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PERFORMANCE PERSISTENCE OF ACTIVE MUTUAL FUNDS AGAINST PASSIVE INDEX FUNDS

Evidence from Actively Managed European Equity Mutual Funds

Bachelor's Thesis
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Abstract

This research studies short- and mid-term persistence in the performance of actively managed European equity mutual funds in a sample from June 2002 to June 2022. The focus of this study is to evaluate the performance persistence against alternative portfolios of index funds, which reflect individual investors' other options. This research finds a significant persistence in the performance of actively managed mutual funds over the subsequent month. In that period, the portfolio of the best-performing mutual funds from the previous period outperforms the alternative portfolios. In the more extended evaluation periods, 3-12 months, the outperformance disappears, and the persistence pattern becomes minor.

Keywords performance persistence, active funds, index funds, European equity mutual funds

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1. INTRODUCTION

Performance persistence in actively managed European equity mutual funds is significant over the subsequent month when the performance is compared against alternative portfolios of index funds. Over that period, the best-performing mutual funds outperform, and the worst-performing mutual funds underperform. Even if the outperformance is significant during that short period, it does not reflect superior skill in the best-performing mutual funds. The outperformance appears only in the one-month period and primarily by change. The outperformance can be explained with short term momentum effect, but not because the funds would follow momentum strategy. In the more extended evaluation periods, 3 to 12 months, the momentum factor exposure drops in the best-performing mutual funds, the outperformance disappears, and the overall performance persistence becomes minor. The only performance persistence pattern in the more extended evaluation periods is the low performance of worst-performing mutual funds.

Performance persistence is a well-researched topic in finance literature. It is an interesting topic for both academics and practitioners. Performance persistence relates to the efficient market hypothesis, which states that future performance should be unpredictable. Academics have found evidence in line with the efficient market hypothesis and against it. In one of the most important research, Carhart (1997) finds a significant performance persistence pattern in mutual funds returns, but also finds that the performance persistence is almost entirely attributable to the momentum effect.

In my research, I have a different view and methodology than Carhart (1997), but my findings are consistent with Carhart's findings. Momentum factor is the most critical explainer of short-term performance persistence and mainly happens by chance. My evidence supports Carhart's findings that the best-performing mutual funds outperform because of a significant momentum factor exposure, but they do not follow a momentum strategy. The momentum factor exposure in the funds is only short-term, and therefore it happens mainly because the best-performing funds just happen to have more significant holdings in the last year's winning stocks. The momentum factor exposure is not consistent over time. In my research, the momentum factor has a significant role. Index funds are not able to provide similar momentum exposure as the best-performing active funds.

For practitioners, performance persistence means that investors can select the best mutual funds to invest in by evaluating past performance. Commonly, one of the most impart selection

criteria is past performance. Although, the evidence from the finance literature does not support it strongly. The evidence of performance persistence mainly concentrates on the underperformance of worst-performing mutual funds, and the evidence on the outperformance of the best-performing mutual funds has been thin (see, e.g. Hendricks, Patel, and Zeckhauser 1993; Goetzmann and Ibbotson 1994; Carhart 1997). These findings imply that investors can use past information to avoid the worst-performing funds, but they cannot obtain higher returns by using past information.

According to my results, Investors would have outperformed the alternative portfolios of index funds by investing in the best-performing active mutual funds from the past 12 months and rebalancing the positions at the beginning of every month. This strategy would have outperformed the alternative portfolios by 0.22 percent per month and 2.6 percent per annum. The evidence from the more extended evaluation periods shows that investing in index funds would have been better. Although, the economic significance of these findings is low. I do not consider possible costs from continuous "trading" with mutual funds. In addition, I construct the research by evaluating the past. I do not construct a model which could predict future returns.

My most significant contribution is that I show that most typically used evaluation models in the performance persistence literature may give a too pessimistic view of the performance of actively managed mutual funds. I construct my research using the typically used factor models and using the alternative approach introduced by Huij and Blitz (2012). In the factor models, I compare the mutual funds' performance against Fama-French (1992, 1993) and Carhart (1997) factors. While in the alternative approach, I compare the performance against alternative portfolios, which consists only of index funds. The results show that even if the portfolio of last year's winning mutual funds does not produce positive factor alphas, it might still outperform the alternative portfolio of index funds.

The purpose of evaluating alternative portfolios of index funds is to make the performance evaluation more concrete. The concern in the factor models is that the FFC factors are based on the hypothetical factor portfolios, which do not consider transaction costs, trade impact, or other real-life trading restrictions (Cremers, Petäjistö, and Zitzewitz 2013; Huij and Verbeek 2009). So, if an actively managed mutual fund produces negative alpha against these factors, it does not directly imply that you should not invest in the fund. It might still be the best option, as the factors are not investable or replicable. In contrast, results from the alternative evaluation models directly show a portfolio of index funds with similar risk exposure and whether the active mutual fund portfolio has outperformed this alternative portfolio.

This research expands the literature on European equity mutual funds. European equity mutual funds have been under minor coverage compared to U.S. equity mutual funds, and the performance persistence evaluation against alternative portfolios of index funds has not been done before. The research also contributes to the discussion of the effective investment strategy for individual investors: do mutual fund managers generate abnormal returns, or is it better to invest in passive index funds.

2. LITERATURE REVIEW

The starting point for performance persistence literature is the efficient market hypothesis introduced by Fama (1965, 1970). It states that the performance of individual mutual funds should be unpredictable. All available information is already in the stock prices. Therefore, no individual money manager should be able to outperform more than would be expected from random chance. Persistence in the performance of mutual funds would break this hypothesis, particularly if some mutual funds could persistently produce higher returns and outperform the market.

The first study on performance persistence finds supporting evidence for the efficient market hypothesis. Jensen (1969) discovers that good future performance does not follow from good past performance.

Later, studies have found evidence on mutual funds' performance persistence. For example, Hendricks et al. (1993) discover strong evidence that the performance of growth-oriented mutual funds persists in a one-year evaluation period. Portfolios of lower-performing mutual funds from the previous period do significantly worse than standard benchmarks, and those of best-performing mutual funds outperform the benchmarks, though not significantly. Goetzmann and Ibbotson (1994) document a similar short-term persistence in raw returns, Jensen risk-adjusted alpha measures, and rankings in style-categorized subgroups. They find that some managers are better than others, and reviewing past performance is useful in differentiating managers. Brown and Goetzmann (1995) find persistence in mutual funds' relative risk-adjusted performance, which is mostly due to low-performing mutual funds. They also find that the performance pattern correlates across mutual funds. Brown and Goetzmann suggest that winning funds are loading up on some systematic factors that their model does not consider.

Performance persistence is also found in more extended periods. For example, Grinblatt and Titman (1992) document persistence in mutual fund performance in a five-year evaluation period. Elton et al. (1996) find performance persistence pattern in a three-year evaluation period.

In one of the most influential papers on performance persistence, Carhart (1997) shows that the performance persistence pattern is a result of the momentum effect of Jegadeesh and Titman (1993). Carhart finds a significant performance persistence pattern in one-year raw returns and CAPM alphas. Although, the performance persistence pattern vanished after taking the momentum factor exposure into account in Carhart's 4-factor model. The only performance persistence not explained by the 4-factor model is a substantial underperformance by the worst-performing mutual funds. Carhart finds only very slight evidence consistent with skilled mutual funds managers. He argues that one-year momentum effect mainly drives the "hot hands" effect, but no mutual funds seem to follow the momentum strategy. The best-performing mutual funds happen to hold the last year's winning stocks, which continue good performance also in the subsequent period.

Carhart's 4-factor model has become a widely approved methodology in mutual funds literature, and Carhart's findings are generally the starting point in new research.

Even if the 4-factor model is widely approved, the factor models have also been criticized in the literature. The systemic factors are based on hypothetical stock portfolios that do not consider transaction costs, trade impact, or other real-life trading restrictions (Huij and Verbeek 2009; Cremers, Petäjistö, and Zitzewitz 2013). Huij and Verbeek (2009) find that this systematic bias cause miscalculation in the factor models and bias in estimations. They argue that it would be better to construct the factor proxies using mutual fund returns rather than stock returns. Cremers et al. (2013) document that benchmark indexes such as the S&P 500 and Russel 2000 produce economically and statistically significant non-zero alphas, which proves that the comparison against factor models is misleading. They introduce alternative evaluation models to clear up this issue, four and seven factor index-based models. The models consist of the most referenced indices instead of factor proxies. The index-based models make the comparison more concrete. Unlike the systematic factor, the indexes are replicable and investable through index funds. In recent literature, the index-based models have become an internal part of performance evaluation alongside the factor models (Mateus, Mateus, and Todorovic 2019; Cuthbertson, Nitzsche, and O'Sullivan 2022). Cuthbertson et al. (2022) find evidence of positive alpha persistence in a small portfolio of past winner mutual funds by using the seven factor index-based model.

Huij and Blitz (2012) introduce an alternative approach in their study on U.S. equity mutual funds. They evaluate the actively managed mutual funds directly against an alternative portfolio of passive index funds. When no evidence of mutual funds' positive abnormal returns against the common factors is found, the typical conclusion is that investing in a low-cost index fund would be better than active mutual funds. Although, this conclusion might be premature because the common

factor portfolios are not investable products. Huij and Blitz find that the best-performing mutual funds from the previous period outperform the alternative portfolio of index funds in the subsequent month, even though the best-performing funds do not produce positive 4-factor alpha. The results imply that the best-performing active mutual funds provide value over index funds, and the conclusion is against the common understanding from the literature.

3. DATA

3.1 Actively Managed European Equity Mutual Funds

My research data consist of monthly returns of 5,543 surviving and non-surviving actively managed European equity mutual funds from June 2001 to June 2022. I include all non-index funds that invest predominantly in European equities from Morningstar Direct Global Database (14.7.2022). In the case of multiple share classes, I use the Oldest Share Class determined by Morningstar. The monthly returns reflect the actual returns passed on to investors. They take into account the management, administrative, 12b-1 fees, and other costs.

I cleaned the original data from monthly returns before the registered opening date to the public to prevent the data from incubation bias. Some investment firms use a private incubation to open new funds. They first operate privately and later open the best-performing funds to the public. This incubation strategy causes upward bias in the Morningstar Direct database as it includes the return data from this incubation period for the funds opened to the public. These funds tend to outperform during the incubation period, but post-incubation, the outperformance disappears. Including a ticker creation date filter eliminates this upward bias (Evans 2010).

Table 1: Summary of Actively Managed European Equity Mutual Funds

The table describes my research data on actively managed European equity mutual funds from June 2001 to June 2022. It reports time-series averages of cross-sectional monthly average attributes for all funds and Europe Equity Large Cap, Europe Equity Mid/Small Cap, and Europe Emerging Markets Equity -funds. The categories are the three Morningstar Global Category that include all European equity mutual funds in from Morningstar Direct database.

	Total Number	Time-Series Averages of Cross-sectional Monthly Averages, June 2001 - June 2022		
		Avg. Number	Monthly Excess Ret.	Std Dev
All Funds	5,543	3,091	0.41	5.56
By Global Category				
Europe Equity Large Cap	4,015	2,210	0.35	5.42
Europe Equity Mid/Small Cap	1,299	737	0.60	5.94
Europe Emerging Markets Equity	190	144	0.68	7.62

3.2 Selected Index Funds

In alternative investment portfolio models, I use five index funds and the U.S. one-month T-bill rate as an interest for cash. The selected index funds are Vanguard European Stock Index Fund (Vanguard Market), Sparinvest Index Europa Small Cap Fund (Sparinvest Small Cap), Sparinvest Index Europa Value Fund (Sparinvest Value), Sparinvest Index Europa Growth Fund (Sparinvest Growth), and iShares Edge MSCI Europe Momentum Factor UCITS ETF (iShares Momentum). The data include monthly returns from June 2002 to June 2022, except for iShares Momentum. Its data is available from February 2015 onwards. I obtained the index funds' data from Morningstar Direct Global Database (14.7.2022) and the T-bill rate data from Kenneth R. French Data Library (14.7.2022). The monthly returns of the index funds reflect the actual returns passed on to investors. They take into account the management, administrative, 12b-1 fees, and other costs.

I selected the market, small-cap, value, and growth index funds based on their 20-year tracking error to MSCI Europe benchmark indexes; MSCI Europe, MSCI Europe Small Cap, MSCI Europe Value, and MSCI Europe Growth. The selected index funds also provide the most extended data history. Sparinvest launched small-cap, value, and growth index funds years before its competitors. The iShares Momentum fund is the first European momentum index fund, and its performance in tracking MSCI Europe Momentum Index has been superior to others. Unfortunately, the iShares Momentum provides only ~7-year history.

Table 2: Summary of Selected Index Funds

The table presents the selected index funds. It reports the launch Date to the public, primary benchmark, 20-year tracking error, and 10-year tracking error, and describes the monthly returns. 20-year tracking error and monthly return metrics are calculated from July 2002 to June 2022. 10-year tracking error is calculated from July 2012 to June 2022. iShares Momentum is an exception. The tracking error and monthly return metrics are calculated from February 2015 to June 2022. The ranking in the tracking errors is presented in parentheses.

Index Funds	Launch Date	Benchmark	20-year tracking error, %	10-year tracking error, %	Monthly Excess Returns, %, June 2001 - June 2022	
					Average	Std Dev
Vanguard European Stock Index Fund	14.9.1998	FTSE Developed Europe All Cap Index	0.46 (1)	0.30 (1)	0.46	5.34
Sparinvest Index Europa Small Cap Fund	18.5.2001	MSCI Europa Small Cap	2.54 (1)	1.31 (1)	0.74	6.12
Sparinvest Index Europa Value Fund	18.5.2001	MSCI Europe Value	1.02 (1)	0.57 (1)	0.39	5.95
Sparinvest Index Europa Growth Fund	18.5.2001	MSCI Europa Growth	0.97 (1)	0.43 (1)	0.49	4.88
iShares Edge MSCI Europe Momentum	16.1.2015	MSCI Europe Momentum		0.25* (1)	0.45*	4.20*

*) Data available from Feb. 2015 onwards, tracking error and monthly return metrics from the period Feb. 2015 to June 2022

4. METHODOLOGY

I research short and mid-term persistence in the performance of actively managed European equity mutual funds and whether active mutual funds provide value over passive index funds. My overall methodology follows a typical approach to research performance persistence. I rank the actively managed mutual funds into decile portfolios at the beginning of every month based on their past 12-month return. Then, I evaluate the decile portfolios' post-ranking performance over the following months using commonly used multifactor models with the Fama-French (1992, 1993) and Carhart (1997) factors. I also evaluate the post-ranking performance using an alternative approach introduced by Huij and Blitz (2012). It compares the post-ranking performance against alternative investment portfolios consisting of different factor strategy index funds. The underlying idea is to evaluate the decile portfolios against the closest alternative option formed from index funds. I evaluate performance persistence over the following month as well as over the following three six and twelve months.

I construct the decile portfolio by ranking the mutual funds at the beginning of every month based on their past 12-month return and using the returns over the subsequent evaluation period to construct the decile portfolios. The data from June 2001 to June 2022 allows me to construct decile portfolios from June 2002 onwards. I construct the decile portfolios using equal weights. As an evaluation period, I use the following one, three, six, and twelve months. In the longer evaluation

periods, the decile portfolio returns are partly overlapping as I construct decile portfolios each month but evaluate the performance over multiple months. At each point, I include all actively managed mutual funds with sufficient data for the ranking and evaluation periods.

4.1 Multifactor Models with Fama-French and Carhart Factors

I employ 1-factor, 3-factor, and 4-factor model specifications based on the Fama-French (1992, 1993) and Carhart (1997) factors. I obtain the factor returns of RMRF, SMB, HML, and WML factors from Kenneth R. French Data Library (14.7.2022).

I evaluate the decile portfolios' performance using the multifactor models as:

$$r_{it} - r_{ft} = \alpha_i + \beta_{1_i} RMRF_t + \epsilon_{it}, \quad t = 1,2,\dots,T \tag{1}$$

$$r_{it} - r_{ft} = \alpha_i + \beta_{1_i} RMRF_t + \beta_{2_i} SMB_t + \beta_{3_i} HML_t + \epsilon_{it}, \quad t = 1,2,\dots,T \tag{2}$$

$$r_{it} - r_{ft} = \alpha_i + \beta_{1_i} RMRF_t + \beta_{2_i} SMB_t + \beta_{3_i} HML_t + \beta_{4_i} WML_t + \epsilon_{it}, \quad t = 1,2,\dots,T \tag{3}$$

where r_{it} is the return of a decile portfolio; r_{ft} is the U.S. one-month T-bill rate; RMRF is the return on Europe region's value-weighted market portfolio minus the U.S. one-month T-bill rate; and SMB, HML, and WML are returns on equal-weighted factor-mimicking portfolios for size, book-to-market equity, and one-year momentum in stock returns. More detailed description in Kenneth R. French Data Library.

The multifactor models evaluate the performance against expected return concerning the underlying systematic risk exposure. The comparison involves asset pricing models, and the results are sensitive to whether the asset pricing model is accurate or inaccurate. This fact refers to the joint hypothesis problem in expected returns. Abnormal returns in the model may indicate that the returns are indeed abnormal or that the model is inaccurate. Therefore, the joint hypothesis problem affects my research, and it should be considered when analyzing the results. If the first decile portfolio performs better than other decile portfolios, it indicates either performance persistence or that the model does not consider all differences between the deciles.

4.2 Alternative Investment Portfolio Models with Passive Index Funds

I employ three alternative investment portfolio models consisting of index funds: The first portfolio consists of the market fund and cash. The second portfolio consists of the market, small-cap, value,

and growth funds together with cash. The third portfolio consists of the market, small-cap, value, growth, and momentum fund together with the cash. When analyzing the sample from June 2002 to June 2022, I construct a synthetic momentum portfolio as no momentum index fund is available over the period. In the shorter sample from February 2015 to June 2022, I can also analyze with an actual momentum index fund.

I construct alternative investment portfolios using the restricted least squares method with the same restrictions that investors have in real life. The weights in the index funds cannot be negative, and weights always sum up to one. I construct the alternative portfolios as:

$$r_{it} = \alpha_{iT} + \beta_{0_{iT}} r_{ft} + \beta_{1_{iT}} Market_t + \epsilon_{it}, \qquad \mathrm{t} = 1,2,\dots,\mathrm{T} \tag{4}$$
$$s.t. \;\; \beta_0 + \beta_1 = 1$$
$$\beta_1 \geq 0$$

$$r_{it} = \alpha_{iT} + \beta_{0_{iT}} r_{ft} + \beta_{1_{iT}} Market_t + \beta_{2_{iT}} Small\text{-}Cap_t + \beta_{3_{iT}} Value_t + \beta_{4_{iT}} Growth_t + \epsilon_{it}, \tag{5}$$
$$\mathrm{t} = 1,2,\dots,\mathrm{T}$$
$$s.t. \;\; \beta_0 + \beta_1 + \beta_2 + \beta_3 + \beta_4 = 1$$
$$\beta_1, \beta_2, \beta_3, \beta_4 > 0$$

$$r_{it} = \alpha_{iT} + \beta_{0_{iT}} r_{ft} + \beta_{1_{iT}} Market_t + \beta_{2_{iT}} Small\text{-}Cap_t + \beta_{3_{iT}} Value_t + \beta_{4_{iT}} Growth_t + \tag{6}$$
$$\beta_{5_{iT}} Momentum_t + \epsilon_{it}, \qquad \mathrm{t} = 1,2,\dots,\mathrm{T}$$
$$s.t. \;\; \beta_0 + \beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5 = 1$$
$$\beta_1, \beta_2, \beta_3, \beta_4, \beta_5 > 0$$

where r_{it} is the return of a decile portfolio; r_{ft} is the risk-free rate, the U.S. one-month T-bill rate; *Market* is the Vanguard Market index fund; *Small-Cap*, *Value*, and *Growth* are Sparinvest's index funds; *Momentum* is the systematic momentum portfolio when analyzing the sample from June 2002 to June 2022, and it is iShares Momentum when analyzing the sample from Feb. 2015 to June 2022; *Betas* present the weights in the portfolio; Alpha presents average return difference between the decile portfolio and the alternative portfolio.

Synthetic momentum portfolio replaces the momentum index fund in the alternative portfolios when analyzing sample from June 2002 to June 2022. The synthetic momentum portfolio tries to capture some momentum exposure by dynamically investing in the index fund with the highest past 12-month return. The method is inspired by several studies that point out that a large portion of the momentum effect can be attributed to momentum in industries and factor returns (Huij and Blitz 2012; Moskowitz et al. 1999; Chen and de Bondt 2004).

The alternative investment portfolio models compare the decile portfolios against the alternative investment option with similar fluctuations in the returns. Evaluating the decile portfolios this way makes the performance evaluation concrete, and the results directly show how

much value the active management creates within the decile portfolios. By making the comparison concrete, the alternative investment portfolio models are not similarly affected by the joint-hypothesis problem as in the multifactor models. The alternative models do not take a view on expected returns or abnormal returns. They just compare the decile portfolio returns against an alternative option in which the investors could have invested instead of in actively managed mutual funds.

5. EMPIRICAL RESULTS

First, I analyze the index funds' ability to capture the market and other factor returns. Then, I investigate performance persistence by evaluating the performance of return-sorted decile portfolios of actively managed mutual funds. I first evaluate the decile portfolios' one-month performance against the multifactor models and then against the alternative portfolios. After that, I construct a similar analysis using a shorter sample. At last, I evaluate the decile portfolio performance over the following three- to twelve-month periods.

5.1 Index Funds Ability to Capture Factor Returns

I analyze the selected index funds' ability to capture the market, size, value, and momentum factors returns by estimating the multifactor models in Equation (1), Equation (2), and Equation (3). I use the sample from June 2002 to June 2022, except in the case of iShares Momentum, as its data is available from February 2015 onwards.

Table 3 shows that the selected index funds have different factor exposures, and I can use these index funds to construct portfolios with different factor exposure, which is necessary for my research. Although, the table also shows that the index funds are inefficient at capturing the factor returns. These inefficiencies cause the portfolios to be also inefficient. For this reason, I expect that the results from the alternative portfolio models differ from the multifactor model results.

Vanguard Market fund has significant exposure to the market factor and negative exposure to the size factor, but it is inefficient at capturing these returns. The 1-factor model shows that the Vanguard Market fund follows the RMRF factor closely. The RMRF coefficient is 1.00, and the adjusted R-squared is 0.99. In the 3- and 4-factor models, the market factor exposure remains the most important, but the fund also has significant negative exposure to the SMB factor. The SMB coefficient is -0.17 in both models. Other coefficients are not different from zero. The alphas are all

significantly negative, which shows that Vanguard Market is inefficient at capturing the factor returns. The 1-factor alpha is -0.11 percent per month (t-stat. -3.18). The 3-factor alpha is -0.08 per month (t-stat. 2.90). The 4-factor alpha is -0.06 (-2.14).

Sparinvest Small Cap fund captures factor returns relatively efficiently compared to other index funds. The 3- and 4-factor models show that the Sparinvest Small Cap fund has significant exposure to the RMRF and SMB factors. The RMRF coefficients are 1.10 and 1.09, and the SMB coefficients are 0.74 and 0.75. Other coefficients are not different from zero. Moreover, according to the 3- and 4-factor alphas, the small-cap fund efficiently captures these factor returns. The 3-factor alpha is 0.01 percent, and the 4-factor alpha is 0.00 percent. The associated t-statistics of -0.18 and 0.01 are only marginally different from zero.

Sparinvest Value and Growth funds have significant exposures to the market factor and negative exposures to the size factor, but they also provide opposite exposures to the value factor. According to the 3-factor alphas, the value fund captures the factor returns relatively efficiently while the value fund is inefficient. Although, after taking the WML factor exposure into account, both funds are unable to capture the factor returns efficiently. The value fund has a WML coefficient of -0.11 and yields a 4-factor alpha of -0.07 percent. The growth fund has a WML coefficient of 0.08 and yields a 4-factor alpha of -0.08. Even if the value and growth funds are inefficient. It is valuable for my research and investors these funds have strong opposite exposures to the HML factor. The value fund's HML beta coefficients are 0.39 and 0.33 in the 3- and 4-factor models, while the growth fund's HML beta coefficients are -0.40 and -0.36.

Finally, I analyze investors' ability to capture the momentum factor returns with index funds. It has been challenging for investors, as no momentum strategy index fund has been available until February 2015. Therefore, in the sample from June 2002 to June 2022, I investigate whether investors can capture the momentum factor returns by dynamically investing in the best-performing index fund. The systematic momentum portfolio presents that strategy. The portfolio invests in the fund with the highest past 12-month return at the beginning of every month. Using the sample from February 2015 to June 2022, I investigate how investors capture the momentum factor returns by investing in the first momentum strategy index fund, iShares Momentum.

The synthetic momentum portfolio provides higher exposure to the WML factor than the index funds individually, but the difference is not significant. The WML coefficient is 0.14, which is 0.06 higher than the Sparinvest Growth fund's WML coefficient. The 3-factor alpha of 0.01 percent shows that the synthetic momentum portfolio yields some returns over the market, size, and value factor. The difference is minor compared to the growth fund's 3-factor alpha. These findings

indicate that including the synthetic momentum portfolio can provide a bit higher momentum factor exposure, but the exposure in the portfolio will be negligible.

The iShares Momentum fund captures the WML factor returns more efficiently than the synthetic momentum portfolio, but the overall performance in capturing the factor returns is poor. The iShares Momentum fund has a WML coefficient of 0.35, which is significantly higher than the WML coefficient of the synthetic momentum portfolio or any other index fund. The 3-factor alpha is also higher, but it remains statistically insignificant. The 3-factor alpha is 0.06 percent with a t-statistic of 0.49. The iShares Momentum also has significant exposure to the RMRF factor, similar to all other index funds. Even though the iShares Momentum fund is inefficient at capturing the factor returns, it is still the most efficient passive option to capture momentum returns.

Table 3: Performance of Selected Index Funds

The table examines the monthly returns of selected passive index funds and a synthetic momentum portfolio against the Fama-French and Carhart factors. The selected index funds are Vanguard European Stock Index Fund, Sparinvest Index Europa Small Cap Fund, Sparinvest Index Europa Value Fund, Sparinvest Index Europa Growth Fund, and iShares Edge MSCI Europe Momentum Factor UCITS ETF. The synthetic momentum portfolio demonstrates a strategy that dynamically invests in the index fund with the highest return over the preceding 12 months. The table shows index funds' average monthly return over the U.S. one-month T-bill rate and estimated 1-, 3-, and 4-factor models with RMRF, SMB, HML, and WML factors. T-statistics are presented in parentheses. The sample covers monthly returns from June 2002 to June 2022, except for iShares Momentum, whose data is available from February 2015 onwards.

		1-Factor Model			3-Factor Model					4-Factor Model					
Index Fund	Monthly Excess Return	Alpha	RMRF	Adj R-sq	Alpha	RMRF	SMB	HML	Adj R-sq	Alpha	RMRF	SMB	HML	WML	Adj R-sq
Vanguard Mrkt	0.46	-0.11 (-3.18)	1.00	0.99	-0.08 (-2.90)	1.00	-0.17	-0.01	0.99	-0.06 (-2.14)	0.99	-0.17	-0.02	-0.02	0.99
Sparinvest Small-Cap	0.74	0.12 (1.01)	1.10	0.92	-0.01 (-0.18)	1.10	0.74	-0.00	0.97	0.00 (0.01)	1.09	0.75	-0.01	-0.01	0.97
Sparinvest Value	0.39	-0.23 (-2.62)	1.08	0.95	-0.18 (-3.28)	1.01	-0.26	0.39	0.98	-0.07 (-1.46)	0.98	-0.23	0.33	-0.11	0.98
Sparinvest Growth	0.49	-0.02 (-0.23)	0.89	0.94	0.00 (-0.08)	0.96	-0.12	-0.40	0.98	-0.08 (-1.73)	0.98	-0.14	-0.36	0.08	0.98
Synthetic Momentum	0.60	0.07 (0.70)	0.93	0.91	0.01 (0.16)	0.96	0.30	-0.16	0.93	-0.12 (-1.32)	1.00	0.27	-0.09	0.14	0.94
iShares Momentum*	0.45	0.12 (0.69)	0.83	0.86	0.06 (0.46)	0.90	-0.08	-0.37	0.92	-0.17 (-1.76)	0.99	-0.14	-0.15	0.35	0.96

* In the sample from February 2015 to June 2022.

5.2 One-Month Performance Against Fama-French and Carhart Factors

I start investigating the persistence in the performance of actively managed European equity mutual funds by evaluating the decile portfolios' one-month performance against the 1-, 3-, and 4-factor models with the Fama-French and Carhart factors. I construct these factor models as in Equation (1), Equation (2), and Equation (3) using the sample from June 2002 to June 2022. This analysis gives the starting point for my research.

Figure 1 shows a sizable persistence pattern in the performance of the actively managed mutual funds when reviewing the monthly excess returns, 1-factor alphas, and 3-factor alphas. These performance measures are monotonically declining across the deciles, and the differences between the top and bottom deciles are significant. The spread is 0.52 percent in the monthly excess returns, 0.65 percent in the 1-factor alphas, and 0.58 percent in the 3-factor alphas. The alphas show that the first decile portfolio outperforms the market, size, and value factors, while the bottom decile portfolio underperforms. The first decile yields a 1-factor alpha of 0.27 percent (t-stat. 2.29) and a 3-factor alpha of 0.18 percent (t-stat. 1.82), while the bottom decile yields a 1-factor alpha of -0.38 percent (t-stat. -3.25) and a 3-factor alpha of -0.40 percent (t-stat. -2.47). In general, performance persistence is more concentrated on the underperformance of the lower-performing mutual funds.

Figure 1 also shows that the performance persistence pattern vanished in the 4-factor alphas. The 4-factor alphas are not monotonically declining, and the spread in the 4-factor alphas is only marginally different from zero, 0.03. The 4-factor model explains the differences in top and bottom deciles significantly better than the 3-factor model. The bottom decile's alpha increases, and the top decile's alpha decreases. For the decile portfolios in between, the difference in the 3- and 4-factor alphas is less significant.

Table 4 shows that the most significant part of the performance persistence can be attributed to the WML factor. In the 4-factor model, the top decile portfolio has a WML coefficient of 0.27, while the bottom decile portfolio's coefficient is -0.33. This difference is the most significant between the top and bottom decile portfolios. The second most prominent difference is in the SMB coefficients. The spread in SMB beta coefficients is 0.24. Differences in RMRF and HML coefficients are negligible. In the 3-factor model, the differences in coefficients are more evenly distributed. Notably, all decile portfolios have significant market factor exposure. The RMRF coefficient is around one for all deciles in all factor models.

Figure 1: One-month performance of decile portfolios against Fama-French and Carhart factors

The figure presents the one-month performance of decile portfolios constructed from active mutual funds against Fama-French and Carhart factors. The sample of active mutual funds consists of 5,543 surviving and non-surviving actively managed European equity mutual funds covered in the Morningstar Direct Global database (14.7.2022). The active mutual funds are ranked into deciles based on the past 12-month return at the beginning of every month. The figure shows decile portfolios' average monthly return over the U.S. one-month T-bill rate and the alphas of estimated one-, three- and four-factor models with RMRF, SMB, HML, and WML factors. 1 minus 10 -portfolio presents a long-short portfolio between the top and bottom decile. The sample covers monthly returns from June 2002 to June 2022.

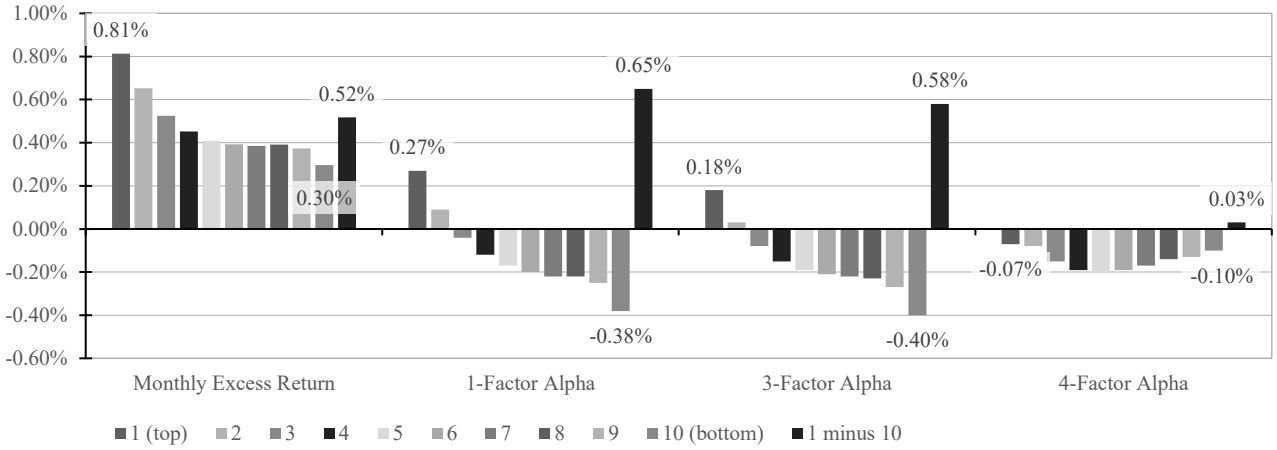

Table 4: One-month performance of decile portfolios against Fama-French and Carhart factors

The table examines the one-month performance of decile portfolios constructed from actively managed mutual funds against Fama-French and Carhart factors. The sample of active mutual funds consists of 5,543 surviving and non-surviving actively managed European equity mutual funds covered in the Morningstar Direct Global database (14.7.2022). The active mutual funds are ranked into deciles based on the past 12-month return at the beginning of every month. The table shows decile portfolios' average monthly return over the U.S. one-month T-bill rate and estimated 1-,3-, and 4-factor models with RMRF, SMB, HML, and WML factors. T-statistics are presented in parentheses. 1 minus 10 -portfolio presents a long-short portfolio between the top and bottom decile. The sample covers monthly returns from June 2002 to June 2022.

		1-Factor Model			3-Factor Model					4-Factor Model					
Decile Portfolio	Monthly Excess Return	Alpha	RMRF	Adj R-sq	Alpha	RMRF	SMB	HML	Adj R-sq	Alpha	RMRF	SMB	HML	WML	Adj R-sq
1 (top)	0.81	0.27 (2.29)	0.95	0.89	0.18 (1.82)	0.97	0.48	-0.11	0.92	-0.07 (-0.78)	1.04	0.43	0.02	0.27	0.95
2	0.65	0.09 (1.26)	0.98	0.96	0.03 (0.55)	1.00	0.33	-0.09	0.97	-0.08 (-1.44)	1.03	0.31	-0.03	0.12	0.98
3	0.53	-0.04 (-0.71)	0.99	0.97	-0.08 (-1.56)	1.00	0.22	-0.07	0.98	-0.15 (-2.86)	1.02	0.20	-0.03	0.07	0.98
4	0.45	-0.12 (-2.58)	1.01	0.98	-0.15 (-3.32)	1.02	0.14	-0.05	0.98	-0.19 (-4.06)	1.03	0.13	-0.03	0.04	0.98
5	0.41	-0.17 (-3.99)	1.02	0.99	-0.19 (-4.47)	1.02	0.08	-0.04	0.99	-0.20 (-4.50)	1.03	0.08	-0.03	0.01	0.99
6	0.39	-0.20 (-4.67)	1.04	0.99	-0.21 (-4.96)	1.04	0.06	-0.02	0.99	-0.19 (-4.37)	1.03	0.06	-0.03	-0.02	0.99
7	0.38	-0.22 (-4.90)	1.05	0.99	-0.22 (-5.07)	1.05	0.04	-0.01	0.99	-0.17 (-3.91)	1.04	0.05	-0.04	-0.06	0.99
8	0.39	-0.22 (-4.30)	1.07	0.98	-0.23 (-4.48)	1.07	0.06	0.01	0.98	-0.14 (-2.92)	1.05	0.07	-0.04	-0.09	0.98
9	0.37	-0.25 (-4.19)	1.10	0.98	-0.27 (-4.50)	1.09	0.09	0.04	0.98	-0.13 (-2.51)	1.05	0.12	-0.04	-0.15	0.98
10 (bottom)	0.30	-0.38 (-3.25)	1.19	0.92	-0.40 (-3.47)	1.16	0.13	0.15	0.93	-0.10 (-1.03)	1.07	0.19	-0.02	-0.33	0.96
1 minus 10	0.52	0.65 (3.49)	-0.24	0.16	0.58 (3.29)	-0.19	0.35	-0.27	0.25	0.03 (0.25)	-0.03	0.24	0.04	0.60	0.65

5.3 One-Month Performance Against Alternative Portfolios of Index Funds

Next, I evaluate the one-month performance of the decile portfolios against the selected index funds. I construct a similar analysis as in the previous subsection but evaluate the decile portfolios using alternative investment portfolio models in Equation (4), Equation (5), and Equation (6). The previous subsection shows that none of the decile portfolios produces positive 4-factor alpha. The negative alphas mean that investors cannot outperform by selecting funds based on their past performance. The common interpretation from the previous literature would be that most investors are better off buying low-cost index funds. Although, this conclusion might be premature. The first subsection shows that index funds cannot efficiently capture these factor returns. Especially

capturing the momentum factor returns is challenging. For these reasons, the results of alternative investment portfolio models are likely to differ from the results of multifactor models.

In this subsection, I construct the analysis using the sample from June 2002 to June 2022. I use the synthetic momentum portfolio as no momentum strategy index fund is available over this period. In the following subsection, I construct the analysis using the sample from February 2015 to June 2022 and evaluate how the results differ if I use the synthetic momentum portfolio or the iShares Momentum index fund.

Figure 2 shows a similar persistence pattern in the alternative portfolio models 1 and 2 as Figure 1 shows in the 1-factor and 3-factor models. The alphas in the alternative portfolio models 1 and 3 declines monotonically, and the spreads in the alphas are same magnitude as in the 1- and 3-factor models. The spread in the alternative portfolio model 1 is 0.63, while the spread in the 1-factor model is 0.65. The spread in the alternative portfolio model 2 is 0.50, while the spread in the 3-factor model is 0.58. The findings show that the alternative investment portfolios 1 and 2 explain the decile portfolio returns similar to the 1- and 3- factor models. Table 5 shows that the index fund weights in alternative portfolios are analogous to those in the factor models.

Figure 2 and Table 5 show that the alternative investment portfolio models 1 and 2 yield consistently around 0.10 percent higher alphas than the 1- and 3-factor models. The inefficiencies in the index funds yield that the portfolios of these index funds are less inefficient. Therefore, the performance in actively managed mutual funds seems to persist better against the alternative portfolios. The outperformance of the best-performing funds is higher and more significant, while the underperformance of the lower-performing funds is less significant. The performance persistence in the alternative models is more evenly distributed between the outperformance of best-performing and underperformance of lower-performing funds than in the 1- and 3-factor models.

Unlike in the 4-factor model, the performance persistence pattern remains significant in the alternative investment portfolio model 3, which tries to capture the momentum factor exposure. In the 4-factor model, the WML exposure fully explains the performance persistence that occurs in the 3-factor model. Including the synthetic momentum portfolio in the alternative evaluation model does not measurably impact the alpha spread between the top and bottom deciles. The spread is 0.49, only 0.01 lower than in the alternative investment portfolio model 2. The top decile's alpha decreased by 0.01, and the bottom decile's alpha stayed the same. Figure 2 also shows that the differences between the alternative investment portfolio models 2 and 3 are minimal.

The performance persistence pattern exists in the alternative portfolio model 3, as the investors cannot capture the momentum factor returns by investing according to the synthetic momentum portfolio. The results from multifactor models show that the momentum factor exposure explains most of the performance persistence. It is essential to capture momentum factor returns to earn similar returns as the best-performing actively managed mutual funds.

Table 5 shows that the synthetic momentum portfolio coefficients are significant for the top-end decile portfolios as the corresponding alternative portfolios try to capture the momentum exposure. As the first subsection shows the synthetic momentum portfolio provides some momentum exposure. However, the exposure is so low that it fails to bring any significant momentum factor exposure into the portfolio.

Figure 2: One-month performance of decile portfolios against index funds

The figure presents the one-month performance of decile portfolios constructed from active mutual funds against alternative investment portfolios of index funds. The sample of active mutual funds consists of 5,543 surviving and non-surviving actively managed European equity mutual funds covered in the Morningstar Direct Global database (14.7.2022). The active mutual funds are ranked into deciles based on the past 12-month return at the beginning of every month. The figure shows decile portfolios' average monthly return over the U.S. one-month T-bill rate and the alphas of estimated alternative investment portfolio models. Alternative Portfolio 1 includes Vanguard European Stock Index Fund (Mrkt) and Cash (RF). Alternative Portfolio 2 adds Sparinvest Index Europa Small Cap Fund (Small Cap), Sparinvest

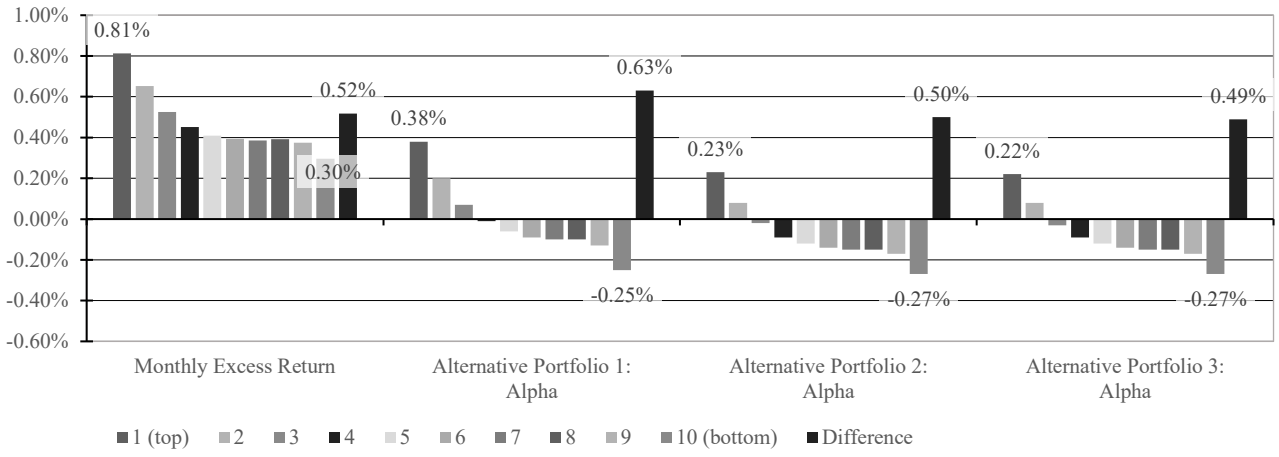

Table 5: One-month performance of decile portfolios against index funds

The table examines the one-month performance of the decile portfolios constructed from actively managed mutual funds against three alternative portfolios of index funds. The sample of active mutual funds consists of 5,543 surviving and non-surviving actively managed European equity mutual funds covered in the Morningstar Direct Global database (14.7.2022). The active mutual funds are ranked into deciles based on the past 12-month return at the beginning of every month. The table shows decile portfolios' average monthly return over the U.S. one-month T-bill rate and estimated alternative portfolio models. Alternative Portfolio 1 includes Vanguard European Stock Index Fund (Mrkt) and Cash (RF). Alternative Portfolio 2 adds Sparinvest Index Europa Small Cap Fund (Small Cap), Sparinvest Index Europa Value Fund (Value), and Sparinvest Index Europa Growth Fund (Growth). Alternative Portfolio 3 adds a synthetic momentum portfolio. The synthetic momentum portfolio demonstrates a strategy that dynamically invests in the index fund with the highest return over the preceding 12 months. T-statistics are presented in parentheses. The sample covers monthly returns from June 2002 to June 2022.

	Alternative Portfolio 1: Market and Cash				Alternative Portfolio 2: Market, Small-Cap, Value, Growth and Cash							Alternative Portfolio 3: Market, Small-Cap, Value, Growth, Momentum and Cash							
Decile Portf.	Alpha	Mrkt	RF	Adj R-sq	Alpha	Mrkt	Small Cap	Value	Growth	RF	Adj R-sq	Alpha	Mrkt	Small Cap	Value	Growth	Synt. Mom.	RF	Adj R-sq
1 (top)	0.38 (2.91)	0.94	0.06	0.86	0.23 (2.11)	0.05	0.50	-	0.39	0.06	0.91	0.22 (2.16)	0.05	0.25	-	0.16	0.52	0.02	0.92
2	0.20 (2.31)	0.97	0.03	0.94	0.08 (1.27)	0.30	0.41	-	0.26	0.03	0.96	0.08 (1.25)	0.30	0.26	-	0.12	0.31	0.01	0.97
3	0.07 (0.96)	0.99	0.01	0.96	-0.02 (-0.38)	0.48	0.31	-	0.18	0.02	0.97	-0.03 (-0.47)	0.48	0.23	-	0.10	0.18	0.01	0.98
4	-0.01 (-0.21)	1.00	-0.00	0.97	-0.09 (-1.77)	0.61	0.26	-	0.13	0.00	0.98	-0.09 (-1.84)	0.60	0.21	-	0.09	0.10	-0.00	0.98
5	-0.06 (-1.14)	1.01	-0.01	0.98	-0.12 (-2.68)	0.69	0.21	-	0.10	-0.01	0.98	-0.12 (-2.70)	0.69	0.19	-	0.08	0.05	-0.01	0.98
6	-0.09 (-1.71)	1.03	-0.03	0.98	-0.14 (-3.18)	0.78	0.20	-	0.05	-0.02	0.99	-0.14 (-3.18)	0.78	0.19	-	0.04	0.01	-0.02	0.99
7	-0.10 (-1.99)	1.05	-0.05	0.98	-0.15 (-3.21)	0.84	0.18	-	0.02	-0.04	0.99	-0.15 (-3.20)	0.84	0.18	-	0.02	-	-0.04	0.99
8	-0.10 (-1.83)	1.07	-0.07	0.98	-0.15 (-2.84)	0.82	0.19	0.04	-	-0.05	0.98	-0.15 (-2.83)	0.82	0.19	0.04	-	-	-0.05	0.98
9	-0.13 (-2.01)	1.10	-0.10	0.97	-0.17 (-2.91)	0.72	0.23	0.12	-	-0.07	0.98	-0.17 (-2.90)	0.72	0.23	0.12	-	-	-0.07	0.98
10 (bottom)	-0.25 (-2.07)	1.18	-0.18	0.92	-0.27 (-2.35)	0.48	0.27	0.38	-	-0.13	0.93	-0.27 (-2.35)	0.48	0.27	0.38	-	-	-0.13	0.93
Diffe-rence*	0.63 (4.99)	-0.25	0.25	-0.06	0.50 (4.46)	-0.42	0.23	-0.38	0.39	0.18	-0.02	0.49 (4.50)	-0.43	-0.02	-0.38	0.16	0.52	0.15	-0.01

* Difference is calculated by substracting top portfolios statistic with bottom portfolio statistic, $x_{top\ portfolio} - x_{bottom\ portfolio}$

5.4 One-Month Performance in Shorter Sample from February 2015 to June 2022

Figure 3 shows that the persistence in the performance of actively managed mutual funds is similar in the sample from February 2015 to June 2022 as in the sample from June 2002 to June 2022, but it is less significant. The spreads between the performance of the top and bottom portfolios are lower, and the performance does not decline monotonically across the deciles. The spread is 0.32 percent in average monthly excess returns, 0.28 percent in alternative model 2, and 0.28 percent in alternative model 3 with synthetic momentum. While the corresponding spreads in the longer sample are 0.52 percent, 0.63 percent, and 0.50 percent. The spread in the alternative model 3 with iShares Momentum is 0.24 percent in the shorter sample. Table 6 shows that the outperformance of the best-performing funds and the underperformance of the lower-performing funds are both less significant in the shorter sample than in the longer sample.

The iShares Momentum fund can deliver more momentum exposure into alternative portfolios than the synthetic momentum portfolio and capture part of the top decile's outperformance, but the difference is marginal. Using the iShares Momentum fund in the alternative portfolio decreases the outperformance of the top decile portfolio by 0.04 percent point. It does not have an impact on the underperformance of the bottom deciles. The difference between the top and bottom decile portfolio decreases by the same 0.04 percent point. The spread in the alphas is 0.24 in the alternative model 3 with iShares Momentum. The top portfolio outperforms the alternative portfolio by 0.11 percent per month, while the bottom portfolio underperforms by 0.13 percent. The findings show that iShares Momentum provides higher exposure to the momentum factor and yields higher returns. However, the difference is relatively minor. The outperformance still exists.

The findings from the shorter sample do not change the interpretations from the longer data. The iShares Momentum does not capture the momentum returns so that investors could produce as high returns with index funds as the best-performing actively managed mutual funds. The iShares Momentum captures the momentum effect more efficiently than the synthetic momentum portfolio, but the difference is insignificant, with only a 0.04 percent point drop in the top decile's alpha. The statistical significance of the findings is low partly because of the fewer observations in the sample from February 2015 to June 2022. The shorter sample includes 89 observations, while the longer sample includes 241 observations.

Figure 3: One-month performance of decile portfolios against index funds in Sample from February 2015 to June 2022

The figure examines the one-month performance of the decile portfolios and evaluates the difference between the synthetic momentum portfolio and iShares Momentum in the alternative evaluation models. The sample consists of 4,450 surviving and non-surviving actively managed European equity mutual funds. The active mutual funds are ranked into deciles based on the past 12-month return at the beginning of every month. The figure shows averages of monthly returns over the U.S. one-month T-bill rate, alphas against alternative portfolio 2, alphas against alternative portfolio 3 with the synthetic momentum portfolio, and alphas against alternative portfolio 3 with iShares Momentum Fund.

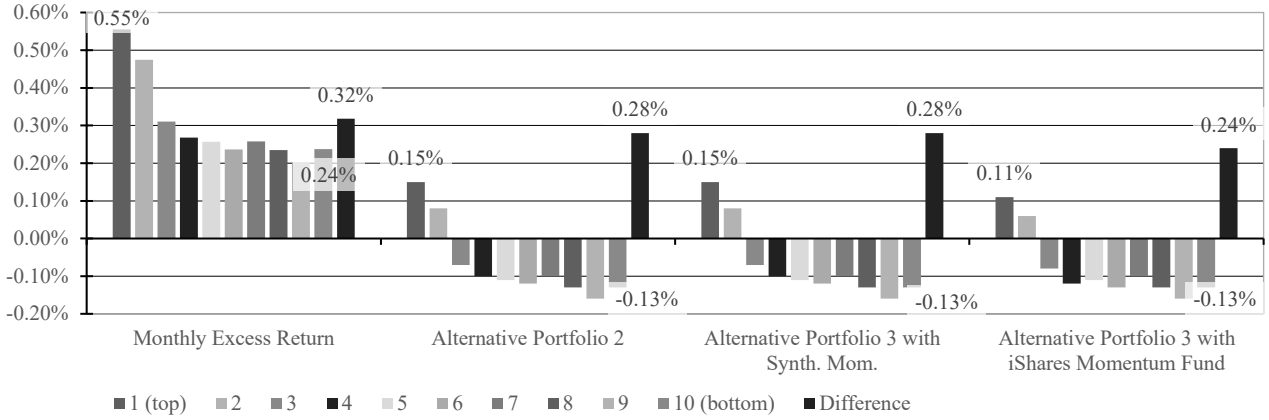

Table 6: One-month performance of decile portfolios against index funds in sample from February 2015 to June 2022

The table examines the one-month performance of the decile portfolios and evaluates the difference between the synthetic momentum portfolio and iShares Momentum in the alternative evaluation models. The sample consists of 4,450 surviving and non-surviving actively managed European equity mutual funds. The active mutual funds are ranked into deciles based on the past 12-month return at the beginning of every month. The table shows averages of monthly returns over the U.S. one-month T-bill rate and estimated alternative portfolio model 2, alternative portfolio model 3 with the synthetic momentum portfolio, and alternative portfolio model 3 with iShares Momentum Fund.

		Alternative Investment Portfolio 2							Alternative Investment Portfolio 3 with Synthetic Momentum Portfolio								Alternative Investment Portfolio 3 with iShares Momentum Fund							
Decile Portf.	Monthly Excess Return	Alpha	Mrkt	Small Cap	Value	Growth	RF	Adj R-sq	Alpha	Mrkt	Small Cap	Value	Growth	Synt. Mom.	RF	Adj R-sq	Alpha	Mrkt	Small Cap	Value	Growth	Mom. Fund	RF.	Adj R-sq
1 (top)	0.55	0.15 (1.09)	-	0.51	-	0.42	0.08	0.93	0.15 (1.19)	-	0.37	-	0.20	0.38	0.05	0.94	0.11 (0.91)	-	0.47	0.00	0.01	0.50	0.03	0.94
2	0.47	0.08 (0.99)	-	0.47	0.06	0.39	0.07	0.97	0.08 (1.06)	-	0.40	0.05	0.26	0.23	0.06	0.98	0.06 (0.80)	-	0.44	0.07	0.12	0.33	0.04	0.98
3	0.31	-0.07 (-0.97)	-	0.41	0.16	0.38	0.05	0.98	-0.07 (-0.99)	-	0.37	0.15	0.31	0.13	0.04	0.98	-0.08 (-1.27)	-	0.39	0.16	0.20	0.21	0.03	0.98
4	0.27	-0.10 (-1.71)	0.08	0.37	0.19	0.33	0.02	0.99	-0.10 (-1.72)	-	0.35	0.22	0.33	0.08	0.02	0.99	-0.12 (-1.99)	0.33	0.35	0.07	0.08	0.16	0.01	0.99
5	0.26	-0.11 (-1.89)	0.25	0.32	0.16	0.25	0.01	0.99	-0.11 (-1.89)	0.19	0.31	0.19	0.25	0.06	0.01	0.99	-0.11 (-2.04)	0.40	0.31	0.09	0.10	0.10	-0.00	0.99
6	0.24	-0.12 (-2.27)	0.31	0.32	0.18	0.20	-0.01	0.99	-0.12 (-2.26)	0.27	0.31	0.20	0.20	0.04	-0.01	0.99	-0.13 (-2.35)	0.40	0.31	0.13	0.11	0.06	-0.02	0.99
7	0.26	-0.10 (-1.82)	0.30	0.30	0.21	0.21	-0.02	0.99	-0.10 (-1.81)	0.30	0.30	0.21	0.21	0.00	-0.02	0.99	-0.10 (-1.81)	0.30	0.30	0.21	0.21	-	-0.02	0.99
8	0.23	-0.13 (-1.85)	0.19	0.35	0.28	0.22	-0.04	0.98	-0.13 (-1.83)	0.19	0.35	0.28	0.22	-	-0.04	0.98	-0.13 (-1.83)	0.19	0.35	0.28	0.22	-	-0.04	0.98
9	0.20	-0.16 (-2.00)	0.18	0.38	0.33	0.17	-0.06	0.98	-0.16 (-1.99)	0.18	0.38	0.33	0.17	-	-0.06	0.98	-0.16 (-1.99)	0.18	0.38	0.33	0.17	-	-0.06	0.98
10 (bottom)	0.24	-0.13 (-0.83)	-	0.48	0.49	0.11	-0.09	0.94	-0.13 (-0.83)	-	0.48	0.49	0.11	-	-0.09	0.94	-0.13 (-0.83)	-	0.48	0.49	0.11	-	-0.09	0.94
Diffe-rence*	0.32	0.28 (1.92)	-	0.02	-0.49	0.30	0.17	-0.01	0.28 (2.02)	-	-0.11	-0.49	0.09	0.38	0.14	-0.00	0.24 (1.73)	-	-0.01	-0.49	-0.11	0.50	0.12	0.00

5.5 Three- to Twelve-Months Performance of Decile Portfolios

The findings so far show that the best-performing active mutual funds outperform the alternative portfolios of passive index funds, while the lower-performing active funds underperform the alternative passive portfolios. The best-performing funds have significant momentum factor exposure, which is not efficiently captured in the alternative portfolio models. Table 8 shows that the top decile portfolio produces significantly positive alphas in all alternative portfolio models, and the bottom decile portfolio produces significantly negative alphas. The findings imply that mutual funds' performance persists against index funds over the following month. Table 7 shows that the performance persistence is also significant in plain monthly returns, 1-factor and 3-factor alphas, but in the 4-factor alphas, the performance persistence disappears. In the 4-factor model, the WML exposure fully explains the performance persistence.

The performance persistence is significant over the following month according to the alternative portfolio models and 1-factor, and 3-factor models, but the persistence gets smaller as the evaluation period gets longer. The top decile portfolio performs the best also in the longer evaluation periods, but the difference to the bottom decile decrease as soon as the evaluation period exceeds one month. Figure 4 shows that the difference in average monthly returns shrinks from 0.51 percent per month to 0.09 percent per month as the evaluation periods increase from one month to twelve months. Figure 5 shows a similar pattern in the 1- and 3-factor alphas, and Figure 6 shows a similar pattern in the alternative portfolio model alphas. In the 4-factor alphas, the difference becomes negative as the evaluation period gets longer. Figure 5 shows that the top decile portfolio's positive 1- and 3-factor alphas disappear and become negative. In Figure 6, the top decile portfolios' alternative portfolio model 2 and 3 alphas become zero. This show that the best-performing active mutual funds cannot outperform portfolio of market, small-cap, value and growth funds as they do in a shorter evaluation period.

Table 7 shows that the statistical significance of the 1- and 3-factor alphas decrease as the alpha levels decrease. The difference between the top and bottom portfolios' alphas becomes statistically insignificant when the evaluation period is six months or longer. I calculate the t-statistics with Newey-West standard errors (Newey and West 2014) which takes into account the autocorrelation in my stacked time series data. In the stacked time series data, the evaluation periods are partly overlapping when the evaluation period is longer than one month. In Table 8, the t-statistics are higher than expected from the alpha levels. These relatively high t-statistics come from the fact that I calculate these with normal standard errors. The Newey-West estimator does not work in restricted regression models as such. Although, just the significantly lower alpha levels imply that the performance persistence diminishes in more extended evaluation periods.

The importance of the momentum factor gets lower as the evaluation period gets longer, which decreases the difference between the portfolios of actively managed mutual funds and alternative portfolios of index funds. Table 7 shows that the WML coefficient for the top decile portfolio decreases from 0.27 to 0.07, and the difference to the bottom decile decrease from 0.60 to 0.27. The difference in WML coefficients is still the most significant difference between the top and bottom decile portfolios, but it is less dominant within the longer evaluation periods. This finding leads to lower outperformance of the first decile portfolio against the alternative portfolios of index funds. Figure 6 and Table 8 show that the top decile portfolio does not outperform the alternative portfolios with the market, small-cap, value, growth funds, and synthetic momentum portfolio in the longer evaluation periods. The synthetic momentum portfolio does not capture momentum factor

returns either in a longer evaluation period, but it becomes unnecessary as the importance of the momentum factor diminishes. Figure 6 and Table 8 show that there is no difference in alternative portfolios 2 and 3.

Figure 4: Average monthly returns of decile portfolios over different evaluation periods

The active mutual funds are ranked into decile portfolios based on their past 12-month return at the beginning of every month. Then, the decile portfolios' post-ranking performance is evaluated over the next month and the next three, six, and twelve months. The figure shows the average monthly returns over the U.S. one-month T-bill rate using these different evaluation periods. The sample of active mutual funds consists of 5,543 surviving and non-surviving actively managed European equity mutual funds, and it covers monthly returns from June 2002 to June 2022.

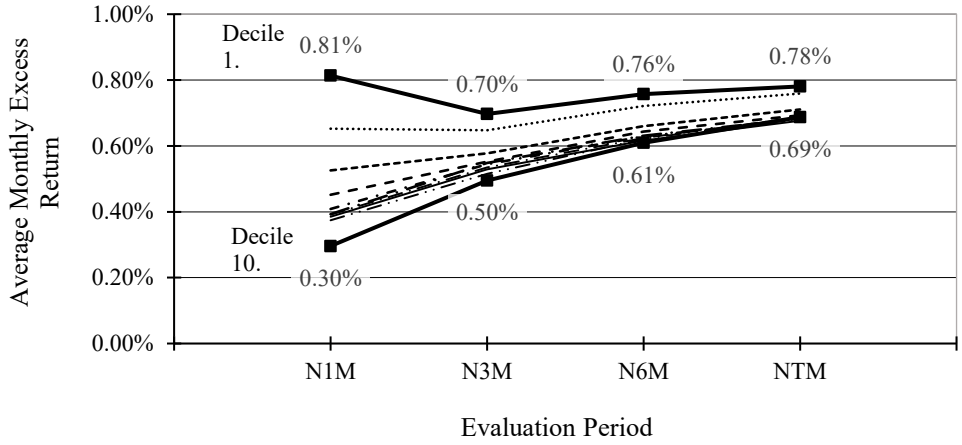

Figure 5: One-, three-, and four-factor alphas of the top and bottom decile portfolios over different evaluation periods

The active mutual funds are ranked into decile portfolios based on the past 12-month return at the beginning of every month. The sample consists of monthly returns of 5,543 surviving and non-surviving actively managed European equity mutual funds from June 2002 to June 2022. The figure shows the 1-, 3-. And 4-factor alphas of the first and tenth decile portfolios in the next one, three, six, and twelve months.

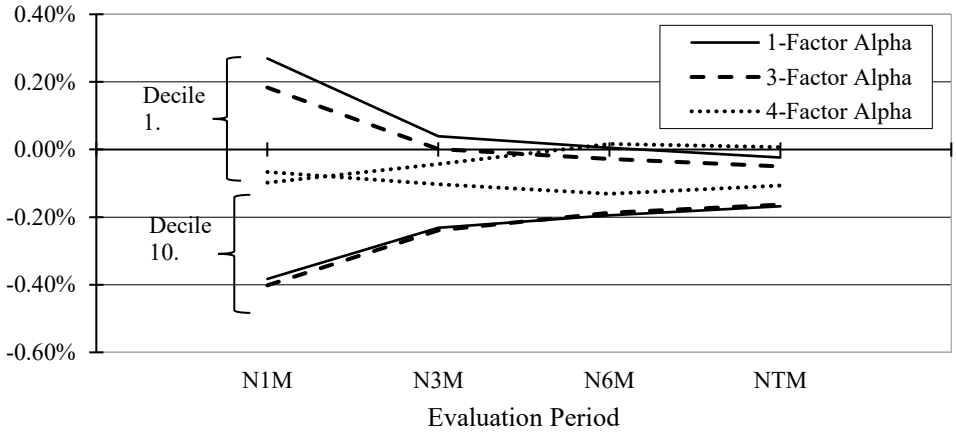

Figure 6: Alternative model alphas of the top and bottom decile portfolios over different evaluation periods

The active mutual funds are ranked into decile portfolios based on the past 12-month return at the beginning of every month. The sample consists of monthly returns of 5,543 surviving and non-surviving actively managed European equity

mutual funds from June 2002 to June 2022. The figure shows the alphas of the alternative portfolio model 1, 2, and 3 of the first and tenth decile portfolios in the next one, three, six, and twelve months after the ranking.

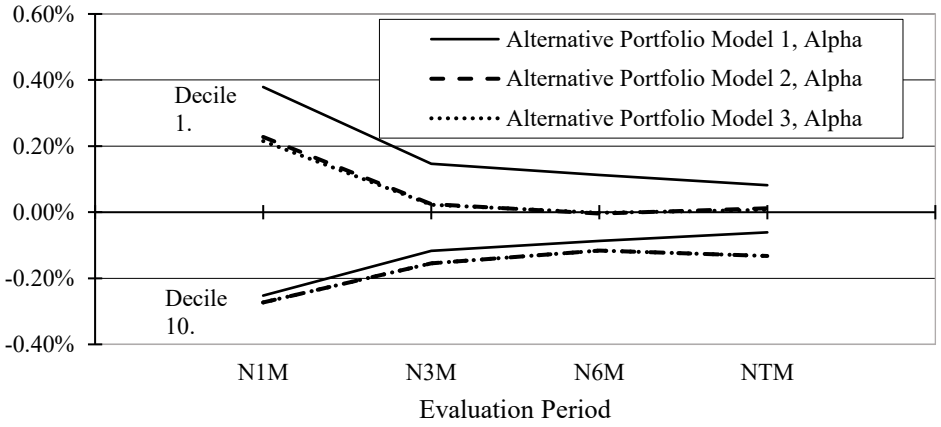

Table 7: Post-ranking performance of decile portfolios in the next one, three, six, twelve months evaluated against Fama-French and Carhart factors

The active mutual funds are ranked into deciles based on the past 12-month return at the beginning of every month. The sample of active mutual funds consists of 5,543 surviving and non-surviving actively managed European equity mutual funds covered in the Morningstar Direct Global database (14.7.2022). The table shows decile portfolios' average monthly return over the U.S. one-month T-bill rate and estimated 1-,3-, and 4-factor models with RMRF, SMB, HML, and WML factors. T-statistics are presented in parentheses. T-statistics are calculated using Newey-West standard errors, which considers the autocorrelation in my stacked time series data. 1 minus 10 -portfolio presents a long-short portfolio between the top and bottom decile. The sample covers monthly returns from June 2002 to June 2022.

	1-Factor Model			3-Factor Model					4-Factor Model					
Decile Portfolio	Alpha	RMRF	Adj R-sq	Alpha	RMRF	SMB	HML	Adj R-sq	Alpha	RMRF	SMB	HML	WML	Adj R-sq
Over Next 1 Month Return														
1 (top)	0.27 (2.29)	0.95	0.89	0.18 (1.82)	0.97	0.48	-0.11	0.92	-0.07 (-0.78)	1.04	0.43	0.02	0.27	0.95
10 (bottom)	-0.38 (-3.25)	1.19	0.92	-0.40 (-3.47)	1.16	0.13	0.15	0.93	-0.10 (-1.03)	1.07	0.19	-0.02	-0.33	0.96
1 minus 10	0.65 (3.49)	-0.24	0.16	0.58 (3.29)	-0.19	0.35	-0.27	0.25	0.03 (0.25)	-0.03	0.24	0.04	0.60	0.65
Over Next 3 Months Return														
1 (top)	0.04 (0.37)	1.01	0.96	0.00 (0.02)	1.00	0.32	-0.09	0.97	-0.10 (-1.29)	1.03	0.30	-0.05	0.11	0.98
10 (bottom)	-0.23 (-2.26)	1.11	0.96	-0.24 (-2.36)	1.08	0.10	0.10	0.96	-0.04 (-0.44)	1.02	0.13	0.02	-0.21	0.97
1 minus 10	0.27 (1.82)	-0.10	0.09	0.24 (1.83)	-0.09	0.22	-0.19	0.18	-0.06 (-0.59)	0.00	0.17	-0.07	0.32	0.52
Over Next 6 Months Return														
1 (top)	0.00 (0.04)	1.04	0.97	-0.03 (-0.39)	1.00	0.36	-0.09	0.98	-0.13 (-1.94)	1.03	0.36	-0.05	0.11	0.98
10 (bottom)	-0.20 (-2.09)	1.10	0.96	-0.19 (-1.98)	1.07	0.03	0.10	0.96	0.02 (0.16)	1.01	0.05	0.03	-0.22	0.97
1 minus 10	0.20 (1.44)	-0.06	0.04	0.16 (1.44)	-0.07	0.33	-0.19	0.21	-0.15 (-1.55)	0.01	0.31	-0.08	0.33	0.57
Over Next 12 Months Return														
1 (top)	-0.02 (-0.27)	1.04	0.97	-0.05 (-0.85)	0.98	0.37	-0.02	0.98	-0.11 (-1.69)	0.99	0.37	-0.01	0.07	0.98
10 (bottom)	-0.17 (-1.40)	1.10	0.94	-0.16 (-1.57)	1.04	0.18	0.07	0.94	0.01 (0.04)	1.01	0.17	0.02	-0.20	0.96
1 minus 10	0.14 (1.13)	-0.05	0.02	0.11 (0.96)	-0.06	0.19	-0.10	0.06	-0.11 (-0.59)	-0.02	0.20	-0.02	0.27	0.32

Table 8: Post-ranking performance of decile portfolios in the next one, three, six, and twelve months evaluated against index funds

The active mutual funds are ranked into deciles based on the past 12-month return at the beginning of every month. The sample of active mutual funds consists of 5,543 surviving and non-surviving actively managed European equity mutual funds covered in the Morningstar Direct Global database (14.7.2022). The table shows estimated alternative portfolio models 1, 2, and 3. Alternative Portfolio model 1 includes Vanguard European Stock Index Fund (Mrkt) and Cash (RF). Alternative Portfolio model 2 also includes Sparinvest Index Europa Small Cap Fund (Small Cap), Sparinvest Index Europa Value Fund (Value), and Sparinvest Index Europa Growth Fund (Growth). Alternative Portfolio model 3 also includes a synthetic momentum portfolio. The synthetic momentum portfolio demonstrates a strategy that dynamically invests in the index fund with the highest past 12-month return. T-statistics are presented in parentheses. The sample covers monthly returns from June 2002 to June 2022.

	Alternative Portfolio 1: Market and Cash				Alternative Portfolio 2: Market, Small-Cap, Value, Growth and Cash							Alternative Portfolio 3: Market, Small-Cap, Value, Growth, Momentum and Cash							
Decile Portfolio	Alpha	Mrkt	RF	Adj R-sq	Alpha	Mrkt	Small	Value	Growth	RF	Adj R-sq	Alpha	Mrkt	Small	Value	Growth	Synt. Mom.	RF	Adj R-sq
Over Next 1 Month Return																			
1 (top)	0.38 (2.91)	0.94	0.06	0.86	0.23 (2.11)	-	0.50	-	0.39	0.06	0.91	0.22 (2.16)	0.05	0.25	-	0.16	0.52	0.02	0.92
10 (lowest)	-0.25 (-2.07)	1.18	-0.18	0.92	-0.27 (-2.35)	-	0.27	0.38	-	-0.13	0.93	-0.27 (-2.35)	0.48	0.27	0.38	-	-	-0.13	0.93
Difference*	0.63	-0.25	0.25	-0.06	0.50	-	0.23	-0.38	0.39	0.18	-0.02	0.49	-0.43	-0.02	-0.38	0.16	0.52	0.15	-0.01
Over Next 3 Months Return																			
1 (top)	0.15 (2.74)	1.02	-0.02	0.94	0.02 (0.55)	0.26	0.41	-	0.32	0.01	0.96	0.02 (0.52)	0.13	0.24	0.07	0.27	0.31	-0.02	0.97
10 (lowest)	-0.12 (-2.14)	1.13	-0.13	0.95	-0.16 (-2.95)	0.29	0.29	0.36	0.12	-0.07	0.96	-0.16 (-2.94)	0.29	0.29	0.36	0.12	-	-0.07	0.96
Difference*	0.26	-0.11	0.11	-0.01	0.18	-0.03	0.11	-0.36	0.20	0.08	0.00	0.18	-0.16	-0.05	-0.29	0.15	0.31	0.05	0.01
Over Next 6 Months Return																			
1 (top)	0.11 (2.86)	1.06	-0.06	0.95	0.00 (-0.12)	0.19	0.36	0.04	0.43	-0.03	0.97	0.00 (-0.05)	-	0.22	0.15	0.42	0.26	-0.05	0.97
10 (lowest)	-0.09 (-2.27)	1.13	-0.13	0.96	-0.12 (-3.09)	0.47	0.29	0.28	-	-0.04	0.96	-0.12 (-3.08)	0.47	0.29	0.28	-	-	-0.04	0.96
Difference*	0.20	-0.07	0.07	-0.01	0.11	-0.28	0.07	-0.24	0.43	0.01	0.00	0.11	-0.47	-0.07	-0.13	0.42	0.26	-0.01	0.00
Over Next 12 Months Return																			
1 (top)	0.08 (2.93)	1.08	-0.08	0.96	0.01 (0.40)	-	0.25	0.31	0.49	-0.06	0.96	0.01 (0.23)	-	0.17	0.29	0.46	0.15	-0.07	0.96
10 (lowest)	-0.06 (-1.72)	1.14	-0.14	0.94	-0.13 (-3.60)	0.40	0.44	0.18	-	-0.01	0.95	-0.13 (-3.60)	0.40	0.44	0.18	-	-	-0.01	0.95
Difference*	0.14	-0.06	0.06	0.02	0.15	-0.40	-0.18	0.13	0.49	-0.04	0.01	0.14	-0.40	-0.27	0.11	0.46	0.15	-0.06	0.01

* Difference is calculated by substracting top portfolios statistic with bottom portfolio statistic

6. CONCLUSION

In this research, I study short- and mid-term persistence in the performance of actively managed European equity mutual funds. I evaluate the performance of return-sorted decile portfolios against multifactor models and alternative investment portfolios. I construct the return-sorted portfolios by ranking active mutual funds at the beginning of every month based on their past 12-month returns and evaluate the post-ranking performance over the following one, three, six, and twelve months. I use monthly returns of 5,543 actively managed European equity mutual funds from June 2001 to June 2022.

The results show that the performance of the mutual funds persists over the following month against the alternative portfolios of index funds. The performance also persists in the plain monthly returns, 1-factor alphas, and 3-factor alphas. However, performance persistence gets less significant when the evaluation period gets longer. There is a significant drop as soon as the evaluation period exceeds one month, and in the twelve months evaluation period, the performance persistence is insignificant. Performance persistence does not occur in the 4-factor alphas in any evaluation period. The findings from the one-month evaluation periods are consistent with Huij and Blitz's (2012) findings from U.S. equity mutual funds.

The alternative evaluation model shows that the best-performing mutual funds from the previous twelve months outperform the alternative portfolio of index funds over the next month. This finding suggests that investors can earn higher returns by investing in past winner mutual funds than by investing in index funds. However, the economic significance of this finding is only minor, as the outperformance disappears in the more extended evaluation periods. The possible costs from continuous "trading" with mutual funds also lower the economic significance of this finding.

The momentum effect primarily drives the outperformance of the best-performing mutual fund in one month evaluation period in the alternative portfolio models. These funds have a significant momentum factor exposure in short-term returns, and investors cannot mimic that exposure by investing in index funds. In the more extended periods, the momentum factor exposure decreases, and the outperformance vanishes with it. These findings imply that the best-performing mutual funds do not earn higher returns by following a momentum strategy. They just happen to hold last year's winning stocks.

For investors, it would be highly beneficial if an active fund (or index fund) could consistently follow the momentum factor returns over time. Now, the best option for investors is to

invest in the best-performing mutual funds from the previous twelve months, but the momentum exposure stays only in the short term.

In this research, I evaluate the historical data and how mutual funds' performance has persisted in history. The model does not try to predict the future or explain how investors should use past information in investment decisions now. For these reasons, the results do not have direct implications for investors on selecting mutual funds. I focus on investigating the differences between active and index funds on a general level.

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