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Designing an information asymmetry model with emphasis on the role of financial and managerial criteria

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Abstract

The main problem of the current research is the absence of a suitable measure to measure the information asymmetry between managers who forecast profits and statistical analysts who forecast profits through statistical methods. The lack of a suitable criterion for measuring information asymmetry between managers who forecast earnings and statistical analysts who forecast earnings through statistical methods is the main problem of the present study. The present study aims to provide a model of information asymmetry with emphasis on the role of financial and managerial criteria; The present research is a qualitative and quantitative research (mixed method) which is based on the purpose of applied research. In order to prepare and formulate theoretical bases for reviewing research records, the library method is used, and also for collecting information in order to measure and identify indicators and modeling, the field method is used. To analyze the data, first after identifying the dimensions and variables of financial and managerial criteria of information symmetry, to eliminate irrelevant factors and classify them with the help of factor analysis, this work was done and 5 main dimensions were identified, which are: Corporate profit forecast is 2- corporate governance, 3- capital market, 4- return on capital, 5- managerial characteristics of the company.

Keywords: information asymmetry, corporate profit forecasting, corporate governance, capital market, capital return
2020 MSC: 91B24

1 Introduction

One of the most important needs of people is to decide on various issues. Due to the existence of various options and solutions to an issue, human beings are forced to make decisions and according to the principle of desirability, by choosing a better option to increase their desirability, people make decisions in order to achieve their main purpose, which is to increase the desirability and level of welfare in order to obtain returns, they give their financial resources to other people, which is a kind of investment. According to agency theory, directors as shareholders' representatives may act or make decisions that are not necessarily to maximize shareholder wealth. According to this theory, adequate control or oversight mechanisms should be put in place to protect shareholders from conflicts of interest. The issue of transparency of financial statements and the quality of disclosure of information provided in it has been considered as a practical solution. Transparent and quality information flow reduces information asymmetry [9] Poor financial

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disclosure misleads shareholders and has an adverse effect on their returns. Theoretical analysis and empirical evidence indicate that increasing information asymmetry between managers and shareholders of the company by reducing the number of investors and decreasing the liquidity of securities, reducing the volume of transactions and, in general, reducing the social benefits of The location of these transactions is directly related. Therefore, quality disclosure will increase the volume of transactions and liquidity by reducing information asymmetry.

This paper addresses the absence of a suitable criterion for measuring information asymmetry between managers forecasting earnings and analysts forecasting earnings through statistical methods. The purpose of explaining the factors affecting the information asymmetry of budgeted managers' profit with other profit forecasting methods is to identify the degree of information asymmetry between people inside the organization and people outside the organization. This paper is based on agency theory and the theory of information asymmetry. According to the information asymmetry theory, company managers have the advantage of confidential information from within the company. Investors pay special attention to the company's profit figures to examine the company's situation and make investment decisions. Therefore, profit management is one of the most controversial and attractive topics in accounting research [12]. As the number of companies listed on the stock exchange and the process of privatization and capital growth has increased, and the public release of financial statements has become mandatory, measuring the forecast of the probability of fraud in the financial statements in the published financial information in methods other than conventional auditing methods seems necessary to disclose and prevent fraudulent reporting methods [22]. Much research has been done on detecting fraud and its possible manipulation. Beneish [4] proposed a model with eight accounting variables to detect profit manipulation. His model showed that the likelihood of profit manipulation also increased with unusual increases in receivables, a decline in gross profit margins, the reduction in asset quality, sales growth, and increased accruals. The Beneish studies model has been based on a survey of companies from the United States; however, studies conducted in other countries showed that the Beneish model could not perform similarly in all societies and capital markets [13].

Applications of accounting figures work differently in different markets, so it is not possible to identify the nature of these figures just by looking at a specific market. As a result, in a world of multiple countries and changing institutions and structures, it is essential to understand the applications of accounting numbers in other countries as much as possible. Subsequent research based on the Beneish model for detecting profit manipulation showed that the Beneish model does not have the same function in predicting manipulation and profit management, so localized variables or other variables should be used [10]. Although effective in different societies, any fraud detection model may not necessarily be very accurate and should be localized according to the economic situation of each country. In the primary model of Beneish, the financial condition of Iran is not taken into account. Therefore, it is less accurate than the adjusted Beneish model, which has been localized to the economic environment of Iran. Thus, the fraud detection models should be localized based on the economic structure of that country before implementing in any country [22]. Beneish [4] predicted profit manipulation methods using financial ratios and accruals. He used three sources to select his model variables. The first source is variables related to the future of the company, for it is assumed that the possibility of profit manipulation is when the company is in a weak position in the future. The second source is the variables based on cash flow and liabilities based on the models of Jones [8] and Healy [5]. Finally, he used the contract hypothesis based on the positive theory of Watts and Zimmerman [23].

Using the eight accounting variables he extracted from the companies' financial statements, Beneish developed his model and ignored the motivational effects arising from the company's environment. Meanwhile, the influential and motivating factors for profit manipulation can be classified into aspects from the company's accounting and non-accounting data via the literature review and classifications done in profit management and manipulation. In other words, in addition to the status of accounting data, non-accounting data such as external and environmental factors also provide the necessary incentives to manipulate earnings. They are effective in manipulating and managing earnings. Kordestani and Tatli [10] showed that the Beneish model is 70% predictable at best; in other words, the Beneish model in the Iranian capital market identifies the possibility of profit manipulation with a 30% error, which is a significant error percentage. Therefore, by increasing motivational factors of the environment outside the company to manipulate profits that have not been considered in the Beneish model, the degree and predictive power of the model can be increased. In previous research, the company's competitive environment has been introduced as one of the motivational factors for profit manipulation. According to the signalling hypothesis, managers in companies operating in highly competitive industries find sufficient motivation and inclination to manipulate accounting information, including profits, to communicate good information about the firm's future performance [20].

On the other hand, there is less oversight of management activities in a less competitive environment, which motivates profit manipulation. Still, for companies operating in highly competitive industries, due to more control and supervision, profit manipulation for these companies is very limited and weak [24]. There is a direct and significant

relationship between competition indicators in the product market and financial quality criteria [16].

2 Profit manipulation influential and motivating factors

Information asymmetry has various adverse consequences, including reduced market efficiency, increased transaction costs, weak market, low liquidity, and, in general, reduced profit from trading in capital markets. The above can indicate the importance of information asymmetry and its undeniable impact on economic decisions.

3 Theoretical foundations and empirical background

In general, profit management is the conscious actions of management to achieve specific goals within the framework of accounting procedures. If the managers using profit management intend to transfer information that reflects the facts and the actual value of the business unit, there is no objection to it; Nonetheless, concern arises when profit management is done with the aim of misleading users of information about the company's performance [6]. Moradi, Osoolian, and Norouzi [14] examined the relationship between earnings management and the auditor's conditional comment on the ambiguity of continuing the activity. In this regard, the auditor's conditional statement is divided into conditional due to ambiguity in the continuation of the client company activity and conditional for other cases. They used the adjusted three models of Jones [8], to measure earnings management through optional accruals. The mentioned relationship has been investigated using the logistic regression model. The findings of this study showed a direct relationship between profit management and the auditor's conditional comment due to the ambiguity in the company's continuity. However, between management, the ambiguity regarding the continuity of the client company increases the inherent risk of the audit. It increases the probability of issuing a conditional report in the presence of profit management.

Some studies show a significant positive relationship between competition in the product market and profit management based on actual activities. This result indicated an increase in profit management due to increased competition in the product market and decreased profit quality [3]. Also, competition is a corporate infrastructure mechanism allowing companies to do things like cost shocks to customers, reduce cash flow fluctuations and thus reduce the need for profit manipulation [2]. Adjusted Herfindahl–Hirschman Index has a positive and direct effect on the actual management of corporate profits; however, this effect is not significant [19]. Najafizadeh and Kayhan [15] showed that earnings management and information asymmetry are directly related to each other. Also, with increasing environmental uncertainty, the relationship between earnings management and information asymmetry is weakened. Kordestani and Tatli [10] concluded that in the Iranian economic environment, the initial model of Benish, compared to the adjusted Beneish model, does not have good power to identify levels of profit manipulation. Adjusted Beneish model and models developed with differential analysis and logit approach can identify manipulating and non-manipulating companies with a total accuracy of 72%, 75%, and 81%, respectively. Based on their evidence, accounting information is also helpful in predicting earnings manipulation.

Sheri Anagiz et al. [22] examined 100 companies listed on the stock exchange based on the two main adjusted Beneish models in the economic situation of Iran to determine which of these two models works better in detecting fraud. In this paper, fraudulent and nonfraudulent companies are divided into two groups: bankrupt and healthy. Their results showed an adjusted Beneish model with an overall accuracy of 66.2% and a total error of 33.8%. The original Beneish model, with an overall accuracy of 61% and an absolute error of 39%, can better show the fraud in companies' financial statements. Business owners turn to an independent auditor to oversee the agent, prevent opportunistic behaviors and information asymmetries and reduce agency costs. This audit role is significant for investigating financial statement manipulation and, consequently, for reporting earnings managed by managers. Piri and Ghorbani [17] examined the relationship between the independent auditor's comments and earnings quality metrics, indicating a significant relationship between the type of independent auditor's report and earnings quality indices. They also identified two sets of information in their decisions. The accrued earnings management is a potential factor to distort this feature. To evaluate the comparability feature, they used the output of the accounting system and examined the relationship between profits and returns of companies in the same industry. Their research findings show no significant relationship between the comparability of accounting figures and the management of actual and accrued earnings. Salehi and Farrokhi Pilehroud [21] showed that the neural network and decision tree method in predicting profit management is more accurate than linear methods with a lower level of error. In the absence of a model for detecting fraud in Iran, the Beneish model is commonly used in Iran for fraud detection.

Herawati [7] examined the ability of the Beneish model to detect financial fraud. He showed that the general Beneish model [4] could detect financial fraud. In this study, the gross margin index, depreciation index, sales index,

administrative cost index, and total accruals were significant in identifying financial fraud, and the sales index, asset quality index, and financial leverage index were not statistically significant in detecting financial fraud. Li and Zaiats [11] also focused on the corporate information environment, examining the extent of profit manipulation by companies operating in a poor information environment. They showed that there is a good platform for profit manipulation in companies with high information asymmetry and poor information environment. Managers of these companies have more motivation to manage profits. Ramírez Orellana, Romero, and Mariño Garrido [18] tested the Beneish model [4] to assess the likelihood of fraud and profit management. In other words, they measured fraud through the Beneish model [4]. According to their findings, fraud and daring accounting practices occur before financial problems are disclosed. Companies have taken bold accounting measures by manipulating the days of credit sales in the debt ratio and the sum of accruals to total assets. Ajina and Habib [1] found that companies manage profit intending to manage liquidity, so, based on experimental results, less liquid companies do more profit management.

4 Research methods

This is an applied descriptive survey. The relevant literature was reviewed to prepare and formulate theoretical foundations. Also, the field method was used to collect information to measure and identify indices and evaluate information asymmetry. This research will be done in two phases. In the first phase, we examine and identify the components of information asymmetry by emphasizing the role of financial and managerial criteria in providing a model. Then, the modeling was done using fuzzy mathematics through triangular numbers, Mamdani implication, and center of gravity methods. In the second phase, artificial neural networks were used to predict information asymmetry, emphasizing the role of financial and managerial criteria. These analyzes were performed using MATLAB and SPSS software. Below we give a complete description of the mentioned cases.

5 Research findings

We have researched and identified all the variables to finalize the model in the qualitative section, cover the various dimensions of the problem, and examine the main variables. In the qualitative part of the present study, after in-depth interviews with experts, the collected information was analyzed in three stages open coding, axial coding, and selective coding. Then, the conceptual research model was summarized.

The interviewees answered questions under the framework of open-ended interview questions. The researchers classified the answers in each session, taking into account the challenges created by the researcher in each interview, his knowledge and the audit committee expertise, and the number of respondents per company. Thus, the answers were categorized based on their type and content under a research category. They were defined and determined as a criterion for evaluating that category. Finally, according to the content of the answers provided, each of the concepts' subcategories was placed in related categories. It is noteworthy that in the qualitative research process, based on a sampling of managers and experts in the field, a sample of 15 subjects was selected during in-depth interviews. In the continuation of the chapter, we will present the process and results of qualitative research to finally reach the final research framework.

Table 1: Axial coding of exploratory study

Repetition	Corresponding codes	Concept	No.
9	A1B1	Economic uncertainty	1
	A11B6		
	A4B10		
	A12B7		
	A4B10		
	A15B17		
	A14B10		
	A2B7		
	A2B14		

8	A3B7 A1B13 A8B4 A4B2 A9B15 A10B6 A14B18 A10B17	Management behavior in profit forecasting	2
3	A1B17 A15B7 A8B1	Sales returns	3
4	A7B9 A8B7 A12B7 A8B2	Number and expertise of the audit committee	4
5	A13B17 A3B18 A13B9 A10B8 A1B17	Institutional ownership	5
4	A2B1 A13B1 A3B13 A14B16	Presence of internal audit	6
7	A4B11 A4B14 A14B15 A15B18 A12B15 A3B4 A13B10	Quality of profit	7
6	A1B14 A1B15 A2B15 A3B15 A9B4 A9B16	Systematic risk	8
3	A1B3 A12B2 A9B17	Company competitiveness	9
5	A10B2 A7B1 A7B16 A9B4 A9B17	Company growth opportunities	10
4	A3B16 A7B13 A6B18 A4B9	Return on assets	11
5	A1B11 A8B12 A4B5 A9B6 A6B1	Number and expertise of board members	12

4	A2B12 A4B4 A5B4 A7B10	Independence of the Audit Committee	13
3	A1B4 A10B5 A11B1	The dual role of the CEO	14
4	A2B1 A13B2 A2B3 A8B15	Change of CEO	15

The coding table depicts the concepts per category and their frequency. Accordingly, 18 identified concepts were classified into 5 categories, shown in the table below.

Table 2: Selective coding table of qualitative-exploratory study

Frequency	**Category**	**No.**
3	Company profit forecast	1
3	Corporate governance	2
5	Capital Market	3
2	Stock returns	4
5	Company management characteristics	5

Information asymmetry variables with emphasis on the role of financial and managerial metrics include company profit forecast, corporate governance, capital market, stock return, and management characteristics of the company. The variables are measured by the Likert scale so that the items represent the measurement of different aspects of each variable. The fuzzy mathematics method (method of triangular averages), was used and then these means were defuzzification using the center of gravity method and entered in MATLAB software and in the model as inputs, and finally the model output was obtained as the amount of micro and asymmetry information with emphasis on the role of financial and managerial criteria of companies listed on the Tehran Stock Exchange.

The general formula for calculating the average of triangular numbers is:

$$A_{ave} = (m_1, m_2, m_3) = \left(\frac{1}{n} \sum_{i=1}^{n} a_1^{(i)}, \frac{1}{n} \sum_{i=1}^{n} a_m^{(i)}, \frac{1}{n} \sum_{i=1}^{n} a_2^{(i)} \right) \tag{5.1}$$

The mean score given to each person is shown according to the mean of the triangular numbers and also the calculated fuzzy mean of each index (or variable) is at the bottom of the table. For example, the average of a triangle of person 3 is as follows:

$$\begin{aligned} A_{ave} = (m_1, m_2, m_3) &= \left(\frac{1}{n} \sum_{i=1}^{n} a_1^{(i)}, \frac{1}{n} \sum_{i=1}^{n} a_m^{(i)}, \frac{1}{n} \sum_{i=1}^{n} a_2^{(i)} \right) \\ &= \left(\frac{1}{5}(20 + 10 + 7 + 12.5 + 8), \frac{1}{5}(60 + 90 + 50 + 63 + 50), \frac{1}{5}(90 + 100 + 93 + 87 + 92) \right) \\ &= (11.5, 62.6, 92.4) \end{aligned}$$

Now that the fuzzy mean of each of the indices has been determined, it is time to enter the fuzzy means into the domestic model designed in the software and obtain the output, which is the information asymmetry amount. After giving these inputs to the system, the presented result of the information asymmetry amount with emphasis on the role of financial and managerial criteria is 55.1. In other words, the score of information asymmetry of companies listed on the Tehran Stock Exchange in the range of [100 0] is 55.1, in other words, the rate of applying information asymmetry in companies listed on the Tehran Stock Exchange is 55.1%. The following figures present the output of the fuzzy model. Membership Degree is the amount of information asymmetry at all three levels:

$$x = 55.1 \qquad a_1 = 0 \qquad a_M = 50 \qquad a_2 = 100$$

$$A \triangleq \mu_A(x) = \begin{cases} \frac{x-a_1}{a_M-a_1}, & 0 \leq x \leq 50 \\ \frac{x-a_2}{a_M-a_2}, & 100 \leq x \leq 50 \\ otherpoints, & \text{zero.} \end{cases} \tag{5.2}$$

$$\mu(Wisdom_{low}) = 0$$
$$\mu(Wisdom_{middle}) = 0.898$$
$$\mu(Wisdom_{high}) = 0.102$$

That is, information asymmetry in companies listed on the Tehran Stock Exchange is 89.8% at the medium level and 10.2% at the high level.

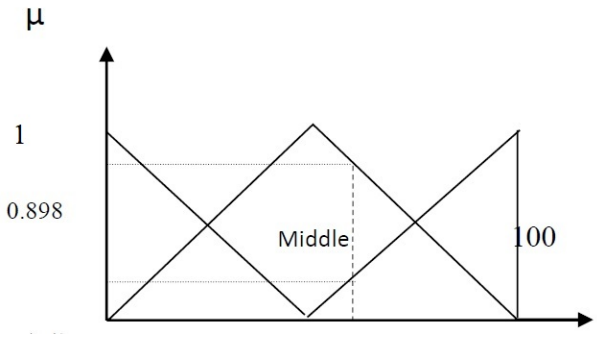

Figure 1: Degree of membership of information asymmetry with emphasis on the role of financial and managerial criteria

Also, using the mentioned formula for each of the dimensions, we de-fuzzificate the results, that will be:

First index:

$$\mu(Wisdom_{low}) = 0.03$$
$$\mu(Wisdom_{middle}) = 0.97$$
$$\mu(Wisdom_{high}) = 0$$

Second index:

$$\mu(Wisdom_{low}) = 0$$
$$\mu(Wisdom_{middle}) = 0.86$$
$$\mu(Wisdom_{high}) = 0.14$$

Third index:

$$\mu(Wisdom_{low}) = 0$$
$$\mu(Wisdom_{middle}) = 0.82$$
$$\mu(Wisdom_{high}) = 0.18$$

Fourth index:

$$\mu(Wisdom_{low}) = 0$$
$$\mu(Wisdom_{middle}) = 0.78$$
$$\mu(Wisdom_{high}) = 0.22$$

Fifth index:

$$\mu(Wisdom_{low}) = 0$$
$$\mu(Wisdom_{middle}) = 0.64$$
$$\mu(Wisdom_{high}) = 0.36$$

Table 3: Statistical information of MSE, RMSE and coefficient of determination

Prediction method	**MSE**	**RMSE**	**Adjusted R Squared**
Multiple linear regression method with data panel method	7.4	2.72	0.7646
Artificial network method	1.206	1.098	0.84
Fuzzy neural network method	0.136964	0.37	0.894

The low error of fuzzy neural network prediction method in comparison with two methods of multiple linear regression - data panel and artificial neural network method is confirmed. Also, the multiple linear regression method has the highest mean and the square mean of the errors.

Table 4: Mean, SD, and variance of earnings error per share by fuzzy neural network method

Statistical information	**Mean**	**SD**	**Variance**
Earnings error per managed budgeted share	66.74	319.202	101890
Profit error per share predicted by neural network method	78.672	402.5	107800

Given the assumption of inequality of variance between the two statistical populations, the value of t-test statistics is:

$$t_{0.95,df=158} \approx t_{0.95,\infty}$$
$$|-0.2196| \prec 1.645 \Rightarrow RH_0 \tag{5.3}$$

Degree of freedom: 158

Therefore, the significance of the difference between the average management profit error and the earnings error per share predicted by the fuzzy neural network and the smaller the average management earnings error compared to the average earnings error per share predicted by the fuzzy neural network are confirmed.

5.1 Information asymmetry findings

All components of profit quality have a significant relationship with the relative accuracy of error or information asymmetry and the results show that the relative accuracy of error or information asymmetry has a negative relationship with profit quality. Apart from the percentage of non-executive board members, the presence of internal audit and duplication of duties of other components of corporate governance, especially the components related to institutional ownership and the focus of institutional ownership have a significant relationship with the relative accuracy of information error or asymmetry. There is a significant negative relationship between the independent variable of disclosure quality and the relative accuracy of the error or information asymmetry.

6 Discussion and conclusion

The lack of a suitable criterion for measuring information asymmetry between managers who forecast earnings and statistical analysts who forecast earnings through statistical methods is the main problem of the present study. The purpose of explaining the factors affecting the information asymmetry of managers' budgeted profits with other methods of profit forecasting is to identify the degree of information asymmetry between people inside the organization and people outside the organization. The theoretical basis of the present study is related to the theory of representation and the theory of information asymmetry. According to the theory of information asymmetry, company managers have the advantage of hidden information from within the company. This paper examined information asymmetry variables and dimensions by factor analysis method, with emphasis on the role of financial and managerial criteria in the domestic model. The studied factors include, corporate governance, capital market, return, and management characteristics of the company. Then, the model was presented using three verbal variables and 243 rules were compiled for the model by experts, supervisors and consultants. Finally, after compiling the model in MATLAB software, the level of information asymmetry was measured by emphasizing the role of financial and managerial criteria and its five dimensions, which is 55.1 in the range of 0 to 100, which is an average level, at the medium to high levels.

The possession of the majority of the company's shares by state-owned investment companies, quasi-government, insurance and banks and state-owned companies includes another key factor is the information advantage in forecasting profits and creating information asymmetry, for the concentration of institutional ownership. Large commercial or

industrial-focused companies have more information advantages in profit forecasting than more competitive ones. The difficulty of forecasting profits due to economic uncertainty is another major factor in creating information asymmetry.

The following research entitles are recommended for future research:

"The effect of privatization on information asymmetry between external and internal people", and "Explain the effect of institutional ownership and business concentration on information asymmetry in conditions of economic uncertainty and compare it with economic prosperity."

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