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The role of passive effects in the relationship between active management and short-term performance: Evidence from mutual fund portfolio holdings☆

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ABSTRACT

This study proposes a new method to measure active management in a given quarter based on the correlation between fund returns and the returns of a passively-managed synthetic portfolio emulating fund portfolio holdings. A lower level of correlation indicates higher levels of active management since the behaviour of actual fund daily returns deviates to a greater extent from those that the fund would have obtained in the case of no trading activity. Abnormal fund performance is measured as the difference between fund and synthetic portfolio alphas to distinguish the value added by active management during a quarter from that obtained passively by fund holdings. Thus, each synthetic portfolio serves as an endogenous benchmark to assess active management and performance of the fund it emulates, while avoiding biases due to passive effects. In line with previous literature, the aggregate abnormal performance is negative. Moreover, results suggest that active management due to stock trading activity is lower in more volatile periods, and relates negatively to abnormal fund performance in the short-term.

1. Introduction

An extensive literature analyses active management in mutual funds. One of the topics most frequently examined is the assessment of fund performance and, more specifically, the added value that active management provides to investors (see reviews by Ferson, 2010; Mateus et al., 2019; Elton and Gruber, 2020). In this context, the objective of this study is to analyse the relationship between active management and short-term performance.

With the aim of capturing active management, previous studies use fund tracking error (Cremers and Petajisto, 2009; El Ghoul and Karoui, 2022) or apply the level of idiosyncratic risk from risk-adjusted returns in the frame of linear models (Huij and Derwall, 2011; Amihud and Goyenko, 2013). Nonetheless, idiosyncratic risks may arise from the passive behaviour of fund assets even if there is no active management (Matallín-Sáez, 2023). In this context, we propose a novel method to estimate active fund management that is robust to passive idiosyncratic risks. Based on the portfolio composition of each fund at the end of a specific quarter, we construct a

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synthetic portfolio with an identical composition that follows a buy-and-hold strategy throughout the following quarter.[1] Where there is no active management, fund daily returns in the next quarter should not differ greatly from those of the passively-managed synthetic portfolio emulating fund assets. Hence, to measure active management, we focus on the comparison between the mutual fund and its passive synthetic portfolio returns, since the latter can be used as an endogenous benchmark for the former. Since fund trading activity will affect the behaviour of fund returns, active management is therefore proxied through the correlation coefficient between a fund's daily returns and the returns of its synthetic portfolio. Accordingly, lower levels of correlation will indicate greater differences in the behaviour of fund and synthetic portfolio returns and, consequently, higher levels of activity in the management of the mutual fund.

Regarding the effect that active management has on the short-term fund performance, we first differentiate between actual fund performance and the performance it would have obtained if it had not experienced any trading activities (i.e., that of the passive synthetic portfolio). This distinction is required to avoid any bias due to omitted variables or passive effects in estimating fund performance (Pástor and Stambaugh, 2002; Matallín-Sáez 2006; Mateus et al., 2019); otherwise, we would not be able to isolate the performance of the fund due to active management during a given period from the performance obtained passively by the assets held in the fund portfolio (as shown by Cremers et al. (2013), passive portfolios can have non-zero alphas). Then, fund and synthetic portfolio performances are estimated quarterly as the alphas obtained from a multifactor model (Carhart, 1997). Accordingly, the alpha difference between the mutual fund and the comparable synthetic portfolio measures the abnormal performance of the fund in a given period. This abnormal performance refers to the value added by the trading activity of fund managers during the quarter, and not to that obtained passively by their portfolio holdings at the beginning of the quarter.

This study contributes to the literature in several ways. On the one hand, we propose a new method to measure the level of trading activity based on the correlation between fund and synthetic portfolio returns. Results show that passive synthetic portfolios following a buy-and-hold strategy present similar levels of idiosyncratic risk to those of the funds they replicate. We also observe that, overall, the level of activeness is lower in bear market periods, suggesting that managers deviate from their synthetic portfolios less in times of higher market volatility. Moreover, the correlation measure capturing active management seems to relate positively to fund alphas. Nonetheless, this is mainly due to the performance experienced by the assets held in the fund portfolio, not to the trading activity during the quarter. Consequently, a negative relationship arises between active management and the value it adds in the short term.

The remainder of the paper is organised as follows. Section 2 defines the methodology for the measurement of active management and performance. Section 3 describes the data used. Section 4 reports the results derived from the empirical analyses. Section 5 presents the main conclusions.

2. Methodology

We compare mutual funds with their peer synthetic portfolios. To this end, we first compute the weight, $w_{p,i}$, of the asset i on the mutual fund p at the end of the quarter. Next, we estimate the daily returns of the synthetic portfolio, $r_{s,t}$, in a day t included in the following quarter, as shown in expression (1):

$$r_{s,t} = \sum_{i=1}^{N} w_{p,i} r_{i,t} - e_{p,t} \tag{1}$$

where $r_{i,t}$ is the return of each asset i in excess of the risk-free asset on day t, and $e_{p,t}$ reflects the same expenses borne by the emulated fund. Then, $r_{s,t}$is the daily return in excess of the risk-free asset of a passively-managed synthetic portfolio that mimics mutual fund holdings at the end of the previous quarter.

To measure active management, we examine the relationship between $r_{p,t}$ (i.e., the daily net return of the mutual fund, also in excess of the risk-free asset) and $r_{s,t}$, through their correlation coefficient in each quarter. This measure is of the same nature as others based on tracking error (Cremers and Petajisto, 2009; El Ghoul and Karoui, 2022) and idiosyncratic risk (Huij and Derwall, 2011; Amihud and Goyenko, 2013). However, its origin lies in an endogenous approach since the fund is evaluated in relation to the behaviour of a comparable synthetic portfolio. A lower (higher) correlation during a period implies a higher (lower) deviation between the returns of the mutual fund, obtained through active management, and the returns of the synthetic portfolio, derived from following a passive buy-and-hold investment strategy on the assets managed by the fund at the beginning of that period. One of the advantages of this measure lies in its simplicity and standardisation, ranging from −1 to 1. If the managed fund does not deviate from its comparable synthetic portfolio during a period, both portfolios will experience the same daily returns, leading to a correlation of 1. We also compare the results with the *active share* measure proposed by Cremers and Petajisto (2009).

Regarding the measure of the short-term abnormal performance linked to active management, we propose differentiating between actual fund performance and the performance of the corresponding passive synthetic portfolio. By doing so, we avoid the bias due to non-zero alphas in the underlying assets (Pástor and Stambaugh, 2002; Matallín-Sáez, 2006; Cremers et al., 2013; Mateus et al., 2019). Thus, we estimate in (2) the abnormal performance of the mutual fund, A_p, as the *alpha gap*, i.e. the difference between the fund alpha (α_p) and the synthetic portfolio alpha (α_s). In this way, A_p should measure the value added by active management within the quarter.

$$A_p = \alpha_p - \alpha_s \tag{2}$$

[1] Previous studies use synthetic, simulated or implicit portfolios to analyse mutual fund management (Bollen and Busse, 2001; Kothari and Warner, 2001; Angelidis et al., 2013).

Alphas for the fund and its synthetic portfolio are estimated by implementing (3), the well-known model of Carhart (1997), and widely used in the mutual fund literature (recently, for instance, Mateus et al., 2019; El Ghoul and Karoui, 2022; Andreu et al., 2023; Matallín-Sáez, 2023, among others).

$$r_{p,t} = \alpha_p + \beta_{p,m} r_{m,t} + \beta_{p,smb} r_{smb,t} + \beta_{p,hml} r_{hml,t} + \beta_{p,wml} r_{wml,t} + \varepsilon_{p,t} \quad (3)$$

In this model, risk factors are the excess market return, $r_{m,t}$, the return of small-cap stocks minus the return of large-cap stocks, $r_{smb,t}$, the difference of the return between higher and lower book-to-market ratio stocks, $r_{hml,t}$, and the return of past winners minus past losers, $r_{wml,t}$.

3. Data

We analyse a sample of US equity mutual funds. The availability of information on portfolio holdings determines our sample period, from January 2000 to March 2020. The sample is free of survivorship bias. Several filters are applied to these data.[2] The final sample is formed with 1,136 mutual funds. We obtain data on mutual funds from the Morningstar database.[3] To generate synthetic portfolios, we use quarterly mutual fund holdings from the Thomson Reuters database and information on stock daily returns from Morningstar. Data from both databases are merged using tickers and CUSIPs. We control for stale data and delete outdated observations (Hoberg et al., 2018). For each mutual fund and quarter, we calculate initial portfolio weights at the beginning of the quarter. Then, using fund portfolio weights and daily returns on 11,714 stocks, we compute daily returns of the synthetic portfolios that follow passive buy-and-hold strategies within the quarter.[4]

Table 1 reports some descriptive statistics for the sample, namely the annualised mean and standard deviation from the daily returns of mutual funds, synthetic portfolios and the factors of the Carhart (1997) model. The cross-sectional average of the annualised mean of the mutual funds' daily returns is 4.80 %, while their peer synthetics portfolios achieve an overall 5.34 %, which is closer to the return of the market factor.

4. Results

4.1. Performance model estimation

Using daily returns in each quarter, we apply Eq. (3) to funds and their peer synthetic portfolios. Table 2 shows the cross-sectional mean and standard deviation (s.d.) for the average of quarterly coefficient estimates and R^2. Overall, mutual funds show a negative aggregate alpha (as shown in the first column, an annualised −1.02 %). This result is in line with the evidence widely found in the literature (Gruber, 1996; Carhart, 1997; Fama and French, 2010; Glode, 2011; Fleta-Asín and Muñoz, 2023). The funds' market beta is close to 1, and the R^2 is high.

Regarding the last columns, the passive synthetic portfolios obtain a positive alpha (0.23 %), a lower beta with the market, very similar coefficients in relation to the other factors, and a high R^2. These results support our proposal to measure the abnormal performance as the *alpha gap* using (2). It is useful to isolate the value provided by fund managers since, in line with Cremers et al. (2013), we found that synthetic portfolios show non-zero alphas despite being passively-managed. On the other hand, we found that the level of idiosyncratic risk ($1 - R^2$) of the synthetic portfolios which are absolutely passive within the quarter (they follow a buy-and-hold strategy) is not zero, but is similar to that of the mutual funds; hence, idiosyncratic risk may be implicitly and passively caused by the assets the fund invests in (Matallín-Sáez, 2023). This could lead to some bias in measuring active management through $1 - R^2$ (Amihud and Goyenko, 2013). Therefore, we propose to measure the level of active management through an endogenous analysis based on the correlation between the returns of the mutual fund and the comparable synthetic portfolio.

Additionally, Fig. 1 plots the evolution of the performance, based on quarterly four-factor alphas. Specifically, the figure shows the cumulative abnormal value (on the left axis) of investing 100 US dollars at the beginning of the sample period in the average mutual fund (black solid line) and in the average synthetic portfolio (dashed line). In line with Table 2, Fig. 1 shows that abnormal mutual fund performance is, on aggregate, lower than that linked to the corresponding synthetic portfolios. Nevertheless, their differences increased over time. While the overall cumulative values for synthetic portfolios were close to zero during most of the sample period, funds generally experienced more difficulties in yielding positive quarterly alphas, especially since the 2008 financial crisis. Fig. 1 also shows how the number of funds in the sample (grey dotted line, right axis) increases in the first years of the sample but afterwards it

[2] Index funds and funds of funds are excluded (Amihud and Goyenko, 2013; Doshi et al., 2015); to avoid any incubation biases, we additionally exclude observations for funds with less than eighteen months since inception, and only funds with more than 15 million dollars in assets under management are considered (Elton et al., 2001; Evans, 2010).

[3] This includes information on daily net returns, tickers, inception date, expense ratio, turnover, assets under management, managers' tenure, aggregate holdings by asset classes and active share.

[4] Following Kacperczyk et al. (2008), we rescale synthetic portfolio returns in accounting for the investment in non-equity assets. Specifically, fund investment returns related to bonds and cash are proxied, respectively, by the Bloomberg Barclays US Aggregate Bond Index and the risk-free asset return (one-month US Treasury-Bill rate). In addition to the risk-free asset, returns on the explanatory factors considered in the performance evaluation model were also obtained from Kenneth French's website (https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/index.html). We are grateful to Professor French for making this data available.

Table 1
Descriptive statistics of the returns in the sample.

	Mean (%)	s.d. (%)
Risk-free asset	1.62	0.11
Mutual funds − risk-free asset	4.80	20.97
Synthetic portfolios − risk-free asset	5.34	19.52
Market − risk-free asset	5.34	19.97
SMB	1.67	9.78
HML	1.74	10.76
WML	4.06	15.56

This table shows the annualised mean and standard deviation (s.d) for daily fund returns (in percentages) from January 2000 to March 2020 for US equity mutual funds, their peer synthetic passive portfolios and the risk factors included in Eq. (3).

Table 2
Estimation of performance model.

	Mutual funds			Passive synthetic		
	Mean	*P*-value	s.d.	Mean	*P*-value	s.d.
Intercept (alpha)	−1.02 %	(0.000)	2.24 %	0.23 %	(0.000)	2.08 %
Market − risk-free asset	0.98	(0.000)	0.07	0.89	(0.000)	0.10
SMB	0.22	(0.000)	0.34	0.23	(0.000)	0.32
HML	0.04	(0.000)	0.22	0.04	(0.000)	0.21
WML	0.03	(0.000)	0.09	0.03	(0.000)	0.07
R^2	93.13 %	(0.000)	4.17 %	90.27 %	(0.000)	4.71 %

This table shows the cross-sectional mean and standard deviation (s.d) of the average of quarterly coefficient estimates and R^2 obtained from implementing Eq. (3) to daily returns of mutual funds and synthetic passive portfolios. Estimates for the intercept (alpha) are annualised. *P*-values (in parentheses) are from the *t*-stat for the null hypothesis test of mean equal to zero.

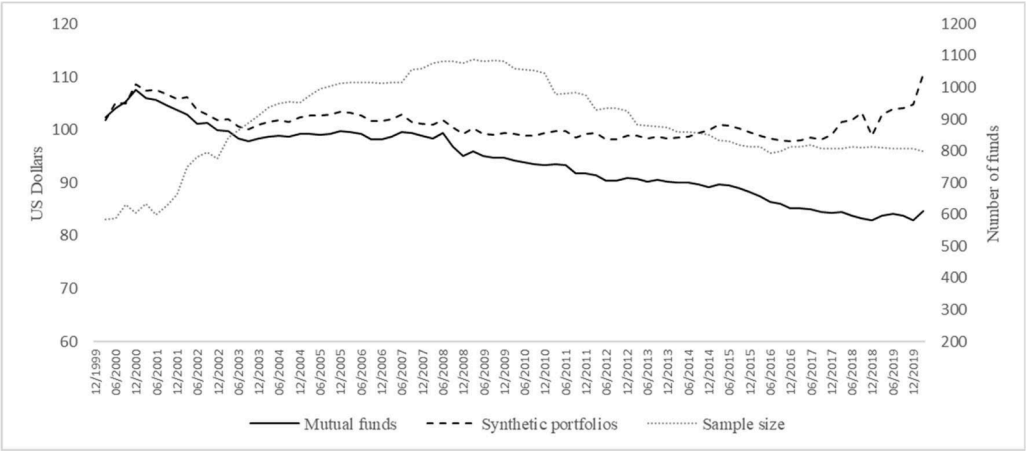

Fig. 1. Cumulative abnormal performance and number of funds in sample.
This figure shows the evolution of the cumulative abnormal performance, assuming a 100 US dollar initial investment, of an equally-weighted portfolio investing in each period in all the funds (black solid line) or their corresponding synthetic portfolios (dashed line). Cumulative abnormal values are plotted on the left axis and relate to quarterly alphas derived from implementing the four-factor model. The number of funds included in the sample in each period (grey dotted line) is shown on the right axis.

does not present relevant variations that could drive the results.

4.2. Active management and performance

In this section, we examine fund performance in relation to the level of active fund management. Accordingly, for each quarter we first compute the correlation between fund daily returns and those of the corresponding synthetic portfolios. For each fund, we then sort the periods from the lowest to the highest correlation and group them into quintiles. This step yields quintiles comprising periods when funds deviate to a greater (lower quintiles) or lower extent (higher quintiles) from their comparable synthetic portfolios. Table 3 summarises the main results of this analysis.

Table 3
Active management and performance.

	All (%)	Low (%)	Q2 (%)	Q3 (%)	Q4 (%)	High (%)	High–low	*P*-value
Correlation	97.35	93.24	97.16	98.18	98.80	99.35	6.11	(0.000)
Mutual funds excess return	4.85	7.83	6.93	8.50	8.50	−9.01	−16.84	(0.000)
Passive synthetic excess return	5.44	8.59	7.42	8.46	8.57	−7.38	−15.97	(0.000)
Return gap	−0.60	−0.76	−0.49	0.03	−0.06	−1.63	−0.87	(0.000)
Mutual fund alpha	−1.02	−0.32	−0.73	−0.98	−1.34	−1.74	−1.42	(0.000)
Passive synthetic alpha	0.23	1.94	0.53	−0.11	−0.48	−0.79	−2.73	(0.000)
Abnormal performance (A_p)	−1.25	−2.26	−1.26	−0.87	−0.86	−0.95	1.30	(0.000)
Market excess return	5.25	5.48	7.41	9.62	9.97	−4.18	−9.66	(0.000)
Volatility market excess return	17.14	15.62	14.93	15.27	16.68	24.27	8.65	(0.000)
Active share	79.16	79.54	79.62	79.33	78.88	78.32	−1.22	(0.040)

This table shows cross-sectional averages in percentages except for the *P*-value in brackets. The first column shows the mean from all quarters' average or estimation. The level of active management is proxied by the correlation between daily returns of funds and their peer passive synthetic portfolios. For each fund, quarters are sorted into quintiles from low to high correlation. The difference between the High and the Low quintile is also reported. *P*-values (in parentheses) are from the *t*-stat for mean equality hypothesis test. Return gap is defined as the difference between mutual fund excess return and that of the corresponding passive synthetic portfolio. Alpha is estimated from Eq. (3). Abnormal performance is defined in Eq. (2) as the difference between the alphas of the fund and the comparable synthetic portfolio. Returns and alphas are annualised. Active share is based on the differences in the holdings between the fund and its benchmark.

On aggregate, Table 3 shows an average correlation of 97.35 %, implying that mutual funds do not greatly differ in their return behaviour from a corresponding buy-and-hold strategy. Regarding quintiles, this correlation remains high even when funds deviate the most from their synthetic portfolios (93.24 % for the Low quintile). Periods associated to the lowest fund deviation exhibit an average correlation much closer to unity (99.35 %).

Also, Table 3 shows the average return for funds and their corresponding synthetic portfolios,[5] as well as their differences (return gap), in periods of different fund correlation. Both the funds and the synthetic portfolios present better (worse) returns in quarters with lower (higher) correlation levels. Consequently, the differences in the returns between the highest and the lowest quintiles are statistically significant. For its part, the return gap is negative, especially at times of high correlation (−1.63 %). For all funds, the average annualised return gap is −0.60 %. This value is lower than that obtained by Kacperczyk et al. (2008) for the same market, but for the period 1984–2003, which would indicate worse results for the funds more recently, just as Fig. 1 has also shown.[6]

The following rows of Table 3 show the alphas obtained by applying Eq. (3). Consistent with Table 2, the average fund alpha is worse than that of the synthetic portfolios. Regarding quintiles with different levels of correlation, we find a negative relationship between correlation and alpha. Mutual fund performance, for instance, significantly decreases by −1.42 % from low- to high-correlation periods. These results seem to suggest that active funds deviating more from their synthetic portfolios perform better. Nonetheless, previous studies (e.g., Pástor and Stambaugh, 2002; Matallín-Sáez, 2006; Cremers et al., 2013; Mateus et al., 2019) illustrate how a passive effect could drive the assessment of fund performance. Along these lines, we note a similar correlation-performance relationship among synthetic portfolios. Since these portfolios are passively-managed throughout the quarter, this relationship cannot be attributed to trading activity during the quarter but to a passive effect of the underlying assets. It is therefore of great interest to measure fund performance through A_p (i.e. the *alpha gap* defined as difference in the alphas of the fund and the comparable synthetic portfolio). As shown in Table 3, A_p is negative across quintiles, with the highest difference achieved in low-correlation periods. The difference in the High–Low quintile is in fact a significant 1.30 %. Therefore, we found a positive relationship between correlation and abnormal performance (measured by A_p), i.e. funds deviating more (less) from their synthetic portfolios achieve worse (better) short-term performance attributed to active management.

Table 3 shows the market conditions that could explain the returns and alphas of passive synthetic portfolios (and, by extension, those of the corresponding funds). Quarters characterised with the greatest correlation levels relate to periods of high market volatility (s.d. of daily returns) and negative market returns. In fact, market volatility is 55 % higher in periods of greater correlation than in low-correlation periods, with the High–Low differences being statistically significant. The table also shows the active share (Cremers and Petajisto, 2009) of the mutual funds. It is a measure of active management based on the differences in the holdings between the fund and its benchmark index. Despite the differences from our measure of active management, results are consistent since lower (higher) correlations between funds and their synthetics are associated with higher (lower) active share. Therefore, in periods of greater market volatility funds deviate to a lesser extent from their synthetic portfolios and their benchmarks, entailing a reduction in the *alpha gap*.

[5] Note that reported means returns slightly differ from those in Table 1 due to differences in the methods used to compute the averages. Both approaches lead to the same evidence, however.

[6] In this line, Cai et al. (2018) find that the performance of the funds decreases over time. Busse et al. (2022) note that a decrease in the opportunities for funds to achieve alpha causes predictors like active share and *R*-square to lose their effectiveness and performance fails to persist, leading to a significant flow of money into passive funds.

4.3. Active management and performance: a dynamic approach

Given the evidence in the previous section, we next apply a dynamic approach. Specifically, for each period we group funds into quintiles based on their correlation within the period, thus preventing the temporary effect of market volatility on the correlation between funds and synthetic portfolios. Therefore, the Low (High) quintile comprises funds showing the lowest (highest) correlation in each period. This also allows us to examine the performance of dynamic investment strategies based on the level of past correlation.

Table 4 reports the results of this analysis. Panel A shows the correlation and performance computed within the same quarter. Funds with the lowest correlation obtain worse overall alphas than funds in the highest quintile, with statistically significant differences (1.16 %, as shown in the High–Low column). We do not find a significant relationship for the synthetic portfolios. As a result, a positive relationship between correlation and abnormal performance (A_p) is observed, with the High–Low difference being an annualised and significant 1.20 %. In the following panels, we compute the correlation in previous periods, and estimate fund performance in the following quarter. Results are very similar to those in Panel A, but lead to lower High–Low differences.

4.4. Robustness analysis: a regression approach

For robustness purposes, we next regress quarterly performance on the correlation between funds and their synthetic passive portfolios. We include fund size, age, manager tenure, turnover and stock market volatility as control variables.

Results are reported in Table 5 and are in line with those in Table 3. That is, we find a negative relationship between alpha and correlation for both the mutual funds and the synthetic portfolios. However, subtracting the passive effect from fund performance yields a positive relationship between correlation and the abnormal performance attributed to active management (A_p). This evidence is also consistent with the results shown in Table 4.

4.5. The long-term overall performance of mutual funds and synthetic portfolios

The previous results focus on the analysis of active management and performance within the quarter. However, the higher correlation between funds and their synthetics also suggests that funds' performance mainly results from their stock holdings rather than their short-term stock trading. Therefore, although active funds may be regarded as bad performers in the short-term, those funds may actually deliver more to their investors since their stock picking ability could outweigh their short-term trading ability in determining actual fund performance.

Consequently, it is also of interest to analyse the long-term overall performance of funds and synthetics. With this aim, we estimate the alpha using (3) but in this case for the whole sample period. The synthetic portfolios are therefore now partially active since their long time series of returns incorporate quarterly changes in holding portfolios. Table 6 shows the aggregate results. In line with the previous tables, the performance of the funds is lower than that of their respective synthetics. On the other hand, the overall

Table 4
Active management and performance: a dynamic approach.

	Low (%)	Q2 (%)	Q3 (%)	Q4 (%)	High (%)	High–low	*P*-value
Panel A: same quarter							
Mutual fund alpha	−1.16	−1.19	−1.11	−0.60	0.00	1.16	(0.045)
Passive synthetic alpha	0.87	0.34	0.20	0.40	0.83	−0.04	(0.953)
Abnormal performance (A_p)	−2.03	−1.53	−1.31	−1.00	−0.83	1.20	(0.025)
Panel B: past quarter – next quarter							
Mutual fund alpha	−1.17	−1.39	−1.09	−0.82	−0.30	0.87	(0.100)
Passive synthetic alpha	0.59	0.34	0.37	0.25	0.65	0.05	(0.924)
Abnormal performance (A_p)	−1.76	−1.73	−1.46	−1.07	−0.95	0.81	(0.045)
Panel C: past year – next quarter							
Mutual fund alpha	−1.18	−1.55	−1.44	−1.44	−0.65	0.53	(0.292)
Passive synthetic alpha	0.34	0.10	0.07	−0.23	0.29	−0.05	(0.928)
Abnormal performance (A_p)	−1.52	−1.65	−1.51	−1.21	−0.93	0.58	(0.174)
Panel D: past 2 years – next quarter							
Mutual fund alpha	−1.03	−1.53	−1.32	−1.17	−0.58	0.46	(0.306)
Passive synthetic alpha	0.56	0.21	0.29	−0.01	0.24	−0.32	(0.562)
Abnormal performance (A_p)	−1.59	−1.74	−1.61	−1.16	−0.82	0.77	(0.066)

This table shows the annualised time series mean (expressed as percentages) and the *P*-value (in parentheses) from the *t*-stat for the mean equality hypothesis test. The level of active management is proxied by the correlation between daily returns of funds and their peer passive synthetic portfolios. For each quarter, funds are sorted into quintiles from low to high correlation. Panel A shows the mean alpha and abnormal performance of quintile-portfolios investing equally-weighted in funds (or passive synthetic portfolios) with similar correlation levels in the same quarter. Panel B reports performance in the next quarter. In Panel C, funds are grouped into quintiles based on the average quarterly correlation during the previous year; and performance is estimated in the next quarter. In Panel D, funds are grouped into quintiles based on the average quarterly correlation during the previous two years; and performance is estimated in the next quarter.

Table 5
Robustness analysis: regression approach.

Explanatory variables	Dependent variable Mutual fund alpha	*P*-value	Passive synthetic alpha	*P*-value	Abnormal performance (A_p)	*P*-value
Constant	0.1328	(0.000)	0.1610	(0.000)	−0.0282	(0.366)
Correlation	−0.0777	(0.000)	−0.2324	(0.000)	0.1547	(0.000)
ln (size)	−0.0063	(0.000)	−0.0024	(0.000)	−0.0039	(0.000)
ln (age)	0.0010	(0.676)	−0.0045	(0.063)	0.0055	(0.001)
ln (manager tenure)	0.0047	(0.186)	0.0042	(0.284)	0.0006	(0.783)
ln (turnover)	−0.0052	(0.000)	−0.0049	(0.000)	−0.0003	(0.710)
Volatility market excess return	0.2702	(0.000)	0.6537	(0.000)	−0.3835	(0.000)
R^2	0.0942		0.2016		0.2522	

This table shows the results from two-way fixed effects panel regressions. Three models are considered to explain performance, measured as: the annualised quarterly alphas of funds and their synthetic passive portfolios, estimated as in (3); and the annualised abnormal performance measured by A_p, as defined in (2). Explanatory variables are the quarterly correlation between the returns of the fund and the comparable synthetic portfolio; the natural logarithm of the total net assets under management (size); the natural logarithm of the number of years since fund inception (age); the natural logarithm of the manager tenure; the natural logarithm of the turnover ratio; and the annualised volatility of the market excess return. *P*-values (in parentheses) are from HAC standard errors for panel estimation.

Table 6
The long-term overall performance of mutual funds and synthetic portfolios.

	All (%)	Low (%)	Q2 (%)	Q3 (%)	Q4 (%)	High (%)	High–low	*P*-value
Mutual fund alpha	−0.47	−0.68	−0.67	−0.63	−0.30	−0.08	0.59	(0.012)
Synthetic alpha	0.61	0.35	0.61	0.57	0.77	0.75	0.41	(0.072)
Difference	−1.08	−1.02	−1.27	−1.20	−1.07	−0.84	0.19	(0.213)

This table shows cross-sectional averages in percentages except for the *P*-value in brackets. Alphas are estimated from Eq. (3) using daily returns for the whole period sample. The level of active management is proxied by the correlation between daily returns of funds and their peer passive synthetic portfolios during a quarter. The percentile ranks for the distribution of the fund correlation coefficients are estimated each quarter. Funds are then sorted into quintiles from Low to High according to the time-series means of percentile ranks. The difference between the High and the Low quintile is also reported. *P*-values (in parentheses) are from the t-stat for mean equality hypothesis test. Alphas are annualised.

performance of the funds that have deviated the most (least) from their synthetics is worse (better): the High–Low difference is 0.59 % and significant. This result is in line with the evidence in Table 4, but to a lesser extent. Hence, the long-term stock picking ability of mutual funds could be compensating part of the evidence shown in Table 4. Finally, as synthetics in this case are partially active, the evidence is similar to that of funds (High–Low difference of 0.41 %) although with a lower significance. Because of this similarity, the difference between the two portfolios is smaller (0.19 %) and not statistically significant.

5. Conclusions

This study proposes a methodology using synthetic portfolios to capture active management in mutual funds. These portfolios replicate mutual fund portfolio holdings and follow a passive buy-and-hold strategy during the quarter. Hence, the presence of trading activity would lead a fund's daily returns to deviate from its passive synthetic portfolio. Accordingly, we consider the correlation between fund and synthetic portfolio returns during a quarter as a proxy for the level of active management in that period. Also, comparing fund alphas with those obtained for synthetic portfolios allows us to differentiate the results of active management during that quarter from the implicit effects emerging passively from the assets held in the fund portfolio. Hence, synthetic portfolios are considered as an endogenous benchmark to measure both active management and fund performance in the short term.

Results show high correlation coefficients between the funds and their corresponding synthetic portfolios, especially in bearish and high market volatility periods. When evaluating active management, we firstly observe a negative correlation-alpha relationship, preliminarily suggesting that funds achieve higher alphas when they deviate more from their initial portfolio holdings. Nonetheless, this result is also found in assessing synthetic portfolio performance. Once this passive effect is considered, a positive relationship arises between correlation and abnormal fund performance in the short-term. Moreover, funds deviating more from their synthetic portfolios during a period underperform funds with the highest correlation coefficients, both in terms of alphas and abnormal performances. Their corresponding synthetic portfolios, in contrast, do not experience significant alpha differences. The evidence therefore shows a negative relationship between the level of active management and the performance it yields in the short term. Finally, we analyse the long-term overall performance of the funds and find that the short-term relationship between trading activity and performance is partially offset by their long-term stock picking ability.

This study has several implications for academics and other stakeholders. For instance, it contributes to the literature that shows the need to consider passive effects when analysing mutual fund management, given that passive portfolios can also entail idiosyncratic risks and experience non-zero alphas. The conclusions drawn are also of great interest to investors and practitioners due to the importance of assessing the impact attributed to managerial actions. Some active managers can display good performance records that mainly result passively from the behaviour of their previously disclosed holdings, and not from the trading decisions they made during

the quarter. Nevertheless, managerial decisions could impact negatively and erode the fund performance that should be achieved in the short-term.

CRediT authorship contribution statement

Juan Carlos Matallín-Sáez: Writing – review & editing, Writing – original draft, Validation, Project administration, Methodology, Investigation, Formal analysis, Conceptualization. **Diego Víctor de Mingo-López:** Writing – review & editing, Writing – original draft, Validation, Software, Methodology, Investigation, Data curation.

Data availability

Data will be made available on request.

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