**Characteristics influencing the historical
performance of U.S. mutual funds**

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ABSTRACT

This study examines variables influencing mutual fund performance. Data were collected from U.S. 181 equity mutual funds during the bull market from 2009 to 2018. The overall object of this study is to determine how funds' characteristics, risks, and managerial factors are related with 10-year time weighted average return.

Using correlation and regression analysis, the results show that asset size and turnover ratio are not statistically significant factors for fund performance. Sales charges and expenses are highly negatively correlated; management tenure and management style, whether team or single management, does not impact on fund return over the examination period. A fund managers' MBA education does not produce extra return.

It is also found that the risks and performance are statistically significantly related. Alpha, beta, skewness, kurtosis, the Sharpe ratio and Treynor impact on funds' return positively but standard deviation does not. Evaluation metrics are used to examine if regression models can predict 2019 return (out-of-sample performance). It is revealed that the historical data does not explain future returns well.

Overall, the results suggest that past performance on mutual funds does not predict future returns well. This is consistent with the weak form of market efficiency.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

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CHAPTER I: INTRODUCTION

The U.S. mutual fund industry has grown. There were 7,790 open-end mutual funds in 1999 and the numbers increased to 9,599 in 2018. In the U.S., there are 99.5 million individuals and 56 million households who own mutual funds. Mutual funds are important for short- and long-term savings for the U.S. families.

According to the Investment Company Institute. 93 percent of fund investors' goals are for retirement. Forty six percent of them use mutual funds for emergency savings or tax benefits. Twenty four percent of investors want to save for education. The investors consider the fund's performance when they select their investment (Investment Company Institute 2019).

1.1 Historical Perspective on the US Stock Market

The U.S. stock market's earnings in the past ten years, from 2009 to 2018, is one of its best bull markets since 1940s (Figure 1.1).

Figure 1.1 Real Dow Jones Industrial Average, 1946-2018

Source: https://finance.yahoo.com

The S&P 500, Russell 2000, and NASDAQ (National Association of Security Dealers Automated Quotations System) index increased more than three times from 2009 to 2018. For ten years, the annual average index returns are 15.45% (NASDAQ), 11.11% (Russell 2000), and 10.75% (S&P 500) (Table 1.1).

It is calculated that one dollar invested in 2009 in the NASDAQ, Russell and S&P, respectively grew to $4.21, $2.8,7 and $2.78 if it would have been reinvested annually (Table 1.2). The growth rates (Figure 1.2) are 78% (S&P 500), 21% (NASDAQ), and 87% (Russell 2000).

Table 1.1 S&P, NASDAQ, & Russell Annual Index Changes (Jan 2009-Oct 2019)

	S&P 500	NASDAQ	Russell 2000
2019	19.12%	21.92%	14.04%
2018	-6.24%	-3.88%	-3.84%
2017	19.42%	28.24%	13.19%
2016	9.54%	7.50%	19.66%
2015	-0.73%	5.73%	-6.12%
2014	11.39%	13.40%	3.79%
2013	29.60%	38.32%	36.98%
2012	13.41%	15.91%	13.20%
2011	0.00%	-1.80%	-6.68%
2010	12.78%	16.91%	24.68%
2009	23.45%	43.89%	25.25%

Source: https://finance.yahoo.com

Table 1.2 Dollar Value Changes Compounding from 2009 to 2018

	S&P 500	NASDAQ	Russell 2000
2008	$1.00	$1.00	$1.00
2009	$1.2345	$1.4389	$1.2525
2010	$1.3923	$1.6822	$1.5616
2011	$1.3923	$1.6519	$1.4573
2012	$1.5790	$1.9148	$1.6496
2013	$2.0464	$2.6485	$2.2597
2014	$2.2794	$3.0034	$2.3454
2015	$2.2628	$3.1755	$2.2019
2016	$2.4787	$3.4137	$2.6349
2017	$2.9600	$4.3777	$2.9824
2018	$2.7753	$4.2078	$2.8679

Figure 1.2 S&P 500, NASDAQ, and Russell 2000 index changes 2008-2018

Source: https://finance.yahoo.com
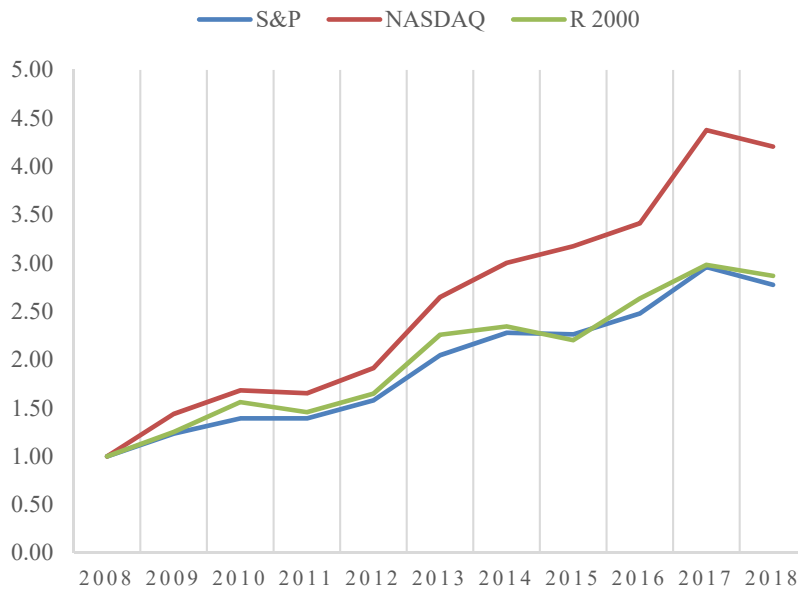
1.2 The Problem Discussion

1.2.1 U.S. Mutual Funds from 2009 to 2018

While the overall stock market grew, dollar values invested in U.S. mutual funds increased four or five times from 2009 to 2018. In the U.S., there were 9,599 open-end

3

mutual funds (mutual funds), 506 closed-end funds, and 2,057 Exchange Trade Funds (ETFs) (Investment Company Institute 2019). When analyzing mutual funds' 10-year total returns, the performance rates vary. While some funds achieved more than a 20% average return, some funds experienced negative returns (Morningstar (a) n.d.).

The 10-year weighted average annual returns are unique for each mutual fund. In this thesis, the characteristic that contributed to U.S. mutual fund performance is analyzed. After reviewing three different fund groups; 1st group with 12% more return, 2nd group 8% to 11% return, 3rd group 5% or below return, the common characteristics for 1st group funds are analyzed.

There were 181 open-end equity mutual funds in the first group that experienced a 12% or more average annual return. The funds are studied considering general characteristics, statistical risks and managerial factors. The general characteristics include Morningstar rating, asset size, fund style, expenses and fees, and fund age. The statistical risks are alpha, beta, R-squared, standard deviation, skewness, and kurtosis. Finally, the managerial factors are the turnover ratio, number of holdings, fund manager's tenure and education.

1.2.2 U.S. Capital Market & Mutual Fund

The total amount invested in the U.S. stock market in 2019 was about $34 trillion. The U.S. stock market is 43% of world's capitalization (Surz 2018). U.S. investors choose mutual funds for their short- and long-term savings. Mutual fund owners include more than 99 million people (56 million households) in the U.S. in 2018. They use mutual funds for retirement (93%), emergency funds (46%), and education saving (24%) (Investment Company Institute 2019).

1.2.3 U.S. Open-End Mutual Funds

There are several types of mutual funds. Investors choose funds based on their risk tolerance. Investors looking for capital appreciation select equity mutual funds while bond funds and money market funds are chosen more for current income.

According to the Investment Company Institute (ICI), the majority of U.S. mutual fund assets (52% of 17.7 trillion) are in equity funds followed by bond funds (23%), and then money market funds (17%). In 2018, retail investors owned 89% of $17 trillion of U.S. mutual fund assets. Retail investors use mutual funds for IRAs (Individual Retirement Accounts), retirement plans, variable annuities, college saving plans, and Coverdell accounts. Businesses and institutions select mutual funds to meet their financial objectives.

1.2.4 Mutual Fund in Retirement Market

Mutual funds have been the most popular product for accumulating money for retirement. In 2012, 73% of households who owned mutual funds answered that retirement saving was their primary goal (Fevurly 2013). In 2018, 93% of mutual fund investors indicated retirement savings was a priority concern and a large amount of retirement money was invested in mutual funds (Investment Company Institution 2019).

The Individual Retirement Account (IRA) was introduced in 1974, and it became popular in 1981 after the Economic Recovery Tax Act. The act allowed anyone to contribute an IRA regardless of an employee's retirement plan from work. Before 1981, an IRA was not available for workers who had an employer-sponsored plans (Smith 2019). In the 1980s, interest rates began to decline and money market products became unpopular. As a result, equity mutual funds were introduced to the investor and households for their long-term financial goals including retirement (Mobius 2007).

There is $27.1 trillion invested in U.S. retirement accounts and about 30% of the money ($8.2 trillion) was invested in mutual funds. Mutual funds play a major role in the U.S. retirement system (Investment Company Institution 2019).

1.2.5 Actively Managed Mutual Fund Characteristics

Mutual funds are a method for investing in stocks. It is a pool of money from individuals, businesses, and institutions for investment. A mutual fund hires a portfolio manager or team of managers to decide which stocks should be bought or sold for its portfolio. This is considered as an actively managed fund (Becker 2019). The investment performance depends on the managers' investment style, stock selections, management fees, and turnover and expense ratios (Goel and Mani 2012).

Actively managed funds are different from passively managed funds. Unlike actively managed funds, passively managed funds do not need management for its portfolio. The investment return of mutual fund comes from the performance of benchmark index such as S&P 500 or Russell 2000. It is one of simplest investment strategies. The cost and expenses of index funds are lower than actively managed funds as these funds have less trading time and/or portfolio changes (Becker 2019).

In this research, actively managed mutual funds are selected based on the ten year, from January 2009 to December 2018, historical average return. The funds' characteristics such as asset size, expenses and fees, statistical risks, fund managers' education background, and number of fund managers are studied. It is determined how the characteristics are related with the funds' historical returns.

1.2.6 Open-End vs Closed-End Funds

With open-end funds, the number of mutual fund's shares change daily. When investors buy funds, the management company issues more shares for the buyers. The new shares are continuously issued for investors every business day, and the number is not limited. When the share owner pulls money out of the fund, the share numbers decline. The price of open-end fund is calculated by the NAV (net asset value) at the end of day.

Closed-end funds are publicly traded funds. Unlike open-end funds, the management company issues a fixed number of shares to the public. Then, the shares are traded in the secondary market, the same as stocks. Because a specific number of shares are allowed, no new shares are issued after the initial public offering. As the closed-end funds are traded in the open market, the price is decided by supply and demand.

1.3 Benefits of Mutual Funds

Investors are attracted to mutual funds for many reasons. A mutual fund company recruits investors with common financial goals to gain greater purchasing power.

1.3.1 Diversification

A fund portfolio is the holding of securities. A mutual fund portfolio can have various securities including stocks, bonds, money market, or other funds. Diversification is an investment strategy that reduces the risk of one security or business sector failing. A diversified portfolio is safer than a single security because unsystematic risk is reduced.

1.3.2 Professional Management

A professional fund manager or team of management carefully select the securities to buy. Many fund managers have an MBA degree from a top business school or a Ph.D. in

economics. Golec (1996) found that investors should expect better performance from managers with an MBA degree.

The management team spends many hours studying market changes, and managers review companies' financial statements to access potential growth. Professional portfolio managers are allowed to access extensive information that an individual investor can't digest. Because the fund manager objective is to make the portfolio grow in value, his or her skills and knowledge are valuable. A successful fund manager is highly compensated by the fund's expenses and fees.

1.3.3 Lower Costs

The costs for buying a diversified mutual fund are cheaper than paying for individual stocks. It is cheaper to buy a mutual fund than collect individual stocks, bonds, and other securities. For transactions, the costs and expenses are shared by all investors, so the net transactional costs charged to an investor are less (Mobius 2007).

1.3.4 Liquidity

Mutual funds can be easily sold at any time for open-end mutual funds, and for close-end funds. Investors sell closed-end funds on the exchange market. For closed-end funds, the price could be the higher or lower than the issued price as it is defined by supply and demand.

1.4 U.S. Mutual Fund Investors

U.S. investors are saving and investing to achieve their financial freedom. They want to save money to retire or have a bigger home. Naturally, parents want to accumulate college funds for education. Investing in mutual funds is one of tools that helps investors become financially independent.

1.4.1 Mutual Fund Investing Goal

U.S. investors select mutual funds for their immediate financial needs or long-term investment. The Investment Company Institute (2019) found that 89% of total U.S. mutual fund invested assets are held by retail investors. According to the research "Profile of Mutual Fund Shareholders", more than 90% of households who own mutual funds indicated that their saving goal was retirement. Fifty percent of households answered their goal was emergency funds and 28% of them looked for current income (ICI 2019).

Table 1.3 Importance of Factors for Mutual Fund Investors (%)

Retirement	92
Reduce taxable income	48
Emergency funds	50
Education	24
Current income	28
House or other large items	16
Other	7

Source: ICI 2019

1.4.2 Key Factors to Select Mutual Funds

The main criteria that many investors consider is a historical rate of return when they purchase a mutual fund. According to ICI's report "What the U.S. investors consider when they select mutual funds for their financial independency, 2018**,** about 85% of households responded that they looked past performance, and 50% of investors said that fund performance was very important (ICI 2019).

Figure 1.3 What the US investors consider when they select mutual funds

Nine in 10 Mutual Fund–Owning Households Review Fund Performance, Fees, and Expenses

Percentage of mutual fund–owning households, 2018

Legend:
- Very important
- Somewhat important
- Not very important
- Not at all important

	Very important	Somewhat important	Not very important	Not at all important
Historical performance	51	34	7	8
Performance compared with an index	36	43	9	12
Mutual fund rating service	20	35	20	25
Fees and expenses	39	39	11	11
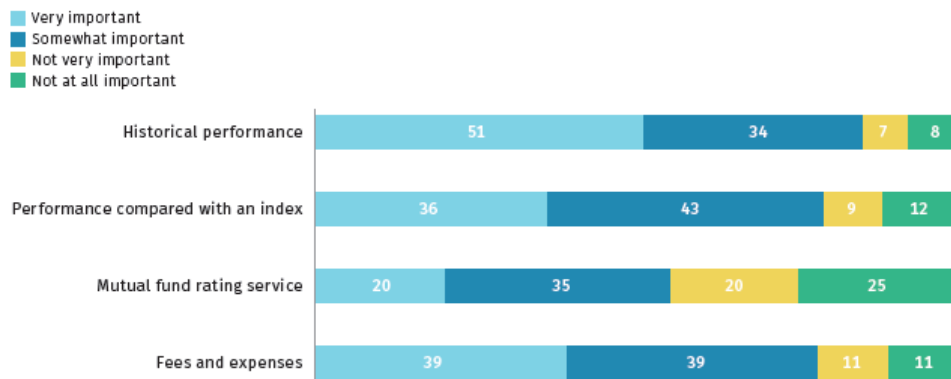
Source: Investment Company Institute Annual Mutual Fund Shareholder Tracking Survey

In 2017, the ICI conducted 2,223 mutual-fund owing households for the "Annual Mutual Fund Shareholder Tracking Survey". Eighty seven percent said that they looked at historical performance when they selected a mutual fund even through past performance does not guarantee of future returns (Robbins 2018). Past performance is one of main criteria that investors use to choose mutual funds. A study also shows that mutual funds with better historical returns tend to perform well in near future years (Ibbotson and Patel 2002).

Using historical returns to predict future return, however, would be a violation of the weak form efficiency, also known as the random walk theory. An article "Random Walk Theory" explains that historical returns and current equity price are not related. Future stock prices are not affected by past events and information (T. Smith 2019). What is random about the return or market is the revelation of new information.

1.5 Thesis objective

Before making an investment decision, U.S. mutual fund owners check a fund's historical performance. Investors want higher returns and look for potential opportunities of

buying a type of fund to make money. They want to know the fund's risks and management structure. Before putting money in, investors want to examine fund size, expense, and sales charges. They are also interested in market risk and fund managers' experience and skills. For this study, the 10-year compound annual growth rates (CAGR) are calculated for 181 open-end U.S. mutual funds with 12% or higher CAGR.

Total returns, rates of return of investment during the evaluation period, are data to measure investment performance. Total return calculates interest, capital gains, dividends and distributions if any, and reinvestment over a specific time period. Morningstar provides an annual total return for mutual funds. In general, Morningstar does not adjust total return for loads for A & C share funds. Total return, however, includes expenses and fees for management, administration, and other costs deducted from the assets.

In this study, the annual total return given by Morningstar used to calculate the CAGR. The total return evaluation period is from January 2009 to December 2018, a historic rising market in the U.S.

The CAGR is a geometric average that represents the rate at which the investment grew if the profits were reinvested at the end of each year. In this study, it is assumed that investors would not take any money out, and any dividends and returns are reinvested during the evaluation period. This study identifies the major factors that affect the 10-year CAGR of the best performing mutual funds.

It is the investor's main interest to find mutual funds that produce good returns. It is also important to know what made a mutual fund experience superior returns than others. Research shows mutual funds with historical good returns perform well in the near years.

The recent top performing funds keep doing well, but funds with poor history outcomes do not make profit (Hendricks, Patel and Zeckhauser 1993).

Studies show that historical performance is a main determinant used to select a mutual fund. The returns on investment in a mutual fund performance are linked with the stock market. Overall, the stock market has experienced a historical bull market for past 10 years (2009 – 2018). Many equity funds performed better than the market bench mark. In this thesis, variables that contribute to a fund's high returns are reviewed. The research examines fund characteristics, risks, and management structure with about 20 variables.

The fund's characteristics include Morningstar rating, asset size, expenses ratio, sales charges, fund age, and security holdings. The risks are statistical numbers like alpha, beta, R-squared, standard deviation, Sharpe ratio, skewness, and kurtosis. The management structure consists with fund's management such as managers' tenure and education, fund turnover, and number of managers.

When the stock market is in a boom period, mutual funds that are linked to equities perform well. The gains, however, are not equally distributed. While some funds make profits, other funds struggle. It is interesting to estimate the CAGR, also called Geometric Average Return (GAR) or Time-Weighted Return (TWR), and investigate the factors that impact GAR the most.

Figure 1.4 Formula for CAGR (or GAR)

$$\text{GAGR} = [(1 + R_1) \times (1 + R_2) \times \dots \times (1 + R_n)]^{1/n} - 1$$

   where:

   R = return

   n = numbers of period (=10)

The TWR measures performance of a portfolio's investment return since the last ending period. Additional investments or withdrawals are not included in the portfolio so investors can directly compare the funds' performance during the time period. All cash distributions if any are reinvested into the portfolio.

CHAPTER II: LITERATURE REVIEW FOR FUND PERFORMANCE FACTORS

2.1 General Characteristics

2.1.1 10-Year Morningstar Rating (Star Rating)

The Morningstar rating (also known as star rating) is a tool to measure a fund's risk-adjusted past performance. The fund is rated by star numbers, the more stars indicate a better return. Five stars is the highest rating. Funds with superior performance get five stars and the poor performers receive one star. The stars are determined by various calculations based on 3, 5, and 10-year returns.

Blake and Morey (2000) discussed that the low rating was related with expected poor performance in the future. Morey (2002) studied funds with longer track records that got higher Morningstar ratings than younger funds. Investors rely on the star ratings. The Morningstar rating with a high rating helps money flow in to the investment. It is natural that mutual fund companies use star ratings for their advertising as investors trust Morningstar research and the star rating system. The Morningstar rating is not a prediction for a fund's future return, however it is a good indication of past performance.

Investors should be careful when they select mutual funds if they use the star rating as a reference. In the 1990s, funds that received a five-star rating lost money three years later. Morey (2003) indicated that after a five-star rating, a fund's risk levels increased and the performance became worse than before the five-star rating. When investors select funds that recently received a five-star rating, they should carefully review the funds for next three years.

Blume (1998) discussed that it was harder for funds with a long history to get five stars than funds with a short history. The research further discussed that funds without sales

charges (no-loads) and diversified funds likely get four or five stars. The rating system was more favorable for the U.S. equity funds than international or global funds.

The number of stars is decided by Morningstar's systematic calculation. Morningstar uses both risk and return. Morningstar examines the risk-adjusted return for each fund's category. The funds in the top 10% get five stars. The next, 22.5% get four stars and the 35% in middle group get three. Lastly, 22.5% get two stars, and the worst 10% get one star (Benz 2005).

2.1.2 Fund Asset Size

Ferreira, Miguel and Ramos (2006) explain the relationship of fund size with performance. They studied 10,568 open-end actively managed equity funds in 19 counties from 1999 through 2005. The results show that larger funds outperformed smaller funds because of the benefit of significant economies of scale.

Indro, et al. (1999) indicate that fund size affects mutual funds' performance. Mutual funds should obtain a reasonable fund size for enough investment return to offset marketing and transaction expenses. The result comes from a study of 683 non-indexed US equity funds between 1993 and 1995. However, it is noted that marginal returns are less as the asset size got larger than its optimal asset amount.

Tangjitprom (2014) explains the effect of mutual fund size and performance on actively managed equity mutual funds in Thailand during 2006-2012. Fund size and performance is highly correlated. The study shows that there is an optimal size of mutual fund for marginal returns and a quadratic relationship is found. For small size funds, the performance improves as fund size becomes larger. However, for large funds, as the fund assets grow, the return decreases because of diseconomies of scale.

Berk and Green (2004) also address the diseconomies of scale. While new money flows in successful mutual funds, the size gets bigger and performance becomes worse.

Research explains fund size and expenses. For large funds, the expense ratio should lower as overall costs decrease. Lower expenses and costs help funds perform. Larger funds are likely to perform well because they have a lower expense ratio (Elton, Gruber and Blake 2012).

P'astor, Stambaugh and Taylor (2015) find that funds with a small size of assets and high fees perform well. The high expense funds pay back with high adjusted returns. When a fund charges high fees, managers provide greater skills to find profit opportunities with a greater turnover ratio.

2.1.3 Fund Class and Load (Sales) Charges

Morningstar does not adjust load charges for calculating total return. In this study, however, load charges are applied to find the sales charge adjusted return. Investors pay sales charges or commissions when they purchase a fund from a brokerage firm. The broker takes a portion of the money for his or her compensation.

The sales charges are called "loads". No-load means investors purchase funds directly from a company without a brokerage firm. The usual load rates are 3% to 5.75% (Becker 2019). There are different types of classes of funds and each class has its own load charge schedule (see Table 2.1).

Table 2.1 Class Types and Loads

Class	Load	Description
A	Front Load	A with 4 ~ 5.75% sales charges One-time charges applied at purchasing
B	Deferred Load	Sales charges applied each year with surrender schedule The charges are decreased with the time invested
C	Level Load	Sales charges recurring, 1% per year
D	Level Load or No-Load	Available from mutual fund supermarkets for direct purchase Transaction fee applied 0% front load, 0% deferred load
I	No Load	For large institutional buyer $1 million or more investment needed
M	Front Load	Available for institutional investors Lower front load, 0 to 1 and 3.5% Minimum investment $50,000 or higher required
N	No Load	Frond load 0%, deferred load 0% Larger initial investment required
R	No Load	Funds for retirement plans

Note. No-Load: funds without front of end sales charges
Source: www.morningstar.com (Morningstar Research Services LLC)

Houge and Wellman (2007) mention that the load fund tends to ask investors to pay higher expenses. As a result, investors who pay loads receive lower returns over time as the expenses are applied before obtaining fund shares.

Apap and Griffitch (1998) document the relationship between the performance of equity mutual funds and the expense and sales charges. When the stock market is volatile,

the sales charges helps to reduce unnecessary expenses and promote marketing efforts. Thus, funds with sale charges could outperform. Grinblatt and Titman (1994) find that sales loads are statistically positively related with performance for 279 equity mutual funds from 1975-1984.

2.1.4 Fees & Expenses

The ICI indicates that fees are a good selection tool when selecting mutual funds. ICI's research "Annual Mutual Fund Shareholder Tracking Survey," finds that fees and expenses are the second most important measure when purchasing a mutual fund. Seventy nine percent of the survey respondents agree that fees are somewhat important. A mutual funds' expense structure is listed in in Table 2.2.

Research from analysts at Morningstar and asset managers at Capital Group found that fees were one of the most reliable factors for selecting well-performing mutual funds. The Morningstar study (2016) documented that "funds in the cheapest fifth of the mutual fund industry were three times as likely to survive and outperform their benchmarks as the most expensive fifth of the mutual fund" (Robbins 2018).

Ferreira, Miguel and Ramos (2006) reveal that funds that had higher fees had higher returns as the expensive funds were managed by an individual manager with more experience. P'astor, Stambaugh and Taylor (2015) identified funds that had a high-fee had greater ability and skill to find profit opportunities.

Golec (1996) found that funds with low fees and more diversified portfolios perform better and funds that had lower administrative fees for legal, accounting, processing comparatively performed well. However, high management fees suggested superior investment skills and those funds led the better performance results.

Table 2.2 Fund's Expense Structure

Expense (Recurrent Cost) from NAV
Management fees
Administrative service fees
Legal expenses
Accounting fees
Shareholder service fees
System and processing fees
Custodian and transfer costs
Other costs
Audit fees
Directors fees
Interest costs
12b-1 fees: marketing or distribution fees
Load (Sale) charges
Transaction costs

Gil-Bazo and Riz-Verdu (2009) argue that funds with higher fees underperform, and fees are highly negatively correlated with returns. The study explains the reason why investors are sensitive about fees when they look for outperforming funds.

Hooks (1996) examines 1,012 mutual funds to find the relationship between a fund's sales loads, annual expenses, and returns. While funds with lower expenses outperform, funds with loads do not make better returns to overcome the sales charges in comparison with no-load funds. Load funds with low expenses perform better than no-load funds with high expenses. As a result, for a fund's performance, expenses play a more important role than the load charges.

Droms and Walker (1996) elaborate that investment return is not affected by asset size, turnover rate, or load charges, but higher expenses are related with higher returns for 151 equity mutual funds during 1971 – 1990. Babalos, Kostakis and Philippas (2009) examine Greek equity mutual funds and found that a fund's performance is negatively

related to its expenses. Carhart (1997) found that fund performance is related to expenses and transaction costs. The author concludes that high fees help companies increase profit and decrease investment returns.

2.1.5 Fund Age

The fund age is the years since a fund's inception date. A fund's longevity can explain a manager's ability. The fund age and performance can be both positively or negatively related. The younger mutual funds can act instantly when the market moves with volatility, but they might suffer from their brief historical background. Usually younger funds require higher costs in the early years (Ferreira, Miguel and Ramos 2006).

For mutual fund investors, it is valuable to know the relationship between mutual fund age and performance. If age and returns are negatively correlated, it is not a wise decision to delay buying a young mutual fund (Moore 2016). Shi (2013) cites research by Babalos, Kostakis, and Philippas (2009) that fund age and mutual fund performance are positively and statistically significant related.

Webster (2002) examines established funds with an extensive experience and returns are negative related. As a fund gets older, the market adjusted return becomes worse. Ferreira, Miguel and Ramos (2006) studied the determinants of open-end actively managed mutual fund performance and age for 19 different countries for a sample of 10,668 funds from 1999-2005. They conclude that if the fund focuses on the global market, international funds with a younger age are producing higher returns.

2.2 Risk

According to Robbins (2018), most mutual fund investors consider both a fund's objective and risks when they select investment choices. About 40 percent of households

agree that risk and objectives are very important for their fund selection. From 5,000 U.S. households, only 22 percent are willing to take above-average risk for above-average gains.

2.2.1 Alpha

In modern portfolio theory, fund analysts use alpha, beta and R-squared to explain a mutual fund's risk (Mobius 2007). Alpha is a vehicle to measure a fund's performance and it is the excess return over its market index. The alpha is the extra value that a fund manager generates over the fund's expected return. A higher alpha shows that the fund manager has a higher risk adjusted return than its benchmark. Ibbotson and Patel (2002) explain the fund managers' exessive returns for the U.S. equity mutual funds. They evlauate the adjusted alphas for the funds that consistantly outperform. It is found that managers with a greater than 10% alpha tend to continue to produce successful performance and they are ranked in the top 5% by alpha.

Dhanorkar (2018) documented that investors check managers' higher alpha when they select outperforming funds. Irvine, Kim and Ren (2018) indicate that investors prefer fund managers who show a high active alpha. The active alpha is persistent and related with higher returns. After investigating 2,838 U.S. diversified equity mutual funds that were actively managed during 1983-2014, they find that investors chose fund managers who exhibit high active alpha performance.

2.2.2 Beta

Beta indicates the measurement of sensitivity of a mutual fund's return to the returns of a market index. The 1.0 beta indicates a fund's volatility is the same as the market index. If the beta is greater than 1.0, then the fund's returns are more volatile than the benchmark.

According to financial theory, securities with high beta greater than 1 produce higher returns during market upswings but lower returns during maket downswings. Fletcher's study for the international stock market during 1970 – 1998 is consistent with the theory of beta. During bull markets, high beta returns are higher, but returns are lower for bear market years (Fletcher 2000).

Tang and Shum (2003) recommend that beta is an useful risk indicator for fund managers to make optimal investment decisions. They examine the relationship between beta and returns in the international stock market during January 1991 to December 2000. The research finds that beta is significantly related with market returns during up and down market periods. Stocks with a high beta make positive excess return during up markets, but there are negative market excess returns in bear markets.

2.2.3 R-squared

Sector funds have a lower R-squared, and index funds have high R-squared close to 100 percent. R-squared refers to whether a fund's price change is correlated to the benchmark index. The scale is from 1 to 100. A fund that mirrors the index movement would have an R-squared of 100 as fund's performance can be explained by the index.

Amihud and Goyenko (2013) examine a mutual fund's monthly returns from 1988 to 2010 and explain the fund's performance by R-squared (R^2). The funds with a lower R^2 outperform. Funds size and R^2 are positively related. However, R^2 is negatively correlated with expenses and manager's tenure.

Chang and Luo (2010) examine the correlation between R^2 and expected returns of stocks from July 1966 to June 2008, and found that returns and R^2 are negatively related. Stocks with a lower R^2 achieve the higher future performance. The average return of low R^2 stocks is 0.39 higher than the stocks with high R^2.

2.2.4 Standard Deviation

Beta measures the volatility of returns while the standard deviation estimates the variability of returns for non-diversified portfolios. Standard deviation measures total risk, while beta calculates systematic risk. A higher standard deviation indicates a fund moves more than the average on both upside and downside.

It is important to understand standard deviation and risk when selecting mutual funds. Helveston (2016) recommends that investors select funds with a lower standard deviation if investors are not able to react well as market moves.

2.2.5 Sharpe Ratio

Bacon (n.d.), the chairman of StatPro document that Sharpe ratios (Sharpe 1966) are commonly used for risk-adjusted performance. The Sharpe ratio can be expressed as below in Figure 2.1.

Figure 2.1 Formula and Calculation of Sharpe Ratio

$$\text{Sharpe Ratio } SR = \frac{r_P - r_F}{\sigma_P}$$

where:

r_P = portfolio return normally annualised

r_F = risk free rate (annualised if portfolio return is annualised)

σ_P = portfolio risk (variability, standard deviation of return) again annualised if portfolio return is annualised

Schmid and Schmidt (n.d.) document that the Sharpe ratio indicates how well a portfolio creates profits for given risk. For the mutual fund industry, funds are listed and ranked by Sharpe ratios, and investors should select funds with a high Sharpe ratio. With the same benchmark and risks, it is expected that the funds with a higher Sharpe ratio produce a higher return.

2.2.6 Treynor Ratio

The Treynor ratio is like the Sharpe ratio. The Sharpe ratio uses standard deviation for total risk, the Treynor includes beta to measure systematic risk (see Figure 2.2). Even though the Treynor ratio is a risk measure, it is used less because it does not consider unsystematic risk, as also called specific business risk.

Figure 2.2 Formula and Calculation of Treynor Ratio

$$\text{Treynor Ratio} = \frac{r_P - r_F}{\beta_P}$$

2.2.7 Skewness and Kurtosis

Skewness is a measure of a distribution around its mean. Positive skewness shows low values on right side with longer right tail, and negative skewness has fewer low values on left side (Figure 2.3).

Figure 2.3 Left (Negative) and Right (Positive) Skewed

Negative Skew   Positive Skew
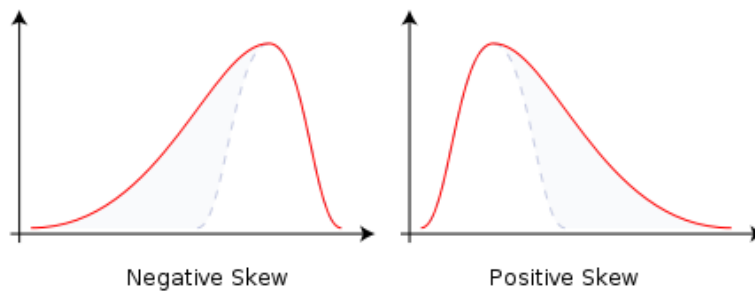
Kurtosis describes the distribution of the observed data from mean. It measures where distributions have a peak compared to a normal distribution. High (positive) kurtosis indicates a high and narrow distribution, and low (negative) kurtosis indicates a flat distribution (Figure 2.4).

Figure 2.4 Kurtosis and Normal Distribution
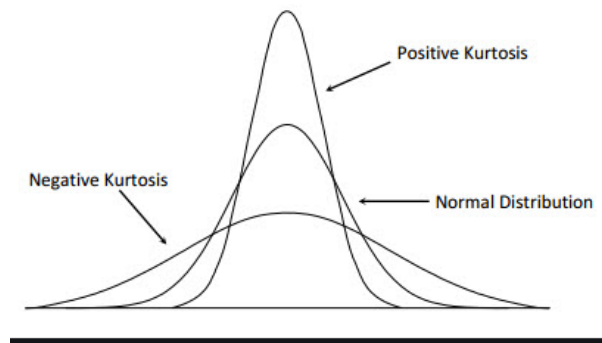
Skewness and kurtosis are important measures. Investors may expect future returns around the standard deviation with a normal distribution. Most investments, however, are not normally distributed and skewness and kurtosis explain the difference from the normal distribution. These are indications if predictions explained by standard deviation are acceptable (EVESTMENT n.d.).

Francis (1975) states that investors who prefer low risk should select investments with positively skewed returns. Ikenberry (n.d.) reviews returns of indivudual stocks during 1962-1995. Funds with positive skewness underperform without some information advantage.

Behavioral financial studies suggest that investors prefer many times of small gains and a single large loss rather than a single win with several small losses. The results of many small returns illustrate the negative skewed (Fusion Investing 2010).

2.2.8 Capture Ratio

The capture ratio is a measure of an investment manager's active return during both upside and downside markets. If the upside capture ratio is higher than 100, the investment gains more than the market index. If the downside capture ratio is lower than 100, the equity loses less than its benchmark (Morningstar 2020). The upside and downside capture

ratios are indications of a manager's ability if he or she can produce more returns than the benchmark (Ferguson, Meidan and Rentzler 2014).

Kuhle and Lin (2018) examine 268 mutual funds: U.S. real estate equity funds, U.S. equity value funds, and global real estate equity funds. After comparing the Morningstar capture ratio and the Sharpe ratio, they found real estate fund returns are affected more by the capture ratio than the Sharpe ratio.

Marlo and Stark (2016) find that the capture ratio supports better returns in upside markets and less losses in downside markets. For outperforming funds, it is shown they have higher upside capture ratios. There is a significant positive relationship for the upside capture ratio and outperforming mutual funds. Further, they note that money inflows and outflows are highly related with both capture ratios. The relationship indicates that investors use the capture ratio when they change their investments.

2.3 Management

Management style and characteristics of fund managers affect a fund's performance, risk and fees. Some of these characteristics are the manager's age, tenure, performance and education level (Bliss, Potter and Schwarz 2008), (Golec 1996).

2.3.1 Management Tenure

Golec (1996) finds when given conditions are equal, younger managers with a MBA education outperform. It is also found that the fund managers' employment years are the most significant factor to predict fund performance. Ferreira, Miguel and Ramos (2006) and Webster (2002) discover manager tenure and fund return is highly related. The funds outperform and returns are high when they are managed by more experienced professionals.

2.3.2 Number of Managers (Team Management)

Bliss, Potter and Schwarz (2008) review 3,000 equity mutual funds for 12 years. They discover that over 50% of the funds are managed by a team. The authors examine whether performance managed by the individual manager is different from funds managed by teams. The fund growth of team management is higher. Even though risk-adjusted performance is not significantly different between two styles, team managed funds had less risk and lower turnover ratios. Further, team managed funds have a lower cost, by 0.5 percent less per year. As a result, team-managed funds are more attractive to investors because of outperformance and risk control, and less expenses.

According to Baer, Kempf and Ruenzi (2005), team management is becoming more popular in the mutual fund industry. The authors examine the funds' structure, management behavior, management style and performance. They find that funds managed by teams have significantly lower unsystematic risk, less extreme investment style, and more stability over time. For fund performance, however, team managed funds are negatively impacted even though the funds produce consistent returns.

Karagiannidis (2010) examines if team structure impacts funds' performance for open-ended mutual funds from 1997-2004. It is found that single-manager funds underformed during the bear market from 2001 to 2004 with no differences in the 1997-2000 bull market. Bliss et. al. (2008) investigate 3000 equity mutual fund for 12 years. They find that a team managed fund had 0.5 percent lower cost than those managed by single manager.

2.3.3 Turnover Ratio

The turnover rate explains how often holding securities are traded. It is measured of the percentage of security changes for the entire year. A turnover rate of 100% indicates that the entire portfolio is changed within a year. A rate lower than 30% is considered as a "buy-and-hold" strategy. Turnover more than 100% is an indication that managers buy and sell securities frequently.

High turnover rates create more transaction costs for commissions and fees and they decrease the fund's return. The high turnover, however, does not always negatively affect fund performance. As necessary, active fund managers need to achieve the short-term profit goal. If a fund manager has an ability to identify the right time to invest in and out, it results high turnover and high return (Mobius 2007).

Bliss, Potter and Schwarz (2008) found if managers prefer less risk, then the turnover rate is significantly low. Droms and Walker (1996) document the relationship between performance and turnover rate. Actively managed funds show high turnover and they outperformed in comparison with passively managed index funds. Wermers (2002) finds that funds with stocks generate a 1.3 percent higher annual return than the benchmark, however, their net returns are one percent lower. The gaps are 2.3 percent. This results in 0.7 percent from the underperformance of nonstock holdings, and expenses and transaction costs decrease 1.6 percent.

Wu (2014) examines 170 open-end equity funds in Taiwan during 2003-2012 and finds that funds with high turnover underperformed. Likely, lower turnover portfolios show superior performance to funds with high turnover. The research explains that active trading decreases fund return, and managers with poor performance make unnecessary trades to

keep their career. P'astor, Stambaugh and Taylor (2015) find that if mutual funds are actively managed with high turnover ratio, then their performance is also high.

2.3.4 Number of Holdings

Understanding holding types of a mutual fund is critical to examine an investment manager's behavior. Cash holdings of equity mutual funds lowers performance. However, it allows managers to make quick investment decisions on interesting securities and timing. Simutin (2014) addresses that while managers with low cash holdings suffer from costly unexpected sales, managers with with high cash holdings are more flexible and able to control fund transaction costs.

It is a managerial decision to hold a number of stocks in a portfolio. Smith and Shawky (2005) conduct a research for U.S. equity mutual fund portfolios from 1992-2000. They find there is a significant quadratic relationship between number of stock holdings and risk-adjusted returns. To achieve maximum marginal returns, there are optimal number of stocks for a mutual fund. Even though diversification is beneficial, the benefits are high to offset transactional and monitoring costs.

2.3.5 MBA

Fund managers ability and knowledge are related to mutual fund performance. Chevalier and Ellison (2002) study the correlation between returns and manager's education. They find the managers with higher education produce higher risk adjusted excess returns. Fang and Wang (2015) and Golec (1996) research how fund manager characteristics are related with a fund's performance and management style such as risk, timing skills, and stock-picking ability. They discover that the fund manager with an MBA degree or CFA have a better stock-picking ability and have higher excess returns.

Gottesman and Morey (2006) found managers' education and mutual fund performance are correlated. Managers with an MBA from the top business schools ranked by *Business Week*, demonstrate a higher return than both managers without an MBA and an MBA holder from unranked schools. In addition, the authors address that CFA, non-MBA master's degree or Ph.D., are not related to mutual fund performance.

2.4 Hypothesis Development

2.4.1 Asset Size

Asset size is a critical area to examine. Fund size and performance is highly correlated. There are several advantages for large size mutual funds. As fund size gets larger, the marketing and trading expenses decrease. The larger funds have lower expense ratios. Also, because of economies of scale, larger funds perform better than smaller funds.

Larger funds are allowed to get a discounted trading rate. Larger funds enjoy benefits that are not provided to smaller funds. Small funds, however, make a quick investment decision for buying and selling their position at critical time. Considering the advantages given to larger funds, the following hypothesis is tested:

Hypothesis 1: Fund size is positively related to the mutual fund return.

2.4.2 Sales Charges & Expenses

Sales charges and expenses are reviewed when an investor selects funds. Research finds that fees and expenses are negatively correlated with a fund's performance. Fund managers are compensated based on managed asset size and the asset gets larger the fees and expenses to investors are decreasing. Managers try to bring new net assets under management for higher compensation. Investors are looking for better returns so the funds with superior performance are likely to get additional assets.

Houge and Wellman (2007), Apap and Griffitch (1998) found that the funds with high load charges produced lower returns. According to Robbins (2008), and Golec (1996), funds with lower fees are likely have higher potential to survive and perform well. Therefore, the following hypothesis is tested:

Hypothesis 2: Fund sales charges and expense ratio are negatively correlated with fund performance

2.4.3 Turnover Ratio

Turnover ratio is one of the factors that investors consider. A fund with high turnover indicates that it is frequently traded. Droms and Walter (1996), Wemers (2002), and Mobius (2007) document that the turnover ratio is positively related to fund performance. While several researchers found that high turnover results in better performance, Wu (2014) found that high turnover does not result in a better return. As a fund's holdings are traded, the transactional costs are charged and taxable events occur.

In this study, the average turnover rates are 66% for selected funds. A rate of less than 30% indicates that the fund has a buy-and-hold strategy. If the turnover rate is more than 100%, it is considered high turnover and a fund manager trades frequently (Mobius 2007). It is assumed that high turnover does not produce high return. For the select actively managed mutual funds, the following hypothesis is predicted:

Hypothesis 3: Fund turnover ratio is significantly negatively related to fund's performance.

2.4.4 Risks

Investors with high risk are compensated by higher return. There are several statistical measures to analysis investment risk and volatility of mutual funds. They are alpha, beta, R-squared, standard deviation and the Sharpe ratio.

Ibboston and Patel (2002), Irvine, Kim and Ren (2018), Flecher (2000), Amihud and Goyenko (2013), and Schmid and Schmidt (n.d.) explain the relationship between risk and return. One trading principle is "the risk-return tradeoff". High risk is associated with high potential earnings. Investors with high levels of uncertainty can expect higher profits. Only investors that are willing to take a higher possibility of losses can have higher returns (Chen 2020). As a result, the hypothesis is tested:

Hypothesis 4: Statistical risks are significantly correlated with fund return

2.4.5 Management Tenure

It is interesting to know if management tenure influences mutual fund performance. Golec (1996) and Ferreira, Miguel and Ramos (2006) address the relationship between management tenure and fund performance. Managers who have a longer period of management of funds provided higher returns. The following hypothesis is tested:

Hypothesis 5: Management tenure impacts on fund return.

2.4.6 Team management

Mutual funds are managed by either a single manager or team management. Bliss, Potter and Schwarz (2008), Baer, Kempf and Ruenzi (2005), and Karagiannidis (2010) examine that historical performances of mutual funds by management style. For a fund managed by a team, both expenses and risks are lower than a single management fund. In the fund industry, team management is a more common style. This suggests the following hypothesis:

Hypothesis 6: Management style, whether it is team or single management, impacts on fund performance.

2.4.7 Fund Manager Education

Education and fund management is highly related. Gottesman and Morey (2019) find that fund managers who have higher SAT scores are more likely active than those with lower SAT scores. There are 446 funds managers shown for the 181 selected mutual funds. Of these, 48% of them earn an MBA degree, 4% have a Ph.D. and 9% have a Master's degree. Overall, 64% of them have post college education.

Seventy two percent of MBA degree holders studied in top 20 business schools ranked by *U.S. News* (US News 2020). As for gender, 91% of the fund managers are male. For further research, following hypothesis is presented:

Hypothesis 7: Fund managers with an MBA education produce higher returns.

CHAPTER III: DATA

3.1 US Open-End Mutual Funds

This thesis examines U.S. open-end equity mutual funds with active management. The primary data source is Morningstar and the Yahoo! Finance website. Morningstar, a global financial services firm, provides research information for U.S. stocks and mutual funds. Morningstar analysts spend much of their time on new within a portfolio profile, managers activities, and strategies (Benz 2005). Like Standard & Poor's, Lipper and Value Line, Morningstar provides a fund ranking to investors to compare funds with other funds with similar goals (Mobius 2007). Yahoo! Finance's "lookup" tool allows accessing a security's historical returns and statistical risks.

Morningstar's search tool is called "Morningstar screener". It is a basic fund screener that allows investors to find and filter mutual funds by their categories, ratings, or performance. There are 4,651 open-end mutual funds inside Morningstar screener's data and 181 funds are selected for the thesis analysis. The selected 181 funds can be grouped by 51 fund families. A mutual fund company manage several funds with various investment objectives and different sales charges. The fund selection processes are following:

- Accessing the Morningstar screener, employees of investment firm or authorized individuals accessible at https://awrd.morningstar.com/advisor/login/; or any individuals accessible at http://screen.morningstar.com/fundselectoraol.html

- Selecting "Mutual Funds" on universe tool. With selection of "Mutual Fund", only open-end equity mutual funds are shown. ETFs, Closed-End Funds, and Money Market Funds are excluded.

- Selecting "10-Year Performance" and sorting descending.

- Selecting the top 181 funds sorted by 10-year average returns during 2009 – 2018. The 10-year average returns ranges are from 12% to 25%.

Morningstar provides an "Investment Summary Report" that summarizes an investment's fundamental characteristics in two pages. It delivers the facts with portfolio information, holdings, and average annual total returns. Morningstar calculates total return by taking the year change in price, reinvesting all income and capital gains distributions during the year, and dividing by the starting value. Morningstar usually does not adjust for sales charges such as front-end loads, deferred loads, and redemption fees. So, the total return would be reduced if those charges were applied. Management and administrative fees are removed from the fund's assets.

3.2 Compound Annual Growth Rate (CAGR)

Morningstar calculates total return without subtracting load charges. In this study, load charges for A and C share funds are fully adjusted before calculating the total return and CAGR. The average annual total returns are used to calculate the Compound Annual Growth Rate (CAGR), which is also called Time Weighted Return (TWR), over the ten-year time period. CAGR is a rate of return for an investment from its beginning asset price to its ending asset price assuming the grains were reinvested at the end of each year.

CAGA is a geometric average return that the investment would have grown if the investment had compounded at the same rate each year. The TWR is a portfolio accounting method that measures investment performance based on income and price changes. TWR eliminates the effects of additional cash inflows and outflows during the period. It is a main tool to evaluate the performance of the portfolio manager. The formula is below:

Figure 3.1 Time Weighted Return

$$TWR = [(1 + HP_1) \times (1 + HP_2) \times \cdots \times (1 + HP_n)] - 1$$

where:

$TWR =$ Time-weighted return

$n =$ Number of sub-periods

$HP = \dfrac{\text{End Value} - \text{Initial Value} + \text{Cash Flow}}{\text{Initial Value} + \text{Cash Flow}}$

$HP_n =$ Return for sub-period n

Source: Investopedia (Investopedia 2020)

After the calculation, it is found that ten-year CAGRs are higher than the indices. The 10-year average rates range from 12% to 25% during 2009-2018. During this period, the CAGR of stock indices are 10.75% (S&P 500), 15.45% (NASDAQ), and 11.11% (Russell 2000). The statistics for the dependent variable (CAGR) are 15.99% (mean), 25.64% (best performing fund's 10-year average return), 11.73% (worst performing fund's 10-year average return), 1.97%. (standard deviation).

3.3. Selected 181 Sample Funds' Details

For analysis, various independent variables are obtained and are sorted by three groups. The independent variables are used to explain the 181 sample funds' 10-year performance from 2009 to 2018 (in-sample) and used to predict the 2019 yearly performance.

1. Independent Variables Group I (General Characteristics): Morningstar Rating, Asset Size, Gross Expenses Ratio, Fee Level, Load/No-load Funds, Industry Categories, Investment Style, Turnover Ratio, Minimum Investment, Fund Classes

2. Independent Variables Group II (Statistical Risks): Alpha, Beta, R-squared, Standard Deviation, Sharp ratio, Treynor, Skew, Kurtosis, and Upside and Downside Capture Ratio

3. Independent Variables Group III (Managerial Factors): Manager Tenure, Number of Managers, MBA degree

3.3.1 Group I: General Characteristics

The financial, Morningstar and Yahoo! Finance, websites provide a fund's detailed information. Most of fund's general information such as star-rating, assets under-management and gross expenses are collected from the Morningstar. For Morningstar ratings, 80% out of 181 funds are ranked 4 or 5 stars and the details are below Table 3.1.

Table 3.1 Morningstar Star-Rating

Star-rating	# of Funds	%
5 Stars	64	35.36%
4 Stars	83	45.86%
3 Stars	15	8.29%
2 Stars	19	10.50%

Morningstar has also developed a fee level measure to help investors compare a fund's fees with those of similar investments within U.S. mutual funds. The following formula (Figure 3.2) is used to determine the percentile rank of an expense ratio and percentile is marked from 1 (best) to 100 (worst).

Figure 3.2 Morningstar Rank of Expense Ratio

$$PctRank\,(v[i]) = Roundup\{100 * \left((C[i]-1)\Big/(n-1)\right)\}$$

where:

PctRank(v[i]) = Percentile rank for fund i
v[i]   = The value being ranked for fund i
C[i]   = The absolute rank of fund i
n   = The total number of observations

Range	Quintile	Word Label
0 < Percentile Rank <= 20	1	Low
20 < Percentile Rank <= 40	2	Below Average or -Avg
40 < Percentile Rank <= 60	3	Average or Avg
60 < Percentile Rank <= 80	4	Above Average or +Avg
80 < Percentile Rank <= 100	5	High

Source: Morningstar, Inc.

In selected 181 mutual funds, one out of two funds (48.06%) is recorded for funds either "below average" or "below".

Table 3.2 Morningstar Fee Levels

Fee Rating (Quintile)	# of Funds	%
High (5)	21	11.60%
Above Average (4)	22	12.15%
Average (3)	51	28.18%
Below Average (2)	46	25.41%
Below (1)	41	22.65%

Morningstar reports also whether a fund has a load (sale charges) or not. For analyzing, no-load funds are marked as "0", and load funds are input as sales charges shown, 1% for C shares and 3-5% for A shares. In the data, there are 88 no-load funds (48%) and funds with load are 93 (52%).

Morningstar has developed category classifications since 1996. The system helps investors to make significant comparisons between mutual funds. Morningstar periodically reviews the categories so a fund is actually investing as the investment objective stated in its prospectus. In the U.S., there are 122 categories (Morningstar (b) 2016). From the data, the categorized groups are shown as Table 3.3. More than 33% of 181 outperforming funds are large cap funds, and 62% are growth funds.

Table 3.3 Morningstar Category

Category	# of Funds	%
US Large Cap Growth	60	33.15%
US Small Growth	32	17.68%
Technology	26	14.36%
US Mid Cap Growth	22	12.15%
Health Care	21	11.60%
Real Estate	4	2.21%

Morningstar uses a style box, with nine squares that represents a mutual fund's characteristics, to evaluate a fund. There are two factors determined: market capitalization and the fund manager's investment style. There are three market capitalization categories; large-cap, mid-cap, and small cap. Funds focus on large companies with market capitalization $10 billion or above are placed in the large cap, funds that buy mid-cap (with $2 billion to $10 billion) stocks are in the middle, funds with small-cap (less than $2 billions) are in the bottom row.

Growth fund investors are looking for earnings growth and capital appreciation as holding companies reinvest earnings into expansion. Most growth funds provide higher potential capital appreciation but the risk is higher than average. Value funds have limited upside potential and are safer than growth funds. Value fund investors expect dividend gains rather than price growth.

Figure 3.3 Morningstar Style Box

Value	Blend	Growth	
			Large
			Mid
			Small

It is found that 91% of the funds are placed growth category and most of them (61%) are large-cap while large-cap value funds are only 1.6%. It is shown that growth funds outperform to value funds during the bull market from 2009 to 2018 (Table 3.4).

Table 3.4 Morningstar Style Box

Category	# of Funds	%
Large Growth	112	61.88%
Mid Cap Growth	39	21.55%
Small Cap Growth	18	9.94%
Large Balanced	4	2.21%
Mid Cap Balanced	4	2.21%
Large Value	3	1.66%
Small Cap Balanced	1	0.55%

While some mutual funds have no minimums, most retail funds require an initial minimum investment and institutional funds require at least $1 million or more. The larger investment requirement provides a discount for fees so the larger minimum may affect fund performance as fees are lower than others. James and Karceski (2006) found that funds

with low initial investment requirements performed significantly worse than other funds after adjusting for risk and expenses.

Reviewing the sample data, only 37 funds out of 181 have a $1 million minimum initial investment requirement. There are 58 funds with A share classes and 30 funds with C share classes. A total of 88 funds are load funds (A&C class) that require extra sales charges.

3.3.2 Risk Factors

The risk factors such as alpha, beta, R-Squared, standard deviation, the Sharpe ratio, and Treynor ratio are gathered from Yahoo Finance. It provides 3-year, 5-year and 10-year average risk statistics. The 10-year average measures are used for this analysis. The Upside/Downside Capture ratios provided by Morningstar are accessed after 2019. Unlike other statistical risks, the capture ratios are not 10-year average numbers and the ratios are adjusted as the portfolio is reallocated.

3.3.3 Managerial Style

Management information is obtained from the Morningstar website. It provides a fund's inception date, number of managers and average tenure of management team. The fund managers' detail information is also presented such as names, career, experience, educational background.

In the financial industry, many mutual fund managers have post college degrees and professional designations. It is interesting to determine if a Master of Business Administration (MBA) degree or Chartered Financial Analyst (CFA) qualification is significantly associated with a fund manager's performance. For the sample data, there are total 181 fund managers and 64% of them have post college education including 86 managers with an MBA (Table 3.5).

Table 3.5 Fund Manager's Post College Education

Education of Fund Manager	# of manager	%
MBA Degree	86	48%
(Top 20 MBA)	62	72%
Ph.D.	7	4%
MD	5	3%
Master	17	9%

It is expected that fund managers from top ranked MBA schools perform better than MBAs from other schools. The 62 fund managers with an MBA studied in the top business schools ranked by *U.S. News.*

Table 3.6 Fund Manager's MBA School

MBA Schools	Manager
Columbia University	13
University of Pennsylvania	8
University of Chicago	7
Harvard University	6
Northwestern University	5
University of Virginia	5
Stanford University	4
University of Southern California	3
New York University	3
University of Michigan	2
UC Berkley	2
Yale University	1
Dartmouth College	1
Duke University	1
Cornell University	1
Total	62

CHAPTER IV: DATA ANALYSIS

In this research, a fund's performance is dependent variable and fund characteristics are independent variables. The independent variables (Table 4.1) explain the numeric values of the 22 factors and how they are calculated and presented for data analysis.

Table 4.1 Independent Variables

Variables	Description	Mean	Max.	Min.	Std. Dev.	Remarks
Star ratings	Morningstar Star rating	4.17	5	1	0.79	1 = worst, 5 = best
Asset Size	Amount managed	4,864	61,008	114	8,069	$ millions as of May 2019
Net Expense	% of asset	1.13	2.36	0.48	0.4	
Load Charges	% of Purchasing or asset value	1.95	5.75	0	2.43	sales charge at purchase or after
Turnover Ratio	% of holding stock change	66.40	436	5	84.21	
Minimum Investment	Initial money required	0.40	5.00	0	1.07	$ millions
Alpha	Numeric values	3.19	13.1	-2.36	3.44	
Beta	Numeric values	1.07	1.3	0.72	0.12	
R-squared	Numeric values	74.18	96.39	34.03	13.53	
Standard Deviation	Numeric values	16.06	23.37	12.91	1.94	

Sharpe Ratio	Numeric values	1.01	1.97	0.68	0.14	
Treynor	Numeric values	14.67	21.57	1.33	2.71	
Skew	10-year performance measurement	0.46	1.71	-0.41	0.36	result from excel analysis
Kurtosis	10-year performance measurement	-0.7	2.99	-2.11	1.01	result from excel analysis
Upside Capture Ratio	%	117.2	174	91	11.19	
Downside Capture Ratio	%	103.1	146	49	20.43	
Management Fees	% of asset	0.68	1.29	0.2	0.19	
Average Tenure	Years of management	12.16	51.42	0.92	8.01	
Number of Managers	Fund manager	2.46	9	1	1.75	Team management
MBA (%)	% of MBA in management	0.43	1	0	0.4	446 fund Managers
Number of Holdings	Number of stocks inside fund	84.73	285	5	49.67	
Fund Age	Years since inception date	20.99	81	10	10.46	

The capture ratios and management fees are excluded from the data analysis. The up/down capture ratios are similar to the funds' beta, and management fees are already accounted for in the adjusted expense ratio. To avoid multicollianry issues, these three variables are not used.

4.1 Data Analyis Proceducre

The independent and dependent variables are analyzed using the Microsoft Excel data analysis tool. Correlation and regression analysis examine how the variables affect funds' compounded average return from 2009 to 2018.

The independent variables are reviewed using correlation anaysis. This methodology estimates the relationship between a fund performance and different independent variables. A higher correlation value indicates that the independent variables (fund's characteristics) tend to be related to higher performance. If the correlation is equal to 1, there is perfect positive correlation while -1 is perfectly negatively correlated. The value close to 0 means no correlation between variables. Table 4.2, 4.5, and 4.8 show the relationship whether the independent variable is positively or negatively related with funds' average performance during the historical bull market from 2009 to 2018.

A simple regression analysis is done for each variable, $y = a + bx$ where y is the ten-year fund performance and x is the indepent factor. This regression helps to estimate the coefficient of a variable and its significant p-value. Multiple regressions are conducted with variables from group I, II, and III to find coefficients of independent variables, R^2, and significant p-value.

4.2 Funds' Characteristics: Group I

4.2.1 Correlation

The relationship between the funds' general characteristics and performance is shown in Table 4.2. The net (adjusted) expense ratio and sales (load) charges are negatively correlated with fund return. The expense ratio is -0.148 and it has a significant p-value lower than 0.05. The load charges are deducted from the investment premium and the fund returns are adjusted. The deductions impact a fund's return and, as a result, the load funds produce inferior performance to no-load funds.

There is a multicollinearity issue between the net (or adjusted) expense ratio and management fees. The management fees are included in the adjusted expense ratio. The two variables are highly correlated with 0.332. Morningstar rating and required minimum investment have a positive correlation, but expenses, fees, sales charges, and fund age are negatively correlated with the performance.

Table 4.2 Correlation between CAGR and Fund's Characteristics

	1	2	3	4	5	6	7
1. Morningstar Rating							
2. Asset Size	0.242						
3. Net Expense Ratio	-0.186	-0.200					
4. Load (Sales) Charges	-0.137	-0.062	0.135				
5. Management Fees	0.058	-0.177	0.332	-0.039			
6. Fund Age	0.014	0.242	-0.155	0.166	-0.218		
7. Required Min. Investment	0.127	-0.051	-0.256	-0.297	0.064	-0.093	
8. CAGR	0.037	-0.066	-0.148*	-0.137	-0.048	-0.014	0.158*

Note. significant level * $p < .05$, **$p < .01$, ***$p < .001$

4.2.2 Simple Regression

A simple regression is estimated to examine how a fund's general characteristics (Group I) influence the independent variable individually. The results from the regressions are shown in Table 4.3.

Table 4.3 Simple Regression of General Independent Variables and the Cumulative Annual Growth Rate

Independent Variable	Coefficient	t Stat	P-value	R^2
Morningstar Rating	0.000	0.48	0.625	0.1%
Asset Size	-0.000	-0.89	0.377	0.4%
Net Expense Ratio*	-0.007	-2.00	0.046	2.2%
Load (Sales) Charges	-0.001	-1.85	0.065	1.8%
Management Fees	-0.005	-0.64	0.518	0.2%
Fund Age	-0.000	-0.18	0.855	0.0%
Required Minimum Investment*	0.003	2.13	0.034	2.5%

Note. significant level * $p < .05$, ** $p < .01$, *** $p < .001$

As funds get larger, investors are charged lower net expenses that benefits funds causing them to outperform (Elton, Gruber and Blake 2012). Small funds may identify market timing and produce outperformance. The simple regression shows asset size is not statistically correlated with return.

The net expense ratio, sales charges, and management fees show negative coefficients. This indicates that the funds that charge high expenses tended to underperform during 2009 to 2018. The net expense ratio has *p*-value under 0.05 that indicates the return is statistically significant while the coefficient of load charges is -0.001 and its p-value is not statistically significant. It is shown that expenses play a more important role than the load charges for funds' return.

The Morningstar rating does not have a statistically significant impact on funds' performance. Morningstar gives star rating based on funds' previous return. Most selected funds have four or five stars. The average stars are 4.17. Performance affects star rating so the star number is not a significant factor in explaining how the funds outperform likely because there is not much variability in the star rating (80% have a 4 or 5 rating).

Fund age is an important factor that investors review before making their investment decision. Newly incepted funds have more challenges to make them attractive

to investors. It would be beneficial for funds with historical track records to bring fresh investable money. From this analysis, the fund age is not a significant factor to funds' performance. The selected funds are already well established and their average ages are 20.99 year with asset undermanagement $4.8 billion.

4.2.3 Multiple Regression

The multiple regression is performed to investigate how strongly fund general characteristics explain fund performance.

Table 4.4 Multiple Regression for the Cumulative Annual Growth Rate and General Characteristics

	Coefficients	Standard Error	t Stat	P-value
Intercept	0.167	0.011	15.85	0.000
Rating	0.000	0.002	0.15	0.882
Asset Size	-0.000	0.000	-1.25	0.214
Expense Ratio	-0.006	0.004	-1.59	0.113
Load (Sales) Charges	-0.001	0.001	-1.27	0.206
Fund Age	0.000	0.000	0.20	0.842
Required Minimum Investment	0.002	0.001	1.13	0.262

Note. R^2=5.4%, *p*-value 0.138, N=181

The multiple regression results (Table 4.4) shows R^2 (5.4%) and *p*-value (0.138). Only 5.4% of data can explain the fund return/s and it is statistically not significant. Like the simple regression, the expense ratio and sales charges are negatively related with fund performance.

4.3 Statistical Risks: Group II

This section evaluates statistical risk and its impacts on fund performance. Using simple and multiple regressions, it is shown how the risk variable contribute to mutual fund performance variability.

4.3.1 Correlation

The risk factors are likely to impact significantly on mutual fund return. Some risks, however, contribute more than others in explaining the variation in returns. To observe a more accurate mutual fund returns exposed to different risks, correlation and regression analysis are performed. Table 4.4 shows the correlations between risks and fund returns.

Table 4.5 Correlation between CAGR and Statistical Risks

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
1.Alpha								
2.Beta	-0.690							
3.R-Squared	-0.601	0.447						
4. Standard Deviation	0.017	0.426	-0.553					
5.Sharpe Ratio	0.290	-0.278	0.272	-0.606				
6.Treynor	0.596	-0.772	-0.413	-0.182	0.189			
7.Skewness	0.238	-0.106	-0.148	0.019	0.089	0.157		
8.Kutosis	0.566	-0.360	-0.399	0.125	0.040	0.299	0.591	
	***				***	**	***	***
9.CAGR	0.445	-0.013	-0.054	0.041	0.336	0.234	0.365	0.395

Note. significant level * $p < .05$, ** $p < .01$, *** $p<.001$

The correlation table shows the risk and return. It is defined the relationship between the level of risk and the level of potential return. It is principle understanding that accepting higher degree of risk could make a greater potential of higher returns. For a mutual fund, investors view the investment's alpha, beta, standard deviation, and Sharpe ratio are the main factors affecting return (Horton 2019).

Using correlation analysis, it is shown that beta and r-squared are negatively related with no statistically significant *p*-value and others are positively influential. Only alpha, Sharpe ratio, Treynor, skewness and kurtosis have significant *p*-value less than 0.05.

4.3.2 Simple Regression

A simple regression is estimated to find the coefficient value of individual risk. The results are shown in Table 4.6.

Table 4.6 Simple Regression of Statistical Independent Variables and the Cumulative Annual Growth Rate

	Coefficient	T-stat	P-value	R^2
Alpha***	0.003	6.64	0.000	19.8%
Beta	-0.002	-0.17	0.850	0.0%
R-Squared	-0.000	-0.72	0.475	0.3%
Standard Deviation	0.000	0.55	0.580	0.2%
Sharpe Ratio***	0.047	4.78	0.000	11.3%
Treynor**	0.002	3.22	0.002	5.5%
Skewness***	0.019	5.23	0.000	13.3%
Kurtosis***	0.007	5.75	0.000	15.6%

Note. significant level * $p < .05$, ** $p < .01$, *** $p < .001$

The alpha, Sharpe, skewness, and kurtosis have statistically significant *p*-value less than 0.001, and Treynor has *p<0.5.* The coefficients of alpha, Sharpe, Treynor, skewness, and kurtosis are positive and beta has a negative coefficient value, however, the *p*-value is high at 0.85. Therefore, beta does not have a statistically significant impact on return in the single regression.

Alpha and the Treynor ratio depend on fund manager's activity. A positive alpha indicates that fund manager performed better than benchmark while negative alpha shows the manager had worse performance than the required return at the given risk. The selected mutual funds considered are successful funds in return so the positive alpha can explain funds' significant outperformance.

4.3.4 Multiple Regression

A multiple regression is estimated to find how the risks explain the funds' performance collectively. The results are shown in Table 4.7.

Table 4.7 Multiple Regression of Statistical Independent Variables and the Cumulative Annual Growth Rate

	Coefficients	Standard Error	t Stat	P-value
Intercept	-0.058	0.0270	-2.14	0.034
Alpha***	0.005	0.0006	8.42	0.000
Beta***	0.243	0.0325	7.47	0.000
R-Squared	-0.000	0.0002	-1.72	0.087
Standard Deviation***	-0.006	0.0018	-3.45	0.000
Sharpe Ratio	0.011	0.0105	1.06	0.286
Treynor***	0.004	0.0006	6.88	0.000
Skewness	0.004	0.0035	1.07	0.285
Kurtosis**	0.005	0.0015	3.09	0.002

Note. $R^2 = 61.09\%$, N=181, *p*-value <0.001

From multiple regression, the R^2 is 61%, at least 61% of the risk data fit in the regression model. It is also found that the coefficients p[-of beta and standard deviation are statistically significant with a *p*-value less than 0.001. Unlike the single regression, the coefficient on beta is 0.243 and it indicates the funds with a high beta tend to outperform at a statistically significantly level. Alpha, Treynor and kurtosis also have a significant *p*-value with a positive coefficient. However, the coefficient for standard deviation negative impacts CAGR and its *p*-value is statistically significant less than 0.001.

4.4 Managerial Variables: Group III

4.4.1 Correlations

Table 4.5 shows the correlations between fund returns and managerial variables. Turnover, management tenure, and MBA education are negatively correlated whereas number of holdings is positively related. The strongest variable that affects fund return is the MBA education of fund managers. It is only variable that has a significant *p*-value of less than 0.01. There are 446 fund managers and 46% of them studied in MBA schools. The funds returns and MBA degree are significantly negatively correlated. Out of 181

funds, 112 (61.8%) funds have at least one fund manager with an MBA education. When the MBA education is measured as a binary variable (1 equal at least one manager has MBA degree in a management team), the correlation is -0.19. The MBA education does not positively correlate with performance.

The fund managers with a longer horizon tend to trade less frequently and have more investment options. The low turnover ratio could reduce overall funds' expenses and tax liabilities. The correlation shows that the tenure and turnover ratio negatively correlated, but longer manager tenure is not positively related with fund return.

Table 4.8 Correlation between CAGR and Managerial Variables

	1	2	3	4	5
1. Average Tenure					
2. Number of Managers	0.15				
3. Turnover Ratio	-0.25	0.17			
4. Number of Holdings	0.22	-0.20	-0.32		
5. MBA Degree (%)	0.09	0.25	-0.06	-0.16	
6. CAGR	-0.11	-0.10	-0.06	0.05	-0.21**

Note. significant level * $p < .05$, **$p < .01$, ***$p<.001$

4.4.2 Simple Regression

A simple regression is performed to find how each managerial factor influences the mutual fund return.

Table 4.9 Simple Regression for the Managerial Variables and the Cumulative Annual Growth Rate

	Coefficient	t Stat	P-value	R^2
Average Tenure	-0.000	-1.46	0.144	1.1%
Number of Managers	-0.001	-0.3	0.193	0.9%
Turnover	-0.000	-0.45	0.452	0.3%
Number of Holdings	0.000	0.66	0.508	0.2%
MBA Degree (%) *	-0.010	-2.87	0.004	4.4%

Note. significant level * $p < .05$, **$p < .01$, ***$p<.001$

The MBA degree is shown as a statistically significant factor. Like the correlation analysis, the coefficient is negatively statistically related with fund return. It explains that earning an MBA does not increase the actively managed mutual fund return. Other managerial factors are not statistically significant and there is little or very small coefficient value and high p-value.

4.4.3 Multiple Regression

A multiple regression is estimated to examine if managerial variables explain fund return cooperatively. Only the MBA degree variable is statistically significant, with a negative coefficient.

Table 4.10 Multiple Regression for the Cumulative Annual Growth Rate and Managerial Variables

	Coefficients	Standard Error	t Stat	P-value
Intercept	0.169	0.005	35.263	0.000
Average Tenure	-0.000	0.000	-1.435	0.153
Number of Managers	-0.000	0.001	-0.162	0.871
Turnover Ratio	-0.000	0.000	-1.115	0.266
Number of Holdings	0.000	0.000	0.143	0.886
MBA Degree (%)*	-0.010	0.004	-2.584	0.011

Note. R^2=6.1%, N=181, p-value=0.049

4.5 Multiple Regression Result Changes by Adding Statistical Risks

4.5.1 Multiple Regression I without Standard Deviation and R-squared

Table 4.11 shows regression output without the Morningstar rating, fund age, required minimum investment, standard deviation, R-squared, average tenure, turnover ratio, and number of holdings. The excluded variables have close to zero coefficients with

high *p*-values. The management fee is also not included because it is highly correlated with net expense ratio.

Table 4.11 Multiple Regression Model I (without Standard Deviation & R-squared)

	Coefficients	t Stat	P-value
Intercept	-0.087	-3.529	0.001
Asset Size	0.000	0.482	0.630
Expense Ratio*	-0.007	-2.671	0.008
Load (Sales) Charges*	-0.001	-2.510	0.013
Alpha*	0.004	7.596	0.000
Beta*	0.146	10.006	0.000
Sharpe*	0.039	5.290	0.000
Treynor*	0.003	5.452	0.000
Skew	0.006	1.855	0.065
Kurtosis*	0.003	2.267	0.025
Number of Managers	0.001	1.563	0.120
MBA Degree (%)	-0.003	-0.982	0.327

Note. R^2=60.8%, Adjusted R^2 = 58.3%, *p*-value <0.05, N=181

From the multiple regression I, there are seven predictor variables with * are shown significant (significant level * $p < .05$, ** $p < .01$, *** $p < .001$), and the regression explains 60.8 percent of the cumulative returns (R^2 equals 60.8%).

4.5.2 Multiple Regression II with Standard Deviation

Standard deviation is one of main risk indicators used to analyze mutual fund performance. The second multiple regression is run including standard deviation. The results reveal that seven variables are significant (Table 4.12). The Sharpe ratio turns to statistically insignificant and standard deviation is shown as significant predictor. The explanatory level is 64.5% which higher than the previous regression without standard deviation.

Table 4.12 Multiple Regression Model II (with Standard Deviation, without R-Squared)

	Coefficients	Standard Error	t Stat	P-value
Intercept	-0.067	0.024	-2.80	0.006
Asset Size	0.000	0.000	0.65	0.516
Expense Ratio*	-0.006	0.002	-2.47	0.014
Load (Sales) Charges*	-0.001	0.000	-2.96	0.004
Alpha*	0.005	0.001	8.91	0.000
Beta*	0.200	0.019	10.57	0.000
Sharpe	0.010	0.010	0.95	0.346
Standard Deviation*	-0.004	0.001	-4.20	0.000
Treynor*	0.004	0.001	6.58	0.000
Skewness	0.005	0.003	1.52	0.131
Kurtosis*	0.004	0.001	2.75	0.007
Number of Managers	0.001	0.001	1.78	0.076
MBA Degree (%)	-0.003	0.003	-1.34	0.181

Note. R^2=64.5%, Adjusted R^2 = 61.9%, *p*-value <0.05, N=181

From the multiple regression II, the independent variables alpha, beta, Sharpe ratio, and Treynor ratio tend to contribute to positive return of funds. Their coefficient values are positive and the *p*-values are highly significant at levels lower than 0.001. A *p*-value less than 0.001 indicates that there is at least 99.9% chance that there is a true relationship between these variables and fund return.

4.5.3 Multiple Regression III with R-squared

Adding R-squared and excluding the standard deviation, the regression results are below in Table 4.13.

57

Table 4.13 Multiple Regression Model III (with R-Squared but without Standard Deviation)

	Coefficients	Standard Error	t Stat	P-value
Intercept	-0.093	0.024	-3.854	0.000
Asset Size	0.000	0.000	0.522	0.602
Expense Ratio*	-0.006	0.002	-2.445	0.016
Load Charges*	-0.001	0.000	-2.787	0.006
Alpha*	0.004	0.001	8.029	0.000
Beta*	0.141	0.014	9.789	0.000
R-squared*	0.000	0.000	2.761	0.006
Sharpe*	0.025	0.009	2.787	0.006
Treynor*	0.003	0.001	5.587	0.000
Skewness*	0.007	0.003	2.058	0.041
Kurtosis*	0.003	0.001	2.187	0.030
Number of Managers	0.001	0.001	1.907	0.058
MBA (%)	-0.003	0.003	-1.209	0.229

Note. R^2=62.5%, Adjusted R^2 = 59.8%, *P-value <0.05, N=181

The coefficient on theR-squared is close to zero. It does not impact on funds'
performance.

4.5.4 Multiple Regression IV with Standard Deviation and R-squared

Two statistical risks, standard deviation and R-Squared, have zero coefficient
values on the simple regressions. They are, however, important factors that should not be
ignored to analysis a fund's risk.

Table 4.14 Multiple Regression IV (with Standard Deviation and R-Squared)

	Coefficients	Standard Error	t Stat	P-value
Intercept	-0.045	0.027	-1.661	0.099
Asset Size	0.000	0.000	0.720	0.472
Expense Ratio*	-0.006	0.002	-2.581	0.011
Load Charge*	-0.001	0.000	-2.922	0.004
Alpha*	0.005	0.001	8.982	0.000
Beta*	0.244	0.032	7.586	0.000
R-squared	-0.000	0.000	-1.684	0.094
Standard Deviation*	-0.006	0.002	-3.539	0.001
Sharpe	0.006	0.010	0.550	0.583
Treynor*	0.004	0.001	6.751	0.000
Skewness	0.003	0.003	0.977	0.330
Kurtosis*	0.004	0.001	3.093	0.002
Number of Managers	0.001	0.001	1.466	0.144
MBA (%)	-0.003	0.003	-1.314	0.191

Note. $R^2 = 65.1\%$, Adjusted $R^2 = 62.4\%$, *p-value <0.05, N=181

As the standard deviation and R-squared are added, the regression R^2 increases. The higher R^2, however, does not always explain if the regression model can forecast the future prediction the best. With coefficients of independent variables, the fund performance can be explained the formula (Figure 4.1) for regression analysis model IV.

Figure 4.1 Regression Equation of Fund Performance

Fund Performance = a + β_1 Expense Ratio + β_2 Sales Charges + β_3 Alpha + β_4 Beta

$\quad\quad$ + β_5 Sharp + β_6 R-squared + β_7 Std Dev + β_8 Treynor + β_9 Treynor

$\quad\quad$ + β_{10} Skew + β_{11} Kurtosis + β_{12} Managers + β_{13} MBA + ε

$\quad\quad$ a = intercept

$\quad\quad$ β_n = coefficients

$\quad\quad$ ε = error term

4.5.5 Multiple Regression Comparison

Table 4.15 shows the summary of four multiple regression approaches and the

results. Model IV has the higher R^2 with low *p*-values.

Table 4.15 Regression Comparison

	Multi Regression Model I w/o Std Dev & R-sq.		Multi Regression Model II w/ Std Dev		Multi Regression Model III w /R-sq.		Multi Regression Model IV w/ Std Dev & R-sq.	
R^2	*60.8%*		*64.5%*		*62.5%*		*65.1%*	
Adjusted R^2	*58.3%*		*61.9%*		*59.8%*		*62.4%*	
Significant. F	*0.000*		*0.000*		*0.000*		*0.000*	
	coeff.	*P-value*	*coeff.*	*P-value*	*coeff.*	*P-value*	*coeff.*	*P-value*
Intercept	-0.087	0.025	-0.067	0.006	-0.093	0.000	-0.045	0.099
Asset Size	0.000	0.000	0.000	0.516	0.000	0.602	0.000	0.472
Exp Ratio	-0.007	0.002	-0.006	0.014	-0.006	0.016	-0.006	0.011
Load Charges	-0.001	0.000	-0.001	0.004	-0.001	0.006	-0.001	0.004
Alpha	0.004	0.000	0.005	0.000	0.004	0.000	0.005	0.000
Beta	0.146	0.015	0.200	0.000	0.141	0.000	0.244	0.000
R-squared	*exclud.*	*exclud.*	*exclud.*	*ecxlud.*	0.000	0.006	0.000	0.094
Standard Dev.	*exclud.*	*exclud.*	-0.004	0.000	*exclud.*	*exclud.*	-0.006	0.001
Sharpe	0.039	0.007	0.010	0.346	0.025	0.006	0.006	0.583
Treynor	0.003	0.001	0.004	0.000	0.003	0.000	0.004	0.000
Skewness	0.006	0.003	0.005	0.131	0.007	0.041	0.003	0.330
Kurtosis	0.003	0.001	0.004	0.007	0.003	0.030	0.004	0.002
# of Managers	0.001	0.001	0.001	0.076	0.001	0.058	0.001	0.144
MBA (%)	-0.003	0.003	-0.003	0.181	-0.003	0.229	-0.003	0.191

4.6 Regression Evaluation Metrics

After the linear regressions are considered, evaluation metrics are used to determine how the regression model I, II, III, and IV fit the data (out-of-sample) and find if they explain the changes in the dependent variables. The in-sample coefficient of determination (R^2) is often used to measure the model quality. A small R^2 does not always indicate a bad model or a large R^2 is not always good. A good predictive model can have a low R^2 and an unacceptable model can have a high R^2 value. The Mean Absolute Error (MAE), Mean Squared Error (MSE), Root Mean Squared Error (RMSE) and Mean Absolute Percentage Error (MAPE) are used to evaluate the results of the predictions.

Morningstar provides the mutual funds' return in 2019 (out-of-sample performance). It is considered as the actual return. In 2019, average return of 181 mutual funds was 33.93%, and median value is 33.67%. The best performing fund shows 54.86%, and the worst performing fund's gain is 18.58% (See Figure 4.2). The predicted return was estimated using the sample mean of the independent variables.

Figure 4.2 Funds' Return and Distribution in 2019
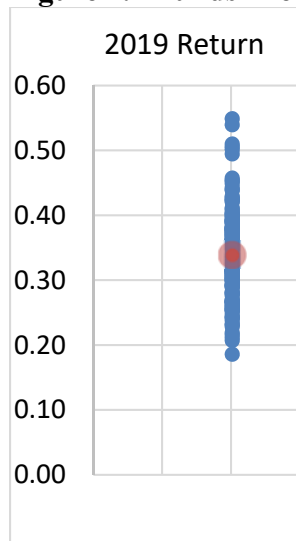
Note. ● Mean = 0.3393 (33.93%)

BIAS calculates the difference between the actual value and forecasted value in the prediction models. In this study, the actual value refers to the funds' actual return in 2019. The BIAS is defined as the average error which is divided by total numbers as shown:

Figure 4.3 BIAS Formula

BIAS = $\sum_{F=1}^{N}(Ar - Fr) / N$

Ar = actual return in 2019
Fr = forecasted return by regression models
F₁ = fund number 1
N = 181 mutual funds

The MAE is the absolute average value of differences between the actual return and forecasted return as shown:

Figure 4.4 MAE Formula

MAE = $\sum_{F=1}^{N}|Ar - Fr| / N$

The MSE and RMSE are commonly used for model evaluations. Willmott and Matsuura (2005) address that unlike MAE, RMSE is inappropriate to measure average errors as it may create misleading indicator of average error. Chai and Draxler (2014) suggest that both RMSE and MAE can be used to access model performance.

RMSE is more appropriate to use than MAE when errors occur in a normal distribution. The RMSE indicates the absolute fit of how the observed data are close to the predicted values. While R-squared is square root of variance, the RMSE measures standard deviation. The lower RMSE indicates an increased accuracy of the model's predictions. Both MSE and RMSE equations are shown as below:

Figure 4.5 MSE Formula

$$\text{MSE} = \sum_{F=1}^{N}(Ar - Fr)^2 \;/\; N \qquad\qquad \text{RMSE} = \sqrt{\sum_{F=1}^{N}(Ar - Fr)^2 \;/\; N}$$

The Mean of Absolute Percentage Error (MAPE) also shows the errors between true and predicted values and it explains the accuracy as a percentage. The smaller MAPE value indicates a better fit.

Figure 4.6 MAPE Formula

$$\text{MAPE} = \sum_{F=1}^{N}(|Ar - Fr|) \;/Ar\; /\; N \text{ x } 100$$

The regression modes are evaluated by the metrics and the results are found in Table 4.16.

Table 4.16 Out-of-Sample Regression Evaluation

	Model I	Model II	Model III	Model IV
	R^2= 60.8%	R^2= 64.5%	R^2 =62.5%	R^2 =65.1%
BIAS	18.17%	17.94%	20.56%	14.24%
MAE	18.17%	17.94%	20.56%	14.25%
MSE	3.68%	3.59%	4.61%	2.39%
RMSE	19.19%	18.93%	21.46%	15.45%
MAPE	52.03%	51.39%	59.29%	40.15%

Each regression model has a unique R^2 value and coefficients. Adding more independent variables increases the R^2. Regression model IV that includes statistical risk with a higher R^2 also has the lowest out-of-sample RMSE. The coefficients of the regression of model IV predicts the 2019 return the best.

According to the results, the statistical risks including standard deviation and R-squared are critical factors. Adding two variables increases the regression R-squared and the RMSE and MAPE decrease.

For further evaluation, the data (181 funds) are divided into two subsets: training and test set data. The training set, a subset to train a model, has 145 funds (80% of total data) and test set, a subset to test the trained model, includes 36 funds (20%). The training and test data are randomly selected by MS Excel tool. Table 4.17 shows the coefficients and regression results from the training data.

Table 4.17 Training Set Data (145 Funds) Regression

	Coefficients	Standard Error	t Stat	P-value
Intercept	-0.081	0.040	-2.032	0.044
Asset Size	0.000	0.000	0.486	0.628
Expense Ratio*	-0.006	0.003	-1.985	0.049
Load Charge*	-0.001	0.000	-2.776	0.006
Alpha*	0.004	0.001	5.041	0.000
Beta*	0.200	0.043	4.698	0.000
R-squared	0.000	0.000	-0.716	0.476
Standard Deviation	-0.003	0.003	-1.328	0.186
Sharpe	0.034	0.021	1.648	0.102
Treynor*	0.004	0.001	5.160	0.000
Skewness	0.007	0.004	1.684	0.095
Kurtosis*	0.004	0.002	2.320	0.022
Number of Managers	0.001	0.001	1.896	0.060
MBA (%)	-0.004	0.003	-1.180	0.240

Note. R^2=63.8%, Adjusted R^2 = 60.2%, *p-value <0.05, N=145

The coefficients of training data regression are used to predict future return of 36 funds, test data. Table 4.18 shows statistical data for 10-year CAGR and forecast return for test data. The test data (36 funds) predict to produce average 18.46% return.

Table 4.18 Test Set Data Cumulative Annual Growth Rate

	10-Year CAGR	CAGR
Mean	15.81%	18.46%
Max	19.99%	22.79%
Min	12.54%	15.07%
Median	15.43%	17.83%
Std Dev	1.79%	1.87%

n=36

Table 4.19 shows the evaluation results of train/test split. RMSE and MAPE are lower than evaluation values from total regression Model IV. The results show the unbiased estimation (splitting data into training and test set) has a bias of 2.65% and a root mean squared error of 2.86%.

Table 4.19 Testing Sample Evaluation

BIAS	-2.65%
MAE	2.65%
MSE	0.08%
RMSE	2.86%
MAPE	16.79%

CHAPTER V: ANALYSIS AND CONCLUSION

5.1 Analysis and conclusion

The purpose of this thesis was to determine how different variables affect the compound annual growth rate (CAGR) of U.S. open-end equity mutual funds. This thesis studied 181 mutual funds and their characteristics, risks and management styles. The 181 funds were selected using 10-year average returns that are higher than 12% from 2009 to 2018. The CAGR is calculated from annual total returns after adjusting fund load (sales) charges for A and C shares.

A correlation analysis indicates whether the variables are positively or negatively correlated and multiple regression analysis estimates the coefficients determining statistically significant p-values. It is interesting to examine the characteristics that contribute to fund performance during a historical bullish market period.

Hypothesis 1: Fund size is positively related to the mutual fund return.

Using the correlation analysis, it is found that while the size of a mutual fund is positively related to fund returns, the relationship is not statistically significant. The p-values are high as 0.377 from the simple regression and 0.630 from multiple regression with an estimated coefficient close to a zero.

Even though the larger fund helps reduce expenses, asset size is not a statistically significant factor increases return. Hypothesis 1 is not supported.

66

Hypothesis 2: Fund sales charges and expense ratio are negatively correlated with performance

All expenses and charges are negatively correlated with the CAGR -0.148 for the expense ratio, -0.137 for the load charges, and -0.048 for the management fees. In addition, from the regression analysis, statistically significant negative coefficients occur for expense ratio and load fees. Expenses, fees, and load charges are highly negatively correlated with funds' performance. Hypothesis 2 is supported.

Hypothesis 3: Fund turnover ratio is significantly negatively related to fund's performance

The turnover rate measures the holding of securities for less than a year. A lower percentage of turnover represents the less trading. The turnover ratio is -0.06 negatively correlated with the CAGR with a p-value of 0.452. During the bullish market, fund managers did not have to frequently buy or sell the holding position. When market moves strongly upwards, the frequent trading is not a tactical strategy.

High turnover is necessary if fund managers want to achieve short-term profit in certain securities such as emerging markets, small caps, and high yield bonds. The high turnover strategy is not applied to the selected funds as they are mostly focusing on the U.S. and the large cap sector. Active and frequent trades may be needed for those who manage newly incepted funds with small asset size.

In this study, most funds examined are large asset with long track records. Hypothesis 3 has some support from the sign of the coefficient, however the turnover ratio is not a statistically significant factor to explaining the fund return.

Hypothesis 4: Statistical risks are significantly correlated with fund return

Investment analysts have developed statistical tools to measure the risk of a fund.

The regression analysis shows that alpha, beta, the standard deviation, Treynor ratio, and kurtosis impact the CAGR at statistically significant level. The coefficients of the variables whether positive or negative have low p-values. Dhanorkar (2018) and Irvine, Kim and Ren (2018) find that investors prefer fund managers that obtain a high alpha that is persistent and related to higher returns.

Using the simple regressions, even though the coefficients are found close to zero, the standard deviation and R-squared are critical factors to evaluate funds' performance. Adding them to the regression increased the R-squared from 60.8% to 65%, and the RSME decreased from 19.19% to 15.45%.

The standard deviation plays a more important role than R-squared. When adding standard deviation in Model II, the regression R-squared increases by 4.5%. It is 2% higher than the regression R-squared from the Model III.

Fletcher (2000) found that beta is statistically significantly positively related with investment performance in raising market but significantly negatively associated during bear markets. In this study, beta has a high positive coefficient. From the single variable regression analysis, the coefficient of beta is -0.002 with p-value 0.850. From the multiple regression, the coefficient of beta is 0.243 and 0.2 with a p-value less than 0.001. Statistical risks like alpha, beta, the Sharpe ratio, the Treynor ration, skewness, kurtosis are positively related with fund return, but standard deviation is not. Hypothesis 4 suggesting a relationship between the risk and return is supported.

Hypothesis 5: Management tenure impacts on fund return.

From the single variable and multiple variable regressions, it is found that the coefficient on tenure is close to zero with high *p*-value. Tenure does not impact on fund returns in this study. The hypothesis is not supported

Hypothesis 6: Management style, whether it is team or single management, impacts on fund performance

Investors believe that team-managed funds are more attractive for performance and risk control, and less expenses. Team managed funds are negatively correlated with fund return although they can produce constant returns. Historically, team managed funds underperform during a bear market from 2001 to 2004 and no difference during the 1997-2000 bull market (Karagiannidis 2010).

From the single variable regression, the coefficients are negative but the *p*-value is 0.19, and is not statistically significant. From the multiple regression, the coefficient is close to zero and the *p*-value is also high 0.87. For analyzing fund performance, management style, whether it is team is single, does not impact on returns. The hypothesis is not supported.

Hypothesis 7: Fund managers with MBA degree produce higher returns.

The investment performance depends on the managers' investment style and stock selections (Goel and Mani 2012). In this study, the coefficient value of fund managers education is found to be negative. This study finds that whether fund managers obtain an MBA degree is not a statistically significant factor for the fund's performance. From regression modes, all coefficient values are negative with a high *p*-value. The MBA degree does not bring extra value to the fund. Hypothesis 7 is not supported.

5.2 Discussion of Out-of-Sample Performance (2019 Performance)

Table 5.1 shows the statistical data on the funds' return in 2019. The funds earned an average of 33.93% and a maximum of 54.86%. The actual average return is higher than forecasted by four models.

Table 5.1 Actual and Forecasted Mutual Returns in 2019

	Actual Return (Ar)	Forecasted Return (Fr)			
	2019	Model I	Model II	Model III	Model IV
Mean	33.93%	15.75%	15.98%	13.37%	19.69%
Median	33.67%	15.35%	15.65%	12.99%	19.46%
Maximum	54.86%	20.68%	21.36%	18.30%	24.45%
Minimum	18.58%	12.86%	12.70%	10.84%	15.04%
Skewness	0.453	0.906	1.005	0.906	0.355

Note. N=181 funds

Regression model IV projects the higher forecasted average return. Model IV includes the standard deviation and R-squared and it explains the future performance better. It is shown that the risks are related to a fund's performance.

According to CNBC, the S&P 500 gained more than 28% and the NASDAQ was up 35.23% in 2019. It was the highest increase since 2013. It was reported as an abnormal gain. One of the factors contribute the year's success was starting from a lower base after the struggles and poor performance in the 4th quarter of 2018 (Lewis 2019).

It is difficult to predict future return (out-of-sample) using the historical data. The four model forecasts do not fully explain actual return in 2019. There was a difference between the actual and forecast return, and the gap was higher than expected because the out-of-sample performance was unusual.

5.2. Future research

This thesis studied 181 U.S. open-end funds. There are more than 9,000 funds are available in the U.S. The selected funds (51 fund families) data does not explain fund industry movement.

Funds that produced the highest returns during 2009 to 2018 invest in large cap and the growth sector. Future research could focus on finding funds returns by industry sectors. Future research may be interested in studying cash flows. Cash in and out is one of critical points to evaluate mutual funds with sudden inflows or outflows, fund managers must sell stocks quickly regardless price, or they are forced to buy stock immediately. According to Coval and Stafford, it is called "fire sale" and "forced purchase" (Mobius 2007).

This study could help the U.S. investors, especially for those with lack of investment experience, when they select mutual funds for their long- or short-term financial goals. The statistical risks provided by investment research firms are critical factors affecting fund performance. However, the forecasting models were not highly successful in predicting out-of-sample returns suggesting that the weak form efficiency is not violated.

Historical price and trend cannot predict future prices. It is recommended that investors should consult with a financial planner to make financial goal and select mutual funds. Generally, the stock market is supposed to grow in value over a long period. Stock and mutual fund prices, however, could increase or fall in a day. Creating a financial plan helps investors have a big picture, and it is easier for them to make financial decisions for staying on track regardless market movement. Financial planning helps to avoid emotional investing.

WORKS CITED

Amihud, Yakov, and Ruslan Goyenko. 2013. "Mutual Fund's R-squared as Predictor of Performance." *The Review of Financial Studies* 26 (3): 667-694. doi:https://doi.org/10.1093/rfs/hhs182.

Apap, Antono, and John M Griffitch. 1998. "The Impact of Expenses on Equity Mutual Fund Performance." *Journal of Financial Planning* 11 (1): 76-81. https://search.proquest.com/openview/0faf2063bbb022a605f8cfa70a946e98/1?pq-origsite=gscholar&cbl=4849.

Babalos, Avassilios, Alexadros Kostakis, and Nikolaos Philippas. 2009. "Managing mutual funds or managing expense rations? : Evidence from Greek fund industry." *Jounal of Multinational Financial Management* 19 (4): 256-272. doi:https://doi.org/10.1016/j.mulfin.2009.01.001.

Bacon, Carl. n.d. *How Sharp is the Sharpe-Ratio? - Risk Adjusted Performance Measures.* Accessed 2020. https://oxfordstrat.com/coasdfASD32/uploads/2016/03/How-Sharp-Is-the-Sharpe-Ratio.pdf.

Baer, Michaela, Alexander Kempf, and Stefan Ruenzi. 2005. "Team Management and Mutual Funds." *CFR Working Paper No. 05-10.* doi:http://dx.doi.org/10.2139/ssrn.809484.

Becker, Gregory. 2019. *Mutual Funds: Comprehensive Beginners Guide to Create Wealth Using Mutual Funds.*

Benz, Christine. 2005. *Guide to Mutual Funds: 5-Star Strategies for Sucess.* 2nd. John Wiley & Sons, Inc.

Berk, Jonathan B, and Richard C Green. 2004. "Mutual Fund Flows and Performance in Rational Markets." *Journal of Plitical Economy* 112 (6). doi:https://doi.org/10.1086/424739.

Blake, Christopher, and Matthew R Morey. 2000. "Morningstar Ratings and Mutual Fund Performance." *Journal of Financial and Quantitiative Analysis* 451-483. doi:10.2307/2676213.

Bliss, Richard T, Mark E Potter, and Christopher Schwarz. 2008. "Performance Characteristics of Individually-Managed versus Team-Managed Mutual Funds." *The Journal of Portfolio Management* . Spring. Accessed March 11, 2020. https://jpm.pm-research.com/content/34/3/110.

Blume, Marshall E. 1998. "An anatomy of Morningstar Ratings." *Financial Analysts Journal* 54 (2). doi:10.2469/faj.v54.n2.2162.

Chai, T, and R R Draxler. 2014. *Root mean square error (RMSE) or mean absolute error (MAE)? –Arguments against avoiding RMSE in the literature.* Accessed April 29, 2020. doi:https://doi.org/10.5194/gmd-7-1247-2014.

Chang, Eric Chieh C, and Yan Luo. 2010. "R-Squared, Noise, and Stock Returns." doi:Chang, Eric Chieh C. and Luo, Yan, R-Squared, Noise, and Stock Returnshttp://dx.doi.org/10.2139/ssrn.1572508.

Charhat, M.M. 1997. "On Persistence in Mutual Fund Performance." *Journal of Finance* 52: 57-82.

Chen, James. 2020. *Risk-Return Tradeoff.* Feb. 3. Accessed April 15, 2020. https://www.investopedia.com/terms/r/riskreturntradeoff.asp.

Chevalier, Judith, and Glenn Ellison. 2002. "Are Some Mutual Fund Managers Better Than Others? Cross-Sectional Patterns in Behavior and Performance." *The Journal of Finance.* doi:https://doi.org/10.1111/0022-1082.00130.

Dhanorkar, Sanket. 2016. "Is tracking high alpha funds the best move?" *The Economic Times.* June. Accessed December 2019. https://economictimes.indiatimes.com/articleshow/52649355.cms?from=mdr&utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst.

Droms, William G, and David A Walker. 1996. "Mutual Fund Investement Performance." *The Quarterly Review of Economics and Finance* 36 (3): 347-363.

Elton, Edwin J, Martin J Gruber, and Christopher R Blake. 2012. "Does Mutual Fund Size Matter? The Relationship Between Size and Performance." *The Review of Asset Pricing Studies* 2 (1): 31-55. doi:https://doi.org/10.1093/rapstu/ras001.

n.d. *EVESTMENT.* Accessed December 2019. https://www.evestment.com/resources/investment-statistics-guide/assessing-skewness-and-kurtosis-in-the-returns-distribution/.

Fang, Yi, and Haiping Wang. 2015. "performance, Fund manager characteristics and performance." *Investment Anlaysts Journal* 44 (1): 102-116. doi:https://doi.org/10.1080/10293523.2015.994453.

Ferguson, Robert, Danny Meidan, and Joel Rentzler. 2014. "The Dependence of Upside Capture Ratios and Downside Capture Ratios on the Length of the Measurement Interval, Beta, and Alpha." *Journal of Investment Management* 12 (2): 105-116. https://ssrn.com/abstact=2524135.

Ferreira, Miguel A., Antonio F Miguel, and Sofia Ramos. 2006. "The Determinats of Mutual Fund Performance: A Cross-County Study." *Swiss Finance Institue Research Paper Series* 06 (31). https://ideas.repec.org/p/chf/rpseri/rp0631.html.

Fevurly, R. Keith. 2013. *The Handbook of Professionally Managed Assets: A Definitive Guide to Profiting from Pooled Investments.* Apress.

Fletcher, Jonathan. 2000. "On the conditional relationship betwwn beta and return in international stock returns." *International Review of Financial Analysis* 9: 235-245.

Francis, Jack C. 1975. "Skewness and Investors' Decision." *Journal of Financial and Quantitative Analysis* 10 (1): 163-172. doi:https://doi.org/10.2307/2330324.

Fusion Investing. 2010. *Fusion Investing and Analysis.* September 16. Accessed March 12, 2020. http://www.fusioninvesting.com/2010/09/what-is-skew-and-why-is-it-important/.

Gil-Bazo, Javier, and Pablo Riz-Verdu. 2009. "The Relation between Price and Performance in the Mutual Fund Industry." *Ther Journal of Finance* 67 (3-4). doi:https://doi.org/10.1111/j.1540-6261.2009.01497.x.

Goel, Sweta, and Muka Mani. 2012. "A Review of Performance Indicators of Mutual Funds." *ResearchersWorld* III (4(1)). Accessed March 6, 2020. https://pdfs.semanticscholar.org/74e9/89caaff0056291d076d0e70a067d45dd394c.pdf.

Golec, Joseph H. 1996. "The effects of mutual fund managers' characteristics on their porfolio performance, risk and fees." *Financial Services Review* 5 (2): 133-147. Accessed March 7, 2020. https://www.sciencedirect.com/science/article/abs/pii/S1057081096900062.

Gottesman, Aron A, and Matthew R Morey. 2006. "Manager education and mutual fund performance." *Journal of Empirical Finance* 13 (2): 145-182.

Gottesman, Aron, and Mathew Morey. 2019. "Mutual Fund Manager Education Background and Activeness." *The Journal of Investing* 28 (6). doi:https://doi.org/10.3905/joi.2019.28.6.128.

Grinblatt, Mark, and Sheridan Titman. 1994. "A Study of Monthly Mutual Fund Returns and Performance Evaluation Techniques." *Journal of Financial and Quantitative Analysis* 29 (3): 419-444. doi:https://doi.org/10.2307/2331338.

Helveston, Michael. 2016. *Why Standar Deviation Matter When Choosing Investment.* February. https://www.forbes.com/sites/mikehelveston/2016/02/03/why-standard-deviation-matters-when-choosing-investments/#2a6792da6258.

Hendricks, Darryll, Jayendu Patel, and Richard Zeckhauser. 1993. "Hot Hands in Mutual Funds: Short-Run Persistence of Relative Performance, 1974-1988." *The Journal of Finance* 93-130. Accessed March 9, 2020. doi:10.1111/j.1540-6261.1993.tb04703.x.

Hooks, John A. 1996. "The Effect of Loads and Expenses on Open-End Mutual Fund Returns." *Journal of Business Research* 36 (2): 199-202.

Horton, Melissa. 2019. "What metrics do I use to evaluate ther risk-return tradeoff for a mutual fund? ." *Investopedia.* June 25. Accessed April 11, 2020. https://www.investopedia.com/ask/answers/050615/what-metrics-should-i-use-evaluate-risk-return-tradeoff-mutual-fund.asp.

Houge, Todd, and Jay Wellman. 2007. "The Use and Abuse of Mutual Fund Expenses." *Journal of Business Ethics* 70: 23-32. doi:https://doiorg/10.1007/s10551-006-9077-6.

Ibbotson, Roger G., and Amita K Patel. 2002. "Do Winners Repeat with Style?" *Yale ICF Working Paper No. 00-70.* doi:http://dx.doi.org/10.2139/ssrn.292866.

Ibbotson, Roger G., and Amita K. Patel. 2002. *Do Winners Repeat With Style?* Accessed March 9, 2020. https://pdfs.semanticscholar.org/2846/da50b4d97faf240dd2ebec894a1c87a8b66e.pdf.

ICI. 2019. "Profile of Mutual Fund Shareholders, 2019." *ICI Research Report.* Accessed March 8, 2020. https://www.ici.org/pdf/rpt_19_profiles19.pdf.

ICI. 2019. "What US Households Consider When They Select Mutual Funds, 2018." 25. https://www.ici.irg/pdf/per25-03.pdf.

Ikenberry, David L. n.d. *Why active fund managers often underperform the S&P 500: The impact of size and skewness.* https://www.researchgate.net/profile/David_Ikenberry/publication/253217931_Why_Active_Fund_Managers_Often_Underperform_the_SP_500_The_Impact_of_Size_and_Skewness/links/572354ca08ae262228aa6633.pdf.

Indro, Daniel C, Christine X Jiang, Michael Y Hu, and Wayne Y Lee. 1999. "Mutual Fund Performance: Does Fund Size Matter?" *Financial Analysts Journal* 55 (3): 74-87. doi:10.2469/faj.v55.n3.2274.

Investment Company Institute. 2019. "Investment Company Fact Book: A Review of Trends and Activities in the Investment Company Industry." http://www.icifactbook.org.

Investment Company Institution. 2019. *Investment Company Fact Book: A review of Trends and Activities in the investment company industry.* www.icifactbook.org.

Investopedia. 2020. *Time Weighted Return.* Accessed March 16, 2020. https://www.investopedia.com/terms/t/time-weightedror.asp.

Irvine, Paul, Jeong Ho Kim, and June Ren. 2018. "The beta anomaly and mutual fund performance." https://www.depts.ttu.edu/rawlsbusiness/about/finance/lonestarconference/paper/Session_2A.pdf.

James, Christopher, and Jason Karceski. 2006. "Investor monitoring and differences in mutual fund performance." *Journal of Banking & Finance* 31 (10): 2287-2808. doi:https://doi.org/10.1016/j.jbankfin.2005.11.003.

Karagiannidis, Iordanis. 2010. "Managemetn team structure and mutual fund performance." *Journal of Internatinal Financial Markets, Institutions and Money* 20 (2): 197-211. doi:https://doi.org/10.1016/j.intfin.2009.10.003.

Kuhle, James L, and Eric C Lin. 2018. "Evaluate Real Estate Mutual Fund Performance Using the Morningstar Upside/Downside Capture Ratio." *Golobal Journal of Business Research* 12 (1): 15-22. doi:https://ssrn.com/abstract=3209543.

Lewis, Al. 2019. *The stock market boomed in 2019. Here's how it happened.* December 31. Accessed May 22, 2020. https://www.cnbc.com/2019/12/31/the-stock-market-boomed-in-2019-heres-how-it-happened.html.

Marlo, Tim, and Jeffrey Stark. 2016. "Ability to Capture Up Market Grains and Avoid Down Market Losses: The Upside and Downside Capture Ratio." doi:http://dx.doi.org/10.2139/ssrn.2836451.

Mobius, Mark. 2007. *Mutual Funds: An Introduction to the Core Concepts.* Singapore: John Wiley & Sons (Asia) Pte Ltd.

Moore, Olivia. 2016. *Mutual Fund Age, Performance, and the Optimal Track Record.* March 7. https://pdfs.semanticscholar.org/780b/c268d44dcb2f9cc1d868aebbe5aebeae40a0.pdf.

Morey, Matthew R. 2003. "Kiss of Death: A 5-Star Morningstar Mutual Fund Rating?" doi:http://dx.doi.org/10.2139/ssrn.455240.

Morey, Matthew R. 2002. "Mutual Fund Age and Morning Star Ratings." *Financial Analysts Journal* 58 (2): 56-63. doi:10.2469/faj.v58.n2.2523.

Morningstar (a). n.d. Accessed June 1, 2019. https://www.morningstar.com/funds/xnas/ptsgx/performance.

Morningstar (b). 2016. "The Morningstar Category Classifications." April 29. Accessed March 17, 2020. https://morningstardirect.morningstar.com/clientcomm/Morningstar_Categories_US_April_2016.pdf.

Morningstar. 2020. *Morningstar.* March. Accessed March 12, 2020.
https://www.morningstar.com/InvGlossary/upside-downside-capture-ratio.aspx.

P'astor, Lubos, Robert F Stambaugh, and Lucian A Taylor. 2015. *Do Funds Make More When They Trade More?* Feburary 9. Accessed March 10, 2020.
https://jacobslevycenter.wharton.upenn.edu/wp-content/uploads/2015/05/Do-Funds-Make-More-When-They-Trade-More-2.9.15.pdf.

Robbins, Christopher. 2018. *Fund Investors Chasing Performance Would Do Better To Watch Fees.* August 16. Accessed March 9, 2020. https://www.fa-mag.com/news/mutual-fund-investors-still-focus-on-past-performance-40320.html.

Schmid, Friedrich, and Rafael Schmidt. n.d. "Statistical Inference for Sharpe Ratio." *Interest Rate Models, Asset Allocation and Quantitative Techniques for Central Banks and Sovereign Wealth Funds* 337-357. Accessed March 12, 2020.
https://link.springer.com/chapter/10.1057/9780230251298_17.

Shi, Qiqiang. 2013. *Equity Mutual Fund Performance: Evidence from China.* March.
https://pdfs.semanticscholar.org/c8b9/23ea554c19345f57983b2ae988535430b4f6.pdf.

Simutin, Mikhail. 2014. "Cash Holdings and Mutual Fund Performance." *Review of Finance* 18 (4): 1425-1464. doi:https://doi.org/10.1093/rof/rft035.

Smith, David M., and Hany A Shawky. 2005. "Optimal Number of Stock Holding in Mutual Fund Portfolio Based on Market Performance." *The Financial Review.* doi:
https://doi.org/10.1111/j.1540-6288.2005.00120.x|.

Smith, Kelly. 2019. *The Fobes Guide to Individual Retirement Accounts (IRAs).* August 22. Accessed March 6, 2020. https://www.forbes.com/advisor/retirement/the-forbes-guide-to-individual-retirement-accounts-iras/.

Smith, Tim. 2019. *Random Walk Theory.* June 25. Accessed May 15, 2020.
https://www.investopedia.com/terms/w/weakform.asp.

Surz, Ron. 2018. "Nasdaq." April 2. Accessed 6 1, 2019.
https://www.nasdaq.com/articles/us-stock-market-biggest-most-expensive-world-us-economy-not-most-productive-2018-04-02.

Tang, Gordon Y.N., and Wai C Shum. 2003. "The conditional relationship between beta and returns: recent evidence from international stock markets." *International Business Review* 12 (1): 109-126.

Tangjitprom. 2014. "The Effect of Fund Size on Performance: The Evidence from Active Mutual Fund in Thailand." *Research Journal of Finace and Accounting* 5 (10).
doi:https://ssrn.com/abstract=2448730.

U.S. News. 2020. *2021 Best Business Schools.* March. Accessed March 17, 2020.
 https://www.usnews.com/best-graduate-schools/top-business-schools/mba-
 rankings.

US News. 2020. *Best Business Schools.* https://www.usnews.com/best-graduate-
 schools/top-business-schools/mba-rankings.

Webster, David. 2002. "Mutual Fund Performance and Fund Age."
 doi:http://dx.doi.org/10.2139/ssrn.1764543 .

Wermers, Russ. 2002. "Mutual Fund Performance: An Empirical Decomposition into
 Stock-Picking Talent, Style, Transaction Costs, and Expenses." *The Journal of
 Finance* 55. doi:https://doi.org/10.1111/0022-1082.00263.

Willmott, Cort J, and Kenji Matsuura. 2005. *Advantages of the mean absolute error (MAE)
 over the root mean square error (RMSE) in assessing average model performance.*
 December 19. Accessed April 29, 2020. doi:doi:10.3354/cr030079.

Wu, Sheng-Ching. 2014. "Interaction between Mutual Fund Performance and Portfolio
 Turnover." *Journal of Emerging Issues in Econonics, Finance and Banking
 (JEIEFB) An Online International Research Journal (ISSN:2306-367X)* 3 (4).

n.d. *yahoo! finance .* Accessed January 2020.
 https://finance.yahoo.com/quote/%5EGSPC?p=^GSPC.

n.d. *yahoo! finance .* Accessed January 2020. https://finance.yahoo.com/.

n.d. *yahoo! finance.* Accessed January 2020.
 https://finance.yahoo.com/quote/%5EDJI?p=^DJI.

APPENDIX A: U.S. FUND MARKET GROWTH

Number of Investment Companies by Type

Year	Mutual Funds*	Closed-End Funds	ETF**	Total
1999	7970	512	30	8512
2000	8649	482	80	9211
2001	8480	490	102	9072
2002	8490	543	113	9146
2003	8406	581	119	9106
2004	8411	618	152	9181
2005	8439	635	204	9278
2006	8704	646	359	9709
2007	8723	664	629	10016
2008	8860	644	743	10247
2009	8594	629	820	10043
2010	8523	626	950	10099
2011	8662	634	1166	10462
2012	8742	604	1239	10585
2013	8970	601	1332	10903
2014	9256	570	1451	11277
2015	9515	561	1644	11720
2016	9505	534	1774	11813
2017	9354	533	1900	11787
2018	9599	506	2057	12162

Note. * Data include mutual funds that invest primarily in other mutual funds.
    ** ETF data include ETFs that invest primarily in other ETFs.

Sources: Investment Company Institute and Strategic Insight Simfund

APPENDIX B: STOCK INDEX RETURNS FROM 01/01/2006 TO 05/31/2019

Source: https://finance.yahoo.com

APPENDIX C: SAVING GOALS OF MUTUAL FUND INVESTORS
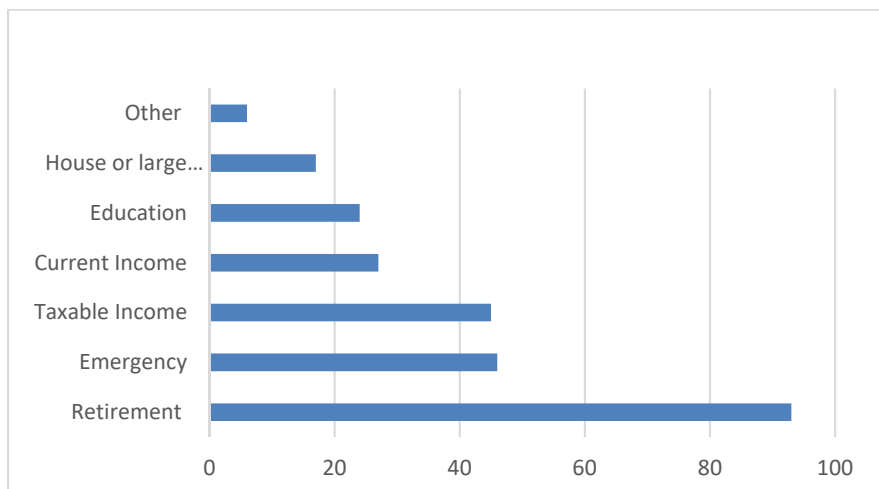
Source: ICI Research Perspective, "Characteristics of Mutual Fund Investors 2018"

APPENDIX D: SUMMARY OF THE PREVIOUS EMPRICAL FINDINGS

Category	Characteristics/Researches	Positive Related	Negative Related	Not Related	Remarks
General	Morningstar Rating				
	Blake & Morey(2000)	√			
	Morey (2002)	√			
	Morey (2003)	√			Future performance does not related with stars
	Blume(1998)			√	Shorter history funds get five stars
	Asset Size				
	Ferreira, Miguel and Ramos (2006)	√			10,568 open-end mutual funds from 19 countries, 1999-2005
	Indro, et al. (1999)	√	√		
	Tangjitprom (2014)	√	√		
	Berk and Green (2004)	√	√		
	Elton, Gruber and Blak (2012)	√			
	Droms & Waler (1996)			√	151 equity funds during 1971-1990
	Pastor, Stambaugh and Taylor (2015)		√		
	Load & Sales Charges	√			
	Houge & Wellman		√		from 2000 to 2004
	Apap&Grifitch (1998)	√			
	Droms & Waler (1996)			√	151 Equity Mutual Funds from 1971 to 1990
	Grinbalatt & Titman (1994)	√			279 Equity Mutual Funds during 1975-1984
	Fees & Expenses				
	Ferreira, Miguel and Ramos (2006)	√			10,568 open-end actively managed equity fund during 1999-2005

	(1)	(2)	(3)	
Golec (1996)		√		
Bliss et. al (2008)			√	Sampling 3000 equity mutual Team managed funds had lower cost
Droms & Waler (1996)	√			151 Equity Mutual Funds from 1971 to 1990
Pastor, Stambaugh and Taylor (2015)	√			
Carhart (1997)		√		Equity funds during 1962-1993
Babalos, Kostakis and Philippas (2009)		√		Greek equity funds
Turnover Ratio				
Pastor, Stambaugh and Taylor (2015)	√			
Droms & Waler (1996)	√		√	151 equity Mutual Funds from 1971 to 1990
Wermers (2002)	√			
Mobius (2007)	√	√		
Wu (2014)		√		170 open-end equity funds in Taiwan during 2003-2012
Number of Holings				
Smith and Shawky (2005)	√	√		US equity mutual funds during 1992-2000 Quadratic relationship, optimal numbers
Fund age				
Babalos, Kostakis, and Philippas (2009)	√			
Webster (2002)		√		Long established equity funds
Ferreira, Miguel and Ramos (2006)		√		10,568 open-end actively managed equity fund during 1999-2005
Risk — **Alpha**				
Dhannorkar (2016)	√			
Irvine, Kim and Ren (2018)	√			2,838 US actively managed mutual funds during 1983-2014
Beta				
Flecher (2000)	√			
Tang and Shum (2003)	√			International stocks during 1991-2000
R-squars				

	Chang and Luo (2010)		√			Stocks during 1966-2008
	Amihud and Goyenko (2013)		√			Mutual funds' monthly returns during 1988-2010
	Sharpe					
	Schmid and Schmidt (n.d.)	√				
	Skewness					
	Ikenberry (n.d.)		√			Stocks reviewed during 1962-1995
	Havery and Siddique (2000)		√			
	Capture Ratio					
	Kuhle and Lin (2018)	√				268 equity and real estate funds in US and global
	Marlo and Stark (2016)					
Managerial	Tenure					
	Golec (1996)	√				
	Ferreira, Miguel and Ramos (2006)	√				
	Webster (2002)	√				
	Number of Managers (Team)					
	Ferreira, Miguel and Ramos (2006)		√			
	Bliss et. al (2008)			√		No significant relationship found Team management is more attractive for investors
	Baer, Kempf and Ruenzi (2005)		√			
	Karagiannidis (2010)		√	√		
	MBA					
	Golec (1996)	√				
	Fang and Wang (2015)	√				
	Gottesman and Morey (2006)	√				

APPENDIX E: SAMPLE DATA (U.S. OPEN-END EQUITY MUTUAL FUNDS)

| Fund Name | Fund Characteristics | | | 10-Year Average Statistical Risks* | | | | | | | Management | | 2009 ~18 |
	Size**	Exp Ratio	Load	Alpha	Beta	Std Dev	Sharpe	Treynor	Skew	Kurt.	# Manager	MBA (%)	CAGR
Touchstone Sand Capital Select Grw Z	1805	1.42	0	0.98	1.16	17.02	0.94	13.47	0.46	-0.60	4	25%	22.45%
BlackRock Health Science Opps InstI	6842	0.87	0	9.17	0.72	13.27	1.16	21.57	0.72	0.58	1	0%	21.53%
MFS Tech I	1286	0.94	0	8.31	1.02	15.79	1.13	17.76	1.71	2.99	1	0%	20.44%
Fidelity Ad Tec I	1950	0.76	0	7.48	1.12	17.42	1.03	16	1.46	2.59	1	0%	20.21%
Morgan Stanley Inst Global I	3115	0.95	0	12.17	0.96	16.46	1.1	19.06	0.98	0.45	1	0%	19.99%
Columbia Global Tech Grw Inst.	1427	0.99	0	13.1	1.2	14.7	1.7	1.7	0.16	-0.50	1	0%	19.89%
Fidelity Advisor Tech A	1948	1.03	5.75	7.17	1.12	17.41	1.02	15.69	1.18	1.54	1	0%	19.13%
MFS Tech A	1286	1.19	5.75	8.06	1.02	15.79	1.12	17.47	1.34	1.46	1	0%	19.07%
Morgan Stanley Inst Grw I	7240	0.59	0	3.7	1.07	16.34	1.08	16.42	0.80	-0.66	6	50%	19.72%
T Rowe Price Sci & Tech	5558	0.79	0	6.22	1.17	17.52	0.93	13.62	0.71	-0.02	1	0%	19.71%
T. Rowe Price Com & Tech	4483	0.78	0	6.7	1.2	14.08	1.33	1.33	1.09	1.05	1	100%	19.70%
Morgan Stanley Insight A	1720	1.15	5.25	4.05	1.09	17.04	1.1	17.22	0.59	-1.14	6	50%	19.02%
Fidelity Advisor Tech M	2100	1.28	3.5	6.91	1.12	17.42	1	15.41	1.30	1.98	1	0%	19.12%
Victory RS Sm Gw Y	2115	1.13	0	1.11	1.19	18.01	0.95	14.03	0.12	-1.99	5	60%	19.44%
T.R. Health	10666	0.77	0	10.32	0.89	16.44	1.14	21.05	-0.11	-0.07	1	0	19.42%
Morgan Stanley Inst Grw A	7163	0.85	5.25	3.75	1.07	16.34	1.11	17.04	0.62	-1.20	6	50%	18.77%
Delaware Health I	997	1.03	0	8.38	0.95	15.56	1.11	18.4	0.89	-0.07	1	100%	19.11%
Columbia Tech Grw A	1438	1.24	5.75	8.57	1.1	16.89	1.07	16.42	-0.19	-0.62	1	0%	18.31%
Allianz GI Tech P	1550	1.31	0	8.59	1.03	17.03	1.08	17.74	0.49	-1.04	2	50%	18.98%
Fidelity Adviser Technology C	1948	1.79	1	6.58	1.13	17.36	0.94	14.15	1.47	1.62	1	0%	25.64%
MFS Tech C	1286	1.94	1	7.3	1.02	15.79	1.07	16.6	1.63	2.73	1	0%	17.82%
Delaware Health A	997	1.28	5.75	8.12	0.95	15.6	1.09	18.05	0.69	-0.57	1	100%	18.14%
Vitus KAR Sm Grw	5225	1.14	0	6.41	0.91	14.56	1.28	21.08	0.35	-1.57	2	100%	18.79%
Fidelity Gw Op I	5705	0.78	0	2.98	1.12	15.67	1.15	16.28	0.48	-0.91	1	0%	18.77%
Janus Glo Tech I	3237	0.75	0	7.5	1.07	15.93	1.1	16.52	0.54	-0.46	2	50%	18.69%

Allianz GI Tech A	1534	1.56	5.5	8.34	1.03	17.03	1.06	17.45	0.33	-1.36	3	66%	18.01%
USAA NSDQ 100 Index	2049	0.48	0	2.38	1.11	15.23	1.13	15.73	0.87	0.32	1	100%	18.52%
Fidelity Gw Op A	5705	1.05	5.75	2.67	1.12	15.66	1.14	15.97	0.21	-1.51	1	0%	17.72%
Touchstone Sand Cap Select Gw Y	1805	1.17	0	1.42	1.16	17.06	0.99	14.47	0.99	0.86	4	25%	18.21%
Janus Global Tech A	3200	1	5.75	7.22	1.07	15.92	1.09	16.21	0.27	-1.04	2	50%	17.50%
Fidelity Heath Care I	3718	0.76	0	9.59	0.81	15.2	1.13	21.42	0.51	0.86	1	0%	18.18%
Fidelity Advisor Grw Opps M	5705	1.28	3.5	2.46	1.12	15.66	1.12	15.75	0.29	-1.37	1	0%	17.72%
Columbia Tech Grw C	1438	1.99	1	7.43	1.08	16.75	1.05	16.26	-0.04	-0.70	1	0%	17.08%
BlackRock Mid-Cap Grw Equity Inv A	3930	1.05	5.25	0.83	1.15	16.19	0.97	13.44	0.52	-1.20	2	100%	17.42%
BlackRock Tech I	1723	0.93	0	8.06	1.02	15.79	1.12	17.47	0.64	-0.95	1	0%	17.99%
Fidelity Health A	3718	1.02	5.75	9.32	0.81	15.21	1.11	21.01	0.66	1.48	1	0%	17.17%
Allianz GI Tech C	1700	2.31	1	7.58	1.03	17.02	1.02	16.6	0.49	-1.04	3	67%	16.78%
PGIM Health Sci Z	2010	0.85	0	9.64	0.92	19.89	0.92	19.18	0.06	0.14	2	50%	17.79%
Morgan Stanley Inst Adv I	361	0.85	0	4.94	0.92	13.06	1.33	19.37	0.89	-0.31	6	50%	17.78%
Rydex NASDAQ 100 Inv	1068	1.36	0	1.78	1.11	15.2	1.09	15.12	0.85	0.31	2	0%	17.76%
BlackRock Tech Opp A	2000	1.18	5.25	7.44	1.06	17.1	1.02	16.3	0.54	-1.09	1	0%	16.96%
Fidelity Grw Opp C	5705	1.81	1	1.92	1.12	15.65	1.09	15.19	0.46	-0.96	1	0%	16.49%
Janus Henderson Global Technology C	3237	1.75	1	6.78	1.08	15.93	1.01	14.78	0.52	-0.52	2	50%	16.47%
PIMCO RAE PLUS 1-2	1609	1.03	0	0.34	1.09	14.14	1.02	13.19	0.38	0.20	5	40%	17.51%
TransAmerica Cap G I	1903	0.88	0	3.12	1.12	17	1.07	16.22	0.43	-1.14	6	50%	17.27%
PIMCO RAE PLUS A	1609	1.33	3.75	0.06	1.09	14.13	1	12.9	0.09	-0.38	5	40%	16.72%
T. Rowe Price Blue Chip Growth	61008	0.7	0	1.72	1.1	14.86	1.07	14.53	0.60	-1.33	1	100%	17.04%
Nationwide Ziegler NYSETech100 Int.	654	0.51	0	7.06	1	14.78	1.06	15.69	0.16	-1.25	2	50%	17.01%
Fidelity Advisor Health Care C	3718	1.77	1	8.28	0.84	15.38	1.01	18.33	0.51	0.88	1	0%	15.96%
Rydex NASDAQ 100 C	1068	2.36	1	0.73	1.11	15.18	0.99	13.47	0.79	-0.16	2	0%	15.94%
Morgan Stanley Insight I	1720	0.86	0	4.33	1.1	17.05	1.12	17.51	1.28	1.17	6	50%	16.98%
AB Small Grw Advisor	2200	0.92	0	0.98	1.25	18.85	0.94	13.84	0.36	-1.98	4	50%	16.94%
Delaware Smid Grw Instl	1590	0.87	0	2.42	1.1	17.09	1.01	15.47	0.38	-1.87	1	0%	16.86%
Franklin DynaTech Adv	8032	0.62	0	2.38	1.09	15.54	1.1	15.68	0.67	-1.21	2	50%	16.84%

TransAmerica Cap. Gw A	1922	1.13	5.5	2.74	1.12	16.98	1.05	15.83	0.55	-0.75	6	50%	16.18%
Eventide Gilead A	2541	1.44	5.75	0.74	1.23	18.29	0.91	13.13	0.64	-0.56	1	0%	16.05%
Fidelity Health Care M	3718	1.28	3.5	9.07	0.81	15.2	1.1	20.67	0.62	0.98	1	0%	16.33%
Nationwide Ziegler NYSEATech100 A	654	0.75	5.75	6.81	1	14.77	1.05	15.42	-0.09	-1.62	2	50%	16.04%
Columbia Seligman Global Tech A	1064	1.32	5.75	6.87	1.02	16.68	0.94	15.03	0.48	0.43	6	67%	16.03%
Janus Henderson Global Life Sci I	3806	0.76	0	9.14	0.8	15.08	1.11	20.9	0.53	0.71	1	0%	16.71%
Delaware Smid Cap Gw A	1590	1.12	5.75	2.15	1.1	17.09	0.99	15.19	0.31	-1.98	1	0%	15.96%
AB Sm Gw A	1973	1.17	4.25	0.62	1.25	18.83	0.93	13.52	0.35	-1.92	4	50%	16.13%
AB Discovery Growth A	2576	0.95	4.25	0.05	1.24	17.91	0.89	12.46	0.29	-2.11	4	50%	16.10%
BlackRock Technology Oppo.Inv C	1723	1.93	1	6.91	1.06	17.01	0.95	14.81	0.63	-0.97	1	0%	15.54%
AB Discovery Growth Adviser	2576	0.72	0	0.15	1.24	17.9	0.9	12.65	0.39	-1.82	4	50%	16.58%
Franklin Dyna Tech A	8032	0.87	5.5	2.13	1.09	15.53	1.08	15.42	0.55	-1.47	2	50%	15.88%
Fidelity BioTech I	2165	0.76	0	8.86	1.02	23.37	0.79	16.58	0.18	0.84	1	0%	16.47%
Janus Henderson Global Life Sci. A	3806	0.99	5.75	8.48	0.82	15.17	1.02	18.82	0.68	1.10	1	0%	15.78%
Alger Small Cap Focus A	3482	1.18	5.25	1.29	1.15	17.6	0.92	13.68	0.18	-1.48	1	100%	15.83%
Wells Fargo Grw Inst	4470	0.75	0	2.26	1.1	15.41	1.1	15.58	0.56	-1.12	2	0%	16.42%
T Rowe Price New America Grw	5009	0.79	0	0.9	1.08	14.37	1.03	13.73	0.80	-0.68	1	100%	16.41%
Columbia Seligman Comm & Info A	5746	1.24	5.75	6.65	1.03	16.92	0.92	14.7	0.46	0.19	6	66%	15.70%
Federated Kaufmann Sm A	2759	1.37	5.5	0.85	1.24	18.82	0.93	13.71	-0.21	-0.90	9	77%	15.68%
Angler Spectra A	5975	1.27	5.25	0.59	1.09	14.56	1.01	13.38	0.69	-0.47	2	0.%	15.70%
PIMCO RAE PLUS C	1609	2.08	1	-0.79	1.1	14.22	0.94	12.02	0.36	0.17	5	80%	15.22%
T Rowe Price Mid Cap Grw	32582	0.75	0	1.65	1.04	13.95	1.08	14.59	0.53	-0.81	1	100%	16.23%
Edgewood Grw Instl	14475	1	0	2.2	1.02	14.26	1.08	15.14	0.55	-1.26	6	66%	16.18%
Fidelity Adviser Biotechnology A	2165	1.04	5.75	7.81	1.05	23.34	0.72	14.38	0.24	0.62	1	0.%	15.47%
BlackRock Health Science Opps A	6842	1.15	5.25	8.896	0.72	13.27	1.14	21.12	0.51	0.52	1	0.00%	15.52%
PIMCO Stocks PLUS Abs. Return I2	1875	0.83	0	1.06	1.08	13.81	1.08	13.98	-0.17	-0.91	3	33.%	16.13%
Janus Henderson Enterprise I	20619	0.75	0	2.98	0.96	13.07	1.18	16.29	0.32	-0.73	2	0.00%	16.11%
DWS Science & Tech Inst.	836	0.72	0	6.14	1.02	16.08	0.93	14.33	1.21	1.41	2	100%	16.11%
T Rowe Price Grw	53466	0.66	0	1.09	1.09	14.69	1.03	13.89	0.51	-1.23	1	100%	16.08%

BlackRock Mid-Cap Grw Equity Instl	3930	0.8	0	1.17	1.15	16.18	0.99	13.78	0.93	-0.78	2	100%	16.08%
JP Morgan Growth Advantage I	9015	0.89	0	0.92	1.14	15.5	1.01	13.64	0.49	-1.26	1	0.00%	16.07%
TransAmerica Cap. Gw C	1922	1.87	1	2.06	1.12	16.98	1.01	15.11	0.43	-1.11	6	50%	15.01%
Wells Fargo Growth A	4470	1.16	5.75	1.58	1.1	15.36	1.03	14.31	0.33	-1.84	2	0.00%	15.36%
NW Ziegler NYSEA Tech 100 C	654	1.47	1	6.13	1	14.77	1	14.64	0.14	-1.28	2	50%	14.91%
Fidelity Advisor Consumer Direct I	390	0.8	0	6.65	0.99	14.98	1.01	15.28	0.33	-1.53	1	0.00%	15.91%
T Rowe Price QM US Sm Cap Gr Eq	7626	0.8	0	0.11	1.2	16.55	0.94	12.77	0.37	-1.23	1	0.00%	15.88%
Eventide Gilead C	2541	2.19	0	-0.02	1.23	18.26	0.87	12.41	0.64	-0.86	1	0.00%	15.85%
JP Morgan Grw Adv. A	9015	1.14	5.25	0.68	1.14	15.52	1	13.4	0.54	-0.89	1	0.00%	15.21%
Clear Bridge Small Cap Grw I	3785	0.9	0	-0.03	1.17	17.13	0.88	12.47	0.57	-1.03	2	100.%	15.82%
Victory RS Small Cap Growth A	2115	1.4	5.75	0.36	1.22	18.19	0.88	12.75	0.38	-1.41	5	60.%	15.12%
William Blair SM Cap Gr I	2758	1.1	0	1.43	1.07	15.08	1.02	14.17	0.68	-0.98	2	50.%	15.81%
PIMCO StockPlus Small Inst.	1493	0.83	0	-2.18	1.3	18.27	0.8	10.63	-0.21	-1.61	3	33.%	15.80%
Fidelity Advisor Biotechnology M	2165	1.35	3.5	7.52	1.05	23.32	0.71	14.08	0.22	0.73	1	0.00%	15.38%
PIMCO StocksPLUS Abs Return A	1875	1.13	3.75	0.74	1.08	13.81	1.06	13.64	-0.41	-1.21	3	33.%	15.35%
Delaware Smid Cap Grw C	1590	1.87	1	1.9	1.12	17.3	0.95	14.34	0.37	-1.89	1	0.00%	14.73%
AB Small Cap Growth C	1973	1.92	1	-0.55	1.28	18.97	0.84	11.9	0.36	-1.97	4	50.%	14.71%
DWS Science & Tech A	836	0.93	5.75	5.85	1.02	16.08	0.91	14.02	0.84	0.06	2	100.%	15.06%
Putnam Growth Opp Y	5408	0.78	0	0.94	1.1	14.55	1.05	13.77	0.43	-1.15	2	100.%	15.71%
Federated Kaufmann Small Cap C	2759	2.02	1	0.2	1.25	18.79	0.85	12.19	-0.22	-1.12	9	66.%	14.64%
Franklin Dyane Tech C	8032	1.62	1	1.48	1.09	15.52	1.01	14.17	0.66	-1.24	2	50.%	14.62%
PIMCO StocksPLUS Small I2	1493	0.93	0	-2.36	1.3	18.29	0.79	10.48	-0.21	-1.60	3	33.%	15.66%
Angler Small Cap Focus C	3482	1.94	1	0.6	1.15	17.58	0.88	12.99	0.38	-1.08	1	100.%	14.60%
Franklin Sm Cap Grw Adv.	2688	0.82	0	-0.29	1.2	18.04	0.84	12.13	0.81	-0.77	2	50.%	15.64%
AB Large Cap Grw A	8666	0.89	4.25	1.65	1.04	13.98	1.08	14.58	0.50	-1.33	3	0.00%	15.13%
Clear Bridge Large Cap Grw I	13375	0.76	0	1.34	1.03	13.48	1.09	14.31	0.67	-0.65	2	100.%	15.62%
Fidelity Advisor Consumer Direct A	390	1.08	5.75	6.35	0.99	14.98	0.99	14.92	0.31	-1.36	1	0.00%	14.92%
Janus Henderson Global Life Sci C	3806	1.77	1	7.7	0.82	15.17	0.98	16.96	0.53	0.74	1	0.00%	14.55%
Rydex NASDAQ-100 A	1068	1.61	4.75	1.46	1.11	15.18	1.04	14.22	-0.17	0.14	2	0.00%	14.99%

AB Growth Advisor	1093	0.94	0	1.79	1.02	13.58	1.11	14.79	0.56	-1.38	3	0.00%	15.48%
Wasatch Core Grw	2283	1.18	0	1.54	1	14.55	0.99	14.35	0.66	-0.04	3	0.00%	15.47%
Ivy Sm Cap Grw I	2686	0.89	0	-0.28	1.15	17.12	0.85	12.2	0.31	-1.57	3	100.%	15.45%
Federated Kaufmann Lg Cap Instl	3186	0.84	0	1.16	1.06	14.58	1.02	13.95	0.16	-1.32	9	66.%	15.44%
AB Discovery Grw C	2576	1.72	1	-0.83	1.23	17.89	0.84	11.74	0.38	-1.86	4	50.%	14.38%
Putnam Growth Opp A	5408	1.03	5.75	0.71	1.1	14.52	1.03	13.54	0.26	-1.38	2	100.%	14.74%
MFS New Discovery I	1392	1.06	0	-0.83	1.18	17.48	0.83	11.67	0.59	-0.59	1	0.00%	15.41%
Wells Fargo Grw C	4470	1.91	1	0.82	1.1	15.36	0.98	13.52	0.54	-1.28	2	0.00%	14.36%
Natixis US Equity Opp. Y	972	0.91	0	0.05	1.13	14.66	0.99	12.78	-0.06	-0.91	5	80.%	15.39%
PIMCO StockPlus Small A	1493	1.23	3.75	6.35	0.99	14.98	0.99	14.92	-0.30	-1.67	3	33.%	14.94%
Principal Midcap Institutional	16099	0.69	0	3.18	0.97	12.91	1.22	16.53	-0.24	-0.80	2	50.%	15.36%
MFS Mid Cap Grw I	5220	0.84	0	1.9	1.03	14.04	1.09	14.84	0.34	-1.29	2	50.%	15.34%
Loomis Sayles Grw Y	8297	0.65	0	1.46	1.07	14.28	1.07	14.34	0.27	-1.33	1	100.%	15.34%
MFS Grw A	21884	0.92	5.75	1.87	1.01	13.53	1.1	14.89	0.53	-1.38	2	50.%	14.65%
Franklin Sm Cap Grw A	2688	1.07	5.5	-0.56	1.2	18.03	0.83	11.87	0.84	-0.41	2	50.%	14.67%
PGIM Jennison Focused Grw Z	637	0.75	0	0.87	1.09	15.5	0.97	13.54	0.68	-1.17	4	100.%	15.31%
BlackRock Health Sci Opps Inv C	6842	1.87	1	8.12	0.72	13.26	1.08	19.97	0.36	0.00	1	0.00%	14.27%
Fidelity Advisor Bio C	2165	1.78	1	7.09	1.05	23.31	0.69	13.62	0.18	0.85	1	0.00%	14.25%
JP Morgan Grw Adv. C	9015	1.64	1	0.19	1.147	15.5	1.97	12.91	0.50	-1.24	1	0.00%	14.20%
Federated Kaufmann Lg Cap A	3186	1.09	5.5	0.91	1.06	14.58	1	13.68	0.00	-1.49	9	66.%	14.58%
MFS Grw I	24884	0.67	0	2.11	1.01	13.53	1.12	15.16	0.59	-1.29	2	50.%	15.22%
American Century Ultra I	11592	0.77	0	0.7	1.09	14.43	1.03	13.52	0.61	-1.36	3	100.%	15.20%
AB Grw A	1093	1.19	4.25	1.51	1.02	13.58	1.09	14.48	0.53	-1.28	3	0.00%	14.66%
Wells Fargo Discovery Inst	2481	0.88	0	1.15	1.16	16.58	0.97	13.71	0.27	-1.81	2	50.%	15.15%
JP Morgan LC Growth I	15229	0.69	0	2.6	1.05	14.67	1.1	15.52	0.40	-1.55	1	100.%	15.14%
MFS Mid Cap Grw A	5220	1.09	5.75	1.66	1.03	14.03	1.07	14.57	0.15	-1.57	2	50.%	14.42%
Natixis US Equity Opp. A	972	1.16	5.75	-0.31	1.13	14.65	0.97	12.52	-0.22	-0.80	4	80.%	14.42%
T Rowe Price Sm Cap Stock	9853	0.89	0	0.17	1.14	16.02	0.93	12.8	0.21	-1.45	1	0.00%	15.09%
PGIM Jennison Focused Grw A	637	1.11	5.5	0.6	1.09	15.47	0.95	13.27	0.59	-1.27	4	25.%	14.41%

Loomis Sayles Grw A	8297	0.9	5.75	1.25	1.07	14.26	1.05	14.11	0.30	-0.93	1	100.%	14.35%
UBS US Sm Cap Grw P	114	1	0	-0.41	1.27	18.97	0.84	12.01	0.57	-1.05	2	0.00%	15.00%
Ivy Sm Cap Grw A	2686	1.32	5.75	-0.66	1.15	17.09	0.83	11.83	0.29	-1.59	3	33.%	14.98%
Voya Large Cap Grw I	1000	0.66	0	1.37	1.02	13.3	1.08	14.14	0.07	-1.63	3	0.00%	14.96%
Baron Partner Inst.	2204	1.77	0	-0.18	1.25	17.94	0.89	12.36	0.40	-1.06	2	0.00%	14.95%
PIMCO StocksPlus Absolute Return C	1875	1.88	1	0.01	1.08	13.8	1.01	12.87	-0.17	-0.91	3	33.%	13.90%
Fidelity Advisor Equity Growth I	3051	0.75	0	1.25	1.06	14.43	1.04	14.08	0.31	-1.60	2	0.00%	14.94%
JP Moran LC Growth A	15229	0.94	5.25	2.4	1.05	14.69	1.09	15.28	0.41	-1.30	1	100.%	14.29%
Loomis Sayles Small Cap Grw Instl	1468	0.94	0	0.76	1.13	16.75	0.91	13.25	0.77	-0.83	2	100.%	14.90%
Putnam Growth Oppor. M	5408	1.41	3.5	0.19	1.1	14.54	1	13	0.30	-1.37	2	100.%	14.44%
BlackRock Mid Cap Grw Eq. Inv C	3930	1.8	1	0.1	1.15	16.18	0.92	12.71	0.92	-0.80	2	100.%	13.77%
JP Morgan Sm Cap Blend I	328	0.99	0	-1.54	1.29	19.03	0.8	11.05	0.50	-1.53	2	100.%	14.80%
Carillon Eagle MC Grw I	5420	0.75	0	-0.62	1.21	16.5	0.91	12.11	0.04	-1.54	3	100.%	14.79%
Wells Fargo Discovery A	2481	1.21	5.75	0.77	1.16	16.59	0.95	13.34	0.28	-1.65	2	0.00%	14.05%
UBS US Sm Cap Grw A	114	1.25	5.5	-0.68	1.27	18.98	0.83	11.77	0.69	-0.58	2	0.00%	14.06%
Victory RS Small Cap Growth C	2115	2.16	1	-0.56	1.22	18.17	0.83	11.89	0.41	-1.47	5	100.%	13.66%
Harford Healthcare I	1272	1	0	7.38	0.84	15.13	0.96	17.17	0.63	1.09	3	100.%	14.69%
Fidelity Advisor Equity Growth A	3051	1.02	5.75	0.94	1.06	14.43	1.02	13.75	0.45	-1.16	2	0.00%	13.90%
Voya Large Cap Grw A	1053	1.04	5.75	1.41	1.02	13.36	1.09	14.4	-0.02	-1.56	3	0.00%	13.86%
Morgan Stanley Inst Discovery I	864	0.72	0	1.19	1.06	17.43	0.85	13.5	0.48	-0.99	6	50.%	14.51%
Harford Grw Opp. I	5040	0.83	0	0.3	1.15	15.88	0.95	12.96	-0.29	-1.27	3	100.%	14.47%
JP Morgan SC Blend A	328	1.24	5.25	-1.84	1.29	19.02	0.78	10.78	0.63	-1.22	2	50.%	13.81%
Wells Fargo Premier Large Co Gr Inst	2354	0.7	0	0.72	1.07	14.58	1	13.5	0.55	-1.33	3	0.00%	14.39%
Hartford Healthcare A	1272	1.28	5.5	7.09	0.84	15.13	0.95	16.77	0.79	1.44	3	33.%	13.72%
JP Morgan Large Cap Grw C	15229	1.44	1	1.89	1.05	14.67	1.05	14.74	0.39	-1.54	1	100.%	13.29%
Invesco Oppenheimer Discovery Y	2624	0.84	0	1.56	1.12	16.81	0.95	14.05	0.57	-0.89	2	50.%	14.16%
Harford Grw Opp. A	5040	1.11	5.5	0.04	1.15	15.87	0.94	12.7	-0.26	-1.03	3	100.%	13.52%
Brown Advisory SC Grw Inv	1277	1.15	0	0.32	1.06	15.39	0.91	12.94	0.54	-1.03	2	100.%	14.15%
Wells Fargo Endeavor Select Inst	127	0.7	0	0.81	1.08	14.77	1	13.58	0.29	-1.62	2	50.%	14.08%

Baron Asset Instl	4120	1.04	0	1.13	1.06	14.5	1.03	13.93	0.39	-1.16	1	100.%	14.07%
Franklin BioTech Discovery Adv	1131	0.77	0	6.4	1.06	22.63	0.68	13.05	0.75	1.37	3	100.%	14.05%
Wasatch Sm Cap Grw Investor	1725	1.2	0	0.87	1.04	15.58	0.92	13.47	0.69	-0.29	3	100.%	14.00%
Wells Fargo Discovery C	2481	1.96	1	0.04	1.15	16.55	0.9	12.62	0.27	-1.81	2	50.%	12.83%
Cohen & Steers Real Estate Secu. I	5417	0.87	0	8.25	0.75	15.4	0.96	19.31	0.62	-0.79	1	50.%	13.85%
Federated MDT Small Cap Grw Instl	819	0.89	0	-1.66	1.3	18.75	0.81	11.03	0.47	-0.50	4	0.00%	13.64%
BNY Mellon Sm/Md Cp Grw A	2084	1	5.75	0.18	1.11	15.89	0.92	12.79	0.70	0.16	3	66.%	12.91%
Cohen & Steers Real Estate A	54171	1.14	4.5	7.95	0.75	15.4	0.94	18.88	0.45	-1.09	2	50.%	12.98%
Invesco Oppenheimer Discover Grw Y	1508	0.87	0	1.66	1.04	14.96	1.01	14.43	0.14	-1.52	2	50.%	13.27%
Cohen & Steers Real Estate Sec C	5417	1.79	1	7.3	0.75	15.4	0.9	17.89	0.61	-0.82	2	50.%	11.73%
Principal Real Estate Security Inst	4621	0.91	0	7.69	0.74	15.36	0.91	18.64	0.41	-1.05	3	66.%	12.54%

Note. 181 funds (51 fund families)

    * Source from Yahoo Finance

    ** $ millions

APPENDIX F: CORRELATION BETWEEN FUND PERFORMANCE AND INDEPENDENT VARIABLES

Correlation between Fund Performance and Variables	
Alpha***	0.45
Kurtosis***	0.40
Skew***	0.37
Sharpe ratio	0.34
Treynor **	0.23
Required Min. Investment	0.16
Number of Holdings	0.05
Standard Deviation	0.04
Morningstar Rating	0.04
Beta	-0.01
Fund Age	-0.01
Management Fees	-0.05
R-squred	-0.05
Turnover ratio	-0.06
Asset Size	-0.07
Number of Managers	-0.10
Average Tenure	-0.11
Load Charges	-0.14
Net Expense Ratio*	-0.15
MBA Degrees**	-0.21

0 3 0 2 0 1 0 0 1 0 2 0 3 0 4 0 5

Note. significant level * $p < .05$, **$p < .01$, ***$p < .001$

Fund Performance: Compound Annual Growth Rate from 2009 to 2018