Research paper

Investigating the Performance and Performance Consistency of Iranian Mutual Funds Using CAPM & CARHARTs Four- Factor Models; A Comparative Approach

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Abstract:
This study seeks to investigate the performance as well as the performance consistency of Iranian mutual funds during the current and subsequent periods. To this end, the Capital Asset Pricing Model along with CARHARTs four-factor model have been utilized to analyze the performance and performance consistency of investment funds. In order to examine persistency, all models are divided into 10 portfolios (10 distributions) based on the performance of the past one-year. Then we considered succeeding 12 months later. Our results revealed that mutual funds in Iran have not outperformed the market, but there is a performance consistency. This means that the mutual funds with the best performance (worst performance) will perform in the same way (better or worse) in the upcoming years. However, the extent of the best and worst performance is not significantly different. The historical performance of mutual funds can, to some extent, explain the future performance. Therefore, investors' reliance on the backgrounds of investment funds as a recourse for investment is well justified. In other words, if investors invest on mutual funds with a past outperformance, there is a reasonable assurance to be repeated the past. The opposite assertion is also true.

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Introduction

A mutual fund is a type of Investment Company that collects investor funds and invests in a diverse portfolio of securities [32]. Mutual funds, as one of the most important financial institutions in the capital market, have gained a special position in recent years. The increasing growth of these funds reflects the general popularity in the national economy. Existence of a guarantor for cancellation of fund units, high liquidity of fund investment units as well as variety of activities based on investors' goals, use of professionals and experts in portfolio management, reduction of brokerage and operating costs compared to small capital investments along with pacifying the risk of investing through ownership in various financial portfolios differentiate the mutual funds from common financial institutions and magnetize people to invest. Investors believe that fund managers have superior capabilities, but professional analysts assess the capabilities of fund managers by analyzing the return on a mutual fund. Measuring the performance of the mutual fund is very important and fundamental, because current and potential investors consider the performance during the annual period. Performance information is very effective for cash inflows and outflows from funds. In addition, from a scientific point of view, evaluating the ability of fund managers is equivalent to testing an efficient market hypothesis [1]. Performance appraisal of mutual funds is a way of evaluating the performance of investment professionals and the effectiveness of investment allocation.

Mutual funds are one of the most important pillars of the capital market and the economy, which on the one hand must meet the needs of investors who seek higher returns with less risk. In the investment management process, the final stage is performance appraisal; therefore, performance appraisal can be considered as a feedback and control mechanism to increase the effectiveness of investment management. Since the early 1960s, many researchers have paid attention to performance evaluation and always tried to study the performance of various tools by modeling and testing existing models. Comparing the performance of a mutual fund and the stock market has long been a matter of debate. Many studies have compared the two, but neither has reached similar conclusions. Some articles have suggested that mutual funds outperform the stock market [1,5]. Hayat & Kraeuss (2011), Otten and Bams (2002), and Christensen (2013) revealed that the funds are not outperforming

the market having lower returns [6, 7]. Tang, Wang, and Xu (2012), Chi (2013)and Kiymaz (2015) examined the performance of Chinese mutual funds and concluded that these funds outperformed the market [8–10]. In the capital market, there is a great tendency to evaluate the performance of investment. To evaluate any investment, it is necessary to look at the risk-reward and use the appropriate criteria for evaluation. We seek to evaluate the performance of mutual funds using the CAPM and CARHARTs four-factor models.

Many studies have been conducted on the performance consistency of mutual funds in developed countries, but in emerging markets such as Iran, limited studies have been done. In Iran, mutual funds are growing rapidly, and over the years these funds have attracted many investors. The mutual fund in Iran has seen increasing growth over the past few years, so that in 2016, the assets under the management of these funds reached about 1, 297, 720 billion rials. Existence of a large number of mutual funds in Iran indicates that there is a competition between these funds and they are trying to perform better in order to attract more investors. This means that some fund managers have superior capabilities that allow them to achieve better returns for investors. Most investors and their advisers spend a lot of time examining the past performance of the funds they want to invest in and to rely on their past performance as a benchmark. The main question that can be raised is whether the past performance of funds can be used as one of the key criteria for selecting funds?

Theoretical Development

In the United States, the 1940 Investment Companies Act defines mutual funds as a type of management investment firm with its own characteristics, whose main profession is primarily investing, re-investing, acquiring, holding, or trading securities and continuously offers redeemable securities to investors [12]. The Securities Market Law of the Islamic Republic of Iran defines investment funds as a financial institution whose main activity is investing in securities and its owners share in the fund's profits and losses proportional to their investment. Mutual funds have a relatively similar operating structure and pattern, regardless of minor differences. [32]. Mutual fund investors benefit from professional management,

diversification, high liquidity, economies of scale and reduced transaction costs with respect of direct investment in securities. The funds generally consider one of the three goals of income, growth or income, growth for themselves and formulate the appropriate investment plan. Funds, which are in fact Management Investment Company, are primarily stay on two general categories of fixed capital (close-end) and variable capital (open-end) in terms of capital structure. Each of these can be divided into two sub-categories, diversified and non-diversified. Furthermore, mutual funds can be classified into different groups based on securities that they invest within the framework of their goals and horizon. Some funds invest their resources in the money market; while there are funds that invest in long-term securities, including fixed-income, equity or both securities with maturities of more than one year.

Earnings and returns from investing in funds can be examined in three main components. First, the cash dividend of each investment unit, which is the amount of income or cash dividends that the fund pays to the holder of the unit per unit of investment during the year, as a percentage of NAV (Net asset value, or NAV, is equal to a fund's total assets less its liabilities). Second, capital gains from sold assets, which are earned as a result of the sale of fund portfolio securities at a price higher than the cost. Third, capital appreciations. This part of the gains, which is due to the increase in the price of securities in the fund's portfolio, manifests as an increase in the price of the fund's investment units. In general, the assessment of a fund's return can be defined as a change in NAV, plus cash payments (D) and change in value (C) [13]. This is shown in equation () below:

$$r_p = \frac{(NAV_t - NAV_{t-1}) + D_t + C_t}{NAV_{t-1}} \tag{1}$$

Where r_p stands for fund return; NAV is net asset value; D_t is cash dividend payment and C_t represents capital gain. Of course, it should be noted that a mere comparison based on the rate of return will be insufficient, and the calculation of the return does not constitute the completion of the performance appraisal process. This means that the return must be risk-adjusted before comparison. The simplest and most common way to adjust the fund's return is to compare rates of return across other investments with similar risk characteristics [34].

Evaluation of Mutual Funds Performance

Performance appraisal measures asset management skills and is based on comparing returns with another suitable portfolio. The advent of the Modern Portfolio Theory by Markowitz (1952) brought improvements to measure portfolio performance [4]. This changed the performance measurement from simple to adjusted risk criteria, which were more accurate. Due to the different principles of risk measurement, different models and tools for performance evaluation have been proposed, among which there are generally two separate views on risk. In the first view or Modern portfolio theory (MPT), any possible fluctuation (positive or negative) of future economic returns is considered as a risk and is obtained by using standard deviation around the average. Whereas in the second view or Post Modern Portfolio Theory (PMPT), the concept of risk is defined as unfavorable deviations from the average, so that fluctuations below the average are considered unfavorable. Downsized risk as a measure of risk uses only negative fluctuations in future economic returns in calculating risk. Performance evaluation indicators based on MPT include Sharp's RVAR, Reward-to-volatility Ratio by Trainer, Jensens Differential Return Measure, M2 benchmark, Ratio, and ,etc. In postmodern theory, different indicators such as Sortino Ratio, Upside Potential ratio, unfavorable beta criterion, Omega index and so on are used for evaluation. The performance appraisal revolution owes much to the capital asset pricing theory co-developed by Sharp (1964), Linter (1965), and Mousin (1966) based on the Markowitz-average variance theory [16]. Capital asset pricing theory showed a linear relationship between systematic risk and expected return. Among the regression approaches to performance appraisal, one of the most common performance metrics is the single-factor model proposed by Michael Jensen (1968) [17]. This criterion uses the concepts of CAPM by measuring portfolio performance and is the difference between the expected return of the portfolio and what is expected if the portfolio is on the stock market line. In the CAPM model, when purchasing power parity (PPP) is established, the expected additional return on asset j in the domestic capital market is a linear combination of market risk rewards in the domestic and foreign capital markets [18]. In the CAPM model, factors such as risk-free return, market return and systematic risk are considered as factors affecting the expected return (equation (1)).

$$E(r_i) = E(r_f) + E(r_m - r_f)\beta_i \tag{2}$$

Where $E(r_i)$ stands for expected return on the share i; $E(r_f)$ expected risk-free returns; $E(r_m - r_f)$ is the excess of market-expected returns and β_i in the CAPM equation measures the systematic risk of ith-share. Beta is a measure of the risk distribution of individual securities for a portfolio. Numerous theoretical and empirical evidences in asset pricing show that the expected return can be explained by using more than one factor. Multivariate models use a set of different variables to describe portfolio returns. The multi factorial model is expressed as follows:

$$R_{pt} = \alpha_p + \sum_{k=1}^{k} \beta_{pk} F_{kt} + e_{pt}$$

Where R_{pt} is the return of portfolio p at time t, β_{pk} stands for portfolio return yield sensitivity to factor k, F_{kt} is factor k return at time t, and α_p is expected portfolio p return if the factor values are zero. Campbell and McKinley (1997) used two theoretical and statistical approaches to select the model factors [8]. The statistical approach is based on Arbitrage Pricing Theory (APT). The arbitrage model was introduced by Ross (1976) as another model for asset pricing. Ross showed that various macroeconomic factors affect efficiency. However, he does not specify how many factors are sufficient to explain the return. Lehman and Modest (1988) used factor analysis to investigate an APT-based multivariate model. They found that sensitivity is very small when the variables are more than five factors. Chen et al. (1986) believe that stock returns are affected by any factor that affects the change in cash flows. They proposed a five-factor model including expected inflation, unexpected inflation, term structure of interest rates, default and industrial production, and found that these factors have a significant impact on the explanatory power of the pricing model. Elton et al. (1993) proposed a three-factor model for evaluating performance, which included large stock returns, small stock returns, and bond indices [19]. In 1992, after evidence against CAPM was presented, Fama and French (1993) expanded the initial CAPM to include the size and the book-to-market ratio as explanatory factors in expressing share returns [21]. If the CAPM model conditions are met, when the size factor enters the model, the CAPM model beta is almost completely correlated with the size. Fama & Frenchs (1993) presented a three-factor model using a multivariate regression as shown in equation (2) below [21]:

$$E\left(R_i\right) - R_f = b_i\left(E\left(R_M\right) - R_f\right) + s_i \times E(SMB) + h_i \times E(HML) \quad (3)$$

In this regard, $E(R_M) - R_f$ is the excess return of the firm compared to the risk-free return. This excess return is related to three factors. The first factor is market risk premium, which is the beta factor (β) provided by the CAPM model. This factor is measured by $R_t^m - R_t^f$ and is called the market factor (MKT). The second factor is the difference between the average returns of a small fund stock portfolio and the stock portfolio of a big fund, called the size factor (SMB). SMB is a measure of "risk" and reflects the view that small firms should reasonably expect to be more sensitive to risk factors and reduce their ability to absorb negative financial events [22]. The third component is the difference between the average returns of the stock portfolio of funds with a high book to market value ratio and low book to market value ratio, commonly referred to as the value factor (HML) [21]. Finally, CARHART added the expedition factor to the Fama and French three-factor model, showing that this factor could increase the explanatory power of the three-factor model and empower the additional efficiency of the expedited portfolio [2]. This is an additional factor in the expression of the anomalies mentioned by Jegadeesh & Titman. CARHART states that the momentum factor (The momentum factor refers to the tendency of winning stocks to continue performing well in the near term. Momentum is categorized as a persistence factor i.e., it tends to benefit from continued trends in markets.) reduces the average pricing error compared to the three-factor model. As a performance ratio, CARHARTs four-factor model incorporates the risk and return characteristics of four stock investing strategies:

- Investing in highly sensitive stocks versus low market sensitive stocks,
- Investing in small stocks versus large stocks in the capital market,
- Investing in valuable stocks versus growing stocks,
- Investing in stocks that are moving in the direction of the market versus stocks that are moving in the opposite direction of the market,

The four-factor performance ratio model in mathematical expression is as follows (equation (3)):

$$R_{i,t} - R_t^f = \alpha_i + b_i RMRF_t + s_i SMB + h_i HML + p_i PR1YR_t + \varepsilon_{i,t} \tag{4}$$

The first three factors are the same as those provided by Fama and French, and $PR1YR$ is the "expedition" factor. This factor is the difference between the average of the highest returns and the lowest returns compared to the previous month. Using this model, CARHART surveyed the performance of mutual funds from 1962 to 1993, based on which concluded that the funds with the highest returns in last month also had higher expected returns in the following month.

Consistency of Mutual Funds Performance

In an efficient market, prices change only as new information dispensed; that is, prices follow the random walk hypothesis. As a result, if the market is efficient, there is no consistency of performance [3]. Greenblatt and Titman (1992) Cuthberson, Nietzsche, and Sullivan (2006) argue that the concept of persistency is different from predictability; because consistency implies that the winner / loser in the future is also the same [23,28]. Since the predictability includes both positive and negative correlations, investors want to know whether choosing a fund based on past performance will lead to unexpected returns in the future. Many studies have been conducted with respect to consistency, but most of them have examined performance consistency as part of a mutual funds performance appraisal study and the results are controversial.

Elton, Gruber, & Black (1996) used the trading strategy portfolio approach to test the performance of mutual funds between 1977 and 1993by controlling for survival bias [29]. They showed that there is short-term stability in the performance of mutual funds. They also used risk-adjusted performance for the funds. Their evidence showed short-term and long-term performance stability. Using large databases from 1972 to 1995 and using a trading strategy portfolio approach, Block and Timmerman (1998) researched performance stability in the United Kingdom. Some of their evidence shows the existence of performance consistency among the funds that had the best and worst performance in the mentioned period [20]. Bolen and Basso (2005) used the daily return data of 230 mutual funds between 1985 and 1995 (with survival control) to estimate the performance stability of the mutual funds [21]. Scholars categorized funds based on quarterly returns over the past quarter and created portfolios to estimate performance using a variety of methods. They confirmed short-term performance stability even with regard to the

momentum factor. This stability was short-lived and disappeared in the long run.

Busse, Goyal, Wahal (2010) examined and confirmed the consistency of fund performance using the CAPM and the Fama & French (1993) three-factor model [21, 24]. However, they could not prove consistency in fund performance using CARHART's four-factor model. Alves, Mendes (2011) did not find a correlation between past performance and capital transfers in the mutual fund markets in Portugal [36]. However, they demonstrated a consistency in mutual fund performance. Ming & suck (2010) examine the performance of 311 Malaysian mutual funds using one-factor criteria, the Fama-French three-factor and the CARHARTs four-factor models over 1, 3, 5, 10 and 16-year time horizons from 1990 to 2005. They concluded beta, size, book value, and movement of important factors in explaining the returns of funds. Also, CARHARTs four-factor model provides better information for evaluating the performance of funds.

Methodology and Design

The primary aim is to study and evaluate the performance of Iranian investment funds in relation to the stock market index, from the date of commencement of activity (approximately) to the end of 2016. In other words, the success rate of investment funds in making more profit than normal profit in the market has been studied. The scope of this research is limited to mutual funds active in the capital market since 2010. In this study, we observe and review the monthly returns of mutual funds in 84 months, which begins in April 2010 and ends in March 2016. Among all the different models and criteria, the following two models are used to evaluate the performance of investment funds in the capital market:

- CAPM (to measure the performance of an investment fund)
- CARHART four-factor model (to evaluate the performance of an investment fund with respect to the market).

The advantage of CARHART model is the presence of factors such as size, book to market value and the momentum of stock prices in the market, which creates the ability to neutralize the effects of these factors on the performance of mutual funds. Information on monthly returns, fund size and market value was extracted from the website of the respective

investment funds. Information on the book value of mutual funds as well as on market returns were extracted from the Securities and Exchange Organization. Other required information and data were extracted from the website of the Central Bank of Iran.

Capital Asset Pricing Model

In the CAPM, factors such as risk-free return, market return and systematic risk are considered as factors affecting the expected return (equation (4)).

$$R_{it} - R_{ft} = \alpha_i + \beta_i \left(R_{mt} - R_{ft}\right) + e_{it} \tag{5}$$

In the above equation, R_{it}, is the return of fund i in month t; R_{ft} is risk-free rate in month t; α_i indicates the good performance of the fund. R_{mt} is market return. The total monthly market index is collected from the website of the Tehran Stock Exchange Company and based on that, market return is calculated as the end of the month index minus the beginning of the month index divided by the beginning of the month index. $(R_{mt} - R_{ft})$ is the market risk, which is in excess of the return of the market portfolio compared to the risk-free rate of return, which in this model is called the market factor and is also shown with MKT. Beta in the CAPM equation is a measure of systematic risk, which indicates the sensitivity of the fund's return to the stock market. e_{it} stands for error terms.

CARHARTs Four-Factor Model

The regression formula used in this model is as follows (equation (5)):

$$R_{it} - R_{ft} = \alpha_i + b_i \left(R_{Mt} - R_{ft}\right) + s_i SMB_t + v_i HML_t + m_i PR12m_t + e_{it} \tag{6}$$

In this formula, R_{it} is fund i return in month t, R_{ft} is risk-free rate of return, $R_{it}R_{ft}$ stands for excess fund return over risk-free rate. SMB reflects the size of mutual funds. This variable is obtained by multiplying the number of investment units at the end of the period by their average price during that year (total NAV) on a monthly basis, which is divided into two categories of funds in Small and Big sizes. HML implies book

to market value ratio. This ratio is obtained by dividing the book value of the investment units of the funds by their market value on a monthly basis. This classifies funds into three high, low or medium market to book value ratios. The HML factor is obtained from the difference between high books to market value (value funds) and low books to market value (growth funds) . $PR12m$ is the expedition factor (moving trend) of the fund, which is also indicated by UMD, and is achieved on a monthly basis through the difference between the returns of funds with higher momentum (MOM)s minus the returns of funds with lower MOMs. In other words, PR12m is the difference between the return on a winning stock portfolio and the return on a losing stock portfolio.

Return & Market Premium

The return on investment fund as a dependent variable is calculated from the equation.

$$RNAV_{it} = \frac{NAV_{it} - NAV_{it-1}}{NAV_{it-1}} \tag{7}$$

Where $RNAV_{it}$ is the Return on Fund i over time t, NAV_{it} is Net asset value of Fund i at the end of period t and NAV_{it-1} is the net asset value of Fund i at the end of period $t-1$. The net daily value of each investment unit is published daily on the funds' website and this information is also under the supervision of the Tehran Stock Exchange. Funds return figures were received daily. To calculate the market return, the growth rate of the total index of the Tehran Stock Exchange has been used, which is reported daily on the official website of the Tehran Stock Exchange Company. Market risk premium is defined as the excess of the market portfolio return over the risk-free rate of return. Total monthly market index was collected from the website of the Tehran Stock Exchange and based on that, the market return was calculated as the end-of-month index minus the beginning-of-month index divided by the beginning-of-month index. The formal risk-free rate was set to be (17%) as for governmental bonds and has been different in various years.

At the end of each month, all sample funds are sorted by size, which is obtained by the total capital assets (capital value) of each fund. When the average size of the funds is calculated, the funds with values more than medium in the period of question are in group Big (B) and the funds with values lower than average are lied in group Small (S) (Chang and

Johnson, 2004). Similarly, at the end of each month, all sample funds are sorted by book to market value ratio (BM). Funds with (BM) above 30% are lied in group (H) and funds with (BM) less than 30% in group (L) as well as funds with 40% middle, in group (M). To calculate the boundary point of the groups, funds with a negative book to market value ratio are not considered when forming portfolios based on size. The division made in this section leads to the formation of three portfolios based on the BM ratio. At the end of each year, all sample funds are divided into two groups: losers (50% less) and winners (50% more). From the combined portfolios, 12 portfolios were formed based on the combinations of two portfolios based on size, three portfolios based on BM ratio and two portfolios based on expedition. It should be noted that each of the sample fund is lied in only one of the following portfolios:

- BHW: A Big, High B/M ratio & Winner portfolio
- SHW: A Small, High B/M ratio & Winner portfolio
- BMW: A Big, Medium B/M ratio & Winner portfolio
- SMW: A Small, Medium B/M ratio & Winner portfolio
- BLW: A Big, Low B/M ratio & Winner portfolio
- SLW: A Small, Low B/M ratio & Winner portfolio
- BHLO: A Big, High B/M ratio &Loser portfolio
- SHLO: A Small, High B/M ratio &Loser portfolio
- BMLO: A Big Medium B/M ratio &Loser portfolio
- SMLO: A Small, Medium B/M ratio &Loser portfolio
- BLLO:A Big, Low B/M ratio &Loser portfolio
- SLLO: A Small, Low B/M ratio &Loser portfolio

After forming 12 portfolios, their monthly returns were calculated and used to obtain SMB, HML and PR12mt variables.

Size (SMB), Book to Market Ratio (HML) & Expedience (PR12M)

SMB (Small minus Big): The stock risk factor that is related to the size of the funds and means the difference between simple the average return of three small portfolios and the simple average return of three large portfolios in a situation where the B/M and expedition factors are

controlled. The SMB factor is calculated on a monthly basis (equation (7)).

$$SMB = \frac{SHLO + SLLO + SMLO + SHW + SMW + SLW}{6} - \frac{BHLO + BLLO + BMLO + BHW + BLW + BMW}{6} \quad (8)$$

HML (High Minus Low): is the risk factor of stock returns, which is related to the book value of the funds in relation to the market value, and in the form of the difference between the average monthly return of the portfolio with the highest B/M ratio and the portfolio with the lowest B/M ratio. It is expressed in conditions where the size and acceleration factors are controlled. It can be said that this variable measures the sensitivity of stock returns to the difference between value and growth stocks (equation (8)).

$$HML = \frac{BHLO + SHLO + BHW + SHW}{4} - \frac{BLLO + SLLO + BLW + SLW}{4} \quad (9)$$

PR12m: is the difference between the average monthly return of a past winner stock portfolio and the monthly return of a past loser stock portfolio when the size and B/M factors are controlled. In fact, this variable explains the sensitivity of the expected stock return to the difference in the past performance of companies' stocks in terms of the returns they have already achieved (equation (34)).

$$WML = \frac{BHW + BLW + BMW + SHW + SMW + SLW}{6} - \frac{BHLO + BLLO + BMLO + SHLO + SMLO + SLLO}{6} \quad (10)$$

In the second part of the research, we evaluate the consistency of the performance of Iranian mutual funds. To this end, the research samples are divided into 10 sections with equal weights based on the performance of the previous year, calculated at the beginning of each year. For this segmentation, we use the published annual returns of the funds, which are net of operating expenses. We evaluate the yield of the formed portfolios for 12 months and then normalize the portfolios. This time series

trend creates a monthly return of 10 portfolios of funds from 2010 to 2016. Then, in more detail, we divide the top and bottom deciles into three portfolios, then use the asset pricing model and the four-factor CARHART model, and use the ordinary least squares regression. This trend creates a time series of monthly returns of 10 portfolios of funds. Then we divide the top and bottom deciles into three portfolio and utilized the CAPM and CARHARTs four-factor model across ordinary least squares regression.

Empirical Findings

Table 1 shows the summary of statistics of Iranian mutual funds with active management during 2010 to 2016.

Table 1: summary of Iranian mutual funds statistics

year	Annual return %	Av. Total net assets	Annual growth in total net assets (%)	Total net assets (billion)	Number of mutual funds	Number of investment funds	Standard deviation of fund returns
2010	62.7	104	17.8	1, 564	15	53	26.4
2011	10.9	36	-38.4	964	27	79	12.3
2012	37.2	36	47	1, 418	39	92	19.9
2013	88.2	138	367.6	6, 629	48	119	38.4
2014	-17.09	178	47.8	9, 800	55	136	9.3
2015	30.2	241	81.7	17, 811	74	157	14.5
2016	-2.5	200	-7.8	16, 421	82	174	14.2

As can be seen, the total number of funds and the number of funds suitable for the present study as well as the total net assets, annual growth and average assets of the funds are given in columns of the table. Annual returns and standard deviations of fund returns are also mentioned in the columns of the table above. Table 2 shows the descriptive statistics related to the variables during the study.

As can be deduced from the descriptive statistics table, for the $R_{it}R_f$ variable, the mean, median, standard deviation, minimum and maximum are 0.17, -0.4, 5.96, 25.17 and 54.23, respectively. Since the mean is higher than the median, the distribution of returns among the statistical sample

Table 2: descriptive statistics of variables

variables	Symb.	mean	median	St. dev.	min	max
Excess return	Rit Rft	0.17	-0.4	5.96	-25.17	54.23
Risk premium	Rmt Rft	0.54	-0.47	5.88	-9.42	16.99
Size	SMB	-1.87	-1.66	9.22	-37.7	18.23
B/M ratio	HML	0.92	-10.05	71.4	-133.2	253.9
Expedition	PR12m	8.21	11.28	59.22	-159.2	284.77

is right-skewed. Regarding the RM-RF variable; the mean, median, standard deviation, minimum and maximum are equal to 0.54, -0.47, 5.88, -9.42 and 16.99, respectively. Since the mean is higher than the median, it is also right-skewed. After examining the prerequisites and ensuring the significance of regression models, the results of inferential statistics are presented in the form of testing two main underlying hypotheses.

First, we assume that there is no significant difference between the performance of mutual funds and the market. To test this hypothesis, the data of the statistical population were analyzed in three steps using two models, CAPM and CARHART.

In the first stage, the data from 2010 to 2016 were analyzed using two models of CAPM and CARHART. According to the obtained regression results, the amount of alpha in the general CAPM model is significant and negative. This means that the fund does not outperform the markets. The alpha level in the overall CARHART model also confirms this. Also, the variable RM - RF in both CAPM and CARHART models affects the response variable and according to the CARHARTs model, neither SMB, HML nor PR12m variables affect the response variable. Tables 3 and 4 summarizes the results of the general 7-year model for testing the hypothesis based on the CAPM and CARHART models.

In the second stage, our hypothesis was investigated by forming two three-year (from 2010 to 2012) and four-year (from 2013 to 2016) portfolios using CAPM and CARHART. The results showed that the amount of alpha in the CAPM model is not significant. This means that the performance of funds is not better than the performance of the market. But in the CARHARTs model, the alternative hypothesis is confirmed because the alpha level in the model is negative and significant, which indicates the out performance of market over funds in this time period.

Table 3: 7-years model results

Coefficients				
models	Alpha	Interpret	RM - RF	Interpret
CAMP	Negative & significant	Market out performance	Positive & significant	The effect of RM - RF on the response variable
CARHART	Negative & significant	Market out performance	Positive & significant	The effect of RM - RF on the response variable

Table 4: 7-years model results

Coefficients						
model	SMB	Interpret	HML	Interpret	PR12m	Interpret
CARHART	Not significant	No effect	Not significant	No effect	Not significant	No effect

The variable RM - RF in both CAPM and CARHART models affect the response variable. According to the CARHART model for the data of 2010-2012, the SMB variable has no effect on the response variable, but HML and PR12m have an effect on the response variable. Tables 5 and 6 show the final regression results in the 3-year period from 2010 to 2012 to test the first hypothesis based on CAPM and CARHART models:

Table 5: 3-years model results

Coefficients				
models	Alpha	Interpret	RM - RF	Interpret
CAMP	Not significant	No difference	Positive & significant	The effect of RM - RF on the response variable
CARHART	Negative & significant	Market outperformance	Positive & significant	The effect of RM - RF on the response variable

In the third stage, to increase the accuracy of the analysis, two models were applied annually for the years 2010 to 2016. Annually reviewing the data using the CAPM model, we conclude that the performance of investment funds has been better than market only in 2010, but in 2012,

Table 6: 3-years model results

Coefficients						
model	SMB	Interpret	HML	Interpret	PR12m	Interpret
CARHART	Not significant	No effect	Positive & significant	The effect on the response variable	Positive & significant	The effect on the response variable

2013 and 2016, the results show market out performance. In 2011, 2014 and 2015 the performance of mutual funds was similar to the performance of the market. Annual analysis of the data using the CARHART model showed the alpha in 2010 and 2011 was positive and significant, and this means that the performance of mutual funds during these two years has been better than market. However, during the years 2012 to 2016, mutual funds have not been able to achieve better performance than the market. Also, according to the obtained results, the coefficient of variable RM - RF in both models is positive and significant. Therefore, it can be concluded that this variable is effective on the response variable. Examining the coefficients of other variables in the CARHART model, it is observed that only the variables RM - RF and HML are significant in some years and affect the response variable. Table 7 and Table 8 summarize the 7-year regression results, separately, to test the first hypothesis based on CAPM and CARHART models.

Table 7: Results of 7-year model interpretation (separately)

Model	Coefficients			
CAMP	Alpha	Interpret	RM - RF	Interpret
2010	Positive & significant	Fund outperformance	Positive & significant	The effect of RM - RF on the response variable
2011	Not significant	No difference	Positive & significant	The effect of RM - RF on the response variable
2012	negative & significant	Market outperformance	Positive & significant	The effect of RM - RF on the response variable
2013	negative & significant	Market outperformance	Positive & significant	The effect of RM - RF on the response variable

2014	Not significant	No difference	Positive & significant	The effect of RM - RF on the response variable
2015	Not significant	No difference	Positive & significant	The effect of RM - RF on the response variable
2016	negative & significant	Market outperformance	Positive & significant	The effect of RM - RF on the response variable

Table 8: Results of 7-year model interpretation (separately)

Model	Coefficients			
CARHART	Alpha	Interpret	RM - RF	Interpret
2010	Positive & significant	Fund outperformance	Not significant	No effect of RM - RF on the response variable
2011	Positive & significant	Fund outperformance	Positive & significant	The effect of RM - RF on the response variable
2012	Not significant	No difference	Not significant	No effect of RM - RF on the response variable
2013	negative & significant	Market outperformance	Positive & significant	The effect of RM - RF on the response variable
2014	negative & significant	Market outperformance	Not significant	No effect of RM - RF on the response variable
2015	Not significant	No difference	Positive & significant	The effect of RM - RF on the response variable
2016	Not significant	No difference	Not significant	No effect of RM - RF on the response variable

We now assume that there is a significant relationship between the performance of mutual funds in successive periods. To test this assumption, the data were arranged in ascending order based on annual returns and divided into 10 portfolios (from high annual returns to low) and analyzed using CAPM and CARHART models. Furthermore, to increase the accuracy, each of the best and worst portfolios in terms of annual returns are similarly divided into three smaller portfolios. In the first stage, each of the 10 portfolios formed separately were analyzed using both models. According to the results obtained, alpha coefficients in portfolios 1 to 3 were significant and positive, but in portfolios 6 to 10 were significant and

Table 9: Results of 7-year model interpretation (separately)

Model	Coefficients					
CARHART	SMB	Interpret	HML	Interpret	PR12m	Interpret
2010	Positive & significant	Effect on response variable	Not significant	Not effect on the response variable	Not significant	Not effect on the response variable
2011	Not significant	No effect	Positive & significant	The effect on the response variable	Not significant	Not effect on the response variable
2012	Not significant	No effect	Positive & significant	The effect on the response variable	Not significant	Not effect on the response variable
2013	Not significant	No effect	Positive & significant	The effect on the response variable	Not significant	Not effect on the response variable
2014	Not significant	No effect	Positive & significant	The effect on the response variable	Not significant	Not effect on the response variable
2015	Positive & significant	No effect	Positive & significant	The effect on the response variable	Not significant	Not effect on the response variable
2016	Not significant	No effect	Positive & significant	The effect on the response variable	Not significant	Not effect on the response variable

negative. These results indicate that there is a steady trend in the performance of mutual funds in different periods, and portfolios with higher annual returns have performed positively in other periods and vice versa. There is consistency in the performance of Iranian mutual funds. Also, considering the significance of RMF, HML and PR12m coefficients in the models, it is observed that these coefficients are sometimes significant and non-significant (Table 10 summarize the analysis of the regression results).

To increase the accuracy, portfolios 1 and 2 were divided into 6 smaller portfolios and then the data were analyzed using CAPM and CARHART models. Alpha coefficients in portfolios A1 to C1 were significant and positive, but in portfolios A10 to C10 were negative. These results indicate that there is a steady trend in the performance of mutual funds in different periods, and portfolios with higher annual returns in other periods have

Table 10: Model interpretation results for 10 portfolios

interpret	Sig.	PR12m	interpret	Sig.	HML	interpret	Sig.	SMB	portfolio	Models
Not significant	0.13	-0.56	Not significant	0.69	0.18	Negative & significant	0	-0.17	1	CARHART
Not significant	0.9	0	Negative & significant	0	-0.17	Positive & significant	0	0.3	2	CARHART
Not significant	0.07	-0.05	Not significant	0.27	0.05	Positive & significant	0	-0.24	3	CARHART
Not significant	0.12	-0.05	Not significant	0.88	-0.008	Not significant	0.12	0.08	4	CARHART
Not significant	0.48	-0.025	Negative & significant	0.03	-0.011	Positive & significant	0	0.37	5	CARHART
Not significant	0.97	-0.007	Negative & significant	0	-0.26	Not significant	0.52	-0.03	6	CARHART
Not significant	0.8	-0.007	Positive & significant	0.04	0.08	Positive & significant	0	0.18	7	CARHART
Negative & significant	0.03	-0.07	Negative & significant	0	-0.1	Not significant	0.08	-0.01	8	CARHART
Negative & significant	0	-0.16	Not significant	0.29	0.04	Negative & significant	0.005	-0.18	9	CARHART
Negative & significant	0	-0.19	Not significant	0.89	0.006	Not significant	0.88	0.01	10	CARHART

performed positively and vice versa. According to the results obtained from both models, there is performance stability in Iranian investment funds (Tables 11, 12, 13 & 14).

Table 11: Estimation results of CAPM and CARHART models for portfolios A1, B1 and C1

Models	portfolio	$\alpha_{0,t}$	Sig.	interpret	RM - RF	Sig.	interpret
CAPM	A1	-0.11	0.000	Positive & significant	0.63	0.000	Positive & significant
CARHART	A1	-0.21	0.000	Not significant	0.33	0.000	Positive & significant
CAPM	B1	-0.11	0.000	Positive & significant	0.99	0.000	Positive & significant
CARHART	B1	0.05	0.000	Not significant	0.49	0.000	Positive & significant
CAPM	C1	-0.10	0.010	Positive & significant	0.90	0.000	Positive & significant
CARHART	C1	-0.66	0.000	Negative & significant	0.15	0.000	Positive & significant

Table 12: Estimation results of CAPM and CARHART models for portfolios A1, B1 and C1

interpret	Sig.	PR12m	interpret	Sig.	HML	interpret	Sig.	SMB	portfolio	Models
Negative & significant	0	-0.59	Negative & significant	0	-0.95	Not significant	0.08	0.28	A1	CARHART
Negative & significant	0	-0.61	Not significant	0.09	-0.24	Positive & significant	0.05	0.38	B1	CARHART
Negative & significant	0	-0.8	Negative & significant	0	-0.81	Positive & significant	0.01	0.15	C1	CARHART

Table 13: Estimation results of CAPM and CARHART models for portfolios A10, B10 and C10

Models	portfolio	0, t	Sig.	interpret	RM - RF	Sig.	interpret
CAPM	A10	-0.89	0.010	Positive & significant	0.43	0.000	Positive & significant
CARHART	A10	-0.80	0.000	Positive & significant	0.07	0.020	Positive & significant
CAPM	B10	-0.61	0.160	Not significant	0.40	0.000	Positive & significant
CARHART	B10	-0.73	0.040	Positive & significant	0.30	0.000	Positive & significant
CAPM	C10	-1.62	0.000	Positive & significant	1.29	0.000	Positive & significant
CARHART	C10	-1.18	0.000	Negative & significant	0.47	0.000	Positive & significant

Table 14: Estimation results of CAPM and CARHART models for portfolios A10, B10 and C10

interpret	Sig.	PR12m	interpret	Sig.	HML	interpret	Sig.	SMB	portfolio	Models
Negative & significant	0	-1.1	Negative & significant	0.42	-0.16	Negative & significant	0.004	0.86	A10	CARHART
Negative & significant	0	-0.54	Negative & significant	0	-0.58	Not significant	0.25	-0.2	B10	CARHART
Negative & significant	0	-0.69	Negative & significant	0	-0.73	Negative & significant	0.5	-0.09	C10	CARHART

Examining the performance of investment funds with respect to the market revealed that in both models (from 2010 to 2016), the perfor-

mance of mutual funds was smoothly lower than the market return. In other words, the stock market index outperformed the mutual funds. Our results also show that in the seven-year period under review, there has been stability in the performance of mutual funds. This reflects the fact that funds that have performed well or badly over a period of time can be expected to repeat their past performance in subsequent periods (persistence of performance).

Conclusions and Recommendations

The aim of study is the evaluation of performance and consistency of the performance of Iranian mutual funds. Accordingly, two models of capital asset pricing (CAPM) and CARHARTs four-factor model have been used to evaluate the performance and consistency. The method used in this study was alpha-based tests. For this purpose, the monthly market rate of return and active funds from 2010 to 2016 as independent variables have been entered into CAPM and CARHART models and using the other variables required in the two models, the collected data have been analyzed. In the return process, all active mutual funds were reviewed each year. The results show that during the years under review, the performance of investment funds has a significant and negative relationship with market performance. In other words, mutual funds in Iran have lower returns than the stock market. Of course, in some cases, the performance of the funds is similar to the market. According to the results of tests and models used, the underlying hypothesis implying a lack of consistency in the performance of investment funds in active stocks, was rejected. Therefore, there is consistency in the performance of investment funds in Iran. Investors' reliance on the past performance of investment funds as a criterion for selecting an investment in Iran is well justified. If investors spend on mutual funds with superior past performance, there will be relative confidence in the repetition of the past and the selected fund will be among the winners in future periods. The opposite is also true. Investors are advised to pay close attention to the past performance of investment funds. The limitations of the proposed model are related to performance, which is based on the quality of the data used as input. According to the results, it is better to use portfolio approaches of trading strategy and class correlation in future research to examine the

performance stability of mutual funds.

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