

**MUTUAL FUND PERFORMANCE ANALYSIS PRE AND POST FINANCIAL  
CRISIS OF 2008**

by

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## **Abstract**

Using a sample of 955 mutual funds, free of survivorship bias, we analyse the performance of diversified equity mutual funds in the United States of America that invest solely in stocks listed on the U.S. stock exchanges before and after the financial crisis of 2008. We categorize all mutual funds into their respective strategy including value, growth, and blend in order to see any relationship with respect to their strategic focus.

We find that mutual funds were not able to provide a positive alpha, neither before nor after the financial crisis of 2008. These findings are consistent with other researchers such as Mark M. Carhart (1997) and Michael C. Jensen (1969).

Moreover, by using Fama and French`s (1993) 3 - factor model plus an additional momentum factor, we can perceive a strong relationship between the factors size and momentum and the overall performance of mutual funds.

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## **Glossary**

- CAPM** CAPM stands for “Capital Asset Pricing Model” and describes an approach that seeks to determine an appropriate rate of return for an underlying asset based on the level of systematic risk (beta) of the respective asset.
- ETF** An “Exchange Traded Fund” is a specific security type that tracks the performance of an underlying asset such as an index, commodity price or other asset classes. An ETF is a passive investment vehicle.
- NAV** The “Net Asset Value” measures the price of a fund based on the difference of fund’s asset and liability values.

## **Introduction**

A mutual fund is a type of an investment vehicle that pools together the investments from investors and manages those investments on their behalf for pre-specified fees. Mutual funds are usually “open-ended”, meaning that people can buy units or shares directly from a mutual fund and later on sell those units back to a mutual fund at a price that is determined by the corresponding NAV (Net Asset Value).

Mutual funds differ from each other on their investment strategies; some funds invest mainly in bonds such as government bonds, corporate bonds etc., while others invest in equities alone or pursue a balanced strategy by investing in both bonds and equities. People choose to invest in mutual funds since it allows their investments to be managed by professional investment managers that can diversify their investments and minimize risks associated with their investment. However, as all investments, mutual funds also have associated risks whereas it is possible for an investor to lose money on his or her investment. The value of mutual funds will go up or down correspondingly with the value of their underlying investments. Therefore, depending on the underlying assets the value of the mutual fund can change frequently.

Fees are paid by investors to the fund manager for the active management of their investments. Therefore, the performance of mutual funds has been a topic for researches over the last century where academicians and researchers have been trying to analyse whether mutual funds provide an alpha and whether it is worth to invest in mutual funds

instead of investing in passively managed vehicles with zero alpha such as ETFs (exchange-traded fund) and index funds.

Academic papers published by Jensen (1969), Carhart (1997) and French (2008) aim to conduct analysis on mutual fund performance. Jensen (1969) measures the performance of 115 mutual funds between 1945 and 1964 and concludes that mutual funds were on average not able to foresee security prices and beat the market, even if the performance is measured in gross returns, including management expenses. Therefore, mutual funds on average are not successful to provide an alpha for the investors. The findings also suggest that there is only little evidence that an individual fund is able to provide a significant alpha.

Moreover, Carhart (1997) uses a 4-factor model on a survivorship bias free sample of mutual funds between January 1962 and December 1993 and concludes that most funds failed to generate an alpha on their investments. There is very little evidence that mutual fund managers are better informed and skilled than the market consensus. In addition, the paper also suggests that funds with higher returns last year will also have above average returns for the subsequent year, but not in years thereafter, which he describes as the momentum factor. Last but not the least, French (2008) also conducts a research on the cost of active investing to analyse whether it was worth to invest in actively managed funds. By analysing the returns of actively managed funds and overall the market portfolio between 1980 and 2006, the paper concludes that had the typical investor invested in the market portfolio in 1980, he or she would have increased his or her average annual return by 67 basis points up until 2006.

We analyse the performance of mutual funds both before and after the financial crisis of 2008 to determine whether mutual funds in U.S. are able to provide an alpha for their investors and, therefore, yield a higher return than the market consensus. Considering high fees that investors have to pay to invest in mutual funds, we analyse whether these fees are justified by a superior return.

Section 1 elaborates on data collection, Section 2 illustrates the model that was used for our regression analyses and its advantages over the other models, Section 3 provides and interprets the output of the analysis and Section 4 concludes the paper.

## Data

Our analysis focuses on diversified equity mutual funds in the United States of America that invest solely in stocks listed on the U.S. stock exchanges. Our data excludes funds that invest in bonds, over-the-counter securities and international or sector equities. We extract monthly data for 955 mutual funds from January 2000 to the end of August 2017 from Bloomberg. In order to avoid the survivorship bias that would invalidate the results of our analysis, we include all known equity funds in the respective period recorded in Bloomberg. Table 1 reports summary statistics on our database of mutual funds.

*Table 1 Mutual Fund Dataset Summary*

### Mutual Fund Dataset Summary

This table documents sample averages of our data from January 2000 to August 2017. AUM is the total asset under management. Avg. Fee is the total annual management and administration fee and maximum load is the total of front-end, rear end, and deferred sales charges as a percentage of the investment. Active funds are the still actively traded funds at the end of the observation period, August 31st, 2017. Closed funds are the discontinued funds prior to this date.

Object	Total	Averages of annual data January 2000 - August 2017				
		Avg. AUM (\$ mm)	Avg. Fees (%/year)	Avg. Turnover (%/year)	Avg. Max Load (%/year)	Avg. Age (years)
All Funds	955	\$ 4,771.3	1.1%	60.5%	2.0%	27.9
<i>By fund strategy</i>						
Value	300	\$ 3,350.9	1.1%	52.6%	2.1%	28.2
Growth	371	\$ 3,338.3	1.1%	68.3%	2.2%	28.0
Blend	284	\$ 8,143.6	0.9%	58.6%	1.6%	27.4
<i>By current status</i>						
Active Funds	900	\$ 5,046.9	1.0%	59.4%	2.0%	27.9
Closed Funds	55	\$ 260.8	1.2%	77.7%	2.5%	27.7

Our sample covers 955 national mutual funds listed in the United States. These funds are divided into three general strategies, value, growth, and blend. The objective of value strategy funds is to invest in undervalued stocks with stable cash flows that are more likely to pay dividends in the future. On the other hand, the primary objective of a growth fund is to invest in stocks that have higher potential for capital appreciation with above-average risk levels and have little or no expected dividend payments. Companies within growth portfolios are usually reinvesting their earnings into research and development, expansion or acquisition plans of their companies. Finally, blend strategy focused funds maintain a balanced portfolio, which is a mixture of both value and growth stocks. We use this classification to analyze whether we can perceive a significant difference between any of those strategies.

The average size, measured by asset under management, of our sample mutual funds is \$4,771.3 million with an average expense ratio of 1.1 percent per year. Most funds in our database charge load fees with an average of additional 2.0 percent per year.

Within our sample period, 55 out of 955 funds closed down; however, as mentioned above we have included the performance of those funds in our analysis up until their disappearances. In that way, we can avoid the survivorship bias issue that can distort the validity of our analysis. Therefore, to our knowledge the sample is the most complete survivorship-free mutual fund sample. As our data suggests, the funds that closed down were rather smaller funds with smaller assets under management and had higher than average annual fees. Moreover, the average age of the mutual funds in our sample is almost 28 years, showing a tendency towards more established and older funds.

## Model of Performance Measurement

In order to measure mutual funds' performance, hereby we use the 4-factor model as described in Carhart (1995). This section will briefly illustrate the model and the reasons for choosing the 4-factor model. The 4-factor model is constructed by using Fama and French's (1993) 3 - factor model plus an extra factor that captures the momentum. This 4-factor model can also be called the performance attribution model since coefficients on factors indicate the attribution to four main measures: monthly excess market returns over the risk free rate, small stocks in terms of market capitalization against large stocks, value stocks against growth stocks and one-year monthly momentum returns against contrarian stocks. The data for the 4-factor model and its interpretation was taken from Kenneth French's data library and the formula that was implemented for our regression is as following;

$$r_{it} = \alpha_{iT} + \beta_{iTRMRF_t} + \beta_{iTSMB_t} + \beta_{iTHML_t} + \beta_{iTMOM_t} + e_{it} \quad t=1,2,3,\dots, T;$$

where  $r_{it}$  is the mutual funds' return in excess of the 1-month T-bill return. RMRF is the excess return on the market, which is the value-weighted return of all firms that have been incorporated in the U.S. and listed on the New York Stock Exchange, American Stock Exchange, or NASDAQ. SMB is the difference between the average returns on small portfolios and big portfolios. HML is the difference between the average returns on two value portfolios and two growth portfolios. MOM is the difference between the average returns of two high and two low prior return portfolios. The summary table below illustrates the fact that the 4-factor model can significantly clarify return variations. High variances of SMB, HML and MOM and their low correlations with each other and the market suggest that the 4-factor model can explain sizable time variations.

Moreover, pre and post crisis low cross-correlations among the returns also show that the problem of multicollinearity is minimal and does not affect the 4-factor model. In addition, Carhart (1997) found that the 4-factor model considerably enhances the results of the 3-factor model and CAPM. Carhart (1997) calculates pricing errors on 27 quantitatively governed portfolios of stocks and finds that the 3-factor model enhances pricing errors from (CAPM) as it includes size and book-to-market factors. However, 3-factor model errors were negative for the last year's loser stock portfolios and positive for winners. In contrast, the 4-factor model considerably diminishes the average pricing errors by 45 percent and excludes almost all pricing error patterns. Consequently, in this paper we use the 4-factor model in order to enhance the validity of our analysis.

Table 2 Model Statistic Summary (Pre-Crisis)

**Model Statistic Summary (Pre-Crisis)**

RMRF, SMB, and HML refer to Fama and French's (1993) 3-factor analysis. MOM is an extension to the Fama and French three factor model with a momentum factor introduced by Mark Carhart.

Factor Portfolio	Monthly Excess Return	Standard Deviation	Cross-Correlations			
			RMRF	SMB	HML	MOM
RMRF	-0.30%	4.50%	1.00			
SMB	0.30%	2.70%	0.30	1.00		
HML	0.20%	2.80%	-0.24	-0.10	1.00	
MOM	0.30%	5.50%	-0.58	-0.21	0.29	1.00

Table 3 Model Statistic Summary (Post-Crisis)

**Model Statistic Summary (Post-Crisis)**

Factor Portfolio	Monthly Excess Return	Standard Deviation	Cross-Correlations			
			RMRF	SMB	HML	MOM
RMRF	1.20%	4.00%	1.00			
SMB	0.10%	2.30%	0.36	1.00		
HML	-0.12%	2.80%	0.40	0.17	1.00	
MOM	-0.40%	4.90%	-0.34	-0.12	-0.40	1.00

## **Mutual Fund Performance Analysis**

In this section, we elaborate on the results derived from our regression analysis, outlined in the previous part. We follow the approach of Hendricks, Patel, and Zeckhauser (1993) and form mutual fund portfolios based on previous calendar years' one-year return. At the beginning of each year, we sort all mutual funds according to their previous year's net returns and divide them into ten decile portfolios. Net returns include all operating expenses and transaction costs. Afterwards we maintain the portfolios for one year before we re-form them and repeat the procedure until we reach the end of our sample period. This results in a time series of monthly returns for each equally weighted decile portfolio from January 2001 to August 2017. Funds that are closed within the sample period are also included in the analysis until their disappearance date. Afterwards the weights are readjusted to reflect the new composition of the respective portfolio.

### **Regression Results**

In order to understand better the possible relationships, we divide our dataset into the previously defined strategies, value, growth, and blend and run the regression for each investment approach separately. Additionally, we subdivide the sample period into two sub-periods, from January 2001 to December 2008 and from January 2009 to August 2017, to analyse the performance of mutual funds before and after the financial crisis of 2008.

First, we start with the results of mutual funds that follow a blend strategy. Similar to Carhart (1997), Table 4 shows a high variation in mean return of the different decile portfolios.

Table 4 Regression Analysis (Blend Strategy / Pre-Crisis)

**Portfolios of Mutual Funds - Regression Analysis  
(Blend Strategy, Pre-Crisis)**

This table shows the regression results of mutual funds that pursue a blend strategy. The portfolios are sorted on January 1 each year from January 2001 to August 2017 into 10 decile portfolios based on their previous calendar year's return. Portfolio 1 contains the funds with the highest previous year performance and portfolio 10 the lowest. RMRF, SMB, and HML refer to Fama and French's (1993) 3-factor analysis. MOM is an extension to the Fama and French 3-factor model with a momentum factor introduced by Mark Carhart. T-Statistics are in parentheses.

Portfolio	Monthly Excess Return	Standard Deviation	4-Factor Model					Adjusted R-Square
			Alpha	RMRF	SMB	HML	MOM	
1 (high)	-0.57%	5.01%	-0.01% (-2.90)	1.12% (16.60)	0.37% (4.01)	0.20% (2.29)	0.36% (6.68)	0.786
2	-0.38%	4.51%	0.00% (-3.51)	1.01% (29.16)	0.37% (7.90)	0.18% (3.93)	0.18% (6.41)	0.929
3	-0.30%	4.64%	0.00% (-2.80)	1.04% (36.99)	0.32% (8.34)	0.16% (4.18)	0.12% (5.37)	0.956
4	-0.46%	4.39%	0.00% (-3.51)	0.99% (35.64)	0.18% (4.71)	0.13% (3.43)	0.07% (3.25)	0.952
5	-0.48%	4.31%	0.00% (-3.46)	0.98% (39.50)	0.09% (2.60)	0.12% (3.65)	0.05% (2.49)	0.960
6	-0.60%	4.62%	0.00% (-3.20)	1.01% (34.39)	0.03% (0.69)	0.07% (1.79)	0.02% (0.81)	0.950
7	-0.74%	4.80%	0.00% (-4.33)	1.07% (35.66)	0.03% (0.76)	0.05% (1.31)	0.03% (1.17)	0.953
8	-0.77%	4.80%	-0.01% (-4.34)	1.02% (28.29)	0.11% (2.35)	0.13% (2.70)	-0.03% (-0.90)	0.933
9	-0.82%	5.03%	-0.01% (-3.91)	1.06% (25.37)	0.13% (2.23)	0.09% (1.58)	-0.01% (-0.28)	0.917
10 (low)	-1.02%	6.63%	-0.01% (-2.68)	1.14% (18.75)	0.02% (2.38)	-0.06% (-0.71)	-0.27% (-5.48)	0.899

These findings are consistent throughout all fund strategies and time horizon. In the period from January 2001 to December 2008, returns decrease nearly simultaneously with a drop in portfolio rank and indicate a significant spread between the different portfolios. This relationship seems to be less significant after the financial crisis.

Table 5 Regression Analysis (Blend Strategy / Post-Crisis)

### **Portfolios of Mutual Funds - Regression Analysis (Blend Strategy, Post-Crisis)**

This table shows the regression results of mutual funds that pursue a blend strategy. The portfolios are sorted on January 1 each year from January 2001 to August 2017 into 10 decile portfolios based on their previous calendar year's return. Portfolio 1 contains the funds with the highest previous year performance and portfolio 10 the lowest. RMRF, SMB, and HML refer to Fama and French's (1993) 3-factor analysis. MOM is an extension to the Fama and French 3-factor model with a momentum factor introduced by Mark Carhart. T-Statistics are in parentheses.

Portfolio	Monthly Excess Return	Standard Deviation	4-Factor Model					Adjusted R-Square
			Alpha	RMRF	SMB	HML	MOM	
1 (high)	0.75%	4.27%	-0.01% (-3.45)	1.02% (25.42)	0.19% (2.96)	-0.07% (-1.25)	0.15% (4.79)	0.893
2	0.80%	4.22%	0.00% (-5.09)	1.02% (38.78)	0.16% (3.88)	-0.07% (-1.97)	0.05% (2.65)	0.953
3	0.87%	4.23%	0.00% (-5.52)	1.03% (47.90)	0.16% (4.75)	-0.07% (-2.17)	0.03% (1.91)	0.969
4	0.78%	4.34%	-0.01% (-5.05)	1.05% (36.13)	0.06% (1.25)	-0.04% (-0.89)	0.02% (1.09)	0.945
5	0.84%	4.20%	0.00% (-4.97)	1.02% (40.94)	0.06% (1.63)	-0.05% (-1.39)	-0.01% (-0.46)	0.958
6	0.86%	4.21%	0.00% (-4.19)	0.99% (36.18)	0.13% (3.04)	-0.07% (-1.73)	-0.05% (-2.18)	0.949
7	0.81%	4.36%	0.00% (-3.80)	0.99% (29.75)	0.12% (2.35)	0.00% (0.00)	-0.06% (-2.47)	0.930
8	0.78%	4.56%	-0.01% (-3.49)	1.10% (24.02)	0.17% (2.57)	-0.04% (-0.66)	-0.09% (-2.70)	0.898
9	0.77%	4.54%	-0.01% (-3.79)	0.98% (25.79)	0.17% (2.75)	-0.02% (-0.32)	-0.14% (-4.62)	0.916
10 (low)	0.88%	4.58%	0.00% (-1.96)	0.92% (18.18)	0.20% (2.50)	-0.04% (-0.51)	-0.18% (-4.68)	0.853

In the period from January 2009 to August 2017, monthly excess returns show neither a significant trend nor a relationship with the portfolio rank. These findings indicate that previous year's performance did not drive performance to the same extent as they did before the crisis.

Looking at Table 4 and Table 5, we document that portfolio 1 outperformed portfolio 10 by almost 50 basis points in the period from January 2001 to December 2008, whereas after the crisis portfolio 10 outperformed Portfolio 1 by 13 basis points. Thus, the momentum factor seems to be less significant after the crisis.

Furthermore, the standard deviation of each portfolio indicates a negative relationship between risk and ranking. Accordingly, the lower the rank of the portfolio the higher the standard deviation of the excess returns and, therefore, the risk associated with the investment. Again, this relationship appears to be weaker after the financial crisis.

The results of the 4-Factor Model indicate a strong pattern in the MOM factor as already documented by Carhart (1997). According to the formation of portfolios each year, the top decile funds are positively correlated with the one-year momentum factor, while the returns of the lower ranked portfolios are considerably negatively correlated with the MOM factor. These findings are significant in both observation periods.

Another significant finding is that before the financial crisis, the factor SMB shows a higher correlation with the top percentile portfolios and decreases with a drop in ranking. This indicates that higher ranked portfolios seem to have a higher percentage of small stocks than the bottom portfolios. However, after the financial crisis we cannot perceive a similar significance. Especially the bottom portfolio shows a relatively high correlation with the factor SMB and so does the top portfolio.

In order to test the findings for their robustness, we run the same analysis for other strategies to identify similarities or differences. Table 6 shows the same 4-factor analysis for portfolios that pursue a value strategy. We note that the findings are almost identical with respect to monthly excess returns and standard deviation.

*Table 6 Regression Analysis (Value Strategy / Pre-Crisis)*

**Portfolios of Mutual Funds - Regression Analysis  
(Value Strategy, Pre-Crisis)**

This table shows the regression results of mutual funds that pursue a value strategy. The portfolios are sorted on January 1 each year from January 2001 to August 2017 into 10 decile portfolios based on their previous calendar year's return. Portfolio 1 contains the funds with the highest previous year performance and portfolio 10 the lowest. RMRF, SMB, and HML refer to Fama and French's (1993) 3-factor analysis. MOM is an extension to the Fama and French 3-factor model with a momentum factor introduced by Mark Carhart. T-Statistics are in parentheses.

Portfolio	Monthly Excess Return	Standard Deviation	4-Factor Model					Adjusted R-Square
			Alpha	RMRF	SMB	HML	MOM	
1 (high)	-0.23%	4.69%	0.00% (-2.34)	1.00% (23.96)	0.44% (7.65)	0.31% (5.49)	0.13% (4.02)	0.905
2	-0.32%	4.49%	0.00% (-3.01)	0.95% (23.87)	0.36% (6.69)	0.37% (7.03)	0.07% (2.34)	0.907
3	-0.40%	4.60%	0.00% (-2.42)	0.90% (16.58)	0.34% (4.59)	0.37% (5.10)	0.01% (0.20)	0.834
4	-0.41%	4.44%	0.00% (-2.85)	0.94% (21.66)	0.28% (4.65)	0.35% (6.04)	0.06% (1.67)	0.886
5	-0.47%	4.56%	0.00% (-2.99)	0.94% (20.59)	0.25% (4.03)	0.40% (6.57)	0.00% (0.13)	0.881
6	-0.58%	4.50%	-0.01% (-3.41)	0.93% (21.96)	0.16% (2.85)	0.35% (6.12)	-0.03% (-0.82)	0.894
7	-0.69%	4.71%	-0.01% (-3.81)	1.00% (21.86)	0.15% (2.33)	0.39% (6.39)	0.00% (0.09)	0.888
8	-0.71%	4.69%	-0.01% (-3.54)	0.95% (19.58)	0.15% (2.36)	0.32% (5.00)	-0.05% (-1.41)	0.874
9	-0.83%	4.92%	-0.01% (-3.31)	0.95% (16.16)	0.13% (1.67)	0.32% (4.12)	-0.09% (-1.81)	0.830
10 (low)	-0.83%	5.55%	-0.01% (-3.03)	0.99% (14.52)	0.31% (3.31)	0.31% (3.44)	-0.14% (-2.53)	0.821

Before the financial crisis in 2008, we have again a strong relationship between the size factor and the rank of the portfolio. Higher ranked portfolios appear to hold a larger percentage of small stocks and have a significant positive correlation with the momentum factor.

Table 7 Regression Analysis (Value Strategy / Post-Crisis)

### **Portfolios of Mutual Funds - Regression Analysis (Value Strategy, Post-Crisis)**

This table shows the regression results of mutual funds that pursue a value strategy. The portfolios are sorted on January 1 each year from January 2001 to August 2017 into 10 decile portfolios based on their previous calendar year's return. Portfolio 1 contains the funds with the highest previous year performance and portfolio 10 the lowest. RMRF, SMB, and HML refer to Fama and French's (1993) 3-factor analysis. MOM is an extension to the Fama and French 3-factor model with a momentum factor introduced by Mark Carhart. T-Statistics are in parentheses.

Portfolio	Monthly Excess Return	Standard Deviation	4-Factor Model					Adjusted R-Square
			Alpha	RMRF	SMB	HML	MOM	
1 (high)	0.69%	4.44%	-0.01% (-4.55)	1.01% (30.01)	0.25% (4.70)	0.10% (2.09)	0.09% (3.27)	0.931
2	0.77%	4.43%	-0.01% (-5.55)	1.01% (40.56)	0.22% (5.42)	0.08% (2.23)	0.02% (0.81)	0.962
3	0.75%	4.31%	0.00% (-4.68)	0.99% (34.45)	0.15% (3.38)	0.09% (2.16)	0.02% (0.87)	0.947
4	0.67%	4.28%	-0.01% (-5.32)	0.97% (33.72)	0.12% (2.67)	0.07% (1.76)	-0.02% (-1.06)	0.945
5	0.73%	4.47%	-0.01% (-4.49)	1.01% (30.06)	0.15% (2.83)	0.08% (1.72)	-0.02% (-0.83)	0.933
6	0.70%	4.54%	-0.01% (-4.20)	1.00% (26.65)	0.14% (2.38)	0.09% (1.72)	-0.06% (-1.98)	0.918
7	0.67%	4.54%	-0.01% (-4.02)	0.99% (24.07)	0.09% (1.40)	0.07% (1.17)	-0.09% (-2.66)	0.900
8	0.53%	4.72%	-0.01% (-3.57)	0.97% (17.56)	0.18% (2.00)	0.08% (1.05)	-0.07% (-1.72)	0.834
9	0.58%	4.73%	-0.01% (-3.44)	0.94% (17.85)	0.22% (2.57)	0.09% (1.15)	-0.14% (-3.49)	0.851
10 (low)	0.60%	5.17%	-0.01% (-2.66)	0.96% (13.46)	0.20% (1.78)	0.06% (0.61)	-0.20% (-3.59)	0.771

After the crisis, the coefficients show a slightly different relationship. While the momentum factor shows the same patterns, the size factor seems to have a higher variation and lower ranked portfolios seem to hold a significant percentage of small stocks, which is inconsistent with the findings prior to the financial crisis.

*Table 8 Regression Analysis (Growth Strategy / Pre-Crisis)*

**Portfolios of Mutual Funds - Regression Analysis  
(Growth Strategy, Pre-Crisis)**

This table shows the regression results of mutual funds that pursue a growth strategy. The portfolios are sorted on January 1 each year from January 2001 to August 2017 into 10 decile portfolios based on their previous calendar year's return. Portfolio 1 contains the funds with the highest previous year performance and portfolio 10 the lowest. RMRF, SMB, and HML refer to Fama and French's (1993) 3-factor analysis. MOM is an extension to the Fama and French 3-factor model with a momentum factor introduced by Mark Carhart. T-Statistics are in parentheses.

Portfolio	Monthly Excess Return	Standard Deviation	4-Factor Model					Adjusted R-Square
			Alpha	RMRF	SMB	HML	MOM	
1 (high)	-0.54%	5.12%	-0.01% (-3.55)	1.16% (25.35)	0.44% (7.02)	0.02% (0.40)	0.29% (8.08)	0.905
2	-0.51%	5.09%	0.00% (-3.65)	1.15% (33.88)	0.37% (8.06)	-0.03% (-0.76)	0.21% (7.61)	0.947
3	-0.58%	5.18%	0.00% (-4.11)	1.15% (37.52)	0.35% (8.25)	-0.08% (-2.00)	0.16% (6.64)	0.958
4	-0.60%	5.01%	0.00% (-4.25)	1.14% (44.75)	0.21% (6.15)	-0.11% (-3.28)	0.15% (7.40)	0.969
5	-0.57%	5.14%	0.00% (-3.44)	1.13% (44.43)	0.25% (6.12)	-0.18% (-5.20)	0.11% (5.41)	0.971
6	-0.71%	5.20%	-0.01% (-4.33)	1.13% (35.85)	0.26% (6.16)	-0.15% (-3.63)	0.11% (4.45)	0.956
7	-0.68%	5.12%	0.00% (-4.30)	1.10% (37.44)	0.25% (6.32)	-0.13% (-3.33)	0.08% (3.31)	0.960
8	-0.81%	5.59%	0.00% (-3.21)	1.13% (27.92)	0.22% (4.03)	-0.27% (-4.98)	0.03% 0.81%	0.937
9	-0.89%	6.09%	-0.01% (-3.22)	1.18% (26.65)	0.29% (4.79)	-0.35% (-5.90)	-0.01% (-0.32)	0.937
10 (low)	-1.07%	6.78%	-0.01% (-3.18)	1.24% (20.33)	0.37% (4.40)	-0.27% (-3.31)	-0.09% (-1.91)	0.903

The last portfolios to compare follow the growth strategy. Prior to the financial crisis, the momentum factor shows a similar relationship as indicated earlier. However, the size factor appears to have overall a higher correlation in each portfolio. This is plausible, considering the fact that growth oriented funds invest more in small stocks.

*Table 9 Regression Analysis (Growth Strategy / Post-Crisis)*

**Portfolios of Mutual Funds - Regression Analysis  
(Growth Strategy, Post-Crisis)**

This table shows the regression results of mutual funds that pursue a growth strategy. The portfolios are sorted on January 1 each year from January 2001 to August 2017 into 10 decile portfolios based on their previous calendar year's return. Portfolio 1 contains the funds with the highest previous year performance and portfolio 10 the lowest. RMRF, SMB, and HML refer to Fama and French's (1993) 3-factor analysis. MOM is an extension to the Fama and French 3-factor model with a momentum factor introduced by Mark Carhart. T-Statistics are in parentheses.

Portfolio	Monthly Excess Return	Standard Deviation	4-Factor Model					Adjusted R-Square
			Alpha	RMRF	SMB	HML	MOM	
1 (high)	0.80%	4.37%	-0.01% (-3.76)	1.04% (26.35)	0.32% (5.33)	-0.29% (-5.09)	0.09% (2.78)	0.902
2	0.84%	4.25%	0.00% (-3.36)	1.01% (26.84)	0.22% (3.74)	-0.22% (-4.06)	0.03% (1.09)	0.904
3	0.84%	4.41%	-0.01% (-3.34)	1.07% (30.52)	0.23% (4.04)	-0.32% (-6.41)	0.02% (0.60)	0.923
4	0.87%	4.33%	0.00% (-3.79)	1.02% (29.96)	0.28% (5.10)	-0.26% (-5.23)	0.00% (-0.05)	0.924
5	0.70%	4.54%	-0.01% (-4.24)	1.05% (23.49)	0.25% (3.57)	-0.29% (-4.46)	-0.03% (-0.74)	0.882
6	0.78%	4.54%	-0.01% (-3.42)	1.05% (24.87)	0.29% (4.26)	-0.27% (-4.49)	-0.02% (-0.58)	0.895
7	0.84%	4.57%	-0.01% (-2.92)	1.04% (20.53)	0.26% (3.20)	-0.30% (-4.15)	-0.04% (-1.05)	0.852
8	0.78%	4.78%	-0.01% (-2.98)	1.05% (17.98)	0.28% (2.96)	-0.33% (-4.01)	0.08% (-1.84)	0.820
9	0.73%	4.87%	-0.01% (-2.68)	1.03% (15.19)	0.27% (2.52)	-0.33% (-3.40)	-0.11% (-2.04)	0.768
10 (low)	0.55%	5.28%	-0.01% (-2.60)	0.98% (11.53)	0.39% (2.87)	-0.25% (-0.24)	-0.15% (-2.21)	0.685

After the financial crisis, the size factor still has the highest correlation with each individual portfolio. Additionally, the momentum factor shows the same strong pattern as previously identified.

The comparison of each strategy shows an interesting relationship between the performance of each fund and the HML factor, which aims to explain the difference between a focus on value and growth stocks. Therefore, we can correctly perceive a positive relationship between the HML factor and funds pursuing a value strategy. For funds that pursue a growth strategy this relationship is strongly negative. At the same time, the factor has little influence on the performance of mutual funds pursuing a blend strategy, which is plausible, considering that these funds invest in both growth and value stocks. However, the relationship between the HML factor and the performance of mutual funds following a blend strategy changes after the financial crisis of 2008. While before 2008 it shows a positive relationship, after the crisis, this relationship becomes negative. These findings indicate that the respective funds overweighed value stocks before the crisis and shifted the investments towards growth stocks after 2008.

In conclusion, we analyse mutual funds with three different strategies and two sub periods and find quite interesting relationships. While our analysis in the period from January 2001 to December 2008 results in quite similar findings to that of Carhart (1997), we can see altering correlations after the financial crisis. Before the financial crisis, monthly excess returns have a positive relationship with the rank of the portfolio. The lower the ranking the lower the excess return. However, the momentum factor shows a persistent relationship. While it is positively correlated with higher ranked portfolios, the relationship becomes negatively correlated with the performance of the bottom portfolios. Finally, the

size factor seems to have a big influence on the performance of mutual funds. Higher ranked portfolios appear to hold a larger percentage in smaller stocks, which is a main driver of the performance.

## **Portfolio Statistics**

In a next step, we examine whether the average statistics of the mutual funds in each decile portfolio influence the performance, which could explain the deviations in excess returns and alphas. Therefore, we calculate the cross-sectional average for each portfolio characteristic before and after the financial crisis in 2008. The analysis indicates that turnover is related to the funds' performance. Especially, if we look at portfolio 1 and 10, we perceive big variations in the average turnover.<sup>1</sup> However, expense ratio and maximum load do not show a significant trend even though the difference between portfolio 1 and 10 is quite large. Since expense ratios are included in the regression analysis and, therefore, in the overall result, we cannot explain portfolio alphas by looking at the difference expense ratios. Our data suggests that higher fees are often justified by superior performance. The remaining factors asset under management and average age do not show a significant trend either. Consequently, it seems like these factors cannot explain the spread in performance since the characteristics are quite similar for the top and bottom portfolios.

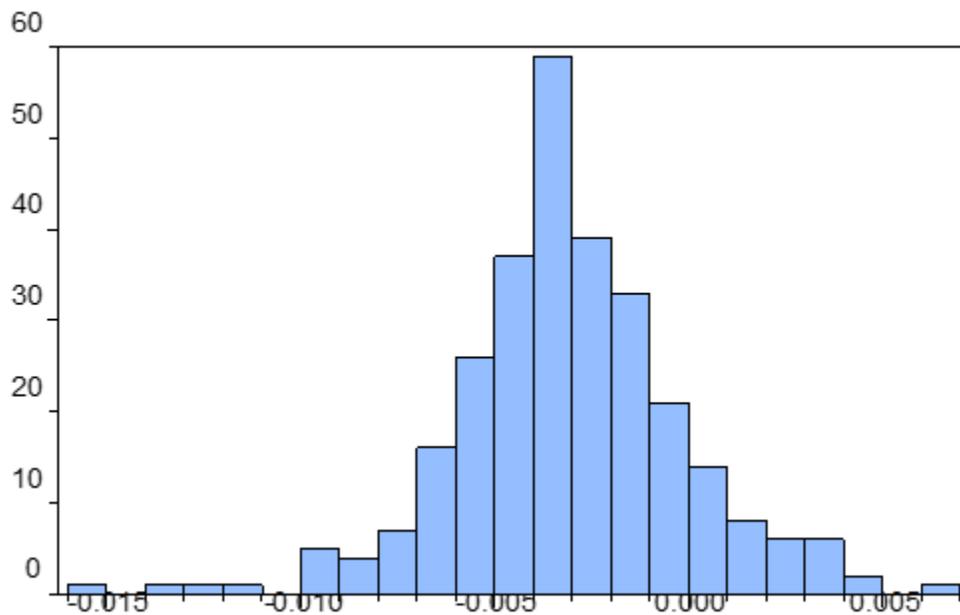
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<sup>1</sup> See Appendix A) Portfolio Statistics

## Individual Mutual Funds' Alpha Estimates

In this section, we discuss the interpretation of our results and determine whether mutual funds were able to provide alpha either before or after the crisis. For that purpose, we use EViews to calculate the respective histograms showing whether mutual funds were able to provide alpha both before and after the financial crisis of 2008.

Figure 1 illustrates the pre-crisis frequency distribution of 284 intercepts for mutual funds pursuing a Blend strategy, calculated net of all expenses. The average value for alpha calculated net of all expenses was -0.003, which indicates that the funds earned on average 0.3% less than they should have earned given their level of market risk. Figure 1 also indicates that the distribution is skewed towards the negative side with 244 funds having a negative alpha.



*Figure 1 Estimated Intercept (Blend Strategy / Pre-Crisis)*

Figure 2 illustrates the post-crisis frequency distribution of 284 intercepts for the same sample of mutual funds, calculated net of all expenses. The average value for alpha calculated net of all expenses was even more negative with -0.005, which indicates that the funds earned on average 0.5% less than they should have earned given their level of market risk. Figure 2 also indicates that the distribution is again skewed towards the negative side with 272 funds having a negative alpha, which is even more than before the crisis.

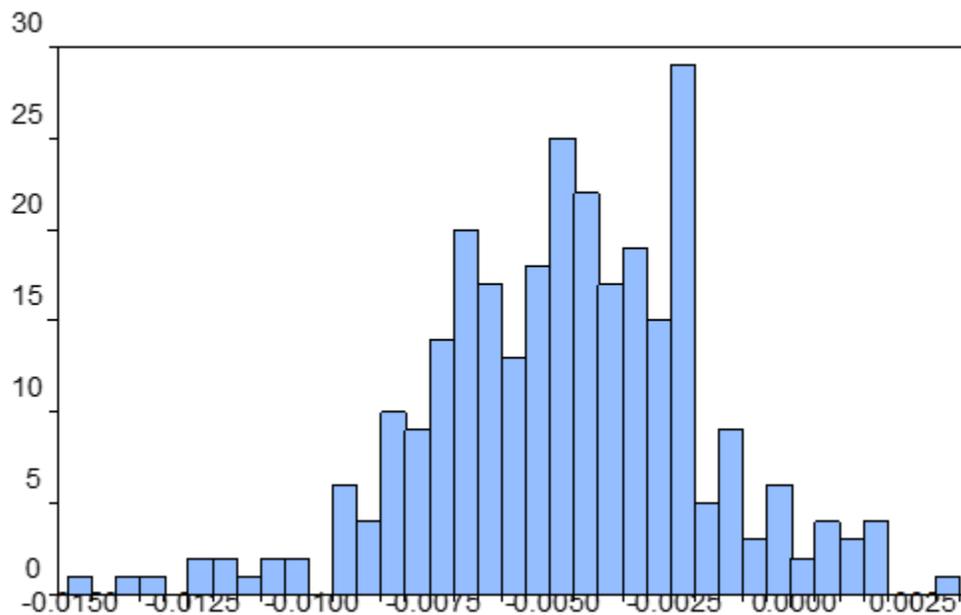


Figure 2 Estimated Intercept (Blend Strategy / Post-Crisis)

Intercept estimates have also been conducted for mutual funds pursuing value and growth strategies. The results have been almost identical to mutual funds pursuing a blend strategy whereas both growth and value funds provided negative alphas pre- and post-crisis.<sup>2</sup>

<sup>2</sup> See Appendix B

## **Conclusion**

In this paper, statistical analysis has been conducted on 944 mutual funds whereas mutual funds were divided into three main strategies between January of 2001 and August of 2017. We construct 10 portfolios for each mutual fund strategy based on their prior one-year performance in order to see whether mutual funds were able to provide an alpha using 3-factor model and momentum strategy. In addition, we also analyze whether mutual funds were able to provide an alpha for 7-year period both before and after the financial crisis of 2008. The results have been consistent in both analysis and with other prior published papers, whereas it is possible to notice that the mutual funds, despite their strategy, were not able to provide a significant alpha for their unit holders. Therefore, on average the funds were not able to foresee security prices and outperform the market, even the number of the individual funds that provided an alpha for their unit holders both before and after the crisis was very small. Interesting question arises from these facts that if mutual funds have provided zero alpha over the years as ETFs, then why investors have been investing in mutual funds and paying higher fees than they would have paid for passively managed funds. Further analysis needs to be done to address the question whether the investment tendencies have switched towards the passively managed funds over the years.

## Appendices

### Appendix A) Portfolio Statistics

#### Portfolios of Mutual Funds - Statistics (Pre-Crisis)

The table below shows averages of key statistics divided into each strategic focus. AUM is the total asset under management. Fees include the total annual management and administration fee and maximum load is the total of front-end, rear end, and deferred sales charges as a percentage of the investment.

Average Portfolio Statistics						
Portfolio	Strategy	AUM (\$ millions)	Avg. Fee (%/year)	Turnover (%/year)	Maximum Load (%/year)	Age (years)
1 (high)	Growth	2,007	1.17%	70.5%	1.39%	25.7
	Value	1,842	1.18%	49.6%	2.27%	26.8
	Blend	3,213	1.08%	75.1%	1.40%	25.5
2	Growth	3,845	1.13%	62.4%	1.72%	27.4
	Value	2,848	1.10%	44.2%	2.00%	27.2
	Blend	8,044	0.88%	59.9%	1.20%	26.7
3	Growth	3,911	1.16%	65.0%	2.62%	27.8
	Value	5,131	1.11%	52.8%	2.16%	28.3
	Blend	8,261	0.93%	54.6%	1.79%	27.2
4	Growth	4,242	1.11%	61.7%	2.33%	28.4
	Value	3,832	1.08%	51.4%	2.06%	27.5
	Blend	10,329	0.87%	50.4%	1.92%	27.2
5	Growth	4,640	1.08%	71.0%	2.05%	29.6
	Value	3,945	1.04%	50.5%	2.14%	28.8
	Blend	11,236	0.92%	55.1%	1.68%	26.8
6	Growth	5,536	1.09%	68.1%	2.55%	27.9
	Value	4,957	1.03%	49.8%	2.10%	29.0
	Blend	17,575	0.69%	45.6%	1.87%	27.8
7	Growth	2,983	1.09%	61.6%	2.02%	28.6
	Value	2,631	1.09%	56.3%	2.23%	28.0
	Blend	14,044	0.71%	53.8%	1.19%	26.1
8	Growth	2,369	1.09%	66.9%	2.40%	28.4
	Value	3,476	1.08%	51.9%	2.13%	29.3
	Blend	4,566	0.88%	48.3%	1.62%	29.3
9	Growth	2,494	1.15%	69.5%	2.61%	28.3
	Value	3,272	1.11%	53.6%	2.63%	28.4
	Blend	3,044	1.01%	60.6%	1.76%	29.3
10 (low)	Growth	1,408	1.27%	86.1%	1.96%	28.0
	Value	1,574	1.14%	65.5%	1.69%	28.7
	Blend	2,002	1.14%	79.9%	1.84%	28.4

## Portfolios of Mutual Funds - Statistics (Post-Crisis)

The table below shows averages of key statistics divided into each strategic focus. AUM is the total asset under management. Fees include the total annual management and administration fee and maximum load is the total of front-end, rear end, and deferred sales charges as a percentage of the investment.

Average Portfolio Statistics						
Portfolio	Strategy	AUM (\$ millions)	Avg. Fee (%/year)	Turnover (%/year)	Maximum Load (%/year)	Age (years)
1 (high)	Growth	3,119	1.15%	73.1%	2.15%	27.0
	Value	1,862	1.15%	61.8%	1.67%	25.6
	Blend	2,945	1.09%	81.4%	1.38%	25.7
2	Growth	3,381	1.12%	65.4%	2.26%	28.0
	Value	3,066	1.09%	52.8%	2.15%	26.3
	Blend	10,858	0.91%	57.2%	1.59%	27.4
3	Growth	3,923	1.10%	60.8%	2.17%	28.4
	Value	3,982	1.05%	44.1%	1.74%	27.1
	Blend	8,780	0.84%	52.4%	1.65%	26.6
4	Growth	5,275	1.09%	58.1%	1.97%	28.6
	Value	4,116	1.08%	51.5%	2.38%	30.2
	Blend	21,554	0.80%	45.4%	1.63%	27.0
5	Growth	4,157	1.07%	67.1%	1.97%	27.8
	Value	4,080	1.06%	45.8%	2.45%	27.5
	Blend	12,048	0.76%	46.0%	1.85%	29.0
6	Growth	3,638	1.15%	67.9%	2.51%	29.5
	Value	4,381	1.07%	49.3%	2.30%	29.3
	Blend	8,554	0.88%	50.2%	1.87%	28.4
7	Growth	4,225	1.13%	69.2%	2.25%	27.8
	Value	3,882	1.06%	51.7%	2.53%	29.3
	Blend	4,002	0.84%	49.1%	1.50%	28.6
8	Growth	1,968	1.14%	70.1%	2.34%	29.1
	Value	3,341	1.09%	51.4%	2.42%	30.1
	Blend	8,755	0.84%	54.9%	1.97%	27.8
9	Growth	2,187	1.14%	73.1%	1.99%	27.3
	Value	3,221	1.13%	53.5%	2.26%	28.2
	Blend	2,923	1.04%	65.3%	1.94%	27.8
10 (low)	Growth	1,556	1.24%	78.1%	2.06%	26.5
	Value	1,577	1.17%	63.8%	1.51%	28.3
	Blend	1,907	1.13%	81.3%	1.53%	26.4

## Appendix B) Intercept Histograms

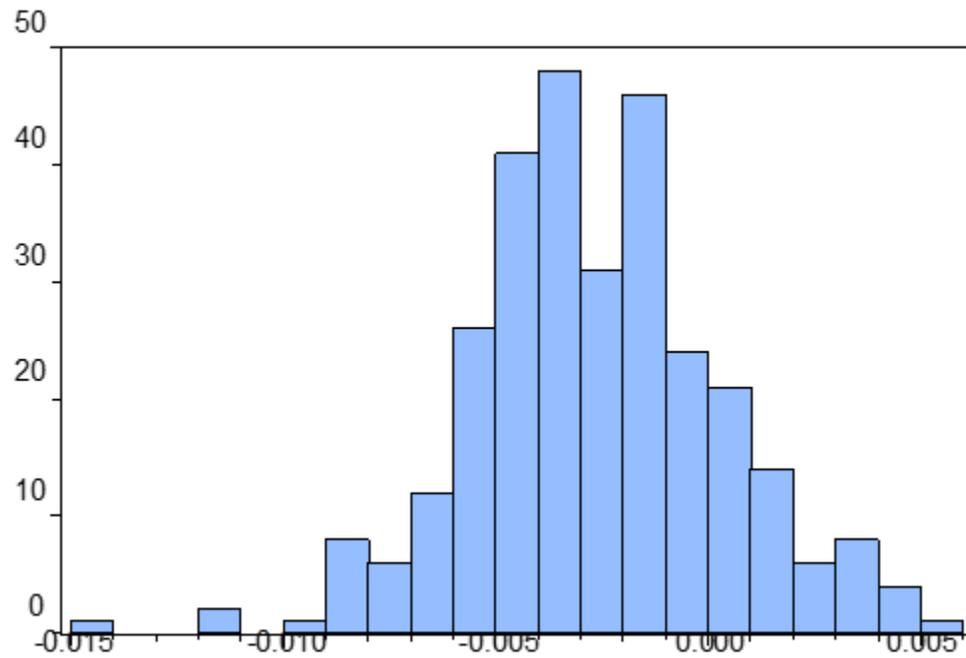


Figure 3 Estimated Intercept (Value Strategy / Pre-Crisis)

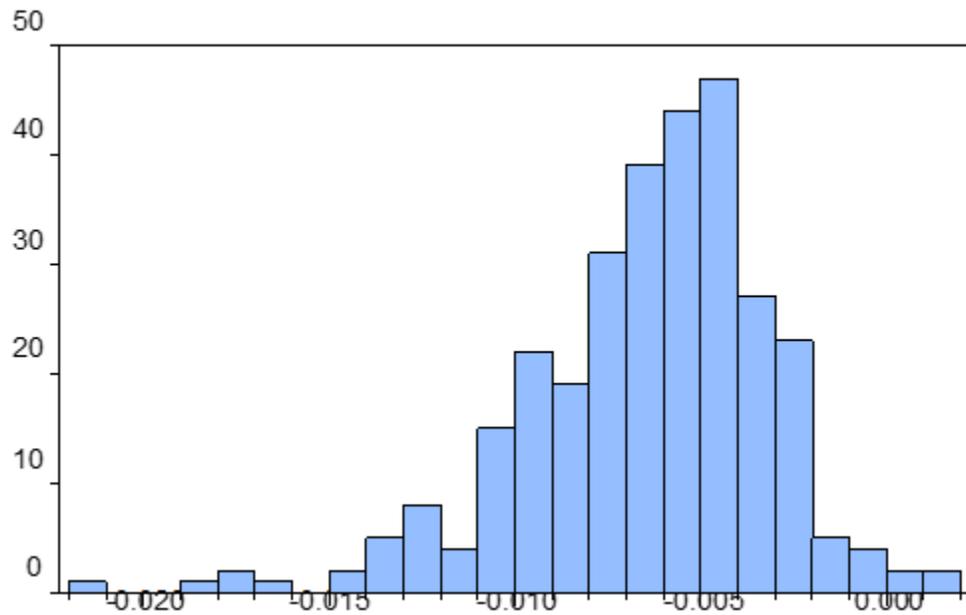


Figure 4 Estimated Intercept (Value Strategy / Post-Crisis)

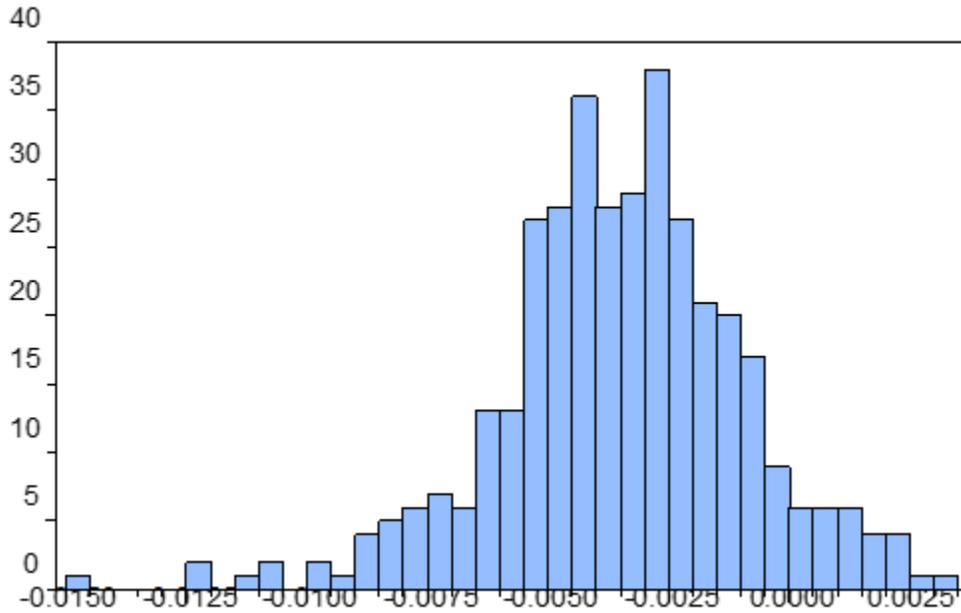


Figure 5 Estimated Intercept (Growth Strategy / Pre-Crisis)

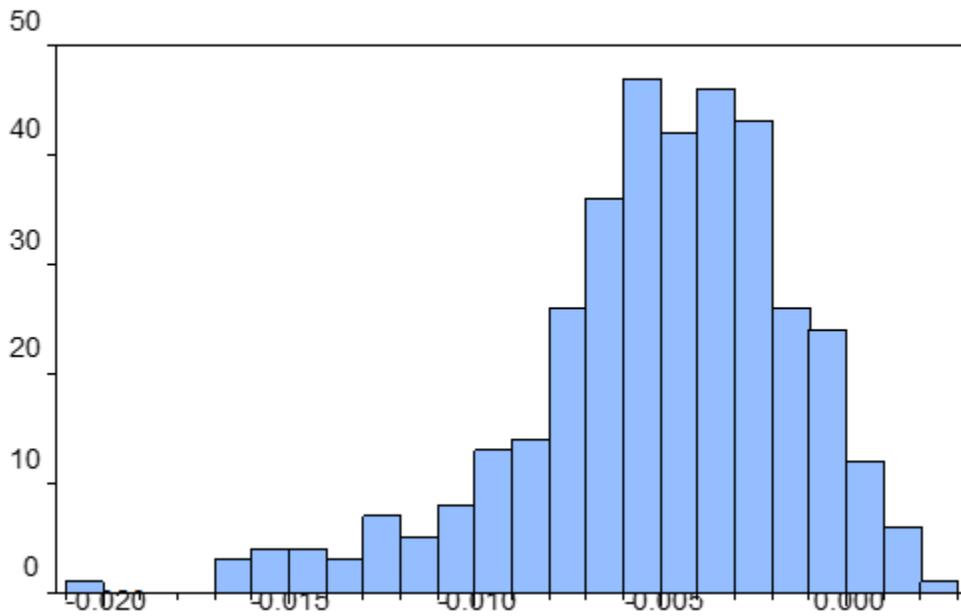


Figure 6 Estimated Intercept (Growth Strategy / Post-Crisis)

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