

Modeling factors affecting the accuracy of management profit forecasts in Iranian companies

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Abstract

Profit forecasting by management is one of the mechanisms through which management provides information about the company's future profitability status. This research has been conducted with the aim of providing a model to identify factors affecting the accuracy of management profit forecasts in Iranian companies on the Tehran Stock Exchange. his research is applied in terms of purpose and correlational in terms of nature. In order to achieve the goal of the research, 131 companies were selected from among the companies admitted to the Tehran Stock Exchange during the years 2010 to 2019 by systematic elimination and considered as the main sample. Bayesian averaging and dynamic averaging approaches have been used to determine the optimal model. Based on the results of BMA, TVP-DMA, TVP-DMS, BVAR and OLS models to identify the most important influencing variables on the accuracy of management profit forecast, the BMA model had the highest efficiency. Based on this, 50 identified variables affecting the accuracy of management profit forecasting were entered in the Bayesian averaging model (in 5 audit categories; financial ratios; macroeconomic variables; corporate and managerial governance indicators) and based on previous probabilities, 13 variables were identified as important variables. These variables include management profit forecasts of the past period; Profit or loss of the company; discretionary accruals; type of industry; the existence of the audit committee; Financial Leverage; operational debt leverage ratio; return on equity; economic uncertainty; economic growth fluctuations; swelling; Accrued profit management and management ability. According to the results of the research, several factors influence the management profit forecast, and this indicated the multi-dimensionality of the management profit forecast, and this indicates the fact that managers need to have a systemic perspective in order to reduce the management profit forecast error.

Keywords: profit management, Bayesian, TVP-DMA
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1 Introduction

Forecasting the future profitability of companies is one of the things that investors use in decisions related to stock trading, and it is used in stock valuation; An issue that can be considered both an opportunity and a threat. Some

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researchers such as Wang et al. [71], They believe that the management profit forecasts of companies admitted to the stock exchanges can reduce information asymmetry and cost of capital and improve the efficiency of resource allocation in the capital market. Meanwhile, the laws related to the disclosure of management profit forecasts are different in different countries; For example, in China, before 2001, there were no regulations regarding the disclosure of management's profit forecasts, and after 2001, companies were only required to disclose this type of information under certain conditions. and in other cases, its disclosure is optional. In countries such as America and France, the disclosure of management profit forecasts is voluntary and motivated. In some countries, like Japan, disclosure of this information is mandatory. In Iran, the disclosure of management profit forecasts was mandatory for companies active in the stock market before 2016 [40], But currently, this disclosure is not done.

It should be noted that in Iran since 2016, the "Management Interpretive Report" has replaced the annual performance forecast of listed companies. In this report, the managers of the companies must disclose the company's perspective and prospective information with a complete analysis. The disclosure of management's profit forecasts, whether optional or mandatory, is an important source of information in the capital market, because it not only provides information about the company's future to investors, but also changes investors' expectations [1], but also affects the trading behavior of investors [65].

Despite the many advantages of disclosing management's profit forecasts, these disclosures can also be accompanied by errors, so investigating this issue can lead to a better understanding of the value of information disclosure and can be used by investors and standard-setting authorities as well [40, 31]. In general, the predicted profit of companies is considered a key element in the decision-making of investors, creditors, managers of commercial enterprises and other economic actors who need to predict profit. On the other hand, because future profit forecasts do not have sufficient reliability and certainty, they are associated with the inherent limitations of the forecast and their use may lead to confusion. This issue indicates a consequence that can indicate a research vacuum for conducting more studies in this field. In other words, sufficient evidence regarding the factors that can affect the error rate and accuracy of company management's profit forecasts is limited and insufficient; Especially in Iran, where the disclosure of this type of information was mandatory until 2016, and now there is no requirement for this. Despite the fact that company managers can disclose the company's forecasted information, including future profits, in the "Management Interpretive Report", probably one of the reasons why the stock exchange organization prohibits companies from disclosing the profit forecasts of the management have been prohibited separately and in the form before 2016, it is not reliable. As a result, it should be possible to help solve this issue by identifying factors that affect the amount of error and accuracy of company management's profit forecasts; Therefore, the problem of the upcoming research can be seen in the lack of sufficient knowledge of the factors affecting the error rate and accuracy of profit forecasts of companies' management. Dynamic Bayesian models are a new approach to modelling. Some research on multi-indicator decision-making methods, especially Analytic Hierarchy Process (AHP) and Analytical Network Process (ANP); has been widely used in prioritizing and determining important variables [23, 24]. Among the disadvantages of these methods is that they are used only if the number of identified factors is limited. The important point in all these models is that they evaluate and analyze each factor, its importance and its impact as a single concept without considering the types of connections between different factors in a system. For this purpose, some have used the network analysis process method to evaluate and prioritize factors by considering the connections that may exist between various factors [70, 38]. The main problem is that this method is only used when the number of factors is small so that a pairwise comparison between them is possible and the inconsistency in judgments is small; While if the number of identified factors is large (which is usually the case for factors effective in predicting profits), then one factor is considered critical if it is present with other factors; Therefore, in addition to identifying the factors, identifying the communication network between them and the characteristics of this network is also very important in analyzing and presenting solutions. to examine and compare a large number of factors in the presence of other factors. It should be noted that this approach does not lose the degree of freedom; The ability to consider a large number of factors affecting an index without worrying about the occurrence of co-linearity and the lack of correct specification of the model has the ability to form an optimal model. In this regard, the main problem of this research is to model the influencing factors on management profit forecasts in Iranian companies using Bayesian and dynamic modelling. It has been tried in this research; using the Bayesian averaging models (BMA) approach; Time-varying parameter Bayesian selection models (TVP-DMS) and time-varying parameter Bayesian dynamic averaging models (TVP-DMA) will attempt to localize the management profit prediction accuracy model in Tehran Stock Exchange. It has been tried in this research; More than 50 variables affecting the accuracy of management profit forecasting should be examined at the same time, which is the first time that this process has been noticed in internal research. In the continuation of the research after the introduction, which was explained. In the second part, the theoretical foundations and background of the research have been examined. In the third part, the basics of the research method; In the fourth part, the estimation and analysis of the results will be presented, and finally, in the fifth part, summarization and policy proposals have been made.

2 Theoretical foundations and research background

2.1 Theoretical foundations

According to Habib and Hansen [35], forecasting means estimating the value of a variable (a set of variables) for a certain point in time in the future. Also, they are of the opinion that forecasting is done in order to help in decision-making or future planning. In Iran, before 2016, listed companies were required to submit their budget reports forecasting the company's future profits; However, from the end of 2016 until now, the Stock Exchange and Securities Organization has required listed companies to submit "Management Interpretive Report"; has done. The range of information disclosed in this report is beyond the budget reports that companies provided before. But due to the uncertainty of the future, the Stock Exchange and Securities Organization has pushed companies to provide an interpretive report with a complete description of the company's future status, instead of pure budget numbers. However, in the interpretive report, managers will disclose future information related to the company, including their estimate of the company's profitability and its future trends. Evaluating the opportunities and risks of commercial activities is one of the duties of management, which requires understanding the nature of commercial activities, including the profitability potential of the profit-making unit. The attractiveness of a company, in addition to the current state of the company, depends on its potential ability to generate future revenues. A company that is currently profitable and is expected to continue to be profitable in the future is more attractive than a company whose potential profits will decrease soon [55]. It can be claimed that the most important criterion for investors to choose companies for investment is the current profitability level and expected future profitability of the companies; In the way that investors make decisions based on the profits of companies in different investment strategies [64]. Investors and financial analysts regard profit as one of the main criteria for evaluating companies and tend to measure the company's future profitability in order to decide whether to keep or sell their shares; In this way, by predicting profit, they judge the state of a company. The importance of this prediction depends on its deviation from reality. The smaller this deviation is, the more accurate the prediction is [51].

In the accounting literature, two different views have been mentioned in relation to management's profit forecasts; The first view is the message-delivering view and the second view is the opportunistic view of management. Based on the messaging perspective, the manager, as the most knowledgeable person about the current and future state of the company, communicates the company's information to external people and in this way reduces information asymmetry [56]. The point of view of the present research is also in accordance with the point of view of the management profit forecasts and its usefulness, which tries to avoid the requirement to re-disclose the information related to the forecast by providing strong documentation and evidence regarding its usefulness. Management benefits help. This importance can be realized by identifying the factors that affect the accuracy of these predictions.

It is possible to introduce the main goal of financial reporting to provide appropriate information for financial information users to make decisions. One of the features necessary for financial and economic information to be relevant is usefulness in forecasting. Forecasting helps investors to improve their decision-making process and reduce the risk of their decisions [56]. Since the managers have more accurate information about the future state of the company and its future profitability trend, therefore, it is expected that, based on the messaging point of view, the disclosure of the management's profit forecasts will be beneficial for investors.

On the other hand, according to the opportunistic point of view, the manager takes advantage of the information asymmetry between himself and external persons for his own benefit and by this means he tries to transfer the flow of benefits to himself [2]. However, according to the efficient market hypothesis, the more efficient the market, the less managers can benefit from the opportunistic view of disclosing management's profit forecasts, because the efficient market will quickly learn about this issue [46, 3, 75]. This matter deserves attention. Several variables affect the prediction of management profit, which can be classified into two general categories.

A: macro indicators and accuracy of managers' profit forecast

The profit of a company is one of the important items of financial statements that has attracted the attention of investors and company managers. On the one hand, investors use profit per share forecasts to form a profitable stock portfolio, and on the other hand, managers use it in making important decisions such as operational budgeting, capital expenditures, and other decisions related to the allocation of company resources [17]. Managers' forecast is discretionary profit; However, there are economic reasons for it. For example, concerns about disclosure costs, insider buying and selling of shares, and fear of laws that can affect management's decision to release voluntary forecasts of bad news are among the reasons for managers' profit forecasts. The initial research on profit forecasts by managers indicated that these forecasts have informational content; So that the publication of such forecasts causes a sharp increase in price volatility. One of the hypotheses of managers' voluntary forecasts is that these forecasts align investors' expectations with more information that the manager has. This adjustment hypothesis indicates that the

management's profit forecasts are better than the market's expectation of profit at the time of management's forecasts [47].

Some researchers such as Mousavi et al. [57], In order to predict future profits, they used the study of past profits over time and believed that the only way to predict profits is to use the average of past profits. This idea was also taken into consideration by other researchers; But it should be noted that other information than the time series of past profits can be effective in predicting future profits. For example, some fundamental variables (financial ratios) affect the prediction of future earnings, and the use of financial statement information can improve the prediction of future profits [62].

In addition to the uncertainty about which of the financial statement information can be a suitable predictor for the future performance of companies and important variables such as the company's future profit by managers, another hypothesis has been proposed regarding the more accurate prediction of profit by managers. In this hypothesis presented by Kim and colleagues [43], the position of macroeconomic variables in influencing these predictions is pointed out. In the first theory (confidentiality of information), it is claimed that managers make their profit forecasts based on their confidential information. For this reason, these decisions provide users with information about the future prospects of the economy. In the second theory, it is believed that the economic situation of the country has an effect on management forecasts. According to this theory, managers' decisions and forecasts will be influenced by economic conditions. As a result, it can be claimed that managers make decisions about the company's activities under the influence of internal factors.

Therefore, to the extent that these internal factors are dependent on the country's economic situation, it is expected that managers' forecasts will reflect the existing expectations related to the state of economic variables. For example, in a country like Iran that suffers from a high inflation economy, the effect of macroeconomic variables such as interest rate, inflation and gross domestic product, liquidity and trade balance on the accuracy of profit forecast by managers is obvious. As a result, based on this hypothesis, it is better that in countries with an unstable economic situation, the impact of macroeconomic factors should also be taken into account by managers in profit forecasts. In general, the conditions and operating environment of a company can be influenced by various factors, which in a general classification, these factors can be divided into two systematic and non-systematic categories [43].

Unsystematic factors are factors that are specific to a particular company. These factors, such as entering a new market and learning and merging with a new company, can only affect the activities of these specific companies in the best conditions. Also, the most important point related to these factors is that companies have the ability to react to these unsystematic factors and even eliminate them.

This is while systematic factors affect all companies in an economy. The most important feature of systematic factors such as inflation and interest rate are that these factors are not under the control of a particular company. However, companies can react to systematic factors; But they cannot remove it [43]. Uncertainty in macroeconomic variables can cause managers to face problems in accurately predicting the company's profit. In this way, economic variables can be considered among the variables affecting the correctness and accuracy of profit forecast by managers. Exchange rate variables, inflation rate, gross domestic product, balance of payments and liquidity are among the most important macroeconomic indicators in Iran, which have experienced severe fluctuations in recent years. The importance of the selected indicators is the reason that, for example, when inflation increases, due to the direct effect of the inflation rate on profit, investors are interested in knowing how much profit is affected by inflation and inflationary expectations. Anyway, despite the two-digit inflation conditions in the country, the profit predicted by the managers will be affected by the inflation conditions [67]. From the perspective of the Central Bank of the Islamic Republic of Iran, GDP is considered one of the most important macroeconomic variables of the country, which represents the overall result of the country's economic activities. Gross domestic product is an indicator through which one can be aware of the progress and record and the growth and decline of the country's economy as a whole. If a good prospect of GDP growth is expected, it is natural that the predicted profit is also optimistic according to this economic growth. This is while the accuracy of profit forecast will decrease if economic growth is not realized. On the other hand, in the conditions of inflation, the areas of interest and attention of managers and investors change significantly.

The exchange rate can also be effective in companies from two aspects; First, that the income of companies that import and export goods and services have a direct relationship with the exchange rate, and secondly, that the price of the currency, as a competitive asset in the portfolio of economic entities, is effective on their decisions in the field of buying and selling shares [52, 58]. For this reason, if the exchange rate fluctuates as a macroeconomic indicator, it is natural that the forecasting accuracy of managers will also fluctuate. Due to the unfair sanctions imposed by the western countries against our country, in recent years, the fluctuation of this index has caused some problems to the companies accepted in the Tehran Stock Exchange. In this regard, the research conducted in Iran has shown that

fluctuations in liquidity and balance of payments lead to fluctuations in current costs and ultimately lead to inflation; Therefore, such an increase in the society's liquidity does not lead to an increase in the gross domestic product and is considered an aggravating factor of inflation [74].

B: Micro indicators and accuracy of managers' profit forecast

Representation theory explains how to create representation problems between the employer (shareholder) and the agent (manager), due to information asymmetry. In this regard, effective regulatory structures help prevent conflicts of interest between managers and shareholders by creating informational balance. In other words, these structures provide the management with the necessary incentives for sufficient measures to increase the value of the company. Therefore, the higher efficiency of the company depends on the improvement of the control structures and, as a result, a more accurate prediction of the stock price; Because this leads to the reduction of agency costs, higher stock valuation, and as a result, better performance in the long run. Various factors affect the reduction of information asymmetry and consequently the accuracy of company profit forecasting, some of which are as follows:

Size: Kiel and Nicholson [42], They believe that the size of the company including total assets, total sales and market value of equity and company value are directly related to each other. It is obvious that the size of the company determines the volume and extent of the activity of a company. Larger companies have less commercial risk due to more communication with stakeholders and the existence of more control mechanisms. On the other hand, Watts and Zimmerman [72], claim that large companies are forced to disclose more due to bearing more political costs. In large companies, due to the establishment of precise control and monitoring systems, the use of expert employees and managers, responding to a wide range of investors, creditors and employees are among the reasons for the need for more accuracy in profit forecasting; Therefore, it is expected that there is a positive relationship between company size and profit forecast accuracy [41].

Age of the company: old companies have more experience about profit forecasting than young companies; Therefore, it is expected that there is a positive relationship between the life of the company and the accuracy of profit forecasting [49].

Financial leverage: It is the existence of fixed costs in the company's list of costs. Financial leverage is obtained by dividing total liabilities by total assets. The name of leverage is the similarity between the benefit of relying on mechanical leverage and the benefit of relying on fixed costs. The greater the degree of financial leverage, the greater the degree of financial risk; Because if the degree of financial leverage is high, with a relatively small decrease in the figure of profit before interest and taxes, the profit per share may become negative. The presence of risk indicates the impossibility of precision in predicting profit; Therefore, it is expected that there is a negative relationship between leverage and profit forecasting accuracy [48].

Forecast period: The forecast period means the interval between the company's entry into the stock market and the end of the financial year. It is expected that there is a negative relationship between the forecasting period and the accuracy of profit forecasting [33].

The type of auditor's opinion: financial statements audited by independent auditors are considered a very suitable means of transmitting information. Profit forecast is one of the most important information that is considered by stakeholders. It is obvious that if the aforementioned forecast is approved by the auditors, it will also be effective on the decisions of the users of the financial statements. In this research, the type of auditor's opinion on last year's financial statements is divided into acceptable and unacceptable based on the auditor's opinion [27].

Hall and type of industry: The presence of the company in the main or subsidiary hall is defined based on the classification announced by the stock exchange into the categories of companies present in the main hall and companies present in the subsidiary hall. The type of industry is also defined based on the industry classes defined by the stock exchange organization [18].

Revision times: Revision times in the last year is the number of times the company has made changes in the provided forecast [53].

Mohammadi [53], It has investigated the factors affecting the accuracy of profit forecasting of companies. The results of the hypothesis test indicate that among the considered financial factors, only the revision frequency variable and among the non-financial variables, only the board changes are effective on the accuracy of profit forecasting, and the effect of other variables considered in this research It was not approved. Ghaemi and Vatanparast [32], investigated the role of stock returns on the accuracy of management forecasts by moderating information asymmetry. The results of the research show that there is no significant relationship between stock returns and the accuracy of profit forecast by management; But there is a significant relationship between information asymmetry and the accuracy of management profit forecast. Also, the results show that information asymmetry does not moderate the relationship between stock

returns and management's earnings forecast accuracy. It can be stated that stock returns do not increase or decrease the accuracy of management's profit forecast at a high level of confidence; But the increase in information asymmetry leads to an increase in the management's forecasting error, and as a result, the accuracy of the profit per share forecast by the management decreases; It can also be concluded according to the results that it cannot be said that at a high level of confidence information asymmetry moderates the relationship between stock returns and management profit forecasting accuracy. Elvisa and Ilgün [27], tried to provide a comprehensive composite index to measure management profit forecasting bias. The findings of the research show that the aforementioned composite index included criteria such as the management profit forecast error of the current period and the previous period, total accrual items of the current period and the previous period, management bonus changes and cash flow changes due to operational activities; Among these criteria, according to the experts, the management profit prediction error of the previous period is the worst criterion and management bonus changes are the best criteria for measuring the management profit forecast bias; Also, the evaluation of the obtained combined index shows that it has a higher predictive power than the individual criteria. Mohammadian et al. [53], They investigated the effect of environmental complexity and uncertainty on the accuracy of management profit forecast, emphasizing audit quality as a mediating variable. The results of this study showed that the complexity and uncertainty of the environment has a negative and significant effect on the accuracy of the management profit forecast, and the effect of audit quality on the accuracy of the management profit forecast is positive and significant. Also, the results show that audit quality as a mediating variable affects the relationship between complexity and environmental uncertainty with the accuracy of management profit forecast. Chang et al. [18], Environmental factors with an emphasis on terrorist processes were evaluated in predicting managers' management profits. Zhu [76]; As a result, companies with stable management provide information with lower accuracy than companies with faster management changes.

Dechow et al. [22], Investigated business characteristics on management profit forecasts in Vietnam. This study used OLS, REM, FEM, and GLS regression methods and research data on listed companies in the Vietnam stock market from 2010 to 2018 with 3677 observations. The results show the fact that factors such as company size, income growth rate, accruals and profit sharing policy have a positive effect on management's profit forecast; While financial leverage has an inverse effect on management's profit forecast. In addition, liquidity has an uncertain effect on management's profit forecast. Othman and Zeghal [61], In his research, he investigated the effect of inflation on the accuracy of company management's profit forecasts. The results of his research showed that when the inflation rate rises, not only the management's ability to predict income, but also the accuracy and accuracy of management's forecast decreases; Also, the results of the work indicate that when the inflation rate rises, the state ownership structure in companies aggravates the decrease in the accuracy of management's profit forecasts. In addition, this study showed that in the case of voluntary disclosure of management profit forecasts, the ability of managers can reduce the severity of the negative effects of inflation on the accuracy of management profit forecasts. Ashbough and Pincus [6], They investigated the relationship between management's profit forecast, management's motivations and risk taking. The results of their study showed that there is a strong and significant negative relationship between the disclosure of management profit forecasts and risk-taking, and a higher level of managerial ownership reduces this relationship. Boubaker et al. [15], They investigated the relationship between profit management and management profit forecasting in initial public offerings of companies. The results of their research indicate that the level of profit management for companies that had an initial offering and whose management presented a profit forecast report is lower than those that did not report this forecast.

2.2 Managers' profit forecast

In order to check the accuracy of managers' profit forecast, the model used in the study of Momani and Obeidat [54], which is the adjusted model of Boubaker et al. [15], has been used. The mentioned features are the accuracy of managers' previous forecast, forecast time horizon, forecast difficulty and forecast news. The first pattern for prediction accuracy is as follows.

$$\begin{aligned}
 ActualAccuracy_{i,t} &= \alpha_0 + \alpha_1 PriorAccuracy_{i,t} + \alpha_2 ForecastHorizon_{i,t} \\
 &+ \alpha_3 ForecastDifficulty1_{i,t} + \alpha_4 ForecastDifficulty2_{i,t} \\
 &+ \alpha_5 ForecastNews_{i,t} \times GoodNews_{i,t} \\
 &+ \alpha_6 ForecastNews_{i,t} \times BadNews_{i,t} + \alpha_7 CAR_{i,t} \\
 &+ \alpha_8 Concentration_{i,t-1} + \alpha_9 Distress_{i,t-1} + \alpha_{10} MB_{i,t-1} \\
 &+ \alpha_{11} Size_{i,t-1} + \alpha_{12} Bundle_{i,t} + \varepsilon_{i,t}
 \end{aligned} \tag{2.1}$$

In this way, the first model is specified and after checking the possibility of explaining the accuracy by means of

forecasting features, the effect of calculated forecasting accuracy (estimated forecasting accuracy) through the first model is determined on the drift after the profit announcement.

The second model to investigate the drift is a model that was chosen based on Momani and Obeidat [54], and in that unexpected profit enters the model alone and interactively with other control variables. The effect of the accuracy of the profit forecast on the drift after the profit announcement is checked using the following model.

$$\begin{aligned}
 ADJ_RET_{i,t} = & \beta_0 + \beta_1 NSUE_{i,t} + \beta_2 BUNDLE_{i,t} + \beta_3 NSUE_{i,t} \times BUNDLE_{i,t} \\
 & + \beta_4 NSUE_{i,t} \times BUNDLE_{i,t} \times Accuracy_{i,t} + \beta_5 NSUE_{i,t} \times NME_{i,t} \\
 & + \beta_6 NSUE_{i,t} \times NVOL_{i,t} + \beta_7 NSUE_{i,t} \times NPRC_{i,t} \\
 & + \beta_8 NSUE_{i,t} \times NINS_{i,t} + \beta_9 NSUE_{i,t} \times NEP_{i,t} + \beta_{10} NSUE_{i,t} \\
 & \times BADNEWS_{i,t} + \beta_{11} NME_{i,t} + \beta_{12} NOVLI_{i,t} + \beta_{13} NPRC_{i,t} \\
 & + \beta_{14} NINS_{i,t} + \beta_{15} NEP_{i,t} + \beta_{16} BADNEWS_{i,t} + \varepsilon_{i,t}
 \end{aligned} \tag{2.2}$$

Time series pattern in profit forecasting

There are seven time series patterns

Moving average pattern

$$EPS_t = 1/5 \sum_{i=1}^5 EPS_{t-1} \tag{2.3}$$

$Ln(EPS_t) = \alpha + \beta t + \varepsilon_t$, Exponential trend pattern

$EPS_t = \alpha + \beta t + \varepsilon_t$, Linear trend pattern

$EPS_t = \alpha + \beta(EPS_{t-1}) + \varepsilon_t$, First order autoregression Model

$EPS_t = \alpha + \beta(EPS_{t-1}) + \theta \varepsilon_{t-1} + \varepsilon_t$, Mean autoregression Model

Moving 1 and 1 (first and first order)

$EPS_t = \alpha + \beta_1(EPS_{t-1}) + \beta_2 EPS_{t-2} + \varepsilon_t$, Second order autoregressive pattern

$EPS_t = \alpha + \beta_1(EPS_{t-1}) + \beta_2 EPS_{t-2} + \theta \varepsilon_{t-1} + \varepsilon_t$, Average autoregressive pattern
where EPS is the profit of each poison

Bias in profit forecasting by management

Model of Kato et al. [39], is used to measure the bias in profit forecasting by management. In this model, the bias in profit forecasting by managers is divided into two components including forecast growth and forecast error. How to calculate managers' bias in profit forecasting is presented below

$$FI = (\bar{E}_t - E_{t-1}) \div TA_{t-1} \tag{2.4}$$

$$FE = (E_t - \bar{E}_t) \div TA_t \tag{2.5}$$

in which, FI, forecast growth; E, the expected profit of each period; 1-E, actual profit of the previous period; -TA, total assets at the beginning of the period; FE, prediction error; E, real profit of each period; and TA is the total assets at the end of the period.

Company investment behavior

Beneish [11], model was used to measure the investment behavior of companies. This model for normal investment at the company level expresses the total investment as a function of the company's growth opportunities:

$$Investment_{i,t+1} = \alpha_0 + \alpha_1 Sales Growth_{i,t} + \varepsilon_{i,t+1} \tag{2.6}$$

In which, Investment, the total investment obtained by dividing the net increase in tangible and intangible fixed assets by total assets and Sales Growth, the percentage change in sales from year 1-1 to year t.

3 Research method

This research is based on the theoretical basis and background of research in Iran and the world in order to solve the problem related to this research in the field of applied research. In terms of the goal, it is of analytical type (correlation method). The information extracted in the current research includes 5 main categories, which are intra-company; auditing; Financial Ratio; Macroeconomic variables and indicators of corporate and managerial governance. The information of variables of financial ratios is extracted from the information of financial statements. Information on corporate governance, audit and management has been extracted from the attached reports and information on macro indicators from the website of Central Bank and Statistics Organization. The time horizon of this research is a nineteen-year period from 2011 to 2020 for companies admitted to the Tehran Stock Exchange. Based on the systematic elimination method, 131 companies were selected. A complete list of variables affecting the management profit forecast, how to calculate them and the position of the mentioned variables in the estimation models in table number (1); Provided.

Table 1: Introduction of research variables

Calculation method	Definition	Variable type	Agents
Calculation of the model based on the first order autoregressive $ROA_{t+1} = \alpha_0 + \alpha_1 ROA_t + e_t$ The difference between the predicted value and the realized value = prediction error	Management profit forecasts	The dependent variable	
$ROA_t = \alpha_0 + \alpha_1 ROA_{t-1} + e_t$ Calculation of the model based on the second order autoregressive	Management profit forecasts for the past period	explanatory variable	Intra-company variables
Logarithm of assets	size of the company	explanatory variable	
Using the Harishman index of the top 4 companies in the industry in selected companies	Intensity of industry competition	explanatory variable	
Being among the top 50 companies annually. In every year that the company has been among the top companies, the number 1 has been assigned, otherwise the number 0 has been assigned.	The superiority of the company	explanatory variable	
Income changes compared to the first year	Revenue growth	explanatory variable	
Net profit and loss	Profit or loss of the company	explanatory variable	
Using the GARCH model to extract the volatility of stock returns	Volatility of stock returns	explanatory variable	
Short-term assets to short-term liabilities	Liquidity index	explanatory variable	
Profit after tax minus cash flow from operating activities divided by total assets	Optional accrual items	explanatory variable	
Average education level of human resources (diploma 1), associate degree (2), bachelor degree (3); Master's (4) Doctorate (5).	Quality of staff	explanatory variable	
The amount of cash created as a result of the company's normal operations is obtained after deducting all operating expenses.	Cash flow changes due to operating activities	explanatory variable	

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Calculation method	Definition	Variable type	Agents
$TACCI_t = \Delta CAI_{i,t} - \Delta CLI_{i,t} - DPi_{i,t}$ $\Delta CAI_{i,t}$: Change in current assets other than cash of company i in year t compared to year t-1 $\Delta CLI_{i,t}$: Change in current liabilities (after deducting the current share of long-term liabilities) of company i in year t compared to year t-1 $DPi_{i,t}$: Depreciation cost of company i in year t The change in current assets other than cash (ΔCA) is calculated based on the following equation: $\Delta CAI_{i,t} = \Delta ARi_{i,t} + \Delta INVi_{i,t} + \Delta OCAI_{i,t}$ $\Delta ARi_{i,t}$: Change in accounts and documents receivable of company i in year t compared to year t-1 $\Delta INVi_{i,t}$: change in the inventory of company i in year t compared to year t-1 $\Delta OCAI_{i,t}$: change in other current assets of company i in year t compared to year t-1 The change in current liabilities is calculated based on the following relationship: $\Delta CL_{i,t} = \Delta AP_{i,t} + \Delta TXP_{i,t} + \Delta OCL_{i,t}$ $\Delta AP_{i,t}$: Change in accounts payable of company i in year t compared to year t-1 $\Delta TXPi_{i,t}$: change in income tax payable by company i in year t compared to year t-1 $\Delta OCLi_{i,t}$: change in other current liabilities of company i in year t compared to year t-1	Total accruals	explanatory variable	
The first break of total accruals	Total accrual items of the previous period	explanatory variable	
Earnings per share	profit sharing	explanatory variable	
Year of establishment of the company	Age of the company	explanatory variable	
The length of the forecast period. which is presented in the form of 3, 6, 9 and 12 months forecast.	Profit forecast period	explanatory variable	
The presence of the company in the main or sub hall. If present in the main hall, the number is one, otherwise, the number is zero	Hall type	explanatory variable	
According to the ISIC code. If the selected company is located in any industry, the ISIC code of the industry is considered.	Type of industry	explanatory variable	
The type of auditor's opinion on last year's financial statements is divided into acceptable and unacceptable based on the auditor's opinion. If it is acceptable, the number is one and otherwise it is zero.	Auditor's opinion type	explanatory variable	audit
It is the number of times the company has made changes in the profit forecast.	Revision times	explanatory variable	
If there is an audit committee, the number is one and otherwise it is zero.	Existence of audit committee	explanatory variable	
Percentage changes in current year's sales over last year's sales	Sales growth ratio	explanatory variable	Financial Ratio
Ratio of total debt to total assets	Financial Leverage	explanatory variable	
The percentage of changes in the division of the current year's net operating assets over the last year's net operating assets	Net growth of operating assets	explanatory variable	
Dividing operating income by last year's net operating assets	The ratio of net return on operating assets	explanatory variable	
Dividing current year's sales by last year's net operating assets	Operating assets turnover ratio	explanatory variable	
Division of operational liabilities over operational assets	Leverage ratio of operating debts	explanatory variable	
Division of operating profit on current year's sales	Profit margin ratio	explanatory variable	
Distribution of advertising and advertising expenses on the current year's sales	The severity of advertising expenses	explanatory variable	
Current assets divided by current liabilities	current ratio	explanatory variable	
Cash balance plus short-term investment divided by current liabilities	cash ratio	explanatory variable	

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Calculation method	Definition	Variable type	Agents
Current assets minus inventory of materials and goods divided by current liabilities	instantaneous ratio	explanatory variable	
Dividend of net profit by shareholders' share	Return on equity	explanatory variable	
It is equal to net profit before tax divided by average assets	Return on assets	explanatory variable	
It should be noted that the average assets of the company are equal to the total assets at the beginning and end of the financial period under review, divided by 2.	The intensity of research and development costs	explanatory variable	
Dividing research and development costs over current year's sales	activity ratio	explanatory variable	
The ratio of accounts receivable to total assets	Economic uncertainty (uncertainty of monetary and financial policies)	explanatory variable	Macroeconomic variables
Extracted conditional variance of GARCH model	Fluctuations in economic growth	explanatory variable	
The difference between actual GDP and potential GDP based on the Kalman filter	swelling	explanatory variable	
Percentage of relative changes in consumer price index	exchange rate	explanatory variable	
The difference between exports and imports	Trade balance	explanatory variable	
The volume of money plus the volume of pseudo-money	Liquidity	explanatory variable	
If the government has a share, the number is one, otherwise, the number is zero	State ownership of companies	explanatory variable	Corporate and managerial governance indicators
It has been obtained from the collection of shares held by banks and insurance companies, holding companies, investment companies and pension funds on the total issued shares of the company.	Institutional ownership	explanatory variable	
If bonus is paid to the members of the board of directors in year t, the number is one and otherwise it is zero.	Board Bonus	explanatory variable	
Modified version of Rochodhari model (2006) $TACC_{it} = b_0 + b_1 PPE_{it} + b_2 \Delta SALE_{it} + b_3 ROA_{it} + \varepsilon_{it}$ $TACC_{it}$: The total accruals of the company are divided by the difference between cash flows from operations and net profit after taxes, divided by total assets at the beginning of the period. PPE_{it} : gross property, machinery and equipment of the company, divided by the property, machinery and gross equipment at the beginning of the period divided by the total assets at the beginning of the previous year, divided by the total assets at the beginning of the period $\Delta SALE_{it}$: annual changes in the company's sales, which is divided by the annual changes in the sales of the current year compared to the previous year, divided by the total assets at the beginning of the period ROA_{it} : return on assets in the current period of the company, which is obtained by dividing the profit before tax by the total assets. ε_{it} : Considering that accruals include an optional part and an optional part of accruals and the ε_{it} part is optional as a representative of management; Therefore, accrual interest is.	Management of accrued interest	explanatory variable	
$\frac{CFO_{i,t}}{AT_{i,t-1}} = \alpha_1 \frac{1}{AT_{i,t-1}} + \alpha_2 \frac{Sales_{i,t}}{AT_{i,t-1}} + \alpha_3 \frac{\Delta Sales_{i,t}}{AT_{i,t-1}} + \varepsilon_{i,t}$ CFO Operating Cash Flows AT total assets SALE Net sales of the company SALE Changes in the company's net sales ε is the residual of the regression model, which is the abnormal cash flow variable of the company. For the variables of production costs and discretionary costs, the following models are examined, based on the view of Richoudari 2006, the error part is the unexpected part of the model. $\frac{PROD_{i,t}}{AT_{i,t-1}} = \alpha_1 \frac{1}{AT_{i,t-1}} + \alpha_2 \frac{Sales_{i,t}}{AT_{i,t-1}} + \alpha_3 \frac{\Delta Sales_{i,t}}{AT_{i,t-1}} + \frac{\Delta Sales_{i,t-1}}{AT_{i,t-1}} + \varepsilon_{i,t}$ $\frac{DISC_{i,t}}{AT_{i,t-1}} = \alpha_1 \frac{1}{AT_{i,t-1}} + \alpha_2 \frac{Sales_{i,t-1}}{AT_{i,t-1}} + \varepsilon_{i,t}$	Real profit management	explanatory variable	

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Calculation method	Definition	Variable type	Agents
If the members of the board of directors have a degree related to the company's activity, the number is one and otherwise it is zero.	Board expertise	explanatory variable	
Imaginary confidence of management is one if the profit predicted by the management of company i is more than the actual profit for year t than the actual profit of company i, and zero otherwise.	Overconfidence of the CEO	explanatory variable	
$\max_{i,t} \theta = \frac{Sales_{it}}{(\delta_1 CGS_{it} + \delta_2 SG\&A_{it} + \delta_3 PPE_{it} + \delta_4 Intan_{it})}$ <p>Company efficiency is measured by considering CGS cost of goods sold, SG&A selling and general administrative expenses, PPE tangible fixed assets and Intan intangible assets as input variables and Sale sales as output variables.</p> <p>In this model, a specific coefficient (δ) is considered for each of the input variables; Because the effect of all input variables on output (sales) is not the same. The value calculated for the efficiency of the company is in the range of 0 to 1. Companies with an efficiency score of one are companies that are very efficient, and companies with a score less than one are below the efficiency frontier and must reach the efficiency frontier by reducing costs or increasing revenues.</p> <p>The purpose of calculating the company's efficiency is to measure the management's ability, and since the inherent characteristics of the company are also involved in the calculations related to the efficiency, it is not possible to measure the management's ability correctly; Because it is calculated more or less than the actual value due to these characteristics.</p> <p>The efficiency measurement criteria in the above way can be attributed to both "manager" and "company" factors. To attribute the efficiency to the manager and specify the role and "management ability", all variables resulting from the role of the "company" are separated from the total efficiency through the following model (Demarjian and McVey, 2012 model):</p> $Firm\ Efficiency = \beta_0 + \beta_1 Ln(Total\ Assets) + \beta_2 Market\ Share + \beta_3 Positive\ Fresh\ Cash\ Flow + \beta_4 Ln(Age) + \beta_5 Foreign\ Currency\ Indicator + Year\ Indicators + \varepsilon$ <p>Logarithm of total assets: Ln(Total Assets) Market share: (Company sales divided by total industry sales; Share Positive free cash flows (the amount of cash to the total assets of the first period): Logarithm of the lifetime (activity) of the company: Ln(Age) Foreign Currency Indicator: 1 if the company exports, and zero otherwise The residual value of ε resulting from the estimation in the above model is attributed to the management and is the main criterion for measuring management ability.</p>	Management ability	explanatory variable	

4 Estimation of the model

Many studies have investigated macro variables using non-linear approach. The purpose of these studies was to investigate the ability of nonlinear models such as Markov switching [37], and SETAR models [20], to provide predictions of economic variables. For example, Clements and Krolzig [19], compared the performance of the MS and ESTAR models in the post-World War II period for US country macro variables. The results of their study showed that although both models considered the characteristics of specific business periods and even these models were superior to linear models; But they did not have the ability to predict with higher accuracy than competing models. A part of the financial literature in recent decades has examined the amount of information necessary to achieve a robust estimate of the forecast of economic and financial variables [50, 13, 12, 14, 21]. One of the important achievements in this regard was the use of various econometric methods to use large data information (big data) for forecasting. In such an approach, factor models are more important and their use has become very common. Factor models summarize information from a voluminous set (big data) of indicators into a small number of unobservable fundamental components. Stock and Watson [69], studies for the United States; Forni et al. [36], and Marcelino et al. [50], Angelini et al. [4], for the Eurozone, Artis et al. [5], for England and Schumacher [66], for Germany, they are examples of empirical studies using factorial models. Extracting information from large data (big data) can greatly help in improving the forecasting process; While the preliminary results of prediction in experimental studies in this regard have been very promising (Stock and Watson [69], Fournery et al. [30], Nasser [59]), that You can read Stock

and Watson [68], He pointed out that by using more than 215 variables, they predicted the macro variables of the United States.

Time-varying parameter (TVP) models employ state-space methods (such as the Kalman filter) that are commonly used in empirical macroeconomic research for structural analysis and forecasting. If a large set of data is used to predict macroeconomic variables, TVP models tend to overfit within the sample; Therefore, they will have poor prediction performance outside the sample. To correct these shortcomings in TVP models, selective averaging (DMS) and dynamic Bayesian averaging (DMA) models have been used [34]. The training period of this research is from 2011 to 2018 and the time period of forecasting performance is from 2019 to 2020. Forecasts using TVP-AR(1)-X DMA and TVP-AR(1)-X DMS such that "-X" represents the exogenous predictor variables present in addition to the AR(1) dynamics. The values of the omitted factors for the DMA and DMS models are ($\alpha=\lambda=0.99$) similar to various empirical studies including Raftery et al. Ferreira and Palma [28], Filippo [29], Ay et al. [7], Dupuis et al. [26], Nasser [59], Drachel [25], and Nasser and Alaei [60], have been considered; Also, the values ($\alpha=\lambda=0.95$) of the forgotten factors for the DMA and DMS models are similar to various experimental studies, including Wing Yan [73], Cope and Korobilis [45], Belmonte and Cope [10], Salile [63], Ferreira and Palma [28], Filippo [29], Nasser [59], Baur et al. [9], and Drachel [25], have been considered. Also, the values ($\alpha=\lambda=0.90$) of the forgotten factors for the DMA and DMS models have been considered in a similar way to various experimental studies, including Wing Yan [73], Baur et al. [9], and Drachel [25]. Also, the values of ($\alpha=0.99, \lambda=1$), the forgotten factors for DMA models have been considered similar to various empirical studies including Ferreira and Palma [28], Filippo [29], and Ay et al. [7]. Finally ($\alpha=0.95, \lambda=1$) the values of the forgotten factors for DMA models have been taken into account as in Filippo (2015). The values ($\lambda=1$) indicate that there is no missing weight on the time-varying coefficients. In other words, all the past errors in the updated estimated coefficients and also in the prior probabilities are equally weighted. In order to compare DMS and DMA models, the following prediction models have been used:

BMA is a special case of DMA in the form of forgotten values ($\alpha = 1, \lambda = 1$), which is a model in which the coefficients evolve very slowly (as in regression OLS estimation) and the combination of models (on average) in the sample length is fixed (as in the Bayesian averaging model). For this reason, this model is considered as TVP-AR(1)-X BMA, as in the study of Cope and Korobilis [45]. In this model, there is no missing weight on the time-varying coefficients ($\lambda=1$) and furthermore, there is no missing weight on the probabilities ($\alpha=1$). In other words, all the past error in the updated estimated coefficients as well as the posterior probabilities are equally weighted. It is used in the BVAR model with the Minnesota prior function. The selection of previous functions was the same as the study of Cope and Korobilis [45], and Balislar et al. [8]. Then, time-varying parameter models with the forgotten factor have been used. First, forecasts are evaluated from a single TVP-AR(1) model (profit forecast), estimator with a forgotten factor, for $\lambda = 0.99$, where the coefficients of relatively smooth motion, as in the study of Cope and Korobilis [45], Ferreira and Palma [28], Bauncica and Mortob [16], and Naser and Alaei [60], and have $\lambda=0.95$, where the coefficients of rapid movement are similar to the study of Cope and Korobilis [45]. Finally, two AR(1) models were used using the OLS method; So that in the AR(1)-X model, all the relevant variables are used, and in the AR(1) model, only the profit forecast variable is used, as in the study of Cope and Kourobilis [45]. In order to evaluate the forecasting performance (MSFE), from the mean square of the forecasting error (MAFE), the mean absolute value of the forecasting error (MAFE), the average percentage of the absolute value of the forecasting error (MAPE), the bias of the forecasting error (Bias) and the variance of the forecasting error (FEV) and the total The logarithm of predictive probabilities (PL) Log was used. The following table shows the performance of management profit forecasting in different models in three forecasting horizons ($h=1,4,8$). In the prediction horizon ($h=1$) by checking the criteria (MSFE), (MAFE), (MAPE) and (FEV) of the TVP-AR(1) DMA model ($\alpha=\lambda=0.90$) and with the criterion (Bias) of the TVP- model AR(1) DMS($\alpha=\lambda=0.90$) were optimal. As can be seen, DMA and DMS have performed worse than the BMA model in all forecast horizons.

On the other hand, the results of (MSFE), (MAFE), (MAPE), (FEV) and BIAS are not strong and have differences compared to the forecast probabilities. The reason for this is that these measures only use point predictions, while prediction probabilities use the entire predictive distribution; Therefore, by examining the models based on using the (PL)Log criterion, it was concluded that the TVP-AR(1) BMA ($\alpha=1, \lambda=1$) model is the optimal model in all prediction horizons. Regarding the comparison of TVP-AR models, as can be seen, in the forecast horizon $h(1)$, according to (MSFE) and (MAFE) criteria, the TVP-AR(1) BMA model ($\alpha=1, \lambda=1$) has is a better performance, and according to other criteria and forecasting horizons, TVP-AR(1) BMA ($\alpha=1, \lambda=1$) models still have better performance. So; When there are more temporal changes in the parameters (α and λ), the prediction performance is better than when (α and λ) is low. In addition, DMA and DMS always have a lower performance than the BMA model with parameters with slow, very slow changes; This issue shows that both types of changes in parameters and models do not have better performance in forecasting. The BVAR model has the weakest performance in almost all forecast horizons

compared to other used models. The result of comparing AR(1)-X OLS and AR(1) OLS models shows that in all forecast horizons, AR(1)-X OLS and AR(1) OLS models have worse performance than TVP-AR(1) DMA ($\lambda=0.99$). In the generality of the above explanations, it should be stated that the main purpose of providing these explanations is to determine the optimal method among BMA, TVP-DMA, TVP-DMS, BVAR and OLS models to identify the most important variables affecting the accuracy of management profit forecasting.

According to the results, the BMA model has better performance in all modes. According to the table and using the maximum right-hand-expansion index (Log(PL)), which indicates the accuracy of the estimated model; It can be seen that in three time periods $h=1, 4, 8$, the optimal model is the Bayesian averaging approach. As a result, the results of the BMA model will be analyzed in the following. In this approach, first, all possible states of presence of explanatory variables are regressed on the dependent variable. In this method, several points are important. First, one variable is not present in all possible models. The second point is that the mentioned variable does not necessarily have a significant effect on the dependent variable in all the models that are present; Based on this, the ratio of the number of models in which the mentioned variable is significant to the number of models present; It is an indicator for the presence of the mentioned variable in the optimal model; Third, with the increase in the number of variables, it is not possible to calculate all states. As a result, according to Salai and Martin’s point of view, after a number of estimations (about 100 to 200 million regressions), the ratio of the significant presence of a variable to all states tends to a specific number, and as a result, there is no need to estimate all states. Finally, there is a need for a decision threshold to eliminate variables; To determine the optimal limit, the ratio of k divided by the total variables has been used (k is the number of proposed variables that have the highest impact on the dependent variable from the researcher’s point of view). This k is experimental and is chosen based on the researcher’s point of view. To reach the result, calculations must be done on all the models in the model space. According to the number of investigated variables, the number of available models (based on the presence or absence of each variable) in the model space is equal to 250 models, which is more than 1125 billion regression models. In other words, the model space includes 250 models, and according to the assumption of model uncertainty, that is, far from applying personal opinion in choosing the model, all models should be examined and the information of all models should be used to reach the result. According to Sala Martin and colleagues, the value of k in this study is considered equal to 10. This number is the representative of this matter that it is expected that 10 variables will be introduced as non-breaking variables by the calculation process; But it is quite clear that it is possible to have less or more than 10 non-breaking variables. In MATLAB software version 2021, first by obtaining a sample containing 10 million regressions from the model space, the coefficients and posterior probability of each variable were calculated. Next, 10 million regressions were added to the first sample, and calculations were made for 20 million regressions, and coefficients and posterior probabilities were obtained. By continuing this process in a sample that included 50 million regressions, convergence was achieved. Based on this, there is no need to increase the sample size to determine non-fragile variables (Table No. 2). In order to introduce a non-fragile variable, two conditions must be fulfilled. 1) An increase in the posterior probability of each variable compared to the prior probability. 2) The posterior probability level is higher than the defined threshold level (“initial threshold level = 12 divided by 50 = 0.24”). It is worth mentioning that in the first stage, non-data information was used due to the assumption of uncertainty in the model, and in the second stage, data information was used due to faster convergence; Also, the variables that had a posterior probability lower than the prior probability were removed from the model due to being fragile compared to other variables (in the first stage, there were 35 non-fragile variables, and in the second stage, with these variables that have a higher posterior probability than the prior probability) We will continue the calculations).

Table 3: The first stage of the sampling process and calculations assuming $\bar{K} = 12$

The first example includes 100 million regression		The first example includes 10 million regression		Variable
Prior probability	Previous coefficient	Prior probability	Previous coefficient	
0.321	0.132	0.207	0.032	Management profit forecasts for the past period
0.092	0.003	0.073	0.004	size of the company
0.246	0.023	0.170	0.024	Intensity of industry competition
0.178	0.176	0.135	0.319	The superiority of the company
0.269	0.127	0.145	0.417	Revenue growth
0.455	0.209	0.318	0.428	Profit or loss of the company
0.294	0.788	0.207	0.147	Volatility of stock returns
0.381	0.034	0.270	0.029	Liquidity index
0.588	0.051	0.407	0.080	Optional accrual items
0.222	0.068	0.199	0.111	Quality of staff

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The first example includes 100 million regression		The first example includes 10 million regression		Variable
Prior probability	Previous coefficient	Prior probability	Previous coefficient	
0.247	0.400	0.122	0.093	Cash flow changes due to operating activities
0.441	0.007	0.222	0.006	Total accruals
0.261	0.127	0.102	0.599	Total accrual items of the previous period
0.362	0.022	0.130	0.039	profit sharing
0.319	0.718	0.179	0.692	Age of the company
0.230	0.025	0.173	0.015	Forecast period
0.225	0.000	0.152	0.016	Hall type
0.290	0.188	0.138	0.059	Type of industry
0.412	0.955	0.162	0.489	Auditor's opinion type
0.195	0.044	0.190	0.189	Revision times
0.428	0.000	0.109	0.039	Existence of audit committee
0.218	0.546	0.123	0.129	Sales growth ratio
0.279	0.014	0.205	0.017	Financial Leverage
0.398	0.034	0.106	0.002	Net growth of operating assets
0.796	0.031	0.691	0.060	The ratio of net return on operating assets
0.283	0.020	0.164	0.034	Operating assets turnover ratio
0.492	0.057	0.317	0.187	Leverage ratio of operating debts
0.263	0.002	0.073	0.002	Profit margin ratio
0.398	0.000	0.239	0.102	The severity of advertising expenses
0.195	0.007	0.122	0.006	current ratio
0.127	0.013	0.102	0.006	cash ratio
0.132	0.216	0.230	0.394	instantaneous ratio
0.529	0.001	0.157	0.002	Return on equity
0.430	0.025	0.273	0.015	Return on assets
0.214	0.188	0.073	0.059	The intensity of research and development costs
0.264	0.721	0.180	0.721	activity ratio
0.831	0.366	0.708	0.346	Economic uncertainty (uncertainty of monetary and financial policies)
0.433	0.044	0.190	0.189	Fluctuations in economic growth
0.650	0.204	0.460	0.203	swelling
0.165	0.366	0.132	0.346	exchange rate
0.160	0.152	0.208	0.083	Trade balance
0.298	0.337	0.106	0.193	Liquidity
0.112	0.005	0.123	0.013	State ownership of companies
0.253	0.020	0.164	0.034	Institutional ownership
0.259	0.955	0.162	0.489	Board Bonus
0.545	0.002	0.473	0.002	Management of accrued interest
0.211	0.000	0.139	0.000	Real profit management
0.383	0.002	0.186	0.003	Board expertise
0.498	0.005	0.306	0.006	Overconfidence of the CEO
0.423	0.002	0.326	0.002	Management ability

Source: Researcher's calculations

In the following, all the steps performed in the first step have been applied to the remaining 39 variables in the second step. In the second stage, a sample including 5 million regressions was applied on 39 selected variables and coefficients and posterior probabilities were calculated. In the following, by applying the mentioned two conditions "secondary threshold level = 12 divided by 39 = 0.3076"; The most important variables affecting the accuracy of management profit forecast will be identified. The results can be seen in table number (4).

Source: Researcher's calculations

In the second stage, 24 variables were selected to determine the non-fragile variables using the conditions. That is, 24 variables had a higher posterior probability value than the prior probability, and these 24 variables had a posterior probability level higher than the threshold level of 0.50. In the following, all the steps performed in the first and second steps have been applied to the remaining 24 variables in the third step. In the third stage, a sample containing 1 million regressions was applied on 20 selected variables and coefficients and posterior probabilities were calculated. Next, by applying the two mentioned conditions "secondary threshold level = 12 divided by 24 = 0.50"; The most important variables affecting management profit will be identified. The results can be seen in table number (5).

In the third step, using conditions, 13 variables were selected to determine the non-fragile variables. These variables

Table 2: Forecast performance criteria in different forecast horizons

		h=1					
		Log(PL)	MAFE	MSFE	MAPE	FEV	Bias
<i>TVP-AR(1)-X</i>	<i>DMA</i> ($\alpha=\lambda=0.99$)	73.36	0.0752	0.0101	0.1987	0.0098	0.0178
<i>TVP-AR(1)-X</i>	<i>DMA</i> ($\alpha=\lambda=0.95$)	81.18	0.0658	0.0077	0.1947	0.0074	0.0154
<i>TVP-AR(1)-X</i>	<i>DMA</i> ($\alpha=\lambda=0.90$)	82.98	0.0602	0.0067	0.1789	0.0065	0.0142
<i>TVP-AR(1)-X</i>	<i>DMS</i> ($\alpha=\lambda=0.99$)	74.19	0.0810	0.0113	0.2030	0.0110	0.0192
<i>TVP-AR(1)-X</i>	<i>DMS</i> ($\alpha=\lambda=0.95$)	85.62	0.0708	0.0087	0.1800	0.0085	0.0118
<i>TVP-AR(1)-X</i>	<i>DMS</i> ($\alpha=\lambda=0.90$)	106.70	0.0560	0.0061	0.1613	0.0059	0.0157
<i>TVP-AR(1)-X</i>	<i>DMA</i> ($\alpha=0.99,\lambda=1$)	70.85	0.0773	0.0102	0.2067	0.0099	0.0172
<i>TVP-AR(1)-X</i>	<i>DMA</i> ($\alpha=0.95,\lambda=1$)	75.58	0.0711	0.0081	0.2351	0.0075	0.0243
<i>TVP-AR(1)-X</i>	<i>BMA</i>($\alpha=\lambda=1$)	116.7	0.0147	0.0023	0.1123	0.0221	0.0048
<i>BVAR -Minnesota</i>		-	0.500	0.341	0.761	0.117	0.473
<i>TVP-AR(1)</i>	<i>DMA</i> ($\lambda=0.99$)	-	0.0831	0.0119	0.2430	0.0109	0.0317
<i>TVP-AR(1)</i>	<i>DMA</i> ($\lambda=0.95$)	-	0.0878	0.0130	0.2240	0.0122	0.0287
<i>AR(1)-X OLS</i>		-	0.1061	0.0186	0.3235	0.0161	0.0492
<i>AR(1) (OLS)</i>		-	0.1416	0.0304	0.4638	0.0182	0.1106
		h=4					
<i>TVP-AR(1)-X</i>	<i>DMA</i> ($\alpha=\lambda=0.99$)	69.49	0.0791	0.0109	0.1943	0.0105	0.0208
<i>TVP-AR(1)-X</i>	<i>DMA</i> ($\alpha=\lambda=0.95$)	76.76	0.0662	0.0078	0.1823	0.0076	0.0162
<i>TVP-AR(1)-X</i>	<i>DMA</i> ($\alpha=\lambda=0.90$)	78.05	0.0606	0.0068	0.1699	0.0066	0.0149
<i>TVP-AR(1)-X</i>	<i>DMS</i> ($\alpha=\lambda=0.99$)	69.59	0.0841	0.0121	0.1990	0.0116	0.0216
<i>TVP-AR(1)-X</i>	<i>DMS</i> ($\alpha=\lambda=0.95$)	79.87	0.0723	0.009	0.1775	0.0089	0.0100
<i>TVP-AR(1)-X</i>	<i>DMS</i> ($\alpha=\lambda=0.90$)	97.92	0.0609	0.0071	0.1709	0.007	0.0100
<i>TVP-AR(1)-X</i>	<i>DMA</i> ($\alpha=0.99,\lambda=1$)	67.06	0.0789	0.0106	0.197	0.010	0.016
<i>TVP-AR(1)-X</i>	<i>DMA</i> ($\alpha=0.95,\lambda=1$)	73.10	0.070	0.007	0.206	0.007	0.022
<i>TVP-AR(1)-X</i>	<i>BMA</i>($\alpha=\lambda=1$)	99.25	0.0174	0.0029	0.1054	0.0026	0.0151
<i>BVAR -Minnesota</i>		-	0.514	0.389	1.096	0.153	0.486
<i>TVP-AR(1)</i>	<i>DMA</i> ($\lambda=0.99$)	-	0.106	0.036	0.426	0.034	0.036
<i>TVP-AR(1)</i>	<i>DMA</i> ($\lambda=0.95$)	-	0.093	0.031	0.375	0.030	0.031
<i>AR(1)-X OLS</i>		-	0.109	0.019	0.315	0.017	0.048
<i>AR(1) (OLS)</i>		-	0.147	0.032	0.435	0.019	0.115
		h=8					
<i>TVP-AR(1)-X</i>	<i>DMA</i> ($\alpha=\lambda=0.99$)	65.44	0.081	0.011	0.549	0.011	0.011
<i>TVP-AR(1)-X</i>	<i>DMA</i> ($\alpha=\lambda=0.95$)	72.49	0.066	0.007	0.402	0.007	0.013
<i>TVP-AR(1)-X</i>	<i>DMA</i> ($\alpha=\lambda=0.90$)	73.55	0.060	0.006	0.317	0.006	0.014
<i>TVP-AR(1)-X</i>	<i>DMS</i> ($\alpha=\lambda=0.99$)	63.3	0.085	0.012	0.552	0.012	0.010
<i>TVP-AR(1)-X</i>	<i>DMS</i> ($\alpha=\lambda=0.95$)	76.27	0.076	0.011	0.460	0.010	0.009
<i>TVP-AR(1)-X</i>	<i>DMS</i> ($\alpha=\lambda=0.90$)	90.7	0.065	0.008	0.428	0.008	0.012
<i>TVP-AR(1)-X</i>	<i>DMA</i> ($\alpha=0.99,\lambda=1$)	67.21	0.078	0.010	0.568	0.010	0.011
<i>TVP-AR(1)-X</i>	<i>DMA</i> ($\alpha=0.95,\lambda=1$)	72.55	0.066	0.007	0.473	0.006	0.013
<i>TVP-AR(1)-X</i>	<i>BMA</i>($\alpha=\lambda=1$)	83.25	0.017	0.002	0.079	0.005	0.002
<i>BVAR -Minnesota</i>		-	0.336	0.197	0.911	0.187	0.096
<i>TVP-AR(1)</i>	<i>DMA</i> ($\lambda=0.99$)	-	0.099	0.141	3.64	0.102	0.199
<i>TVP-AR(1)</i>	<i>DMA</i> ($\lambda=0.95$)	-	0.093	0.083	2.55	0.083	0.089
<i>AR(1)-X OLS</i>		-	0.103	0.017	0.895	0.016	0.037
<i>AR(1) (OLS)</i>		-	0.146	0.032	1.025	0.019	0.111

Table 4: The second stage of the sampling process and calculations assuming $\bar{K} = 12$

The first example includes 50 million regression		The first sample includes 5 million regression		Variable
Prior probability	Previous coefficient	Prior probability	Previous coefficient	
0.896	0.180	0.133	0.002	Management profit forecasts for the past period
0.239	0.804	0.190	0.003	Intensity of industry competition
0.309	0.035	0.281	0.020	Revenue growth
0.702	0.052	0.455	0.271	Profit or loss of the company
0.259	0.069	0.185	0.364	Volatility of stock returns
0.212	0.408	0.400	0.025	Liquidity index
0.450	0.007	0.176	0.068	Optional accrual items
0.223	0.732	0.169	0.094	Cash flow changes due to operating activities
0.337	0.026	0.189	0.005	Total accruals
0.230	0.000	0.087	0.509	Total accrual items of the previous period
0.235	0.192	0.196	0.033	profit sharing
0.316	0.974	0.147	0.013	Age of the company
0.499	0.045	0.203	0.000	Type of industry
0.244	0.014	0.275	0.110	Auditor's opinion type
0.406	0.035	0.090	0.002	Existence of audit committee
0.412	0.032	0.587	0.051	Sales growth ratio
0.387	0.020	0.203	0.000	Financial Leverage
0.396	0.058	0.189	0.005	Net growth of operating assets
0.238	0.002	0.427	0.005	The ratio of net return on operating assets
0.206	0.000	0.451	0.335	Operating assets turnover ratio
0.401	0.007	0.218	0.002	Leverage ratio of operating debts
0.342	0.013	0.232	0.013	Profit margin ratio
0.245	0.220	0.202	0.294	The severity of advertising expenses
0.439	0.026	0.391	0.173	instantaneous ratio
0.418	0.192	0.333	0.294	Return on equity
0.348	0.373	0.090	0.164	Return on assets
0.238	0.045	0.105	0.011	activity ratio
0.663	0.208	0.147	0.002	Economic uncertainty (uncertainty of monetary and financial policies)
0.469	0.155	0.218	0.000	Fluctuations in economic growth
0.304	0.344	0.260	0.005	swelling
0.218	0.005	0.219	0.071	exchange rate
0.317	0.000	0.453	0.002	Liquidity
0.391	0.002	0.139	0.107	Institutional ownership
0.208	0.005	0.111	0.273	Board Bonus
0.545	0.155	0.280	0.111	Management of accrued interest
0.219	0.732	0.306	0.006	Real profit management
0.286	0.148	0.258	0.083	Board expertise
0.391	0.000	0.107	0.692	Overconfidence of the CEO
0.896	0.180	0.164	0.126	Management ability

Table 5: The third stage of the sampling process and calculations assuming $\bar{K} = 12$

The first example includes 1 million regression		The first sample includes 1 million regression		Variable
Prior probability	Previous coefficient	Prior probability	Prior probability	Previous coefficient
0.723	0.385	0.501	0.023	Management profit forecasts for the past period
0.346	0.028	0.298	0.021	Revenue growth
0.926	0.436	0.482	0.287	Profit or loss of the company
0.423	0.054	0.196	0.386	Liquidity index
0.764	0.187	0.424	0.027	Optional accrual items
0.437	0.201	0.092	0.540	Total accruals
0.325	0.003	0.208	0.035	Age of the company
0.514	0.146	0.156	0.014	Type of industry
0.518	0.336	0.215	0.134	Existence of audit committee
0.399	0.021	0.292	0.117	Sales growth ratio
0.664	0.427	0.095	0.002	Financial Leverage
0.452	0.027	0.215	0.109	Net growth of operating assets
0.548	0.546	0.453	0.035	Leverage ratio of operating debts
0.483	0.214	0.478	0.355	Profit margin ratio
0.328	0.005	0.231	0.002	instantaneous ratio
0.727	0.367	0.246	0.014	Return on equity
0.403	0.002	0.638	0.312	Return on assets
0.632	0.754	0.414	0.183	Economic uncertainty
0.741	0.252	0.353	0.312	(uncertainty of monetary and financial policies)
0.503	0.318	0.111	0.012	Fluctuations in economic growth
0.323	0.185	0.125	0.134	swelling
0.349	0.828	0.276	0.143	Liquidity
0.923	0.565	0.125	0.231	Board Bonus
0.449	0.828	0.276	0.015	Overconfidence of the CEO
0.896	0.480	0.164	0.126	Management ability

are in table number (5); They are shown in bold. That is, 13 variables had a higher posterior probability value than the prior probability, and these 13 variables had a posterior probability level higher than the threshold level of 0.50. Considering that the calculated K is very close to the proposed K , the calculations have been stopped (according to Koop [44]), if the difference between the proposed K and the obtained K is less than 10%, the researcher is allowed to use the K obtained from the model. The results of K proposed by the researcher are 12 and K obtained from the model is equal to 13, and due to the difference of 8.5% in the results, $K=13$ was chosen. Due to the fact that 13 variables were selected in the presence of other variables, these variables are called strong or unbreakable, and the rest of the variables that have a lower probability of entering later than the previous probability are called breaking. According to the table number (5), it is evident that the 13 variables in the presence of all the variables have a higher posterior probability than their previous probability and due to the increase of our guess for the presence of these 13 variables in the model, the effect of these variables on the profit can be managed. It was a study, and in other words, these variables are meaningful. In the third and fourth columns, the posterior coefficients and posterior standard deviation of the variables are stated, and in the last column, the t-statistic ratio of each variable is presented. Based on the results, the variables that have the highest ratio of T statistic are more important in the management profit. The priority of influencing variables on management profit is displayed in the last column. In the Bayesian averaging method, because the results are obtained based on the value of the meta-parameter k (in the above calculations, k was assumed to be 12), the question arises whether the results of the research will change if the value of the meta-parameter changes, and if the answer is positive, what is the amount of change? In other words, does choosing the expected size of the model have an effect on the results? Based on this, by choosing different \bar{K} and redoing the entire sampling process and related calculations, the results were compared. It is necessary to remember that in these three cases, the model space and therefore the variables and data are the same and the only difference is the expected size of the model; Of course, it is quite clear that by changing the expected size of the model, the samples and then the result will be different, that is, the variables may be fragile (or non-fragile) in all three values of \bar{K} . A variable that is fragile under the assumption \bar{K} becomes non-fragile by increasing the expected size of the model.

Table 6: Prioritization of variables affecting management profit in the optimal model

Priority	Regressions with $2 \leq t\text{-stat} $	The first sample includes 4 million regression		The first sample includes 5 million regression
		Prior probability	Prior probability	
2	0.861	0.723	0.185	Management profit forecasts for the past period
1	0.932	0.926	0.036	Profit or loss of the company
3	0.858	0.764	0.007	Optional accrual items
13	0.464	0.514	0.046	Type of industry
9	0.584	0.518	0.036	Existence of audit committee
10	0.575	0.664	0.227	Financial Leverage
11	0.506	0.548	0.046	Leverage ratio of operating debts
8	0.618	0.727	0.000	Return on equity
7	0.646	0.632	0.754	Economic uncertainty
4	0.788	0.741	0.152	(Uncertainty of monetary and financial policies)
12	0.491	0.503	0.018	Fluctuations in economic growth
5	0.772	0.923	0.185	Swelling
6	0.701	0.896	0.180	Management of accrued interest

Considering that the non-fragile variables in $\bar{K} = 12$ and $\bar{K} = 10$ with $\bar{K} = 8$ have a higher posterior probability, as a result, due to the small difference (below 10 percent), the use of each of the different K for the researcher It is allowed, the researcher has investigated the more complete state (with more K) due to increasing the comprehensiveness of the research. For a more detailed examination of the results of the above explanation, graph No. (1) is provided.

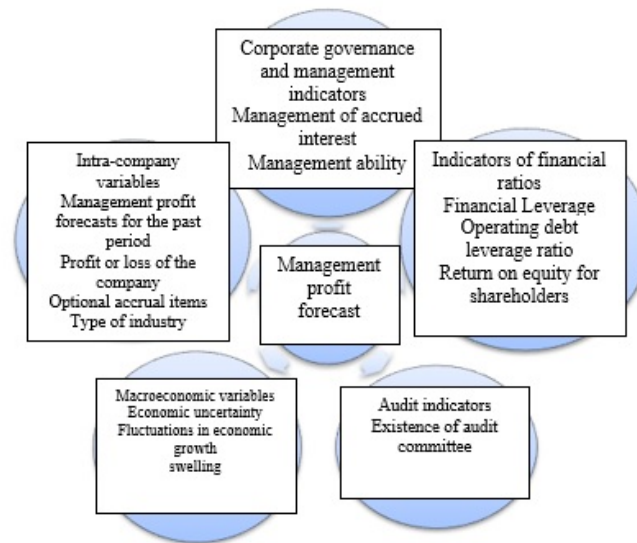


Figure 1: The final research model

In order to verify the results of posterior and anterior functions between variables, research has been presented. Based on the results of table number (6), it can be seen that the research variables have appropriate posterior and prior functions that have high compatibility. As a result, the model is in good statistical conditions.

5 Discussion and conclusion

Based on the results, among the BMA, TVP-DMA, TVP-DMS, BVAR and OLS models to identify the most important influencing variables on the accuracy of management profit forecast, the BMA model had the highest efficiency. Based on this, 50 identified variables affecting the accuracy of management profit forecasting were entered in the Bayesian averaging model (in 5 audit categories; financial ratios; macroeconomic variables; corporate and managerial governance indicators) and based on previous probabilities, 13 variables were identified as important variables. These variables include management profit forecasts of the past period; Profit or loss of the company;

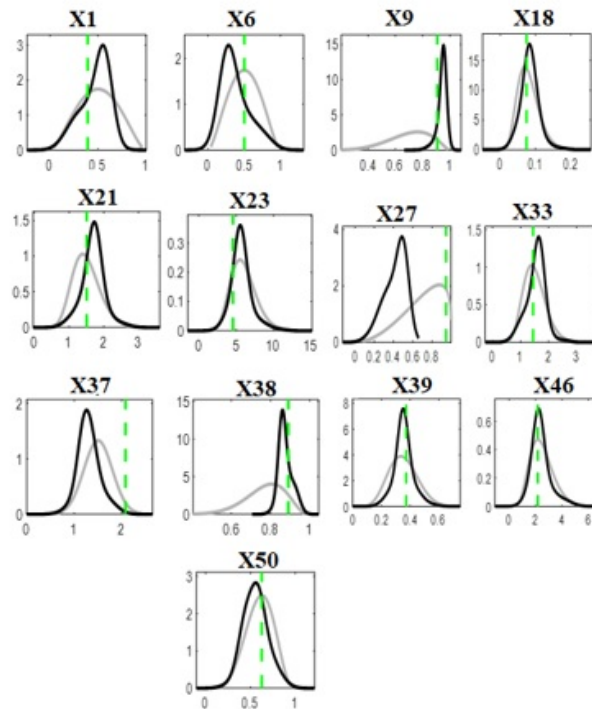


Figure 2: Posterior and anterior functions of selected variables

discretionary accruals; type of industry; existence of the audit committee; Financial Leverage; operational debt leverage ratio; return on equity; economic uncertainty; economic growth fluctuations; swelling; Accrued profit management and management ability. The results of the current research are in line with the results of Mohammadi's research [53], Ghaemi and Vatanparast [32], Elvisa and Ilgün [27], Mohammadian [53], Chang et al. [18], Zhu [76], Dechow et al. [22], Othman and Zeghal [61], Ashbough and Pincus [6], Boubaker et al. [15], Is. Regarding the question of what are the most important components of management profit forecasts; The following suggestions can be made:

due to the many dimensions of indicators affecting the accuracy of management profit forecasting based on the Bayesian averaging approach; There is a need for a systemic perspective regarding this matter and since the human mind does not have the ability to make this distinction, it is suggested to prepare computer programs based on statistical models to predict future profits based on the components of past profits and make it available to all those who want it. Using these types of advanced models to predict profit.

Due to the multiplicity and different effects (positive and negative), the dimensions of the indicators affecting the accuracy of the management profit forecast, providing a composite index in this field will be of great help to managers, investors and policy makers in decision-making.

Considering the many factors affecting the accuracy of management's profit forecast, investors, analysts and other stakeholders are advised to consider the factors mentioned in the research and the history of the company in addition to the used forecasting methods.

The findings of the present research are a factor to inform the policy makers and the compilers of accounting standards, so that they pay attention to the direct effect of some macroeconomic variables on the forecasting accuracy of managers.

Considering that research has been done in the field of comparing and identifying factors affecting the accuracy of profit forecasts in audited reports and the significant effect of these factors has been confirmed; It is suggested to address this issue in companies that provide unaudited reports.

In Iran, due to the fact that most of the companies are state-owned, there is no proper mechanism for punishing managers whose predicted profits are not sufficiently accurate; There is no solution; Therefore, it is recommended that due to the importance of the profit predicted by the managers for the investors, a situation should be provided so that the forecast of the managers as an indicator of the reputation and quality of the managers has the necessary accuracy. It seems that in this context, it is necessary for policymakers to pay attention to macroeconomic variables

such as exchange rate, inflation, uncertainty in financial and monetary policies.

Considering that there is a significant relationship between the existence of the audit committee (quality of financial reporting) and the accuracy of the profit forecast, it is suggested to the stock exchange organization to investigate the necessity of presenting the profit forecast of the companies by disclosing the basis of the forecast so that the market after predicting the change in each to be able to make decisions in a more favorable way from the basics and improve the quality of financial information, it is also suggested to examine the conditions requiring companies to prepare profit forecasts based on different scenarios in conditions of uncertainty, and also stricter implementation of the securities market law for companies that forecast or Changes in the forecast are presented with a delay or with low forecast accuracy.

Considering the significance of the effect of discretionary accruals and accrual profit management on the accuracy of management profit forecasting, it is proposed to oblige listed companies to provide timely information and report information about the components of cash flows and accruals separately in Codified computerized report format and summarized financial statements that can be widely used in decision-making.

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