Adv. Math. Fin. App., 2023, **8**(4), P. 1197-1221

Advances in Mathematical Finance & Applications
www.amfa.iau-arak.ac.ir
Print ISSN: 2538-5569
Online ISSN: 2645-4610
Doi: 10.22034/AMFA.2023.1940400.1634

Research Paper

A Feasibility Study of Dissecting Stock Price Momentum Using Financial Statement Analysis

Hamid Bodaghi [a,*], Rezvan Hejazi [b], Mohammad Reza Mehrabanpour [c]

[a] *Department of Accounting, Kish International IAU Branch, Kish Island, Iran*
[b] *Department of Accounting, Khatam University, Tehran, Iran*
[c] *Department of Accounting, University of Tehran, Tehran, Iran*

ARTICLE INFO

Article history:
Received 2021-09-14
Accepted 2023-01-22

Keywords:
stock price momentum
stock future return
financial performance
fundamental factors
winner portfolio
loser portfolio

ABSTRACT

This paper aimed to explore the feasibility of analyzing stock price momentum in companies listed on the Tehran Stock Exchange using financial statement analysis (FSA). Various variables, encompassing factors related to profitability, financial leverage, liquidity, and operating efficiency, were employed in this analysis. The study sample consisted of 130 firms listed on the Tehran Stock Exchange spanning the years 2008-2019. The findings revealed that fundamental factors influenced stock price momentum for one year in the winning portfolio and two years in the losing portfolio. Beyond this period, financial information no longer exerted a significant impact on stock price momentum. Consequently, stock price momentum performance hinges on the alignment of past price performance with fundamental factors. Moreover, the results derived from investment strategies based on the congruence between past price performance and fundamentals underscore that fundamentals indeed make a significant difference in stock excess returns within both winning and losing portfolios.

1 Introduction

Financial markets are known to respond quickly to new information. Encountering new information, investors only focus on increasing their wealth. Investors in capital markets consider the stock price/return very important and typically seek methods to gain a greater return to amass wealth; therefore, they can make effective use of stock price forecasting models. Many researchers and professionals have tested a wide range of stock trading strategies thus far, and have found two strategies the most important ones in portfolio management: reversal strategy and momentum strategy. Both of these strategies use past information to predict future performance and yield excess returns. Momentum in physics refers to a case where a closed system keeps its kinetic energy and movement as long as it is not affected by an external force.

In financial sciences, momentum is labeled 'Stock Price/Return Momentum', and defined as the continued increase or decrease in the stock price following a recent increase or decrease [30]. The literature shows that investors use stock price momentum to gain excess returns; in other words, the strategy at work here is to buy a stock that was a winner (yielding the greatest returns in the past) and

* Corresponding author. Tel.: *+989181320812*
E-mail address: *bodaghi@binaloud.ac.ir*

to sell a stock that was a loser (yielding lowest returns in the past [3]. If analyzing the financial statements helps to know more about this type of stock, it will also prove effective in increasing returns on investment based on price momentum. The main research question addresses the degree of dependence of stock price momentum performance on the conformance of past price performance to fundamentals. Currently, in the capital markets of the world, two trading strategies that are widely used are the momentum strategy and the reverse strategy. These strategies have always been known as technical analysis and today they are being approved by fundamentalist investors and even the academic community. A large amount of research deals with this topic and a wide literature has been formed about it. Past research shows that changes in past stock prices have been affected by fundamental factors and non-fundamental factors (such as disruption). Stocks whose prices are affected by non-fundamental factors will perform inversely in the following periods. In case the analysis of financial statements helps to recognize this type of stock, it can help to increase the investment yield based on the price impulses.

The main argument in this research was that the momentum performance of stock returns depends on the degree of compliance of the past performance of the stock price with the fundamental factors. The noteworthy point is that there is little evidence about what type and amount of stock return momentum are following the fundamental factors, therefore, in this research, we will try to take into account the research done at the level Internationally, the feasibility of explaining the momentum of stock returns by using the analysis of financial statements in companies admitted to the Tehran Stock Exchange should be investigated. Considering that no research has been done in this field so far can bring significant results both in the field of expanding the existing theoretical foundations and in the direction of improving the investment decisions of investors.

The existence of phenomena that question the efficiency of financial markets is one of the issues that financial thinkers have paid much attention to. These phenomena have led to the creation of a gap between the intrinsic value and the market value of the securities and have finally brought extraordinary profits to some people and, as a result, huge losses to others. Identifying and investigating these phenomena can help a lot to create appropriate solutions to approach the fair distribution and optimal allocation of resources. In this way, investors can take advantage of the mid-term momentum in stock prices by buying recent winning stocks and selling recent losing stocks. Therefore, momentum strategies are one of the subjects whose usefulness has been examined and verified in many developed markets and some emerging markets, including Iran. However, predicting the momentum effect using financial information analysis is an area that, despite the scattered investigations that have been done about it, it is still necessary to carry out comprehensive research in this area. Therefore, in this research, the ability to explain the momentum of stock returns by analyzing financial statements has been investigated in the form of financial information analysis score which is obtained based on the nine fundamental variables of the company.

2 Theoretical Foundations and Research Literature

Momentum awareness means sustenance. A good example is when a price trend persists as long as it is not affected by an external force. Contrary to the efficient market hypothesis, in a momentum strategy, ordinary stock returns display a particular behavior/trend in different periods, and it is possible to gain greater returns than the market using an investment strategy that is commensurate with the time horizon/series in question. Two research approaches seek to account for momentum: (1) A classical financial approach (a risk-based explanation); (2) A behavioral financial approach (a

behavior-based approach). The former believes that because of the high risk of strategies, momentum yields greater returns, while the latter attaches considerable importance to behavioral biases [49]. Many researchers attempted to explain the sustainability of the return in the medium term using modern financial theories. Momentum is also defined as the tendency of a security to move in a particular direction. The classical approach cannot explain momentum due to its inconsistency with the market rules. Behavioral tendencies and orientations of investors are among the fundamental reasons for the existence of momentum in the market. Such behavioral biases exist because investors do not always act wisely and, at times, take unwise decisions under the influence of their psychological characteristics [49]. Some behavioral models such as those of [14,23,28], are based on the approach that momentum profits result from the biased processing of information by investors. Other scholars argue that momentum is not enough to reject a rational model, and the profitability of momentum-based strategies offsets the risks caused by strategies. Conrad and Kaul [12] dissect the momentum profit and claim that a major part of the entire profit can be explained via a cross-sectional dispersion in the unconditional expected returns (not via times series analyses on stock returns); they suggest a risk-based explanation for momentum. Lewellen [33] argues that a consecutive covariance causes momentum, not a positive autocorrelation, which triggers behaviors.

According to him, special returns and behavior models fail to account for momentum adequately. Stock price momentum does not entail forecasting prices and returns in different time horizons/series. This concept contradicts the assumptions of an efficient market and shows that capital market investors do not process the information fully [1]. However, previous studies show that the changes in the past stock prices were affected by fundamentals and non-fundamentals (such as noise). A stock whose price is affected by non-fundamentals reverses in future periods (ibid). The excess returns generated using momentum strategies are compensation for the unknown risks that current theories fail to explain. Studies show that it is advisable to use different strategies in different holding periods. Different strategies employ a simple method where returns are generated in a particular period in the past and held for a particular period in the future. Each strategy seeks to generate excess returns based on the ability to forecast short-term price changes according to past performance. Academic studies reveal that portfolio managers and market practitioners believe that trading via momentum strategies may generate excess returns. These strategies are currently dominant in stock exchanges around the world and are extensively used by natural and legal investors [19].

Despite this strategy has been criticized by scholars, many investors still use it to choose a stock. In addition, firms are usually ranked according to the relative strength strategy; therefore, the success of several investment funds and their forecasting ability support the theory that relative power may generate abnormal returns [30]. It merits mention that time horizons/series may vary among trading rules. The evidence shows that sophisticated investors use the relative strength strategy to choose a stock for 3-to-12-month periods. Furthermore, within 7 months of portfolio formation, previous winner stocks outperform loser ones in generating returns, but the reverse is the case from Month 8 through Month 20 (13 months) (ibid). Recent studies show that despite long and short terms, returns in medium terms follow a pattern where they tend to maintain their state. In other words, returns are inclined to show in the next 3 to 12 months the same performance shown in the past 3 to 12 months. Consequently, a momentum strategy here results in abnormal returns, because according to this strategy, stocks with a better performance in the past 3 to 12 months should be bought and those with a poorer performance in the said period should be sold. Grinblatt and Titman [25] point out that most mutual funds tend to buy stocks whose prices increased in the past. Most scholars attribute momentum

profits to investors' behavioral biases. In other words, they believe that investors process information incorrectly and display a bias. This view casts doubt on the economic human hypothesis stating that economic actors do not always act wisely and display biases at times [19]. Studies in the financial literature that address the relationship between risk and return include Sharpe's Capital Asset Prices Theory [45], which assumed that only the systematic (Beta) risk affects the returns of portfolios; this theory came to be known as the One-Factor Model. However, models consisting of multiple factors, such as Ross Arbitrage Pricing Theory [43] and Fama and French Three-Factor Model [21,22], criticized this one-factor model. Adding two variables of (firm) size and book-to-market ratio (B/M) to the one-factor model, Fama and French argued that considering these factors, the role of Beta has become significantly less prominent in justifying the distribution of stocks. Their studies revealed that there is a negative relationship between size and average returns, but there is a positive relationship between size and B/M. In addition, they found that the variable size needs greater attention and that B/M plays a more prominent role in average returns.

This model managed to identify the abnormalities in the Capital Asset Pricing Model (CAPM) such as firm size Banz [4], price-earnings ratio [6,7], financial leverage [8], B/M [47,42], and long-term returns [16]; however, this model failed to explain Jegadeesh and Titman's Stock Price Momentum (buying and holding best-performing stocks and selling worst-performing ones). In 2013, Fama and French added two other factors to their model, i.e. profitability and investment, and strengthened the explaining power of their model compared to previous models. In this new model, they ranked the portfolios based on weighted values and then calculated the variables; afterward, they tested the variables using Time Series Regression and concluded that there is an inverse relationship between size and average returns, but a direct one between B/M and average returns. They reported that momentum boosted the performance of the Fama and French Three-Factor Model [21]. Having tested their model in 2013, Fama and French concluded that this model addressed 69% to 93% of cross-sectional changes in the expected returns for portfolios in terms of size, B/M, profitability, and investment. In their study on NYSE data, they found that the Five-Factor Model, taking into consideration market indicators, size, B/M, profitability, and investment, outperforms the Three-Factor Model in measuring average returns.

Even though the Five-Factor Model cannot provide a comprehensive cross-sectional analysis of returns, it can provide a clear picture of average returns. Adding the factors of profitability and investment gave a prominent advantage to the factor of value in comparison with the Three-Factor Model, enabling it to account for the average returns of the US Capital Market sample studied. The main problem with this model is that it cannot explain the low average returns of small firms, which have low profitability despite huge investments. analyzing the financial statements boosts stock price momentum strategies in two ways: (1) It identifies a stock whose past performance is affected by noise (unrelated to fundamentals) and is likely to reverse in the future, excludes them, and increases the returns; (2) It detects the firms with a stable performance. As a result, the firms with strong (weak) fundamentals are more likely to sustain a higher (lower) profitability, and this maximizes the returns generated by the momentum strategy. In line with this, the current paper aims to ascertain the likelihood of dissecting stock price momentum via FSA to sort out the past performance in terms of fundamentals and non-fundamentals and examine the role financial information analyses play in improving momentum strategies. The stock price performance research literature shows that the past price of the stock predicts the future price (over the next 3 to 12 months. Ahmad et al[1] argue that past prices can be driven by either fundamental or non-fundamental factors, and other than financial

statement analysis (FSA) can help distinguish between these drivers of past returns. They used the three-factor models of Fama and French [21] and the five-factor models of Fama and French [20] and by dividing the investigated companies into different portfolios based on the returns obtained from their holding in the last six months and the score obtained from the information analysis. The financial statements examined the number of excess stock returns (alpha values) in matched portfolios in terms of stock return momentum and fundamental factors. And in their research, they find that price action reverses where the fundamentals are inconsistent with past price performance, making it possible for an investment strategy to outperform a momentum strategy more than 80 percent of the time.

Research shows that investors can use momentum strategies to yield excess returns. To put it another way, buying a stock that was a winner (yielding the greatest returns in the past) and selling a stock that was a loser (yielding the lowest returns in the past) will culminate in positive, significant excess returns. This way, investors can make effective use of medium-term momentum in the stock price. As a result, momentum strategies are among topics that have been much debated, tested, and confirmed in developed markets as well as emerging ones such as Iran's market. Nevertheless, forecasting the effect of momentum via FSA has been sparsely studied and needs an exhaustive piece of research. In keeping up with this, the present paper aims to study the feasibility of dissecting stock price momentum using FSA in terms of 9 fundamental corporate variables.

2.1 Research Background

Moreira and Muir [35] and Eisdorfer and Misirli [17] showed that portfolios with controlled volatility yield a positive, significant alpha in envelopment regressions. Blackburn and Nusret [10] addressed the following capital asset pricing models in Africa, Europe, the Middle East, and Asia: Fama and French Three Factor Model and Carhart Four Factor Model. Their results showed that Carhart's Model outperforms the other model in capital asset pricing in these regions. However, there was no difference regarding stock returns in developing countries between the four-factor model and Capital Asset Pricing Model (CAPM). This finding recommends a distinction between stock markets in developing countries and those in developed ones. Asness et al [2] examined the effect of momentum in 8 markets and determined the effect of momentum returns in all of the markets studied. Value and momentum returns correlate more strongly across asset classes than passive exposures to the asset classes, but value and momentum are negatively correlated with each other, both within and across asset classes. Global funding liquidity risk is a partial source of these patterns, which are identifiable only when examining value and momentum jointly across markets. findings present a challenge to existing behavioral, institutional, and rational asset pricing theories that largely focus on U.S. equities. Sundqvist [48] applied Fama and French Five-Factor (asset pricing) Model to stock markets in northern Europe (the Nordic stock markets).

The results showed that in all three models, portfolios that are sorted in terms of size and suitability fail to explain the mean return. They also revealed that small-cap stocks have a lower beta compared to large-cap ones in the European northern market. Among the models, the five-factor one was proved to explain the mean return in greater detail. Bin et al [9] tested Fama and French Five-Factor Model in the Chinese stock market and showed that there is a strong pattern of size, value, and profitability in the mean return, but there is a weak relationship between the investment factor and the mean return. They argued that their tests indicate that investment was redundant in China during the study period. On the contrary, the value was not a redundant variable in this market. In a study (2018) titled 'Noisy prices and Fama and French Five-Factor Asset Pricing Model in China , Qi Lin [31] addressed the

new Fama and French Model in Shanghai and Shenzhen stock markets. Lin's findings were consistent with those of Bin et al [9], confirming the better performance of the five-factor model in China's stock market compared to the eight-factor model. Kubota and Takehara [32] tested Fame and French Model in Japan, and showed that the factors of profitability and investment were not statistically significant; thus, this model cannot adequately account for data in the period 1978-2014.

Yazdani varzi et al [50] explained the pattern of micro and macro variables on return of stock trading strategies. Markov model showed that within next 12 months, using contrarian strategy i.e. selling previous winners and purchasing previous losers can be profitable. According to the research findings, from among micro variables (base volume, trade volume, institutional investment, and free float) and from among macro variables (currency and inflation rates), only three variables of the first (base volume, institutional investment, and free float) are effective on stock trading strategy; and, they can be used as auxiliary variables to predict return on stock and to specify stock trading strategy in future as a result. Ghiyasvand et al [24] investigated the Impact of Momentum on Stock Returns in Different Market Conditions. Based on the results of the hypotheses test, the momentum in each of the market conditions, including normal, ascending and descending conditions, has a positive and direct effect on the stock returns of the companies listed in Tehran Stock Exchange, which indicates the principle of investors' insatiability in the stock exchange Tehran seeking to maximize its return on investment with a certain risk that in a downside mode of market, their insatiability exits less and faster than their momentum conditions, which is a reason for investors' loss evasion in this situation. Elhaei Sahar et al [18] conducted a research titled Modeling Stock Price Movement: Grounded Theory Approach. The research findings suggest that the winner stock price omentum phenomenon should not be considered a speculation opportunity. Rather, it is an anomaly that has to be regulated with the proposed strategies according to the experts. Kebriyaie and Dehghan [31] touched upon the evaluation of factors determining price momentum in Iran's stock market. Their results showed that momentum trading strategies do affect the stock price; as a result, such strategies can accurately estimate the stock price. There is also a positive, significant relationship between momentum strategies and portfolio returns, and these strategies may increase returns on securities.

When there is a clear relationship between trade volume and stock returns, established via momentum strategies, investors and beneficiaries will view financial markets and the market structure with greater transparency. Salehi et al [44] investigated the development of a revised model out of capital asset pricing models via the momentum premiums model. The data from 90 firms listed on Tehran Stock Exchange in the period 2007-2016 revealed that momentum premiums increase the strength of the proposed model in pricing capital assets. In addition, the returns of the winning stock portfolio are greater than the loss stock portfolio. Rahimipour and Ghaemi [40] evaluated the time-calendar portfolio approach and pricing model in long-term event studies. Their results recommended three years after an event to evaluate the long-term performance of the corporate stock price. Moreover, the following were proven good models in the three years: the four-factor model based on stock liquidity using the ordinary least squares (OLS) method, Fama and French Three-Factor Model, the stock-liquidity-based four-factor model, and the four-factor model based on accruals using weighted least squares (WLS). Bashir Khodaparasti et al. [5] studied the efficiency of the Fame and French Five-Factor Model in offensive and defensive shares. In their research, value and size were redundant variables. Profitability was shown to have a negative, significant effect on the excess returns on defensive shares, but it had no significant effect on excess returns on offensive shares. The investment factor had a positive, significant effect on offensive shares, but it had no significant effect on defensive

shares. Ranjbar et al [41] investigated capital asset pricing models and compared them with the Fama and French Five-Factor Model using economic variables of the foreign exchange rate, inflation rate, imports, and liquidity. They showed that Fama and French Five-Factor Model, proposed in 2014, outperforms other models. This model is followed by CAPM, Fama and French Three-Factor Model, and Consumption-based CAPM. Davallou and Javadian [15] compared the profitability of a new momentum strategy, which is based on the timing of a 52-week high price, with that of the 52-week high price strategy. The results confirmed the higher profitability of the former, while the winner portfolio of the 52-week high price failed to generate greater returns than its loser counterpart; therefore, the profitability of the said strategy was not confirmed. Daneshvar et al [13] studied the impact of market, liquidity, and momentum on large changes in the stock price using Cox regression, and they showed that among the factors studied, the ratio of the book-to-market value of stockholders was the most important variable accounting for the over 5% and 10% increases in the stock price, and the size was the most important in increases by over 20% and 30%. The results also revealed that there was no significant relationship between momentum and large changes in the stock price.

3 Research Methodology

3.1 Research Hypotheses

According to the research literature and theoretical foundations, the hypotheses of the research can be stated as follows:

Hypotheses 1: The performance of stock price momentum is affected by the degree past price performance follows fundamentals. (Stock price momentum is significantly affected by the financial fundamentals of firms).

Hypotheses 2: There is a significant difference in the Fama and French Three-Factor Model between the stock excess returns (alpha coefficient) of momentum- and fundamentals-based portfolios and premium-based portfolios. (Fundamentals cause a significant difference in the stock excess returns of momentum-based portfolios).

Hypotheses 3: There is a significant difference in the Fama and French Five-Factor Model between the stock excess returns (alpha coefficient) of momentum- and fundamentals-based portfolios and premium-based portfolios. (Fundamentals cause a significant difference in the stock excess returns of momentum-based portfolios).

Full description of the research method by purpose, inference method, and outline of research:

Purpose Classification: Because the results of this research can be used in the financial decision-making process, this is applied research in terms of purpose.

Inference Method Classification: Since the researcher has evaluated the relationship between two or more variables, this research is descriptive-analytical.

Research Outline Classif: this research is of the type of post-event research.

The sampling method can be stated as follows:

3.2 Statistical Population of the Study

The study population includes firms listed on Tehran Stock Exchange because their financial information is standard and homogeneous and easily accessible. The sample consists of the firms that meet the following requirements, selected through systematic random sampling:

1. The financial information spans the period 2008-2019.

2. The fiscal year ends on March 20.
3. The firm is listed on Tehran Stock Exchange not later than 20 March 2008, and its name is included among the listed firms during the study period.
4. The fiscal period does not change during the study period.
5. Financial institutions, banks, investment companies, and the like were excluded because of their specific operation and revenue features.
6. The firm has not experienced a blackout period of more than 6 months.

After the inclusion criteria were applied, 130 firms met the above requirements in the study period, i.e. 2008-2019; therefore, no sampling was conducted and all firms entered the study. It deserves mention that the financial information for 2006 and 2007 was also used to calculate some of the study variables.

- **The Sampling Method Can be Stated as Follows**:

This paper employed desk research for its theoretical foundations and collected the data through fieldwork. The data were gathered from different sources such as corporate financial statements, Tehran Stock Exchange CDs, Rahavard Novin Software Package, and the Securities and Exchange Organization Website, known as the Comprehensive Database of All Listed Companies at www.codal.ir. Excel was used to classify and summarize the data and formulate the database, and Eviews ver. 10 was employed for hypothesis testing.

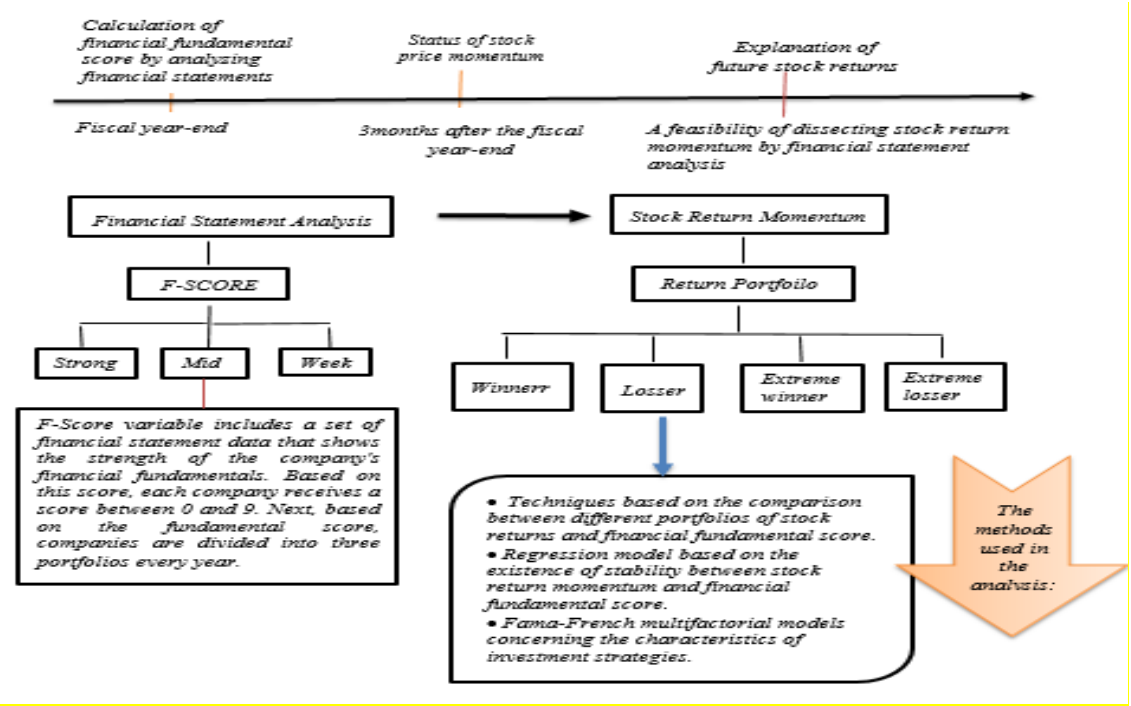

Fig. 1: Research Conceptual Model

4 Research Model

The current paper sought to address the feasibility of dissecting stock price momentum using FSA. Determining past performance in terms of fundamentals and non-fundamentals (noise), the paper examined the role of FSA in improving the momentum strategy. Statistical analyses went as follows. For a better understanding of the current research and investigation, the following conceptual model is presented.

Table 1: Calculation of Factors Related to the Independent Variable

Variable	Symbol	Calculation
Return on Assets	ROA	ROA is measured as the ratio of net profit to total assets at the beginning of a given period. If ROA is greater than 0, the value of 1 is allocated; otherwise, the value of 0 is allocated.
Cash Flows	CFO	CFO is measured as the ratio of operating cash flows to total assets at the beginning of a given period. If CFO is greater than 0, the value of 1 is allocated; otherwise, the value of 0 is allocated.
Accruals	ACCR	ACCR is measured as the ratio of accruals (difference between net profit and operating cash flows) to total assets at the beginning of a given period. If ACCR is less than 0, the value of 1 is allocated; otherwise, the value of 0 is allocated.
Profitability Growth	DROA	DROA is measured as the percentage of changes of ROA in the current period compared to that of the previous period. If changes percentage is greater than 0, the value of 1 is allocated; otherwise, the value of 0 is allocated.
Financial Leverage	DLEV	DLEV is measured as the percentage of changes in the financial leverage (ratio of long-term financial facilities to total assets) of the current period compared to that of the previous period. If the financial leverage decreases (percentage of changes is negative), the value of 1 is allocated; otherwise, the value of 0 is allocated.
Liquidity Ratio	DLIQ	DLIQ is measured as the percentage of changes in the current liquidity (ratio of current assets to current liabilities) compared to the previous liquidity. If the current liquidity increases (percentage of changes is positive), the value of 1 is allocated; otherwise, the value of 0 is allocated.
Share Issuance	ISSU	ISSU is measured according to the number of new shares issued. If a firm does not issue new shares in a fiscal period, the value of 1 is allocated; otherwise, the value of 0 is allocated.
Profit Margin	DMARG	DMARG is measured as the percentage of changes in the gross profit margin (1 minus product cost by sales) of the current period compared to that of the previous period. If the changes in the gross profit margin increase (percentage of changes is positive), the value of 1 is allocated; otherwise, the value of 0 is allocated.
Turnover	DTURN	DTURN is measured as the percentage of changes in the turnover (ratio of sales to total assets) of the current period compared to that of the previous period. If the rate of the current turnover increases compared to the rate of the previous turnover (percentage of changes is positive), the value of 1 is allocated; otherwise, the value of 0 is allocated.

4.1 Dependent Variable

Stock price/return is the study's dependent variable. Returns are defined as the profitability ratio calculated as the gains accrued to a share of stock over a particular period (one year, one month, one week, or one day) compared to the initial purchase price. Returns on investment in common stock in a particular period are defined according to initial and final prices and gains from the ownership and capital increase and they are calculated via the following equation:

$$R_{it} = \frac{(1+\alpha_{it})\times P_{it} - P_{i\,(t-1)} + D_{it} - M}{P_{i\,(t-1)}} \quad (1)$$

where R_{it} stands for the returns of the stock i in the period t.
P_{it} stands for the price of the stock i in the period t.
D_{it} stands for the dividends of the stock i in the period t.

M refers to the capital share, and α_{it} stands for the ratio of capital increase of the firm i in the period t. It should be noted that the present study uses the buy-and-hold returns and renounces the effects of dividends, capital increase, etc.

4.2 Independent Variable

The study's independent variable is the score measured in the financial statement analyses [1]. This score, known as F-score, is calculated as the sum of scores from the analysis of the financial data [38].

4.3 Portfolio Classification by Past Returns and Fundamentals

The momentum-based ranking is conducted yearly and based on past 6-month returns. Using 6-month returns (from 3 months before fiscal year-end through 3 months after it) and ranking them in ascending order, the study firms fall under the following groups:

- Winners: stocks in the tercile three based on their past 6-month returns.
- Neutrals: stocks in tercile two based on their past 6-month returns.
- Losers: stocks in tercile one based on their past 6-month returns.
- Extreme Winners: stocks in decile ten (highest returns) based on their past 6-month returns.
- Extreme Losers: stocks in decile one (lowest returns) based on their past 6-month returns.

Afterward, the firms are subsumed under three categories according to the F-score given to them based on the financial statement data.

- Strong firms (Group 1): F-scores of 7-9
- Medium firms (Group 2): F-scores of 4-6
- Weak firms (Group 3): F-scores of 0-3

4.3.1 Comparison of Returns to Momentum- and Fundamentals-Based Portfolios

In this section, first, the buy-and-hold returns (as of Month 4 after fiscal year-end) are calculated in the study firms, and then portfolio returns are calculated in terms of past performance (winners, neutrals, and losers) and fundamentals (strong, medium, and weak). The stock price momentum is also compared in these groups.

4.3.2 Status of Stock Price Momentum and Congruence Between Performance and Fundamentals

This section focuses on the central hypothesis of the paper on the congruence between momentum and fundamentals using the following Fama-Macbeth type regression [1]. To this end, the effects of momentum and fundamentals and their combined effects on stock returns are determined in 6-month, 1-year, 2-year, and 3-year periods.

$$R_{t+1,i} = \alpha_{0,t} + \alpha_{1,t}Winners_{t,i} + \alpha_{2,t}Winners \times MidFS_{t,i} + \alpha_{3,t}Winners \times Strong_{t,i} + \alpha_{4,t}MedMom \times Strong_{t,i} + \alpha_{5,t}MedMom \times Weak_{t,i} + \alpha_{6,t}Losers_{t,i} + \alpha_{7,t}Losers \times MidFS_{t,i} + \alpha_{8,t}Losers \times Weak_{t,i} + \beta_{1,t}ExtWinners_{t,i} + \beta_{2,t}ExtLosers_{t,i} + \gamma_{1,t}Size_{t,i} + \gamma_{2,t}BM_{t,i} + \varepsilon_{t,i}. \quad (2)$$

Table 2: Calculation Factors in Fama-Macbeth Models Proceeds as Follows:

Variable Symbol	Calculation
$R_{t+1,i}$	Buy-and-hold returns in 6 months, one year, two years, and three years after the fiscal year-end
Winners	The value of 1 if the firm falls into tercile 3 as of 3 months after fiscal year-end, and 0 otherwise
MedMom	The value of 1 if the firm falls into tercile 2 as of 3 months after fiscal year-end, and 0 otherwise
Losers	The value of 1 if the firm falls into tercile 1 as of 3 months after fiscal year-end, and 0 otherwise
Strong	The value of 1 if the firms falls under strong fundamentals category (F-score 7-9), and 0 otherwise.
MidFS	The value of 1 if the firms falls under medium fundamentals category (F-score 4-6), and 0 otherwise.
Weak	The value of 1 if the firms falls under weak fundamentals category (F-score 0-3), and 0 otherwise
ExtWinners	The value of 1 if the firm falls into decile 10 (highest returns) as of 3 months after fiscal year-end, and 0 otherwise
ExtLosers	The value of 1 if the firm falls into decile 1 (lowest returns) as of 3 months after fiscal year-end, and 0 otherwise
Size	The size decile of the firm determines this variable. In line with this, the study firms are classified at year-end in an ascending order in 10 deciles according to their size
BM	The book-to-market ratio-based decile of the firm determines this variable. In line with this, the study firms are classified at year-end in an ascending order in 10 deciles according to their book-to-market ratios

Table 3: Calculation Factors in Fama and French Models Proceeds as Follows:

Variable Symbol	Calculation
$R_{Win\times Str - Los\times Wk}$	Difference between buy-and-hold returns of the winning portfolio with strong fundamentals and the losing portfolio with weak fundamentals
$R_{Winners - Losers}$	Difference between buy-and-hold returns of the winning portfolio and those of the losing portfolio
$MRKT_t$	Capital Market Risk Premium refers to the difference between market returns in the study period and risk-free returns in the same period (Risk-free returns are those on the Central Bank of Islamic Republic of Iran-CBI-bonds in this study.)
$SMB_{i,t}$	Difference between returns of portfolios including the stocks of major firms and those including the stocks of minor firms (size). This variable was introduced into Fame and French models to determine and control the firm size factor on excess returns, and it is calculated via the equation below: $\mathrm{SMB} = \frac{(S/_L + S/_M + S/_H)}{3} - \frac{(B/_L + B/_M + B/_H)}{3}$
$HML_{i,t}$	Difference between returns of the portfolios of the stock of major and minor investee firms (book-to-market ratio). This variable shows the difference between average returns of firms with high and low book-to-market ratios, calculated as below: $\mathrm{HML} = \frac{(S/_H + B/_H)}{2} - \frac{(S/_L + B/_L)}{2}$
$RMW_{i,t}$	Difference between returns of the portfolios of high-profitability and low-profitability firms. Profitability is defined as the ratio of earnings before taxes (EBT) to total assets. $\mathrm{RMW} = \frac{(S/_R + B/_R)}{2} - \frac{(S/_W + B/_W)}{2}$
$CMA_{i,t}$	Difference between returns of the portfolios of conservative and aggressive/risk-taking firms in terms of investment. Investment signifies total asset growth percentage to the last year. $\mathrm{CMA} = \frac{(S/_C + B/_C)}{2} - \frac{(S/_A + B/_A)}{2}$

4.3.3 Investment Strategy Based on Congruence Between Past Performance and Fundamentals and its Effects on Stock Price Momentum

This section uses Fama and French's Three-Factor Model [21] and Five-Factor Model [20] to check how effective the investment strategy based on the congruence between past performance and fundamentals is and how this congruence affects stock price momentum Ahmed et al [1]. To this end, in late March and late September, the firms are classified into different portfolios according to their buy-and-hold returns in the past six months and their F-scores. Using the above-mentioned models, stock excess returns are examined in the portfolios, which are consistent in terms of stock price momentum and fundamentals. The results from the analysis of the financial data in momentum and fundamentals portfolios and premium portfolios are also compared to determine the role fundamentals play in creating a difference in returns in momentum-based strategies. These models are examined using Fama-Macbeth type regression.

$$R_{Win\times Str-Los\times Wk} = \alpha_{FF} + \beta_{mkt}MRKT + \beta_{smb}SMB + \beta_{hml}HML + \varepsilon_t \quad (3)$$

$$R_{Winners-Losers} = \alpha_{FF} + \beta_{mkt}MRKT + \beta_{smb}SMB + \beta_{hml}HML + \varepsilon_t$$

$$R_{Win\times Str-Los\times Wk} = \alpha_{FF} + \beta_{mkt}MRKT + \beta_{smb}SMB + \beta_{hml}HML + \beta_{RMW}RMW + \beta_{CMA}CMA + \varepsilon_t$$

$$R_{Winners-Losers} = \alpha_{FF} + \beta_{mkt}MRKT + \beta_{smb}SMB + \beta_{hml}HML + \beta_{RMW}RMW + \beta_{CMA}CMA + \varepsilon_t$$

In Fame and French models, as described above, all firms are ranked in terms of size at the end of a fiscal year. The median firm is then used to divide stocks into 2 categories: (1) Market value less than the median; (2) Market value greater than the median. Afterward, the firms subsumed under these categories are ranked every year based on their book-to-market ratios. In this 3-category classification, 30% of the stocks go to portfolios with high book-to-market ratios, 30% to portfolios with low ones, and the remaining 40% to the median portfolios. As a result, there are 6 different portfolios:

−S/L, S/M, S/H: Portfolios of small-size stocks with low, median, and high book-to-market ratios, respectively.

−B/L, B/M, B/H: Portfolios of big-size stocks with low, median, and high book-to-market ratios, respectively.

Stocks are divided into 2 categories based on size and into 3 categories based on book-to-market ratio because Fama and French studies show that book-to-market ratio plays a greater role in accounting for returns (stock price momentum) than the size

5 Findings

5.1 Descriptive Statistics

Data were analyzed in the descriptive statistics section using measures of central tendency such as mean and median, as well as indexes of dispersion such as standard deviation (SD), skewness, and kurtosis. There were some irrelevant data, which were excluded. Investigations into the normal distribution of the study dependent variable indicated that the variable of future returns has a relatively normal distribution. Results regarding the stationary cointegration of variables showed that there is no pseudo-regression and variables do not have abnormal relationships.

Table 4: Descriptive Statistics of Main Variables

Variables		Mean	Median	SD	Skewness Coefficient	Kurtosis Coefficient	Min	Max
Name	Symbol							
Future 6-Month Returns	$R_{1+t,6}$	0.205	0.048	0.491	1.820	3.507	-0.400	1.964
Next Year Returns	$R_{1+t,12}$	0.442	0.181	0.797	1.459	1.801	-0.488	2.973
Next 2-Year Returns	$R_{1+t,24}$	0.834	0.624	0.994	1.011	0.623	-0.515	3.643
Next 3-Year Returns	$R_{1+t,36}$	1.234	1.072	1.117	0.732	-0.059	-0.409	3.969
Capital Market Risk Premium	MRKT	0.005	-0.001	0.062	0.609	0.356	-0.133	0.217
Size (three-factor model)	SMB	0.004	0.005	0.033	-0.560	0.466	-0.099	0.076
Market Value	HML	-0.029	-0.028	0.054	0.356	2.103	-0.168	0.182
Profitability	RMW	0.006	0.007	0.041	-0.614	2.648	-0.161	0.148
Investment	CMA	-0.004	-0.005	0.030	-0.645	4.443	-0.137	0.092

Table 5: Descriptive Statistics of Main Variables for Fundamentals Evaluation

Variables		Mean	Median	SD	Skewness Coefficient	Kurtosis Coefficient	Min.	Max
Name	Symbol							
Return on Assets	ROA	0.153	0.121	0.154	0.874	0.515	-0.124	0.581
Cash Flows	CFO	0.135	0.128	0.148	0.783	0.514	-0.106	0.558
Accruals	Accrual	-0.001	-0.014	0.142	0.447	0.446	-0.3	0.376
Profitability Growth	DROA	-0.003	-0.003	0.080	-0.012	0.922	-0.207	0.203
Financial Leverage	DLEVER	-0.004	0.000	0.031	0.007	3.395	-0.092	0.091
Liquidity Ratio	DLIQUID	0.047	0.001	0.269	1.091	1.728	-0.434	0.896
Share Issuance	ISSUE	0.252	0.000	0.434	1.144	-0.692	0.000	1.000
Profit Margin	DMARG	0.006	0.000	0.446	0.664	3.572	-1.223	1.504
Turnover	DTURN	0.037	0.014	0.293	0.952	1.900	-0.531	0.991

Table 6: Frequency of Dummy Variables for Fundamentals State Identification

Fundamentals Evaluation Variables		Frequency		Frequency Percentage	
Name	Symbol	0	1	0	1
Return on Assets	ROA	130	1430	8.3%	91.7%
Cash Flows	CFO	173	1387	11.1%	88.9%
Accruals	Accrual	713	847	45.7%	54.3%
Profitability Growth	DROA	831	729	53.3%	46.7%
Financial Leverage	DLEVER	1049	511	67.2%	32.8%
Liquidity Ratio	DLIQUID	773	787	49.6%	50.4%
Share Issuance	ISSUE	1167	393	74.8%	25.2%
Profit Margin	DMARG	859	701	55.1%	44.9%
Turnover	DTURN	741	819	47.5%	52.5%

Results show that $R_{1+t,6}$ which is measured based on buy-and-hold returns in six months after the momentum period, is 0.205 in the sample firms; this means that the sample firms had 6-month returns of 21% in the study period. The next 1-, 2-, and 3-year returns are 0.442, 0.834, and 1.234, respectively, showing a positive cumulative return in the periods after the momentum. Other results show that MRKT, which shows the difference between capital market monthly returns and risk-free returns, is 0.005, showing a slight monthly excess on risk-free returns in the capital market.

Results also show that SMB, signifying size in the Fama and French Model, is 0.004, and HML, showing market value in the said model, is -0.029. RMW, which shows the difference in monthly stock returns in conservative and aggressive firms, is -0.004, indicating the lower monthly returns of

conservative firms compared to those of aggressive firms. Results of Tables 2 and 3 show that the mean ROA in study firms is 0.153, signifying that the returns of the firms account for about 15% of their total assets. Dummy variables results show that about 92% of the study firms have a positive ROA, indicating their remarkable profitability. Other results show that the mean CFO is 0.135, and in 89% of the study firms, operating cash flows are positive, namely, they possess a considerable money creation power. Results pertaining to ACCR reveal that 54% of the study firms have negative accruals. Other results show DROA in the study firms is -0.003, and 47% of the firms have a positive profitability growth, while in the rest, the profitability grew negatively. It is also shown that DLEV is -0.004, and the financial leverage decreased in 32% of the firms, while in the remaining 68%, there was an increase in finance thanks to long-term financing facilities. DLIQUID is shown to be 0.047 and ISSU to be 0.252, signifying that on average there was a capital increase in 25% of the firms studied. DMARG is 0.006, and 45% of the firms witnessed an increase in their profit margin, while 55% experienced a decrease. Lastly, DTURN is shown to be 0.037, and turnover increased in 53% of the study firms.

5.2 Portfolio Classification in Terms of Returns and Fundamentals and Portfolio Comparison

The momentum-based classification is performed every year taking into consideration the past 6-month returns. The study firms are classified in the following portfolio in ascending order using a 6-month returns period.

Table 7: FSA-Based Classification of Firms

Stock Portfolio Returns State	Loser	MedMom	Winner
Frequency	516	528	516
Frequency Percentage	33.1%	33.8%	33.1%

Once the firms are scored according to fundamentals, they are classified into 3 portfolios according to their F-scores. The following table displays the frequency of each portfolio.

Table 8: FSA-Based Classification of Firms

Firm Financial State	Weak	MidFS	Strong
Frequency	344	924	292
Frequency Percentage	22.1%	59.2%	18.7%

Table 9: Mean Future Returns in Momentum-Based Portfolios

Future Returns		Loser	MedMom	Winner	ANOVA
Name	Symbol				
Future 6-Month Returns	$R_{1+t,6}$	0.261	0.188	0.168	5.133***
Next Year Returns	$R_{1+t,12}$	0.554	0.433	0.339	8.783***
Next 2-Year Returns	$R_{1+t,24}$	1.064	0.742	0.698	17.913***
Next 3-Year Returns	$R_{1+t,36}$	1.565	1.092	1.048	26.631***
*Significant at 90% confidence level; ** Significant at 95% confidence level; ***Significant at 99% confidence level					

Results from Table 4 show that 22% of the study firms are in a weak fundamental and financial state, 59% are in a medium state, and 19% are in a strong state. The next section addresses the performance of different portfolios in terms of past performance and fundamentals after buy-and-hold returns are calculated in the next 6-month, year, 2-year, and 3-year periods. Afterward, the mean stock price momentum is examined in matching and non-matching firms in terms of past performance and

fundamentals. The results show that the mean future 6-month returns are 0.261 for loser firms, while they are 0.168 for winner firms. ANOVA results detected a significant difference between the values of different portfolios. Consequently, the stock returns follow a reverse pattern, and there exists a significant difference between stock price momentums of different portfolios. The next year's returns results show that the mean next year's returns for winner and loser firms are 0.554 and 0.339, respectively. This means that the next year's returns have a reverse effect, and the returns in the loser portfolio will be significantly greater than those of the winner portfolio one year after the portfolio classification. Results regarding the next 2- and 3-year returns show that the loser's returns are significantly higher than those of the winner. At a proper confidence level, this suggests that stock price momentum does not have any effects and confirms the effects of the reverse strategy in the study firms.

Table 10: Mean Future Returns in Fundamental-Based Portfolios

Future Returns		Weak	MidFS	Strong	ANOVA
Name	Symbol				
Future 6-Month Returns	$R_{1+t,6}$	0.131	0.219	0.252	5.633***
Next Year Returns	$R_{1+t,12}$	0.405	0.453	0.454	0.461
Next 2-Year Returns	$R_{1+t,24}$	0.859	0.824	0.836	0.136
Next 3-Year Returns	$R_{1+t,36}$	1.324	1.242	1.090	2.655*
**Significant at 90% confidence level; ** Significant at 95% confidence level; ***Significant at 99% confidence level*					

The results show that the mean future 6-month returns are 0.131 for weak firms, while they are 0.219 and 0.252 for MidFS and strong firms, respectively. The comparison of different portfolios shows no statistically significant difference. The next year's returns results show that the mean next year's returns for weak and strong firms are 0.405 and 0.454, respectively. However, this difference is not statistically significant. Results regarding the next 2- and 3-year returns show that there is no statistically significant difference between portfolios in terms of fundamentals. In sum, fundamentals may cause a significant difference in future returns in the short run, but the difference loses significance in the long run.

5.3 Estimation of Model Parameters Related to the First Research Hypothesis

5.3.1 Status of Stock Price Momentum and Congruence Between Performance and Fundamentals

Table 11 displays the status of stock price momentum after fundamentals effects and is based on momentum in the next 6-month, 1-year, 2-year, and 3-year periods.

5.3.2 Validity of the Study Model

The value for F-statistic in all parts of the above table indicates the significance of the model and the existence of a significant relationship between the study variables; thus, the study model is significant. The table results show that the coefficient of determination is about 4% in Section 1 of the table (next 6 months), which is a relatively small value; however, this value drops to 0.109 in Section 4 (next 3-year returns). Results regarding Durbin-Watson statistic (DWs) show that there is no auto-regression, thus confirming one of the regression assumptions. Results from the variation inflation test, conducted to examine collinearity between independent variables, indicated the non-existence of such collinearity. (The test results are not given for space reasons).

Table 11: Effects of Fundamentals on Stock Price Momentum

Variable (Symbol)	t+6 Months		Year t+1		Year t+2		Year t+3	
	coeff	statistic & significance	coeff	statistic & significance	coeff	statistic & significance	coeff	statistic & significance
Intercept (C)	0.231	5.496***	0.468	6.573***	0.758	8.248***	1.198	11.194***
Winner	-0.122	-1.986**	-0.150	-1.703*	0.076	0.589	0.143	0.947
Winner × MidFS	0.140	2.298**	0.188	1.893*	0.013	0.101	-0.025	-0.169
Winner × Strong	0.178	2.612***	0.124	2.113**	-0.044	-0.309	-0.065	-0.388
MedMom × Strong	0.083	1.486	0.218	2.252**	0.256	2.004**	0.051	0.342
MedMom × Weak	-0.082	-1.567	-0.073	-0.839	0.092	0.825	0.175	1.348
Loser	0.127	1.768*	0.128	1.920*	0.557	3.518***	0.443	2.308**
Loser × MidFS	-0.065	-0.913	-0.053	-1.729*	-0.272	-1.742*	0.012	0.063
Loser × Weak	-0.161	-2.092**	-0.051	-1.680*	-0.335	-1.986**	-0.075	-0.369
EXTLoser	0.083	1.775*	0.167	2.122**	0.227	2.248**	0.225	1.915*
EXTWinner	-0.078	-1.673*	-0.157	-1.992**	-0.104	-1.031	-0.249	-2.103**
Size	-0.019	-4.297***	-0.035	-4.812***	-0.06	-6.372***	-0.081	-7.421***
BM	0.011	2.508**	0.025	3.309***	0.046	4.755***	0.053	4.679***
F-test		4.675***		5.720***		9.106***		11.784***
Coeff of Determination		0.035		0.046		0.078		0.109
DWs		2.092		2.097		1.906		1.933

5.3.3 First Hypothesis Result

Hypotheses 1: The performance of stock price momentum is affected by the degree past price performance follows fundamentals. (Stock price momentum is significantly affected by the financial fundamentals of firms). The next 6-month (t+6 months) returns results show that the dummy variable of Winner has a negative, significant effect on the next 6-month returns as the dependent variable of the study. This means that the winner's portfolio experiences a drop in stock returns in the next 6 months. Results of fundamentals effects show a significant increase in returns for Winner × MidFS and Winner × Strong in the next 6 months. As a result, the fundamentals of the firms enhance the effects associated with stock price momentum considerably.

According to other results, the dummy variable of Loser has a positive effect on the next 6-month returns, showing a considerable increase in the next 6-months returns for Loser. Therefore, there is no stock price momentum and return reversals in the Loser portfolio. Once fundamental's effects are exerted on Loser, there is a noticeable, significant decrease in the next 6-month returns in Loser × Weak. This signifies that the fundamentals of the firms enhance the effects associated with stock price momentum considerably, and there is a decrease in the next 6-month returns in the loser portfolio.

The results of the winner and loser portfolios regarding the next 6-month returns show that before the fundamental's effects are exerted, there is no (stock price) momentum in the next 6 months after portfolio formation, but once these effects are exerted, there will exist a significant momentum. As a result, Winner affects future returns positively and Loser affects them negatively, indicating the persistence of past performance in the future and the existence of a stock price momentum. In a similar vein, results regarding the next 1-year returns (Year t+1) show that there is no momentum in winner and loser portfolios 1 year after portfolio formation; however, once fundamentals effects are exerted, there will be a relatively significant momentum. Results of the nest 2-year returns (Year t+2) indicate that there is no significant momentum in the winner portfolio, but there is such momentum in the loser portfolio. Regarding the next 3-year returns (Year t+3), before the effects are exerted, there is a small, insignificant momentum in the winner portfolio, and it remains still insignificant even after the effects are exerted. The same is the case with the loser portfolio.

Results from different periods show that in the winner portfolio, in the t+6 months and Year t+1, stock price momentum is significantly affected by fundamentals, and there is an increase in future returns in these periods. Other results demonstrate that stock price momentum is significantly affected by fundamentals in the loser portfolio in t+6 months, Year t+1, and Year t+2. Consequently, this portfolio experiences a decrease in future return in these periods. In sum, stock price momentum is affected by fundamentals for 1 year and 2 years in the winner and loser portfolios, respectively. Once these periods are over, the effects lose their significance. This result confirms at a 95% confidence level Hypothesis 1, which says, 'The performance of stock price momentum is affected by the degree past price performance follows the fundamentals. (Stock price momentum is significantly affected by the financial fundamentals of the firms, for 1 year in the winner portfolio and 2 years in the loser portfolio).

5.4 Estimation of Model Parameters Related to the Second Research Hypothesis

5.4.1 Examination Results of an Investment Strategy Based on Congruence Between Past Performance and Fundamentals and Its Effect on Stock Price Momentum—Fama and French Three-Factor Model

This section uses Fama and French Three-Factor Model to confirm Hypothesis 2, which says 'There is a significant difference in the Fama and French Three-Factor Model between the stock excess returns (alpha coefficient) of momentum- and fundamentals-based portfolios and premium-based portfolios. (Fundamentals cause a significant difference in the stock excess returns of momentum-based portfolios). The results are given in Table 12.

5.4.2 Validity of the Study Model

The value for F-statistic in all parts of the above table indicates the significance of the model and the existence of a significant relationship between the study variables; thus, the study model is significant. The table results show that the coefficient of determination is 0.214 in the winner portfolio, 0.300 in the loser portfolio, 0.455 in Winner × Strong, and 0.548 in Loser × Weak. DWs results show that there is no auto-regression, thus confirming one of the regression assumptions.

Table 12: Results of Fama and French Three-Factor Model Regarding Past Performance and Fundamentals

Variable (Symbol)	Momentum-Based Portfolio				Momentum- and Fundamental-Based Portfolio			
	Winner		Loser		Winner × Strong		Loser × Weak	
	Coeff	statistic & significance	coeff	statistic & significance	coeff	statistic & significance	coeff	statistic & significance
Intercept (α)	0.045	18.027***	-0.022	-15.819***	0.010	11.891***	-0.005	-10.638***
MRKT	0.015	4.257***	-0.031	-5.509***	0.032	9.972***	-0.059	-9.899***
SMB	0.006	3.836***	-0.001	-0.185	-0.003	-1.668*	0.010	2.455**
HML	0.002	0.667	-0.017	-3.32***	-0.001	-0.288	-0.023	-4.044***
F-test		11.437***		18.009***		30.019***		46.062***
Coeff of Determination		0.214		0.300		0.455		0.548
DWs		1.621		1.731		2.206		1.961
*Significant at 90% confidence level; ** Significant at 95% confidence level; ***Significant at 99% confidence level								

5.4.3 Second Hypothesis Result

Hypotheses 2: There is a significant difference in the Fama and French Three-Factor Model between the stock excess returns (alpha coefficient) of momentum- and fundamentals-based portfolios and premium-based portfolios. (Fundamentals cause a significant difference in the stock excess returns of momentum-based portfolios). MRKT results show the difference between capital market monthly returns and risk-free returns. In the winner portfolio in the Fama and French Three-Factor Model, this variable affects the excess returns positively and significantly; this effect is negative and significant in the loser portfolio. As a result, MRKT affects the loser stocks reversely, i.e. when the market grows, these stocks follow a descending pattern and vice versa. Results from momentum and fundamentals portfolios indicate that in Winner × Strong, MRKT has a positive, significant effect on stock returns whereas this effect is negative and significant in Loser × Weak. Results of SMB, signifying the difference in stock returns between major and minor firms, show that this variable affects stock returns positively and significantly; namely, the firm size significantly affects future returns. According to the results, future results are greater in smaller firms. Size affects future returns negatively in Winner × Strong; its effect is negative and insignificant in the loser portfolio, and positive and significant in Loser × Weak. Results of HML, signifying the difference between average returns of firms with high and low book-to-market ratios, show that this variable affects the dependent variable positively and insignificantly in the winner portfolio; however, this effect is negative and insignificant in Winner × Strong. HML's effect is negative and significant in the loser portfolio and Loser × Weak. As a result, firms with a higher book-to-market ratio produce fewer returns and vice versa.

Results from the comparison of the alpha coefficient difference in the winner and loser portfolios show that the winner portfolio's alpha coefficient is 0.067 greater than that of the loser portfolio, which is statistically significant. According to other results, the alpha difference between Winner × Strong and Loser × Weak is 0.015, which is also statistically significant. Results from the comparison of momentum portfolios and premium ones indicate that the difference in alpha coefficient between Winner × Strong and the winner portfolio is the statistically significant value of -0.035; this shows that alpha coefficient values in Winner × Strong are remarkably smaller than those in the winner portfolio. Other results show that the difference in alpha coefficient between Loser × Weak and the

loser portfolio is 0.017, which is significant at a 99% confidence level. These results show that fundamentals cause a significant difference in excess returns (alpha coefficient) in portfolios based on past performance. This confirms at a 99% confidence level Hypothesis 2, which says, 'There is a significant difference in the Fama and French Three-Factor Model between the stock excess returns (alpha coefficient) of momentum- and fundamentals-based portfolios and premium-based portfolios. (Fundamentals cause a significant difference in the stock excess returns of momentum-based portfolios).

Table 13: Comparison of Alpha Coefficients in Terms of Past Performance and Fundamentals-Fame and French Three-Factor Model

Portfolio	Alpha Coefficient				Results of Alpha Coefficient Comparison	
	Momentum Portfolio		Momentum and Fundamentals Portfolio			
	winner	loser	winner × strong	loser × weak	alpha difference	statistic & significance
Winner-Loser	0.045	-0.022			0.067	23.491***
Winner × Strong-Loser × Weak			0.010	-0.005	0.015	15.724***
Winner × Strong-Winner	0.045		0.010		-0.035	13.415***
Loser × Weak-Loser		-0.022		-0.005	0.017	11.780***
*Significant at 90% confidence level; ** Significant at 95% confidence level; ***Significant at 99% confidence level						

5.5 Estimation of Model Parameters Related to the Third Research Hypothesis

5.5.1 Examination Results of an Investment Strategy Based on Congruence Between Past Performance and Fundamentals and Its Effect on Stock Price Momentum—Fama and French Five-Factor Model

This section uses Fama and French Five-Factor Model to confirm Hypothesis 3, which says 'There is a significant difference in the Fama and French Five-Factor Model between the stock excess returns (alpha coefficient) of momentum- and fundamentals-based portfolios and premium-based portfolios. (Fundamentals cause a significant difference in the stock excess returns of momentum-based portfolios). The results are given in the table below.

5.5.2 Validity of the Study Model

The value for F-statistic in all parts of the above table indicates the significance of the model and the existence of a significant relationship between the study variables; thus, the study model is significant. The table results show that the coefficient of determination is 0.337 in the winner portfolio, 0.308 in the loser portfolio, 0.474 in Winner × Strong, and 0.608 in Loser × Weak. DWs results show that there is no auto-regression, thus confirming one of the regression assumptions.

Table 14: Results of Fama and French Five-Factor Model Regarding Past Performance and Fundamentals

Variable (Symbol)	Momentum-Based Portfolio				Momentum- and Fundamental-Based Portfolio			
	Winner		Loser		Winner × Strong		Loser × Weak	
	Coeff	statistic & significance	coeff	statistic & significance	coeff	statistic & significance	coeff	statistic & significance
Intercept (α)	0.043	22.991***	-0.022	-16.721***	0.009	11.132***	-0.005	-10.735***
MRKT	0.016	5.149***	-0.03	-5.321***	0.030	9.886***	-0.055	-10.97***
SMB	0.008	4.829***	0.001	-0.111	-0.002	-0.866	0.010	2.366**
HML	-0.002	-0.846	-0.016	-3.216***	-0.003	-1.241	-0.026	-4.067***
CMA	-0.001	-0.327	-0.003	-0.634	0.001	0.717	0.010	2.295**
RMW	-0.007	-3.034***	0.011	2.356**	0.001	0.360	0.024	3.888***
F-test	12.580***		11.048***		19.295***		34.829***	
Coeff. of Determination	0.337		0.308		0.474		0.608	
DWs	1.715		1.746		2.170		1.914	

5.5.3 Third Hypothesis Result

Hypotheses 3**:** There is a significant difference in the Fama and French Five-Factor Model between the stock excess returns (alpha coefficient) of momentum- and fundamentals-based portfolios and premium-based portfolios. (Fundamentals cause a significant difference in the stock excess returns of momentum-based portfolios). MRKT results show the difference between capital market monthly returns and risk-free returns. In the winner portfolio in the Fama and French Five-Factor Model, this variable affects the excess returns positively and significantly; this effect is negative and significant in the loser portfolio. As a result, MRKT affects the loser stocks reversely, i.e. when the market grows, these stocks follow a descending pattern and vice versa. Results from momentum and fundamentals portfolios indicate that in Winner × Strong, MRKT has a positive, significant effect on stock returns whereas this effect is negative and significant in Loser × Weak.

-Results of SMB, signifying the difference in stock returns between major and minor firms, show that this variable affects stock returns positively and significantly. Size affects future returns negatively and insignificantly in Winner × Strong; its effect is negative and insignificant in the loser portfolio, and positive and significant in Loser × Weak. -Results of HML, signifying the difference between average returns of firms with high and low book-to-market ratios, show that this variable affects the dependent variable negatively and insignificantly in the winner portfolio. HML's effect is negative and significant in the loser portfolio and Loser × Weak.

-Results of CMA, which shows the difference between the monthly returns of conservative and aggressive firms in terms of investment, suggest that this variable affects excess returns negatively and insignificantly in the winner portfolio, and this effect is positive and insignificant in Winner × Strong. CMA's effect is negative in the loser portfolio, and positive and significant in Loser × Weak.

-Results of RMW, the difference between returns of the portfolios of high-profitability and low-profitability firms, show that this variable affects excess returns (the dependent variable) negatively

and significantly in the winner portfolio. RMW's effect is positive and significant in the loser portfolio and Loser × Weak.

Table 15: Comparison of Alpha Coefficients in Terms of Past Performance and Fundamentals-Fame and French Five-Factor Model

Portfolio	Alpha Coefficient				Results of Alpha Coefficient Comparison	
	Momentum Portfolio		Momentum and Fundamentals Portfolio			
	winner	loser	Winner × strong	loser × weak	alpha difference	Statistic & significance
Winner-Loser	0.043	-0.022			0.065	28.470***
Winner × Strong-Loser × Weak			0.009	-0.005	0.014	14.755***
Winner × Strong-Winner	0.043		0.009		-0.034	16.322***
Loser × Weak-Loser		-0.022		-0.005	0.017	12.648***
*Significant at 90% confidence level; ** Significant at 95% confidence level; ***Significant at 99% confidence level						

Results from the comparison of the alpha coefficient difference in the winner and loser portfolios show that the winner portfolio's alpha coefficient is 0.065 greater than that of the loser portfolio, which is statistically significant. According to other results, the alpha difference between Winner × Strong and Loser × Weak is 0.014, which is also statistically significant. Results from the comparison of momentum portfolios and premium ones indicate that the difference in alpha coefficient between Winner × Strong and the winner portfolio is the statistically significant value of -0.034; this shows that alpha coefficient values in Winner × Strong are remarkably smaller than those in the winner portfolio. Other results show that the difference in alpha coefficient between Loser × Weak and the loser portfolio is 0.017, which is significant at a 99% confidence level and shows that on average the values of the alpha coefficient are greater in the Loser × Weak than the loser portfolio. These results show that fundamentals cause a significant difference in excess returns (alpha coefficient) in portfolios based on past performance. This confirms at a 99% confidence level Hypothesis 3, which says 'There is a significant difference in the Fama and French Five-Factor Model between the stock excess returns (alpha coefficient) of momentum- and fundamentals-based portfolios and premium-based portfolios. (Fundamentals cause a significant difference in the stock excess returns of momentum-based portfolios).

6 Conclusion

The current study addressed the feasibility of dissecting stock price momentum in the firms listed on the Tehran Stock Exchange using FSA. Different FSA variables included those related to profitability, financial leverage and liquidity, and operating efficiency. In addition, the effects of momentum were also examined in periods of the next 6 months, 1 year, 2 years, and 3 years. FSA showed that 22% of the sample firms are weak, 59% are MidFS, and 19% are strong. Statistical results from regression models indicated that fundamentals affect momentum significantly in 6-month and 1-year periods in the winner portfolio; an increase in future returns was observed in the winner portfolio. Other results demonstrated that in the loss portfolio fundamentals affect momentum significantly in 6-month, 1-year, and 2-year periods; a drop in future returns was observed in the loser portfolio. According to the results, the effects of fundamentals on stock price momentum last for 1 year in the winner portfolio and 2 years in the loser portfolio; once these periods are over, the effects lose significance. This shows that the performance of stock price momentum is affected by the degree past

price performance follows fundamentals. This merits notice because it improves the FSA of momentum-based strategies in two ways: (1) It identifies and excludes the stocks whose past price is affected by noise and will experience a reversal in their returns in the future; thus, returns will increase; (2) FSA helps identify the firms with stable financial performance, and, as a result, strong and weak firms will show more stable and less stable profitability.

This increases the momentum-based strategy returns. Therefore, investors are recommended to pay careful attention to the fundamental status of stocks using the indicators introduced in this paper when deciding on what stocks to buy to strengthen their investment portfolios. This is a new study in terms of its type, with no counterpart, though there is some degree of similarity between its variables and those of some Iranian and international studies. This study is consistent with Ahmed et al [1], Cakici and Tan [11], Hubinette, and Jonsson [29], Shen et al [46], Moskowitz and Grinblatt [36], Mousavi Shiri et al [37], and Hashemi and Miraki [27], and it is inconsistent with McKnight and Ho [34] and Hajiannejad et al [26], Results of applying an investment strategy based on the congruence between past performance and fundamentals using Fame and French Three-Factor and Five-Factor Models indicate a significant difference between the alpha coefficient of momentum- and fundamentals-based portfolios and those based on premiums (winner and loser portfolios not affected by fundamentals). This shows that there is a significant difference between the winner portfolio's alpha coefficient and that of Winner × Strong; there is also such a difference between the alpha coefficient of the loser portfolio and that of Loser × Weak. As a result, fundamentals cause a significant difference in the stock excess returns of winner and loser portfolios. This result strongly confirms the results of the first part of the study, so investors are recommended again to set their sights on stocks with strong fundamentals.

References

[1] Ahmed, A.S., Safdar, I., *Dissecting stock price momentum using financial statement analysis*, Accounting and Finance, 2018, **58**(1), P.3-43. Doi:10.1111/acfi.12358.

[2] Asness, C., Moskowitz, T., Pedersen, L., *Value and momentum everywhere*, The Journal of Finance, 2013, **68**(3), P.929-985. Doi:10.1111/jofi.12021.

[3] Badri, A., Fathullahi, F., *Return momentum: evidence from Tehran stock exchange*, Investing Knowledge, 2014, **3**(9), P.1-20. (in persian).

[4] Banz, R.W., *The relationship between return and market value of common stocks*, Journal of Financial Economics, 1981, **9**(3), P.3-18. Doi:10.1016/0304-405X (81)90018-0.

[5] Bashir Khodaparasti, R., Saba, M., Boromandzadeh, H., *The efficient Fama and French five-factor model in the offensive and defensive shares*, Financial Management Strategy, 2018, **6**(4), P.109-130. (in Persian). Doi:10.22051/JFM.2018.16192.1423.

[6] Basu, S., Investment performance of common stocks in relation to their price-earnings ratios: a test of the efficient market hypothesis. Journal of Finance, 1977, **12**(3), P.129-156. Doi:10.1111/j.1540-6261.1977.tb01979.x

[7] Basu, S., *The relationship between earnings yield, market value, and return for nyse common stocks: further evidence*. Journal of Financial Economics, 1983, **12**(8), P.129-156. Doi:10.1016/0304-405X(83)90031-4.

[8] Bhandari, L., *Debt/equity ratio and expected common stock returns: empirical evidence.* Journal of Finance,

1988, **43**(12), P.507-528. Doi:10.2307/2328473.

[9] Bin, G., Zhang, Y., Zhange, H., *The five-factor asset pricing model tests for the Chinese Stock Market*, Pacific-Basin Finance Journal, 2018, **43**(4), P.84–106. Doi: 10.1016/j.pacfin.2017.02.001.

[10] Blackburn, D.W., Nusret, C., *Frontier stock markets: local vs global factors*, Gabelli School of Business, Fordham University Research, 2020, **29**(3), P.108-127. Doi: 10.3905/joi.2020.1.124.

[11] Cakici, N., Fabozzi, F. J., Tan, S., Size, *value, and momentum in emerging market stock returns*, Emerging Markets Review, 2013, **16**, P.46-65. Doi:10.2139/ssrn.2070832.

[12] Conrad, J. Kaul, G., *An anatomy of trading strategies*, The Review of Financial Studies, 1998, **11**(3), P.489-519. Doi:10.1093/rfs/11.3.489.

[13] Daneshvar Mofrad, M., Hejazi, R., Mousavi M.H., *Studying the impact of market, liquidity, and momentum on large changes in stock prices using cox regression*, Financial Management Strategy, 2014, **2**(2), P.1-19. (in Persian). Doi:10.22051/JFM.2015.980.

[14] Daniel, K., Hirshleifer, D., Subrahmanyam, A., *Investor psychology and security market under and overreactions*, Journal of Finance, 1998, **53**(6), P.1839-1885. Doi:10.1111/0022-1082.00077.

[15] Davallou, M., Javadian, B., *The timing of 52-week high price momentum: evidence from Tehran Stock Exchange*, Financial Knowledge of Securities Analysis, 2017, **10**(35), P.63-77. (in Persian).

[16] DeBondt, W.F.M., Thaler, R.H. *Does the stock market overreact?* Journal of Finance. 1985, **40**(4), p.793-805. Doi:10.1111/j.1540-6261.1985.tb05004.x

[17] Eisdorfer, A., Misirli, E.U., *Distressed stocks in distressed times*, Management Science, 2020, **66**(6), P.2452–2473. Doi:10.1287/mnsc.2019.3314.

[18] Elhaei Sahar, M., Hejazi, R., Salehi, A., Moltafet, H. *Stock price momentum modeling: a grounded theory approach*. advances in mathematical finance and applications, 2020, **5**(2), P.167-181. Doi:10.22034/amfa.2020.1882300.1324

[19] Eslami Bidgoli, Gh., Nabavi Chashmi, S., Yahyazadehfar, M., Eikani, S., *Investigating the profitability of momentum investing strategy in Tehran stock exchange*. Quantitative Studies in Management, 2010, **1**, P.49-78. (in Persian).

[20] Fama, E., French, K., *Dissecting anomalies with a five-factor model*, The Review of Financial Studies, 2016, **29**(1), P.69–103. Doi:10.1093/rfs/hhv043.

[21] Fama, E., French, K., *Common risk factors in the returns on stocks and bonds*, Journal of Financial Economics, 1993, **33**(1), P.3–56. Doi:10.1016/0304-405X (93)90023-5.

[22] Fama, E., French, K. The cross-section of expected stock returns. Journal of Finance,1992, **47**(2), P.427-465. Doi:10.1111/j.1540-6261.1992.tb04398.x

[23] George, T. J., Hwang, C. Y., *The 52-week high and momentum investing.* Journal of Finance, 2004, **59**(5), P.2145-2176. Doi:10.1111/j.1540-6261.2004.00695.x.

[24] Ghiyasvand, A., Darabi, R., Hamidian, M. *Impact of momentum on stock returns in different market conditions*. Advances in Mathematical Finance and Applications, 2020, **5**(3), P.391-402. Doi:10.22034/amfa.2019.577556.1138.

[25] Grinblatt.M., Titman, S., *Mutual fund performance: an analysis of quarterly portfolio holdings*, Journal of

Business, 1989, **62**(3), P. 393-416. Doi:10.1086/296468

[26] Hajiannejad. A., Ebrahimi, M., Izadinia. N., *A Comparison between basic Fama and French Three Factor model and basic Carhart four factors Model in Explaining the Stock return on Tehran Stock Exchange*, Journal of Asset Mangament and Financing, 2014, **2**(3), P.17-28. (in Persian). Doi.20.1001.1.23831170.1393.2.3.3.0.

[27] Hashemi, S.A., Mirki, F., *Review the return on excess momentum risk in the Tehran stock exchange*, Journal of Accounting and Social Interests, 2013, **3**(1), P.39-56 (in Persian). Doi:10.22051/IJAR.2013.420.

[28] Hong H., Stein, J.C., *A unified theory of underreaction, momentum trading, and overreaction in asset markets*, The Journal of Finance, 1999, **54**(6), p.2143-2184. Doi:10.1111/0022-1082.00184.

[29] Izadikhah, M. *Financial Assessment of Banks and Financial Institutes in Stock Exchange by Means of an Enhanced Two stage DEA Model*. *Advances in Mathematical Finance and Applications*, 2021, **6**(2), P. 207-232. Doi: 10.22034/amfa.2020.1910507.1491

[30] Izadikhah, M., *Using goal programming method to solve DEA problems with value judgments*, *Yugoslav Journal of Operations Research*, 2016, **24** (2), P: 1-16, doi: *10.2298/YJOR121221015I*

[31] Kebriyaie, A., Dehghan, A., *evaluation of determining parameters in Iran stock market*, Financial Engineering and Securities Management, 2020, **11**(43), P.431-450. (in Persian). Doi:20.1001.1.22519165.1399.11.43.18.1.

[32] Kubota, K., Takehara, H., *Does the Fama and French five-factor model work well in Japan?* International Review of Finance, 2017, **18**(1), P.137-146. Doi:10.1111/irfi.12126

[33] Lewellen, J., *Momentum and autocorrelation in stock returns*, Review of Financial Studies, 2002, **15**(2), P.533-563. Doi:10.1093/rfs/15.2.533

[34] McKnight.P. J, Hou.T.C. T., *The determinants of momentum in the United Kingdom*, The Quarterly Review of Economics and Finance, 2006, **46**(2), P.227-240. Doi:10.1016/J.QREF.2005.11.004.

[35] Moreira, A. Muir, T., *Should long-term investors time volatility?* Journal of Financial Economics, 2020, 131, P.507-527. Doi:10.1016/j.jfineco.2018.09.011

[36] Moskowitz, T., Grinblatt, M., *Do industry explain momentum?* The Journal of Finance, 1999, **54**(4), P.1249-1290. Doi:10.1111/0022-1082.00146.

[37] Mousavi Shiri, M., Salehi, M., Shakeri, M., Bakhshian, A., *Profitability of momentum strategy and the effect of stock trading volume on it in Tehran Stock Exchange*, Journal of Financial Engineering and Securities Management, 2016, **6**(25), P.107-124. (in Persian). Doi:20.1001.1.22519165.1394.6.25.6.8

[38] Piotroski, J. D., *Value investing: the use of historical financial statement information to separate winners from losers*, Journal of Accounting Research, 2000, **38**, P. 1–41. Doi:10.2307/2672906.

[39] Qi, L., *Noisy prices and the Fama–French five-factor asset pricing model in China*, Emerging Markets Review, 2018, **31**(3), P.141–163. Doi. 10.1016/j.ememar.2017.04.002.

[40] Rahimpour, M., Ghaemi, M.H., *Evaluation of the pricing model and calendar-time portfolio approach in long-term event study*, Empirical Studies in Financial Accounting, 2019, **15**(61), P.101-130. (in Persian). Doi:10.22054/qjma.2019.41172.1991.

[41] Ranjbar, M.H., Badiee, H., Mohebi, M., *Review and assessment of capital assets pricing models and compare them with the 5-factor model of Fama and French whit using economic variables exchange; rates inflation, import and liquidity*, Financial Knowledge of Securities Analysis, 2019, **12**(42), P.195-215.(in

Persian).

[42] Rosenberg, B., Reid, K., Lanstein, R. *Persuasive evidence of market inefficiency*, Journal of Portfolio Management,1985, **11**(3), P.9-17. Doi:10.3905/jpm.1985.409007.

[43] Ross, S. *Risk, return and arbitrage, in Finance I, Friend, I. and Bicksler, J*. (*Eds*.), Risk and Return in Finance, Ballinger , Cambridge, 1976.

[44] Salehi, M., Hejazi, R., Talebnia, Gh., Amiri, A., *A scheme of CAPM models considering momentum premium*, Financial Knowledge of Securities Analysis, 2019, **12**(43), P. 223-239.(in Persian).

[45] Sharpe, W.F. *Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk*, Journal of Finance,1964, **19**(3), P. 425-442. Doi: j.1540-6261. 1964.tb02865. x.

[46] Shen, Q., Szakmary, A.C., Shamara, S.C., *Momentum and contrarian strategies in international stock market. Further evidence*, Journal of Multinational financial managemen, 2005, **15**, P.235-255. Doi:10.1016/j.mulfin.2004.09.001.

[47] Stattman, D., *Book Values and Stock Returns*, The Chicago MBA: A Journal of Selected Papers, 1980, **4**, P.25–45.

[48] Sundqvist, T., *Tests of a Fama-French five factor asset pricing model in nordic stock markets*, Department of Finance, Hanken School of Economics, 2017.

[49] Taqian Dinani, Z., Farid, D., *Relationship between momentum excess returns and systematic risk in Tehran stock exchange*, financial management perspective, 2016, **6**(16), p.9-30. (in Persian).

[50] Yazdani Varzi, A., Memarian, E., Nabavi Chashmi, S, A., *pattern explanation of micro and macro variables on return of stock trading strategies*, Advances in Mathematical Finance and Applications, 2022, **7**(4), P.997-1011. Doi:10.22034/amfa.2021.1912667.1501.