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MUTUAL FUND PERFORMANCE WITH RESPECT TO THE FAMA FRENCH AND CAPITAL ASSET PRICING MODELS

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Abstract

This thesis applies the capital asset pricing model (CAPM) and the Fama-French three-factor model (1992) to examine the performance of equity mutual funds over a ten year period, from 2000-2009. The results are largely consistent with recent empirical studies and efficient markets theory demonstrating that there is little evidence to suggest that skilled mutual fund managers exist. The majority of mutual fund returns can be explained by common risk factors and expenses, and it does not appear that any particular manager can generate consistently superior returns.

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Introduction

Equity Mutual Funds

Mutual funds are companies that use investors' money to invest in a collection of securities. These securities can include stocks, bonds, cash, or other financial instruments. Investors buy shares in the mutual fund at the fund's net asset value (NAV) in addition to paying any fees charged by the fund. Subsequently, investors earn money from mutual funds in three ways:

- The fund distributes income earned from dividends on equities and interest on bonds
- The fund distributes capital gains earned on appreciated securities it has sold
- Securities the fund holds increase in price cause the NAV to increase, allowing the investor to sell shares in the fund for a profit

There are several different types of mutual funds that are available to investors. Money market funds invest in low-risk securities. Bond funds (also known as income funds) invest mainly in debt securities. Equity funds, which will be the focus of this thesis, invest primarily in stocks. Index funds are a type of equity fund and attempt to replicate the performance of a particular index such as the S&P 500 Composite.

Equity funds allow investors to gain broad exposure to the markets without having to buy many individual stocks directly. Therefore, these funds help to minimize unsystematic risk by improving diversification in an investor's portfolio. Also, investing in mutual funds helps to minimize transaction costs for investors as these large funds can take advantage of economies of scale and pay much less per transaction than an individual could. Moreover, investors

supposedly benefit from the expertise of the manager that operates the fund; however, this issue is highly debated in finance. There is significant evidence indicating that managers do not actually have exceptional stock-picking ability and cannot provide superior returns on a consistent basis.

Equity funds can be either passively or actively managed. Passively managed funds simply try to emulate the returns of certain stock market indices. Actively managed funds, which will be the focus of this thesis, require the manager to select stocks in an attempt to outperform the market. These funds can employ numerous investment strategies in an attempt to provide high returns for investors through capital gains and dividends. For example, a value mutual fund might focus on large, stable companies that pay dividends; whereas, a growth fund might invest largely in smaller companies with high growth potential.

Additionally, a fund could invest in a particular sector of the economy, or invest broadly across all sectors.

The performance of equity funds can be evaluated in a number of different ways. It can be compared to specific benchmarks in order to determine if a particular fund outperformed the market. Furthermore, the performance of a mutual fund can be compared against its peers in order to determine if it outperformed other funds with similar investment strategies. Moreover, the fund's actual performance can be measured relative to its expected performance as determined by an asset pricing model such as the Capital Asset Pricing Model (CAPM) or the Fama-French three-factor model (1992). These models calculate the expected return of an asset based on certain risk factors that impact returns.

Capital Asset Pricing Model

The capital asset pricing model was created by William Sharpe, John Lintner, and Jan Mossin in the 1960s. It was developed as a method to assess the systematic risk (also known as market risk) of an asset, which cannot be diversified away. CAPM calculates the expected return of a security, which is directly linked to the riskiness of that security.

The model can be summarized using the following equation:

$$E(R_i) = R_f + \beta_i(E(R_m) - R_f) \quad (1)$$

In equation 1, $E(R_i)$ is the expected return of the asset, R_f is the risk free rate, B_i is the beta, and $E(R_m)$ is the expected market return. The risk-free rate is usually equivalent to the yield on treasury bills, and the expected market return is the total expected return on the equity market. Thus, the expected market return less the risk-free rate is known as the market risk premium and is the excess return above the risk-free rate that investors demand to compensate for the extra risk taken by investing in a risky asset. Beta measures the volatility of a stock relative to the overall market. For example, if a stock has a beta of 1.2 and the market rises by 1%, then the stock would theoretically increase by 1.2%. Beta is the only risk factor in CAPM, and is calculated using a regression analysis comparing the returns of an individual stock with the returns of the overall market over the same time period. However, beta's relevancy is a point of contention in modern finance. Other studies, such as that of Eugene Fama and Kenneth French, have found that the relationship between beta and returns does not exist as Sharpe had originally discovered. Although CAPM has dominated finance for many years and is

still prevalent today, there are now other models that many consider to be more accurate and more useful.

Fama-French Three-Factor Model

In 1992, Eugene Fama and Kenneth French published "The Cross-Section of Expected Stock Returns" in the *Journal of Finance* presenting ideas that were in many ways contrary to the popularly held beliefs about finance at that time. It conveyed three main ideas:

- With a diversified portfolio of any U.S. stocks, there are three factors that contribute to performance: market exposure, small-cap exposure, and its value as characterized by the price to book ratio.

- Based on the size and value factors identified by Fama and French, beta alone is unable to explain return for a diversified portfolio of any U.S. stocks. This means that a stock with a higher beta did not necessarily have higher returns than a stock with a lower beta, as was previously believed.

- Their most significant finding was that the value and size factors generated positive returns since they were risk factors. They proposed that small stocks should return more than large stocks, and that value stocks should return more than growth stocks. This meant that small value stocks should generate the highest return, while large growth stocks should generate the lowest return.

This model disputed the Sharpe-Lintner-Black Model, which found a positive correlation between average return and beta from 1926-1968. Fama and French, however, found that this relation does not exist during the period of their study, from 1963-1990. They also noted that the relationship is very weak from 1941-1990. Fama and French found that average returns had a strong correlation with size, but that beta, when isolated, demonstrates little ability to predict returns.

This finding points out the significant shortcomings of the Capital Asset Pricing Model (CAPM) that is so commonly used in the world of finance. This model uses beta as a means of calculating the risk of an individual security. Fama and French, however, dispute the relevance of beta, thereby significantly devaluing the validity of CAPM.

The Fama-French three factor model includes two factors in addition to the traditional beta used in CAPM: market capitalization and book-to-market ratio. The expected return for a portfolio as described by the Fama-French model is illustrated below:

$$r = R_f + \beta_3(K_m - R_f) + bs \cdot SMB + bv \cdot HML \qquad (2)$$

In equation 2 "r" is the rate of return for the portfolio, R_f is the risk-free rate, and K_m is the overall return of the market. SMB stands for "small minus big" and measures the difference in market capitalization between stocks, and HML stands for "high minus low" and measures the book-to-price ratio differential between stocks. The betas each correspond to a factor and are determined by linear regressions. These coefficients can be negative or positive, and indicate higher returns for small cap and value portfolios, and vice versa.

The Fama-French model is becoming more popular in finance, and is increasingly being used as a basis for evaluating fund performance for mutual funds and ETFs. Morningstar.com now classifies funds based on Fama-French factors (size and value). Also, specific growth and value and large cap and small cap funds have been gaining popularity. Moreover, there have been attempts to build on this model with additional factors. For example, one model claims the existence of a "momentum" factor, which basically suggests that stocks that experienced strong returns in the previous year are more likely to perform better in the future, and vice versa.

Literature Review

Returns from Investing in Equity Mutual Funds 1971 to 1991 (1995)

Mutual funds have always been an attractive option for investors because they minimize the investment decisions that individuals must make for themselves. Rather than having to choose many different stocks, investors can choose one mutual fund and gain broad exposure to the market. Furthermore, since most of the general public is relatively uneducated about markets and investing in general, giving money to "expert" fund managers seems to be a great option. For years it was believed that equity mutual fund managers were able to persistently attain superior returns; however, a 1995 study by Burton Malkiel found that this was simply not true.

His article entitled "Returns from Investing in Equity Mutual Funds 1971 to 1991," which was published in the *Journal of Finance*, states that on average equity mutual funds underperform benchmark portfolios even without factoring in expenses. Moreover, funds show no ability to generate consistent returns over time. He observes that funds that performed well in the 1970s were unable to replicate those returns in the 1980s. Malkiel's results were contrary to several previous studies most likely due to the fact that he took into account survivorship bias, which is ignoring funds that failed over the time period of the study. This effect was not thought to be overly significant; however, Malkiel found it to be much more important than previously believed. It likely skewed the results of prior studies, causing mutual fund performance to appear better than it was in actuality.

Figure 1 below examines the 20 mutual funds with the highest returns from 1970 to 1980. It shows their subsequent returns and ranking in the 1980s.

	1970–1980		1980–1990	
	Rank	Average Annual Return (%)	Rank	Average Annual Return (%)
1. Twentieth Century Growth	1	27.12	151	11.24
2. Templeton Growth	2	22.34	101	12.68
3. Quasar Associates	3	20.56	161	10.99
4. 44 Wall Street	4	20.13	260	−16.83
5. Pioneer II	5	20.12	112	12.49
6. Twentieth Century Select	6	19.95	17	15.78
7. Security Ultra	7	19.74	249	2.22
8. Mutual Shares Corp.	8	19.52	29	15.23
9. Charter Fund	9	19.50	97	12.78
10. Magellan Fund	10	18.87	1	21.27
11. Over-the-counter	11	18.13	210	9.24
12. Amer. Cap. Growth	12	18.11	243	4.90
13. Amer. Cap. Venture	13	17.97	136	11.75
14. Putnam Voyager	14	17.41	65	13.88
15. Janus Fund	15	17.29	18	15.74
16. Weingarten Equity	16	17.28	30	15.21
17. Hartwell Leverage Fund	17	16.92	222	8.44
18. Pace Fund	18	16.82	50	14.53
19. Acorn Fund	19	16.50	147	11.36
20. Stein Roe Special Fund	20	15.75	48	14.54
Average of 20 funds		19.01		10.87
Overall fund average		9.74		11.56
S&P 500		8.45		13.87
No. of funds with 10-year record		211		260

Figure 1: Returns in the 1980s of the 20 best performing mutual funds from the 1970s. (Source: Malkiel 565)

These results demonstrate the lack of persistence in mutual fund performance across decades. Only three funds were ranked in the top 20 in both the 1970s and the 1980s. Also, this table points out the performance of these funds and of all funds in the study versus the returns of the S&P 500. Although mutual funds did outperform the S&P 500 from 1970-1980 on average, they were unable to do so from 1980-1990.

On Persistence in Mutual Fund Performance (1997)

In 1997, Mark Carhart published an article in the *Journal of Finance* supporting Malkiel's conclusion that superior mutual fund managers do not exist. This article, entitled "On Persistence in Mutual Fund Performance, describes Carhart's study attempting to explain persistence in equity mutual funds' returns. He is able to almost entirely explain fund returns with risk factors in stock returns, expense ratios, and transaction costs. His results are summarized in Figure 2 below.

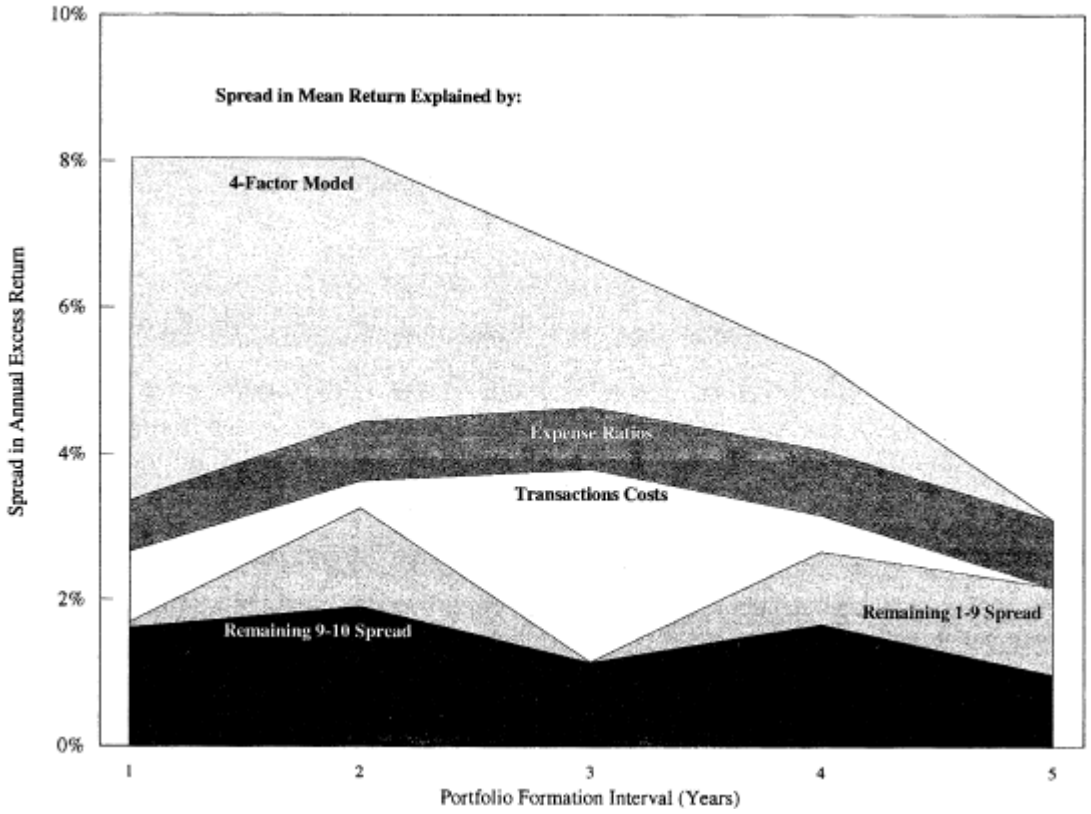

Figure 2: Summary of explanations for persistence in mutual fund performance. (Source: Carhart 75)

Carhart finds that the best performing equity mutual funds one year have above average expected returns the subsequent year, but not in the years after that. Thus, he observes that

implementing a strategy of buying the previous year's best performing mutual funds and selling the previous year's worst performing funds would yield an 8 percent annual return. He can explain most of that return with a 4-factor model, expense ratios, and transaction costs. The 4-factor model is similar to the Fama-French model (1992) using an additional "momentum" factor, which basically implies that better performing stocks tend to perform well the next year, and vice versa. The majority of unexplained performance in Carhart's study is attributable to significant relative underperformance of the previous year's worst performing funds. He finds that these funds generally underperform by about two times their investment costs, whereas most funds underperform only by the amount of their investment costs. Moreover, Carhart observes a high negative correlation between returns and expense ratios, portfolio turnover, and load fees.

These results suggest that very little, if any of equity mutual fund performance is due to the stock-picking skill of the manager. Rather, the large majority of performance is attributed to common risk factors and investment costs.

Mutual Fund Performance (2010)

The results of the previous two studies mentioned are largely echoed in Eugene Fama and Kenneth French's 2010 article entitled "Luck versus Skill in the Cross-Section of Mutual Fund Returns," which was also published in the *Journal of Finance.* After performing a study of equity mutual funds from 1984 to 2006, when relatively little bias existed, Fama and French concluded that few funds generate high enough returns to cover costs, and that most underperform by about the amount of their costs.

In their study, they compare actual mutual fund returns with extensive bootstrap simulations, CAPM estimates, three-factor model estimates, and four-factor model estimates. These tests demonstrate that even the top performing funds do not produce better than expected net returns. Rather, they perform very similarly to passively managed market portfolios, suggesting that on average there is little to nothing to be gained from investing in actively managed equity mutual funds. When expenses are added back to analyze gross returns, Fama and French observe that some evidence exists to suggest some manager skill both positive and negative. In the extreme tails of their cross-section, there is some measurable abnormal performance in both directions.

Methodology

First, using Wharton Research Data Services (WRDS) I gathered a sample of 30 of the largest actively managed equity mutual funds from the beginning of 2000 (see Appendix A), only using the funds with at least a 10-year history. I then collected the monthly returns, with expenses deducted, for these funds from 2000 to 2009, and subtracted the monthly risk free rates from these returns. The monthly risk free rates were obtained from the Fama-French factors from Kenneth French's website (see Appendix B).

Using the adjusted returns, I determined the beta of each fund for the CAPM model by calculating the slope between the funds' adjusted returns and the market returns. These betas were obtained for both 2000-2004 and 2005-2009. Then I found the average returns for each fund from those same time periods, and ran a regression analysis for each time period with the average returns of the 30 funds as the dependent variables and the betas of those funds as the independent variables.

Then I calculated the Fama-French betas by running a regression analysis with the each fund's adjusted returns as the dependent variable and the Fama-French factors (see Appendix B) as the dependent variables. This analysis produced values for the market beta (B_M), the size beta (B_{SMB}), and the value beta (B_{HML}) for 2000-2004 and 2005-2009. Next, I ran a regression analysis using the calculated betas for all of the funds as the independent variables and the average returns as the dependent variables for each time period.

Results

CAPM

We can determine the relative excess performance of the 30 mutual funds used in this sample in the context of the Capital Asset Pricing Model, which describes the relationship between a single risk factor, beta, and the expected return of an asset. By calculating the average returns and betas for each fund in each time period we get the following sets of data:

CAPM
2000-2004

Fund	Return	Beta
FMAGX	-2.59%	0.9484
AIVSX	4.05%	0.6925
AWSHX	6.34%	0.5939
FGRIX	-0.26%	0.6524
FCNTX	2.33%	0.6156
TWCUX	-4.48%	1.0515
JANSX	-6.93%	1.1978
JAVLX	-9.03%	1.1253
FBGRX	-4.47%	1.0151
AGTHX	3.58%	1.049
VWNFX	8.52%	0.6195
PVOYX	-7.73%	1.0648
FDGRX	-2.13%	1.378
FAGOX	-4.46%	0.9791
FEQIX	5.45%	0.72
PGRWX	4.04%	0.7039
VWUSX	-11.76%	1.3573
PNOPX	-8.79%	1.5211
CSTGX	-4.23%	1.2613
VPMCX	4.21%	1.0909
VWNDX	9.40%	0.8209
ANCFX	4.33%	0.8399
FFIDX	-1.95%	0.9753
FDEGX	-15.28%	1.8353
JAMRX	-8.84%	1.2129
PGIBX	3.30%	0.7056
LMVTX	4.01%	1.1059
PRFDX	8.49%	0.6043
PRSCX	-11.92%	2.2004
PNOBX	-9.51%	1.5207

Figure 3: Average returns and betas from 2000-2004. (Raw data from WRDS database)

CAPM
2005-2009

Fund	Return	Beta
FMAGX	1.64%	1.1826
AIVSX	2.75%	0.8198
AWSHX	1.37%	0.8407
FGRIX	-5.43%	1.0754
FCNTX	5.86%	0.8566
TWCUX	0.35%	0.9079
JANSX	3.35%	0.9815
JAVLX	8.63%	1.0307
FBGRX	3.31%	0.9874
AGTHX	4.18%	0.9258
VWNFX	2.19%	0.93
PVOYX	5.57%	1.0615
FDGRX	6.12%	1.012
FAGOX	0.95%	1.1503
FEQIX	1.14%	1.0519
PGRWX	-0.49%	0.9793
VWUSX	2.23%	0.9042
PNOPX	1.89%	0.9333
CSTGX	-0.91%	0.9153
VPMCX	5.59%	0.9318
VWNDX	0.90%	1.0416
ANCFX	5.42%	0.9739
FFIDX	2.98%	0.9625
FDEGX	1.86%	1.1012
JAMRX	4.83%	1.1184
PGIBX	-1.27%	0.9777
LMVTX	-5.71%	1.2627
PRFDX	2.20%	0.9676
PRSCX	5.59%	1.1936
PNOBX	1.14%	0.9325

Figure 4: Average returns and betas from 2005-2009. (Raw data from WRDS database)

Using this data, we can determine a regression line of the expected returns and calculate the residual - the difference between the actual and expected returns - for each fund in each time period. The residuals explain which mutual funds were able to perform better than CAPM would predict and which performed worse. The expected returns and residuals are listed below in Figure 5:

CAPM Residuals

	2000-2004		2005-2009	
Fund	***Predicted Return***	***Residual***	***Predicted Return***	***Residual***
FMAGX	-0.08%	-2.51%	1.17%	0.48%
AIVSX	3.66%	0.39%	3.37%	-0.62%
AWSHX	5.10%	1.24%	3.24%	-1.88%
FGRIX	4.25%	-4.51%	1.82%	-7.25%
FCNTX	4.78%	-2.45%	3.15%	2.72%
TWCUX	-1.59%	-2.90%	2.84%	-2.49%
JANSX	-3.72%	-3.20%	2.39%	0.96%
JAVLX	-2.67%	-6.37%	2.09%	6.54%
FBGRX	-1.05%	-3.42%	2.35%	0.95%
AGTHX	-1.55%	5.13%	2.73%	1.45%
VWNFX	4.72%	3.79%	2.70%	-0.51%
PVOYX	-1.78%	-5.95%	1.90%	3.67%
FDGRX	-6.36%	4.23%	2.20%	3.92%
FAGOX	-0.53%	-3.94%	1.36%	-0.41%
FEQIX	3.26%	2.19%	1.96%	-0.82%
PGRWX	3.49%	0.55%	2.40%	-2.89%
VWUSX	-6.05%	-5.71%	2.86%	-0.63%
PNOPX	-8.45%	-0.34%	2.68%	-0.79%
CSTGX	-4.65%	0.42%	2.79%	-3.70%
VPMCX	-2.16%	6.37%	2.69%	2.90%
VWNDX	1.78%	7.61%	2.02%	-1.12%
ANCFX	1.51%	2.83%	2.43%	2.98%
FFIDX	-0.47%	-1.48%	2.50%	0.47%
FDEGX	-13.04%	-2.24%	1.66%	0.20%
JAMRX	-3.95%	-4.89%	1.56%	3.27%
PGIBX	3.47%	-0.17%	2.41%	-3.68%
LMVTX	-2.38%	6.39%	0.68%	-6.39%
PRFDX	4.95%	3.55%	2.47%	-0.27%
PRSCX	-18.37%	6.45%	1.10%	4.50%
PNOBX	-8.44%	-1.06%	2.69%	-1.55%

Figure 5: Predicted returns and residuals based on CAPM. (Raw data from WRDS database)

Fama-French

In order to compare the performance of these 30 funds with respect to the Fama-French 3-factor model (1992), we must consider two additional risk factors: size (B_{SMB}) and value (B_{HML}). Below in Figure 6 are the values of the betas for each fund:

Fama-French Betas

	2000-2004			2005-2009		
Fund	**Beta (m)**	**Beta (smb)**	**Beta (hml)**	**Beta (m)**	**Beta (smb)**	**Beta (hml)**
FMAGX	0.967954	-0.180964	-0.058164	1.239994	0.0657592	-0.294631
AIVSX	0.82297	-0.085952	0.2295203	0.832032	-0.121786	0.0437096
AWSHX	0.868095	-0.211052	0.4655731	0.840566	-0.209435	0.1645904
FGRIX	0.729822	-0.195945	0.0563988	1.074421	-0.0788	0.0659531
FCNTX	0.65216	0.1285612	0.1482946	0.926459	-0.055248	-0.252887
TWCUX	1.00281	-0.07718	-0.145824	1.014297	-0.026031	-0.430281
JANSX	1.119483	-0.016388	-0.175325	1.04095	0.1058281	-0.334865
JAVLX	0.91976	-0.187308	-0.539384	1.173058	-0.080104	-0.540253
FBGRX	0.952105	-0.114774	-0.196922	0.99919	0.0726352	-0.106629
AGTHX	0.971132	0.1616459	-0.07616	0.971947	0.0118314	-0.204759
VWNFX	0.92896	-0.16266	0.5669954	0.917097	-0.242903	0.2447958
PVOYX	0.941215	0.0802449	-0.218116	1.072803	0.2382828	-0.234467
FDGRX	1.089693	0.5195678	-0.325651	1.096643	0.1547307	-0.479888
FAGOX	0.981808	-0.099307	-0.048943	1.338544	-0.029068	-0.774646
FEQIX	0.980708	-0.208856	0.4382486	1.02795	-0.184987	0.2464226
PGRWX	0.952272	-0.241257	0.3940868	0.940188	-0.124821	0.2635814
VWUSX	1.213009	-0.298521	-0.470624	0.967666	0.1045827	-0.350907
PNOPX	1.227745	0.2096178	-0.507015	0.994129	0.1908258	-0.407048
CSTGX	1.097531	0.1546045	-0.262328	1.009192	0.0488013	-0.436156
VPMCX	1.046545	0.1927395	0.0119499	0.943372	0.1374043	-0.156592
VWNDX	1.094889	-0.169194	0.4883093	1.023901	-0.05377	0.1169821
ANCFX	0.967127	-0.014733	0.261963	1.008918	-0.078967	-0.086694
FFIDX	0.937421	-0.03964	-0.102284	1.007346	-0.127055	-0.090417
FDEGX	1.455556	0.1751504	-0.709286	1.174619	0.2418408	-0.500533
JAMRX	1.038585	0.0353346	-0.350531	1.169177	0.1004467	-0.293737
PGIBX	0.953882	-0.241608	0.3937538	0.939389	-0.12971	0.2641014
LMVTX	1.234046	-0.084673	0.2252255	1.253838	0.101702	-0.041909
PRFDX	0.889323	-0.197149	0.4961719	0.907899	-0.120528	0.3472578
PRSCX	1.790343	0.010666	-0.864286	1.272757	0.5021531	-0.728821
PNOBX	1.227765	0.208947	-0.506611	0.993276	0.1904684	-0.406843

Figure 6: Market, size, and value betas from the Fama-French model. (Raw data from WRDS database)

After running a regression analysis, we can determine the residuals the same way as with CAPM, and observe which funds outperformed and which underperformed their expected returns based on the Fama-French risk factors. The predicted returns and residuals are listed below in Figure 7:

Fama-French Residuals

	2000-2004		2005-2009	
Fund	*Predicted Return*	*Residual*	*Predicted Return*	*Residual*
FMAGX	-3.03%	0.45%	0.91%	0.74%
AIVSX	2.90%	1.14%	2.97%	-0.23%
AWSHX	6.59%	-0.25%	2.08%	-0.71%
FGRIX	-1.44%	1.18%	0.30%	-5.73%
FCNTX	2.59%	-0.26%	3.88%	1.98%
TWCUX	-3.87%	-0.61%	4.09%	-3.74%
JANSX	-3.74%	-3.19%	3.27%	0.08%
JAVLX	-12.43%	3.39%	3.08%	5.55%
FBGRX	-5.24%	0.76%	2.26%	1.05%
AGTHX	-0.81%	4.39%	3.13%	1.05%
VWNFX	9.03%	-0.51%	0.75%	1.44%
PVOYX	-4.21%	-3.53%	2.37%	3.20%
FDGRX	-2.68%	0.54%	3.63%	2.49%
FAGOX	-2.22%	-2.25%	2.85%	-1.90%
FEQIX	6.32%	-0.87%	-0.40%	1.53%
PGRWX	5.17%	-1.13%	0.45%	-0.94%
VWUSX	-11.33%	-0.43%	4.14%	-1.91%
PNOPX	-8.19%	-0.60%	4.26%	-2.37%
CSTGX	-4.18%	-0.05%	4.22%	-5.13%
VPMCX	1.27%	2.94%	3.19%	2.40%
VWNDX	7.81%	1.58%	0.53%	0.37%
ANCFX	4.36%	-0.03%	1.95%	3.46%
FFIDX	-2.89%	0.94%	1.97%	1.01%
FDEGX	-11.86%	-3.42%	2.98%	-1.11%
JAMRX	-6.88%	-1.95%	1.66%	3.17%
PGIBX	5.16%	-1.86%	0.45%	-1.72%
LMVTX	3.68%	0.33%	-0.81%	-4.90%
PRFDX	7.33%	1.16%	0.26%	1.94%
PRSCX	-15.38%	3.45%	3.51%	2.08%
PNOBX	-8.19%	-1.32%	4.27%	-3.13%

Figure 7: Predicted returns and residuals based on the Fama-French model. (Raw data from WRDS database)

Persistence

Each period, for both models, approximately half of the mutual funds in the sample perform better than expected while the other half performs worse than expected. It is impossible to tell whether any outperformance in a single period is the result of skill or luck; however, we can measure the ability of each fund to outperform in consecutive periods in order to help gauge whether particular managers actually have stock picking skill. If persistence in performance exists for a mutual fund over an extended period of time, it suggests that a manager may be more than just lucky. By continuously providing superior returns, it would contradict efficient markets theory, which states that it is not possible to consistently achieve excess returns when adjusted for risk.

There have been several previously mentioned studies that have investigated mutual fund performance and persistence extensively, and although this study examines a relatively small time period (2000-2009), it produces similar results that help to confirm previous findings. With regards to CAPM, there was minimal persistence between 2000-2004 and 2005-2009:

CAPM

	Second Period (2005-2009)		
Initial Period (2000-2004)	Winner	Loser	Percentage Repeat Winners
Winner	5	9	35.71%
Loser	9	7	

Figure 8: Persistency in fund performance using CAPM.

As Figure 8 portrays, only five mutual funds that outperformed their expected returns as determined by CAPM in the first period were able to outperform again in the second period. This represents just 36 percent of the winners from the first period.

In the context of the Fama-French 3-factor model, however, much more persistence existed:

Fama-French

	Second Period (2005-2009)		
Initial Period (2000-2004)	Winner	Loser	Percentage Repeat Winners
Winner	10	3	76.92%
Loser	7	10	

Figure 9: Persistency in fund performance using the Fama-French model.

Of the 13 winners from 2000-2004, ten, or 77 percent, were also winners from 2005-2009. Although this number seems high and could suggest some persistence, it would need to be confirmed over a longer period of time to draw more convincing conclusions. It seems more likely that the financial crisis in the late 2000s may have caused the model to be inaccurate, skewing some of the data.

Predictability of the Models

In his previously mentioned study, Mark Carhart found that common risk factors, expenses, and transaction costs could explain most of mutual fund performance, leaving little to be explained by the potential skill of managers. For the first period, 2000-2004, this study echoes his observation in that the Fama-French model and even the CAPM to some extent were able to explain most of the mutual fund returns. We can see from Figure 10 below how well the CAPM predicted returns during the first period:

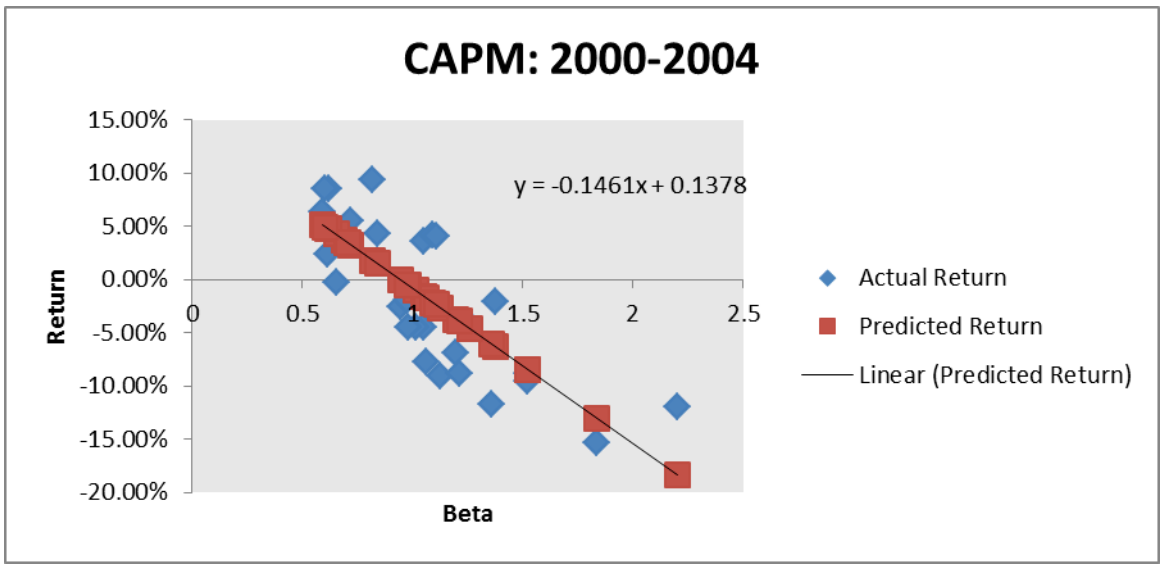

Figure 10: Returns versus beta based on CAPM from 2000-2004.

The CAPM regression analysis had an R-squared value of about 65 percent for this period, which means that it can explain 65 percent of the movements in the mutual funds' prices. The Fama-French 3-factor model predicts returns even better with an R-squared value of about 92 percent. Since expenses are already factored into returns, this data supports Carhart's findings that risk factors and expenses can explain a large part of mutual fund returns. This study has not even considered transaction costs associated with buying and selling these funds, which Carhart found to explain part of performance as well. Therefore, with such a large majority of performance explained by common factors and expenses, there is not much performance that could possibly be attributable to skilled or informed managers.

The second period of data from 2005-2009, however, seems to be much more difficult for the models to predict. Figure 11 below demonstrates how the CAPM had virtually no ability to explain mutual fund returns in this period:

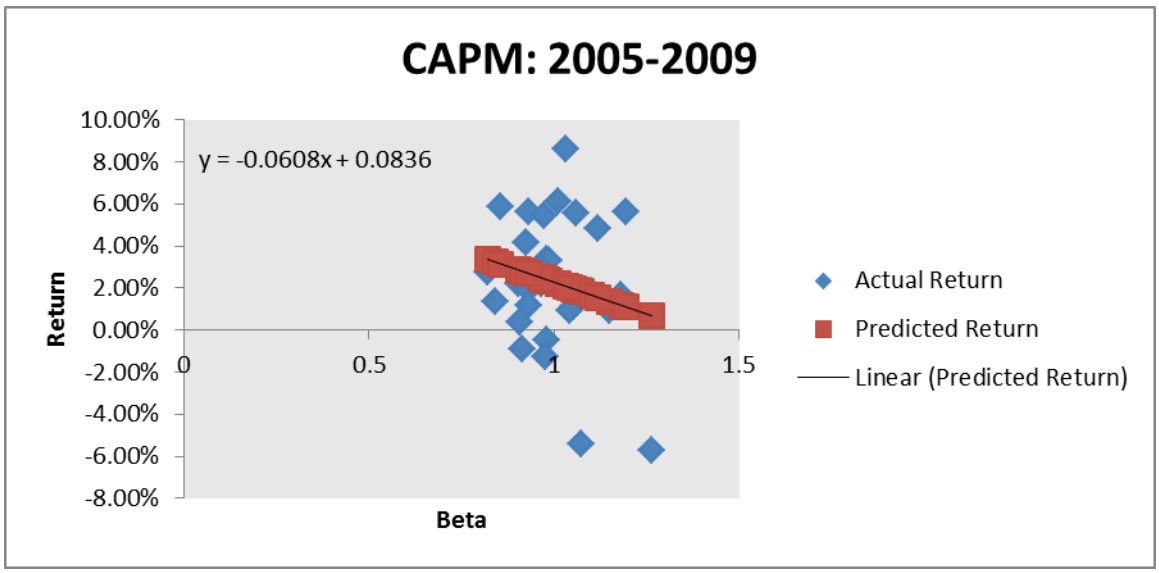

Figure 11: Returns versus beta based on CAPM from 2005-2009.

The CAPM regression analysis had an R-squared value of just 4 percent, while the Fama-French regression had an R-squared value of just 24 percent. Clearly, these models were extremely inaccurate in predicting fund returns during this period, likely due to the financial crisis. This event is such a statistic improbability that models like Fama-French and CAPM cannot possibly account for it.

Conclusion

This study has produced results consistent with those of previous literature on equity mutual fund performance. It is evident that in normal time periods, the majority of fund returns can be explained by common risk factors, such as those described in the Fama-French 3-factor model, and expenses. Thus, there is little to be potentially explained by the skill of a particular manager.

Moreover, there is minimal persistence from 2000-2004 to 2005-2009 in the context of the CAPM, further opposing the idea that better managers actually exist. Although there appears to be relatively high persistence between the two periods with regards to the Fama-French model, it is not conclusive enough to definitely suggest manager skill. Since the model explains the returns for the second period extremely poorly, the data is not completely convincing. The persistence of these funds would need to be measured over a longer time horizon to draw better conclusions.

Overall, the data is largely consistent with efficient markets theory. It seems that actively managed equity mutual funds are unable to generate superior returns for investors on a consistent basis. Manager skill does not appear to be a significant explanation for fund returns.

Appendix A

Mutual Fund Sample

NASDAQ Ticker	Fund	Total Net Assets (as of 12/31/99) (in millions)
FMAGX	Fidelity Magellan	$105,938.50
AIVSX	Investment Company of America	$56,095.20
AWSHX	Washington Mutual Investors	$53,135.70
FGRIX	Fidelity Growth & Income	$48,528.30
FCNTX	Fidelity Contrafund	$46,927.00
TWCUX	American Century Ultra Fund	$43,192.60
JANSX	Janus Fund	$42,330.20
JAVLX	Janus Twenty Fund	$36,909.40
FBGRX	Fidelity Blue Chip Growth	$27,876.30
AGTHX	Growth Fund of America	$27,406.80
VWNFX	Vanguard Windsor II	$26,901.80
PVOYX	Putnam Voyager	$24,363.40
FDGRX	Fidelity Growth Company	$24,337.20
FAGOX	Fidelity Advisor Growth Opportunities	$24,245.90
FEQIX	Fidelity Equity-Income	$22,828.60
PGRWX	Putnam Growth and Income A	$21,089.60
VWUSX	Vanguard U.S. Growth	$19,068.00
PNOPX	Putnam Multi-Cap Growth	$17,962.50
CSTGX	AIM Constellation	$17,920.40
VPMCX	Vanguard PRIMECAP	$17,911.90
VWNDX	Vanguard Windsor	$16,699.80
ANCFX	Fundamental Investors	$16,603.10
FFIDX	Fidelity Fund	$16,114.30
FDEGX	Fidelity Growth Strategies	$15,199.30
JAMRX	Janus Research Fund	$13,543.10
PGIBX	Putnam Growth and Income B	$13,386.50
LMVTX	Legg Mason Capital Mgmt Value Trust	$12,540.10
PRFDX	T. Rowe Price Equity Income	$12,321.20
PRSCX	T. Rowe Price Science & Technology	$12,270.60
PNOBX	Putnam Multi-Cap Growth B	$11,893.00

Appendix B

Fama/French Factors

Date	Mkt-RF	SMB	HML	RF
200001	-4.37	4.45	0.29	0.41
200002	2.75	22.19	-12.78	0.43
200003	4.88	-16.67	7.91	0.47
200004	-6.41	-7.68	9.3	0.46
200005	-4.4	-4.79	3.79	0.5
200006	4.76	13.81	-9.95	0.4
200007	-2.19	-2.77	8.38	0.48
200008	7.08	-0.87	-1.32	0.5
200009	-5.62	-1.81	6.86	0.51
200010	-3.02	-3.75	4.93	0.56
200011	-10.76	-3.15	12.49	0.51
200012	1.53	1.53	6.21	0.5
200101	3.41	6.95	-5.64	0.54
200102	-10.32	-1.13	13.84	0.39
200103	-7.47	0.58	6.27	0.44
200104	8	0.32	-4.51	0.39
200105	0.74	2.96	2.87	0.32
200106	-2.03	6.41	-2.12	0.28
200107	-2.13	-4.2	5.6	0.3
200108	-6.22	2.17	3.31	0.31
200109	-9.43	-6.53	1.62	0.28
200110	2.58	6.86	-7	0.22
200111	7.7	0.4	0.83	0.17
200112	1.63	5.12	0.39	0.15
200201	-1.74	1.13	3.47	0.14
200202	-2.3	-1.67	3.93	0.13
200203	4.34	4.35	1.12	0.13
200204	-5.12	5.83	4.2	0.15
200205	-1.19	-3.71	2.47	0.14
200206	-7.16	3.52	1.47	0.13
200207	-8.26	-5.18	-3.66	0.15
200208	0.66	-2.19	2.18	0.14
200209	-10.14	2.71	1.15	0.14
200210	7.35	-3	-6.51	0.14
200211	6.01	3.18	-1.55	0.12
200212	-5.44	-0.52	3.88	0.11
200301	-2.44	1.39	-0.89	0.1
200302	-1.63	-0.29	-1.46	0.09
200303	0.93	0.83	-1.71	0.1
200304	8.18	1.12	-0.03	0.1

200305	6.26	4.71	0.17	0.09
200306	1.53	1.47	0.63	0.1
200307	2.24	5.6	-2.07	0.07
200308	2.43	2.66	1.78	0.07
200309	-0.99	0.58	0.94	0.08
200310	5.96	2.91	1.81	0.07
200311	1.59	2.23	1.39	0.07
200312	4.47	-2.81	2.68	0.08
200401	2.23	2.63	1.63	0.07
200402	1.49	-1.19	0.36	0.06
200403	-1.16	1.85	0	0.09
200404	-2.5	-2.53	-1.72	0.08
200405	1.35	-0.15	-0.26	0.06
200406	2.08	2.27	1.68	0.08
200407	-3.87	-3.83	4.41	0.1
200408	0.16	-1.53	1.15	0.11
200409	1.94	2.84	0.37	0.11
200410	1.67	0.45	-0.93	0.11
200411	4.67	4.11	1.91	0.15
200412	3.36	0.2	-0.36	0.16
200501	-2.82	-1.6	2.47	0.16
200502	2.11	-0.76	2.81	0.16
200503	-1.9	-1.31	1.67	0.21
200504	-2.73	-3.97	-0.46	0.21
200505	3.56	2.99	-1.21	0.24
200506	0.92	2.59	2.72	0.23
200507	4.09	2.77	-0.45	0.24
200508	-0.89	-0.89	1.4	0.3
200509	0.77	-0.64	1.19	0.29
200510	-2.35	-1.04	-0.71	0.27
200511	3.73	1.01	-1.81	0.31
200512	0.03	-0.48	0.48	0.32
200601	3.65	5.38	1.13	0.35
200602	-0.5	-0.37	-0.84	0.34
200603	1.54	3.52	-0.02	0.37
200604	0.94	-1.21	3.06	0.36
200605	-3.53	-2.99	2.72	0.43
200606	-0.44	-0.47	1.48	0.4
200607	-0.59	-3.91	3.28	0.4
200608	2.09	0.79	-1.72	0.42
200609	1.53	-1.19	-0.45	0.41
200610	3.3	1.68	0.48	0.41
200611	1.95	0.7	0.46	0.42
200612	0.68	-0.9	2.55	0.4
200701	1.5	0.04	-0.09	0.44
200702	-1.78	1.39	0.31	0.38

200703	0.87	-0.19	0.32	0.43
200704	3.55	-2.11	-0.96	0.44
200705	3.48	-0.07	-0.08	0.41
200706	-1.87	0.65	-1.05	0.4
200707	-3.57	-2.71	-2.97	0.4
200708	0.75	-0.13	-2.35	0.42
200709	3.77	-2.47	-2.09	0.32
200710	2.26	0.08	-1.98	0.32
200711	-5.27	-2.74	-0.99	0.34
200712	-0.7	0.06	-0.07	0.27
200801	-6.44	-0.76	3.05	0.21
200802	-2.33	-0.54	0	0.13
200803	-1.21	0.85	0.19	0.17
200804	4.94	-1.53	0.07	0.17
200805	2.22	2.87	-0.31	0.17
200806	-8.03	1.08	-1.05	0.17
200807	-1.47	3.71	3.61	0.15
200808	0.99	3.76	1.46	0.12
200809	-9.96	-0.24	4.48	0.15
200810	-18.54	-2.12	-3.13	0.08
200811	-8.55	-3.62	-4.93	0.02
200812	2.06	4.04	-1.28	0.09
200901	-7.75	-0.91	-9.93	0
200902	-10.12	-0.41	-6.73	0.01
200903	8.76	0.74	2.55	0.01
200904	11.04	5.14	5.74	0.01
200905	6.73	-2.61	0.44	0
200906	-0.28	2.64	-2.48	0
200907	8.24	2.48	4.83	0.01
200908	3.18	-0.58	7.62	0.01
200909	4.52	2.36	1.5	0
200910	-2.84	-4.28	-4.38	0
200911	5.74	-2.83	0.12	0
200912	2.92	5.88	0.74	0

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