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**Active vs Passive Management:**  
**A study on the persistence of active mutual fund performance**

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## **Abstract**

This paper studies the persistence of active mutual fund performance across bear and bull markets separately. More specifically, the research looks at all active mutual funds invested in US equities across two bull and bear markets each between April 2000 and January 2020. The empirical results indicate that there is persistence in outperformance only in bear market 1 (dot-com bubble), which is concentrated among the best-returns portfolios. The only significant persistence in the remaining time horizons is found in the worst-return portfolios, which underperform.

## **Introduction**

Ever since the great financial crisis, the decade long bull run has seen the emergence of passive investing. The rise of index mutual funds and exchange traded funds (ETFs) has sparked countless discussions about the economic relevance of active portfolio management given its underperformance. This has led to many questioning the stock picking ability of active fund managers.

Passive portfolio management has expanded rapidly over the last decade and represents a significant portion of the global mutual fund business. According to a report from the Bank for International Settlements (BIS), passive funds managed \$8 trillion or 20% of the aggregate investment fund assets in 2017, reflecting an 8% increase over the decade. Within the realm of passive funds, the growth in ETFs outpaced that of index mutual funds. The proportion of ETF's share of passive fund assets surpassed 40% in 2017 from 30% in 2007.

In this research, we focus solely on US equity funds, where the growth in passive investing has been most apparent. Investments in passive US equity funds have exceeded \$4 trillion, representing 43% of all US equity fund assets in 2017. This is also reflected in our data set, which shows that 48%, 41% and 45% of Large, Medium and Small Cap US equity funds consist of index mutual funds.

The growth in passive investing was accompanied by the underperformance of active mutual funds during the last decade. This is not surprising given the existing research on mutual fund persistence, where academics like Carhart (1997) showed that most mutual funds underperform

by the magnitude of their expense ratios. However, this topic has moved into the spotlight due to the consistent underperformance of actively managed funds during the decade long recovery post great financial crisis. According to the SPIVA U.S. Scorecard released by S&P, the majority of large cap funds (71%) underperformed the S&P 500 for 10 consecutive one-year periods. 89% of large cap funds underperformed over a 10-year period.

The active versus passive debate has been a contentious subject and is one that this research will attempt to address. Advocates of active fund management have argued that their relevance shines at certain stages of the market cycle. Outperformance can come in bull markets when fund managers overweight high beta stocks, a sign of market timing. Similarly, active managers are able to rebalance portfolios towards cash or defensive sectors during bear markets. By this definition, we would expect to find evidence of positive alphas across our sample dataset.

In order to test this, we will be comparing the persistence of active mutual fund performance over different time horizons across the last 20 years. We have demarcated four distinct time periods between April 2000 and January 2020, with two bear and bull markets each. Each bear market is characterized by a fall of at least 20% from its previous high and vice versa for bull markets. This was data was taken from S&P Dow Jones Indices.

Our four windows are broken down into:

- **Bear Market 1:** April 2000 to September 2002 (30 months)
- **Bull Market 1:** October 2002 to September 2007 (60 months)
- **Bear Market 2:** October 2007 to February 2009 (17 months)
- **Bull Market 2:** March 2009 to January 2020 (131 months)

This research draws from statistical methods from Carhart (1997) and Bryan and Li (2016). We adopt similar regression models and portfolio formation methods from these studies to test our datasets.

At the core of our research, we aim to examine and test for the persistence of positive alphas. Where this differs from past research is the fact that our investigations will span across four different time periods for comparisons. Our hypothesis is that we should expect to find some evidence of persistent outperformance in bear markets more often than in bull markets.

Bull market runs reflect an extended period of momentum gains, which suits better towards passive strategies that hold on to winners for extended periods of time. On the other hand, we expect active management to be better suited to outperform in a bear market with high volatility. Another key distinction between bear and bull markets is the time horizon of each. Bear markets typically fall within a short-term horizon, where we expect to observe persistence in outperformance.

## **Background on Time Periods**

### Bear Market 1

Between April 2000 and September 2002, the S&P 500 declined by 49.1%. This was caused by the collapse of the dot-com bubble following a period of rising stock prices, which inflated expectations on internet companies. Many of these internet companies were loss-making and the overreaction in the market culminated in the bursting of the bubble. This was exacerbated by the September 11 attacks in 2001.

### Bull Market 1

During the post dot-com bubble bull market, the S&P 500 increased 101.5% over a 60-month window. This was a period where the US mortgage bubble was starting to develop. Financial institutions were leveraging up as the housing boom drove the economic recovery.

### Bear Market 2

The great financial crisis was the result of the collapse of the US mortgage bubble, where the S&P 500 lost 56.4% over 17 months. A systemic banking crisis ensued following the housing crisis, eroding the foundations of financial institutions globally.

### Bull Market 2

Following the great financial crisis was one of the longest bull market recoveries to date. The 131-month period saw the S&P 500 climb 400% up until the Covid-19 pandemic hit in February 2020.

## Literature Review

The performance of mutual funds has been a widely discussed topic amongst both academics and finance industry professionals.

One of the most prominent research papers on persistence in mutual fund performance was from Carhart in 1997. He also introduced the momentum factor in his regression analysis. In his paper, he analyzes mutual fund returns across a 31-year period and finds evidence of persistence over short-term horizons between one and three years. However, his paper attributes this to “hot-hands funds”, where fund managers who happen to hold larger proportions of winner stocks by default generate positive alphas in the short-term. He argues that the persistence is a result of passive strategies and not through active momentum strategies. Over a longer horizon, the only evidence of persistence is in the underperformance by the worst-return funds. Carhart concludes that there is no evidence to support any existence of skilled or informed fund managers.

Carhart’s reasoning for short-term persistence is in mostly consistent with our hypothesis, where we expect to find evidence of outperformance. However, we attribute this to stock picking ability in short-term bear markets (between one and three years). While Carhart attributes the short-term persistence to a passive effect, our research examines active mutual funds. Furthermore, Wermers (1997) shows that the use of active momentum strategies was in fact pivotal in explaining performance persistence. The issue with Carhart’s conclusion is that it generalizes across market cycles. It seems inappropriate to apply a similar “hot-hands funds” argument for bear market periods where market volatility is high, and market dynamics are unpredictable.

The underperformance of mutual funds has also been well documented within the financial industry. S&P Dow Jones Indices released its SPIVA U.S. Scorecard in 2019, documenting the underperformance of active mutual funds. Morningstar also released a report by Bryan and Li (2016) which provided a more updated study of performance persistence among US mutual funds. Their findings similarly show that there is evidence of performance persistence in the short-term and attribute this to exposure to momentum stocks rather than managerial skill. This echoes Carhart’s view on short-term persistence. They also find that there is no evidence of long-term performance persistence.

There is also some evidence that supports active management within the financial industry. In a report by US based asset manager, Vanguard, their Chief Economist Peter Westaway mentions that active management does “reasonably well” in certain bear market. He cites the early 2000s bear market as the best outcome for active managers but also concedes that there is a lack in consistency and persistence in active managers’ ability to outperform in subsequent market cycles. Following the five-year period ending September 2002, Vanguard found that fewer than a third of fund managers managed to repeat their outperformance in the next five years. This signals that past return are a poor indicator of a manager’s skill.

The main motivation of our study was to examine the active versus passive debate by analyzing active funds. There has also been an increasing amount of literature on the implications of the rise in the proportion of passive indexed investments. The BIS report by Sushko and Turner (2018) studies the implications of passive investing for securities markets and shows how increased correlations between components of an index may distort the pricings of securities. We will discuss these issues further when we look at the implications of our statistical analysis.

## Data

### Active versus Passive Mutual Funds

In our research, we distinguish between active and passive index mutual funds manually, and largely based on discretion. The first cut includes mutual funds that are labelled as “Index Funds” explicitly. Thereafter, we look for indications of distinctly low expense ratios or descriptions of passive investment objectives.

With this manual process, there may be passive mutual funds that we may have missed out on in forming our active fund dataset. However, the proportion of passive funds that have been identified roughly corresponds with the aggregate proportion of passive funds as reported by BIS and S&P. Hence, we assume that the manually constructed dataset is a reasonable proxy for active mutual funds.

**Table 1: Breakdown of mutual fund dataset by AUM**

	<b>Full Dataset AUM (\$m USD)</b>	<b>Passive Dataset AUM (\$m USD)</b>	<b>Active Dataset AUM (\$m USD)</b>
<b>Large Cap</b>	5,322,093.35 100.0%	2,554,904.06 48.0%	2,767,189.29 52.0%
<b>Mid Cap</b>	451,650.98 100.0%	183,858.00 40.7%	267,792.98 59.3%
<b>Small Cap</b>	309,099.12 100.0%	137,870.19 44.6%	171,228.93 55.4%
<b>Total</b>	6,082,843.45 100.0%	2,876,632.25 47.3%	3,206,211.20 52.7%

### Mutual Fund Data

In order to construct our dataset, we used a screener from [www.mutualfunds.com](http://www.mutualfunds.com) to identify US equity funds. This dataset contains mutual funds that are in operation and actively traded in the market. The screener provides information on each fund’s assets under management (AUM), expense ratio, NASDAQ ticker and primary category. This resulted in 1,672 funds, with 1102 large cap, 239 mid cap and 331 small cap funds. Our self-constructed active dataset resulted in 978 large cap, 211 mid cap and 301 small cap active funds.



**Table 2: Breakdown of mutual fund dataset by count**

	<b>Full Dataset</b>	<b>Passive Dataset</b>	<b>Active Dataset</b>
<b>Large Cap</b>	1,102	124	978
<b>Mid Cap</b>	239	28	211
<b>Small Cap</b>	331	30	301
<b>Total</b>	1,672	182	1,490

It is interesting to note that the average AUM for passive mutual funds is significantly larger than that of active mutual funds. This also reflects the increasing growth in passive investing that has been well documented over the last decade.

**Table 3: Breakdown of mutual fund dataset by average AUM**

	<b>Full Dataset Average AUM (\$m USD)</b>	<b>Passive Dataset Average AUM (\$m USD)</b>	<b>Active Dataset Average AUM (\$m USD)</b>
<b>Large Cap</b>	4,829	20,604	2,829
<b>Mid Cap</b>	1,890	6,566	1,269
<b>Small Cap</b>	934	4,596	569
<b>Total</b>	3,638	15,806	2,152

Using the NASDAQ tickers, we extract the fund returns data from CRSP Mutual Funds via the Wharton Research Data Services. For this study, we used daily returns to accommodate for the short time horizons of the bear market periods.

### **Factor Pricing Model Data**

For our regression analysis, we make use of two prominent pricing models – the Capital Asset Pricing Model (CAPM) and the Carhart 4-factor model.

We utilize data from Kenneth R. French’s database, which provides the Fama French factors (market risk premium, value and size) as well as the momentum factor for US returns data.

## Methodology

Similar to Carhart's study on persistence, the core of the analysis aims to identify whether active mutual funds display significantly statistic alphas in each given time horizon. Each analysis involves a portfolio formation phase and an observation (holding) phase. The formation phase involves sorting mutual funds into decile portfolios based on lagged returns. This distinguishes the "winner" managers and the "loser" managers. We then hold these portfolios for the same duration in our observation phase and re-form portfolios for the next formation phase. This process is carried on until the end of the time period.

One issue faced during the study was the short time horizon of bear markets. The study of persistence implicitly requires some continuity with our analysis. Initially, we allocated half of each time horizon to the formation period, with eight months for Bear Market 1 and 15 months for Bear Market 2.

**Figure 1: Formation and Observation structure with formation period of half the time frame**

Bear Market 1 – 15-month formation period

2000-04 to 2001-06	2001-07 to 2002-09
Formation	Observation

Bear Market 2 – eight-month formation period

2007-10 to 2008-05	2008-06 to 2009-02
Formation	Observation

However, this analysis failed to capture the essence of persistence as it does not measure the continuity in the performance of mutual funds. This is where we deviate from the standard one-year formation period. Since our bear market datasets consists of only 17 and 30 months (as compared to 60 and 131 months for our bull market periods), we form our portfolios based on six-month lagged returns. We then hold the portfolios for six months in the observation period, then re-form them. This method of forming portfolios is similar to the study by Bollen and Busse (2005), who use an even shorter look back period of three months. However, we avoided using a three month look back period as our preliminary analysis resulted in extremely low adjusted R-squared values in our regressions.

**Figure 2: Formation and Observation structure with six-month formation period**

Bear Market 1

2000-04 to 2000-09	2000-10 to 2001-03	2001-04 to 2001-09	2001-10 to 2002-03	2002-04 to 2002-09
Formation	Observation			
	Formation	Observation		
		Formation	Observation	
			Formation	Observation

Bear Market 2

2007-10 to 2008-03	2008-04 to 2008-09	2008-10 to 2009-02
Formation	Observation	
	Formation	Observation

As for our bull market periods, we adopted a one-year lagged returns formation period similar to that of Carhart's study.

Once we have obtained each dataset for each formation period, the portfolios are split into ten groups based on their returns. These returns are then equally weighted for each portfolio resulting in ten sets of time series daily returns.

Another deviation from Carhart's study was that we used gross returns and ignored the expense ratios. This research aims to examine stock picking ability through the persistence of performance and hence should not be affected by exogenous expenses, which do not reduce a fund manager's skill. This was similarly applied in Grinblatt, Titman and Wermers (1995) study.

One of the challenges faced in our data set was survival bias. Since we are looking into specific time horizons, funds may cease operations midway or new funds may emerge within the time frame. Hence, we adopt Carhart's and the SPIVA U.S. Scorecard methodology in correcting for survivorship bias by including the entire opportunity set and not just the survivors for each specific time period. This meant only accounting for funds that operate over the entire window of each pair of formation and observation phases.

With the dataset in hand, we turn to our factor pricing models to assess the persistence of positive alphas of active mutual funds. We utilize the Capital Asset Pricing Model and Carhart 4-factor model.

#### CAPM

$$r_{it} = \alpha_{iT} + \beta_{iT}MRP_t + e_{it}$$

$$t = 1, 2, \dots, T$$

#### Carhart 4-Factor Model

$$r_{it} = \alpha_{iT} + \beta_{iT}MRP_t + s_{iT}SMB_t + h_{iT}HML_t + m_{iT}MOM_t + e_{it}$$

$$t = 1, 2, \dots, T$$

$r_{it}$  is the portfolio returns in excess of the risk-free rate for each decile  $i = 1, 2, \dots, 10$ .

The daily data for the factor portfolios were obtained from Kenneth R. French's database:

- **MRP** (Market Risk Premium) is the excess return on the market, which is calculated as the value-weight return of all CRSP firms in the US and listed on the NYSE, AMEX or NASDAQ
- **SMB** (Small Minus Big) is calculated as the average return on three small portfolios minus three big portfolios in the form:

$$SMB = \frac{1}{3}(Small\ Value + Small\ Neutral + Small\ Growth)$$

$$- \frac{1}{3}(Big\ Value + Big\ Neutral + Big\ Growth)$$

- **HML** (High Minus Low) is calculated as the average return on two value portfolios minus two growth portfolios in the form:

$$HML = \frac{1}{2}(Small\ Value + Big\ Value) - \frac{1}{2}(Small\ Growth + Big\ Growth)$$

- **MOM** (Momentum) is calculated as the average return on two high prior return portfolios minus two low prior return portfolios in the form:

$$MOM = \frac{1}{2}(Small\ High + Big\ High) - \frac{1}{2}(Small\ Low + Big\ Low)$$

We make use of both CAPM and the 4-factor model to measure mutual fund performance on a risk adjusted basis. The use of the 4-factor model, which includes the crucial Momentum factor, allows us to distinguish whether CAMP alphas can be attributed to momentum strategies as well.

## Results and Discussion

### Bear Market 1

We used two different approaches to forming our portfolios as described in the methodology. In the first analysis, we split the 30-month time period by half and form the portfolio based on the 15-month lagged returns. This results in a portfolio of 501 mutual funds and a regression analysis with 311 daily return observations. The daily average excess return is negative for all deciles except for the top 10%.

**Table 4: Regression results for bear market 1 with 15-month formation period**

Decile	Daily Average Excess Return	Monthly Excess Return (based on 21 trading days)	CAPM			4-Factor Model					
			Alpha	MRP	Adj R-sq	Alpha	MRP	SMB	HML	MOM	Adj R-sq
1	0.021%	0.444%	0.0002 1.1700	0.8058 61.498	0.924	2.087E-05 0.207	0.9403 87.597	0.441 26.234	0.3618 17.776	0.0299 2.104	0.979
2	-0.011%	-0.227%	0.0002 1.285	0.8181 68.986	0.939	-3.02E-05 -0.296	0.9723 89.472	0.3329 19.564	0.3457 16.776	0.1008 7.003	0.979
3	-0.031%	-0.655%	7.432E-05 0.639	0.7908 98.461	0.969	-8.44E-05 -0.929	0.8822 91.18	0.1239 8.179	0.1992 10.857	0.0801 6.25	0.981
4	-0.048%	-0.997%	3.649E-05 0.346	0.8191 112.575	0.976	-7.28E-05 -0.825	0.8815 93.95	0.1003 6.827	0.1845 10.37	0.0348 2.797	0.984
5	-0.065%	-1.356%	-6.86E-05 -0.526	0.9165 101.806	0.971	-0.0001 -1.13	0.9541 88.767	0.2292 13.618	0.1681 8.246	-0.0404 -2.838	0.983
6	-0.081%	-1.683%	-4.52E-05 -0.824	0.8811 233.009	0.994	-9.31E-05 -1.798	0.9095 165.094	0.0358 4.153	0.0328 3.141	0.0352 4.819	0.995
7	-0.095%	-1.970%	-7.37E-05 -1.88	0.9705 337.901	0.997	-7.88E-05 -1.877	0.9725 217.695	-0.0085 -1.212	0.0056 0.664	0.0041 0.694	0.997
8	-0.109%	-2.254%	-0.0001 -1.793	0.9641 179.213	0.99	-0.0001 -1.996	0.9679 140.092	0.1133 10.468	-0.016 -1.223	-0.016 -1.746	0.994
9	-0.131%	-2.707%	-0.0002 -1.641	1.0184 103.836	0.972	-0.0001 -1.124	0.9732 79.459	0.1571 8.191	-0.01 -0.43	-0.124 -7.639	0.982
10	-0.176%	-3.628%	-0.0004 -1.846	1.096 71.204	0.942	-0.0001 -0.823	0.9586 53.428	0.1495 5.321	-0.0895 -2.63	-0.2747 -11.554	0.968
L/S (1 - 10)	0.197%	4.217%	0.0006 2.242	-0.2902 -14.874	0.415	0.0002 0.795	-0.0183 -0.857	0.2915 8.715	0.4513 11.143	0.3046 10.762	0.711
*Significant at 90% level											
**Significant at 95% level											

The regression suggests that there is no persistent outperformance of active mutual funds during this time period and some persistent underperformance concentrated in the lower returns deciles. The CAPM shows that for deciles 7, 8 and 10, the alphas are negative and statistically significant at the 90% level. The alpha is most negative for decile 10, which is consistent with the worst performing mutual funds.

The 4-factor model similarly reflects persistent underperformance in several deciles, with 6, 7 and 8 showing statistically significant negative alphas. The remaining deciles show that there is no evidence of persistence as the alphas are statistically insignificant.

**Table 5: Regression results for bear market 1 with six-month formation period**

Decile	Daily Average Excess Return	Monthly Excess Return (based on 21 trading days)	CAPM			4-Factor Model					
			Alpha	MRP	Adj R-sq	Alpha	MRP	SMB	HML	MOM	Adj R-sq
1	0.060%	1.270%	0.0003 1.785	0.7805 69.335	0.906	-6.04E-05 -0.536	0.9627 84.813	0.4472 23.274	0.3367 17.487	0.057 5.153	0.959
2	0.007%	0.153%	0.0004 2.367	0.7505 67.748	0.902	1.127E-05 0.104	0.9452 87.004	0.4173 22.692	0.3832 20.791	0.0517 4.88	0.96
3	-0.019%	-0.394%	0.0003 1.785	0.7839 82.052	0.931	-6.76E-05 -0.678	0.9488 94.531	0.2615 15.39	0.3741 21.969	0.0199 2.038	0.968
4	-0.041%	-0.849%	0.0002 1.642	0.8174 105.506	0.957	-4.82E-05 -0.552	0.9471 107.797	0.1718 11.553	0.2733 18.334	0.0346 4.041	0.977
5	-0.062%	-1.284%	5.961E-05 0.66	0.8576 143.425	0.976	-8.95E-05 -1.205	0.9432 126.184	0.1527 12.064	0.1337 10.539	0.0515 7.072	0.984
6	-0.081%	-1.687%	0.0001 1.227	0.8857 144.016	0.977	-2.82E-05 -0.383	0.945 127.449	0.0634 5.052	0.217 17.248	-0.0477 -6.604	0.986
7	-0.098%	-2.032%	-2.42E-05 -0.447	0.9385 262.207	0.993	-8.11E-05 -1.578	0.9685 187.385	0.0538 6.154	0.0588 6.711	0.0093 1.852	0.994
8	-0.120%	-2.496%	-4.62E-05 -0.775	0.9777 247.75	0.992	-5.02E-05 -0.858	0.9716 165.207	0.039 3.915	0.0005 0.051	-0.0171 -2.975	0.992
9	-0.151%	-3.115%	-9.27E-05 -0.728	1.0365 122.906	0.968	-3.03E-06 -0.029	0.969 90.869	0.1052 5.828	-0.1596 -8.82	-0.0297 -2.855	0.978
10	-0.222%	-4.550%	-0.0002 -0.612	1.0888 63.818	0.891	-2.73E-05 -0.122	0.9642 42.88	0.2165 5.688	-0.2157 -5.655	-0.1135 5.18	0.92
L/S (1 - 10)	0.282%	6.083%	0.0005 1.375	-0.3083 -13.884	0.278	-3.31E-05 -0.117	-0.0016 -0.055	0.2307 4.771	0.5525 11.403	0.1705 6.127	0.492
*Significant at 90% level											
**Significant at 95% level											

The analysis based on six-month lagged returns results in four portfolios formed over the period. These portfolios are rebalanced every six months and result in 511, 550, 596 and 621 mutual funds in each portfolio. The analysis also looks at 499 daily return observations.

When we base our portfolios on six-month lagged returns, we obtain contrasting results in our CAPM analysis. The CAPM suggests some evidence of persistent outperformance in the top three deciles. Deciles 1 and 3 have positive daily alphas of 0.03%, statistically significant at 90%, while decile 2 has a CAPM alpha of 0.04%, statistically significant at 95%. It is also interesting to note that there are positive average returns for the top two deciles over a period where the S&P 500 lost 49.1%.

The 4-factor model provides us with results of no significant persistence among all deciles.

This result supports our hypothesis, that there is some evidence of persistent outperformance during bear markets, albeit concentrated among the best-returns deciles. When comparing our CAPM and 4-factor alpha, we see that the persistence disappears once we have accounted for momentum. This implies that the persistence in performance can be attributed to the momentum factor. It is also worthwhile noting that we only observe outperformance when we reduce the holding period from 15 months to six months. This is in line with past research that have shown that persistence of outperformance is likely to be observed over shorter horizons.

However, we must be cautious with interpreting the outperformance over short-term horizons. Carhart (1997) attributes such outperformance to passive momentum strategies, where fund managers just so happen to hold onto past winners. Given the nature of bear markets, we it seems unlikely that this is the case. We do not expect active fund managers to adopt such a passive strategy and expect active strategies to adapt to a market with heightened volatility.



## Bear Market 2

**Table 6: Regression results for bear market 2 with eight-month formation period**

Decile	Daily Average Excess Return	Monthly Excess Return (based on 21 trading days)	CAPM			4-Factor Model					
			Alpha	MRP	Adj R-sq	Alpha	MRP	SMB	HML	MOM	Adj R-sq
1	-0.123%	-2.556%	-0.0003 -0.8990	0.9528 82.749	0.973	-0.0003 -1.008	1.0044 77.357	0.1838 7.132	-0.1301 -4.929	-0.003 -0.131	0.983
2	-0.145%	-3.003%	-0.0002 -0.849	0.9426 106.58	0.984	-0.0002 -1.054	0.9823 104.985	0.1385 7.46	-0.132 -6.941	-0.0184 -1.115	0.991
3	-0.155%	-3.195%	-9.64E-05 -0.441	0.9567 128.885	0.989	-9.4E-05 -0.629	0.9809 137.381	0.1626 11.472	-0.1027 -7.072	-0.0372 -2.952	0.995
4	-0.163%	-3.358%	-0.0002 -0.815	0.9501 132.068	0.989	-0.0002 -1.265	0.97 155.984	0.1964 15.914	-0.0643 -5.084	-0.0316 -2.875	0.996
5	-0.167%	-3.455%	-6.24E-05 -0.464	0.9637 211.293	0.996	-4.9E-05 -0.713	0.9729 212.383	0.0952 10.468	-0.0639 -6.864	-0.0332 -4.098	0.998
6	-0.173%	-3.565%	-6.93E-05 -0.513	0.9706 211.721	0.996	-7E-05 -0.857	0.9762 250.073	0.1292 16.671	-0.0286 -3.601	-0.0281 -4.081	0.998
7	-0.180%	-3.717%	-9.32E-05 -0.657	0.9846 204.785	0.996	-8.4E-05 -1.034	0.991 255.8	0.1459 18.997	0.0022 0.274	-0.0136 -1.983	0.999
8	-0.188%	-3.879%	-9.16E-05 -0.606	0.9898 193.016	0.995	-0.0001 -1.407	0.9771 288.161	0.1457 21.651	0.0278 4.036	-0.0367 -6.126	0.999
9	-0.200%	-4.107%	-0.0001 -0.682	1.0197 170.968	0.994	-0.0001 -1.706	0.9957 253.345	0.1528 19.583	0.0356 4.458	-0.0555 -7.998	0.999
10	-0.228%	-4.684%	-0.0002 -0.744	1.0198 98.503	0.981	-0.0003 -2.625	0.9628 194.265	0.2463 25.034	0.098 9.722	-0.1036 -11.826	0.998
L/S (1 - 10)	0.105%	2.228%	-7.79E-05 -0.183	-0.0671 -4.634	0.099	-1.4E-06 -0.006	0.0415 3.411	-0.0625 -2.585	-0.2281 -9.212	0.1006 4.673	0.676
*Significant at 90% level											
**Significant at 95% level											

The first analysis involves taking a formation period of eight months, which is half of the 17-month time frame for Bear Market 2. Constructing the portfolio based on eight-month lagged returns gives us 874 mutual funds with 188 daily return observations. All deciles have negative daily average excess returns.

Both the CAPM and 4-factor model analysis show that there is no evidence of persistent outperformance during this time horizon. In fact, the 4-factor model suggests some persistent underperformance for active mutual funds that fall into the bottom two deciles. Decile 9 has a statistically significant (at 90%) alpha of -0.01%, while decile 10 has an alpha of -0.03% at 95% significance. All the remaining decile portfolios have negative alphas, albeit without statistical significance.

This result echoes that of Carhart's (1997) study in showing that persistence in underperformance is concentrated among the worst-return funds.

**Table 7: Regression results for bear market 2 with six-month formation period**

Decile	Daily Average Excess Return	Monthly Excess Return (based on 21 trading days)	CAPM			4-Factor Model					
			Alpha	MRP	Adj R-sq	Alpha	MRP	SMB	HML	MOM	Adj R-sq
1	-0.092%	-1.916%	-0.0002 -0.5330	0.9381 63.102	0.945	-0.0002 -0.716	1.0009 79.393	0.4911 19.609	0.1201 4.74	0.0938 4.344	0.98
2	-0.127%	-2.623%	-0.0002 -0.699	0.9492 91.612	0.973	-0.0002 -1.127	0.9836 114.639	0.3482 20.425	0.0269 1.561	0.0178 1.209	0.991
3	-0.143%	-2.960%	-0.0001 -0.853	0.9339 173.904	0.992	-0.0001 -1.209	0.9544 179.189	0.1528 14.436	-0.0168 -1.567	0.0038 0.412	0.996
4	-0.156%	-3.217%	-7.16E-05 -0.624	0.9702 227.767	0.996	-7.8E-05 -0.903	0.9786 220.053	0.1125 12.734	-0.0205 -2.294	-0.014 -1.844	0.998
5	-0.167%	-3.439%	3.41E-06 0.043	0.973 330.086	0.998	-4.2E-06 -0.058	0.9795 264.268	0.0334 4.53	-0.0357 -4.789	-0.0115 -1.807	0.998
6	-0.175%	-3.620%	4.98E-05 0.547	0.9989 295.622	0.997	3.69E-05 0.483	1.0016 254.547	0.0569 7.28	-0.0456 -5.765	-0.0279 -4.147	0.998
7	-0.185%	-3.818%	4.47E-05 0.403	0.9834 238.889	0.996	2.84E-05 0.328	0.991 222.493	0.0788 8.905	-0.0642 -7.17	-0.0318 -4.174	0.998
8	-0.197%	-4.061%	4.62E-05 0.353	0.9986 205.146	0.995	2.69E-05 0.265	0.9846 188.382	0.0991 9.546	-0.0342 -3.257	-0.0613 -6.853	0.997
9	-0.215%	-4.417%	3.7E-05 0.244	0.9933 176.648	0.993	3.3E-06 0.029	0.9818 166.782	0.0978 8.359	-0.0948 -8.012	-0.869 -8.623	0.996
10	-0.261%	-5.338%	-8.52E-06 -0.037	1.0194 118.67	0.984	-6.3E-05 -0.375	0.9806 112.991	0.1417 8.217	-0.1202 -6.891	-0.1595 -10.734	0.992
L/S (1 - 10)	0.169%	3.605%	-0.0002 -0.485	-0.0813 -5.183	0.101	-0.0001 -0.351	0.0202 1.227	0.3494 10.669	0.2403 7.253	0.2533 8.973	0.486
*Significant at 90% level											
**Significant at 95% level											

The analysis based on six-month lagged returns results in two portfolios held throughout the time period. The data includes portfolios with 881 and 898 active mutual funds and is based on 231 daily return observations.

The regression analysis provides a very clear indication that there is no outperformance of active mutual funds during the great financial crisis. All alpha values are statistically insignificant while the average daily returns are also negative for all deciles.

In our analysis, we only find evidence in bear market 1 that supports our hypothesis that there is evidence of persistence in positive alphas in downturns. However, we cannot conclude that this is the case for bear markets in general since we do not observe a similar trend in bear market 2.

It is worth noting that our analysis differs from previous research as we compare across different bear markets rather than looking at a single time horizon. The two bear markets in question are remarkably different in terms of severity and reach, resulting in two drastically

different market environments that fund managers faced. This is supported by the report from US-based asset manager, Vanguard, which noted “reasonable” outperformance by fund managers during the early 2000s bear market.

Looking at the results, we can deduce that different bear market environments affect the performance of mutual funds. If we compare the two bear market periods, the great financial crisis had a much more severe and widespread effect on markets than the bursting of the dot-com bubble. The great financial crisis resulted in the systemic failure of the banking system, while the dot-com bubble was focused largely on inflated nascent technology firm valuations. This may explain the lack of evidence supporting persistence in bear market 2 when we look at the six-month formation analysis.

## Bull Market 1

Given that our bull market periods were sufficiently long enough, we based the portfolios off of one-year lagged returns. This method is similar to that of Carhart's 1997 study.

**Table 8: Regression results for bull market 1 with one-year formation period**

Decile	Daily Average Excess Return	Monthly Excess Return (based on 21 trading days)	CAPM			4-Factor Model					
			Alpha	MRP	Adj R-sq	Alpha	MRP	SMB	HML	MOM	Adj R-sq
1	0.112%	2.376%	-4.39E-06 -0.0540	1.1304 101.084	0.91	-8.59E-06 -0.193	0.9513 131.872	0.3868 34.958	0.1135 6.473	0.2278 21.82	0.974
2	0.076%	1.610%	-2.76E-05 -0.433	1.109 127.821	0.942	-2.75E-05 -0.823	0.9677 178.587	0.315 37.9	0.0848 6.443	0.1675 21.359	0.984
3	0.067%	1.412%	1.217E-05 0.243	1.0536 154.144	0.959	1.208E-05 0.435	0.9455 209.717	0.2505 36.219	0.0739 6.748	0.1188 18.199	0.988
4	0.060%	1.274%	2.363E-05 0.568	1.0529 185.768	0.972	2.624E-05 1.107	0.9635 250.227	0.2064 34.94	0.05 5.345	0.097 17.4	0.991
5	0.055%	1.159%	1.621E-05 0.512	1.0291 238.309	0.983	1.687E-05 0.869	0.9636 305.428	0.1471 30.401	0.038 4.959	0.0759 16.61	0.994
6	0.050%	1.045%	0.0002 0.936	1.0207 42.303	0.64	0.0002 0.959	0.972 33.797	0.0968 2.195	0.003 0.043	0.0666 1.601	0.643
7	0.044%	0.934%	-6.51E-06 -0.296	0.9907 330.651	0.991	4.889E-06 0.248	0.9629 300.66	0.0579 11.786	-0.0312 -4.012	0.0288 6.218	0.993
8	0.039%	0.812%	2.034E-06 0.072	0.9963 258.961	0.985	2.237E-05 0.864	0.9677 230.026	0.0727 11.272	-0.054 -5.283	0.0102 1.668	0.988
9	0.031%	0.657%	1.793E-05 0.563	0.9913 228.455	0.981	4.255E-05 1.419	0.9656 198.165	0.0569 7.619	-0.0807 -6.816	0.0132 1.867	0.983
10	0.015%	0.318%	2.579E-05 0.599	0.9166 156.144	0.96	0.0000589 1.441	0.9043 136.155	0.062 6.091	-0.091 -5.639	-0.044 -4.581	0.965
L/S (1 - 10)	0.097%	2.053%	-3.02E-05 -0.305	0.2138 15.835	0.199	-6.75E-05 -0.955	0.047 4.097	0.3248 18.45	0.2044 7.333	0.2719 16.368	0.596
*Significant at 90% level											
**Significant at 95% level											

For the 60-month time frame, we constructed four portfolios based on one-year lagged returns, which resulted in 1,006 daily return observations. The results from the regressions reflect no evidence of persistence for both the CAPM and 4-factor model. We do observe negative alphas in the top performing deciles and positive alphas in the worst performing deciles, albeit statistically insignificant. This also supports the argument for a lack of persistence, where a manager's past returns are a poor indicator for manager's skill.

## Bull Market 2

**Table 9: Regression results for bull market 2 with one-year formation period**

Decile	Daily Average Excess Return	Monthly Excess Return (based on 21 trading days)	CAPM			4-Factor Model					
			Alpha	MRP	Adj R-sq	Alpha	MRP	SMB	HML	MOM	Adj R-sq
1	0.102%	2.168%	-0.0001 -2.0050	1.1307 195.554	0.939	-0.0001 -2.633	1.0814 231.221	0.3095 35.976	-0.1015 -11.097	0.0932 14.368	0.965
2	0.084%	1.770%	-8.31E-05 -2.046	1.0864 255.861	0.963	-7.7E-05 -2.488	1.0469 303.681	0.2393 37.736	-0.05 -7.417	0.0673 14.077	0.979
3	0.075%	1.595%	-8.2E-05 -2.649	1.0616 327.878	0.977	-6.81E-05 -2.908	1.0267 393.24	0.1992 41.482	-0.0026 -0.502	0.0461 12.72	0.987
4	0.069%	1.457%	-7.34E-05 -3.301	1.0337 444.558	0.988	-5.88E-05 -3.48	1.0073 535.347	0.1472 42.517	0.0103 2.796	0.0238 9.105	0.993
5	0.063%	1.336%	-5.61E-05 -3.142	1.0127 542.584	0.992	-3.86E-05 -2.759	0.9911 636.629	0.1125 39.298	0.0335 10.987	0.0092 4.247	0.995
6	0.058%	1.223%	-6.04E-05 -3.182	0.9932 500.092	0.99	-3.88E-05 -2.448	0.974 551.685	0.0966 29.742	0.042 12.158	-0.0112 -4.59	0.993
7	0.053%	1.117%	-4.78E-05 -2.328	0.9866 459.274	0.988	-2.4E-05 -1.373	0.9677 496.492	0.0919 25.637	0.0503 13.184	-0.0172 -6.351	0.992
8	0.047%	0.994%	-4.02E-05 -1.428	0.9788 332.876	0.978	-7.77E-06 -0.323	0.9539 355.604	0.122 24.732	0.0618 11.77	-0.0298 -7.997	0.984
9	0.040%	0.833%	-5.37E-05 -1.557	0.9754 270.429	0.967	-1.17E-05 -0.405	0.944 294.234	0.1571 26.621	0.0642 10.234	-0.0509 -11.438	0.977
10	0.022%	0.455%	-5.54E-05 -1.228	0.9478 201.103	0.942	-3.65E-06 -0.097	0.9102 216.107	0.1979 25.544	0.0381 4.623	-0.0897 -15.347	0.0959
L/S (1 - 10)	0.081%	1.706%	-5.55E-05 -0.682	0.1829 21.489	0.156	-0.0001 -1.454	0.1713 20.905	0.1116 7.406	-0.1396 -8.711	0.1829 16.091	0.313
*Significant at 90% level											
**Significant at 95% level											

The second bull market examined consists of 131 months and ten portfolios held. The regression is based on 2,499 daily return observations.

Again, the results suggest that there is no evidence of persistent outperformance. However, we do find evidence of persistent underperformance over this time period. The CAPM results suggest that deciles 1 to 7 have statistically significant negative alphas at the 95% level, while the 4-factor model results show the same for deciles 1 to 6. The most severe underperformance is found within the best-returns decile for both regressions.

In general, both bull markets examined produce results that are consistent with past research and discussions on active mutual fund performance. The widespread persistent underperformance of active mutual funds aligns with the S&P SPIVA U.S. Scorecard report, which has been tracking the underperformance of US equity mutual funds during the same time horizon.

## Discussion

Our analysis on active US equity mutual funds aligns with the general literature. The bull market periods are consistent with semi-strong market efficiency, where fund managers are unable to earn abnormal returns using all available public information. This suggests that there is no evidence to support fund managers' stock picking ability during bull markets.

We do observe some persistent outperformance in one of the bear markets examined. This suggests some evidence of stock picking ability but is limited to bear market 1. The lack of evidence to support persistent outperformance in bear market 2 implies that there is a lack of persistence and consistency of fund managers performance across bear markets in general. The evidence suggest that active fund managers are not able to consistently outperform the market. This would lead us to draw either conclusion:

- 1) Persistence in outperformance was due to the "hot-hands funds" theory as suggested by Carhart, OR,
- 2) There was evidence of fund manager's skill in bear market 1

We hypothesize that this inconsistency should not lead us to draw a similar "hot-hands funds" conclusion as Carhart (1997) did. Each bear market is vastly different in nature and this cannot be more apparent for our two periods examined. The impact of the dot-com bubble in bear market 1 had a less significant impact than the great financial crisis. The great financial crisis was a systemic banking crisis that brought upon liquidity and solvency risks across industries and households. This additional volatility and market stress created greater limits to arbitrage and access to capital, which could explain why fund managers were unable to outperform in bear market 2. Different funds may also have had different exposures to certain sectors that would have been impacted more than others. This does not take away from a fund manager's skill in outperforming the market, but we also note that there is a lack of persistence across longer time horizons.

Drawing from these observations, we may consider the great financial crisis as an anomaly – a once in a lifetime type of downturn. Ideally, we would examine a larger sample of bear market periods but are limited by the daily returns data provided by CRSP Mutual Funds to the last 20 years.

Our analysis also has some drawbacks, with the first being its inability to analyze the economic significance of outperformance. At the end of the day, mutual funds are investment products that generate income, which are net of expenses. This study focuses solely on the manager's ability and does not examine the net effect of mutual fund returns.

We also draw conclusions on the assumption that active mutual funds do in fact utilize active portfolio management strategies. This requires us to give active mutual funds the benefit of the doubt as we are unable to observe and track their actual trading strategies.

The results show some evidence of persistent outperformance in bear markets, which supports our hypothesis. This would also lead us to conclude that markets cannot be thought of as semi-strong efficient (at least not for bear markets). Evidence of short-term persistence would thus imply that active mutual fund managers are skilled and informed when dealing with volatile bear markets. Despite this, we only observe this for bear market 1 and cannot extend this conclusion to all other bear market periods. The persistent outperformance within bear markets does not persist across bear market periods.

Our study does not consider the economic relevance of active mutual funds. Our dataset shows that large-, mid- and small-cap active mutual funds have expense ratios of 1.29%, 1.36% and 1.48% respectively. This does not include additional transaction costs that distributors may charge. Incorporating such costs would eliminate the persistence in outperformance and even result in persistent underperformance in a larger proportion of mutual funds. This was evident from Carhart (1997), who observed that expenses and transaction costs explained almost all the predictability in mutual fund returns.

Overall, there seem to be more arguments against active management. Taking a more theoretical approach, we look at investing in the financial markets as a zero-sum game. There are always two parties in any transaction, a long and short position, which implies that one person's gain is another person's loss. We can extend this logic to active and passive fund management. Passive investment strategies whose returns follow closely to benchmarks. Their average returns are therefore equal to the market return before transaction costs and would be considered an optimal strategy. (Sharpe (1991), Malkiel (2003)) On the other hand, active fund managers attempt to beat the market by actively selecting stocks. Based on a market that is a zero-sum game, there will be active fund managers who outperform and underperform in the

market. Our data has shown that there is a lack of consistency in an active fund manager's ability to outperform across bear markets, which would lead us to conclude that past returns are not indicative of future outperformance. This means that it is difficult if not impossible to identify winner fund managers. Including the higher expense ratios and transaction costs of active mutual funds also worsens the case for investing in active mutual funds.

Our main motivation for this study was to analyze the active versus passive management debate. When we start to consider the argument for active management from statistical approach, the data seems to reject its economic relevance. We only find that one out of the four time periods examined support our hypothesis, while we have yet to consider expenses and transaction costs. However, there are several other implications of active versus passive investing on the wider financial market.



## Implications

Since we have established that there is more evidence supporting passive management, we turn towards a more qualitative approach to understand the implications of a shift from active to passive investments. These implications are extensions of our research and focus on the impact on financial stability and market efficiency.

In a report by the Federal Reserve, Anadu et al (2018) outlines potential repercussions of a shift from active to passive investments. A rise in the proportion of index funds and ETFs reduces the liquidity transformation and redemption risks, which pose a threat to the stability in the asset management industry. They attribute this to evidence of smaller performance-related redemption risks for passive funds than for active funds. The growth of ETFs also reduces liquidity transformation as redemptions largely involve an exchange of the basket of securities in the ETF. This minimizes the likelihood of large-scale cash redemptions from mutual funds, which can result in destabilizing fire sales.

An increase in the proportion of indexed investing can also impact the correlation of the components within the index itself. Wurgler's (2010) paper on index inclusion effects theorizes that the return pattern of a newly added stock into an index, like the S&P 500, moves more closely with the other 499 stocks than with the rest of the market. This increase in co-movement becomes more pronounced as the volume of indexed investments being traded increases. It will also magnify any pricing differences between index components and the rest of the market. Hence, increased co-movement would allow for a wider propagation of shocks across all components of the index and result in increased market volatility.

These implications reflect some of the potential consequences when we extend our results to financial markets and investment behaviors.

## Conclusion

There has been a substantial amount of literature written on the persistence of mutual fund performance and the active versus passive management debate. Our study only reveals that one out of the four time periods show evidence of persistent outperformance within the best-returns portfolios. We can attribute some of this outperformance to the manager's skill given that we observe this in a bear market environment, where active managers are unlikely to adopt passive momentum strategies. A large portion of our results suggest a lack of persistence across the other bear markets, with some significant persistent underperformance in bull markets. We hypothesized that this may be due to different types of bear markets, which may affect active fund managers differently. Ideally, we would prefer to have analyzed more bear market periods to back up this claim but were limited with the daily returns data available.

We also look at the extensions of our study to the broader financial market. The current literature on the implications of shifting towards a larger proportion of passive indexed investments have mostly discussed the impact of increased correlation between index components. The data behind these studies suggest that the effects of security price distortion are still small today but theorize that this may become a larger issue with the rapid growth of passive investing.

## Suggestions for Further Studies

Due to the lack of resources available, our dataset was not as robust as we would have liked it to be. Analyzing a larger time horizon would have allowed us to examine cross period persistence better.

Future studies should also consider active share management to track how active the strategies of fund managers are. This measures how much of a fund's holdings deviate from its benchmark. This statistic will allow us to examine whether the momentum effect driving persistence in performance is caused by passive holding of past winners or through active rebalancing towards winners.

Another suggestion to consider would be to tweak the method used to form portfolios in our regression analysis. Currently, the portfolios are formed by sorting based on past returns. This

fails to identify true outperformers as past returns are not indicative of the risk factor loadings. We can consider sorting based on alphas to form our holding portfolios. In addition, a measure of market timing could also shed some light on the manager's skill.

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