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Investigation of Residual and Conventional Momentum Strategies in Short-term and Long-term Time Periods (Evidence from Tehran Stock Exchange)

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Abstract

Many researchers have attempted to explain the phenomenon of medium-term return continuation using modern financial theories. The excess return gained in the momentum investment strategy, in fact, compensates for unknown risks that current theories are unable to explain. Research indicates that various strategies can be beneficial at different maintenance periods. Various strategies generally involve a simple method in which they are formed based on the criterion of return over a certain period in the past and are maintained for a corresponding period in the future. Each investment strategy tends to generate excess returns based on the predictability of short-term price movements, as indicated by past performance. The purpose of this study is primarily to investigate the usefulness of residual momentum and conventional momentum strategies in the short-term and long-term. The time period of this study is from 2009 to 2018, and the general approach for calculations is based on the method described by Jegadeesh and Titman (1993), Blitz et al. (2011), and Blitz et al. (2020). The results of this study show no significant difference between residual and conventional momentum strategies in both short-term and long-term periods, indicating that both approaches exhibit similar risk-adjusted performance and forecasting capabilities.

Keywords: Residual Momentum, Conventional Momentum, Pricing Models, Tehran Stock Exchange

JEL Classification: C01, C12, D90, D53

Introduction

Stock returns momentum is one of the most challenging discussions in the efficiency of financial markets, and most momentum theories are based on investors' behavioural and cognitive biases. Within the framework of the efficient market hypothesis, there can be no anomalies, implying that there is no trend in prices and market efficiency, and it is not possible to generate additional profits from market trends (Fama & French, 1993; Khonsha et al., 2023; Koushki et al., 2023).

Momentum is a part of sustainable anomalies in finance and is a strategy that simultaneously buys the winning stocks and sells the losing stocks (Zare Bahnamiri & Michaghani, 2023). The residual momentum strategy was first formulated by Gutierrez and Prinsky (2007), who introduced two types of momentum: abnormal return momentum and relative return momentum. Gutierrez and Prinsky (2007) and Blitz et al. (2011) observed the success of the

residual momentum strategy in the US market, as Gutierrez and Prinsky (2007) examined the residual momentum profitability in the long run, while Blitz et al. (2011) focused on residual momentum profitability in the short run. Gutierrez and Prinsky (2007) argue that institutional investors overreact to traditional momentum strategies, while underreacting to residual momentum strategies, largely due to their job and credit dependencies. In contrast, Blitz et al. (2011) demonstrated that residual momentum strategies become practical because time-varying exposure is minimized against Fama-French factors, as residual returns are used to identify the winning and losing portfolios. Blitz et al. (2011) attribute this interpretation to Grundy and Martin (2001), who argued that price momentum exhibits considerable time-varying exposure to Fama and French factors, which can generate significant profits.

The focus of this study aligns with the hypothesis that information disseminates slowly, as company-specific information is gradually disseminated to the general public (Barberis et al., 1998; Blitz et al., 2011).

Blitz et al. (2020) in the US stock market stated that investor under-reaction remains a potential reason for the success of the residual momentum strategy.

Every investor, upon entering the capital market, seeks to devise and implement strategies that can succeed in the market. This view is in direct conflict with the accepted doctrine of market efficiency. According to the efficient market hypothesis, the performance of a portfolio is independent of its past performance. However, momentum strategies attempt to utilize past performance to predict future returns and generate excess returns.

Research has also shown that investors can use the return momentum method to generate excess returns. Badri and Fathullahi (2014) conducted a study on stock return momentum in the Tehran stock exchange over the period from 2001 to 2010. Their findings suggest that behavioural finance models can explain medium-term momentum in stock returns. However, they also found that momentum returns tend to disappear over the long term, and the returns of momentum-based strategies are close to zero and statistically insignificant.

The necessity of this study stems from the fact that the residual momentum strategy and its profitability in the Tehran Stock Exchange have not been previously investigated. While momentum as a market anomaly has persisted from the past to the present, it has always existed in many international

financial markets, making it an important subject. The purpose of this study is to compare the profitability of two residual momentum and conventional momentum strategies in the Tehran Stock Exchange. This is because choosing the right strategy is crucial for investors active in the capital market, as it enables them to select more profitable investment strategies that can generate returns above the market average.

Literature Review

There are also several types of trading momentum strategies. One of them is earnings momentum, which suggests that stocks that have recently experienced earnings surprises are likely to do so again in the near future. In other words, stocks that have undergone a positive adjustment are likely to yield good returns in the near future. Another type of momentum is industry momentum, which posits that industries that have performed well (or poorly) in the recent past will continue to do so in the future. Another type is price momentum, in which stocks that outperform others based on the relative strength index are selected and held for a specified period. The results indicate that this approach yields excess returns to the market (Grinblatt & Titman, 1989; Grinblatt & Han, 2005).

Jegadeesh and Titman (1993) selected stocks based on past returns over periods of 3, 6, 9, and 12 months from 1965 to 1986 in the United States, and maintenance periods of the formed portfolios also varied during these time periods. While confirming the return momentum phenomenon, they show that, on average, a significant return of 1.31% is achieved per month. They conclude that momentum earnings are not due to systematic risk; however, the evidence is consistent with stock price under-reactions to company-specific information. The results show that the return on momentum time strategies during the 9 years from 1990 to 1998 is 1.39% per month and is statistically significant.

The residual momentum strategy is estimated using the Fama and French three-factor model. Momentum has significant time-varying exposure to Fama and French factors. In particular, momentum has a positive (negative) effect on systemic factors when these factors exhibit positive (negative) returns during the period of momentum strategy formation. The residual momentum shows smaller time-varying exposure when the strategy fluctuations decrease. The residual momentum is also unbiased relative to the Fama-French size factor, indicating that the success of momentum strategies does not depend on small capital (Grundy & Martin, 2001).

The residual momentum, unlike total return momentum (conventional momentum), is not concentrated in stocks with small capitalization, and transaction costs have a minimal effect on the profitability of this strategy. In the conventional momentum strategy, stocks are first ranked based on their total return over the previous period. Then, past winners are bought, and past losers are sold. This strategy is implicitly a sustainable location in the common factor of returns that will affect the risk characteristics and its return. For example, if the market premium is positive during the portfolio period, a momentum strategy typically involves buying high-beta stocks and selling low-beta stocks. For example, when the market is rising, higher-beta stocks tend to outperform lower-beta stocks.

The conventional momentum strategy, as discussed in the initial findings of Jegadeesh and Titman (1993) and Jegadeesh and Titman (2001), is based on total stock returns. The residual momentum strategy is investigated using Fama and French factor models. They demonstrated that Sharp's ratio of residual momentum is approximately twice that of conventional momentum, primarily due to turbulence and low fluctuations in returns. This is because momentum exhibits considerable time-varying exposure to Fama and French factors, as explained by Grundy and Martin (2001). As a result, a conventional momentum strategy experiences losses when factor returns during the maintenance period are inconsistent with the formation period. The residual momentum exhibits lower time-varying exposure, thereby reducing the volatility and fluctuations of the strategy. Cooper et al. (2004) examined the relationship between market conditions and conventional return momentum profit (total returns momentum) for the US market. Their studies showed that conventional momentum is profitable only in markets with an uptrend, as investor biases intensify after gains in market returns. The residual momentum strategy was discussed by Gutierrez and Prinsky (2007), who introduced two types of momentum: abnormal return momentum and relative return momentum. Gutierrez and Prinsky (2007) argue that institutional investors overreact to traditional momentum strategies, while underreacting to residual momentum strategies, primarily due to concerns about job and credit risk, which leads to continued long-term underperformance without a return. They also argued that for the short-term maintenance period, both residual momentum and conventional momentum strategies yield significant returns. For the long-term maintenance period, they claimed that conventional momentum has stronger return patterns.

Blitz et al. (2011) confirmed the hypothesis of momentum returns in the

United States during the period 1926-2009. They argued that residual momentum in the United States generates significant positive returns regardless of business cycles, as this strategy affects exposures associated with systematic risk by creating them. Blitz et al. (2011) demonstrated that short-term residual momentum strategies are effective because time-varying exposure to Fama-French factors is minimized, as residual returns are utilized to identify winners and losers for informed portfolio decisions. The residual momentum strategy was also developed by Gutierrez and Prinsky (2007). Blitz's (2011) findings are attributed to the explanations of Grundy and Martin (2001), as the traditional total return momentum exhibited significant time-varying exposures to Fama and French factors, which yielded significant earnings by hedging these exposures. Blitz et al. (2020) attributed the profitability of the residual momentum strategy to investors who underreact to company-specific information more than to public information. Kim and Suh (2018) concluded, in their study on emotion-based momentum strategy, that investors can achieve a return beyond the conventional momentum by using a new method in earnings momentum.

Foster and Kharrazi (2008) examined the return behaviour of over fifty active companies listed on the Tehran Stock Exchange. Using weekly data, they concluded that continuation of returns in the Tehran Stock Exchange is observed in the period under study, and the momentum investment strategy is profitable. Mehrani and Nonahal Nahr (2009) evaluated the underreaction of investors hypothesis using short-term returns on shares listed on the Tehran Stock Exchange between 1999 and 2006. Their results showed that investor underreaction was in 6-month time periods. Thus, it is not possible to achieve significant excess returns through the application of a relative power investment strategy (momentum) in the Tehran Stock Exchange in 6-month periods. Rostami and Heydary (2013) examined 90 companies in their study to explain the momentum phenomenon and its sources of creation, spanning the period from 2006 to 2011. The results show that the momentum strategy has been profitable in both three and 6-month formation and maintenance periods. Winning and losing stock returns were estimated using the CAPM model and the Fama-French three-factor model. The results of the relevant test showed that the return of the momentum strategy does not disappear and is only slightly adjusted. Sadeghi Sharif and Askari Rad (2013) investigated the effect of the momentum factor on increasing the explanatory power of the Fama and French three-factor model in the Tehran Stock Exchange. The purpose of this study was to experimentally evaluate the validity of Carhart's four-factor model by adding momentum as a fourth explanatory variable to the Fama and French

three-factor model, based on Carhart's (1997) study, during the period from 2001 to 2010. Preliminary results indicate that growth portfolios yield higher returns than value portfolios, and winning portfolios exhibit higher returns than losing ones. However, no specific trend was observed for the size factor. In addition, the adjusted coefficients for the one-factor model, the Fama and French three-factor model, and the Carhart four-factor model were 26, 50.7, and 56.7%, respectively, indicating an improvement in the explanatory power of the Fama and French model by adding the momentum factor.

Hashemi and Miraki (2013) examined the excess return on momentum risk in the Tehran Stock Exchange and concluded that although a portfolio based on nine- and 10-month momentum creates a positive return, applying the momentum strategy does not generate a surplus return on risk (abnormal returns). Through a study, Badri and Fathullahi (2014) examined stock return momentum in the Tehran Stock Exchange from 2001 to 2010. Evidence suggests that return momentum in the medium term can be explained through behavioural models, as the Fama and French three-factor risk model is unable to account for momentum. They also concluded that, in the long run, the return momentum dissipates, and the returns of momentum-based strategies approach zero, becoming insignificant. Examining the experimental test of return momentary in financially helpless companies by evidence from the Tehran Stock Exchange, Fadayee Nezhad and Mayeli (2015) concluded that controlling the size and ratio of book value to market value of helpless companies is not higher than non-helpless companies. They also demonstrated that the returns of financially helpless companies were not lower than those of non-helpless companies, and the emergence of momentum in these companies was confirmed. Abdolbaghi Ataabadi and Mirlohi (2020) concluded that the existence of momentum behavior along with emotions caused by herding and imitation of investors' behavior can intensify the results of momentum-based investment strategies. Their results indicate the existence of short-term return momentum in highly herding winner portfolios compared to lowly herding loser portfolios.

Chang et al. (2018) asserted that the residual momentum strategy in the Japanese stock market is profitable only in hold periods of less than one year. They ranked the stock returns based on the latest standardized average residual return from the Fama and French three-factor model over periods of 6 or 12 months. Conventional momentum in Japan is ineffective in any case, leading to data mining. Consistent with Chang et al. (2018), it was explained that unique momentum yields result in Japan. Chang et al. (2018) also specifically test the

unique momentum in Japan and relate it to a smaller reaction than the size of investors.

Novy-Marx and Velikov (2016) demonstrated that unique momentum exhibits a lower average of unique fluctuations and a higher market value than conventional momentum, indicating a positive and negative relationship with the transaction costs associated with strategy.

Lin (2019) demonstrated that a conventional momentum strategy yields insignificant returns in the Chinese stock market. Nevertheless, the residual momentum strategy generates significant benefits, as noted by Blitz et al. (2011 and 2020). Singh and Walia (2020) stated that, despite extensive literature on momentum strategy and consensus on the existence of momentum, there is disagreement among researchers about the explanation of this phenomenon. However, descriptions of momentum strategy are generally divided into rational and behavioral reasons. For example, some new behavioral models focus on implementing or explaining the momentum strategy. Grinblatt and Han (2005) categorized investors into rational and irrational investors. Their model shows that irrational behavior of occupier investors creates a gap between the current price of shares and their intrinsic value. The behaviour of rational investors in the stock ask-bid will lead to upward or downward momentum. Scientists know that proxy control of a variable is unpredictable for total unrealized capital gains and past returns on cross-sectional stock returns. Although there is other evidence of the effect of capture in Hur et al. (2010) and Singh and Walia (2020), they also asserted that delay bias contributes to the momentum strategy, in addition to the effect of capture.

In a study by Seppä-Lassila (2021), two residual momentum and volatility-scaled momentum strategies were mixed, and the performance of the mixed strategy was examined in the United States using daily stock return data from January 1926 to September 2020. The results showed that volatility-scaled residual momentum in the five-factor alpha of Fama and French (2015), total return, volatility-scaled total return and residual momentum are statistically significant. The study also showed that the theoretical transaction costs of volatility-scaled residual momentum are significantly higher than those of the traditional momentum strategy. The performance of momentum portfolios was examined by Berggrun et al. (2020) in Latin America. The results of this study showed that the conventional momentum strategy yields zero risk-adjusted returns.

In contrast, the residual momentum strategy is not able to provide adjusted returns with significant and, of course, positive risk. Syamni et al. (2021) examined the momentum strategy in the capital market. This is a trading strategy employed by investors who purchase stocks that have performed well, with the expectation that their good performance will continue. The results of this study showed that most capital market investors employ a momentum strategy, even though its implementation is still inefficient or inappropriate. This suggests that the development of multiple capital markets can lead to inefficient markets.

Ehsani and Linnainmaa (2022) demonstrate that residual momentum strategies encompass three distinct effects: momentum in firm-specific returns, betting against betas, and momentum in factors excluded from asset pricing models. Consequently, the finding that residual returns exhibit greater momentum than aggregate returns does not provide conclusive evidence for momentum in firm-specific returns. Although this may indicate the presence of momentum in firm-level returns, it could also suggest that asset pricing factor lines are flat (as they are) or that certain factors outside the Fama-French model also exhibit momentum (as they do).

The study by Tanaka and Suzuki (2024) examines the existence of the residual momentum effect in the Japanese stock market. Their findings show that, after accounting for both short-term and long-term reversal effects, the residual momentum effect loses its statistical significance. This suggests that the methods previously used to calculate residual momentum may have inherent limitations. By adopting a revised calculation method, they demonstrate that the residual momentum effect lacks significant explanatory power.

The current study investigates the profitability of two residual momentum and conventional momentum strategies in both the short term and long term. To achieve this, the following hypotheses were investigated:

Hypothesis 1: There is no significant difference between the residual momentum strategy and the conventional momentum strategy in the short run.

Hypothesis 2: There is no significant difference between the residual momentum strategy and the conventional momentum strategy in the long run.

Research Methodology

The general approach to reviewing and comparing the two conventional momentum and residual momentum strategies is as follows:

The conventional momentum strategy is a strategy based on total stock returns expressed by Jegadeesh and Titman (1993 and 2001). In fact, it is a strategy that ranks stocks based on their total returns over a specific period and then buys past winning stocks and sells past losing stocks. This strategy plays a sustainable role in common factor returns that affect risk and return characteristics. For example, suppose the market premium is positive during the formation period. In that case, the momentum strategy typically buys high-beta stocks. It sells low-beta stocks, as high-beta stocks tend to outperform low-beta stocks when the market is growing (resulting in a positive market beta from the momentum strategy). The profitability of a momentum strategy will be positively affected by the dynamic exposure to factor returns and negatively affected by the return on factor returns. In addition, a significant portion of momentum risk-returns will be generated by factor exposure; therefore, the Jegadeesh and Titman (2001) approach is used to evaluate the profitability of the conventional momentum strategy.

Like Jegadeesh and Titman (1993), securities are categorized at the beginning of each month, t, in ascending order based on their returns over the last J months. They are divided into ten portfolios of equal weight. Thus, the first portfolio includes the losing portfolio (the one with the lowest total return), and the last portfolio includes the winning portfolio (the one with the highest total return). For each month t, the momentum strategy involves buying winning portfolios and selling losing portfolios and maintaining this position for K months. Therefore, weights are ─revised each month to reflect 1K securities in the total portfolio, with the rest being transferred from the previous month. J equals the portfolio formation period, and K equals the maintenance period (investment period). Then, total returns of the winning and losing portfolios are calculated by Equation (1).

$$\text{Total Stock Return} = \frac{(P_t - P_{t-1}) + D}{P_{t-1}} \quad (1)$$

Where P_t is the closing price of the stock at time t, P_{t-1} is the closing price of the stock at time t-1, and D is the dividend per share. After calculating the

total return, the average total return of the portfolios is calculated so that the stocks in the portfolio with the average total return above A% are introduced as the winner, and the stocks in the portfolio with the average total return below A% are introduced as the loser are introduced; eventually, the winning portfolios are bought and the losing portfolios are sold.

Portfolios are held for the next K months (maintenance period 3, 6, 9, 12, 15, 18, 21, 24, 27, 30,33, 36),

The profitability of the conventional momentum strategy is evaluated using autocorrelation-robust t-statistics and Newey-West heteroscedasticity. Finally, the last month is missed to prevent a one-month return on stock returns, which may be due to liquidity or a micro-structural market problem.

Equation (2) presents the weight of each portfolio in the momentum strategy:

$$w_{i,t} = \frac{1}{N}\left(r_{i,t-1} - \bar{r}_{t-1}\right) \quad (2)$$

Where N is the number of portfolios in the sample, $r_{i,t-1}$ is the return of portfolio i at time t-1, t represents time, $\overline{\text{and } r}_{t-1}$ is the average return of portfolios in the sample at time t-1. The profitability of the momentum strategy is calculated as follows:

$$\pi = \frac{1}{N}\sum_{i=1}^{N} r_{i,t}\ \left(r_{i,t-1} - \bar{r}_{i-1}\right) \quad (3)$$

The residual momentum strategy is a strategy based on residual returns, not total returns, which ranks stocks in ascending order based on their residual returns in the last J months and then buys past winning stocks and sells past losing stocks. This strategy is an effective approach to neutralize the dynamic factor exposure of the momentum strategy. To examine the residual momentum, the stocks are first sorted based on their residual returns over the last J months, excluding the last month. They are divided into ten portfolios of equal weight. The reason for the formation period

t-1 of the momentum strategy is usually to eliminate the effect of the medium-term momentum from the effect of the short-term return (Jegadeesh & Titman, 1993).

According to Blitz et al. (2011-2017), the residual momentum strategy is estimated using the Fama and French (1993) three-factor model:

$$r_{i,t} = \alpha_i + ß_{1,i} RMRF_t + ß_{2,i} SMB_t + ß_{3,i} HML_t + \varepsilon_{i,t} \quad (4)$$

where, $r_{i,t}$ is returns of stock i in month t, Rt, SMB_t and HML_t represent excess returns of market factor portfolios, size and value (book value to market value) in month t, respectively, and α_i, $ß_{1,i}$, $ß_{2,i}$, and $ß_{3,i}$ are estimation coefficients, $\varepsilon_{i,t}$ is residual return of stock i in month t. Regression is also estimated during 36-month rolling windows, ie from month t-36 to month t-1. Thus, for each month, the residual returns are estimated using a monthly rolling regression from the stock market premium ($r_{i\ ,t-rf,t}$) on the Fama and French three-factor model from t-36 to t-1. Specifically, at the beginning of each month t, the following time series regression is performed:

$$r_{i,t} - r_{f,t} = \alpha_i + ß_i^{MKT} \times MKT_t + ß_i^{MB} \times SMB_t + ß_i^{HML} \times HML_t + \varepsilon_i \quad (5)$$

where $_{rf,t}$ is the interest rate set by the Central Bank of Iran for month t, MKT_t, SMB_t, HML_t are the Fama and French three factors, α_i, $ß_i^{MKT}$, $ß_i^{MB}$, $ß_i^{HML}$ are estimates, and εi, t is the residual return of stock i in month t. Note that only stocks with a full return history during the 36 months of the rolling regression window are included in the analysis. Equation (6) shows how to calculate the residual returns:

$$\hat{\varepsilon}_{i,t} = r_{i,t} - r_{f,t} - \hat{\alpha}_i - \hat{ß}_i^{MKT} \times MKT_t - \hat{ß}_i^{SMB} \times SMB_t - \hat{ß}_i^{HML} \times HML_t \quad (6)$$

After calculating the residual return, the average residual return of the portfolios is standardized in the same period by their standard deviation from the residual returns and is constructed by ranking the portfolios based on the standardized average residual return; therefore, in portfolios with standardized average residual returns, the highest (lowest) decile contains A% of the stocks in the portfolio with the highest (lowest) standardized residual returns over the past J month. In other words, the stocks in the portfolio with the standardized average residual return above A% are introduced as winners, and the stocks in the portfolio with the standardized average residual returns below A% are introduced as the losers; eventually, the winning portfolios are bought, and the

losing portfolios are sold.

Note that these portfolios are of equal weight and are held for the next K months (maintenance periods: 3, 6, 9, 12, 15, 18, 21, 24, 27, 30, 33, 36). Finally, the profitability of the residual momentum strategy is tested using autocorrelation-robust t-statistics and Newey-West heteroscedasticity-corrected standard errors.

Factor Models

To evaluate the returns of portfolios based on conventional momentum strategies and residual momentum strategies in short-term and long-term time periods, the return premium (RET-RF) as well as the alpha of CAPM models, the Carhart four-factor model, and the Fama-French three-factor and five-factor models will be used.

Fama-French Three-Factor Model

$$RET_{i.m} - R_{f.m} = \alpha_i + \beta\left(R_{M.m} - R_{f.m}\right) + \beta_{SMB.i}SMB_m + \beta_{HML.i}HML_m + \varepsilon_i \quad (7)$$

where $RET_{i.m}$ is related to monthly stock returns for company i per month m; $R_{f.m}$ is the risk-free rate of return per month m, which uses interest on short-term bank investment deposits; $\left(R_{M.m} - R_{f.m}\right)$ is the stock market premium, which is in fact the excess return on stock i of the market in month m.

In this model, SMB_m represents the size factor per month, m, which is derived from the difference in average portfolio returns between small and large companies. HML_m is the factor of book value to market in month m, which is the difference between the average portfolio return with a high ratio of book value to market value and the average portfolio return with a low ratio of book value to market value.

Fama-French Five-Factor Model

$$RET_{i.m} - R_{f.m} = \alpha_i + \beta\left(R_{M.m} - R_{f.m}\right) + \beta_{SMB.i}SMB_m + \beta_{HML.i}HML_m + \beta_{RMV.i}RMV_m + \beta_{RCMA.i}CMA_m + \varepsilon_i \quad (8)$$

The Fama and French five-factor model (2015), which, in addition to the market premium, size (SMB) and book-to-market value (HML), like the Fama

and French model (1993), includes the profitability factor and investment factor.

Profitability factor (RMW): The Profitability factor is calculated as the difference between the stock returns of high-profit companies and those of low-profit companies.

Investment factor (CMA): The investment factor is derived from the difference between the stock returns of high-investment (bold) companies and those of low-investment (conservative) companies.

Carhart Four-factor Model

Carhart's (1997) four-factor model, which, in addition to market premium, size and B/M ratio, like the Fama and French (1993) model, also includes the momentum factor, is calculated as follows:

$$RET_{i.m} - R_{f.m} = \alpha_i + \beta\left(R_{M.m} - R_{f.m}\right) + \beta_{SMB.i}SMB_m + \beta_{HML.i}HML_m + \beta_{WML.i}WML_m + \varepsilon_i \quad (9)$$

The WML momentum factor, which is the difference between the returns of a winning stock portfolio (companies with high past performance tendencies) and the returns of losing companies (companies with low past performance tendencies), represents the momentum of the cumulative monthly returns of companies over the past 12 months in month m.

CAPM

$$RE_{it} = Rf_{it} + \beta\ (RM_{it} - Rf_{it}) \quad (10)$$

β represents the firm risk, and RM and RE represent the expected market return and stock returns, and Rf represents the risk-free rate of return. The beta is measured and published annually via Novin Rahavard software for all companies.

$$\beta = \frac{\mathrm{COV_{i,M}}}{\sigma_i * \sigma_M}$$

where, $\mathrm{COV_{i,M}}$ is the covariance of stock returns i at time t with market returns at time t; σ_i is the standard deviation of the stock return i in time; σ_m is the standard deviation of the capital market return in time.

This study examines financial variables and aims to assist investors in informed decision-making.

Data Collection Instrument and Method

Validity and Reliability

Data collection is done using an archival/documentary method. Closing prices of stocks were obtained from the Tehran Stock Exchange Technology Management Company's website from April 2009 to March 2016. The data were based on real stock market information, using reports published by the Stock Exchange Organization through the Codal database. The study encompasses all companies listed on the Tehran Stock Exchange and Iran Fara Bourse over 10 years, from 2009 to 2016.

Sample Size and Sampling

The sample consists of companies from the population that meet the following criteria:

1. During the studied period, the trading symbol should not stop for more than 3 months.
2. Due to their different financial structures, they should not be classified as banks, financial intermediaries, leasing companies, or insurance companies.
3. Because investment firms have a distinct financial and operating structure compared to other firms, their stock portfolios typically include companies that are listed only once. To avoid double inclusion, investment firms are excluded from the sample.

Given the non-random nature of the sampling method, it is important to note that the results may not be generalizable to the entire population. Therefore, the findings are limited to the specific subset of companies included in the sample.

After applying these criteria, the final sample consists of 179 companies.

Results

After filtering the companies based on the defined criteria, the tests were finally performed using data from 179 companies spanning the period from 2009 to 2016. The table of descriptive statistics, based on monthly data for the variables, is presented in Table 1, using View's statistical software.

Table 1. Descriptive statistics of variables

Variable	Symbol	Mean	Median	Max	Min	SD	Skewness	Kurtosis
Stock return	RET	0.022450	0.002233	1.464614	-0.63796	0.134667	1.30866	8.44570
Risk-free rate of return	RF	0.014358	0.014167	0.019167	0.011667	0.002259	0.88152	2.78507
Market return	RM	0.021375	0.012993	0.231115	-0.09275	0.059657	0.89735	3.74865
Size	SMB	-0.004401	0.000672	0.253362	-0.21993	0.063701	0.17184	6.48853
Value	HML	0.015851	0.018846	0.113540	-0.10725	0.038221	-0.1603	3.45058
Momentum	WMA	0.070573	0.066359	0.200133	0.013597	0.035605	1.03751	4.36432
Profitability	RMA	0.005535	0.006571	0.136260	-0.08857	0.040590	0.29464	3.54378
Investment	CMA	-0.003324	-0.005665	0.098661	-0.0623	0.029323	0.68433	4.02284

The mean of the monthly returns of the companies in the sample is 2.2% and its standard deviation is 13.7%. The range of monthly stock returns varies from -63% to +146%. The mean of market return is 2.1% and the standard deviation is 0.05. The skewness of the stock return is +1.30, and the kurtosis is 8.44, indicating that the skewness is right and the relationship (mean > median > median) prevails. Kurtosis and height of the distribution are greater than the height and kurtosis of the normal distribution.

Stationery Test

Before estimating the regression model of the study, it is necessary to test the reliability of all variables used in the estimates. Since this study spans 10 years, with data collected monthly, and the data structure is panel, the Levin-Lin-Chu test will be used to analyze the study. As the results indicate, the null hypothesis is rejected, and all variables are found to be stationary.

Table 2. stationery test

Variable	Symbol	Test statistics	Test probability level
Stock return	RET	-122.515	0.0000
Risk-free rate of return	RF	-2.01318	0.0000
Market return	RM	-91.9841	0.0000
Size	SMB	-177.272	0.0000
Value	HML	-68.7127	0.0000
Momentum	WMA	-128.478	0.0000
Profitability	RMA	-150.630	0.0000
Investment	CMA	-130.137	0.0000

As the results show, the variables are stationary.

Portfolio Analysis

Analysis of Residual Momentum Strategy and Conventional Momentum Strategy

Portfolio analysis is used to examine the residual momentum strategy and the conventional momentum strategy and to test the hypotheses. In the conventional momentum strategy, at the beginning of each month t, securities are categorized in ascending order based on their returns in the last J months and divided into five portfolios of equal weight. The first portfolio includes the losing portfolio (the one with the lowest total return), and the last portfolio includes the winning portfolio (the one with the highest total return). For each month t, the momentum strategy involves buying winning portfolios and selling losing portfolios and maintaining this position for K months. The residual momentum strategy is based on residual returns, rather than aggregate returns, which ranks stocks in ascending order based on their residual returns over the last J months. It then buys past winning stocks and sells past losing stocks. This strategy is an effective approach to neutralize the dynamic factor exposure of the momentum strategy. To examine the residual momentum, the stocks are first sorted based on their residual returns over the past J months, excluding the last month, and divided into five portfolios of equal weight. To

evaluate the returns of portfolios based on conventional momentum and residual momentum strategies, return market premium (RET-RF) as well as alpha of the CAPM models, the Carhart four-factor model, and the Fama-French three-factor and five-factor models will be used.

Table 3. Portfolio return based on conventional momentum strategy

Portfolio based on total return	Statistic	Return market premium	CAPM α	Fama-French 3-factor α	Carhart 4-factor α	Fama-French 5-factor α
Portfolio (1) (winner)	factor	0.0031***	0.0090***	0.0053**	0.013***	0.007***
	t-statistic	11.313	4.027	2.295	2.949	2.928
Portfolio (2)	factor	0.0088***	0.0019	0.0056**	-0.0033	0.0067***
	t-statistic	3.601	0.9302	2.443	-0.7276	2.824
Portfolio (3)	Factor	0.0069***	0.0013	0.0033	-0.0036	0.0047**
	t-statistic	2.748	0.6254	1.482	-0.822	2.000
Portfolio (4)	factor	0.0039	0.0017	0.0059**	-0.0054	0.0061**
	t-statistic	1.531	0.7857	2.541	-1.085	2.558
Portfolio (5) (loser)	Factor	-0.0072***	-0.0033	-0.0015	-0.018***	-0.0005
	t-statistic	3.058	-1.625	-0.648	-3.553	-0.220
(winner-loser)[1]	Factor	0.0391***	0.012***	0.0069**	0.032***	0.007**
	t-statistic	10.63	4.063	2.083	4.615	2.252

*significant at 10%; ** - at 5%; *** - at 1%

[1] The difference between the highest and lowest portfolios

As shown in Table 3, the difference between the highest and the lowest (winner-loser) based on the conventional momentum strategy is significant at 95% and 99% significance levels. This means that the portfolios of the winning portfolio (the portfolio with the highest total return) have higher and significant excess returns in all five models (return premium, CAPM model, Fama and French three-factor alpha, Carhart four-factor alpha, Fama and French five-factor alpha) compared to the losing portfolio (the portfolio with the lowest total return).

Table 4. portfolio return based on residual momentum strategy

Portfolio based on residual return	Statistic	Return premium	CAPM	Fama-French 3-factor α	Carhart 4-factor α	Fama-French 5-factor α
Portfolio (1)	Factor	0.029***	0.0101***	0.0044*	0.017***	0.0047**
	t-statistic	12.373	4.814	1.949	3.897	2.121
Portfolio (2)	Factor	0.007***	0.0013	0.0057***	-0.0008	0.006***
	t-statistic	3.185	0.653	2.660	-0.163	2.752
Portfolio (3)	Factor	0.0066***	0.0012	0.0035	-0.0044	0.0053**
	t-statistic	2.705	0.628	1.621	-1.003	2.363
Portfolio (4)	Factor	0.0013	0.0002	0.0052	-0.0049	0.0055**
	t-statistic	0.536	0.1000	2.212	-0.9756	2.302
Portfolio (5)	Factor	-0.008***	-0.005**	-0.0031	-0.0313***	-0.0010
	t-statistic	-3.093	-2.137	-1.221	-5.304	-0.3999
(winner-loser)	Factor	0.038***	0.015**	0.0075**	0.0489***	0.005*
	t-statistic	10.594	4.805	2.203	6.579	1.680

*significant at 10%; ** - at 5%; *** - at 1%

Other results in Table 4 also show that the difference between the highest and the lowest (winner-loser) based on the residual momentum strategy is significant at 95% and 99% significance levels. The portfolios of the winning portfolio (the portfolio with the highest residual return) have higher and significant excess returns in all five models (return premium, CAPM model, Fama and French three-factor alpha, Carhart four-factor alpha, Fama and French five-factor alpha) compared to the losing portfolio (the portfolio with the lowest residual return).

Residual Momentum Strategy and Conventional Momentum Strategy in the Short Term

For both conventional momentum and residual momentum, the winner and loser portfolio information are listed in each table.

Table 5. residual momentum strategy and conventional momentum strategy based on market premium

Strategy	Variable	Winner				Loser				Difference	
		Factors	Standard error	t-statistic	p-value	Factors	Standard error	t-statistic	p-value	Size	t-statistic
Conventional momentum	α	0.014372	0.004487	3.203271	0.0014	0.000304	0.004308	0.070470	0.9438	0.014	2.262
Residual momentum		0.010183	0.005430	1.875164	0.0612	0.008597	0.003430	2.506012	0.0124	0.002	2.247

Table 6. residual momentum strategy and conventional momentum strategy based on CAPM alpha

Strategy	Variable	Winner				Loser				Difference	
		Factor	Standard error	t-statistic	p-value	Factor	Standard error	t-statistic	p-value	Size	t-statistic
Conventional momentum	α	0.00122	0.004764	0.025616	0.9796	0.000304	0.004308	0.070470	0.9438	0.001	0.143
Residual momentum		0.004586	0.003284	0.291872	0.7705	0.000958	0.005679	0.807587	0.4196	0.004	0.553

Table 7. residual momentum strategy and conventional momentum strategy based on the Fama-French three-factor α model

Strategy	Variable	Winner				Loser				Difference	
		Factor	Standard error	t-statistic	p-value	Factor	Standard error	t-statistic	p-value	Size	t-statistic
Conventional momentum	α	0.007762	0.006377	1.217189	0.2240	-0.006955	0.005402	-1.287518	0.1982	0.015	1.761
Residual momentum		0.002384	0.004834	0.493176	0.6220	-0.005372	0.006006	-0.894393	0.3714	0.008	1.006

Table 8. residual momentum strategy and conventional momentum strategy based on the Carhart four-factor α model

Strategy	Variable	Winner				Loser				Difference	
		Factor	Standard error	t-statistic	p-value	Factor	Standard error	t-statistic	p-value	Size	t-statistic
Conventional momentum	α	0.020035	0.009663	2.073370	0.0386	-0.018066	0.007994	-2.259931	0.0240	0.038	3.038
Residual momentum		0.007018	0.007926	0.885451	0.3762	-0.025162	0.010073	-2.498019	0.0127	0.032	2.511

Table 9. residual momentum strategy and conventional momentum strategy based on the Fama-French five-factor α model

Strategy	Variable	Winner				Loser				Difference	
		Factor	Standard error	t-statistic	p-value	Factor	Standard error	t-statistic	p-value	Size	t-statistic
Conventional momentum	α	0.015200	0.007166	2.121303	0.0343	-0.001644	0.006939	-0.236946	0.8127	0.017	1.689
Residual momentum		0.012567	0.006240	2.013980	0.0443	-0.002185	0.008242	-0.265072	0.7910	0.015	1.727

As the results show:

In Table 5, according to the size of the t-statistic, the difference between the winning and losing portfolios in both the residual momentum strategy and the

conventional momentum strategy based on the return premium model is significant at a 95% confidence level, indicating that using these two strategies will lead to excess profits.

In Table 6, according to the size of the t-statistic, the difference between the winning and losing portfolios in both the residual momentum strategy and the conventional momentum strategy based on the CAPM alpha model is significant at a 95% confidence level, indicating that using these two strategies will lead to excess profits.

In Table 7, according to the size of the t-statistic, the difference between the winning and losing portfolios in the conventional momentum strategy based on the Fama-French three-factor alpha model is significant at a 95% confidence level, indicating that using this strategy will lead to excess profits. As the results indicate, the difference between the winning and losing portfolios in the lower residual momentum strategy is not statistically significant at a 95% confidence level.

In Table 8, according to the size of the t-statistic, the difference between the winning and losing portfolios in both the residual momentum strategy and the conventional momentum strategy based on the Carhart four-factor alpha model is significant at a 95% probability level, which means that using these two strategies will lead to excess profit.

In Table 9, according to the size of the t-statistic, the difference between the winning and losing portfolios in both the residual momentum strategy and the conventional momentum strategy based on the Fama-French five-factor alpha model is significant at a 90% probability level, which means that using these two strategies will lead to excess profit.

Residual Momentum Strategy and Conventional Momentum Strategy in the long term

For both conventional momentum and residual momentum strategies, the winner and loser portfolio information are listed in each table.

Table 10. residual momentum strategy and conventional momentum strategy based on market premium

Strategy	Variable	Winner				Loser				Difference	
		Factors	Standard error	t-statistic	p-value	Factors	Standard error	t-statistic	p-value	Size	t-statistic
Conventional momentum	α	0.031945	0.002824	11.31347	0.0000	-0.008158	0.002343	-3.481742	0.0005	0.040	10.929
Residual momentum		0.029914	0.002575	11.61878	0.0000	-0.008266	0.002672	-3.093071	0.0020	0.038	10.289

Table 11. residual momentum strategy and conventional momentum strategy based on CAPM alpha

Strategy	Variable	Winner				Loser				Difference	
		Factor	Standard error	t-statistic	p-value	Factor	Standard error	t-statistic	p-value	Size	t-statistic
Conventional momentum	α	0.009041	0.002245	4.027953	0.001	-0.003940	0.002047	-1.924675	0.0543	0.013	4.273
Residual momentum		0.010147	0.002108	4.814332	0.0000	-0.005021	0.002349	-2.137465	0.0326	0.015	4.806

Table 12. residual momentum strategy and conventional momentum strategy based on the Fama-French three-factor α model

Strategy	Variable	Winner				Loser				Difference	
		Factor	Standard error	t-statistic	p-value	Factor	Standard error	t-statistic	p-value	Size	t-statistic
Conventional momentum	α	0.005384	0.002346	2.295005	0.0218	-0.002136	0.002317	-0.921583	0.3568	0.008	2.281
Residual momentum		0.004400	0.002257	1.949312	0.0513	-0.003149	0.002577	-1.221781	0.2219	0.008	2.204

Table 13. residual momentum strategy and conventional momentum strategy based on the Carhart four-factor α model

Strategy	Variable	Winner				Loser				Difference	
		Factor	Standard error	t-statistic	p-value	Factor	Standard error	t-statistic	p-value	Size	t-statistic
Conventional momentum	α	0.013815	0.004685	2.949022	0.0032	-0.019578	0.005237	-3.738388	0.0002	0.033	4.752
Residual momentum		0.017619	0.004521	3.897101	0.0001	-0.031301	0.005903	-5.302343	0.0000	0.049	6.579

Table 14. residual momentum strategy and conventional momentum strategy based on the Fama-French five-factor α model

Strategy	Variable	Winner				Loser				Difference	
		Factor	Standard error	t-statistic	p-value	Factor	Standard error	t-statistic	p-value	Size	t-statistic
Conventional momentum	α	0.007143	0.002439	2.928510	0.0034	-0.001089	0.002348	-0.463778	0.6428	0.008	2.432
Residual momentum		0.004798	0.002262	2.121409	0.0340	-0.001059	0.002652	-0.399246	0.6897	0.006	1.680

As the results show:

In Table 10, according to the size of the t-statistic, the difference between the winning and losing portfolios in both the residual momentum strategy and the conventional momentum strategy based on the return premium model is significant at a 95% confidence level, indicating that using these two strategies will lead to excess profits.

In Table 1, according to the size of the t-statistic, the difference between the winning and losing portfolios in both the residual momentum strategy and the conventional momentum strategy based on the CAPM alpha model is significant at a 95% confidence level, indicating that using these two strategies will lead to excess profits.

In Table 12, according to the size of the t-statistic, the difference between the winning and losing portfolios in both the residual momentum strategy and

the conventional momentum strategy based on the Fama-French three-factor alpha model is significant at a 95% probability level, which means that using these two strategies will lead to excess profit.

In Table 13, according to the size of the t-statistic, the difference between the winning and losing portfolios in both the residual momentum strategy and the conventional momentum strategy based on the Carhart four-factor alpha model is significant at a 95% probability level, which means that using these two strategies will lead to excess profit.

According to Table 14, the difference between the winning and losing portfolios in the conventional momentum strategy based on the Fama-French five-factor alpha model is significant at a 95% confidence level, as indicated by the size of the t-statistic. The residual momentum strategy is significant at a 90% probability level, which means that using these two strategies will lead to excess profit.

Assumption of Regression Model

Before performing any interpretation of the regression results, in order to verify the accuracy and reliability of the regression model estimation, the assumptions of the model should be checked as follows:

1. To reduce the effect of heteroskedasticity in estimating the coefficients, the Newey-West method was used to obtain the t-statistic.
2. The Watson-Durbin statistic was used to examine autocorrelation, and in all models, the Watson-Durbin statistic varies from 1.5 to 2.5. Finally, the output of the Watson-Durbin regression model estimates is shown in the appendix.
3. Variance inflation factor (VIF) was used to detect the presence of collinearity. Myers (1990) suggests that, as a general rule, a VIF greater than 10 indicates serious collinearity. VIF<10 indicates the absence of collinearity. When this factor exceeds 10, it indicates the presence of collinearity.

Table 15 shows the variance inflation factor of independent and control variables. According to VIF, this study reveals no collinearity between the variables.

Table 15. VIF of independent and control variables

Variable symbol	VIF
RM-RF	1.135
SMB	2.601
HML	1.119
CMA	1.511
RMA	2.102

Conclusion

Final results of the hypotheses are presented in the following table:

Results of testing the hypotheses	
Hypothesis	Conclusion
There is no significant difference between the residual momentum strategy and the conventional momentum strategy in the short term.	Not rejected
There is no significant difference between the residual momentum strategy and the conventional momentum strategy in the long term.	Not rejected

The results show that there is no significant difference between the residual momentum strategy and the conventional momentum strategy in the short and long term.

Momentum is a concept in physics that suggests that a moving object tends to remain in motion unless an external force is applied to it. An example of this rule in the market is that a trend in price and profit tends to persist until an external force stops it. This strategy involves investing in the market and claims that positive or negative returns of the past will continue for a certain period in the future. This strategy has always been known as technical analysis, and today it is gaining approval from fundamentalist investors and even the academic community. According to the momentum investment strategy, contrary to the efficient market hypothesis, the return on ordinary stocks in different time periods has a special behaviour, and the obtained return can be higher than the market return by using the investment strategy in proportion to the desired time horizon.

Many researchers have attempted to explain the phenomenon of continued returns in the medium term using modern financial theories. The excess return gained from the momentum investment strategy here compensates for unknown risks that current theories are unable to explain. Research indicates that various strategies can be beneficial at different maintenance periods. Various strategies generally involve a simple method in which they are formed based on the criterion of return over a certain period in the past and are maintained for a corresponding period in the future. Each investment strategy

tends to generate excess returns based on the predictability of short-term price movements, as indicated by past performance.

As the results showed, in both residual momentum strategy and momentum strategy, across both short-term and long-term horizons, based on market premium models, the CAPM alpha model, the Carhart factor model, and the Fama-French three-factor and five-factor models, the use of these two strategies resulted in higher profits in the short and long term.

As the efficient market hypothesis states, it should be impossible to profit from historical trends using a simple, costless strategy such as the momentum trading strategy. However, the momentum strategy, which leverages the serial correlation between market returns and securities, is among financial exceptions and capital market irregularities. Due to this, the efficiency of the Iranian capital market has been repeatedly examined in various studies. It has been found to have a weak level, indicating that past trends have a significant impact on the future performance of the Iranian capital market. This means that companies that had good returns in the past may experience higher returns in the future.

The results of this study are consistent with the results of Kim and Sue (2018). In their study on emotion-based momentum strategy, they concluded that by employing a new method, investors can achieve returns beyond conventional momentum in earnings momentum. The results of this study are also consistent with the results of Abdolbaghi Ataabadi et al. (2020). They concluded that the presence of momentum behavior along with emotions resulting from herding and imitation of investors' behavior can intensify the results of momentum-based investment strategies. Their results indicate the existence of short-term return momentum in high-herding winner portfolios compared to low-herding loser portfolios. The results of this hypothesis are inconsistent with those of the reverse trading strategy. De Bondt and Thaler (1985) demonstrated that stocks that performed poorly over the past three to five years outperformed those that performed well over the same period in the subsequent three to five years. They attributed this phenomenon to overreaction by investors and demonstrated that a reverse investment strategy, which recommends buying stocks that have performed poorly in the past (losing portfolios) and selling stocks that have performed well in the past (winning portfolios), can achieve higher returns in the long run than market returns.

As the results showed, in the two cases of residual and conventional momentum strategies in both short-term and long-term, based on risk-taking models, return premium, alpha of the CAPM model and Carhart four-factor and Fama-French three-factor and five-factor models, the use of the two strategies has resulted in higher profits in the short and long term.

Any research, however comprehensive, is unable to examine all aspects of the subject and address it from different angles; therefore, it is suggested that future studies investigate the effect of company characteristics on conventional and residual momentum strategies and compare the results with those of this study. Considering that stock market returns in certain years in Iran are significantly higher than in other years, it is suggested that the momentum strategy, which focuses on stock market recession and boom periods, be examined separately to determine its effectiveness.

One of the limitations of this study was that some listed companies utilized the law of capital increase through asset revaluation to benefit from tax exemption and update their assets. While most older firms continue to report assets at cost on their balance sheets, this reduces comparability and thus limits the analysis of ratios based on corporate balance sheet items, such as the book value-to-market value ratio.

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