75%	-2.07%	-3.82%
JIMSX	18.33%	6.79%	-11.54%
HIMGX	23.52%	5.39%	-18.13%
WAMVX	-2.50%	-2.75%	-0.25%
PPCAX	5.29%	2.03%	-3.25%
FKASX	-3.73%	3.74%	7.46%
		average	-3.90%

The table above found the difference between the return of the mutual fund performance without the net expense ratio and the motif performance in 2014. The average of the nine differences was found and the motifs outperformed the mutual funds an average of 3.90%.

Figure 12: 2 Year Returns for All Funds

The figure above gives a visual representation of the returns for all nine funds, including large, mid, and small growth, for the two year period of 2013-2014. For each fund the mutual fund's performance is shown both before and after the net expense ratio is subtracted, the replication motif's performance is shown, and so is the return of the S&P 500.

Table 18: 2 Year Returns for All Funds

Ticker	Motif	Fund-Net Expense Ratio	Fund-Motif
MXXVX	51.85%	45.19%	-6.66%
PARNX	49.24%	52.97%	3.73%
KLCAX	63.25%	52.08%	-11.17%
WWWFX	47.95%	42.16%	-5.79%
JIMSX	58.41%	45.83%	-12.58%
HIMGX	61.58%	43.28%	-18.30%
WAMVX	49.72%	40.02%	-9.69%
PPCAX	48.99%	45.16%	-3.83%
FKASX	21.96%	46.36%	24.40%
		average	-4.43%

The table above found the difference between the return of the mutual fund performance without the net expense ratio and the motif performance for the two year period between 2013 and 2014. The average of the nine differences was found and the motifs outperformed the mutual funds an average of 4.43%.

Chapter 5

Discussion

The goal of this study was to see if mutual funds could be replicated using *Motif Investing* to get similar returns for a lower cost. It was discovered that there were many limitations to the website and the method design that prohibited the mutual funds from being recreated fully online. However, the replications that were made ended up having very similar returns to the mutual funds they were replicating and the majority of the time outperformed them. Overall the markets did much better in 2013 than in 2014. This can be seen by looking at the annual return of the S&P 500 which was 29.60% and 11.39% respectively. Every single mutual fund and motif performed better in 2013 than in 2014. In 2013 the S&P 500 did not perform better than any motif/mutual fund combination. In 2014 the S&P 500 outperformed all of the small-cap growth funds and motifs. It also beat the motif and mutual fund for the mid-cap growth Kinetics Internet fund. When looking at the overall two year returns the S&P 500 was not the best performer for any of the nine funds options.

In 2013 four of the replicated motifs outperformed the total performance of the mutual funds they were replicating. These were the Federate Kaufmann Large-cap, Kinetics Internet, JHancock Funds2, and Wasatch Micro funds. After the mutual fund performance was adjusted by deducting their net expense ratios the Matthew 25 and Parnassus funds also beat the mutual funds. This means a total of six motifs were created that beat the mutual funds they were attempting to replicate after expenses were subtracted from the returns. The other three mutual

funds offered higher returns than both the motifs and the S&P 500 even after their expenses were taken out.

These results were interesting because it showed that in the short term the top performing stock mutual funds from 2012 continued to be strong performers as they all beat the S&P 500 benchmark. The motifs were all also able to produce greater returns than the S&P 500 except for the motif that replicated the Federated Kaufmann Small Cap fund. This motif underperformed the mutual fund by 18.94% including expenses, but the other motifs were able to replicate their respective mutual funds well. The Harbor fund and the PNC fund also underperformed compared to the mutual funds they attempted to replicate by 2.85% and 0.39% respectively once fees were included. The other six motifs outperformed their mutual funds with the Wasatch fund and Federated Kaufmann Large Cap funds beating theirs by 10.97% and 9.24% respectively. On average the motifs beat their funds by 0.60% in 2013.

All of the returns were much smaller in 2014 compared to the returns in 2013. The S&P 500 had a return of 11.39% for the year. It had the highest performance in four out of the nine fund categories. It beat all the small cap growth funds and motifs which is interesting because these funds performed the best overall the previous year. For the other five funds the mutual fund was the top performer in two cases and the motif was the top performer for the other three. In 2014 the two motifs that underperformed the most when compared to the mutual funds they were replicating were the Federated Small Cap fund by 7.46% and the Parnassus fund by 2.79%. The motifs that outperformed their replicated funds the most were the Harbor fund by 18.13%, the JHancock Funds2 by 11.54%, and the Matthew 25 fund by 7.89% after expenses were included. The fees of the mutual fund only made a difference in the top performer of one fund, the Federated Kaufmann Large cap meaning the motif did not beat the return of the fund until after

the expense ratio was taken into account. On average there was a lot more variation in the second year than in the first and on average the motifs beat the funds they replicated by 3.90% but there was a wide range in their individual performances. It makes sense that the motifs performed with greater variation from their mutual funds in 2014 because it had been two years since the stocks were chosen from the funds to be replicated. Since then the fund had all changed their holdings and weights while the motifs were kept constant.

The overall results for the two years combined showed that the motifs actually performed higher than their mutual funds and the S&P 500 in seven out of the nine cases. The only exceptions were the Federated Kaufmann Small Cap fund and the Parnassus fund. This was unexpected because the motifs were not adjusted in any way after they were created based off the mutual funds' 2012 year end holdings. Meanwhile the mutual funds were being actively managed by professional managers and constantly reweighted and adjusted.

The straight results look very promising for this strategy of replicating mutual funds using an online investment platform to get similar returns for a lower cost. In some ways this is true, these funds were able to generate similar and often better returns than the mutual funds they replicated. *Motif Investing* also has a low minimum investment requirement of only \$250. The mutual funds in this study had much higher initial investment requirements in the \$1,000-\$2,500 range. The exceptions were the Matthew 25 fund which has a \$10,000 minimum and the JHancock Funds2 which has no minimum. The cost of investing could be much cheaper through *Motif Investing* depending on how much money is going to be invested and the amount of time the investment will be held. To create a motif there is zero cost and then to actually invest money into it there is a \$9.95 commission charge. There are also SEC and FINRA fees but they are very small. The SEC fee is \$0.0000224 for every dollar invested and the FINRA is \$0.000119 per

share so they were ignored in this study. The one-time commission fee that is charged when the money is initially being invested is what needs to be considered. If only \$1000 was being invested for one year than the \$9.95 would be about a 1% commission charge. However, if a greater amount of money was invested or the motif was held for longer this fee would remain constant so the percentage of expense would decrease. The mutual funds charge load fees and ongoing management fees. The net expense ratio for the funds used in this study varied from 0.93%-2.03% of total earnings. This is an annual fee that could add up quickly because it is applied every year. However, for the one year study depending on the amount of money that was invested these fees could have been similar to that of the motif. Factors such as higher required minimum investments and ongoing rates still make the *Motif Investing* pricing structure more attractive overall in most cases. An extension of this study could focus on investing a certain dollar amount so the exact percentage cost of the \$9.95 commission fee for the motif could be factored in to the pricing comparisons.

In this study the mutual funds' annual expense ratios only made a difference for the motif outperforming the mutual fund in three situations. So the lower cost of investment was not the factor that determined which would be the better investment. Also it is important to note that these motifs were made as if they were created at the beginning of 2013 and not changed for two years. In this time the actual mutual funds were adjusted many times because they are actively managed. So by the end of the two year period the mutual funds probably represented the mutual funds to a much smaller extent. If an investor wanted to reweight their motif to continue to replicate a mutual fund over time this could get very expensive because it costs \$4.95 to buy or sell a stock or to reweight your motif on the website. These costs could add up very quickly depending on how often the mutual fund changes its portfolio and could make the cost of the

motif exceed the expenses of the fund. This study bought and held the stocks so this wasn't a factor but then the motif should only really be held for a shorter period of time before the mutual fund changes significantly.

The motifs in this study also were not able to even come close to a perfect replication of the mutual funds for several reasons. First of all it was known ahead of time that a motif created using *Motif Investing* can only hold a total of 30 stocks. Many of the mutual funds had many more stocks than 30, some had over a hundred holdings. The percentage of the stock holding in the mutual fund that were actually able to be replicated in the motif can be seen in Table 2. For the most part they were only able to replicate 40%-70%. The 30 stocks that held the most weight in the mutual fund portfolio were supposed to be used to create the motifs but even this was not actually possible. Since the holdings from year-end 2012 were being used this presented additional problems. A lot of stocks that were held then are no longer offered on the stock market due to the companies being acquired or going out of business since then. This is an issue because if this strategy was implemented in real life these stocks would have been held in the motif until the time of their acquisition but in this study they were not used. Instead the next highest weight stock was used in its place in the motif. Foreign stocks held in the funds were also an issue because *Motif Investing* only offers stocks and ETFs that are traded on U.S. exchanges. Any foreign holdings were also left out for this study. Every fund had at least one stock that couldn't be replicated into the motif. In some cases this was just one stock, such as with the Matthew 25 fund where one company called Medco Health Solutions was acquired by Express Scripts in late 2012 after their shareholder report was released. In other cases there were more stocks that couldn't transfer, the Harbor Mid Cap Growth fund had six stocks that had to be excluded and replaced with lower weighted holdings in the motif.

In the end the motifs ended up being able to replicate the mutual funds with varying accuracy. Five of the motifs were able to replicate their mutual funds with an accuracy in the 42%-54% range. Three of the motifs were able to replicate 70%-77% of their mutual funds. The Parnassus fund motif held stocks that represented 98.25% of the mutual fund but that was because that mutual fund only holds 31 stocks to begin with. This replication percentage was determined by finding the total dollar value of all the stocks held in a mutual fund. Then the dollar value of just the stocks included in the motif was calculated and divided by the total stock value to figure out what percentage of the stock holdings was being represented in the motif. The fact that over half of the motifs in this study only replicated 54% or less of their mutual funds shows that this strategy is not very successful in creating a true replication of a mutual fund. The limitation of 30 stocks to a motif limited how well the replication could be done most significantly. However, *Motif Investing* was the only platform found that could be used to select and weight stocks and invest in them as a portfolio like a mutual fund for such a low cost. In a future study other investment methods could be explored more to see if there is another existing platform that could provide more accuracy. Also if the study was done using current holdings and weights of mutual funds and present day pricing that could reduce a lot of the differences. This would eliminate the problem of stocks no longer being available because it would be present day and both the motif and mutual fund would be effected at the same time due to any mergers and acquisitions. The inability to invest in foreign stocks was only an issue for 5 stocks that fell in 3 different motifs. This is not very significant but again a different investment platform that offered foreign stocks would be a solution to this problem.

This study was designed and executed independently from any previous research or study. There were no similar studies found during an investigation of previous literature and

studies. While this study had many imperfections it is a relevant topic today and could be expanded upon in many ways in the future. There was no way to test for statistical significance in this study as there were only nine mutual funds used and many of the funds held similar stocks so they were independent of one another. The study could be altered to try and find significance within the results. The study could also be done in present time to eliminate factors discussed previously such as acquisitions. This would allow the motifs to represent a greater percentage of the funds. This study could be done with several more mutual funds and span other categories instead of just focusing on stock growth funds. If another platform was found that could be used to recreate mutual funds maybe other investment types other than just stocks could be included. There are so many ways that this study could be expanded on in the future.

Chapter 6

Conclusion

The results of this study showed that using *Motif Investing* to attempt to replicate mutual funds online at a lower cost is possible but exact replications can't be created. The majority of the motifs were only able to represent 40%-75% of the actual mutual funds. In addition, the fees of the mutual funds only made a difference for whether or not it was outperformed by its motif in three instances. The motifs ended up outperforming their mutual funds in 2013 for five of the nine funds. In 2014 six of the motifs outperformed the mutual funds they were replicating. The average difference between the motif performance and mutual fund performance for the two years were 0.6% in 2013 and 3.90% in 2014 and in both cases this was the percentage the motifs outperformed their respective mutual funds. The fact that the motifs were often able to produce similar results to their mutual funds or better results with the exception of the Federated Kaufmann Small Cap fund makes it look like this is a promising investment strategy. However, these results are only relevant to these specific funds during this time period. More extensive research would have to be done in the future to see if these trends are seen across different fund types and time periods. The options that have been created by online investing are broad and many have yet to be investigated in depth. This study began to look at one potential investment strategy and has led to discovering trends that have great potential to be expanded upon in the future.

Appendix A

List of 2012 Top Performing Mutual Funds

Fund name or category	2012 return	3-year average annualized return	5-year average annualized return	Expense ratio
Large-Cap Blend	_____	_____	_____	_____
Smead Value Investor (SMVLX)	27.8%	14.6%	NA	1.40%
PIMCO Fundamental IndexPLUS Total Return (PIXAX)	26.5	19.9	8.6	1.19
PIMCO StocksPLUS Total Return (PTOAX)	25.9	17.3	5.2	1.04
Large-Cap Growth	_____	_____	_____	_____
Matthew 25 Fund (MXXVX)	31.6	24.3	11.1	1.22
Parnassus Fund (PARNX)	26.1	11.8	6.4	0.94
Federated Kaufmann Large Cap (KLCAX)	26.0	13.2	6.1	1.50
Large-Cap Value	_____	_____	_____	_____
Fairholme (FAIRX)	35.8	4.8	2.4	1.01
JHancock2 Fundamental Large Cap Value (JFVAX)	23	NA	NA	1.30
Dodge & Cox Stock (DODGX)	22	9.9	-0.2	0.52
Mid-Cap Blend	_____	_____	_____	_____
Keeley Small-Mid Cap Value (KSMVX)	29.7	14.9	3.5	1.40

Fidelity Leveraged Company Stock (FLVCX)	28.8	12.8	0.8	0.85
Fidelity Advisor Value Strategies (FASPX)	26.4	12.8	2.1	1.35
Mid-Cap Growth	_____	_____	_____	_____
Kinetics Internet No Load (WWWFX)	23.2	13.6	4.7	1.89
JHancock Funds2 Mid Cap Stock (JIMSX)	21.9	10.7	0.0	0.92
Harbor Mid Cap Growth (HIMGX)	21.5	10.4	0.1	1.22
Mid-Cap Value	_____	_____	_____	_____
Legg Mason Capital Management Opportunity (LMOPX)	39.6	1.9	-7.7	2.12
Hotchkis and Wiley Mid-Cap Value (HWMAX)	30.8	16.9	7.2	1.35
Hotchkis and Wiley Value Opportunities (HWAAX)	29.3	17.2	9.0	1.35
Small-Cap Blend	_____	_____	_____	_____
Hennessy Cornerstone Growth Investor (HFCGX)	30.3	9.0	-4.3	1.33
PIMCO Small Cap StocksPLUS Total Return (PCKAX)	28.1	19.1	10.9	1.09
Bogle Small Cap Growth (BOGLX)	26.0	15.6	3.1	1.35
Small-Cap Growth	_____	_____	_____	_____

Wasatch Micro Cap Value (WAMVX)	22.1	9.5	3.4	2.25
PNC Small Cap (PPCAX)	21.9	16.6	5.0	1.45
Federated Kaufmann Small Cap (FKASX)	21.3	11.1	1.0	1.95
Small-Cap Value	—	—	—	—
Walthausen Small Cap Value (WSCVX)	32.1	20.8	NA	1.32
Aegis Value (AVALX)	25.1	15.9	7.4	1.47
Bridgeway Ultra-Small Company (BRUSX)	24.5	9.5	1.0	1.22

This is the list of the best stock mutual fund performers from 2012 from Morningstar Inc. The stocks are divided into nine general categories with the best performing three funds listed within each category ("Top-performing stock mutual," 2013). This list provided the funds that were replicated using Motif Investing using historical returns for 2013 and 2014. To narrow the scope of the study only the large, mid, and small-cap growth funds were replicated and analyzed.

Appendix B

Motif Holdings

Large Cap Growth Fund Replication Motifs

Matthew 25 (MXXVX) Replication Motif Holdings

Company	Ticker	Weight in Motif
MasterCard Cl A	MA	7.02%
KKR & Co LP (DE)	KKR	5.05%
East West Bancorp Inc	EWBC	4.95%
The Goldman Sachs Group Inc.	GS	4.90%
Brandywine Realty Trust	BDN	4.86%
Berkshire Hathaway B	BRK.B	4.76%
Citigroup Inc.	C	3.49%
Apple Inc.	AAPL	17.77%
Polaris Industries Inc.	PII	4.75%
J.M. Smucker Co.	SJM	4.42%
Cabelas Inc.	CAB	6.93%
Kansas City Southern	KSU	6.44%
Biglari Holdings	BH	1.28%
El Paso Electric Co.	EE	8.01%
Caterpillar Inc.	CAT	5.12%
Weyerhaeuser Co.	WY	0.72%
Google Inc A	GOOGL	5.51%
Stryker Corp.	SYK	4.02%

Parnassus (PARNX) Replication Motif Holdings

Company	Ticker	Weight in Motif
Finisar Corporation	FNSR	6.70%
Cisco Systems Inc.	CSCO	6.60%
Intel Corp	INTC	6.00%
Google Inc	GOOG	5.10%
Qualcomm Inc.	QCOM	5.10%
CIENA CORP	CIEN	4.50%
Adobe Systems Incorporated	ADBE	4.20%
Applied Materials Inc.	AMAT	3.50%
Corning Inc.	GLW	2.90%
Brocade Communications Systems Inc.	BRCD	2.60%
Hewlett Packard Co.	HPQ	0.50%
Altera Corp.	ALTR	0.20%
Lowe's Cos.	LOW	4.30%
Inspireity Inc.	NSP	3.10%
Target Corp.	TGT	3.00%
Verisk Analytics Inc.	VRSK	2.80%
Scripps Networks Interactive	SNI	2.70%
Walt Disney	DIS	1.70%
Staples Inc.	SPLS	0.40%
Toll Brothers Inc.	TOL	4.80%
D.R. Horton Inc.	DHI	4.80%
PulteGroup Inc.	PHM	3.80%
Wells Fargo & Co.	WFC	5.80%
JP Morgan Chase & Co.	JPM	2.20%
SEI Investments Co.	SEIC	1.60%
First Horizon National Corp.	FHN	1.00%
Gilead Sciences Inc.	GILD	4.10%
Teleflex Inc.	TFX	1.70%
W&T Offshore Inc.	WTI	4.30%

Federated Kaufmann Large Cap (KLCAX) Replication Motif Holdings

Company	Ticker	Weight in Motif
American International Group Inc.	AIG	5.86%
Capital One Financial Corp.	COF	3.23%
Visa Inc.	V	3.05%
JP Morgan Chase & Co.	JPM	3.03%
BlackRock Inc.	BLK	2.79%
Wells Fargo & Co.	WFC	2.74%
Gilead Sciences Inc.	GILD	5.56%
Actavis plc	ACT	3.79%
Biogen Idec Inc.	BIIB	3.78%
Express Scripts Holding Company	ESRX	3.45%
Varian Medical Systems Inc.	VAR	2.64%
LyondellBasell Industries NV	LYB	4.24%
Schlumberger Ltd.	SLB	3.27%
Valero Energy Corp.	VLO	3.25%
Halliburton Co.	HAL	2.78%
Cenovus Energy Inc.	CVE	2.72%
Anadarko Petroleum Corp.	APC	2.66%
Vantiv	VNTV	3.61%
Starbucks Corp.	SBUX	3.03%
Las Vegas Sands Inc.	LVS	3.00%
FedEx Corp.	FDX	2.59%
eBay Inc.	EBAY	2.56%
NXP Semiconductors N.V.	NXPI	4.09%
Qualcomm Inc.	QCOM	3.75%
Citrix Systems Inc.	CTXS	3.17%
Salesforce.com Inc.	CRM	2.60%
Apple Inc.	AAPL	3.74%
Michael Kors Holdings Ltd. ADS	KORS	2.96%
Owens Corning	OC	3.29%
Precision Castparts Corp.	PCP	2.78%

Mid Cap Growth Fund Replication Motifs

Kinetics Internet (WWWFX) Replication Motif Holdings

Company	Ticker	Weight in Motif
Liberty Media Corp (DE)	LMCA	11.12%
Viacom	VIAB	6.40%
Liberty Global plc	LBTYK	5.21%
Discovery Communications Inc.	DISCA	4.75%
Ritchie Bros. Auctioneers Inc.	RBA	4.72%
Time Warner Inc	TWX	4.19%
Scripps Networks Interactive	SNI	3.50%
The Madison Square Garden Corp	MSG	3.19%
Dreamworks Animation SKG Inc	DWA	3.15%
eBay Inc.	EBAY	3.07%
CBS Corp.	CBS	1.73%
AutoNation Inc.	AN	1.51%
Walt Disney	DIS	1.49%
Copart Inc.	CPRT	1.29%
Live Nation Entertainment	LYV	1.19%
Sothebys	BID	1.12%
Google Inc A	GOOGL	8.39%
CACI International Inc. (A)	CACI	4.05%
Liberty Interactive Corp	LVNTA	3.82%
ManTech International Corp	MANT	3.42%
Cognizant Technology Solutions Corp	CTSH	3.38%
IAC/InterActiveCorp	IACI	3.34%
SINA Corp. ADS	SINA	2.70%
Infosys Ltd. ADS	INFY	1.80%
Yahoo! Inc.	YHOO	1.33%
Sohu.com Inc.	SOHU	1.26%
Qualcomm Inc.	QCOM	1.00%
MasterCard Cl A	MA	2.70%
Visa Inc.	V	2.58%
Apple Inc.	AAPL	2.59%

JHancock Funds2 (JIMSX) Replication Motif Holdings

Company	Ticker	Weight in Motif
Salesforce.com Inc.	CRM	4.56%
LinkedIn	LNKD	4.34%
Cadence Design Systems Inc.	CDNS	4.18%
IHS Cl A	IHS	3.84%
Skyworks Solutions Inc.	SWKS	3.82%
Equinix Inc (New)	EQIX	3.71%
Solera Holdings	SLH	3.06%
Activision Blizzard Inc.	ATVI	2.86%
IAC/InterActiveCorp	IACI	2.82%
Edwards Lifesciences Corp.	EW	6.19%
Hologic Inc.	HOLX	4.48%
Catamaran Corporation	CTRX	4.44%
Agilent Technologies Inc.	A	3.10%
Heartware International Inc.	HTWR	3.03%
Actavis plc	ACT	2.97%
Life Time Fitness Inc.	LTM	2.85%
GNC Holdings	GNC	2.76%
Cardinal Health Inc.	CAH	2.70%
Sirius XM Radio Inc.	SIRI	2.67%
The Cheesecake Factory Inc.	CAKE	2.66%
Pandora Media	P	2.40%
Hanesbrands	HBI	4.26%
PVH Corp.	PVH	3.16%
Tenneco	TEN	2.47%
DigitalGlobe Inc	DGI	2.92%
Polypore International Inc.	PPO	2.80%
Cabot Oil & Gas Corp.	COG	2.86%
Southwestern Energy Co.	SWN	2.64%
Host Hotels & Resorts	HST	2.83%
Invesco Limited	IVZ	2.61%

Harbor Fund (HIMGX) Replication Motif Holdings

Company	Ticker	Weight in Motif
Hanesbrands	HBI	3.80%
Tempur Sealy International Inc.	TPX	3.79%
Coach Inc.	COH	3.75%
Keurig Green Mountain Inc	GMCR	3.38%
Jarden Corp.	JAH	3.16%
VeriFone Systems	PAY	2.65%
Diamond Foods Inc.	DMND	2.58%
Ball Corp.	BLL	2.42%
Cadence Design Systems Inc.	CDNS	5.65%
F5 Networks Inc.	FFIV	3.75%
Skyworks Solutions Inc.	SWKS	3.12%
Jabil Circuit Inc.	JBL	3.09%
Allscripts Healthcare Solutions Inc.	MDRX	2.92%
Gartner	IT	2.63%
Activision Blizzard Inc.	ATVI	2.50%
Edwards Lifesciences Corp.	EW	5.31%
Hologic Inc.	HOLX	3.94%
Intuitive Surgical Inc.	ISRG	3.74%
Catamaran Corporation	CTRX	2.90%
Heartware International Inc.	HTWR	2.77%
Waters Corp.	WAT	2.53%
Ross Stores Inc.	ROST	4.17%
Weight Watchers International Inc.	WTW	3.78%
Dominos Pizza Inc.	DPZ	3.39%
Express	EXPR	3.19%
AECOM	ACM	3.14%
Deckers Outdoor Corp.	DECK	3.00%
DigitalGlobe Inc	DGI	3.15%
Navistar International	NAV	2.41%
The Western Union Co.	WU	3.38%

Small Cap Growth Fund Replication Motifs

Wasatch Micro (WAMVX) Replication Motif Holdings

Company	Ticker	Weight in Motif
Gordmans Stores Inc	GMAN	3.33%
CAI International	CAP	2.84%
Pep Boys-Manny Moe & Jack	PBY	2.77%
Lumber Liquidators Holdings Inc	LL	2.76%
Marten Transport Ltd.	MRTN	2.64%
IPC Healthcare Inc.	IPCM	3.24%
The Ensign Group Inc.	ENSG	3.08%
NuVasive Inc.	NUVA	2.84%
Bio-Reference Laboratories Inc.	BRLI	2.43%
Virtus Investment Partners Inc	VRTS	5.03%
Encore Capital Group Inc	ECPG	3.84%
Smith & Wesson Holding Corp	SWHC	3.01%
Franklin Electric Co.	FELE	2.92%
Heritage-Crystal Clean Inc.	HCCI	2.59%
Lakeland Financial Corp.	LKFN	2.83%
Regional Management Corp	RM	2.69%
Eagle Bancorp Inc.	EGBN	2.61%
Interactive Intelligence Group Inc	ININ	3.30%
Perficient Inc.	PRFT	2.78%
Colony Financial	CLNY	5.02%
BofI Holding Inc.	BOFI	5.00%
First Cash Financial Services Inc	FCFS	4.80%
NorthStar Realty Finance Corp	NRF	4.46%
Beacon Roofing Supply Inc.	BECN	4.06%
Dorman Products Inc.	DORM	3.34%
InnerWorkings Inc.	INWK	3.31%
Beneficial Mutual Bancorp Inc	BNCL	3.26%
Allegiant Travel Company	ALGT	3.21%
KMG Chemicals Inc.	KMG	3.05%
Ennis	EBF	2.96%

PNC (PPCAX) Replication Motif Holdings

Company	Ticker	Weight in Motif
OSI Systems Inc.	OSIS	5.86%
B/E Aerospace Inc	BEAV	4.12%
EnerSys Inc.	ENS	3.84%
Colfax	CFX	3.67%
Triumph Group Inc.	TGI	3.24%
Esterline Technologies Corp.	ESL	2.96%
Regal-Beloit Corp.	RBC	2.49%
Actuant Corp. Cl A	ATU	2.38%
Heico Corp.	HEI	2.34%
Liquidity Services Inc.	LQDT	4.62%
PRA Group Inc	PRAA	4.36%
The Madison Square Garden Company	MSG	3.35%
Tractor Supply Co.	TSCO	3.19%
Outerwall Inc	OUTR	3.01%
Aarons Inc.	AAN	2.71%
Penn National Gaming Inc.	PENN	2.25%
AmTrust Financial Services Inc	AFSI	5.49%
Bank of the Ozarks Inc.	OZRK	4.91%
Virtus Investment Partners Inc	VRTS	4.39%
WEX Inc.	WEX	3.04%
RLI Corp.	RLI	2.54%
World Acceptance Corporation	WRLD	2.42%
American Axle & Manufacturing Holding	AXL	3.22%
Dorman Products Inc.	DORM	2.42%
TreeHouse Foods	THS	2.33%
World Fuel Services Corp.	INT	3.62%
Contango Oil & Gas Co.	MCF	2.47%
PAREXEL International Corporation	PRXL	3.16%
Neogen Corp.	NEOG	2.13%
Tyler Technologies Inc.	TYL	3.46%

Federated Kaufmann Small Cap (FKASX) Replication Motif Holdings

Company	Ticker	Weight in Motif
Dynavax Technologies Corp	DVAX	17.60%
Protalix BioTherapeutics Inc.	PLX	2.94%
Amarin Corporation plc	AMRN	2.53%
DexCom Inc.	DXCM	2.52%
Insulet Corporation	PODD	2.27%
Salix Pharmaceuticals Ltd	SLXP	2.23%
MSC Industrial Direct Co.	MSM	3.25%
Dicks Sporting Goods Inc.	DKS	3.15%
Atlas Air Worldwide Holdings NEW	AAWW	3.11%
Envestnet	ENV	2.95%
Ryder System Inc.	R	2.76%
Trinity Industries Inc.	TRN	2.71%
Air Lease	AL	2.56%
Vitamin Shoppe	VSI	2.41%
Titan Machinery Inc.	TITN	2.38%
Old Dominion Freight Line Inc.	ODFL	2.34%
CommVault Systems Inc.	CVLT	5.81%
Mellanox Technologies Ltd.	MLNX	3.43%
Radware Ltd.	RDWR	3.31%
BroadSoft Inc.	BSFT	2.78%
Microsemi Corporation	MSCC	2.55%
Teledyne Technologies Inc.	TDY	2.39%
Walker & Dunlop	WD	3.35%
Affiliated Managers Group Inc.	AMG	3.04%
CoStar Group Inc.	CSGP	2.38%
Chicago Bridge & Iron Co. N.V.	CBI	3.14%
Owens Corning	OC	2.71%
Meritage Homes Corp.	MTH	2.60%
Lululemon Athletica Inc.	LULU	2.55%
MRC Global	MRC	2.23%

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Academic Vita

Dana Lindt

School: 318 W. Nittany Ave, APT 2, State College, PA, 16801 • Mobile: (717) 598-7207 • Email: del5149@psu.edu
Permanent: 111 Bentley Lane, Lancaster, PA, 17603

EDUCATION:

The Pennsylvania State University, Schreyer Honors College
B.A. in Finance, Spanish minor

University Park, PA
Expected graduation: May 2015

WORK EXPERIENCE:

Goldman Sachs

Summer Analyst, Fed & Bank Controllers

New York, NY

2014

- Worked for 10 weeks on the FR Y9C team preparing a quarterly financial report for the Fed
- Contributed to several schedules on the report, used data from the balance sheet and income statement

Live It

Student Intern

State College, PA

2014

- Interned with this startup company with the goal to launch an online student platform in fall 2014
- Perform market research and act as a liaison to Penn State student organizations and local retailers

Berry Plastics

Lab Intern, Research and Product Development Team

Lancaster, PA

Summers 2011 - 2013

- Maintained lab sample database and worked with customers to create lab test requests
- Ran package tests in functional and analytical lab for customer problems and protocol samples

PSU KnowHow

Executive Desk Assistant, 8-10 hours per week during academic year

State College, PA

2012-2014

- Manage administrative duties for tutoring review sessions and supervise Junior Desk Assistants

Lindt Properties

Painting and Maintenance Supervisor

Lancaster, PA

2004-2013

- Train and supervise a team of entry level painters and cleaning help

COLLEGE ACTIVITIES:

National Association of Home Builders (NAHB)

2013

Vice President of Finances

- Research and create a market and financial analysis for housing community to pitch to real investors
- Chosen to travel to Las Vegas as part of the team to present in the national residential construction competition

Finance THON Captain

2014

Captain

- Helped to track the Penn State Dance Marathon's fundraising total for the year which was over \$13 million
- Led a 30 member finance committee. Held weekly meetings and led several events throughout the year

Finance THON Committee

2012-2013

Member (Finance 2013, Morale 2012)

- Track donations throughout the fundraising period. Assist donors with financial needs.
- The THON 2013 total was \$12,939,895.39 which was donated to the Four Diamonds Fund

Atlas THON

2011-2013

Canning Captain, Member

- Participated in canning and other fundraisers resulting in \$559,358.48 raised for THON 2013

SHOTIME Mentor

2012

Mentor

- Mentored 10 incoming freshmen in the fall for the three day Honors College orientation

HONORS:

Acceptance to Schreyer Honors College

2011

International Baccalaureate Diploma recipient

2011

National Merit Scholar Candidate

2010