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Effect of mutual funds characteristics on their performance and trading strategy: A dynamic panel approach

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Abstract: Investors search for criteria that are systematically related to performance of mutual funds so as to maximize their personal return. The present study is on effect of selected fund characteristics on performance of the mutual funds. The data on Indian equity mutual funds for the period 2004–2013 was utilized for the purpose. The dynamic panel data is estimated with the most efficient estimator system-Generalized Method of Moment (sys-GMM). The results show that past year's performance, flow to funds, and cash ratio explained the fund performance measured with conditional Carhart alpha. Thus, earlier documented non-persistence in the performance of mutual funds could be due to not considering the dynamic effect of lagged dependent variable. Further, we examined whether mutual fund characteristics systematically affect the naïve beta strategies followed by mutual funds. The findings show that fund characteristics such size, expense ratio, portfolio turnover ratio, and age affect trading strategy of mutual funds. The study has implications for investors of mutual funds as they can optimize their portfolio return with a strategy based on past one-year risk adjusted conditional Carhart alpha. Further, mutual fund ranking firms can consider conditional Carhart alpha as one of the criteria to rank mutual funds.

Subjects: Economics; Econometrics; Finance

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ABOUT THE AUTHOR

Dr. Inderjit Kaur has worked extensively and published many articles in the area of mutual funds. She has pursued her Fellowship Program in Management on performance and selection criteria of mutual funds. The present article is an extension of the work. She has further extended her work to understand the determinants of flow of mutual funds.

PUBLIC INTEREST STATEMENT

"Where to invest" so as to achieve financial freedom is the goal of every human being. Mutual funds are one of the popular investment alternative. But, "How to choose" a mutual fund is always a concern. Mutual funds advertise about their returns but with disclaimer of non-guarantee. Financial advisors tend to act in their personal interests. This perspective article suggests some of criteria to consider while choosing mutual funds. The suggestions are based on data from Indian equity mutual funds. The study found the importance of considering the effect of risk when measuring actual return to investors. Understanding the difference between risk adjusted return and gross return can be beneficial for investors. Mutual fund selected on the basis of risk adjusted return can generate profitable bet for investors.

Keywords: Mutual funds; fund characteristics; performance; dynamic panel; trading strategy; India

MR Subject classifications: G11; G20; G23

1. Introduction

Mutual funds provide an opportunity for investment in a stock market with professional acumen. They provide the benefit of risk diversification with a minimum allocation of funds. The selection of mutual fund itself is tedious given growth in number of schemes offered by them. The number of world-wide regulated open-ended mutual fund schemes was 114,131 in 2017 (Investment Company Institute Fact Book, 2018). Investors consistently search for investment strategy to maximize their personal gains. Adverstisements by mutual funds largely glorfies their past performance. While, the same comes with a disclaimer that past year's performance may not guarantee future performance. This raises a question about why mutual funds spend so much to advertise about their performance when it carries no information for investors. Investors can also access publicly available information about various operational parameters of mutual funds. They may wish to know whether such information can generate any profitable bets for them.

The present study aims to investigate whether performance of funds is associated with past performance and other fund characteristics. We examined this for Indian mutual funds as the industry has interesting trajectory of growth. The growth trajectory is probably similar to many emerging countries. The Government of India, offered the first equity mutual fund scheme, "Unit 64", to Indian investors by setting up "Unit Trust of India" (UTI) mutual fund way back in 1963. The unique feature of the scheme was guaranteed returns as its investments were not linked to market returns. UTI suffered erosion of assets due to market crash in 2002 leading to severe payment crisis. This eroded faith of investors in mutual funds. Simultaneously, Government of India, under its Liberalization, Privatization, and Globalization (LPG) policy, allowed private sector to offer mutual fund schemes in 1993. This led to growth of private sector mutual funds, but, with hesitant investors.

The Government of India took various measures to restore the faith of investors in capital markets in general and mutual funds in particular. The first reform was to bring all mutual funds under capital market regulator, Securities Exchange Board of India (SEBI). The SEBI provides various operational regulations for mutual funds and further, prescribes the format for dissemination of information to investors. For instance, offer document must disclose adequate information such as tax, principles of valuation, frequency, and model of distribution of income, to enable investors to make informed decisions. Further, to bring transparency in expenses charged by mutual funds, expense ratio charged by mutual funds is specified as per average weekly net assets and is limited to 2.5% for equity and 2.25% for debt mutual funds. There is need to provide detailed break-up of expenses. Through various reformative measures, it brought transparency in computation of Net Asset Value (NAV), expenses charged by mutual funds, transparency in portfolio holdings, and distribution charges.

There is transparency in functioning of mutual funds and all relevant information is publicly available with such measures. But, the issue is whether investors can generate profitable bets through such information. The effect of past performance and other fund characteristics on performance is widely researched in context of developed countries. It will be interesting to investigate such issue in Indian context as there is counter argument that with transparency, and so much restrictive regulations, such information is not valuable for investors. The present study is an attempt to investigate this issue.

The important contributions of the study are, one, we applied sys-GMM approach which has advantages over fixed effect panel data model. In this, dependent variable is explained by its own past values. It allows to enter non-observable constant characteristics of a fund that do not vary over

a period of time. The managerial acumen and ownership of mutual fund are constant non-observable characteristics that need to taken into consideration. Another contribution is consideration of various measures of performance, that is, gross returns and risk-adjusted returns (measured with Sharpe ratio and conditional Carhart alpha). The investors usually consider gross return but it is desirable to adjust risk undertaken to achieve particular return. Further, we studied effect of fund characteristics on trading strategy of mutual funds. This will provide better insights into the fund management style of fund manager. It can establish the probable link between trading strategies and performance.

The rest of article is organized as follows: A brief discussion on related literature is in Section-2. Section-3 has discussion on data. Section-4 has discussion on methodological issues. The findings of the study are discussed in Section-5. Finally, Section-6 concludes the study.

2. Review of literature and hypothesis of study

There is an extensive list of variables such as past performance, size, expense ratio, cash or liquidity ratio, and portfolio turnover ratio, to name a few that have been investigated in literature. In this section, literature related to performance determinants is discussed with the objective to explore the fund characteristics that are relevant to develop the hypothesis for the study.

2.1. Past performance

The most important variable among all fund characteristics has been past performance of mutual funds (Siri & Tufano, 1998). The effect of past performance on the current performance of the mutual fund has been termed as "*persistence in performance*". Grinblatt and Titman (1992) found long-run persistence in performance. They showed each one percent abnormal return in first five-year period expected 0.28% greater abnormal return in the second five-year period. Hendricks, Patel, and Zeckhauser (1993) found short run persistence in performance of mutual funds. Elton, Gruber, and Blake (1995) constructed a portfolio based on past return strategy and found returns were sufficient to cover expenses only. Bollen and Busse (2004) showed no persistence in performance measured with returns but found evidence with risk-adjusted return. Other than the USA, there has been no evidence for persistence in performance. In Greece, Babalos, Kostakis, and Philippas (2007) showed non-incorporation of momentum effect in performance measure led to persistence in performance of funds. They found neither good nor poor performance persistence. Ferreira, Keswani, Miguel, and Ramos (2012) found short-term persistence in performance of mutual funds only in case of the USA but not in other countries. Dahlquist, Engstrom, and Soderlind (2000) showed non-persistence in performance for Swedish mutual funds. Deb, Banerjee, and Chakrabarti (2008) found short-run persistence for three to six months which disappeared in time-period of 30 months in India. Based on the discussion, since there is no evidence of persistence in performance for one year in India, therefore, study proposes to test the hypothesis,

H_1: Past performance of mutual fund does not affect the current performance of mutual funds.

2.2. Flow to funds

There has been an argument about whether new fund flow in fund leads to non-persistence in performance. Gruber (1996) showed that net new money flows in the mutual funds earn better returns to which he termed as "*smart money*". Sapp and Tiwari (2004) demonstrated that investors chase the recent winners and "smart money" effect is due to momentum strategy. Berk & Green (2004) raised the issue that if funds in general underperform and past performance has not been predictive future performance then why there has been irrational behavior among investors. They theoretically developed a model based on rational expectations of investors. They argued that investors keep investing in winner fund till its performance becomes same as of its peers. Therefore, new fund flow resulted in diseconomy of scale and decline in performance of winner funds. Reuter and Zitzewitz (2010) empirically examined Berk & Green model but found no evidence related to this during the period 1996–2009 in the USA mutual funds. The study proposes to test the hypothesis:

H_2: Flow to Funds negatively affect the performance of mutual funds.

2.3. Expense ratio

Grossman and Stigliz (1980) argued that in an efficient market, it is difficult to obtain free information, that is, there is no free lunch. This meant that even if a mutual fund manager is able to somehow obtain information; its cost will be equal to the management fee and transaction cost for the trade. Wermers (2000) showed that though mutual funds outperformed benchmark returns by 130 basis points per year their net returns were 100 basis points lower due to expenses and transaction cost. Negative effect of expense ratio has been widely found world-wide (Babalos, Kostakis & Philipas, 2009; Carhart, 1997; Elton et al., 1995; Ferreira et al., 2012; Grinblatt & Titman, 1994; Grubber, 1996; Malkiel, 1995; Otten & Bams, 2002). SEBI also limits charging of expense ratio to investors to 2.5% for equity mutual funds and 2.25% for debt mutual funds.

H_3: There has been a negative effect of expense ratio on the performance of mutual funds.

2.4. Size of mutual fund

The size of a mutual fund can affect the performance in many ways. There can be both economies as well as diseconomies of scale. Chen, Hong, Huang, and Kubik (2004) argued that economies of scale could be due to lowering of expense ratio and administrative costs. While diseconomies of scale could be due to the organizational complexity and inability to trade without giving a signal in the market (which could result in costly trades). Brennan & Hugges (1991), Ciccotello and Grant (1996), Indro, Jiang, Hu, & Li (1999), and Latzko (1999) found "inverted U-shaped" relationship between size and performance of mutual funds. Chen et al. (2004), Ferreira et al. (2012), Gallagher and Martin (2005), Pollet and Wilson (2008), and Yan (2008) found negative effect of size on performance. Chen et al. (2004) found that diseconomies of scale are due to liquidity constraints. While Pollet and Wilson (2008) showed that it is due to concentrated portfolio held by large size mutual funds. In Singapore, Sing (2007) found insignificant outperformance of large funds. Tang, Wang, and Xu (2012) found an inverted U-shaped relationship between fund size and performance in China. This was due to the simultaneous existence of economy of scale and liquidity constraints. For small funds, scale of economy played a more important role while in large funds, liquidity constraints were important. Thus, we test the following hypothesis.

H_4: There is negative effect of size on performance of mutual funds

2.5. Portfolio turnover ratio

The portfolio turnover ratio reflects the extent of the active trading strategy of equity mutual funds. It reflects effect of active trading strategy on performance. It has a direct relationship with expense ratio of the firm. Carhart (1997) found a negative effect of portfolio turnover ratio on the performance of mutual funds. Wermers (2000) also reported underperformance in mutual funds due to net transaction cost. Jan and Hung (2003) using stochastic dominance approach found negative effect of high turnover in equity mutual funds. The study proposes to test the following hypothesis:

H_5: There is negative effect of portfolio turnover ratio on performance of mutual funds

2.6. Cash ratio

The cash ratio is the proportion of cash and cash equivalents to total assets under management for a mutual fund. The cash ratio of a mutual fund could affect the performance as there could be liquidity constraints. Babalos et al. (2009) showed a negative effect of cash ratio on performance of mutual funds. We test the following hypothesis:

H_6: There is negative effect of cash ratio on performance of mutual funds

2.7. Age of mutual fund

Age of the mutual fund is the number of years for which mutual fund has been in existence. Mutual funds gain experience with each number of year in stock market. Older funds may perform better than newer funds due to "learning by doing" effect. On the other side, newer fund may be more committed and hence may perform better. In the USA, Chen et al. (2004) showed no relationship between age of fund and performance. In contrast, Otten and Bams (2002) found a positive relationship between age of fund and performance in five European countries. Babalos et al. (2007) showed a positive effect of age of fund on performance in Greece. Based on this, the study proposes to examine the following hypothesis:

H_7: There is positive effect of age of mutual fund on performance of mutual funds

The above discussion provides inconclusive evidence about the effect of fund characteristics on performance. Further, most of the studies have showed the effect of fund characteristics on performance but not on trading strategy. This study aims to bridge this gap by studying the effect of fund characteristics on performance as well as on their trading behavior.

3. Data

The sample constitutes all diversified growth equity funds in India for which data related to fund characteristics is available for at least two years. The time period of the study is 2004–2013. The period coincides with level playing field for mutual funds in Indian mutual fund industry.[1] The data related to mutual fund characteristics such as expense ratio, size of mutual funds, portfolio turnover ratio, cash ratio, its inception year, and net asset value (NAV) is collected from *NAV India database* for mutual funds by *Capitaline*. The reported NAV are the adjusted NAV after any dividend declaration. Since we have taken equity mutual funds with "growth" objective, therefore, dividends are reinvested in the scheme itself. There is no information about flow of funds in a year in database. We followed Siri and Tufano (1998) for computation of flow of funds in a mutual fund for a year. A brief about variables in the database is given in Appendix A. Proportion of funds in the sample to database are provided in Appendix B.

The year-wise descriptive statistics of all variables is reported in Table 1. The data for portfolio turnover is available from 2009, therefore, two regression models, with and without portfolio turnover ratio will be estimated. There is a large variation for variables, size, and portfolio turnover ratio, therefore, logarithmic values of these variables will be taken in estimation. Average size of fund declined in 2008 and 2009, which coincide with Global Financial Crisis-2008 period. The performance of funds with all the three measures is negative in 2008. There has been consecutive negative flow of funds in 2009. The average conditional Carhart alpha is positive except for period 2007–2008. This shows that Indian capital market provides opportunities for abnormal returns. The cash ratio is the highest for 2008 and 2009. This shows not enough investible opportunities for mutual funds during the recessionary phase of capital market.

4. Methodology

4.1. Performance measures

The study has considered both gross return and risk-adjusted return as performance measures. For investors, though, only gross returns matter. But, it is important to adjust return with the relevant risk as to ascertain the source of return as well.

The gross return is measured as holding period return based on daily data for each year:

$$gr_t^i = \sqrt[n]{(1+r_1^i)*(1+r_2^i)*\ldots\ldots\ldots..*(1+r_n^i)} - 1 \quad (1)$$

Where, gr_t^i= average return for fund "i" for year "t" with "n" number of days,

Table 1. Descriptive statistics of all variables

Year	Size (in INR '10 Million)	Expense ratio (in %)	Portfolio turnover ratio (in %)	Cash ratio (in %)	Flow to funds (in INR '10 Million)	Age (in years)	Gross return	Sharpe ratio	Cond. Carhart alpha
2004	324.062	2.280	-	-	1.385	8.881	0.088	0.039	0.031
2005	401.151	2.273	-	2.811	0.587	9.113	0.150	0.112	0.014
2006	652.569	2.190	EM_{it}^{smb}	3.879	0.681	10.203	0.127	0.063	0.015
2007	842.606	2.138	-	4.488	0.608	11.074	0.186	0.110	−0.007
2008	719.649	2.149	-	7.278	0.278	12.010	−0.344	−0.158	−0.029
2009	778.125	2.188	83.323	7.402	−0.267	12.523	0.250	0.127	0.031
2010	986.755	2.145	34.637	4.561	1.313	13.314	0.065	0.386	0.017
2011	651.700	2.174	23.973	4.890	0.177	13.845	−0.114	−0.131	0.003
2012	642.936	2.204	21.901	2.373	0.346	14.678	0.118	0.099	0.036
2013	832.264	2.574	24.643	0.873	1.839	15.494	−0.007	−0.038	0.011
Overall average	730.833	2.240	34.908	4.143	0.671	12.981	0.038	0.057	0.013
Minimum	0.281	1.000	0.030	−16.401	−1.161	2.000	−0.585	−0.246	−0.266
Maximum	10,971.900	5.655	402.000	38.679	113.982	22.000	0.492	1.257	0.120
Standard deviation	1085.213	0.393	64.589	4.925	4.773	4.532	0.166	0.221	0.039

$r_n^i = \frac{NAV_n^i - NAV_{n-1}^i}{NAV_{n-1}^i}$ $\forall i = 1,2\ldots\ldots\ldots\ldots\ldots\ldots n$, *is the daily return for a mutual fund "i" and NAV is Net Asset Value of mutual fund.*

The risk adjusted performance is measured with Sharpe ratio (Sharpe, 1966) and four-factor conditional Carhart alpha (Ferson & Schadt, 1996).

Sharpe ratio for the year "*t*" for each mutual fund "*i*" has been computed as,

$$sharpe_t^i = \frac{yr_t^i - yr_t^f}{\sigma_t^i} \tag{2}$$

Where yr_t^i = return of fund "*i*" for the year "*t*" = $\frac{NAV_t^i - NAV_{t-1}^i}{NAV_{t-1}^i}$,

yr_t^f = risk free rate of return for year "*t*" which is proxy with 90-day *t*-bill rate of return, and

σ_t^i = standard deviation of returns of fund "*i*" for the year "*t*".

Another measure for risk-adjusted return that considers all naïve strategies of the stock market is conditional four-factor Carhart alpha (Caporin & Lisi, 2013; Nagel & Singleton, 2011; Sawicki & Ong, 2000). The conditional Carhart alpha for each mutual fund "*i*" for the year "*t*" is obtained by applying the following regression model:

$$r_d^i - r_d^f = \alpha_i + \beta_1 RMRF_d + \beta_2 SMB_d + \beta_3 HML_d + \beta_4 MOM_d + \sum_{j=1}^{3} B_j^1 z_{jd-30} RMRF_d + \sum_{j=1}^{3} B_j^2 z_{jd-30} SMB_d + \sum_{j=1}^{3} B_j^3 z_{jd-30} HML_t + \sum_{j=1}^{3} B_j^4 z_{jd-30} MOM_d + \varepsilon_d \tag{3}$$

Where,

$r_d^i - r_d^f$ = *daily excess return of the "i" mutual fund,*

$RMRF_d$ = *daily excess market return,*

SMB_d = *daily size factor returns,*

HML_d = *daily value factor returns,*

MOM_d = *daily momentum factor returns,*

$Z_{jd\text{-}30}$ = *"j" publically available information variables*, viz., *term structure of interest rate, 90-day t-bill interest rate, and dividend yield on NSE-S&P Nifty index for the year at lag of one month which reflect information about long -run economic condition, short-run economic condition, and stock market condition, respectively, and*

α_i = *risk adjusted performance of "i" mutual fund.*

The Equation (3) is estimated with Ordinary Least Square (OLS) method with robust standard errors so as to overcome heteroskedasticity and autocorrelation in the errors. For autocorrelation, lag length has been taken based on Akaike Information Criteria (AIC) for being more efficient than Bayesian Information Criteria (BIC) and Hannan-Quinn Information Criteria (HQIC). A brief note on portfolio construction and computation of factor return is provided in Appendix C. The intercept of the model is the risk adjusted return of mutual fund, that is, conditional Carhart alpha. The regression coefficients of size, value, and momentum factors are utilized further to compute the

extreme trading strategy measures. The computation of trading strategy measures is provided in next section.

4.2. Trading strategy

The proxy for trading strategy of the fund manager is beta coefficients on size, value, and momentum factors (β_2, β_3, β_4 of Equation 3). The study has examined whether different fund characteristics have been related to extreme trading strategy. The extreme trading strategy is standardized variable based on beta of each fund variable (Bar, Kempf, & Ruenzi, 2011),

$$EM_{i,t}^{v} = \frac{\left|\beta_{i,t}^{v} - \bar{\beta}_{k,t}^{v}\right|}{\frac{1}{N^k}\sum_{j=1}^{N^k}\left|\beta_{j,t}^{v} - \bar{\beta}_{k,t}^{v}\right|} \tag{4}$$

where, $EM_{i,t}^{v}$ = extreme market strategy measure for each "*v*" market strategy, that is, size, value, and momentum,

$\beta_{i,t}^{v}$ = coefficient of market strategy "*v*" for fund "*i*" for the year "*t*", and

$\bar{\beta}_{k,t}^{v}$ = average of coefficients of "*v*" market strategy.

4.3. Regression model

The effect of various fund characteristics on performance of mutual funds is studied with the following regression model:

$$Perf_{it} = \gamma + \delta_1 LNAUM_{it} + \delta_2 ER_{it} + \delta_3 LNPTR_{it} + \delta_4 CR_{it} + \delta_5 FLOW_{it} + \delta_6 Perf_{it-1} + \delta_7 AGE_{it} + \delta_8 D.\mu_t + \varepsilon_{i,t} \tag{5}$$

Where, $Perf_{it}$ = either of performance measure, viz., gross return, Sharpe ratio, conditional Carhart alpha

$LNAUM_{it}$ = natural log of size of mutual fund,

ER_{it} = expense ratio,

$LNPTR_{it}$ = natural log of portfolio turnover ratio,

CR_{it} = cash ratio,

$FLOW_{it}$ = flow of funds,

$Perf_{it-1}$ = last year performance, and

AGE_{it} = age of mutual fund

$D.\mu_t$ = time invariant fixed effects measured with year dummies.

The regression Equation (5) violates the assumption of strict exogeneity where lagged dependent variable is independent variable as well. It cannot be estimated efficiently and consistently with fixed effect regression method. Greene (2011, Chapter 11) showed that since y_t is a function of μ_i, so y_{t-1} is also a function of μ_i. This leads to inconsistent pooled-OLS and fixed effect estimator. The problem cannot be resolved particularly in the case when *T* is small and *N* may be large and increasing (which is the case of the present study as T = 10 years and N = 181 mutual funds). Anderson and Hsiao (1981) showed that instrument variable based on level ($z_{it} = y_{i,t-2}$) or differenced ($z_{it} = y_{i,t-2}$—$y_{i,t-3}$) dependent variable provides consistent estimate. Baltagi (2005, Chapter 8) showed that such estimator though may be consistent but is not efficient. Arellano (1989), Kiviet (1995) showed level instrument variable to be more

efficient than difference instrument variable. While, if one utilizes orthogonality condition between lagged values of y_{it} and ε_{it}, then one can obtain additional instrument variables (Arellano & Bond, 1991). Their estimator sets up a GMM problem in which model is specified as a system of equations and different instrument is applied for each period. Arellano and Bond's instrument variable estimator when applied with first differenced variables suffer from weak instrument problem particularly when autoregressive coefficient approaches unity. In this case, the estimator is inefficient. System-Generalized Method of Moments (sys-GMM) approach included lagged level and lagged differenced variables and thus, provided efficient estimator (Arellano & Bover, 1995; Blundell & Bond, 1998). The Nickell bias associated with small-panels (small T and large N) can also be overcome with sys-GMM approach (Baum, 2013; Hayakawa, 2007). Present study applied sys-GMM approach to estimate regression Equation (5). Further, GMM-estimator is consistent only when moment conditions are valid. Sargan test for over-identifying restrictions has been applied for this. The test's results are erroneous under the presence of heteroskedasticity in data. The chi-square test statistics with Wald test for group-wise heteroskedasticity is 7.7×10^{34} (p-value = 0.000). This shows presence of heteroskedasticity in panel data. Therefore, we applied robust standard errors to overcome the problem of heteroskedasticity.

Similarly, following regression model provides the relation between fund characteristics and trading strategy of mutual funds:

$$EM_{it}^{v} = \theta + \omega_1 LNAUM_{it} + \omega_2 ER_{it} + \omega_3 LNPTR_{it} + \omega_4 CR_{it} + \omega_5 FLOW_{it} + \omega_6 AGE_{it} + \varepsilon_{i,t} \quad (6)$$

Where all have their usual meaning as explained earlier.

The regression Equation (6) does not have lagged dependent variable as an independent variable, therefore, can be estimated with the usual panel data methods. Breusch-Pagan Lagrange Multiplier test has been applied to test the random effect. Hausman test has been applied to test the fixed effect in the model.[2] Table 2 shows the results of both tests with each dependent variable. The pooled-OLS method has been applied to estimate the model with size trading strategy. Fixed effect method has been applied to estimate the models for value and momentum trading strategies (Table 2). Null hypothesis for Breusch-Pagan test has been rejected in all cases. This implies presence of heteroskedasticity in data. Regressions models have been estimated with robust standard errors to overcome this problem.

5. Findings and discussion

The regression Equation (5) has been estimated with sys-GMM with robust standard errors for each of the performance measure, viz., gross average return, Sharpe ratio, and conditional Carhart

Table 2. Results of statistical test for estimation method

	EM_{it}^{smb}	EM_{it}^{hml}	EM_{it}^{mom}
Breusch Pagan Multiplier test for random effect			
Chi-square test statistics[$]	0.000	0.000	0.000
p-Value	1.000	1.000	1.000
Hausman test			
Chi-square test statistics[#]	8.040	42.870	105.11
p-Value	0.154	0.000	0.000
Breusch-Pagan test for Heteroskedasticity			
Chi-square test statistics[^]	162.63	$5.9*10^{31}$	$4.3*10^{34}$
p-Value	0.000	0.000	0.000
Method applied	Robust Pooled-OLS	Robust Fixed Effect	Robust Fixed Effect

[$]The failure to reject the null hypothesis implies random effect is not appropriate
[#]Rejection of null hypothesis implies fixed effect is appropriate
[^]Rejection of null hypothesis implies presence of heteroskedasticity.

alpha. The dependent variables have been estimated with Equations (1), (2) and intercept of regression Equation (3). The results for regression Equation (5) have been reported in Table 3. The regression Equation (6) has been estimated with fixed effect method with robust standard errors for each of size, value, and momentum beta strategies adopted by mutual funds. The values for each of the beta strategies for each fund-year has been obtained from regression Equation (3) and standardized with Equation (4). The results of the regression Equation (6) have been reported in Table 4. Since data on variable portfolio turnover ratio has been available only since 2009, therefore, two models have been estimated for each regression.

The estimates of sys-GMM are efficient only when over identifying restrictions are valid. The validity of over-identifying restrictions has been tested with Sargan test. J-Statistic, equivalence of Sargan test has been reported for each of the regression, one, for each dependent variable, and, two, for each of time periods (2004–2013 and 2009–2013) (Table 3). The *p*-value in each column for J-statistics provides that null-hypothesis of validity of over-identifying restrictions has been accepted at 5% level of significance. The results of AR(1) and AR(2) tests shows first-order serial correlation on first difference errors (Table 3). Therefore, one-lag of the dependent variable is considered.

The findings show contradictory results for gross returns and risk-adjusted return measured by conditional Carhart alpha. For instance, *t*-value for lagged dependent variable for performance

Table 3. Effect of fund characteristics on performance of mutual funds

	Gross average return		Sharpe ratio		Conditional Carhart alpha	
	I (2004–2013)	II (2009–2013)	I (2004–2013)	II (2009–2013)	I (2004–2013)	II (2009–2013)
Dependent variable at Lag one (L1.PERF)^	−0.712*	−0.277*	−0.118*	−0.025	0.272*	0.168*
	(−24.385)	(−4.471)	(−2.566)	(−0.924)	(6.978)	(2.752)
Size of fund (LNAUM)	−0.063*	−0.008	−0.046	−0.109*	−0.010	−0.003
	(−8.258)	(−0.624)	(−1.503)	(−2.596)	(−1.618)	(−0.428)
Expense ratio (ER)	0.107*	−0.019	0.411*	0.585*	−0.003	−0.007
	(4.700)	(−0.447)	(4.810)	(3.087)	(−0.121)	(−0.256)
Cash ratio (CR)	−0.004*	−0.004	0.016	0.008	0.001	0.004*
	(−2.218)	(−1.337)	(1.651)	(0.509)	(0.512)	(2.010)
Flow to funds (FLOW)	0.006*	0.004*	0.006	0.004	0.001	0.002
	(6.555)	(2.489)	(1.773)	(0.941)	(1.261)	(1.799)
Age of fund (AGE)	0.058*	−0.010	0.040	0.014	0.009	0.040
	(3.318)	(−0.500)	(0.867)	(0.199)	(0.455)	(1.563)
Portfolio turnover ratio (LNPTR)		0.035*		0.011		0.005
		(4.284)		(0.536)		(1.338)
J-statistic$	52.596	23.899	30.607	26.073	34.645	28.374
	(0.058)	(0.200)	(0.080)	(0.128)	(0.256)	(0.076)
AR(1)$	−3.640*	−3.640*	−5.862*	−6.120*	−4.192*	−4.192*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
AR(2)$	0.976	0.976	−0.229	0.105	−0.635	−0.635
	(0.329)	(0.329)	(0.819)	(0.916)	(0.526)	(0.526)

^The first row shows the coefficient and corresponding *t*-statistics in the second row.
$The F-statistics is reported in the first row and *p*-value in the second row. The acceptance of null hypothesis for J-statistics implies that over-identifying restrictions are valid
*Significant at 5% level of significance

Table 4. Effect of fund characteristics on trading strategy of mutual funds

	EM_{it}^{smb}		EM_{it}^{hml}		EM_{it}^{mom}	
	I (2004–2013)	II (2009–2013)	I (2004–2013)	II (2009–2013)	I (2004–2013)	II (2009–2013)
Size of fund (LNAUM^)	−0.064*	−0.046	−0.046	0.104*	0.012	0.057*
	(−2.44)	(−1.76)	(−0.99)	(2.47)	(0.39)	(2.19)
Expense ratio (ER)	−0.264	−0.179	−0.614*	−0.504*	−0.224	0.003
	(−1.87)	(−1.49)	(−2.34)	(−4.34)	(−1.52)	(0.04)
Cash Ratio (CR)	−0.011	−0.001	−0.030*	−0.042*	−0.005	−0.017
	(−1.97)	(−0.20)	(−2.57)	(−3.71)	(−0.67)	(−1.55)
Flow to fund (FLOW)	0.006	0.005	0.007	0.003	0.001	−0.001
	(1.06)	(0.92)	(1.72)	(0.62)	(0.36)	(−0.20)
Age of fund (AGE)	0.016*	0.013	−0.072*	−0.187*	−0.119*	−0.126*
	(2.30)	(1.42)	(−3.73)	(−5.76)	(−7.75)	(−4.67)
Portfolio Turnover ratio (LNPTR)		−0.052*		−0.067*		−0.031
		(−2.82)		(−2.38)		(−1.15)
R-square	0.016	0.023	0.013	0.010	0.002	0.005
F-statistics$	2.46*	3.34*	3.85*	15.64*	14.02*	5.79*
	(0.031)	(0.003)	(0.002)	(0.000)	(0.000)	(0.000)

^The first row shows the coefficient and corresponding t-statistics in the second row.
$The F-statistics is reported in the first row and p-value in the second row.
*Significant at 5% level of significance.

measures gross returns, Sharpe ratio, and conditional Carhart alpha for period 2004–2013 for model without portfolio turnover ratio is statistically significant but with different signs (refer Table 3, Column I for each performance measure). This implies persistence in performance is robust to performance measure and time period (except for Sharpe ratio for period 2009–2013). But, persistence is positive only for risk adjusted conditional Carhart alpha, and, not for gross returns, and Sharpe ratio.

The effect and statistical significance of all other variables have been also dependent on the performance measure and time period under consideration. The effect of size of fund has been negative for all performance measures. This shows diseconomies in scale when fund grows in size. The effect of expense ratio has been significant positive with gross returns, and Sharpe ratio. While, it is negative and insignificant for conditional Carhart alpha (refer Table 3). Similarly, effect of cash ratio is negative for gross return. While, significant positive with conditional Carhart alpha. The effect of new flow of funds in a current year, age of fund, and portfolio turnover ratio has been positive but significant only in case of gross returns.

The results show that effect of fund characteristics and past performance is dependent upon the performance measure chosen. The gross returns provide unadjusted returns and can have the effect of manipulation. While, alpha provides return adjusted for the risk taken to obtain absolute performance. Further, alpha is the return relative to the market, size, value, momentum strategies, and after considering the effect of dynamic trading strategies of fund manager. Therefore, it is better performance measure as compared to the gross returns and Sharpe ratio. The findings need to be interpreted while considering this.

The effect of fund characteristics on the trading strategy of the mutual fund has been estimated with regression Equation (6) and the results of the same have been reported in Table 4. The

extreme trading strategy has been measured with Equation (4). Here also, the effect of fund characteristics is different for each beta/trading strategy, and time period under consideration.

The effect of the size of the fund has been statistically significant and negative on size strategy while positive on momentum strategy. This provides that large size mutual funds tend to invest to large market capitalization stocks. While they prefer to invest in value stocks and previous year profitable stocks. The effect of expense ratio and cash ratio has been negative for all strategies. It is significant for only value strategy in both time periods, and for size strategy during full sample period. Investment in naïve strategies do not increase expense ratio of mutual funds. But, it tends to increase when mutual funds trade with private information and profitable bets. This makes sense as Grossman and Stigliz (1980) had argued that investment in profitable trades increases expense ratio of mutual funds.

The effect of new flow of funds in current period has been positive and statistically significant for all trading strategies (except for momentum strategy during 2009–2013 period). This shows that mutual funds do not look for other profitable investment strategies with new flow of funds. They tend to invest in naïve strategies (Pollet & Wilson, 2008). The effect of age of fund and portfolio turnover ratio has been negative and statistically significant.

5.1. Discussion

The findings of the study have been interesting as the main motive of the study was ascertaining the logic of expenditure made by mutual funds to highlight their past performance. But, simultaneously, maintaining the claim that past performance cannot be guaranteed for future performance. We found past one-year predicts future performance. There is positive persistence found only in case of risk adjusted performance, conditional Carhart alpha. The positive persistence in performance is after considering all systematic risks and dynamic effect of publicly available information. This finding is contrary to earlier studies in India (Deb et al., 2008; Ferreira et al., 2012) and in other countries (Babalos et al., 2009; Elton et al., 1995). In Greece, consideration of momentum strategy led to non-persistence in performance (Babalos et al, 2009). The dissimilar findings can be attributed to measurement of risk adjusted performance appropriately. The measurement of performance with daily frequency data and with appropriate adjustment of risk lead to better properties (Bollen & Busse, 2004). Another reason for this can be applying sys-GMM approach to panel data. The panel data is more informative than time-series. It carries information along two-dimensions, across time and across cross-sections. Further, sys-GMM estimator is more efficient in presence of AR structure in data. It allows to control effect of non-observable constant variables. Thus, findings of the study provide new light on the puzzle of "persistence" in the performance of mutual funds. This has implications for investors of mutual funds. The investors can generate profitable bets by selecting mutual funds based on conditional Carhart alpha than on gross returns or Sharpe ratio.

Another interesting finding of the study is effect of size and new flow of funds on performance of mutual funds. Gruber (1996) had questioned that "why" investors invest in mutual funds when there is largely reported "underperformance" of mutual funds. He proposed "*smart money effect*", that is, new flows get better returns. Berk and Green (2004) theoretically argued that both size and new flows have negative effect on the performance of mutual funds. We found the presence of "*smart money effect*" in Indian mutual fund industry. There was positive effect of flow of funds on the performance of mutual funds. This shows investors tend to choose winning funds. The effect of size of funds was negative. Negative effect of size of the fund on performance could be due to liquidity constraints (Chen et al., 2004). The findings show positive effect of cash ratio on the performance of the fund. Therefore, better liquidity position results in better performance of mutual fund. The positive effect of cash ratio along with negative effect of size implies that large funds generally face liquidity constraints. Since, large size funds also invested in size trading strategy, therefore, they invested in large size stocks. Due to which, they may be unable to trade in market when some profitable bets are available.

We found positive effect of portfolio turnover ratio on performance measured with gross returns. This is contrary to Carhart (1997), Jan and Hung (2003), and Wermers (2000). This shows that mutual

fund trade actively to manipulate their gross returns to look better. All fund characteristics had a significant effect on gross returns but only a few like past performance, flow of funds, and cash ratio had a significant effect on risk adjusted return measured with conditional Carhart alpha. It implies that fund managers could make their returns favorable by managing fund characteristics but do not have such maneuverability with risk-adjusted return measured with conditional Carhart alpha. This further shows advantage of considering conditional Carhart alpha as investment strategy for investors.

We investigated effect of fund characteristics on trading strategy of mutual funds similar to Bar et al. (2011) and Chevalier and Ellison (1999). It provided better insights into the trading behavior of mutual funds. The fund characteristic which affected the trading strategy were not related to performance of mutual funds measured with conditional Carhart alpha. For instance, size of fund and expense ratio had an insignificant effect on the performance of mutual funds but affected trading strategy of mutual funds. Large sized mutual funds pursued value and momentum strategies more than small size funds. Similarly, cash ratio and flow of funds affected conditional Carhart alpha but not affected naïve trading strategies of mutual funds. Thus, the study showed that effect of past performance, flow of funds, and cash ratio on performance of mutual fund measured with conditional Carhart alpha was not due to particular investment strategy followed by these funds.

6. Conclusion

Mutual funds widely advertise about their past performance but simultaneously provide a disclaimer that past performance cannot be guaranteed. Further, with a plethora of so many mutual funds, investors search for the criteria to select mutual funds. The earlier research in this area has widely found non-persistence in the performance of mutual funds, though, investors chase winner funds. This puzzle has largely remained unresolved. With developments in the estimation methods, consistent and efficient estimates can disseminate more information on relationship between fund characteristics and performance. The study was an attempt in this direction wherein we applied dynamic panel approach to study the effect of fund characteristics on performance. Further, since funds attempt to improve their performance by merely following naïve strategies, therefore, we investigated such relationship as well. The main proposition here was that if same fund characteristics affect performance and trading strategy then investors should not pay for high management fee charged by the mutual funds. The study found past performance of mutual funds as the most important fund characteristic that affects the current year performance. The fund characteristics, flow of funds, and cash ratio, though were related to fund performance, but, not with naïve trading strategies.

Thus, major implication of the study for investors of mutual funds is that past year performance measured with conditional Carhart alpha, and liquidity ratio of mutual funds can be considered while selecting the mutual funds. Further, mutual funds not only should report their past gross returns and Sharpe ratio but also conditional Carhart alpha. Another justification for using conditional Carhart alpha as selection criteria is that study showed same fund characteristics affecting gross returns and trading strategies. This implies that gross returns can be manipulated to look better. Further, since fund characteristics which affected conditional Carhart Alpha had not been related to naïve strategies, therefore, the management fee charged by fund managers could be justified. Finally, the major contribution of the study has been that new and better insights could be developed about the existing relationship between fund characteristics and performance by applying developments in the estimation methods.

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Notes

1. Unit Trust of India (transfer of undertaking and repeal) Act, 2002 was passed under which Unit Trust of India Act, 1963 was repealed. Prior to this, Unit Trust of India (UTI), the public sector mutual fund was not under the

purview of SEBI (Mutual Funds) Regulations, 1996. Securities Exchange Board of India (SEBI) is the mutual fund regulatory body in India.

2. The Breusch-Pagan Multiplier test, Hausman test, and Breusch-Pagan test for heteroskedasticity are the post-estimation tests. The initial estimations have not been reported and can be made available upon request.

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Appendix A. Description of fund characteristics

(1) Size of funds under management (AUM): It is the total market value of investments managed by a mutual fund.

(2) Expense ratio (ER): It is the fee charged by mutual fund to investors for managing the funds. The charges include management fee, administrative fee and other operating costs. According to SEBI (Mutual fund) amendment regulations, 2010, equity mutual funds can charge a maximum of 2.5% for first Rs. 100 crore, 2.25% for next Rs. 300 crore, 2% for next Rs. 300 crore and 1.75% for the rest.

(3) Portfolio turnover ratio (PTR): It is frequency at which assets within fund are bought or sold. It is calculated as lower of sale or purchase of assets divided by total assets of the scheme. For the active mutual fund, it tells about the trading activity of fund manager.

(4) Cash ratio (CR): It is percentage of cash or near cash securities held by fund to total value of assets of fund.

(5) Net flow ratio (FLOW): We computed this variable following Sirri and Tufano (1998). We define this variable as growth in total net assets of fund which is not due to dividend or capital gains. Fund flow for fund "*i*" for year "*t*" is calculated as,

$$FLOW_{i,t} = \frac{TNA_{i,t} - TNA_{i,t-1}(1 + r_{i,t})}{TNA_{i,t-1}}$$

$TNA_{i,t}$ = total net assets for fund "*i*" for the year "*t*", and

$r_{i,t}$ = holding period return for fund "*i*" for the year "*t*" = $\frac{NAV_{i,t} - NAV_{i,t-1}}{NAV_{i,t-1}}$

The equation assumes that all flow occur at the end of the period as there has been no information on new flow of funds.

(6) Age of fund (AGE): It is the total number of years for which mutual fund has been in existence in India. We compute this variable as,

$$AGE_{y,t} = Registration\ year_y - t$$

where *registration year*$_y$ = registration year of y^{th} AMC with SEBI, and

"*t*" = corresponding year for which age has been calculated.

Appendix B. Sample size for the study

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
No. of Funds in Database	52	66	91	133	164	181	196	193	184	269
No. of Funds in Sample	39	46	62	86	97	122	132	159	162	158
Proportion of Funds in Sample (per cent)	75.000	69.700	68.130	64.660	59.150	67.400	67.350	82.380	88.040	58.740

Appendix C. Methodology for factor returns

All the stocks in the NSE-500 index have been considered to construct portfolio for factor returns. For the size and value factors, we have employed methodology proposed by Fama and French (1993). To obtain the size and value factors for the year "*t*", we have sorted the securities based on market capitalization of the year December, "*t*-1". We constructed two portfolios "*S*" and "*B*" based on size with 50% of stocks in upper and lower half each. We then sorted the securities based on book equity price to market equity price (BE/ME) of the year December, "*t*-1". For instance, if we are constructing, factor portfolios for the year 2004, we will take market capitalization and BE/ME for the year December, 2003. 33% of upper, middle and lower securities are put in three portfolios "*H*", "*M*", and "*L*". We construct six portfolios by the intersection of two size and three value portfolios, as S/L (small size with low BE/ME), S/M (small size with medium BE/ME), S/H (small size with high BE/ME), B/L (small size with low BE/ME), B/M (small size with medium BE/ME), B/H(small size with high BE/ME). We compute the value for factor SMB and HML as,

$$SMB = \frac{(S/L + S/M + S/H)}{3} - \frac{(B/L + B/M + B/H)}{3}$$

$$HML = \frac{(S/H + B/H)}{2} - \frac{(S/L + B/L)}{2}$$

For momentum factor, we applied the methodology provided by Fama and French website. We have applied 3/3 short term momentum strategy for momentum factor. The 3/3 strategy means that portfolio is constructed based on previous three months return and is held for another three months. First, to construct the momentum portfolio for the period of three months, m_t-m_{t+2}, we will take previous three month return for the period m_{t-3}-m_{t-1}. For instance, to construct momentum portfolio for the period Jan 2004—Mar 2004, we will compute the return on each security for the previous three months of Oct 2003—Dec 2003. We then sorted the stocks based on the previous three-month return. We construct two momentum portfolios with top 30% (winner, W) and bottom 30% (loser, L) from the return sorted securities. To remove the effect of size, we then sort the securities based on market capitalization. We form two size portfolios S and B with bottom and top 50% respectively based market capitalization sorted stocks. We then construct four portfolios with intersection of two size and two momentum portfolios as S/W, S/L, B/W and B/L. The momentum factor will be computed as,

$$MOM = \frac{(S/W + B/W)}{2} - \frac{(S/L + B/L)}{2}$$

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