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Do Mutual Funds Remain Persistent? Evidence from Pakistan

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Abstract: *This study investigates the performance persistence of 78 mutual funds of Pakistan for the period 2009-2015. The sample period is divided into two sub-periods, based on movement of KSE 100 index closing value. A skilled manager is a manager who can outclass the market consistently during both sub-periods. This study first estimates outer performance, selectivity, market timing and volatility timing skills using Capital Asset Pricing Model. The results show absence of persistence regarding Jensen alpha, selectivity and market timing skill. The study is making novel contribution by investigating persistence in volatility timing skill. The result reveals week evidence of persistence for volatility timing skill under four-index model.*

Keywords: Persistence, contingency tables, market timing, volatility timing, Pakistan mutual funds.

Introduction

For the last two decades, an increasing trend of investing in emerging market has been noticed among the investors. Mutual funds come up as a fast growing investment option to expedite investor's desire of making profits. A mutual fund is a collective venture in which small investors pool their money to buy securities. The fund is managed by a fund manager, serving as an agent for the investors. The manager's job is to analyse the economic, industry and government trends and then forecast the future earnings of these funds. These small investors, unaware of the technical complications of 'market efficiency', expect the fund managers to take care of their investments. If the fund managers are enriched with the superior information, it would be depicted in his forecasting skills.

Mutual funds offer the investors higher returns with minimal risks through portfolio diversification. Investors are not interested in earning short term profits only, rather in long term profits. So they are keen to know whether these profits are temporary or long term? Though the investors keep an eye on past performance of funds but they have great concern about the future performance as well. In fact, the individual and institutional investors will opt the performance methods that can help them to select the funds providing higher future results. Therefore, it is important to investigate whether funds sustain their performance or not? If performance of mutual funds in one period will be continued in the following period, the phenomenon is termed as performance persistence (Muruganandan, 2013).

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The quest of persistence is of prime importance to investors. If there is an indication of persistence in performance, the investors would incline towards funds with superior past performance and penalize poorly performers funds by taking out their investment. If investors find predictability in funds' performance, may transfer their investments towards winner funds to reap abnormal returns (Cuthbertson, Nitzsche, & OŚullivan, 2008). There are numerous studies that examine persistence in performance of mutual funds (Brown, Goetzmann, Ibbotson, & Ross, 1992; Vicente & Ferruz, 2005; Babalos, Caporale, Kostakis, & Philippas, 2008; Mwamba, 2013; Goetzmann & Ibbotson, 1994), and come up with mixed results. Studies by Wermers (2003); Cremers and Petajisto (2009); Huij and Post (2011) find evidence of persistence. Others investigate the reasons behind the persistence phenomenon. Carhart (1997) finds relationship between persistence and momentum factors and transaction costs. Gottesman and Morey (2007) find connection between persistence and expense ratio. Hoberg, Kumar, and Prabhala (2016) find that persistence is more profound when mutual funds face less competition from its rivals.

Persistence is an important component of fund's performance. As per efficient market hypothesis, no fund should outclass the market consistently on risk-adjusted basis. Emerging markets, like Pakistan are professed to be less efficient than developed markets and so one might perceive that they provide more opportunities to fund managers to get abnormal returns as compared to developed markets. Mwamba (2013) argue that the market itself contains some irrational agents that lead to inefficiency of markets and investors have heterogeneous expectations for risk and returns. This causes the fund managers to adjust their portfolios to opt for various investment strategies and trying to outclass the market. On the other hand, investors are also keen to know whether funds with superior performance in the past will continue their behavior in the subsequent period.

It is important to consider that a fund manager can beat the market either by pure chance or by skill. A chance-based performance will not continue while a skill-based performance will persist over episodes of time. So a purely chance based performance is the probability that the manager will beat the market by luck only while skill-based performance is attributable to manager's ability to beat the market through his selectivity, market and volatility timing skills (Arif & Jawaid, 2011).

Successful selectivity timing is defined as ability to select stocks that outperform other securities having similar level of non- diversifiable risk (Munoz, Vargas, & Marco, 2014). Market timing is defined as a strategy intended to improve performance by altering portfolio risk over periods of time in response to expectations about future returns in particular markets (Heaney, Hallahan, Josev, & Mitchell, 2007). Busse (1999) defines volatility timing as ability of a manager to reduce market exposure in anticipation of increase in market volatility, keeping other factors being constant.

This study investigate the persistence using 78 Pakistan mutual funds, as the industry has shown marvelous growth in number of funds and assets under management in recent last past years. In Pakistan, the first Mutual fund was introduced in 1962. By November 2015, the total number of funds operating in Pakistan has increased to 181 and net assets grown to Rs.291 billion (www.mufap.com.pk). Investigating persistence in a small and developing market is a challenging chore as there are data limitations issues. Klapper and Love (2004) argues that mutual fund industry require market integrity and market liquidity

for its growth. Market integrity refers to the phenomenon where there is no information asymmetry and no one can take advantage of information they possess. Market liquidity refers to the situation with low transaction cost and investors do not have to undergo any loss caused by large price movements. Emerging markets lack these phenomenon's so the models applicable to developed countries have some limitations when applied to the emerging countries. Therefore, this study would help the researchers to develop new understanding about the models applied to the emerging markets.

The Literature suggests several performance measures. Cortez, Paxson, and Armada (1999) argue that approaches like rank portfolio or regression (past performance on future performance) are not appropriate for small markets due to limitation of data availability. So we follow the contingency table. To cater various risk factors, mutual funds are categorized into Winners or Losers using Jensen-alpha, Fama and French (1993) and Carhart (1997). Very few studies have been done to investigate the persistence phenomenon for fund manager of emerging markets and for Pakistani market, we found only one. Hameed and Wazir (2015) analyses the Pakistan mutual fund industry from 1995-2010 and do not find persistence in performance and skills. Our study is different from previous study as the data is extended to 2015 and also investigating the persistence of volatility timing skill for the first time.

This study makes novel contribution by investigating persistence in volatility skill of mutual funds using Pakistani market. To our knowledge, literature does not show any study investigating persistence of volatility timing skill among mutual funds. Our results confirm that week evidence for persistence phenomenon is present for volatility timing skills only whereas all funds remain inconclusive for performance, selectivity skill and market timing skills.

The rest of the paper is structured as follow. First, the relevant literature is reviewed in section two, which is followed by data used in the empirical analysis. The methodology that is employed for analysis is discussed in section three and empirical results and interpretation are presented in section four. The last section concludes the study and gives policy implications

Literature Review

The most relevant studies on persistence in performance are reviewed in this section. Grinblatt and Titman (1992) are among the pioneer studies evaluating the persistence phenomenon. They use monthly returns of 279 funds from 1974-1984. Dividing sample period into two subsets comprising of 5 years, they find significant persistence in fund performance both for best-performing and worst-performing funds.

Hendricks, Patel, and Zeckhauser (1993) analysed quarterly returns data of funds from 1974-88. They define funds having consistent short-term abnormal performance as "Hot hands". However, they find little support for consistent funds having consistent superior performance and contrasting results for consistent under performers. They further show that survivorship bias does not affect the persistence of mutual funds.

One of the major contributions is made by Carhart (1997). He finds that funds which

have outperformed in the past year continue to outperform in the following year. However, this performance advantage largely fades away over longer episodes of time. Carhart endorses this advantage to momentum factor, arguing that recent outer performers tend to hold stocks with strong momentum (winning record) on average, though they don't essentially use a momentum strategy. The differences in expense ratios and transaction costs also attributed to this short-term performance persistence phenomenon.

Another contribution is made by Wermers (2003) covering the US industry for the period 1975-1994. They find short-term persistence among the mutual funds. They also highlight the reasons contributing to this short term phenomenon. They held responsible both the fund managers and investors. They find that investors chase last-year out performers and managers also invest the cash inflows in winners funds so that they can keep on performing well. Similarly, losing managers are reluctant to sell low-return stocks so these funds also continue to be losers.

Ferruz, Sarto, and Vargas (2004) find evidence of performance persistence while using 207 Spanish mutual over period of 1994 to 2002. They use parametric and non-parametric techniques to examine the possible presence of persistence. They also conclude that taking longer historical data does not increase the level of persistence.

Babalos et al. (2008) conducts study on Greek mutual funds for the sample period 1998 to 2004. They employ several regressions to measure the performance. They suggest that intercept of Carhart measure proves to be the most appropriate performance measure as it caters impact of most of the strategies mentioned in the literature. They find that performance persistence weakens when more risk factors are taken into account. They further conclude that no persistence is found after 2001. The increase in foreign institutional investors, "dilution effect" (funds flows towards past winners), improvement in regulatory environment and more competitive fund industry are the possible reasons.

Abdel-Kader and Qing (2007) find evidence of performance persistence for winners and losers over shorter period of time. They find similar results when uses the Jensen's alpha and Treynor ratio and concludes that it is indifferent to the choice of measure. Huij and Post (2011) use the rank portfolio approach to investigate persistence among emerging market funds for the period 1993 to 2006. Their results reveal strong persistence in performance of funds, concluding that these markets are less efficient as compared to developed markets so active managers can reap more benefits out of it. They further conclude that winner funds contribute more towards the return spread so investors can take advantage of "hot hands" effect by financing in more in recent winner funds. The rank-portfolio approach is not suitable for small sample size.

Su, Zhao, Yi, and Dutta (2012) fail to find any evidence of long term persistence for 42 Chinese mutual funds for the time period 2002 to 2009. They investigate performance persistence by calculating whether a fund outperform the market benchmark or not. They define winner if a fund beats the market benchmark. They conclude that winners repeat their performance during periods of negative market returns while losers maintain their performance during good market returns.

Mwamba (2013) examine the persistence of hedge fund managers' skills for boom and recession periods. They use 6500 hedge Fund managers across the world. The sample period extends from January 1995 to June 2010. For analysis, they divide the sample

period into four sub-sample periods to cater different economic cycles. They describe a skilled manager as a manager who can outclass the market for two consecutive sub-sample periods. They use contingency table, chi-square test and cross-sectional auto-regression technique to investigate persistence. They conclude that funds are able to outperform and this is attributable more towards market timing skill during recovery phases.

Flam and Vestman (2014) analyse the persistence of performance and selectivity kill for Swedish mutual funds industry for the period ranges from 1993 to 2013. They argue that persistence may be outcome of skill, so they use bootstrap analysis to investigate. They fail to find persistence in performance and stock-picking skill. They argue that positive or negative performance is attributable to good or bad luck only.

Basu and Huang-Jones (2015) analyse the performance and persistence by using data of 498 mutual funds for the period 2000 to 2010 of emerging economies. They employ rank portfolio approach, dividing funds into equally weighted deciles, placing winners into decile 10 and losers to decile 1. A positive statistically significant difference between the top and bottom decile alpha would confirm persistence. They conclude that persistence exists mainly for poor performing funds. They also add that persistence weakens for longer holding period, suggesting that persistence is mainly observed over shorter periods. The rank portfolio approach of splitting funds into decile is suitable when large number of funds are available.

Hameed and Wazir (2015) analyses Pakistani mutual funds from 1995-2010. They examine the performance and manager skills for the sample period. They find that mutual funds are not able to show any persistence regarding performance and skills of the managers. They argue that lack of persistence is a result of efficient mutual funds market and hence the prices adequately reveal all the available information. They split the sample period into pre-financial and post financial crises era. However, we investigate persistence using median of market index as cut-point. So our sample period comprises of two sub-periods below the cut-point and after the cut-point.

Sun, Wang, and Zheng (2016) examine persistence hedge fund performance over the period 1994 to 2014. They conclude that funds with better downside returns outclass their other rivals in the following periods. Whereas funds with high upside return under perform their rivals in down markets and shows mixed results for future up markets. Their results confirm persistence in fund markers in weak markets only.

Vidal and Vidal-Garcca (2016) conduct study on European countries for the year 1990-2015. The sample contains daily data for 2052 open-end mutual funds. They find significant short-term persistence for all the countries and both for top-decile and bottom-decile mutual funds. They argue that their results support both phenomenon “hot hands” (winners being followed by winners) and “Cold hands” (loosers being followed by loosers”). Matallín-Sáez, Soler-Domínguez, and Tortosa-Ausina (2016) investigate performance persistence among US equity mutual funds for the period 1990 to 2015. They report persistence in mutual fund performance, more profound in best performing funds. They further find that performance and persistence varies depending upon the sample period, as they do not find persistence for post financial crises, i.e. 2008 to 2015. They argue that persistence phenomenon is conditioned upon the sample period used, one possible reason for the inconclusive results previously reported in literature.

Hoberg et al. (2016) investigate how competition among the funds affect the persistence? They use 3390 open-end US equity funds over the period 1980 to 2012. They develop a new measure of manager skill, "customized peer alpha". They conclude that more competition limits the persistence phenomenon. They argue that intense competition will lead to fast trading and exploits the alpha generating activities. These circumstances will make difficult for the managers to beat other active managers.

Methodology

To explore performance persistence among the mutual funds, analysis begins with calculating performance coefficients. First the simple CAPM model is used. It is further extended to three-factor Fama & French model and four-factor Carhart model. Babalos et al. (2008) argue that Carhart intercept proves to be the most appropriate performance measure as it caters impact of most of the strategies mentioned in the literature. We provide results for the single-index and four index model. Using the CAPM, the returns characteristics of mutual funds can be calculated through the following equation:

$$R_{pt} - R_{ft} = \alpha_p + \beta_1(R_{mt} - R_{ft}) + \epsilon_{it} \tag{1}$$

where R_{pt} represents the fund return at period t, R_{ft} is the risk-free rate at period t, R_{mt} represents the market returns (benchmark) at period t. The coefficient β_1 is systematic risk, measures the relative risk of the portfolio to the benchmark, α_p, Jensen's alpha, measures the returns on a portfolio having zero covariance with the return on the benchmark. We measure performance by Jensen alpha, regressing excess mutual fund returns against the market returns.

Selectivity and Market Timing Skills

Following the Jensen alpha's results, Treynor and Mazuy (1966) established the models to examine the market timing skill. Using this skill, they argue that the managers can adjust their portfolios to predict the market. They can adjust their risky holdings to increase (decrease) the fund market beta in anticipation of an expected up (down) market. As a result, the β fluctuates over time and is no longer stationary. Hence, the relationship between mutual fund return and market return no longer remain linear. Treynor and Mazuy (1966) extend the CAPM model by introducing the square return term into the basic model. The model thus takes the following form

$$R_{pt} - R_{ft} = \alpha_p + \beta_1(R_{mt} - R_{ft}) + \eta_i(R_{mt} - R_{ft})^2 + \epsilon_{it} \tag{2}$$

Where α_p represents the selectivity timing and η represents the market timing ability and all other variables remain the same as in equation (1). The negative coefficient of the squared term shows that mutual funds lack the ability to anticipate the market. Manager with market timing skill will increase η during the up market and vice versa. Treynor and Mazuy (1966) find that a positive η shows that the portfolio's returns are more responsive to large positive market returns. Here the intercept represents the selectivity skill. A fund

manager lacking market timing skill, will only depend on selectivity skill to earn abnormal returns.

Matallín-Sáez et al. (2016) argues that results are sensitive to the model used or the benchmark considered. We extend the model by incorporating Fama and French (1993) and then Carhart (1997) models due to their wide appreciation in Finance literature. Goetzmann, Massa, and Rouwenhorst (2000), In et al. (2014), who find that this multi-factor model improves market return timing coefficients by reducing measurement bias.

The model thus takes the following form:

$$R_{pt} - R_{ft} = \alpha_p + \beta_1(R_{mt} - R_{ft}) + \beta_2 SMB_t + \beta_3 HMB_t + \eta_i(R_{mt} - R_{ft})^2 + \epsilon_{it} \quad (3)$$

SMB [1] and HML [2] represent the size and book-to market portfolios respectively. A significant positive β_2 portrays that size effect exists. While, a significant negative β_2 depicts that size effect does not exist. However, insignificant β_2 mean that size factor fails to supplement any significant returns to the portfolio. A positive significant β_3 depicts that value effect exists. The presence of value effect shows that high book-to-market portfolios are adding more portfolio returns than the low book- to-market portfolio. However, a negative significant β_3 confirms that the growth effect exists, i.e. returns of the portfolio is attributable more by low book-to-market portfolio.

Carhart (1997) claims that one-year momentum in stock-returns has a significant impact on portfolio returns and thus modifies three-factor model by incorporating momentum factor. Now the extended model takes the following form:

$$\begin{aligned} R_{pt} - R_{ft} = \alpha_p + \beta_1(R_{mt} - R_{ft}) + \beta_2 SMB_t + \beta_3 HMB_t \\ +\beta_4 MOM - t + \eta_i(R_{mt} - R_{ft})^2 + \epsilon_{it} \end{aligned} \quad (4)$$

In above equation, MOM [3] captures the difference between past winners and losers. A positive significant β_4, is an expressions that momentum factor is adding more value to the portfolio return. Whereas, a negative significant β_4 shows that the past loser portfolio is adding more positive returns than the past winner portfolio (contrarian effect). So Selectivity timing and market timing will be calculated from equation 4.

Volatility Timing

Holmes and Faff (2004) develop a cubic model, based on the market timing model of Treynor and Mazuy (1966) for exploring the volatility timing skill, using Australian mutual fund industry. They argue that volatility timing ability is reflected by a market exposure that is impacted by market volatility. The easiest way is by estimating a time-varying beta for a specific fund, comprises of a mean beta and a component, depending on the squared

[1] SMB = [1/3(Small Low+ Small Medium+ Small High)- 1/3 (Big Low+ Big Medium+ Big High)]
[2] HML= [1/2(Small High+ Big High)-1/2(Small Low+ Big Low)]
[3] MOM= [$\frac{1}{2}$(Small Winner + Big Winner) - $\frac{1}{2}$ (Small Looser + Big Looser)

excess market returns. Therefore, by incorporating a time-varying beta component, they develop a cubic market model as per given in equation 5:

$$r_{it} = \alpha_p + \beta_i r_{mt} + \gamma_i r_{mt}^2 + \delta_i r_{mt}^3 + \epsilon_{it} \tag{5}$$

Where α_p represents the fund's security ability. β_i represents sensitivity to the market, γ_i represents the fund's market timing ability and a positive coefficient represents the superior market timing ability. δ_i is coefficient of volatility timing ability, a negative coefficient is an indication of existence of volatility timing ability.

Following Fama and French (1993) and Carhart (1997), the above equation takes the following form, by incorporating size, book-to-market and momentum factors:

$$r_{it} = \alpha_i + \beta_i r_{mt} + \delta_i r_{mt}^3 + \beta_2 SMB_t + \beta_3 HMB_t + \beta_4 MOM - t + \epsilon_{it} \tag{6}$$

Performance Persistence

In order to investigate the persistence in performance, we follow non-parametric measure i.e contingency tables. Contingency tables for the above mentioned performance measures are constructed. Cortez et al. (1999) conclude that approaches like rank portfolio or regression (past performance on future performance) are not suitable for small markets due to limited data availability constraint.

For two-period persistence test, this study constructs contingency tables for winners and losers (Mwamba, 2013). This test scrutinizes the frequency with which winners and loser funds remain in the same category in both time-periods. The median fund returns for each investment category is calculated to categorize funds. To proceed, the mutual funds are categorized as winners (W) or losers (L). A manager is defined as a winner (looser) if the performance measure (intercept term as result of his investment strategies) is higher (lower) than the median of all the performance measures in that category (Mwamba, 2013).

WW are defined as winners in two consecutive periods, LL are defined as losers in two consecutive periods. While winner in first period and loser in second period is denoted by WL, whereas, loser in first period and winner in second period is termed as LW. Performance persistence is evident if the statistical interference confirms that a greater number of funds are categorized in the WW/LL groups compared to the other two. These tables show the probability of funds to be remained in the same category in the following period. Several statistical tests will be used to test whether performance persistence is strong enough. The null hypothesis states that performance in first period has no relation with performance in subsequent period. Hence corresponding to an odds ratio of 1. The null hypothesis of no persistence would be rejected if statistical results confirm that winners in one sub-period remain winner in second sub-period.

Three statistical methods are employed, testing a different facet of persistence. This study uses cross-product ratio (the Odds ratio) posited by Brown and Goetzmann (1995), Z-test posited by Malkiel (1995) and the chi-squared test by Kahn and Rudd (1995). First,

the cross product ratio (CPR) is calculated using following formula:

$$CPR = \frac{(WW * LL)}{(WL * LW)} \tag{7}$$

Equation (7) measures the ratio of the funds showing persistence in performance to the ones lacking persistence. If significantly larger number of funds exists in the WW/LL categories compared to the other two categories (WL or LW), it suggests that performance persistence exists (Grinblatt & Titman, 1992). In other words, if the performance in the first period is unrelated to the performance in the subsequent period, it corresponds to a CPR of one. Therefore under hypothesis of no persistence, CPR would be equal to 1. In order to test the statistical significance, Z-test is conducted assuming sample is asymptotic normally distributed. The standard error is calculated in the following manner.

$$\sigma = \sqrt{(1/WW) + (1 + WW) + (1 + LW) + (1 + LL)} \tag{8}$$

Z-statistic is employed to confirm the significance of the CPR. It is calculated by dividing the log Odd ratio by its standard error, shown by equation (8).

$$Z - Stats = \frac{Ln(CPR)}{\sigma(LnCPR)} \tag{9}$$

The Z-values confirms the persistence for the specific time-period to be investigated. The value of Z-statistic greater than the critical value will lead to the rejection of the null hypothesis, demonstrating that performance persistence exists.

The critical values of Z-stats for 1%, 5% and 10% are 2.575, 1.96 and 1.645 respectively.

Carhart (1997) conclude that Chi-square statistics is more powerful and robust than other estimation techniques, as it carefully tackle the survivorship bias. Hence we employ chi-square test statistic to compare the observed frequencies for the four categories (WW, LL, WL, LW) with the tabulated frequencies. The test is given by Mwamba (2013):

$$Chi - square = \frac{(WW - D_1)^2}{D_1} + \frac{(WL - D_2)^2}{D_2} + \frac{(LW - D_3)^2}{D_3} + \frac{(LL - D_4)^2}{D_4} \tag{10}$$

where D1, D2, D3 and D4 can be calculated using following equations:

$$D_1 = \frac{(WW + WL) * (WW + LW)}{N}$$

$$D_2 = \frac{(WW + WL) * (WL + LL)}{N}$$

$$D_3 = \frac{(LW + LL) * (WW + LW)}{N}$$

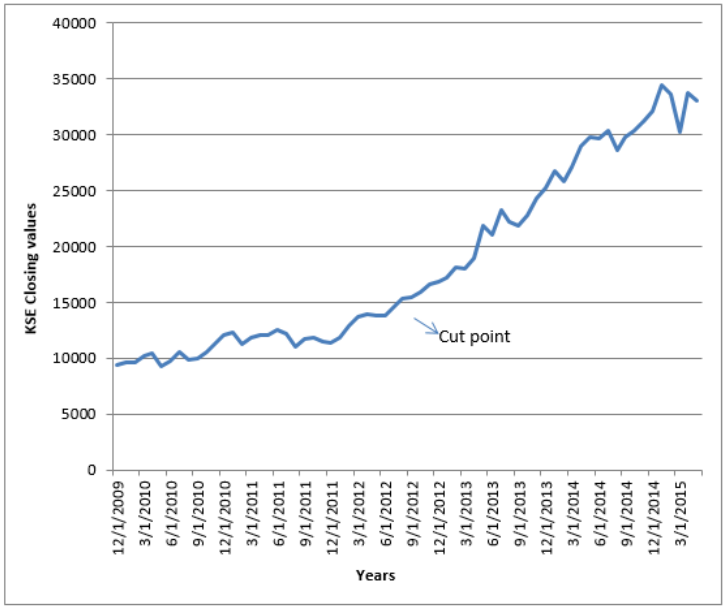
$$D_4 = \frac{(LW + LL) * (WL + LL)}{N}$$

The Chi-square tabulated values for 1%, 5% and 10% significance level are 6.634897 3.841459 and 2.705543 respectively.

Empirical Results and Discussion

This empirical study covers the period from December 2009 to May 2015. To assess the performance persistence the entire sample period has been divided into two sub-periods based on the movement of KSE 100 index closing value, which is shown in Chart 1. The median of the KSE closing returns has been taken, dividing into sub-period 1 ranging from Dec 2009 to August 2012 and sub-period 2 from September 2012 to May 2015. So sub-period 1 and 2 contains 2.8 years. At the cut-point a remarkable difference can be observed in the market index behaviour. After the cut-point, a continuous increasing trend has been observed in the market index value.

Figure 1
Movement of KSE 100 Index closing value for the period from December 2009 to May 2015



Descriptive Statistics

This section presents the details of descriptive statistics of 78 Pakistan mutual fund excess returns and market returns used in the study for the time period 2009-15. We have constructed equally weighted portfolio, Rp to make assessment of mutual funds at aggregate level.

Table 1 presents summary statistics for equally-weighted mutual fund excess returns and market returns for the whole sample ranging from years 2009 to 2015. It has 66 observations in total. The positive means return values of Rp indicates that mutual funds is providing profits to its investors. On average, the mean returns of firms in the sample

is 1.030 and ranges from -7.8754 to 14.1315. On average, the Rp, offering high standard deviation seems to be more risky. The mutual funds industry offer larger excess kurtosis and more positive skewness as compared to the market returns. Panel A and B represents summary statistics for the sub-period 1 and 2 respectively. Sub-period 2 offers higher returns both for the market and mutual funds. Sub-period 1 presents higher skewness and larger excess kurtosis compared to sub-period 2. Table A1 in Appendix reports the names and categories of mutual funds used in this analysis. Table A2, A3, A4 and A5 in Appendix.

Table 1
Mutual Funds Returns for the period December 2009 to May 2015

Variables	Definitions	Obs	Mean	Maximum	Minimum	Std.Dev.	Skewnes	Kurtoss
Rp	Return of Mutual funds	66	1.03	14.1315	-7.8754	4.2066	0.8321	4.6442
Rm	Return of Market	66	0.028	0.2011	-0.0994	0.0591	0.2811	3.8398
Panel A: Summary Statistics for the period December 2009 to August 2012								
Variables	**Definitions**	**Obs**	**Mean**	**Maximum**	**Minimum**	**Std.Dv**	**Skewness**	**Kurtosis**
Rp	Return of Mutual funds	33	0.358	14.1315	-7.49171	3.8876	1.2743	6.8372
Rm	Return of Market	33	0.02	0.18134	-0.09935	0.0575	0.0133	3.9347
Panel B: Summary Statistics for the period September 2012 to May 2015								
Variables	**Definitions**	**Obs**	**Mean**	**Maximm**	**Minimm**	**Std.Dev**	**Skewnes**	**Kurtoss**
Rp	Return of Mutual funds	33	1.702	13.4022	-7.8754	4.4609	0.4746	3.6098
Rm	Return of Market	33	0.037	0.2011	-0.0691	0.0605	0.485	3.5461

reports the coefficients of Jensen alpha, selectivity, market and volatility timing respectively, obtained from equations (1), (4) and (6) using 78 mutual funds from Pakistan.

Then the winners/losers managers are recognized after comparing their coefficients with the medians of the managers using same investment strategy. These are also reported in tables 4, 5 and 6. Once the winners and losers are identified, it is easy to work out the persistence in performance of mutual fund industry using two period performance persistence analysis. Three techniques are used to perform analysis: the contingence table, the chi-square statistics and the cross-sectional regression method. First, for the contingence table, we employ the cross product ratio and by comparing the Z-statistics value and critical value will determine the persistence of fund managers.

Table 2 reports the CPR and Z-statistics for outer performance, the selectivity skill, the market timing and the volatility timing skills using single-index and four-index models. The row (1) reports the Z-stats of the contingency table of winners and losers portfolios for sub-period 1 and sub-period 2, based on Jensen alpha (outer performance) using single-index and four-index models. In case of no persistence, CPR value should be equal to 1 and Z-stats value should be less than 1.96 at 5%. The CPR is 0.406 and Z-stats value is -1.940 for outer performance under single-index model. However under four-index model, the reported CPR and Z-stats is 1.056 and 0.120 respectively. The null hypothesis states there is no persistence in performance. Keeping this in view, the result indicates that the fund managers do not demonstrate persistence in outer performance in sub-period 1 and sub-period 2 under single-index and four-index models. With 1% confidence level, we accept the null hypothesis.

Table 2
CPR and Z-Statistics Value for Performance Persistence

	Single-Index		Four-Index	
	CPR value	**Z-Stats**	**CPR value**	**Z-Stats**
Outperformance	0.406	-1.94	1.056	0.12
Selectivity	0.935	-0.149	0.762	-0.6
Market Timing	1.147	0.303	0.573	-1.223
Volatility Timing	1.407	0.754	2.362	1.859

This table reports the CPR and Z-statistics for outer performance, the selectivity skill, the market timing and the volatility timing skills using single-index, three-index and four-index models for 78 mutual funds of Pakistan. CPR denotes the Cross Product Ratio and Z-stats represents the calculated Z-stats to make decision about rejection of null hypothesis.

Row (2) exhibit the Z-stats of the contingency table of winners and losers for both periods, based on selectivity skill using single-index and four-index models. Under single-index model, the CPR is 0.935 and Z-stats is -0.149. The null hypothesis of no persistence is accepted as the Z-stats score lies within the range of two tail Z-score. Hence these results depict that fund manager lack persistence in selectivity skill. Same results are supported when four-index model is used. Here, the reported CPR value is 0.762 and Z-stats is -0.600. These results also support that funds managers lack the persistence in selectivity ability both under single-index and four-factor models. We can say with 1% confidence level that fund managers lack persistence in selectivity skill.

Row (3) illustrates the contingency table reporting the winners and losers for sub-period 1 and sub-period 2, based on market timing skill when single-index and four-index models are used. The null hypothesis states that there is no persistence in market timing skill of fund managers. The CPR value is 1.147 and Z-stats value is 0.303, we cannot reject the null hypothesis as calculated Z-stats value is less than the critical value. Therefore, fund managers do not exhibit persistence in market timing skill. These results are further supported, when four-index model is used. Under four-index model, the reported CPR is 0.573 and Z-stats is -1.223. These figures suggest that funds managers lack persistence in market timing skills.

Row (4) illustrates the contingency table reporting the winners and losers for sub-period 1 and sub-period 2, based on volatility timing skill. The null hypothesis states that there is no persistence in volatility timing skill of fund managers. Under the single index model, the reported CPR is 1.407 and Z-stats value is 0.754, therefore cannot reject the null hypothesis as calculated Z-stats value is less than the critical value. Therefore, a fund manager fails to exhibit persistence in volatility timing skill. Under four index model, we find little evidence of volatility timing at 10%. The CPR value and Z-stats under four-index model is 2.362 and 1.859 respectively. At 10% significance level, the value of Z-stats is higher than the critical value, so we find week evidence of persistence in volatility timing.

Table 3 computes the chi-square statistics for each manager's skill for the sub- period 1 and 2. These calculate chi-square values are then compared with tabulated chi-square values for one degree of freedom.

Row (1) illustrates the chi-square values for sub-period 1 and sub-period 2, based on Jensen alpha (outer performance) under single-index and four-index models. The chi-square value for Jensen-alpha is 3.826 under single-index model. The null hypothesis states there is no persistence in performance. The calculated value is greater than the tabulated value for 1%. Therefore, we can reject the null hypothesis. Keeping this in view, we can state with 99% confidence that the fund managers exhibit persistence in outer performance for sub-period 1 and sub-period 2, under the single-index model. However, contrasting results are reported when four-index model is used. Under four-index model, the reported Chi-square value is 0.014. These figures suggest that funds managers lack persistence in outer performance.

Table 3
Chi-Square Statistics value

	Single-Index	**Four-Index**
Outperformance	3.826*	0.014
Selectivity	0.022	0.361
Market Timing	0.092	0.581
Volatility Timing	0.57	3.512*

This table reports the chi-square value for outer performance, the selectivity skill, ,the market timing and the volatility timing skills using single-index, three-index and four-index models for 78 mutual funds of Pakistan

Row (2) reveals the chi-square values for both periods, based on selectivity skill under single-index and four-index models. The null hypothesis of no persistence is accepted as the calculated score is less than the associated values for all the significance levels. Both index-value models offer values less than the critical values. As a result, we can say with 99% confidence level that the fund managers lack consistence in the stock-picking ability and their outer performance is based on luck rather on skill.

Row (3) reports the chi-square value for sub-period 1 and sub-period 2, based on market timing skill. Here the chi-square value is 0.092 and 0.581 under single-index and four-index models respectively. As the calculated chi-square value is less than the critical values at 1%, 5% and 10% significance level. These results suggest that we can reject the null hypothesis with 99% significance level and confirm that fund manager's lacks persistence in market timing skills under all the estimation methods.

Row (4) reports the chi-square value for sub-period 1 and sub-period, based on volatility timing skill. The reported chi-square value is 0.570 as per the results of single-index model. The calculated chi-square value is less than the critical values at 1%, 5% and 10% significance level. These results suggest that we cannot reject the null hypothesis with 99% significance level and confirm that fund managers do not possess persistence in volatility timing skills. Once again, the opposite behavior is noticed when Carhart four index model is used. The calculated Chi-square value is 3.512, which is greater than the tabulated value. Hence it can be concluded that the fund's managers possess persistence in volatility timing at 10% confidence level.

In the nutshell, there is no evidence of persistence of mutual fund performance except little evidence for the volatility timing skill. The absence of performance and selectivity timing is in line with Flam and Vestman (2014); Mwamba (2013). They report that positive or negative performance is attributable to good or bad luck only. The lack of long-term persistence is in consistent with literature (Carhart, 1997; Hameed & Wazir, 2015; Basu & Huang-Jones, 2015; Benos & Jochec, 2011) highlight various reasons for lack of long-term persistence. The reasons can be an increase in management fee charged by good performing funds or desire of successful managers to hunt for more lucrative opportunities.

Our results are also in line with Sun et al. (2016), who report consistency in funds markets for weak markets only and not for strong markets. Our sub-period 2 is the boom markets and so do not find evidence for persistence. Our results are also in agreement with Matallín-Sáez et al. (2016) who report lack of persistence in post-financial era .i.e. 2008 to 2015.

Conclusion

This study examines the persistence regarding the timing abilities of Pakistani mutual funds. The monthly data of mutual funds is used for the period 2009 to 2015. As the industry is still in its embryonic stage age, so this study is limited to a total of 78 open end funds. This study employs cross-product ratio (the Odds ratio), Z-test and the chi-squared test (1995). The results suggest that the industry lacks the persistence regarding performance, selectivity skill and market timing skill. As far as volatility timing skills are concerned, the study finds week evidence to support this skill under Carhart four index model.

These results are consistent to the previous literature suggesting that persistence fades away with longer time horizons. The results are also in line with the view that emerging markets are less efficient than developed markets and they offer greater avenues for fund managers to get abnormal returns. Another possible explanation of no persistence can be increased competition among the mutual funds managers. Persistence is not only to outperform the benchmark but also the capability to generate and sustain the outer performance over the time horizon. Pakistan mutual fund is a small market in terms of number of investors and there are less avenues for fund managers to exploit excess returns. Hoberg et al. (2016) argue that outer performance over competitors is a signal of skill. Increased competition makes it difficult for fund managers to outclass other active managers. Hence, this increased competition among the funds can reduce persistence. No doubt, competition within the industry are important but when there are zero entry and exit costs.

The implications of this study are that it helps the managers to decide whether to continue their existing management style or switch to some new style. Another implication is that investors can reap maximum from "hot-hands effect" by investing in recent winners and making intelligent investment decisions. It is the need of an hour that the government should intervene to help the mutual fund market. Steps should be taken to increase the investors' base and provide healthy competition among the managers.

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Appendix

A1: Funds names and their categories

Code	Funds_name	Category
R1	ABL Income Fund	Income
R2	AKD Aggressive Income Fund	Aggressive Fixed Income
R3	AKD Opportunity Fund	Equity
R4	Al Ameen Islamic Aggressive Income Fund	Shariah Compliant Aggressive Fixed Income
R5	Al Ameen Shariah Stock Fund	Shariah Compliant Equity
R6	Al Meezan Mutual Fund	Shariah Compliant Equity
R7	Alfalah GHP Alpha Fund	Equity
R8	Alfalah GHP Income Fund	Income
R9	Alfalah GHP Income Multiplier Fund	Aggressive Fixed Income
R10	Alfalah GHP Islamic Income Fund	Shariah Compliant Income
R11	Alfalah GHP Islamic Stock Fund	Shariah Compliant Equity
R12	Alfalah GHP Stock Fund	Equity
R13	Alfalah GHP Value Fund	Asset Allocation
R14	Askari Asset Allocation Fund	Asset Allocation
R15	Askari High Yield Scheme	Aggressive Fixed Income
R16	Askari Islamic Asset Allocation Fund	Shariah Compliant Asset Allocation
R17	Askari Islamic Income Fund	Shariah Compliant Income
R18	Askari Sovereign Cash Fund	Money Market
R19	Atlas Income Fund	Income
R20	Atlas Islamic Income Fund	Shariah Compliant Income
R21	Atlas Islamic Stock Fund	Shariah Compliant Equity
R22	Atlas Money Market Fund	Money Market
R23	Atlas Stock Market Fund	Equity
R24	BMA Chundrigar Road Savings Fund	Aggressive Fixed Income
R25	BMA Empress Cash Fund	Money Market
R27	Faysal Asset Allocation Fund	Asset Allocation
R28	Faysal Balanced Growth Fund	Balanced
R29	Faysal Income & Growth Fund	Aggressive Fixed Income
R30	Faysal Savings Growth Fund	Income
R31	First Capital Mutual Fund	Equity
R32	First Habib Income Fund	Income
R33	First Habib Stock Fund	Equity
R34	HBL Income Fund	Income
R35	HBL Multi Asset Fund	Balanced
R36	HBL Stock Fund	Equity
R37	JS Fund of Funds	Fund of Funds
R38	JS Growth Fund	Equity
R39	JS Income Fund	Income
R40	JS Islamic Fund	Shariah Compliant Equity

A1: Funds names and their categories

Code	Funds_name	Category
R41	JS Large Cap Fund	Equity
R42	JS Value Fund	Equity
R47	Lakson Equity Fund	Equity
R48	Lakson Income Fund	Income
R49	Lakson Money Market Fund	Money Market
R50	MCB Cash Management Optimizer	Money Market
R51	MCB DCF Income Fund	Income
R52	MCB Pakistan Asset Allocation Fund	Asset Allocation
R53	MCB Pakistan Islamic Stock Fund	Shariah Compliant Equity
R54	MCB Pakistan Sovereign Fund	Income
R55	MCB Pakistan Stock Market Fund	Equity
R56	Meezan Cash Fund	Shariah Compliant Money Market
R57	Meezan Islamic Fund	Shariah Compliant Equity
R58	Meezan Islamic Income Fund	Shariah Compliant Income
R59	Meezan Sovereign Fund	Shariah Compliant Income
R60	NAFA Government Securities Liquid Fund	Money Market
R61	NAFA Income Fund	Income
R62	NAFA Income Opportunity Fund	income
R63	NAFA Islamic Aggressive Income Fund	Shariah Compliant Aggressive Fixed Income
R64	NAFA Islamic Asset Allocation Fund	Shariah Compliant Asset Allocation
R65	NAFA Multi Asset Fund	Balanced
R66	NAFA Savings Plus Fund	income
R67	NAFA Stock Fund	stock
R70	National Investment Unit Trust	equity
R71	NIT ? Government Bond Fund	Income
R72	NIT ? Income Fund	Income
R73	Pak Oman Advantage Asset Allocation Fund	Asset Allocation
R74	Pak Oman Advantage Islamic Income Fund	Shariah Compliant Income
R75	Pak Oman Islamic Asset Allocation Fund	Shariah Compliant Asset Allocation
R76	Pakistan Capital Market Fund	Balanced
R77	Pakistan Cash Management Fund	Money Market
R78	Pakistan Income Enhancement Fund	Aggressive Fixed Income
R79	Pakistan Income Fund	Income
R80	Pakistan Int'l Element Islamic Asset Allocation Fund	Shariah Compliant Asset Allocation
R81	PICIC Energy Fund	Equity
R82	UBL Liquidity Plus Fund	Money Market
R83	Unit Trust of Pakistan	Balanced
R84	United Growth & Income Fund	Aggressive Fixed Income
R85	United Stock Advantage Fund	Equity

A2: Jensen Alpha from Equation (1)

	Period_1			Period_2			
		Median	W/L		Median	W/L	Winner/Loser
R2	-0.0031		W	0.00944		W	WW
R9	-0.00988		L	0.00894		W	LW
R15	-0.00911		W	0.0089		L	WL
R24	-0.00914		L	0.01195		W	LW
R29	-0.0053		W	0.00818		L	WL
R78	-0.00449		W	0.00849		L	WL
R84	-0.01458	-0.00911	L	0.00917	0.00894	W	LW
R13	-0.02564		L	-0.01633		L	LL
R14	-0.0098		L	-0.01243		W	LW
R27	-0.0135		L	-0.01639		L	LL
R52	-0.01573		L	0.00252		W	LW
R73	-0.02052	-0.01573	L	-0.00994	-0.01243	W	LW
R28	-0.02368		L	-0.00847		L	LL
R35	-0.01373		W	-0.01599		L	WL
R65	-0.01111		W	-0.00607		W	WW
R76	-0.01489		L	-0.00602		W	LW
R83	-0.01416		L	-0.00853		L	LL
R86	-0.001	-0.01395	W	0.00568	-0.00727	W	WW
R3	0.00148		W	-0.01957		W	WW
R7	-0.02069		L	-0.02586		L	LL
R12	-0.02118		L	-0.02665		L	LL
R23	-0.02211		L	-0.01292		W	LW
R31	-0.01116		W	-0.02579		L	WL
R33	-0.01846		W	-0.02292		L	WL
R36	-0.01409		W	-0.02501		L	WL
R38	-0.02128		L	-0.02089		L	LL
R41	-0.0428		L	-0.01534		W	LW
R42	-0.01609		W	-0.00798		W	WW
R47	-0.01985		L	-0.02075		L	LL
R55	-0.02465		L	-0.01531		W	LW
R70	-0.0203		L	-0.01062		W	LW
R81	-0.00831		W	-0.01979		L	WL
R85	-0.01961		W	-0.01774		W	WW
R67	-0.01477	-0.01973	W	-0.01259	-0.01968	W	WW
R37	-0.0141	-0.0141	W	-0.03034	-0.03034	W	WW
R1	-0.00622		L	0.00723		L	LL
R8	-0.00418		L	0.00599		L	LL
R19	-0.00798		L	0.00817		W	LW
R30	-0.00401		W	0.00818		W	WW
R32	-0.00319		W	0.00791		W	WW
R34	-0.0023		W	0.00753		W	WW
R39	-0.01394		L	0.00765		W	LW
R48	-0.00224		W	0.00819		W	WW
R51	-0.00352		W	0.00672		L	WL
R54	-0.00282		W	0.00701		L	WL
R61	-0.01105		L	0.00889		W	LW
R62	-0.00576		L	0.01067		W	LW
R66	-0.0041		L	0.00727		L	LL
R71	-0.0038		W	0.00735		L	WL
R72	-0.00379		W	0.00721		L	WL

A2: Jensen Alpha from Equation (1)

	Period_1			Period_2			
		Median	**W/L**		**Median**	**W/L**	**Winner/Loser**
R79	-0.00411	-0.00405	L	0.0073	0.007443	L	LL
R18	-0.0018		W	0.00703		L	WL
R22	-0.00466		L	0.0071		L	LL
R25	-0.0039		W	0.00757		W	WW
R49	-0.00325		W	0.00724		W	WW
R50	-0.00309		W	0.00676		L	WL
R60	-0.00507		L	0.00712		W	LW
R77	-0.00541		L	0.00711		L	LL
R82	-0.00488	-0.00428	L	0.00738	0.007117	W	LW
R4	-0.00847		L	0.00827		L	LL
R63	0.0068	-0.00083	W	0.00957	0.008918	W	WW
R16	-0.01185		W	-0.01272		L	WL
R64	-0.00936		W	-0.00407		W	WW
R75	-0.01309		L	-0.00739		L	LL
R80	-0.02454	-0.01247	L	-0.00394	-0.00573	W	LW
R5	-0.01415		W	-0.01471		L	WL
R6	-0.01396		W	-0.01188		W	WW
R11	-0.02351		L	-0.01833		L	LL
R21	-0.01744		W	-0.01151		W	WW
R40	-0.04814		L	-0.01346		L	LL
R53	-0.0259		L	-0.01197		W	LW
R57	-0.01668	-0.01744	W	-0.01324	-0.01324	W	WW
R10	-0.00267		W	0.00543		L	WL
R17	-0.00338		W	0.00651		W	WW
R20	-0.00453		L	0.00708		W	LW
R58	-0.00381		L	0.00819		W	LW
R59	-0.00411		L	0.00588		L	LL
R74	-0.00367	-0.00374	W	0.00592	0.006212	L	WL
R56	-0.00353	-0.00353	W	0.00697	0.00697	W	WW

A3: Selectivity skill from Equation (4)

	Period_1			Period_2			Winner/Loser
		Median	W/L		Median	W/L	
R2	-0.0099		W	0.00511		W	WW
R9	-0.0196		L	0.00427		L	LL
R15	-0.01441		L	0.00537		W	LW
R24	-0.01064		W	0.01261		W	WW
R29	-0.01086		W	0.00461		W	WW
R78	-0.00935		W	0.00363		L	WL
R84	-0.02293	-0.01086	L	0.00398	0.004609	L	LL
R13	-0.02712		L	-0.02087		L	LL
R14	-0.01517		W	-0.01598		W	WW
R27	-0.01762		W	-0.0207		L	WL
R52	-0.01833		W	-0.00254		W	WW
R73	-0.02279	-0.01833	L	-0.01701	-0.01701	W	LW
R28	-0.02583		L	-0.01185		L	LL
R35	-0.01809		W	-0.01915		L	WL
R65	-0.01485		W	-0.01009		L	WL
R76	-0.01866		L	-0.00699		W	LW
R83	-0.01836		L	-0.00989		W	LW
R86	-0.00313	-0.01822	W	0.00074	-0.00999	W	WW
R3	-0.00245		W	-0.02094		W	WW
R7	-0.02194		L	-0.02923		L	LL
R12	-0.0228		L	-0.03033		L	LL
R23	-0.02393		L	-0.01815		W	LW
R31	-0.01389		W	-0.02601		L	WL
R33	-0.01778		W	-0.02637		L	WL
R36	-0.0158		W	-0.02694		L	WL
R38	-0.0194		W	-0.02191		L	WL
R41	-0.04555		L	-0.01151		W	LW
R42	-0.01539		W	-0.00177		W	WW
R47	-0.0206		L	-0.02078		W	LW
R55	-0.02583		L	-0.01659		W	LW
R70	-0.02012		L	-0.00921		W	LW
R81	-0.0105		W	-0.02442		L	WL
R85	-0.02406		L	-0.02121		L	LL
R67	-0.01643	-0.01976	W	-0.01575	-0.02107	W	WW
R37	-0.01709	-0.01709	W	-0.0453	-0.0453	W	WW

A3: Selectivity skill from Equation (4)

	Period_1			Period_2			Winner/Loser
R1	-0.01224		L	0.00108		L	LL
R8	-0.01072		L	-0.00019		L	LL
R19	-0.01288		L	0.00393		W	LW
R30	-0.0102		W	0.00416		W	WW
R32	-0.00996		W	0.00368		W	WW
R34	-0.0091		W	0.00356		W	WW
R39	-0.0191		L	0.00388		W	LW
R48	-0.00848		W	0.00335		W	WW
R51	-0.00991		W	0.00063		L	WL
R54	-0.01041		L	0.00017		L	LL
R61	-0.01887		L	0.00391		W	LW
R62	-0.01169		L	0.00649		W	LW
R66	-0.01013		W	0.00309		L	WL
R71	-0.01048		L	0.00174		L	LL
R72	-0.0103		W	0.00172		L	WL
R79	-0.01007	-0.01036	W	0.00165	0.003223	L	WL
R18	-0.00813		W	0.00283		L	WL
R22	-0.0108		L	0.0029		W	LW
R25	-0.01041		W	0.00369		W	WW
R49	-0.00913		W	0.00281		L	WL
R50	-0.00994		W	0.00236		L	WL
R60	-0.01134		L	0.00296		W	LW
R77	-0.01074		L	0.00281		L	LL
R82	-0.01076	-0.01058	L	0.00363	0.002865	W	LW
R4	-0.0152		L	0.00348		L	LL
R63	0.00134	-0.00693	W	0.00535	0.004416	W	WW
R16	-0.01678		W	-0.01869		L	WL
R64	-0.0141		W	-0.00762		W	WW
R75	-0.01703		L	-0.01323		L	LL
R80	-0.02687	-0.0169	L	-0.00492	-0.01042	W	LW
R5	-0.01872		W	-0.01887		W	WW
R6	-0.01516		W	-0.01892		L	WL
R11	-0.02619		L	-0.02374		L	LL
R21	-0.02274		L	-0.01792		W	LW
R40	-0.04926		L	-0.00816		W	LW
R53	-0.02121		W	-0.01614		W	WW
R57	-0.01959	-0.02121	W	-0.02163	-0.01887	L	WL
R10	-0.00889		W	7.34E-05		L	WL
R17	-0.00973		W	0.00254		W	WW
R20	-0.01139		L	0.00304		W	LW
R58	-0.0097		W	0.00222		L	WL
R59	-0.01015		L	0.00014		L	LL
R74	-0.0099	-0.00981	L	0.00232	0.002272	W	LW
R56	-0.0097	-0.0097	W	0.00284	0.002841	W	WW

A4: Marketing timing skill from Equation (4)

	Period_1			Period_2			
		Median	**W/L**	**Median**		**W/L**	**Winner/Loser**
R2	2.03027		W	1.28723		W	WW
R9	2.90293		W	1.38838		W	WW
R15	1.58238		L	1.04929		L	LL
R24	0.44806		L	-0.19544		L	LL
R29	1.66128		W	1.06028		L	WL
R78	1.4526		L	1.44547		W	LW
R84	2.49492	1.661283	W	1.53973	1.287228	W	WW
R13	0.44349		L	1.34677		W	LW
R14	1.60328		W	1.05311		L	WL
R27	1.23035		W	1.27966		L	WL
R52	0.77438		W	1.50309		W	WW
R73	0.68006	0.774382	L	2.09955	1.346765	W	LW
R28	0.64385		L	1.00222		W	LW
R35	1.30107		W	0.93936		L	WL
R65	1.117		L	1.19295		W	LW
R76	1.12516		W	0.28884		L	WL
R83	1.25518		W	0.40245		L	WL
R86	0.63471	1.12108	L	1.46793	0.97079	W	LW
R3	1.17233		W	0.40718		L	WL
R7	0.37366		L	0.99964		W	LW
R12	0.48423		L	1.09339		W	LW
R23	0.54436		W	1.55405		W	WW
R31	0.81608		W	0.0646		L	WL
R33	-0.20162		L	1.02363		W	LW
R36	0.50982		W	0.5718		W	WW
R38	-0.56082		L	0.30514		L	LL
R41	0.8211		W	-1.13864		L	WL
R42	-0.20974		L	-1.84446		L	LL
R47	0.22291		L	0.00835		L	LL
R55	0.35147		L	0.37969		L	LL
R70	-0.05218		L	-0.41983		L	LL
R81	0.65234		W	1.37689		W	WW
R85	1.33102		W	1.03233		W	WW
R67	0.4935	0.488862	W	0.93786	0.489487	W	WW
R37	0.89413	0.894133	W	4.44491	4.444911	W	WW
R1	1.79935		L	1.82648		W	LW
R8	1.95428		W	1.83695		W	WW

A4: Marketing timing skill from Equation (4)

	Period_1			Period_2			
		Median	**W/L**	**Median**		**W/L**	**Winner/Loser**
R19	1.46394		L	1.26092		L	LL
R30	1.8485		L	1.19371		L	LL
R32	2.02229		W	1.25608		L	WL
R34	2.0321		W	1.17967		L	WL
R39	1.54146		L	1.11908		L	LL
R48	1.86617		L	1.435		L	LL
R51	1.90997		W	1.80874		W	WW
R54	2.26822		W	2.03178		W	WW
R61	2.33923		W	1.47902		W	WW
R62	1.77214		L	1.24164		L	LL
R66	1.80424		L	1.24087		L	LL
R71	1.99657		W	1.66923		W	WW
R72	1.94566		W	1.63114		W	WW
R79	1.78036	1.888069	L	1.67847	1.457009	W	LW
R18	1.88955		W	1.24863		W	WW
R22	1.83613		L	1.24741		L	LL
R25	1.94575		W	1.15127		L	WL
R49	1.75798		L	1.31687		W	LW
R50	2.04619		W	1.3056		W	WW
R60	1.8732		W	1.23757		L	WL
R77	1.59329		L	1.27739		W	LW
R82	1.75618	1.854661	L	1.11225	1.24802	L	LL
R4	2.01005		W	1.42289		W	WW
R63	1.63298	1.821513	L	1.25178	1.337333	L	LL
R16	1.4725		W	1.77534		W	WW
R64	1.41504		W	1.05375		L	WL
R75	1.17682		L	1.73572		W	LW
R80	0.6948	1.295933	L	0.29146	1.394734	L	LL
R5	1.36795		W	1.23653		L	WL
R6	0.35896		L	2.09114		W	LW
R11	0.79962		W	1.60762		W	WW
R21	1.58299		W	1.90465		W	WW
R40	0.33636		L	-1.573		L	LL
R53	-1.40343		L	1.2408		L	LL
R57	0.86806	0.799619	W	2.49082	1.60762	W	WW
R10	1.86151		W	1.58999		W	WW
R17	1.89884		W	1.17915		L	WL
R20	2.04886		W	1.20002		L	WL
R58	1.75969		L	1.77332		W	LW
R59	1.80436		L	1.70403		W	LW
R74	1.85905	1.860276	L	1.06743	1.395002	L	LL
R56	1.84292	1.842924	L	1.22656	1.226555	L	LL

A5: Volatility timing skill of Equation (6)

	Period_1			Period_2			
		Median	**W/L**		**Median**	**W/L**	**Winner/Loser**
R2	11.6316		W	4.9018		W	WW
R9	16.1219		W	3.37917		W	WW
R15	7.02353		W	2.57427		W	LL
R24	7.86344		W	-8.47963		L	LL
R29	9.3734		W	3.06634		W	WL
R78	7.85419		W	5.74008		W	LW
R84	13.8309	9.3734	W	7.32284	3.37917	W	WW
R13	1.66114		W	4.48093		W	LL
R14	11.1445		W	11.7635		W	WW
R27	9.25532		W	9.74017		W	WW
R52	6.34442		W	8.20235		W	WL
R73	2.54839	6.34442	W	15.5205	9.74017	W	LW
R28	1.38368		W	7.88296		W	LW
R35	9.09368		W	5.45267		W	WL
R65	5.1622		W	10.1519		W	LW
R76	7.10272		W	2.09135		W	WL
R83	8.00459		W	5.22339		W	WL
R86	5.96222	6.53247	W	6.17273	5.8127	W	LW
R3	10.1105		W	1.71937		W	WL
R7	2.22109		W	1.17539		W	LL
R12	5.48728		W	13.0821		W	WW
R23	5.75569		W	14.5879		W	WW
R31	6.67372		W	5.05747		W	WW
R33	0.57599		W	9.25141		W	LW
R36	5.46111		W	5.08689		W	WW
R38	0.2503		W	2.21697		W	LL
R41	-0.95297		L	-4.54477		L	LL
R42	1.77549		W	-12.2738		L	LL
R47	2.71476		W	-0.76694		L	LL
R55	1.84558		W	4.65497		W	LW
R70	2.24603		W	-3.07944		L	LL
R81	7.61814		W	3.53742		W	WL
R85	8.11969		W	11.3062		W	WW
R67	3.9131	3.31393	W	9.6035	4.0962	W	WW
R37	6.62687	6.62687	W	42.0909	42.0909	W	WW
R1	10.1717		W	6.24872		W	LW
R8	11.5377		W	7.16665		W	WW
R19	6.05761		W	3.68214		W	LL
R30	10.2019		W	3.88709		W	LL
R32	10.7532		W	4.38002		W	WL
R34	10.4384		W	3.9677		W	WL
R39	10.8581		W	4.07663		W	WL
R48	9.97883		W	5.17414		W	LL
R51	10.0049		W	7.24813		W	LW
R54	12.5381		W	8.65424		W	WW
R61	11.4223		W	6.77462		W	WW
R62	8.65818		W	5.57912		W	LL
R66	9.43437		W	4.09729		W	LL
R71	10.9247		W	7.45888		W	WW
R72	10.699		W	7.65932		W	WW
R79	9.54864	10.3201	W	6.72128	5.91392	W	LW
R18	10.0117		W	4.02845		W	WL
R22	9.42881		W	4.08263		W	WW
R25	9.8739		W	3.49041		W	WL
R49	9.19383		W	4.69055		W	LW

A5: Volatility timing skill of Equation (6)

	Period_1			Period_2			
		Median	**W/L**		**Median**	**W/L**	**Winner/Loser**
R50	10.5922		W	4.79455		W	WW
R60	9.54183		W	4.05935		W	WL
R77	8.70999		W	4.59442		W	LW
R82	9.42517	9.48532	W	3.22164	4.07099	W	LL
R4	13.8284		W	6.05466		W	WW
R63	10.2069	12.0177	W	4.70795	5.38131	W	LL
R16	7.68724		W	16.67		W	LW
R64	8.12443		W	8.56017		W	WL
R75	8.41107		W	9.862		W	WW
R80	3.56253	7.90584	W	-0.55805	9.21109	L	LL
R5	8.68968		W	11.9618		W	WW
R6	5.24371		W	17.9951		W	WW
R11	3.62807		W	5.11092		W	LL
R21	11.0777		W	18.171		W	WW
R40	-0.23046		L	-6.66117		L	LL
R53	-3.42881		L	9.32582		W	LL
R57	6.76531	5.24371	W	21.8823	11.9618	W	WW
R10	10.9358		W	5.69432		W	WW
R17	10.1439		W	3.78954		W	LL
R20	10.8297		W	3.48628		W	WL
R58	9.18887		W	9.06014		W	LW
R59	9.81239		W	6.65236		W	LW
R74	11.6784	10.4868	W	2.94977	4.74193	W	WL
R56	10.8093	10.8093	W	4.01965	4.01965	W	WW