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Factors Affecting Stock Prices regarding Uncertainty and Asymmetric Information in Tehran Stock Exchange

MonirSadat Mirjamali Mehrabadi[a], Abbas Najafizadeh[a]*, Peyman Ghafari Ashtiyani[b]

[a]Department of Management, Economics college, Arak Branch, Islamic Azad University, Arak, Iran
[b]Department of Management, Business Management college, Arak Branch, Islamic Azad University, Arak, Iran

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ABSTRACT

Two main issues occurring in the economy and largely affecting stock prices are uncertainties and asymmetric information which are influenced by many factors, and along these factors, affect the stock prices. In this study, using Cox, Ingersoll and Ross (CIR) model, we tried to investigate the relationship between theoretical price and stock price under the conditions of uncertainty and asymmetric information. Then, using the GLS panel method, the stock price relationship with these variables and the factors related to the firm performance, economic factors and industrial factors were investigated in Tehran stock exchange. The results indicated that a large part of stock price changes can be explained by two variables of uncertainty and asymmetric information, while other factors had significant effects on stock prices. The difference was that the factors related to the firm's performance and industry index had a positive effect and the macro-economic factors had a negative effect on stock prices. Finally, according to CIR model, asymmetric information and uncertainty in market lead to delays in stock price adjustment, which can affect quality of corporate governance principles.

1 Introduction

The prices in stocks markets reflects stock market value and usually represents equity value of investors. In appropriate stocks pricing means that a firms' stock price is not properly valued for various reasons. These reasons may arise from asymmetric information, agency costs, incorrect corporate governance structure, and etc., which can cause problems in future periods for firms. One of the disincentive factors against investing and the lack of prosperity in capital and stock market is threats of confidence and uncertainly in the current and future conditions of economy and its macro variables.

In addition, asymmetric information is one of the fundamental issues in financial markets. Based on one of the complete competition theory assumptions, all participants in the market are fully aware of prices and technological information. Therefore, on the one hand, firms are aware of all goods prices and production technology that they can possibly produce, and also are aware of the necessary inputs prices that they can buy; On the other hand, all people are aware of all goods

*. Corresponding author. Tel1.: +989181611470
E-mail address: abbnaj@yahoo.com

prices that they can buy and aware of prices that they can sell their resources especially their workforce. Investigating stock market structure reveals that information plays an important role in this market and if there is asymmetric information, the performance of financial markets is disrupted. The existence of sufficient information on the market and timely and prompt reflection of information on the price of securities are closely related to market efficiency. Developing countries, including Iran, have a high degree of instability in macroeconomic variables. In these countries, exchange rate, stock prices and other major macroeconomic variables are more volatile than developed and industrialized economies.

These fluctuations also created an uncertain environment for investors and this issue creates problems for investors that cannot decide easier and more confident on future investment. Uncertainty, regardless of its reasons, is a main factor affecting the behavior of firms. Generally, two basic issues largely occurring in the economy are uncertainties and asymmetric information. There is uncertainty when a supervisor and activists in a field share the same information before making a decision, but a variable, parameter or function is unclear, and there is asymmetric information when activists in a domain have more or better information from the supervisor regarding a parameter, variable, or function. Some economists studying uncertainty and information focus on rational decision making under information constraints. In the classical economics, it is assumed that all necessary information is available to everyone for decision making, and rational decision is made with complete information. In practice, such conditions are not prevailing, and economic decision-makers are faced with information constraint in various aspects and therefore, suffer from uncertainty [1, 71]. Examination of this issue in financial markets will also reveal new delineations regarding pricing terms in these markets. These delicacies can be useful in the large-scale policies of these markets. Consequently, measuring this asymmetric information along with uncertainty in an important market such as the stock market can be an enlightening and efficient tool for all components of this market, the issue that is emphasized in this article. The macro policymakers in this field can gain better understanding of the mechanism of this market and can see the outcomes of their decisions more clearly. Moreover, investors will have access to more points in making their stock portfolios. Using the results of this research, firms in stock market can be more effective in pricing and supply of stocks, and brokers can also perform better by exchanging information. Various studies have been conducted on the factors affecting stock prices; for example, Wang and Wang [2] stated that asymmetric information will lead to herd behavior and creating bubbles in the stock market.

Choi [3] argued that uncertainty in the economy leads to an asymmetric price response to the firm unexpected profit and good and bad news. Cormier et al. [4] believed that environmental uncertainty undermines the relationship between profit management and asymmetric information. Kelly and Ljungqvist [5] showed that asymmetric information had a significant impact on asset prices. Chinzara [6] stated that the uncertainty of macroeconomic variables had a significant effect on stock market fluctuations. Alagidede et al. [7] argued that there was a causal relationship between the exchange rate and stock price. Hu and Li [8] argued that high unpredictable inflation would reduce stock prices. Asil Adib et al. [9] concluded that there was a negative relationship between financial leverage and stock returns. Faghani and Ahmadi Langari [10] found a significant relationship between financial leverage and stock prices. Naji et al. [11] showed that stock prices of firms in Tehran Stock Exchange had a direct and significant relationship with the exchange rate. This research attempted to investigate the factors affecting stock prices in conditions of uncertainty and asymmetric information in an equilibrium system using

the data of the active firms in the Tehran Stock Exchange during the period of 2008-2017. It should be noted that in previous studies, the simultaneous impact of these two issues on stock prices has not been studied and this is innovation in the subject of the present study. In order to measure the asymmetric information, Glosten and Harris (GH) [12] index was used. Then, in order to measure changes in stock prices due to changes in the environment (uncertainty) and market information, a security or a set of theoretical securities were considered and the relationship between the theoretical price and market price of the securities was modeled based on the Cox, Ingersoll and Ross (CIR) [13] model.

The market price is the current price at which an asset can be bought or sold and in finance, theoretical (intrinsic) value refers to the value of a company, stock, currency or product determined through fundamental analysis without reference to its market value. After determining the theoretical value of the stock and estimating its relationship to real price, asymmetric information and uncertainty, in order to identify the factors affecting stock prices of selected firms in the Tehran Stock Exchange, selected factors related to the firm's performance, economic indicators and industrial status were introduced into the model and their impacts were investigated.

2 Literature Review

Based on theoretical foundations, what that determines the theoretical price (intrinsic value) of a firm's stock in a market is the sum of supply and demand by investors and, consequently, their understanding of the return on investment based on the obtained information. However, in practice, sometimes the stock price in the market is not an accurate reflection of the available information, and the market does not act logically in the face of information because there are no perfect competition conditions in the market and markets do not have adequate efficiency, which means that the theoretical price will vary from the stock market prices.

2.1 Factors Affecting Stock Prices

Measuring the theoretical price is difficult and the cost of transactions is exorbitant and important, so, the process of price adjustment towards the theoretical price requires time. In this respect, prices do not always fully reflect theoretical price. In other words, the theoretical price will be different from the stock market price. Some researchers consider lack of adaptability of theoretical price with the market prices to be due to an incorrect valuation of stock prices [14]. One of the factors affecting decision making is the accurate information related to the subject of the decision. If the required information is distributed asymmetrically among individuals, it can lead to different results regarding a single subject. Therefore, before the information itself being important for the decision maker, this is the quality of the distribution of information that needs to be carefully evaluated.

When information asymmetry increases with respect to a firm's stock, its theoretical price will be different from the stock expected value of investors in the capital market [15]. Many studies have so far been conducted to identify and investigate the factors affecting stock prices; some have tried to determine the relationship between selective factors, such as internal, industrial and economic factors, with stock prices. The results vary according to the scope of the study, type of assets and factors examined. Wang and Wang [2] discussed how the asymmetric information creates bubbles in stock market? Also Wang and Wang [16] build a game theoretical model to examine how the level of information advantage

of insiders and the competition between insiders and sophisticated investors affect stock price movements and traders' trading strategies and profits. Ramzi Radchobeh et al. [17] investigated the ambiguity theory and asset pricing in Tehran stock exchange. Khabazkar and Sarlak [18] investigated the relationship between information asymmetry, dividend policies and ownership structure in Tehran Stock Exchange for the period 2011-2015. Badavar Nahandi et al. [19], investigated the moderator role of stock misevaluation on the relationship between information asymmetry and capital structure in Tehran stock exchange. The results suggested a significant and reverse relationship between information asymmetry and capital structure. Wu and Chiu [20] examined economic evaluation of asymmetric and price range information in gold and general financial markets and examines the dependence and structure of fluctuations in gold, stocks and bonds markets.

The results showed that there will be significant economic benefits in markets during periods of crisis and under the presence of asymmetric information. Faghani and Ahmadi Langari [10] investigated the effect of financial structure, financial leverage and profitability on stock prices of firms accepted in Tehran stock exchange during the period of 5 years from 2009 to 2014. The results showed that there was no significant relationship between financial structure and stock price and there was a significant reverse relationship between financial leverage and stock price and there was a significant relationship between profitability and stock price. Mohammadtalebi et al. [21], investigated the effect of the sale of the firm to disclose bad news for firms at different levels of activity ratios. Mohammadi et al. [22] examined an investigation of asymmetric speed of stock price adjustments to new information in Tehran stock exchange. The results showed that the speed of prices had an asymmetric response to past information, so that positive returns are three times more persistent than negative returns. Liu et al. [23] examined the fluctuation of stock prices under asymmetric information.

Choi [3] showed that the change in uncertainty in the economy leads to an asymmetric reaction to stock prices for the firm's unexpected profit. Kelly and Ljungqvist [5], in an article examine asset pricing models in the presence of asymmetric information. The results confirmed that information asymmetry had a significant impact on asset prices, and a major channel that link asymmetries to price is liquidity. Chinzara [6] investigated the relationship between uncertainty of macroeconomic variables and stock prices using the VAR-GARCH model for South Africa. His findings indicated a bilateral relationship between these variables, and the uncertainty of macroeconomic variables had a significant effect on stock market fluctuations. Other studies are also related to this study, which are briefly summarized in Table 1.

Table 1: Previous Studies

Factor		**Researcher**
Asymmetric Information		Kouser et al. [24], Liu et al. [23], Buckley et al. [25]
Uncertainty		Yang et al. [26], Roubaud and Arouri [27], Jensen [28]
Intera- Organizational Factors	EPS	Ni and et al. [29], Farooq and Ahmed [30]
	Financial Leverage	Chong and Kim [31], Brown et al. [32], Ho et al. [33]
	Expected Returns To Risk	Bagirov and Mateus [34], Eldomiaty and Azim [35]
Economic Factors	Inflation	Camilleri et al. [36], Lopez [37]
	Exchange Rate	Akbar et al. [38], Mahapatra and Bhaduri [39], Blau [40], Yang [41]
	Economic Growth Rate	Segal [42], Fufa and Kim [43]
Industrial Factors		Azar and Chopurian [44], Harris [45], Peiro [46],

According to previous studies, stock price information can affect stock pricing in three ways:

First, the internal factors. Shareholders, investors, customers, managers, employees, suppliers of raw materials, distributors, institutions and government agencies, institutions providing facilities and, in the

same way, all those involved with different institutions, have always assessed these institutions and their activities and, based on that make their decisions to do the business [47]. If a firm performs better, its stock price will increase and, as a result, it will yield more returns; if it performs badly, its stock price will decrease and yield less returns [48]. Most researchers believe that stock prices are mainly influenced by variables of dividends policy, holding ratios, post-tax profits, earnings per share, and equity returns [49]. Second, the industrial factors. The relationship between industrial production index and stock price index can be examined from two dimensions.

According to the classification of the National Bureau of Economic Research, the index of industrial production can be considered as an indicator of economic growth or recession. Therefore, changes in the index of industrial production can lead to a change in the value of firms' sales, as a result of this change, the stock returns of the firms and the stock price index will also change. On the other hand, the experts claim that the change in the production index affects inflation, resulting in actual returns and actual stock prices [50]. Third, the macroeconomic factors. Capital markets are one of the most important economic and capital sectors of each country. The capital market is closely related to the country's economic structures. One of the issues surrounding capital markets is its interaction with other pillars of economic systems, usually referred to as microeconomic and macroeconomic variables [51]. In this regard, it seems that macroeconomic variables are more important than microeconomic variables [52].

2.2 Modeling Relationship between Market Price and Theoretical Price

At present, one of the most important issues of capital markets is the question of modeling and determining the theoretical price of stocks. In the pricing mechanism of these stocks assumed short-term interest rate is constant. Because there is a close relationship between bonds and short-term interest rates, the price change in these bonds is heavily dependent on interest rate behavior. In order to analyze this behavior, time structure models are presented for a short-term interest rate, some of which have a stable fluctuation. Vasicek [53], Cox et al. [13], Ho and Lee [54] did a lot of studies in this field. They presented time-structure models for short-term interest rates, that some of which have constant fluctuation. In 1977, Vasicek considered a randomized model for a short-term interest rate where the market risk price is constant, and using this model, an analytical answer for the price of bonds is obtained. Cox, Ingersoll and Ross also introduced the CIR Model in 1985 with a randomized short-term interest rate and obtained a closed-form response for securities pricing. Ho and Lee [54] and Hull and White [55] also created variations in the Vasicek initial model and presented their models. The Vasicek model was based on the Ornstein-Uhlenbeck random process which is the dynamics of short-term interest rate changes $(r_t)_{t\epsilon R^+}$ given by random differential equations.

$$dr_t = \lambda(\bar{r} - r_t)dt + \sigma dW_t \quad (1)$$

In the above equation, W_t is a standard Brownian motion; hence, this model has a Gaussian distribution; however, the objection to this model is that r_t may be negative. Cox, Ingersoll and Ross, adding a sentence $\sqrt{r_t}$ in the diffusion coefficient of the Vasicek model, provided a model under which the short-term rate is always positive. The interest rate r_t is defined using the Cox, Ingersoll and Ross (CIR) model as $dr_t = \lambda(\bar{r} - r_t)dt + \sigma\sqrt{r_t}dW_t$ in which λ, $\bar{r}$ and σ are positive constants. In addition, in Vasicek models and CIR, λ specifies the mean of r_t return speed, $\bar{r}$ is the mean of long run of r_t process, and σ represents the fluctuation of r_t process [56]. Another popular model of the random interest rate

is the Hull and White model, which is an extension of the continuous time of the Vasicek model. In many studies, a random interest rate model that follows the Hull and White model has been used. The advantage of the CIR model over the Hull and White model is that interest rates under the CIR model are always positive [56]. Therefore, with regard to the characteristics of positive interest rates, the fluctuation proportional to the present value of r_t and the convergence to the mean $\bar{r}$ with the λ speed, in this research, the randomized interest rate model of CIR was selected for the stock price survey.

2.3 Capital Asset Pricing

One method that helps investors in explaining the risk and return on investment is the use of capital asset pricing model introduced by William Sharpe in 1960. After the presentation of this model, many adjustments have been made on it so that the performance of this model was extended by introducing variables such as financial risks, liquidity, adverse changes in risk and unexpected economic and operational events. As a result of these developments, new models were proposed based on the standard capital asset pricing model, such as asset pricing behavior models, which are more capable of interpreting capital assets according to market conditions. The behavioral investment portfolio theory defines the behavior of investors in choosing investment units and can also be the basis for determining appropriate performance. In particular, in this theory, investors form their stock portfolios like a pyramid in a sector-by-sector manner, so that the lower parts of the pyramid are designed to protect investment in unfavorable conditions, while the upper pyramid sections for potentially favorable conditions. Some investors fill the highest levels of the pyramid with a few diverse investment portfolios, while other investors complete randomly without any plan. This causes investors to always seek optimal solution to protect their capital against losses which presents the behavioral theory of capital asset pricing [57].

3 Methodology

This study was an applied research and its results can be useful for a wide range of investors and analysts. Based on the content, the main purpose of this research is investigating factors affecting stock prices under uncertainty and asymmetric information. Therefore, the main question of this research is what are the factors affecting stock prices? And despite asymmetric information and uncertainty in the market, how do these factors affect stock prices? In this situation, the conceptual model of research is as Fig. 1. Therefore, the main hypotheses of this research are as follows:

- Uncertainty has a significant impact on the stock price of the accepted firms in Tehran Stock Exchange.
- Asymmetric information has a significant impact on stock prices of accepted firms in Tehran Stock Exchange has a significant effect.
- The variables related to the firm's performance have a significant impact on the stock price of the accepted firms in Tehran Stock Exchange.
- The variables related to the industry performance have a significant impact on the stock price of the accepted firms in Tehran Stock Exchange.
- The variables related to economic conditions have a significant impact on stock price of the accepted firms in Tehran Stock Exchange.

Considering the importance of asymmetric information and uncertainty in financial markets, this study examined the effect of these two factors on stock prices in Tehran Stock Exchange. The statistical population includes firms that were accepted on the Tehran Stock Exchange as active firms (49 firms) on March 1, 2017, and 40 firms have been selected from these firms according to the information history.

Data needed for the study were obtained from the Tehran Stock Exchange, Rahavard Novin software, and the balance sheets of these firms. Since the importance of more active firms is higher and their behavior in Tehran Stock Exchange can be the representative of total firms, this research has tried to study the effect of the above variables along with factors such as firm performance, macroeconomic factors and industry performance.

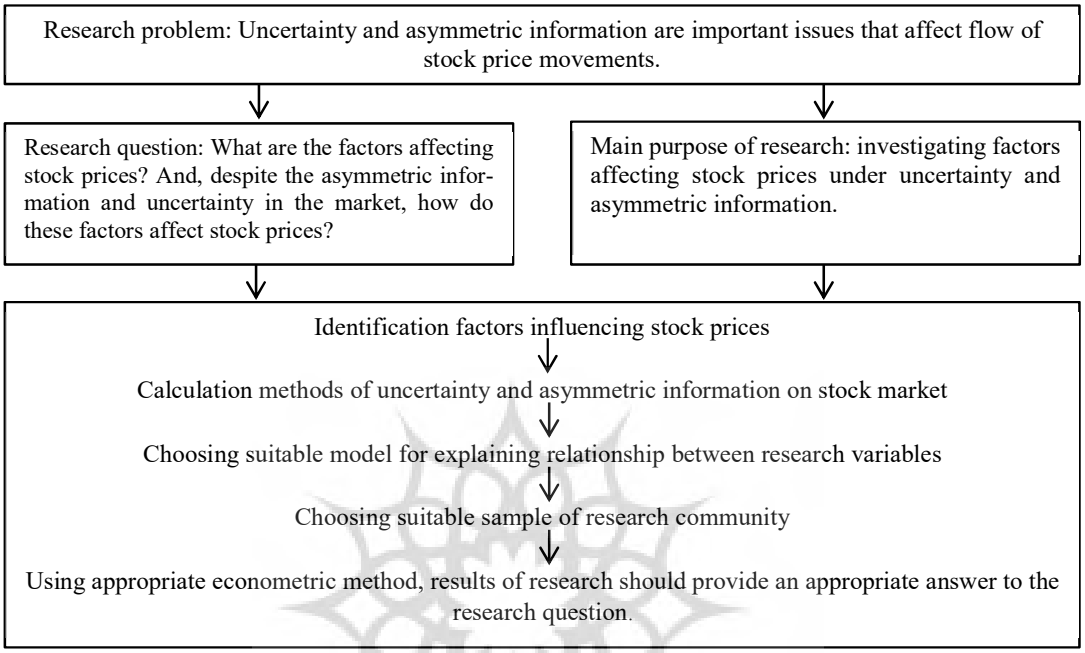

Fig. 1: Conceptual Model

3.1 Cox, Ingersoll and Ross Model (CIR)

Extracting the environmental structure and market information in an ideal way requires that the observed prices of the securities be equal to the number of payment dates associated with the securities; the conditions which is difficult to achieve. To overcome this problem, deductive methods may be used (such as McCulloch [58]) in which the yield curves are extracted from existing information, or inductive methods may be used that defines and limits the structures of the environment based on the theory.

In this section, a well-known and reliable model is needed to be coupled with a theoretical basis and accurate experimental verification. Therefore, the single-variable CIR model is used. The CIR model can be used not only for the valuation of risk-free and independent securities but also for guaranteed prices, options, repayable bonds, and other financial receivables claims [59, 60].

Subsequently, in order to measure changes in the price of securities due to changes in the environment (uncertainty) and market information, a sheet of securities or a portfolio of theoretical securities is considered and, based on the CIR model, the relationship between the theoretical price and market price of the securities is modeled. In the absence of credit risk, changes in the price of the theoretical securities will lead exclusively to changes in the environment and market information. With this in mind, we now try to determine the relationship between the theoretical price of the stock and the observed price of the stock (real price). In this regard, it is assumed that PT_0^i is the theoretical price of the sheet of securities i at time zero; P_0^i is the observed price of the sheet of securities i at time zero; $r_t - 1$ is the risk-free rate

for period t; $R_t - 1$ is the market interest rate for period t, where risk, flow of information and environmental structure are included; C_t is the cash flow for period t and n_i, is the expiration date of securities i, that is, the mental horizon. In this regard, according to Clark and Lakshmi [61], the theoretical and observed prices of securities i are calculated as follows:

$$P_0^i = C_1^i R_1^{-1} + C_2^i R_2^{-2} + K + C_{n_i}^i R_{n_i}^{-n_i} \quad (2)$$

$$PT_0^i = C_1^i r_1^{-1} + C_2^i r_2^{-2} + K + C_{n_i}^i r_{n_i}^{-n_i} \quad (3)$$

First differencing gives

$$dP^i = -1C_1^i R_1^{-1} \frac{dR_1}{R_1} - 2C_2^i R_2^{-2} \frac{dR_2}{R_2} - K - n_i C_{n_i}^i R_{n_i}^{-n_i} \frac{dR_{n_i}}{R_{n_i}} \quad (4)$$

$$dPT^i = -1C_1^i r_1^{-1} \frac{dr_1}{r_1} - 2C_2^i r_2^{-2} \frac{dr_2}{r_2} - K - n_i C_{n_i}^i r_{n_i}^{-n_i} \frac{dr_{n_i}}{r_{n_i}} \quad (5)$$

To simplify the demonstration but with very little loss of generality we assume that changes in the term structures are linked to the short-term riskless rate by functions of time such that

$$\frac{dR_t}{R_t} = G(t) \frac{dr_1}{r_1} \quad (6)$$

$$\frac{dr_t}{r_t} = g(t) \frac{dr_1}{r_1} \quad (7)$$

Divide Eq. (4) by P0 i and Eq. (5) by T0 i and substitute Eqs. (6) and (7).

$$\frac{dP^i / P_0^i}{dr_1 / r_1} = - \frac{\sum_{t=1}^{n_i} t C_t R_t^{-t} G(t)}{P_0^i} \quad (8)$$

$$\frac{dPT^i / PT_0^i}{dr_1 / r_1} = - \frac{\sum_{t=1}^{n_i} t C_t r_t^{-t} g(t)}{T_0^i} \quad (9)$$

Eq. (8) gives the elasticity of the observed securities with respect to the short-term riskless interest rate while Eq. (9) gives a measure of the duration of the theoretical securities, which is also its elasticity with respect to the short-term riskless rate. Denote the right hand side (RHS) of Eq. (8) as Ei and the RHS of Eq. (9) as Di, isolate $\frac{dr_1}{r_1}$, equate the two and rearrange. This gives:

$$\frac{dP}{P_0^i} = \frac{E_i dPT}{D_i PT_0^i} \quad (10)$$

Eq. (10) measures percentage changes in the observed securities market value as proportional to percentage changes in the theoretical securities. The proportion is equal to the ratio of the elasticities of the observed and theoretical securities with respect to the short-term risk-free interest rate, which is, by definition, exclusive of credit risk. Since pure term structure changes reflect changes in the equilibrium conditions on the capital markets, Eq. (10) captures the market risk for security i.

3.2 Glosten and Harris Model (GH)

In this research, we examine the information asymmetry using an alternate model. In this case we employed the Glosten and Harris [12] model which has for estimating spread components in a limit order driven market. Their model is also a trade indicator model with the added feature that both the infor-

mation asymmetry and transitory component (which combines the effects of order-processing and inventory holding costs) are linear functions of the volume traded [62]. The basic model can be expressed as:

$$\Delta P_t = c_0 \Delta Q_t + c_1 \Delta Q_t V_t + z_0 Q_t + z_1 Q_t V_t + \varepsilon_t \quad (11)$$

Where P_t represents the trading price at time t, V_t is the volume of the trade at time t, Q_t is the trademark index and ε_t captures the arrival of new information and the effects of price discreteness.
Under this model the information asymmetry cost component is:

$$Z_0 = 2(z_0 + z_1 V_t) \quad (12)$$

And the transitory component is:

$$C_0 = 2(c_0 + c_1 V_t) \quad (13)$$

So, with the use of the average trading volume $(\overline{V_t})$ for the specific stocks i have:

$$Z_i = \frac{2(z_{0,i} + z_{1,i}\overline{V_i})}{2(c_{0,i} + c_{1,i}\overline{V_i}) + 2(z_{0,i} + z_{1,i}\overline{V_i})} \quad (14)$$

Where Z_i represents the asymmetric information criterion [12].

4 Findings

In this section, risk-free structures for each of the firms in the Tehran Stock Exchange listed in the research sample were used to estimate their theoretical prices. Here, a total of 200 observations (5 years (2011-2016) × 40 stocks (more active firms) were collected from the Tehran Stock Exchange. After calculating the theoretical price and comparing it with the market price, we tried to identify the outlier data and remove them. The first-order difference of the data and its division into market prices gives $\frac{dP}{P_t}$ and $\frac{dPT}{PT_t}$ series. In the first stage, we test for stationarity in the panel data series using the Im, Pesaran, and Shin [63] T-bar test as applied in Wu and Chen [64] and based on the results, we reject non-stationarity. Now, at the next stage, the relationship between market price and theoretical price variables is tested through the following relationship:

$$\frac{dP^i}{P_t^i} = a_1 + a_2 \frac{dPT^i}{PT_t^i} + \varepsilon_t \quad (15)$$

That:
P^i is stock price;
PT^i is theoretical price (equation 3).

Table 2: Estimates of effect of Uncertainty on stock prices in Tehran Stock Exchange

Variable	symbol	Coefficient	Std. Error	t- Statistic	Prob.
Theoretical price	PT	0.3452	0.044	7.836	0.000
Total Observation	178				
Adjusted R-Squared	0.4305				
Prob.	0.000				

Reference: Research finding

To overcome the problems of heteroskedasticity and cross sectional correlation, we used the Kmenta [65] full crosssectionally correlated and time-wise autogressive model. It is expected that a_1 is equal to

zero and a_2 is positive, because the theoretical price changes should be close to market price changes. The coefficient of a_2 is a measure of uncertainty. Results are reported in Table 2. The results of Table 2 showed that a_2 with a p-value of zero is positive and significant. In addition, the general equation with R^2 is well evaluated at 0.43 and there was no evidence of self-correlation in the results. This suggests that diversity in the environmental structure largely explains the stock price changes of the firms under review. In the next step, in order to investigate the effect of asymmetric information on market prices, the following equation was used, where, in addition to the theoretical price as a measure of uncertainty, the market information criterion was also included in the estimation. In this research, the asymmetric information obtained from the Glosten and Harris [12] model, which is one of the microstructure-based criteria has been used as a benchmark for market information.

$$\frac{dP^i}{P_t^i} = a_1 + a_2 \frac{dPT^i}{PT_t^i} + a_3 GH^i + \varepsilon_t \quad (16)$$

That GH^i is asymmetric information index (equation 14). Results are reported in Table 3.

Table 3: Estimates of effect of Uncertainty and Asymmetric Information on stock prices

Variable	symbol	Coefficient	Std. Error	t- Statistic	Prob.
Theoretical price	PT	0.3440	0.041	8.312	0.000
Asymmetric Information	GH	0.4892	0.096	5.091	0.000
Total Observation	178				
Adjusted R-Squared	0.4829				
Prob.	0.000				

Reference: Research finding

The results of Table 3 show that a_2 and a_3 are positive and significant with p-value zero. In addition, the general equation with R^2 more than 0.48 is good and there is no evidence of self-correlation in the results. This showed that diversity in the structure of the environment and market information largely explains the stock price changes of the firms under review. The clearer the information is presented, the faster its impact on prices and decreases the risk of investment. To calculate the effect of other key variables in this framework, three variables are added to the model:

$$\frac{dP^i}{P_t^i} = a_1 + a_2 \frac{dPT^i}{PT_t^i} + a_3 GH^i + b_1 D_1 + b_2 D_2 + b_3 D_3 + \varepsilon_t \quad (17)$$

In which D_1, D_2 and D_3 variables respectively represent the status of factors associated with the firm's performance, industrial factors and macroeconomic factors. Then, the variables associated with each of the factors were added to the model and its effects were investigated.

Factors related to firm performance or internal factors are one of the most important factors that are relevant to the firm's internal situation and affect the stock price and investor decisions. Financial ratios provide useful information to investors and financial market participants, so that they can evaluate the performance of a firm in one sector over time. In this paper, the three factors of predictive of earnings per share (EPS), the financial leverage, and the expected return on risk ratio as factors affecting the stock price of firms were added to the equations and its effects have been investigated.

$$\frac{dP^i}{P_t^i} = a_1 + a_2 \frac{dPT^i}{PT_t^i} + a_3 GH^i + b_{11} EPS + b_{12} LEV + b_{13} EXPR + \varepsilon_t \quad (18)$$

That:

EPS is earnings per share;

LEV is financial leverage (debt/assets);

EXPR is expected return on risk ratio (expected returns/risk).
Results are reported in Table 4.

Table 4: Estimates of effect of Uncertainty, Asymmetric Information and firm performance on stock prices

Variable	symbol	Coefficient	Std. Error	t- Statistic	Prob.
Theoretical price	PT	0.2987	0.059	5.101	0.000
Asymmetric Information	GH	0.1921	0.084	2.278	0.024
Earnings Per Share	EPS	0.1404	0.007	19.777	0.000
Financial Leverage	LEV	0.5883	0.155	3.802	0.000
Expected Returns To Risk	EXPR	0.6116	0.235	2.606	0.010
Total Observation	178				
Adjusted R-Squared	0.6286				
Prob.	0.000				

Reference: Research finding

The results of Table 4 showed that the coefficient of theoretical price, asymmetric information, and factors related to corporate performance were positive and significant. In addition, the general equation with R^2 is well evaluated at 0.63 and there was no evidence of self-correlation in the results.
Earnings per share (EPS) are often used to assess the profitability and risk associated with profits, as well as judgments about stock prices. The higher this factor is, the greater the profitability of the stock and the rise in stock prices. The results also indicated a positive and significant relationship between this factor and stock prices in Tehran Stock Exchange. The leverage indicates the extent to which a firm has financed through a loan or a borrowing. One of the most important and widely used leverage scales is the debt ratio that comes from dividing debt into assets. Researchers such as Wulandari et al. [66], Daryanto et al. [67] Bae et al. [68], Yang et al. [69], Cao [70] have used this ratio as financial leverage in their research. In this study, the debt-to-asset ratio has also been used.
As the results showed, this factor had a positive and significant coefficient indicating that in the case of a rise in corporate debt, stock prices will increase, which is Incompatible with theoretical foundations, which may be due to the existence of inflation and economic fluctuations in Different areas of Iran. The ratio of expected returns to risk was positive and significant meaning that by surpassing the expected returns to risk, investors have an optimistic view of the future, which, in the long run, will lead to higher stock prices. Industrial factors are related to various industries such as cement, petrochemicals, automobile, building and etc. and necessarily affect stock prices of firms. Many analysts in the capital market consider industrial factors as pricing, supply and demand for industrial products, large-scale and long-term investments, and technological changes. Here, by distinguishing the type of industry, the industry index is represented as the agent of the industrial factors in the equation.

$$\frac{dP^i}{P_t^i}=a_1+a_2\frac{dPT^i}{PT_t^i}+a_3GH^i+b_{11}EPS+b_{12}LEV+b_{13}EXPR+b_2IND+\varepsilon_t \quad (19)$$

That IND is Industrial index; Industrial index indicates changes in the value of the securities of the industrial companies and are calculated separately for each industry. This index is provided by the Tehran stock exchange. Results are reported in Table 5.The results of Table 5 showed that the industry index coefficient b_2 was positive and significant. In addition, the general equation with R^2 is evaluated good at 0.7, and there was no evidence of self-correlation in the results. The improvement of industry index over time reflects the improvement in the operating conditions in that industry, and an optimistic view of that industry is formed among investors and the stock prices of that industry increase.

Although stock market changes and fluctuations in the price index are associated with changes in the economy and its macro variables, any changes in the variables such as interest rates, gross national production, investment risk, inflation rate and exchange rate also affect the stock market.

Table 5: Estimates of effect of Uncertainty, Asymmetric Information, firm performance and industry index

Variable	symbol	Coefficient	Std. Error	t- Statistic	Prob.
Theoretical price	PT	0.0558	0.008	7.258	0.000
Asymmetric Information	GH	0.1129	0.626	1.804	0.074
Earnings Per Share	EPS	0.0555	0.025	2.202	0.029
Financial Leverage	LEV	0.2335	0.043	5.451	0.000
Expected Returns To Risk	EXPR	0.6437	0.370	1.822	0.071
Industry index	IND	0.9958	0.204	4.883	0.000
Total Observation	178				
Adjusted R-Squared	0.6989				
Prob.	0.000				

Reference: Research finding

Macro-factors focus more on concepts such as the country's political conditions and factors, the economic situation of the world and Iran, the country annual budget, inflation rates, monetary, financial and currency policies; The set of these factors is entirely out of the hands of firms in stock market, but their stock prices are affected by them. In this study, three factors of economic growth rate, inflation rate and exchange rate have been introduced as the main macro factors affecting stock prices of selected firm in the equation. Results are reported in Table 6.

$$\frac{dP^i}{P_t^i}=a_1+a_2\frac{dPT^i}{PT_t^i}+a_3GH^i+b_{11}EPS+b_{12}LEV+b_{13}EXPR+b_2IND+b_{31}GR+b_{32}INF+b_{33}EXC+\varepsilon_t \qquad (20)$$

That:

GR is The "rate of economic growth" refers to the geometric annual rate of growth in GDP between the first and the last year over a period of time. This growth rate is the trend in the average level of GDP over the period, which ignores the fluctuations in the GDP around this trend. Economic growth is measured as the annual percent change of gross domestic product (GDP). INF is Inflation rate: Inflation rate refers to an overall increase in the Consumer Price Index (CPI), which is a weighted average of prices for different goods. The inflation rate is measured by the percentage rise in the Consumer Price Index, which is reported. EXC is exchange rate: In finance, an exchange rate is the rate at which one currency will be exchanged for another. It is also regarded as the value of one country's currency in relation to another currency. This index has been measured by the growth of the government exchange rate. Results are reported in Table 6. The results of Table 6 showed that the coefficient of three factors of economic growth rate, inflation rate and exchange rate were negative and significant. In addition, the general equation with R^2 with more than 0.71 is evaluated well, and there was no evidence of self-correlation in the results.The economic growth rate does not have a positive effect on the stock price, which can be accurate in the current conditions of Iran's economy. Iran's economy depends on oil revenues and changes in oil prices have changed oil revenues. It has affected domestic investment and resource allocation between the public sector and the private sector, thus affecting economic growth.

Inflation is one of the indicators of macroeconomic instability, which has a significant impact on financial and economic decision making. According to the estimations, the coefficient of this factor is negative and significant. Based on initial theories, stocks can be an appropriate shield against inflation, but

empirical results showed the reverse. In this regard, in order to explain the observed negative relationship, several assumptions have been made, including that stock market investors are exposed to inflationary illusions. When inflation increases, they tend to be more reduce future earnings and expected future dividends using a higher nominal interest rate, resulting in a negative correlation between stock-returns and inflation [72]; or a negative correlation between inflation and stock returns through the short-term negative correlation effect between inflation and true economy activities and short-term positive correlation between actual activities and stock returns (substitution hypothesis) [73].
One of the important factors in the economic fluctuations and, consequently, the performance of a firm are the exchange rate fluctuations. The exchange rate fluctuations affect the expected liquidity and stock prices, which is done by a change in the domestic currency. The relationship between exchange rate and stock price of firms in Tehran stock exchange is estimated to be negative. There are different perspectives on the impact of exchange rates on stock prices. Type of industry, type of activity of active firms in the stock exchange, dependence on the import of raw materials and machinery, export of goods and etc. are factors affecting exchange rate or being affected by it. Moreover, exchange rate changes have caused a fundamental change in the composition of the portfolio of investors, and this combination may be detriment to the firms admitted to the stock exchange.

Table 6: Estimates of effect of uncertainty, Asymmetric information, Firm performance, Industry index and macroeconomic factors on stock prices

Variable	symbol	Coefficient	Std. Error	t- Statistic	Prob.
Theoretical price	PT	0.0552	0.068	8.159	0.000
Asymmetric Information	GH	0.0931	0.045	2.092	0.038
Earnings Per Share	EPS	0.0372	0.010	3.830	0.000
Financial Leverage	LEV	0.5198	0.142	3.675	0.000
Expected Returns To Risk	EXPR	0.9879	0.112	8.823	0.000
Industry index	IND	0.4854	0.115	4.227	0.000
Economic Growth Rate	GR	-0.0162	0.011	-1.576	0.117
Inflation	INF	-0.0167	0.004	-3.917	0.000
Exchange Rate	EXC	-0.0004	0.096	-3.736	0.000
Total Observation	178				
Adjusted R-Squared	0.7145				
Prob.	0.000				

Reference: Research finding

5 Conclusions and Discussion

Given the importance of asymmetric information and uncertainty in financial markets, this study examined the effect of these two factors along with three factors of the performance of firm, the target industry, and the macroeconomics factors on the Tehran Stock Exchange. Since the importance of active firms in the stock market is high, examining these firms can represent the all Tehran Stock Exchange firms regarding the factors. In this research, we tried to model the relationship between market price and stock price in the conditions of asymmetric information and uncertainty, and then, using panel method, the effect of three factors (performance of firm, industrial and macroeconomic) on prices were investigated. Among the factors related to the firm's performance, three factors of earnings per share (EPS), financial leverage (ratio of debt) and expected return to the selected risk ratio, the industry index was considered as representative of the industrial factor and three factors of economic growth rate, Inflation and exchange rates were also considered as macroeconomic factors affecting stock prices.

In order to model the relationship between market price and theoretical price, the Cox, Ingersoll and Ross method (CIR) [13] has been used which has a correct theoretical basis and accurate empirical confirmation, and many studies have used this method for modeling. This model argues that an uncertain environment is governed by a single variable, the interest rate (momentarily), which seems to be the rate that covers all current available information about the price of securities. CIR theory is based on equilibrium pricing of assets. The GLS panel estimator has been used to estimate the coefficients of the model and the effectiveness of other factors, which allows filtering unobserved factors for a specific firm. The results were extracted as follows:

The first hypothesis states that uncertainty has a significant effect on the stock price of listed firms in Tehran Stock Exchange, which confirms this hypothesis. The uncertainty variable, with a coefficient of 0.35, explains about %43 of the stock price changes. This finding suggested that variation in the environmental structure and existing uncertainties explains the stock price changes of the listed firms. It is worth noting that the results are consistent with the results of Choi [3] and Chinzara [6] researches.

The second hypothesis stated that the existence of asymmetric information had a significant effect on the stock prices of accepted firms in Tehran Stock Exchange, which confirmed this hypothesis.

The asymmetric information variable with a coefficient of 0.49, along with uncertainty, explained more than %48 of the stock price changes, and this relationship was significant. Theoretically, asymmetric information will have different effects on different markets and will be influenced by the structure of these firms and the structure of the Tehran Stock Exchange. Interesting point is the sign of this variable; asymmetric information has a positive effect on stock prices which is due to the uncertainty and financial and economic fluctuations, structure of the Tehran Stock Exchange, newness of this market and low participation of the people in Iran economy. It is worth noting that the results are consistent with the results of Wang and Wang [2] and Badavar Nahandi et al. [19].

The third hypothesis argued that the variables related to the firm's performance had a significant effect on the stock price of the accepted firms in the Tehran Stock Exchange, which confirmed this hypothesis. The estimated coefficients of earnings per share (EPS), financial leverage (Ratio of debt) and expected return to risk ratio variables were 0.14, 0.59 and 0.61, respectively, and all three had a significant effect on the stock price variable. Along with uncertainty and asymmetric information, in total, they explained about %63 of stock price changes. As previously stated, financial ratios and their analysis have a great influence on the decision making of investors, but of these variables, three variables were introduced into the model and their significance was studied. All three factors were directly related to stock price changes that do not fit with the theory regarding the financial leverage, which may be due to high inflation in the Iran's economy and the impact of debt settlement on this factor. The results of this study are consistent with the results of Faghani and Ahmadi Langari [10] and Vakili Fard and Salehi [74].

The fourth hypothesis argued that the variables associated with the performance of the industry have a significant effect on the stock price of the accepted firms in the Tehran Stock Exchange. The findings confirmed this hypothesis. The industry index represents the average stock price changes of the active firms in the industrial sector, which is calculated and presented by the Tehran Stock Exchange and used in investing analysis by capital market participants. The coefficient of this index in the estimated equation was 0.99 and significant and, along with other factors, it explained about %70 of stock price changes. The effect of this variable on price changes was positive which was consistent with experimental results. Improving this index means a boom in the capital market and encourages investors in this market. The results are consistent with the results of Sohail and Hussain [75] research. The fifth hypothesis investigated that the variables related to economic conditions had a significant effect on stock price of the accepted firms in the Tehran Stock Exchange. The findings confirmed this hypothesis.

The relationship between stock market developments and changes in stock prices with changes in the economy and macro variables is a bilateral relationship. Any changes in variables such as interest rates, gross national production, investment risk, inflation, and exchange rates affect the stock market. In this study, the effect of three factors of economic growth rate, inflation rate and exchange rate on stock price changes in Tehran Stock Exchange has been investigated and the coefficients of these variables were all negative and significant respectively, 0.016, 0.017 and 0.4004 that Along with other factors, they account for more than %71 of the stock price changes. As can be seen, in addition to the negative effect of all three factors, the effectiveness of these factors was very low. Theoretically, it is expected that the economic growth rate variable will have a positive effect on the Iran's economy and because of the dependence on oil revenues the result can be correct and, for the other two factors, the result can be correct because changes in the inflation rate and the exchange rate will change the composition of the portfolio of investors, and the improvement of other markets in terms of speculation can reduce the attractiveness of investment in the stock exchange. The results are consistent with the results of Shayan Zeinvand et al. [76] and Pedram et al. [77]. In the end, according to the results, can be expressed following suggestions:

- Considering the impact of asymmetric information on Tehran Stock Exchange, it is suggested that this variable should be considered in stock pricing studies.
- Given the relatively high level of asymmetric information in the Tehran Stock Exchange, Authorities should make greater efforts to provide transparent informational environment of firms.
- The control of inflation rate and exchange rate fluctuations is inevitable to stabilize the investment process in Tehran Stock Exchange as an emerging and only formal capital market in Iran.

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