In the Name of God, the Compassionate, the Merciful

Ferdowsi University of Mashhad

Iranian Journal of Accounting, Auditing & Finance
(IJAAF)

Contents

Editorial Board

Articles Writing Guide

Received articles will be published after professional referee, and being approved by the editorial board. Submission to this Journal is required to send at least two files include: an "Article cover" and an "Anonymous file of the main article", through systems, http://ijaaf.um.ac.ir/ .Submission of a manuscript implies that the paper has not been published before and it is not under consideration for publication elsewhere. Please pay attention to the following:

1-Article Cover

The file should be typed in Word software (office), and A4 sized page which include:

- Full title of the paper centered in Times New Roman 16.
- Author's name centered in Times New Roman 12 (Bold),
- Author's characteristics centered in Times New Roman 11 (italics), including the authors' name (the name of correspondence author should be marked with an asterisk), academic rank and the name of the institution or university (do not use pseudonym and nickname), complete address, telephone number and fax of correspondence author and e-mail address of all authors.

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The main article should be typed in Word software (office), A4 sized page and utmost in 7500 words (including references), and numbered pages while page margins are as follows: margin from the above 4 cm, from the below 5/6 cm, from the left 5/4 and from the right 5 cm. The line spacing should be set at 1 cm and the beginning of each paragraph indented about 0.3 cm, the entire text should be Justified and include the following:

The first page:

- Full title of the paper, centered in Times New Roman 16.
- Abstract in Times New Roman 11 and utmost 165 words, including four issues: (1) Subject and purpose of the paper, (2) methodology, (3) findings, and (4) conclusions, and Contribution (maximum).
- Utmost 5 keywords in Times New Roman
- Subject classification code in Times New Roman This coding is designed for subject classification in economic literature and how to use it in detail is available on the following website:www.aeaweb.org/journal/jel_class_system.html
- The main titles in manuscript (including abstract, introduction, literature review, methodology, findings and Conclusion) left aligned in Times New Roman 12(Bold) and sub-titles (such as Keywords, subject classification code and other necessary(important) titles) left aligned in Times New Roman 11(bold) and in the left alignment, content of main manuscript in Times New Roman
- As far as possible, do not use any image in the text and if used, it should be high-quality black and white photos.

Structure of second page until the end of manuscript is as follow:

- *Introduction* Some paragraphs contain explaining the problem, literature review, object (purpose), importance and necessity of it.
- *Literature review* A review of the literature investigates only related researches chronologically and the results exploit at the end of the section theory matrix or conceptual model that document research variables and Formulate research hypotheses.
- *Methodology* including Methods, data collection tools, population, sample size and sampling methods, analysis and model testing hypothesis, definition of study variables and operational definition of them can be in presented the same section that model testing is represented and there is no need to repeat.

- *Results* including the findings compare it with the findings of previous and interpretation of compliance or inconsistency of findings with research findings and theories.
- *Conclusion* includes a summary of the problem, provide a summary of the results and overall conclusion and recommendations based on the results (policy recommendations is necessary only in applied research and, if necessary, recommendations for future research accordant with the research limitations or how development of current research;
- *References* are as Section 3-2 and
- *Endnotes* terminology and some necessary explanations provide in the endnote (no footer) and as a two-column table (contains the endnote number and content of endnote with invisible lines (No Border). Numbering the endnotes are as text and doing without the use of EndNote technique.

3- Other important points in the original file

3-1- References inside the text

- In order to reference within the text (APA) method should be used; so the author's last name with the year of publication it is presented in the text respectively. If there are two authors, last names' will be separated by "and" and if more than three people, "et al." will be used
- After the last name of the first author. If the number of resources is more than one, a semicolon (;) will be used to separate them.
- Any reference which is mentioned in the article, must be included in references part.
- If it is required to explain more about terms or words within the text, endnote can be used.

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To set the reference list, use the (APA) method, as follows:

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When citing a book in APA, keep in mind:

- Capitalize the first letter of the first word of the title and any subtitles, as well as the first letter of any proper nouns.
- The full title of the book, including any subtitles, should be stated and *italicized*.
- Magazines: Author, A.A. (Year of Publication). Title of the Article. *Journal Title*, *Volume* (Issue), pp.-pp.
- When citing a magazine in APA, keep in mind:
- You can find the volume number with the other publication information of the magazine.
- You can typically find page numbers at the bottom corners of a magazine article.
- If you cannot locate an issue number, simply don't include it in the citation.
- Online magazine article: Author, A.A. (Year). Title of the Article. *Magazine Title*, *Volume* (Issue), Retrieved from http://xxxx
- When creating an online magazine citation, keep in mind:
- The volume and issue number aren't always on the same page as the article. Check out the other parts of the website before leaving it out of the citation.
- List of references should not be numbered. If there are 2 or more authors alike, in addition to alphabetical order, the publisher year also should be ordered. In order to avoid the pitfalls of the various sources listed, the beginning of each reference is 0/5 cm protrusion.
- If there are two authors, last names' will be separated by "and" and if more than three people, last names' will be separated by a comma (,) and the last one with "and".

3-3- Charts, Tables and Formulas

Charts' title should be writhen below and tables' title on the top centered in Times New Roman 11 and Bold. Charts and tables render within the text and immediately place after the explaining paragraph. The content of charts and tables in Times New Roman 10

- Tables and images number from No. (1) To refer to the content of the images and diagrams in the text, use the number and appropriate referral.
- Inserting decimal numbers, instead of using slash (/), and show negative numbers by using the minus sign.
- Tables include variables, should contain a column for the symbols used for variables.
- Formulas represent centered in Times New Roman11and render in a two column table with no border and number with figure in parentheses.

3-4- Other notes

- There is no need to spaces before dot, comma, semicolon, colon, question mark, exclamation mark and, but after these signs shall be placed a spaces.
- Use spaces before opening and after the closing parenthesis.
- Articles should not be sent to Persian/English journal or another language at home and/or abroad simultaneously.
- If the format and structure of submitted articles are not same as what mentioned in this guide, it won't be accepted.
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The journal is devoted to research papers. Research paper is extracted from the research project, master's dissertation or thesis.

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Editor's Note

I am pleased to announce that the Ferdowsi University of Mashhad is publishing Iranian Journal of Accounting, Auditing & Finance (IJAAF). On behalf of the board of the IJAAF and my co-editors, I am glad to present the Volume 1, Issue 1 of the journal in December 2017; the journal will publish four issues in a year. The board includes experts in the fields of accounting, finance and auditing, all of whom have proven track records of achievement in their respective disciplines. Covering various fields of accounting, *IJAAF* publishes research papers, review papers and practitioner oriented articles that address significant issues as well as those that focus on Asia in particular. Coverage includes but is not limited to:

- Financial accounting

- Managerial accounting

- Auditing

- Taxation

- Accounting information systems

- Accounting education

Perspectives or viewpoints arising from regional, national or international focus, a private or public sector information need, or a market-perspective are greatly welcomed. Manuscripts that present viewpoints should address issues of wide interest among accounting scholars internationally and those in Asia in particular.

Yours faithfully,
Mahdi Moradi
Editor in Chief

RESEARCH ARTICLE

Prediction of Interest Rate Using Artificial Neural Network and Novel Meta-Heuristic Algorithms

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Abstract

One of the most parameters and variables in every economics is the interest rate. Government officials and lawmakers change interest rates for various purposes: controlling liquidity, inflation, and prices, Economic growth and development, lending, etc. So, it is important to set the interest rate correctly. If you can predict the interest rate correctly, you can earn and gain profit by investing in various sectors. Moreover, the interest rate can impact other sectors through parallel markets such as the stock market, automobile, housing, etc. Interest rates are related to parallel markets. Thus, if you can forecast the interest rate, you can predict the parallel markets too. The main goal of this article, as it is clear from the title, is the prediction of interest rate using ANN and improving the network using some novel heuristic algorithms such as Moth Flame Optimization algorithm (MFO), Chimp Optimization Algorithm (CHOA), Time-varying Correlation Particle Swarm Optimization algorithm (TVAC-PSO), etc. we used 17 variables such as oil price, gold coin price, house price, etc. as input variables. We used GA and a new algorithm called Grey Wolf Optimization, Particle Swarm Optimization (GWO-PSO) algorithm as a feature selection and choosing the best variables. We have used eight loss functions such as MSE, RMSE, MAE, etc. too. Finally, we have compared different algorithms due to their estimation errors. The main contribution of this paper is that, first, this is for the first time which these novel metaheuristic algorithms have been used for the prediction of interest rate. Second, it has tried to use different graphs and tables for better understanding and totally a comprehensive research paper. The results show that Whale Optimization Algorithm (WOA) performed better than other methods along with less error.

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1. Introduction

Economics money is like blood in the body (Desan, 2008). The final goal of the firms and investors is maximizing their profit Jensen, (2002). So, banks, as one of the main pillars in economic, can distribute money between different sections and parties Peek and Rosengren, (2010). One of the main variables that can determine banks' profitability is the interest rate (Trujillo-Ponce, 2013).

This interest rate depends on different parameters and variables such as oil price, stock market, and parallel markets Friedman, (1977). If we can characterize the relationship between these parameters, we can make almost a relative confidence for future investment. Setting and adjusting a correct interest rate, the inflation rate, and liquidity can stabilize (Goodfriend, 1993). However, interest rates are determined by supply and demand (Friedman, 1966). Faced with intense competition and rising demand for loans by Borrowers, most banks are exploring ways to use their data assets to gain a competitive advantage (Subramanyam, 2016). Furthermore, with the increasing economic globalization and improvements in information technology, large amounts of financial data are being generated and stored. In the light of changing business environments, managers see the need for more flexible predicting models(Vercellis, 2009).

An artificial neural network is an adaptive system that changes its structure based on external or internal information that flows through the network during the learning phase to make time-series predictions Abraham, (2005). Neural networks are non-linear statistical data modeling tools or information processing paradigm that have a remarkable ability to derive meaning from complicated or imprecise data (Qasim et al., 2013).

As it is clear from the title, the main goal of this research paper is the prediction of interest rate using ANN and improving the network using some novel heuristic algorithms such as Moth Flame Optimization algorithm (MFO), Chimp Optimization Algorithm (CHOA), Time-varying Correlation Particle Swarm Optimization algorithm (TVAC-PSO), etc. we used 17 variables such as oil price, gold coin price, house price, etc. as input variables. We used GA and a new algorithm called Grey Wolf Optimization, Particle Swarm Optimization (GWO-PSO) algorithm as a feature selection and choosing the best variables. We have used eight loss functions such as MSE, RMSE, MAE, etc. too. Finally, we have compared different algorithms due to their estimation errors. The main contribution of this paper is that, first, this is for the first time which these novel metaheuristic algorithms have been used for the prediction of interest rate with brilliant results. Second, it has tried to use different graphs and tables for better understanding and totally a comprehensive research paper. Because most articles deal with stock price forecasts, bitcoin prices, etc., while forecasting interest rates is critical due to an important economic variable. The results show that Whale Optimization Algorithm (WOA) performed better than other methods along with less error.

The structures of the article are as the following:

The first part is about the introduction. In the second part, we have talked about the literature review and background. The third part is about methodology. The next part is about findings and results, and the last part is about conclusions. You can see more results in the appendix too.

2. Literature Review and Background

In the last decades, several methods based on the theory of market equilibrium and no-arbitrage assumption have been proposed to predict interest rate Yasir et al. (2020). There are some models with stochastic processes too. These models are based on economic theories. They have not been dynamic in predicting interest rates because interest rates are dynamic variables and are always affected by other economic variables. In literature, many research papers have been used regression

models such as VAR[1], ARCH[2], GARCH[3] , etc., to predict interest rate (Yasir et al. 2020). These models have some assumptions and mechanisms, for example, linearity and normality Zhang and Wu (2011). But as we said earlier, financial time series are not normal and linear, while non-linear skewness means negative skewness Taylor, (2008). So, we should apply some models which be able to identify these features. ANN can provide robust results and outperforms traditional models because it can identify linearity and non-linearity (Jain ans Kumar, 2007). When you use the ARIMA[4] model, your sample size should be more than 50, but in ANN, your sample size can be less than 50 with better results Yasir et al. (, 2020).

From the empirical viewpoint, we can divide literature into four different streams; 1) Change in the yield curve in order to predict the price level and GDP. 2) Data-driven models. Mathematical models which focus on the future behavior of interest rate. 3) Dynamic models such as equilibrium models and arbitrage-free models and 4) Data-driven models which rely on knowledge discovery techniques to predict the interest rate Yasir et al. (2020). These models are compatible with some qualifications such as non-linearity, structural breaks, and seasonality issues laying in variables. In recent years, studies are moving towards artificial intelligence for high abilities such as machine learning (ML), deep learning (DL), ANN, expert systems, fuzzy logic, etc. (Abiodun et al. (2018)

In this part, we have tried to mention the capabilities of using neural networks and metaheuristic algorithms in interest rate forecasting and prediction of the stock market and time series forecasting.

Time series such as the stock market is characterized by non-linearity, discontinuity, and volatile multifaceted elements. It is related to many factors such as political events, general economic conditions, and broker expectations (Hadavandi et al., 2010). Also, the quick process of this data by using high-tech technology and communication systems causes the financial and economic time series to fluctuate very fast. Therefore, many banks, financial institutions, big investors, and brokers have to trade the stock within the shortest possible time. Obtaining maximum profit is the ultimate goal of the investors. As a result, many researchers are looking for market forecasting capabilities in various ways Prasanna and Ezhilmaran, (2013).

ANN dedicated the best and most validated method in predicting time series (Idris et al., 2015). There are many training methods for training the ANN, and some are better than others in finding the linear and non-linear relationship. ANN uses two thresholds for exploring linear and non-linear qualifications. First, the number of the input layer and hidden layer is significant in predictability. If we use too many layers, the ANN couldn't find the fittest choice, and the structure will be complicated. In addition, too few layers mean that the ANN cannot find the global solution and non-linear relationships (Sheela and Deepa, 2013). The researchers have tried to discover some high-speed methods with high accuracy and lower the error. For this reason, metaheuristic algorithms are used. These methods are used to optimize the network and find the best number of input and hidden layers. The ANN models in forecasting stock price, stock return, exchange rate, inflation, and imports work better than traditional statistical models.

Gocken et al. (2016) used technical indicators and hybrid ANN Based on GA and HS to predict the price index in the Turkish stock market. The results showed that the error of hybrid meta-heuristic algorithms is less than ANN. Furthermore, they compared the hybrid ANN-HS and ANN-GA model and found that ANN-HS error is less than ANN-GA.

Hassanin et al. (2016) used the GWO to provide good initial solutions to the ANN. The results

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1. Vector Auto-Regressive (VAR)
2. Auto-Regressive Conditionally Heteroskedastic (ARCH)
3. Generalized Auto-Regressive Conditionally Heteroskedastic(GARCH)
4. Auto Regressive Integrated Moving Average (ARIMA)

showed that GWO based ANN outperforms both GA-based ANN and PSO-based ANN. Faris et al. (2016) presented that MVO shows very competitive optimization results of weights and biases for multi-layer perceptron networks. In addition, GA, PSO, DE, FFLY, and Cuckoo Search are used to compare the performance of the proposed method. Finally, Rather et al. (2017) observed that the field of hybrid forecasting had received lots of attention from researchers to form a robust model. At this point, ANN provided successful results in stock market forecasting for different stocks.

Mortezapour and Afzali (2013) assessed Customer Credit through Combined Clustering of Artificial Neural Networks, Genetic Algorithm, and Bayesian, Probabilities. In their work, customer credit was assessed using the combination of Genetics Algorithm, Bayesian, Probabilities, and Neural network. Furthermore, it was compared with the methods such as Clustering-Launched Classification (CLC), Support Vector Machine (SVM), and GA+SVM, where the genetics algorithm has been used to improve them.

Dagmar and Jiri (2011) used Neural Networks China-USA business review in their work financial forecasting. From the result, it was seen that an artificial neural network is a tool for financial forecasting.

3. Rsearch Methodology

3.1. Hybrid Metaheuristic Artificial Neural Networks for interest rate Prediction

3.1.1. Input variables

This section describes the input variables selection methodology. For each case, 17 economic variables, such as oil price, gold coin price, etc., are considered input variables. Many economic variables and selecting useful variables are the key issue (Huang et al., 2012). For this reason, we use GA and a novel metaheuristic algorithm called GWO-PSO[1] for selecting the fittest input variables. GA and GWO-PSO are used for determining the variables that have the most significant effect on the forecasting performance. Using GA and GWO-PSO, we can evaluate the usefulness of variables or eliminate irrelevant ones to simplify the proposed model. In table 1, there are all considered economic variables.

3.2. Artificial Neural Network (ANN)

First, we use normal ANN without using any algorithms. Then, to continue, we get right into hybrid ANN for selecting input variables and determining the number of input and hidden layers. In this study, Gocken et al. (2016) used a multi-layer perceptron (MLP) with three layers (two layers for input and output variables and one layer for hidden layer). An input layer includes 17 input variables, i.e., there are 17 neurons in the input variable. Because the output layer has one variable, it has one neuron.

In this study, the hidden layer neurons of the normal neural network model are obtained through trial and error. So, we examine 1-32 neurons in hidden layers and choose the fittest number of neurons with the most accuracy as the ANN model. For training ANN, we use error-back propagation. The minimization algorithm in learning the model is the Marquardt-Levenberg algorithm used to find the minimum error point (Monfared et al., 2012). The number of training epochs is 1000, and for the first time training rate is 0.01, and we decrease this rate to 0.001 in order to obtain more accurate results. ANN has two threshold functions. One of them is for recognizing the linear qualification, and the other is for recognizing the non-linear qualification of the model. The output function of the hidden layer is the sigmoid function, and the threshold function of the output layer is the pure line function.

Figure 1 represents the proposed neural network architecture (fig.1. is adapted from Gocken et al., 2016).

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1. Grey Wolf-Particle Swarm Optimization algorithm (GW-PSO)

Table 1. Economic variables as input variables

No	Variables	The variable belongs to the desired subset
1	Liquidity in terms of its components (Billion Rial)	Monetary and credit variables (liquidity)
2	Banks and non-bank credit institutions (Billion Rial)	Monetary and credit variables (Note grant facilities of banks to governmental and non-governmental sectors)
3	Commercial Banks (Billion Rial)	Monetary and credit variables (Note grant facilities of banks to governmental and non-governmental sectors)
4	Specialized banks (Billion Rial)	Monetary and credit variables (Note grant facilities of banks to governmental and non-governmental sectors)
5	Banks and non-bank credit institutions (Billion Rial)	Monetary and credit variables (Facilities granted by banks and non-bank credit institutions by contracts)
6	Commercial Banks (Billion Rial)	Monetary and credit variables (Facilities granted by banks and non-bank credit institutions by contracts)
7	Specialized banks (Billion Rial)	Monetary and credit variables (Facilities granted by banks and non-bank credit institutions by contracts)
8	Non-governmental banks and non-bank credit institutions	Monetary and credit variables (Facilities granted by banks and non-bank credit institutions by contracts)
9	Crude oil production (one thousand barrels per day)	Energy Section (Oil)
10	Crude oil exports (thousand barrels per day)	Energy Section (Oil)
11	All urban areas (without units)	Construction and housing sector (land price index)
12	Official rate (Rials)	Price of financial assets (exchange rate and coin price), exchange rate, US dollars
13	new design (thousand Rials)	Price of financial assets (exchange rate and coin price)
14	Total index (no units)	Price indices (price index of consumer goods and services) (100 = 1383)
15	Total index (no units)	Stock Exchange (Indicators)
16	Inflation rate	Price indices
17	Short term	Facility interest rate
18	Long term	Facility interest rate
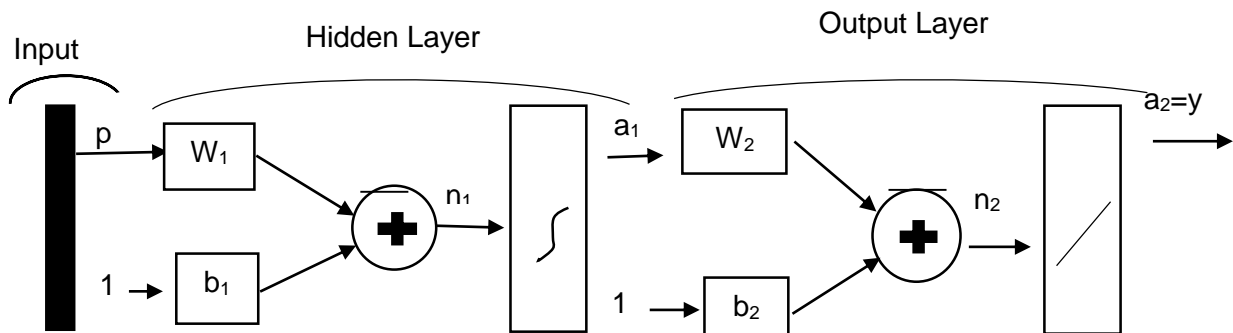
Fig 1. The architecture of the proposed Neural Network

In figure 1, P is the input pattern, b_1 is the vector of bias weights on the hidden neurons, and W_1 is the weight matrix between the 0th (i.e., input) and 1st (i.e., hidden) layers. a_1 is the vector containing the outputs from the hidden neurons, and n_1 is the vector containing net inputs going into the hidden neurons, a_2 is the column vector coming from the second output layer, and n_2 is the column-vector containing the net inputs going into the output layer. Thus, W_2 is the synaptic weight matrix between the 1st (i.e., hidden) layer and the 2nd (i.e., output) layer, and b_2 is the column-vector containing the

input neurons' bias inputs. Each row of the W$_2$ matrix contains the synaptic weights for the corresponding output neuron [Ahmad, Jafri, Ahmad, and Khan, (2005)]. At first, the neuron receives information from the environment. Then this information multiplied by the corresponding weights is added together and used as a parameter within an activation (transfer) function. Haider and Hanif, (2009).

We forecast interest rates by using different hybrid ANN models and comparing their prediction errors. So, we divide interest rate data from 2004-2014 (because of available data) into two parts: training and testing. Then, it is analyzed with artificial intelligence algorithms and forecasting the next season's interest rate. Like Gocken et al. (2016), 70 percent of observation is used for training, and 30 percent of observation is used for testing and validation. We compare models with 8 criteria for prediction error. For training ANN, different algorithms are used. These algorithms exist in the MATLAB toolbox.

We normalized numbers between 0,1. In equation 1, numerator i is the number of data.

$$\widetilde{S_i} = \frac{(S_i - S_{min})}{S_{max} - S_{min}} . i = 1 \dots . N \tag{1}$$

Figure 2 represents the research methodology (Fig.2. is adapted from Ghasemiyeh et al., 2017).

3.3. GA-ANN forecasting model

In this model, GA was used for input variable selection and used ANN as the fitness function. In this study, the considered coding is binary coding. The usable chromosome contains 18 bits which 13 bits present the existence or nonexistence of input (economic indicator) variables. If the bit is "0," it means don't exist variable, and if be "1" means that exist variable and forming neuron in the input layer. 5 other bits are equal to 1-32 (2^5=32), showing the number of neurons in hidden layers. The population size of GA is 20 (Davallou and Azizi, 2017). The first population selects randomly. The fitness function is ANN, and its input variable is economic variables, and the number of hidden layers and its output is the amount of MSE. The smallest MSE in this series is the fittest choice for the next forecasting period. For increasing the training speed algorithms, the epochs are 100. We use 70 percent of the data for training ANN. Other 30 percent used for testing and validation. At first, the training (learning) rate is 0.01, which will decrease with repeating training to obtain more exact results. If we want to obtain a more accurate result, we can increase the epochs to 1000. The considered parameters in the genetic algorithm are as table 2:

Like Gocken et al. (2016), we used a roulette wheel for selecting parents, and the crossover percentage is 80. We use one-point crossover in crossover and doing fitness functions for all of them. We use binary mutation, and the mutation percentage is 20. Among 20 parents and 20 children, we select the 20 best individuals as new generations. The new generation continues with repeating the above method until reaching the termination condition. One of the termination conditions is repeating the best individual to 100 generations. If this condition doesn't hold, we check the maximum generation condition. The maximum number of producing generation is equal to 2000.
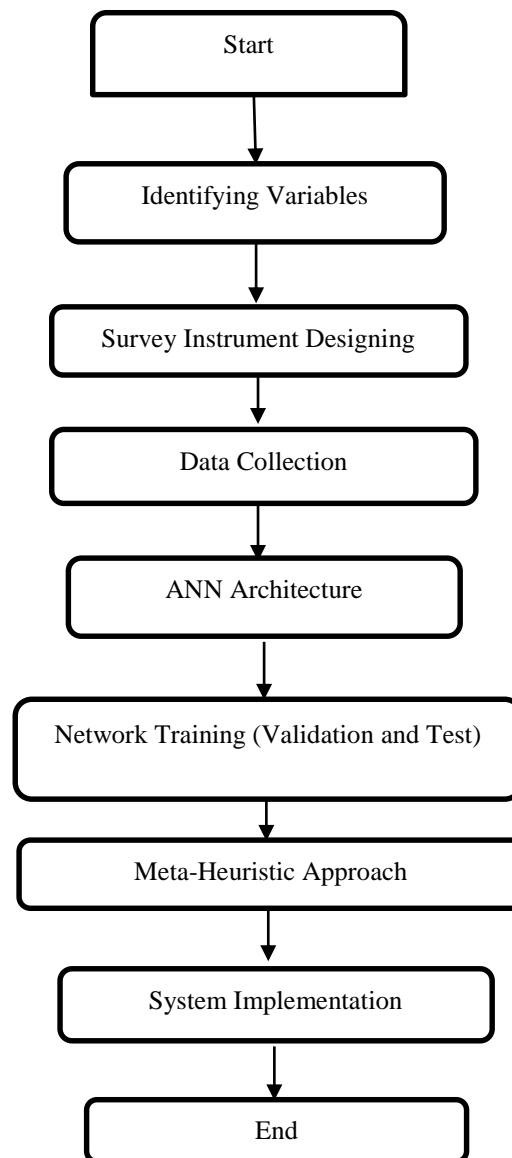
Fig 2. research methodology

Table 2. GA parameters

Output Error	Output Activation Function	Input Activation Function	Mutation Rate	Crossover Rate	Number of Generation	Population Size
SSE	Logistic	Logistic	0.1	0.9	50	50

Figure 3 represents the related flow chart of GA-ANN (Fig.3. is adapted from Gocken et al., 2016).

3.4. GWO-PSO algorithm

This part is adapted from Al-Tashi et al. (2019). It is used PSO and GWO algorithms for optimizing exploitation and exploration, respectively. The inertia weight in GWO modeled as follows:

$$\vec{D_a} = \left| \vec{C_1} \cdot \vec{X_a} - w * \vec{X} \right|. \tag{2}$$

$$\overrightarrow{D_\beta} = \left| \overrightarrow{C_2} \cdot \overrightarrow{X_\beta} - w * \vec{X} \right|. \tag{3}$$

$$\overrightarrow{D_\delta} = \left| \overrightarrow{C_3} \cdot \overrightarrow{X_\delta} - w * \vec{X} \right| \tag{4}$$

In the hybrid model, velocity and position can be updated as follows:

$$V_i^{k+1} = w * \left(V_i^k + c_1 r_1 (X_1 - X_i^k) + c_2 r_2 (X_2 - X_i^k) + c_3 r_3 (X_3 - X_i^k) \right) \tag{5}$$

$$X_i^{k+1} = X_i^k + V_i^{k+1} \tag{6}$$
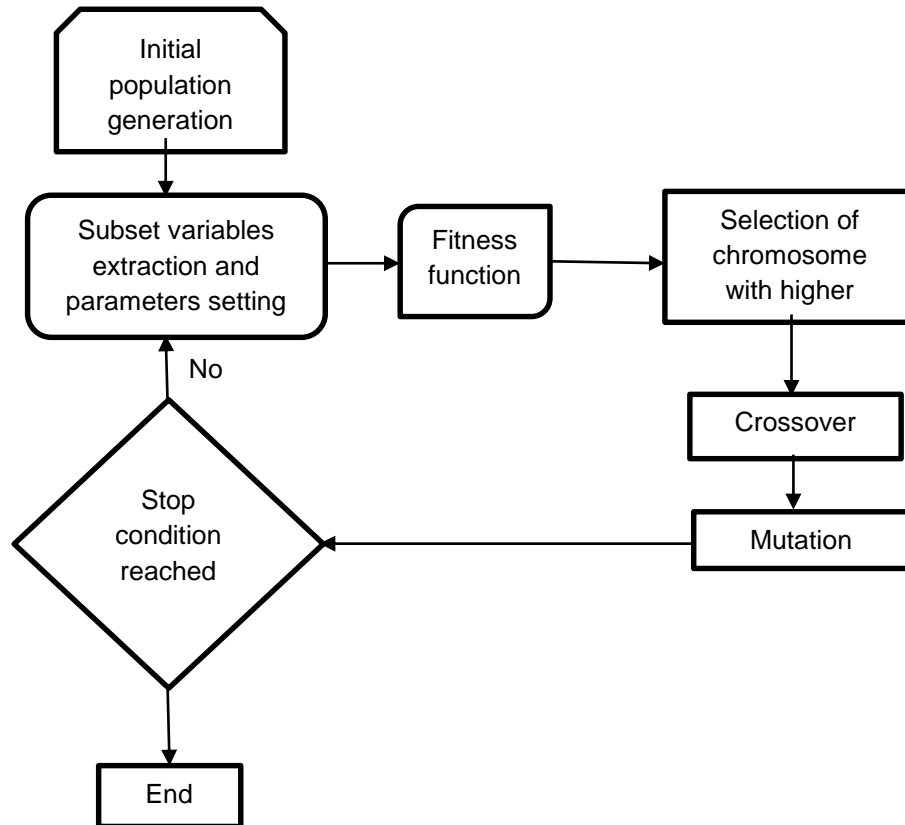
Fig 3. Considered GA flow chart for training ANN

We should turn the problem into a binary position. Agents can continuously move around the search space in the original PSO-GWO since they have position vectors with a real continuous domain. GWO algorithm contains three position vectors: x_1, x_2, x_3, which promotes every wolf to the first three best solutions. We can update the position and modifying it into the following equations:

$$X_d^{i+1} = \begin{cases} 1 \ if \ sigmoid(\frac{x_1.x_2.x_3}{3}) \geq rand \\ 0 \qquad otherwise \end{cases} \tag{7}$$

where X_d^{i+1} is the binary updated position at iteration t in dimension d, a rand is a random number with uniform distribution ϵ [1,0], and sigmoid(a) is denoted as follows:

$$sigmoid\ (a) = \frac{1}{1+e^{-10(x-0.5)}} \tag{8}$$

x_1, x_2, x_3 are updated and calculated using the following equation:

$$X_1^d = \begin{cases} 1 \ if \ (X_a^d + bstep_a^d) \geq 1 \\ 0 \qquad otherwise \end{cases} \tag{9}$$

$$X_2^d = \begin{cases} 1 \ if \ (X_\beta^d + bstep_\beta^d) \geq 1 \\ 0 \qquad otherwise \end{cases} \tag{10}$$

$$X_3^d = \begin{cases} 1 \ if \ (X_\delta^d + bstep_\delta^d) \geq 1 \\ 0 \qquad otherwise \end{cases} \tag{11}$$

Where $X_{a.\beta.\delta}^d$ the position's vector of the alpha, beta, delta wolves in d dimension, and $bstep_{a.\beta.\delta}^d$ is a binary step in d dimension, which can be formulated as follow:

$$bstep_{a.\beta.\delta}^d = \begin{cases} 1 & if \; cstep_{a.\beta.\delta}^d) \geq rand \\ 0 & otherwise \end{cases} \tag{12}$$

where $rand$ a random value derived from uniform distribution ϵ [1,0], d indicates dimension and $cstep_{a.\beta.\delta}^d$ is d's continuous value. This component is calculated using the following equation:

$$bstep_{a.\beta.\delta}^d = \frac{1}{1+e^{-10(A_1^d D_{\alpha.\beta.\delta}^d - 0.5)}} \tag{13}$$

We used 70% for training and 30% for validation and testing. In addition, we used some evaluation measures means statistical measures in each run.

The flowchart of the hybrid GWO-PSO binary algorithm is the following: (Fig.4. is adapted from Shaheen et al., 2020).

3.5. MPSO algorithm

This part is adapted from He and Guo (2013). The simple PSO doesn't have an inertia weight parameter. In the PSO algorithm, inertia factor ω according to literature, decreases linearly.

$$\omega = \omega_{max} - \frac{\omega_{max} - \omega_{min}}{iter_{max}} \times iter \tag{14}$$

Here $iter_{max}$ is the biggest evolution of algebra, $iter$ is the algebra for this evolution. Improved particle swarm optimization algorithm BP operations driven by the amount of correction of the weights of the way, that the amount of correction of the weights between the neural network node m and node n from below equation:

$$\Delta\omega_{nm}(t+1) = \alpha\Delta\omega_{nm}(t) + \eta S_n(t)y_m(t) \tag{15}$$

Here, the amount of correlation of the conventional BP, α is an algorithm, and $y_m(t)$ is the momentum term inertia coefficient for the output node m. The above gradient particle swarm method for three-layer neural network training, through the experiments coding network weights and threshold values, constitutes a vector. The vector is a particle in the particle swarm algorithm. If three feedforward network structure is taken as the $n_{in} - H - n_{out}$ form, you need to optimize network $n_{in}.H + H.n_{out} + H.n_{out}$ parameters.

At first, in the search space, randomly generated initial population P particles constitute, through the adaptation function defined groups each particle fitness value, the definition of appropriate learning network search for an optimal combination of parameters using the method with the smallest function value.

The Flowchart of Modified Particle Swarm Optimization Algorithm (MPSO) is as follows: (Fig.5. is adapted from Amin et al. 2020).

3.6. MPSO-TVAC

This part is adapted from Abdullah et al. (2014). There is a parameter for improving exploitation and exploration and preventing local traps. In this strategy, each particle has its own $[rbest_i^j = rbest_{i1}^j.rbest_{i2}^j.....rbest_{id}^j]$ which is randomly selected from the best position (Pbest) of other particles. A similar approach is applied to other particles in the swarm. For example, we can use the following equations for updating velocity:

$$V_{j+1}^i = W_j V_j^i + c_1 r_1\left(X_j^{i.pbest} - X_j^i\right) + c_2 r_2\left(X_j^{Gbest} - X_j^i\right) + c_3 r_3\left(rbest_{id}^j - X_j^i\right) \tag{16}$$

where, c_3 is the acceleration coefficient that pulls each particle towards the rbest. Both coefficients should be changed to improving exploitation and exploration. A large value of the cognitive component and small social component in the initial iteration pushes the particles to move to the

entire solution space. When we increase iteration, we will decrease the cognitive value, and the social components value will increase, leading the particles to the global solution. The acceleration coefficients are varied according to the following formulas:

$$c_1 = c_{1i} + c_{1f} - c_{1i}) \times \frac{j}{j_{max}} \tag{17}$$

$$c_2 = c_{2i} + c_{2f} - c_{2i}) \times \frac{j}{j_{max}} \tag{18}$$
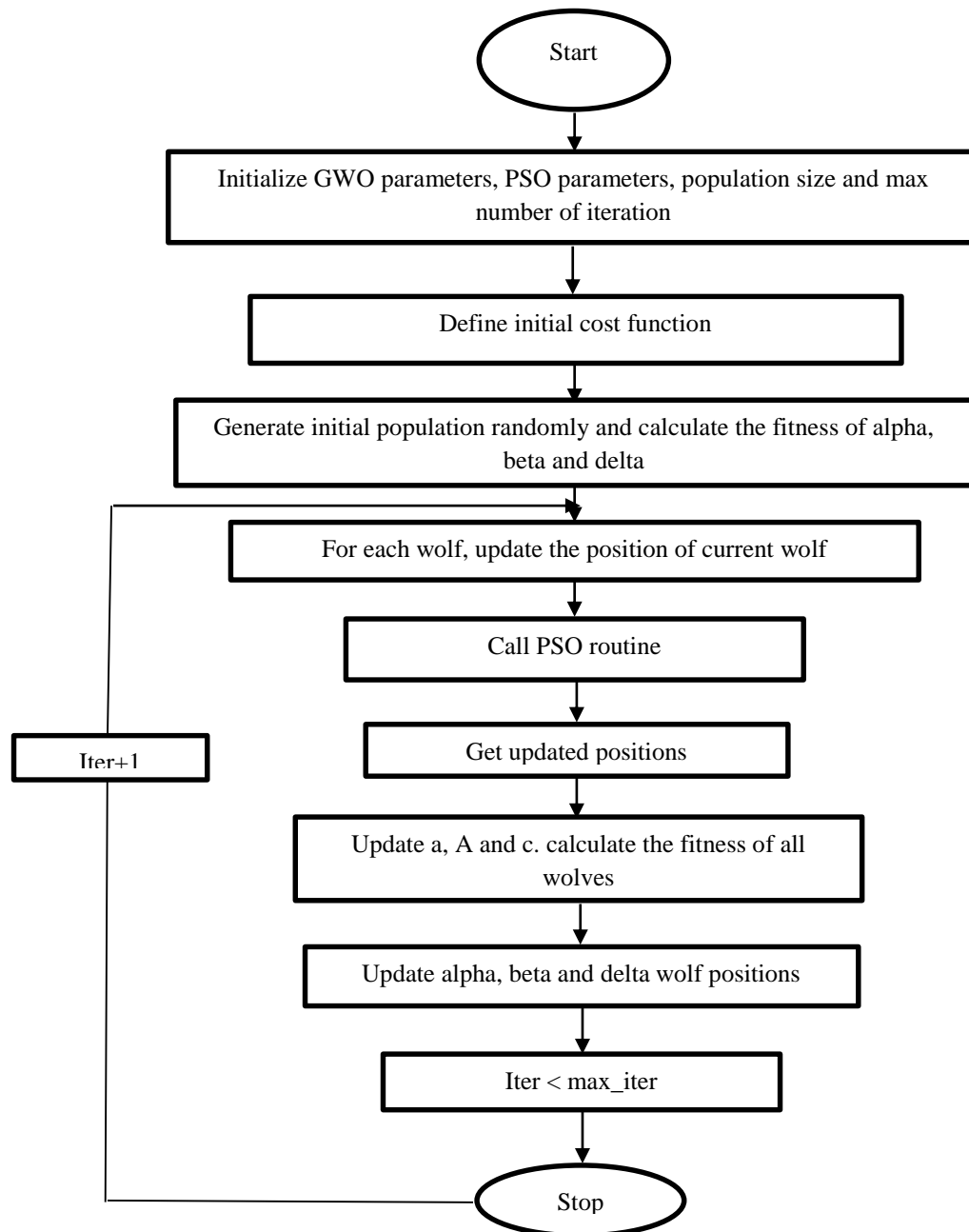
Fig 4. GWO-PSO algorithm flowchart

Prediction of Interest Rate Using Artificial Neural Network and Novel Meta-Heuristic Algorithms
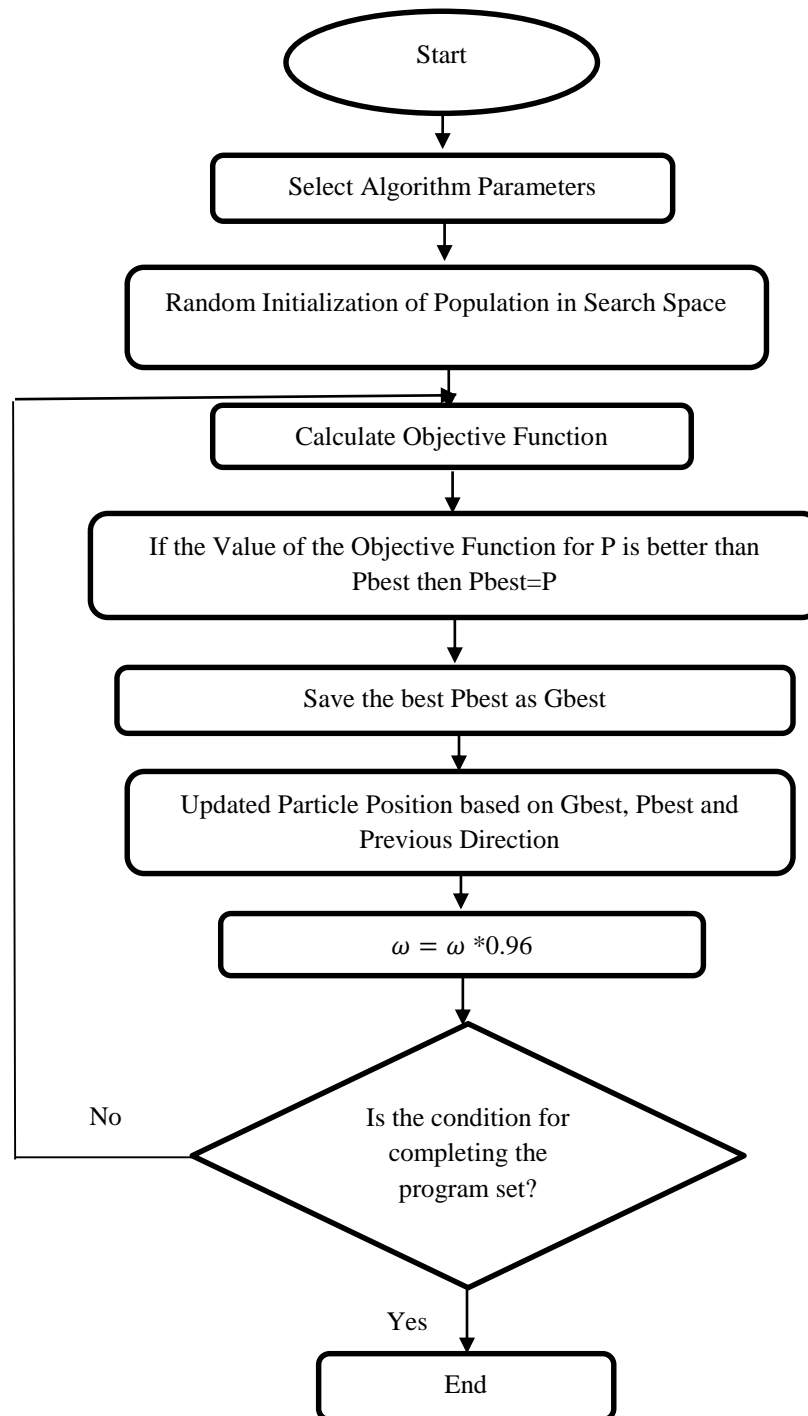
Fig 5. MPSO flowchart

where c_{1i} and c_{1f} are the initial and final values of cognitive coefficient, respectively and c_{2i} and c_{2f} are the initial and final values of the social coefficient, respectively. By adding a new parameter (rbest) in the velocity equation, the convergence rate will be improved because of provided extra information by the rbest value in the current iteration. We can calculate the time-varying acceleration

coefficient for rbest component (c_3) by using the following Eq.

$$c_3 = c_1 \times (1 - exp(-c_2 \times j)) \qquad (19)$$
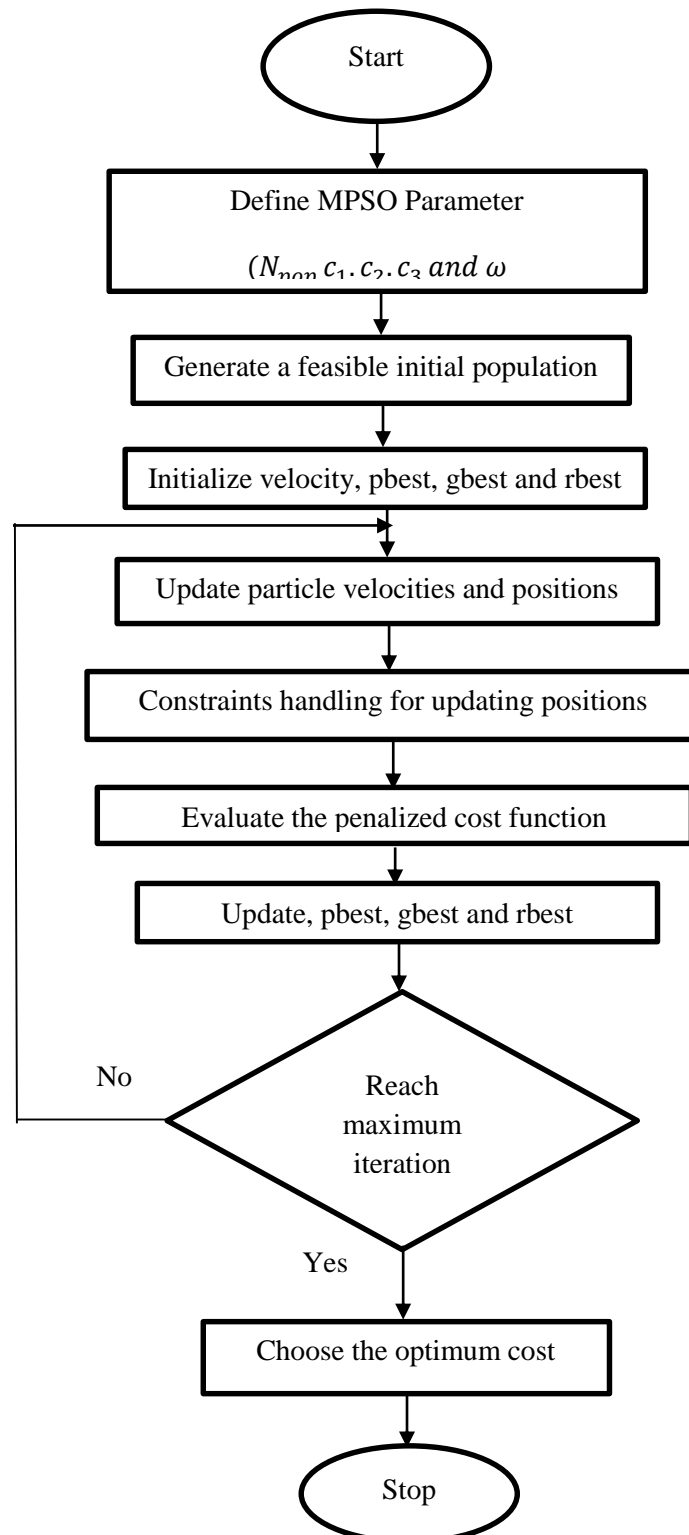
Fig 6. MPSO-TVAC flowchart

It assumed that, the c_1 value varies from 1 to 0.2 and c_2 varies from 0.2 to 1 during 100 iterations.

At the initial iteration, the c_3 value is increased immediately, which expanding the exploration based on the best neighbor particle (rbest). This can avoid quick convergence and local traps. As iteration proceeds, the c_2 value moves toward global gbest. Therefore, it can improve the exploitation and exploration and providing good solutions near-global optimum. The MPSO-TVAC flowchart is as the following:

3.7. MFO algorithm

This part is adapted from Mirjalili (2015). In the MFO algorithm, moths and the position of moths in the space are candidate solutions and the problem's variables, respectively. So, moths fly in different dimensional spaces, and they can shift their position vector too. Here, moths and flames are both solutions. In each iteration, they update themselves. The moths are actual search agents that move around the search space, whereas flames are the best moths that obtain so far. A logarithmic spiral has been chosen for updating the mechanism of moths. However, different kinds of the spiral can be used: Spiral's initial point should start from the moth Spiral's final point should be the position of the flame Fluctuation of the range of spiral should not exceed from the search space considering these points, we can define a logarithmic spiral for the MFO algorithm as follows:

$$S(M_i . F_i) = D_i e^{bt} cos(2\pi t) + F_j \tag{20}$$

Where D_i indicates the distance of the $i - th$ moth for the $j - th$ flame, b is a constant for defining the shape of the logarithmic spiral, and t is a random number in [-1,1]. D is calculated as follows:

$$D_i = |F_j - M_i| \tag{21}$$

Where M_i indicate the $i - th$ moth, F_j indicates the $j - th$ flame, and D_i indicates the distance of the $i - th$ moth for the $j - th$ flame.

Equation1. Simulating the spiral flying path of moths. As you can see in this equation, the next position of a moth is defined regarding a flame. The t parameter in the spiral equation defines how much the next position of the moth should be close to the flame (t = -1 is the closest position to the flame, while t = 1 shows the farthest). Therefore, a hyper ellipse can be assumed around the flame in all directions, and the next position of the moth would be within this space. Spiral movement is important because it shows the updating of moths to their positions around flames. The spiral equation allows a moth to fly "around" a flame and not necessarily in the space between them. Therefore, the exploration and exploitation of the search space can be improved. The exploitation and exploration for finding new and optimum solutions are very important. So, the matrix F in the above equation always includes n recent best solutions obtained so far. In order to further emphasize exploitation, we assume that t is a random number in [r,1] where r is linearly decreased from -1 to -2 throughout the iteration. Note that we name r as the convergence constant. With this method, moths tend to exploit their corresponding flames more accurately proportional to the number of iterations. In order to prevent a local optima trap, each moth must update its position using only one of the flames. After each iteration and updating, the list of flames is sorted based on fitness value. The first moth updates its position due to its flames, whereas the last moth updates its position concerning the worst flame in the list. We should move moths around different flames. However, it increases search space, and it prevents us from reaching the optimal solution. Thus, as a solution, we have proposed an adaptive mechanism for the number of flames.

$$FlameNumber = round(N - l \times \frac{N-1}{T}) \tag{22}$$

Where l is the current iteration number, N is the maximum number of flames and T indicates the maximum number of iterations. There is N number of flames in the initial steps of iterations.

However, in the final steps of iterations, the moths update their positions only for the best flame. By a gradual decrease in the number of flames, a kind of balance between exploitation and exploration is generated.

```
            ┌─────────┐
            │  Start  │
            └─────────┘
                │
    ┌───────────────────────────┐
    │ Define the parameters of  │
    │        algorithm          │
    └───────────────────────────┘
                │
    ┌───────────────────────────┐
    │ Generate initial moths    │
    │         randomly          │
    └───────────────────────────┘
                │
    ┌───────────────────────────────────────┐
    │ Calculate the fitness function and tag │
    │     the best position by flames        │
    └───────────────────────────────────────┘
                │
    ┌───────────────────────────┐
    │ Update flame number, t and r │
    └───────────────────────────┘
                │
    ┌───────────────────────────┐
    │ Calculate D for the corresponding moth │
    └───────────────────────────┘
                │
    ┌───────────────────────────┐
    │ Update M (I, j) for the corresponding moth │
    └───────────────────────────┘
                │
         ◇ Are termination criteria satisfied ◇  ── No
                │
    ┌───────────────────────────┐
    │ Report the best position among the moths │
    └───────────────────────────┘
                │
            ┌─────────┐
            │   End   │
            └─────────┘
```
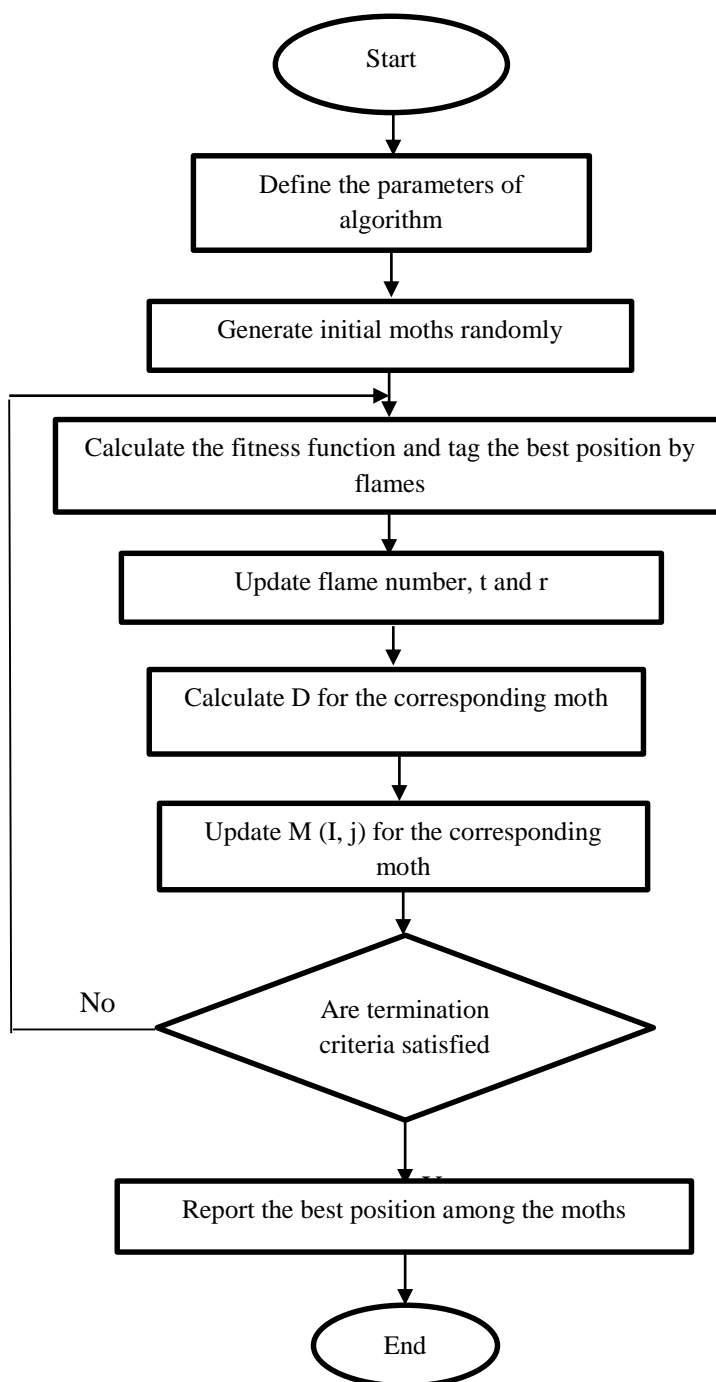
Fig 7. MFO flowchart

3.8. WOA

Humpback whales consider the current best candidate solution and best-obtained solution near the optimal solution. After achieving the best candidate solution, the other agents update their positions towards the best search agent. So, we can show it in the following equations;

$$D = |C.X^*(t) - X(t)| \tag{23}$$

$$X(t+1) = X^*(t) - A.D \tag{24}$$

Where (t) is the current iteration, A and C are coefficient vectors, X^* is the position vector of the best solution, and X indicates the position vector of a solution, | | is the absolute value. The vectors A and C are calculated as follows:

$$A = 2a.r.a \tag{25}$$

$$C = 2.r \tag{26}$$

Where components of a are linearly decreased from 2 to 0 throughout iterations for convergence purpose and r is a random vector in [0; 1]. The humpback whales attack the prey with the bubble-net mechanism. This mechanism is mathematically formulated as follow:

Shrinking encircling mechanism:

In this mechanism, the value of A is a random value in the interval $[-a, a]$, and the value of a is decreased from 2 to 0 for iterations, as shown in Eq. 25.

Spiral updating position mechanism

In this mechanism, the distance between the whale location and the prey location is calculated then the helix-shaped movement of the humpback is created as shown in the following equation;

$$X(t+1) = D'.e^{bl}.cos(2\pi l) + X^*(t) \tag{27}$$

Where $D' = | X^*(t) - X(t) |$ is the distance between the prey (best solution) and the ith whale, b is a constant, l is a random number in [-1; 1].

The humpback whales used the mentioned two mechanisms when they swim around the prey. We set the mathematical model of these two mechanisms. We assume that there is a probability of 50% to choose between these two mechanisms to update the position of whales as follow:

$$X(t+1) = \begin{cases} X^* - A.D & if\ p<0.5 \\ D'.e^{bl}.cos(2\pi l) + X^*(t) & if\ p\geq0.5 \end{cases} \tag{28}$$

Where p is a random number in [0; 1].

In the exploration phase, the humpback whales (search agents) randomly search for prey (best solution) and adjust their positions based on the other whales. In order to oblige the search agent to move far away from the reference whale or best solution, we use the A with values > 1 or < 1. The mathematical model of the exploration phase is as follows:

$$D = |C.X_{rand} - X| \tag{29}$$

$$X(t+1) = X_{rand} - A.D \tag{30}$$

Where X_{rand} is a random position vector chosen from the current population

3.9. CHOA

This part is adapted from Khishe and Mosavi (2020).

generally, the hunting process of chimps is divided into two main phases: Exploration, which consists of driving, blocking, and chasing the prey, and exploitation which consists of attacking the prey.

The chimp's hunting model means driving, blocking, chasing, and attacking is modeled in this section.

3.9.1. Driving and chasing the prey

As mentioned before, during the exploration and exploitation phases, the prey is hunted. Therefore, we can model driving and chasing mathematically like the below equations:

$$d = \left| c \cdot x_{prey}(t) - m \cdot x_{chimp}(t) \right| \tag{31}$$

$$x_{chimp}(t+1) = x_{prey}(t) - \alpha \cdot d \tag{32}$$
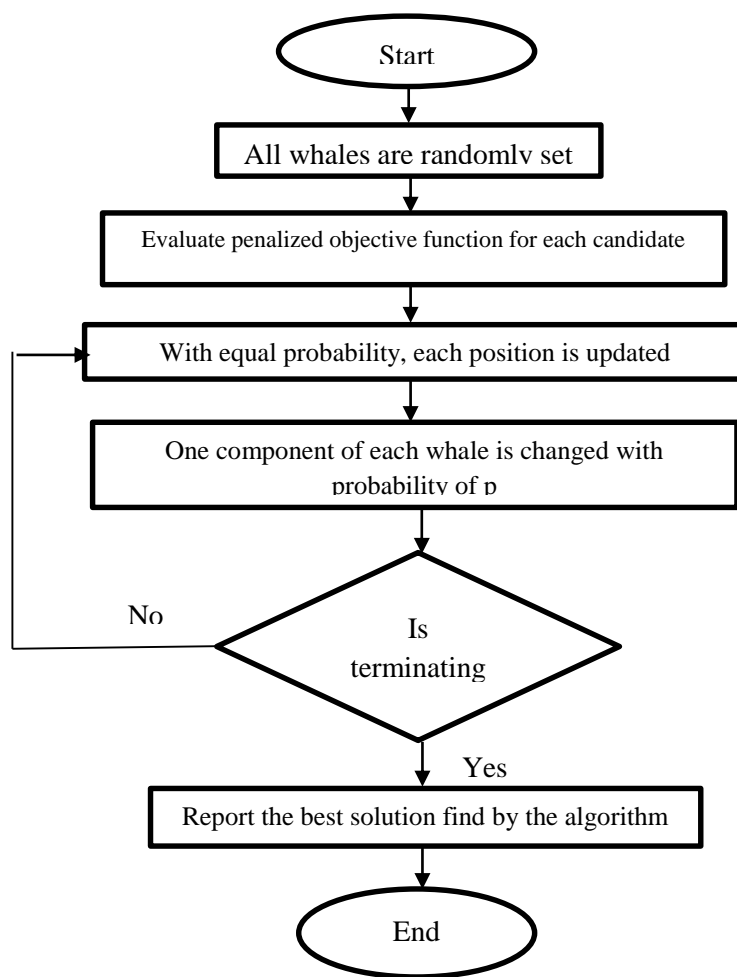
Fig 8. WOA flowchart

Where t indicates the number of the current iteration, a, m, and c is the coefficient vectors, x_{prey} is the vector of prey position and x_{chimp} is the position vector of a chimp. a, m, and c vectors are calculated by the Eq.s (33), (34), and (35), respectively.

$$a = 2 \cdot f \cdot r_1 - f \qquad (33)$$
$$c = 2 \cdot r_2 \qquad (34)$$
$$m = chaotic\_value \qquad (35)$$

In which, f is reduced non-linearly from 2.5 to 0 through the iteration process (in both exploitation and exploration phase). Where r_1 and r_2 are the random vectors in the range of [0,1]. Finally, we can show the sexual motivation of chimps in the hunting process based on the different chaotic map which m is a chaotic vector which is calculated based on the various chaotic map. These four independent groups use their own patterns to search the problem space locally and globally. We have divided strategies into two parts called ChOA1 and ChOA2 are selected to have the best performance in the benchmark optimization problems. The dynamic coefficients of f have been proposed in Table 3. In this table, T represents the maximum number of iterations, and t indicates the current iteration. These dynamic coefficients have been chosen with various curves and slopes so that each independent group has specific searching behavior to improve the performance of CHOA.

Table 3. Two Kinds of CHOA along with four groups

Groups	ChOA1	ChOA2
Group1	$1.95\text{-}22t^{1/4}/T^{1/3}$	$2.5\text{-}(2\log(t)/\log(T))$
Group2	$1.95\text{-}22t^{1/3}/T^{1/4}$	$(-2t^3/T^3)+2.5$
Group3	$(-3t^3/T^3)+1.5$	$0.5 + 2\exp[-(4t/T)^2]$
Group4	$(-2t^3/T^3)+1.5$	$2.5+2((t/T)^2 - 2(2t/T)$

A chimp in position (x, y) can change its position for preys $(X^*.Y^*)$ location. Various locations around the most suitable agent can be taken considering its current location and changing and setting the values of a and c vectors. For instance, the location of $((X^* - X.Y^*)$ is obtained by setting a=(1,0), m=(1,1), and c=(1,1). It should be noted that the chimps are allowed to access any position between the points through the random vectors r_1 and r_2. So, any chimp can randomly change its location within the space surrounding the prey using Eq. s (31) and (32).

3.9.2. Attacking method (exploitation phase)

Chimps can find the prey's location (by driving, blocking, and chasing) and encircling it. In order to mathematically simulate the behavior of the chimps, it is assumed that the first attacker (best solution available), driver, barrier, and chaser are better informed about the location of potential prey. So, the best solutions are stored, and the other chimps update their positions based on the best solutions. The Eqs express this relationship. (36-40).

$$d_{Attacker} = |c_1 x_{Attacker} - m_1 x|. d_{Barrier} = |c_2 x_{Barrier} - m_2 x|. \quad (36)$$
$$d_{Chaser} = |c_3 x_{Chaser} - m_3 x|. d_{Driver} = |c_4 x_{Driver} - m_4 x| \quad (37)$$
$$x_1 = x_{Attacker} - a_1(d_{Attacker}). x_2 = x_{Barrier} - a_2(d_{Barrier}). \quad (38)$$
$$x_3 = x_{Chaser} - a_3(d_{Chaser}). x_4 = x_{Driver} - a_4(d_{Driver}) \quad (39)$$
$$x(t + 1) = \frac{x_1+x_2+x_3+x_4}{4} \quad (40)$$

The final position is located randomly in a circle defined by an attacker, barrier, chaser, and driver chimp positions. In other words, the best position to prey (solution) is obtained by four chimps, and then the remaining chimps adjust their position based on the best position.

3.9.3. Prey attacking (utilization)

The final stage is attacking the prey and kill it as soon as possible. Thus, like other algorithms, the value of f should be reduced. Note that the variation range of the a is also reduced by f. In other words, a is a random variable in the interval of [-2f,2f], whereas the value of f reduces from 2.5 to 0 in the period of iterations when the random values of a lie in the range of [-1,1], the next position of a chimp can be in any location between its current position and the position of the prey.

The risk of a local minima trap is still existing because the other chimps following the agent. So, we should overcome this problem.

3.9.4. Searching for prey

Due to mathematical modeling attacking prey, chimps should take in a domain for divergence. So, the a vector is used with a random value between [-1,1]. This is an exploration process, and it's a global search. The inequality $|a| > 1$ forces the chimps to scatter in the environment to find better prey.

We should improve the position and distance to prey to prevent the local minima trap with the value of c parameter, which is a random variable in [0,2]. The value of c can make the hunt harder or easier.

3.9.5 Social incentive

Finally, chimps show chaotic behavior due to social motivation. This is accompanied by slow convergence and preventing the local minima trap. The chaotic map is used to improve the performance of CHOA. Six chaotic maps are used. The initial value for the map is 0.7, and there is a probability of 50% to choose between either the normal updating position mechanism or the chaotic model to update—the position of chimps during optimization.

$$x_{chimp}(t+1) = \begin{cases} x_{prey}(t) - a \cdot d & if\ \mu < 0 \cdot 5 \\ Chaotic\_value & if\ \mu \geq 0 \cdot 5 \end{cases} \qquad (41)$$

Where μ is a random number in [0,1].

Table 4. Chaotic map with its functions and name

No	Name	Chaotic map	Range
1	Quadratic	$x_{i+1} = x_i^2 - c. c = 1$	(0,1)
2	Gauss / mouse	$x_{i+1} = \begin{cases} 1 & x_i = 0 \\ \frac{1}{mod(x_{i,1})} & otherwise \end{cases}$	(0,1)
3	Logistic	$x_{i+1} = ax_i(1 - x_i). a = 4$	(0,1)
4	Singer	$x_{i+1} = \mu(7 \cdot 86x_i - 23 \cdot 31x_i^2 + 28 \cdot 75x_i^3 - 13 \cdot 3028x_i^4). \mu = 1 \cdot 07$	(0,1)
5	Bernoulli	$x_{i+1} = 2x_i(mod1)$	(0,1)
6	Tenet	$x_{i+1} = \begin{cases} \frac{x_i}{0 \cdot 7} & x_i < 0 \cdot 7 \\ \frac{10}{3}(1 - x_i) & 0 \cdot 7 \leq x_i \end{cases}$	(0,1)

You can see the CHOA flowchart in the following:

4. Findings and Results
4.1. Organize and describe data

in this article, we use 18 technical indicators to predict interest rate which 16 variables are input variables, and 1 variable is output or target variable that is the long-term interest rate for the next day. The desired time interval is from the beginning of 2004 to the end of 2014, about 10years which data is seasonal. In order to access and getting data, we used the Laboratory risk of Khatam University. We used direct write-off for missing value, or N/A data which is the common and default approaches in many software and our research. The method to choose the most appropriate indicators is the genetic algorithm and GWO-PSO algorithm, an evolutionary algorithm.

The numbers of inputs, targets, and unused variables here are 17, 1, and 0, respectively.

The following pie chart details the uses of all the instances in the data set. The total number of instances is 44. The number of training instances is 28 (63.6%), the number of selection instances is 8 (18.2%), the number of testing instances is 8 (18.2%), and the number of unused instances is 0 (0%).
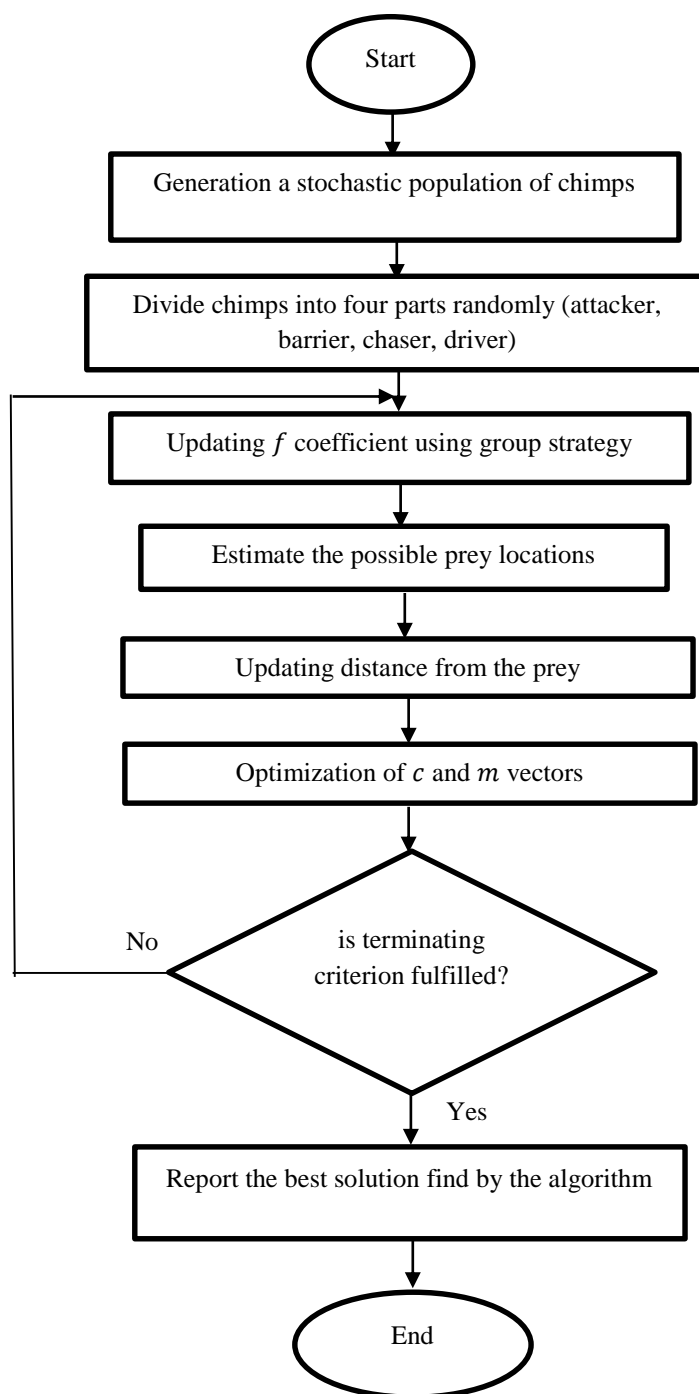
Fig 9. CHOA flowchart

The following table shows the statistics of the parameters of the neural network. The total number of parameters is 1.
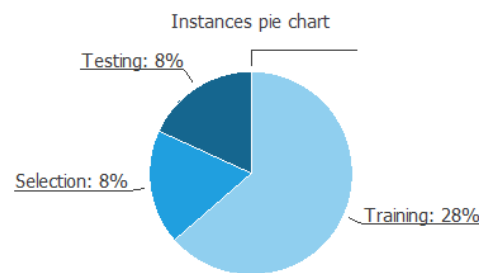
Fig 10. Instances pie chart

Table 5. Neural network parameters

	Max	Min	Mean	Std.dev
Statistics	-0.93	0.966	0.0483	0.552

A graphical representation of the network architecture is depicted next. It contains a scaling layer, a neural network, and an un-scaling layer. The yellow circles represent scaling neurons, the blue circle's perceptron neurons, and the red circle's un-scaling neurons. The number of inputs is 16, and the number of outputs is 1. The complexity, represented by the number of hidden neurons, is 3.

Fig 11. Neural network structure

The quasi-Newton method is used here as an optimization algorithm. It is based on Newton's method but does not require the calculation of second derivatives. Instead, the quasi-Newton method computes an approximation of the inverse Hessian at each iteration of the algorithm by only using gradient information.

The next table shows the training results by the quasi-Newton method. They include some final states from the neural network, the less functional, and the optimization algorithm.

Table 6. Quasi-newton method results

	Value
Final parameters norm	2.25
Final training error	0.000168
Final selection error	0.134
Final gradient norm	0.00084
Epochs number	288
Elapsed time	00:01
Stopping criterion	Gradient norm goal

The next part is about the selection of the most important variables means feature selection by using GA. Then, model selection is applied to find a neural network with a topology that optimizes the error on new data. Finally, input selection algorithms are responsible for finding the optimal subset of input variables.

Table 7. Input selection algorithm

	Value
Trial number	1
Tolerance	0.01
Population size	20
Initialization method	Random
Fitness assignment method	Rank-based
Crossover method	Uniform
Elitism size	2
Crossover first point	0
Crossover second point	0
Selective pressure	1.5
Mutation rate	0.05
Selection loss goal	0
Maximum generations number	1000
Maximum time	3600
Plot training error history	True
Plot selection error history	True
Plot generation mean history	True

A graphical representation of the resulted deep architecture is depicted next. It contains a scaling layer, a neural network, and an un-scaling layer. The yellow circles represent scaling neurons, the blue circle's perceptron neurons, and the red circle's un-scaling neurons. The number of inputs is 16, and the number of outputs is 1. The complexity, represented by the number of hidden neurons, is 7.

The next chart shows the error history for the different subsets during the genetic algorithm inputs selection process. The blue line represents the training error, its initial value is 0.000396812, and the final value after 1000 generations is 0.000418828. The orange line symbolizes the selection error, its initial value is 0.0454684, and the final value after 1000 generations is 0.0299098.

The next chart shows the history of the mean of the selection error in each generation during the genetic algorithm inputs selection process. The initial value is 0.516062, and the final value after 1000 generations is 0.0268.

The next table shows the input selection results by the genetic algorithm. They include some final states from the neural network, the error function, and the selection of the input algorithm

Table 8. Genetic algorithm results

	Value
The optimal number of inputs	7
Optimum training error	0.000418828
Optimum selection error	0.0299098
Generations number	1000
Elapsed time	00:39
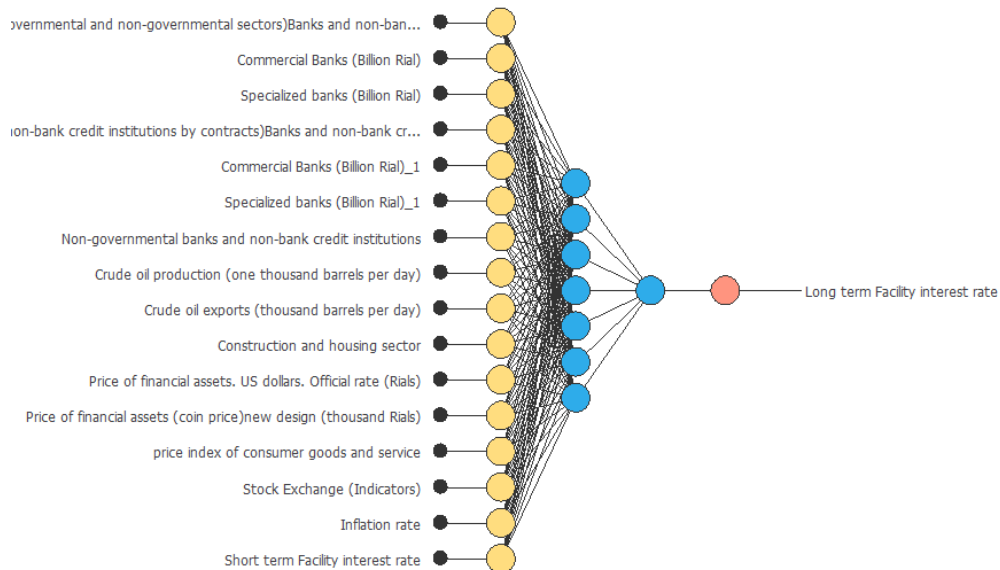
Fig 12. Final architecture
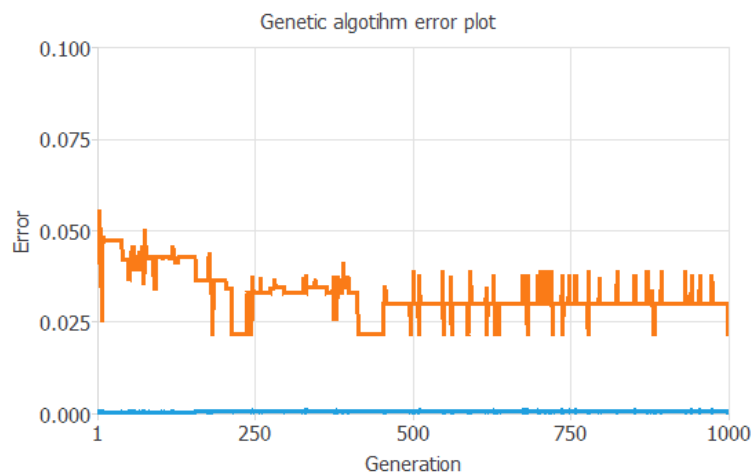
Fig 13. The genetic algorithm error plot

Prediction of Interest Rate Using Artificial Neural Network
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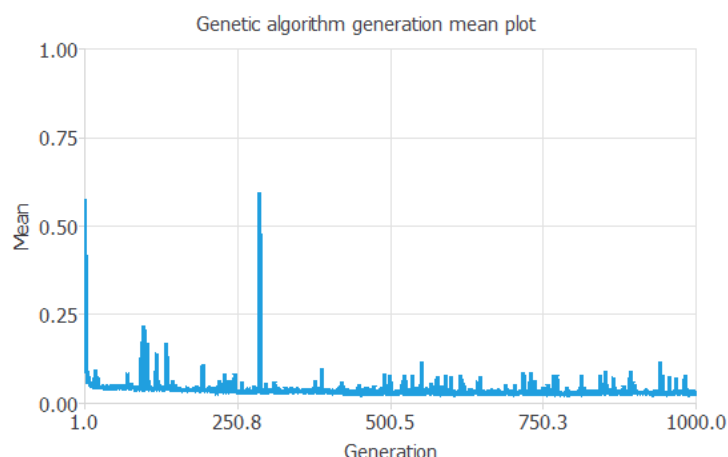
Fig 14. Genetic algorithm generation means plot

A graphical representation of the resulted deep architecture is depicted next. It contains a scaling layer, a neural network, and an un-scaling layer. The yellow circles represent scaling neurons, the blue circle's perceptron neurons, and the red circle's un-scaling neurons. The number of inputs is 7, and the number of outputs is 1. Thus, the complexity, represented by the number of hidden neurons, is 7.
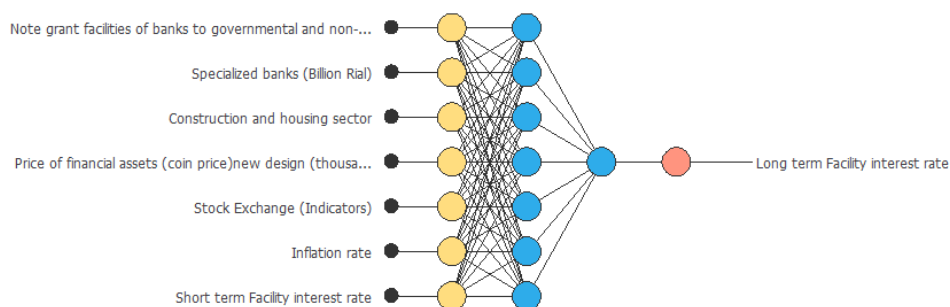
Fig 15. Final architecture

The next chart illustrates the linear regression for the scaled output Long Term Facility interest rate. Again, the predicted values are plotted versus the actual ones as circles. Again, the grey line indicates the best linear fit.

This part measures all the errors of the model. It takes into account every used instance and evaluates the model for each use. The next table shows all the errors of the data for each use of them.

Table 9. Error table

	Training	Selection	Testing
Sum squared error	0.0721675	0.0359317	0.0447423
Mean squared error	0.00257741	0.00449147	0.00559278
Root mean squared error	0.0507682	0.0670184	0.0747849
Normalized squared error	0.0368375	0.0909744	0.0503351
Minkowski error	0.0288267	0.122164	0.148644

There are some more details in the appendix, which has done with MATLAB software.
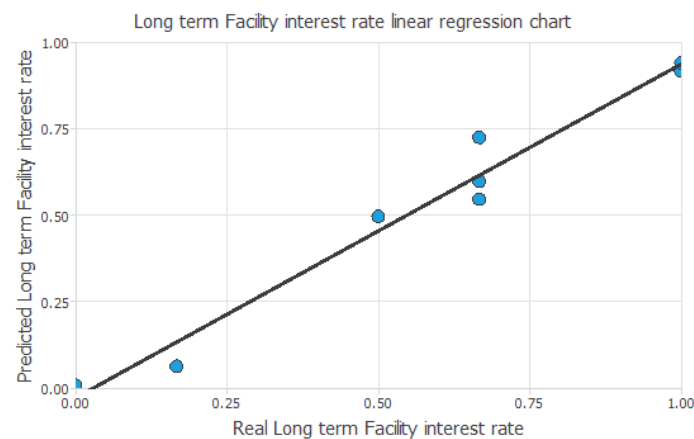
Fig 16. Target parameter linear regression chart

4.2. GWO-PSO algorithm

In this section, we have tried to provide very concise results to avoid prolonging the content. Therefore, the following important variables have considered as input variables:

Table 10. Feature selection using GWO-PSO algorithm

No	Variables	The variable belongs to the desired subset	Selected (1) or not (0)
1	Liquidity in terms of its components (Billion Rial)	Monetary and credit variables (liquidity)	0
2	Banks and non-bank credit institutions (Billion Rial)	Monetary and credit variables (Note grant facilities of banks to governmental and non-governmental sectors)	1
3	Commercial Banks (Billion Rial)	Monetary and credit variables (Note grant facilities of banks to governmental and non-governmental sectors)	1
4	Specialized banks (Billion Rial)	Monetary and credit variables (Note grant facilities of banks to governmental and non-governmental sectors)	1
5	Banks and non-bank credit institutions (Billion Rial)	Monetary and credit variables (Facilities granted by banks and non-bank credit institutions by contracts)	1
6	Commercial Banks (Billion Rial)	Monetary and credit variables (Facilities granted by banks and non-bank credit institutions by contracts)	0
7	Specialized banks (Billion Rial)	Monetary and credit variables (Facilities granted by banks and non-bank credit institutions by contracts)	0
8	Non-governmental banks and non-bank credit institutions	Monetary and credit variables (Facilities granted by banks and non-bank credit institutions by contracts)	0
9	Crude oil production (one thousand barrels per day)	Energy Section (Oil)	1
10	Crude oil exports (thousand barrels per day)	Energy Section (Oil)	0
11	All urban areas (without units)	Construction and housing sector (land price index)	0
12	Official rate (Rials)	Price of financial assets (exchange rate and coin price), exchange rate, US dollars	1
13	new design (thousand Rials)	Price of financial assets (exchange rate and coin price)	1
14	Total index (no units)	Price indices (price index of consumer goods and services) (100 = 1383)	0
15	Total index (no units)	Stock Exchange (Indicators)	1
16	Inflation rate	Price indices	1
17	Short term	Facility interest rate	1

Among these 17 indicators, 10 indicators have been selected as input variables, and others have not been chosen. It is clear that in both feature selection methods means GA and GWO-PSO

algorithms, there are commonly selected variables in them Below table shows the results:

Table 11. GWO-PSO feature selection results

Hybrid Acc	Hybrid Fitness	Hybrid Dimension	Hybrid time	Number of search agents	Maximum number of iterations
1.00000	0.004615	12	13.7438	10	100

4.3. MFO algorithm

First of all, let's set the parameters such as the following table:

Table 12. MFO parameters

Search agents number	**30**
Maximum number of iterations	1000
Upper bound	100
Lower bound	-100
Best score	**8.0081e-32**
dim	12

Below figures show the fitness function and convergence during iterations:
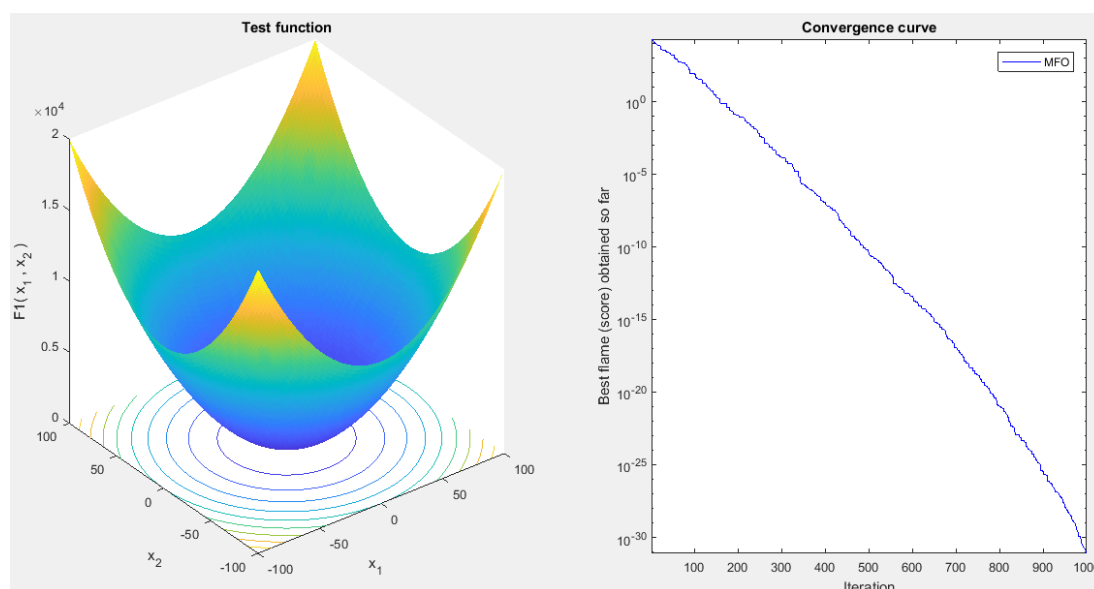
Fig 17. Test Function and Convergence Curve

You can see a clear decrease in each iteration until the best score has been obtained means 8.0081e-32.

4.4. WOA

Like the MFO algorithm, first of all, let's set the parameters such as the following table:

Table 13. WOA parameters

Search agents number	30
Maximum number of iterations	500
Upper bound	100
Lower bound	-100
Best score	**1.6828e-78**
dim	12

Below figures show the fitness function and convergence during iterations:
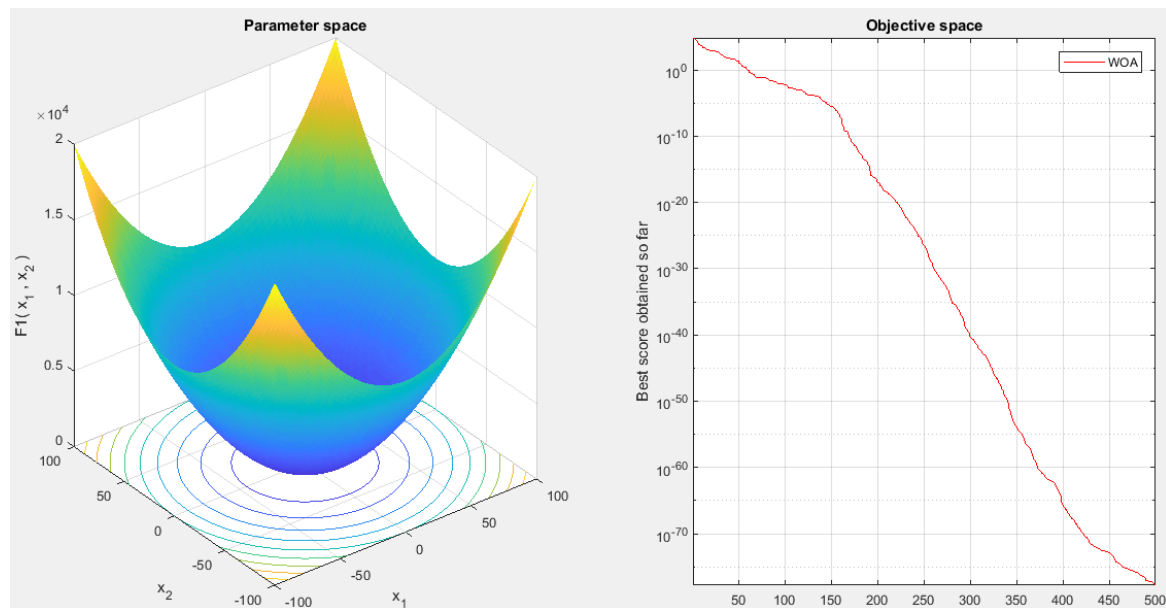
Fig 18. Test Function and Convergence Curve

4.5. MPSO, MPSO-TVAC, CHOA

In this part, we run these three algorithms together, but the result has been depicted separately. The following table shows the parameters:

Table 14. parameters and errors

Search agents number	**30**
Maximum number of iterations	500
Upper bound	100
Lower bound	-100
Best score chimp	**7.4341e-05**
Best score MPSO	**21.4027**
Best score MPSO-TVAC	**0.5373**
dim	12

CHOA, MPSO, MPSO-TVAC, CHOA has the lowest error among these three algorithms. The following figures show the chaotic map for types ChOA1 and ChOA2 after 500 iterations:

You can see that chasers with driver and attacker with barrier almost have the same behavior, but they follow different strategies as we told in previous.

In ChOA2, it is clear that in iteration 400, three groups, mean attacker, barrier, and chaser, are closed to each other.
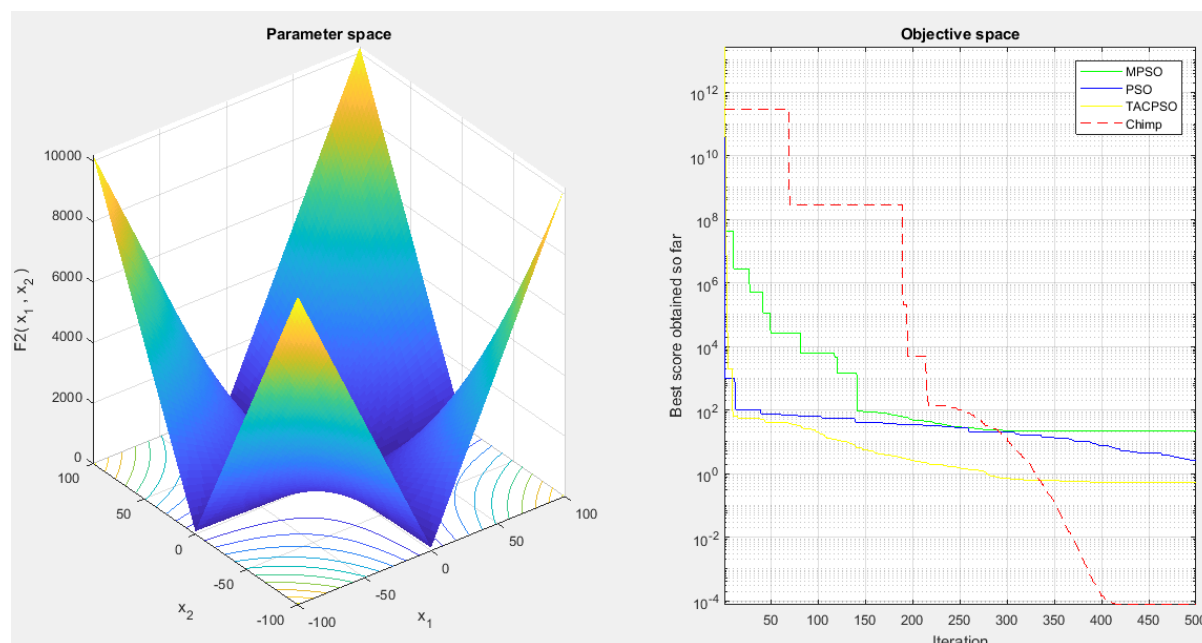
Fig 19. Test Function and Convergence Curve

As it is clear, between these three algorithms, CHOA, MPSO-TVAC, and MPSO have the lowest error and optimal solutions, respectively. CHOA has had a very sharp decline compared to other algorithms.

We set the methods according to their MSE (from minimum to maximum error) to understand results sensibly.

Table 15. Arrange algorithms based on MSE

ROW	Algorithm	MSE
1	WOA	1.6828e-78
2	MFO	8.0081e-32
3	ANN	1e-12
4	ChOA	7.4341e-05
6	GA-ANN	0.00041
6	GWO-PSO	0.004615
7	MPSO-TVAC	0.5373
8	MPSO	21.4027

5. Conclusions

In this article, we used a neural network as a prediction method for predicting long-term interest rates. Then, we used important economic variables such as oil price, inflation rate, etc., as input variables. So, we selected the most important one using GA and GWO-PSO. After that, we trained the network by using novel meta-heuristic algorithms such as MFO, MPSO, MPSO-TVAC, WOA, and CHOA.

We compute different loss functions for each algorithm after obtaining optimized input variables and weights using GA and GWO-PSO. As deduced from table (31) among algorithms, WOA has the lowest training and testing error. I should note that MPSO has the highest forecasting error. To evaluate the model's performance, we should test the model with new data called testing performance and is the right indicator for forecasting performance. We used GA and GWO-PSO as feature selection, and our focus is on other algorithms. The main advantages of using novel meta-heuristic

algorithms are as follow:
- Speed up calculations
- Reduce model complexity
- Increase the network accuracy
- Ease of using models

Our suggestion for future research is to focus on different parameters such as the number of the hidden layer, activation function, and the other HS models such as HIS, etc., using different parameters of GA such as crossover and mutation rate be interesting. One of the other offers is a training network with other new metaheuristic algorithms such as the bat algorithm. We can test other algorithms as feature selection too.

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Performance of Islamic E-Banking: Case of Iran

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Abstract

Banks, as financial and service institutions, play a decisive role in the circulation of money and wealth of society, and therefore have a special place in the economy of any country. Therefore, banks' favorable and effective activity can have important effects on the growth of various economic sectors and increase the quantity and quality of production. Today, Islamic banking requires new methods, effective customer orientation, presentation of new technologies, servicing and services expected by the customer, and any bank that is more successful in those matters, succeeds in attracting resources in a competitive market. As a result, more durability and survival will increase with productivity. E-banking is one of the most important options for banks to achieve these goals. The present study examines the effect of E-banking on bank fees and returns on assets as indices of Islamic banking performance. In order to test the research hypotheses, multiple regression methods and statistics and information of 8 banks in the period 2005-2015 have been used. According to the results, E-banking has a positive and significant effect on both factors of Islamic banking performance, i.e., bank fees and return on assets index.

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1. Introduction

Despite the advances in electronic money services and payment tools in Iran, banks are still in the early stages of using integrated information systems to electronic in-bank and interbank transactions and connect customers to the bank online. Therefore, the platform for the establishment of E-banking should be seriously considered. It seems that identifying the factors that improve the performance of the banking system can be a prerequisite to developing the Iranian banking system. Since in organizations, the improvement of performance and its growth has not been paid much attention. On the other hand, using appropriate tools to reduce the workload, identify and satisfy customers' needs is not performed. It seems that the knowledge and use of appropriate tools in banks can be an effective step in this field due to the monetization of economies and scientific advances in the field of e-commerce. The increasing development of information technologies and the intense competition of banks to obtain the E-banking market, and the significant effect that this form of banking has on improving the performance of banks and the entire banking system, has led to more attention to the effects of E-banking on bank performance, which the present study examines.

The expansion of banking services in the world through information and communication technology networks and the development of virtual and semi-virtual banks and financial institutions, and the presence of private banking system in the country, has created a high level of competition in the banking industry. Furthermore, the nature and method of providing new E-banking services have changed the expectations and desires of customers due to the change in lifestyle and service to them (Pilehvari, 2015). Today, Islamic banking requires innovative, customer-oriented methods based on efficient technologies, appropriate and desired customer service. The more successful a bank is in these matters, the more it will be able to attract more resources in the competitive market and, as a result, its durability, permanent survival, and higher productivity, while E-banking is the best and most effective option for banks to achieve these goals (Abbaszadeh et al. 2014).

One of the essential tools for the realization and expansion of e-commerce is an E-banking system that facilitates the operation and activities related to e-commerce in line with global financial and monetary systems. Therefore, implementing e-commerce requires strong e-banking. The reason why banks are willing to use E-banking can be summarized in three main components: cost advantage, high profitability, and risk reduction (Tunay et al., 2015). E-banking has become very popular in recent years because it has provided faster, less costly, and more accessible ways for people to implement web activities (Claessens et al., 2002).

By definition, E-banking is any banking service that does not restrict the customer's physical presence in a particular place, and banking services are performed using electronic tools (Liao and Chung, 2001).

Also, E-banking is the use of electronic and telecommunication networks to deliver a wide range of value-added products and services to bank customers, as well as customers' use of the Internet to organize, test, or make changes to their bank accounts or invest in banks to provide banking operations and services (Nexhmi, 2004). In addition, E-banking allows banks to use new banking methods in providing services to customers and reduce the costs of both the bank and the customer by providing e-services. Since banking costs are reduced through e-banking, it increases the income of banks (Meihami et al., 2013). Other advantages of using E-banking for banks include freedom from time and space constraints, reduced operating and implementing costs, awareness of customer activities, and potential for expanding the range of services. E-banking also allows customers to make a wide range of financial transactions electronically, through the bank's website, anytime and anywhere, faster and with lower fees compared to the other bank methods (Jenkins, 2007).

In general, performance indices can be divided into two categories, subjective and objective. Objective indices of organizational performance are measured in a completely realistic way and based

on objective data. Among the objective indices of organizational performance, profitability indices such as return on assets, return on equity, return on investment, income per share and return on stocks can be mentioned (Shahikitash et al., 2015). Banks need to attract investors to start implementing e-banking, and on the other hand, investors (shareholders) need banks to understand the profitability of investments (Mishkin, 2006). If the bank management can not use the shareholders' capital optimally, it can not expect it to continue its competition with other banks. Return on equity is an index of profitability commonly used to reflect firms' profitability, especially in the banking industry. This index can signal to shareholders whether their investment in a bank (firm) is particularly cost-effective? (Hosseini and Faramarzi Ebad, 2016).

But what the bank owners (shareholders) care most about is how much the bank has profited from their share capital. Another key index defines this information called return on equity and return on assets (Mishkin, 2006). Most of the world's banks use the index of return on assets and return on equity to measure and show their profitability (Moussu and Petit-Romec, 2013). Other criteria for evaluating the performance of banks include operating expenses and bank fees. In other words, operating expenses represent the ratio of operating expenses to total bank assets, and non-interest income also indicates the ratio of non-interest income to total bank assets, which these variables indicate the bank's performance (Dinh et al., 2015).

According to what has been said, banks are looking to use various methods to improve performance in attracting customers to increase market share and profitability. In the meantime, evaluating the performance of banks is of particular importance and has become one of the most important activities of bank managers. Moreover, since E-banking reduces costs or increases income by reducing human costs, it is important to study the effect of this factor on banking indices. Accordingly, the main question of this study is whether E-banking affects the performance of banks? And it is assumed that:

- E-banking has a positive and significant effect on the profitability of banks.
- E-banking has a positive and significant effect on bank fees.

2. Literature Review
Mateka et al. (2016), in a study entitled "Effect of Internet Banking on Financial Performance of Listed Commercial Banks in Kenya," examined the impact of E-banking on the financial performance of commercial banks in Kenya. The study was conducted using a sample of 84 men and 40 women employees in commercial banks of Kenya. The results showed that E-banking positively affects bank revenues, operating expenses, the book value of loans, and customer deposits.

Hajizadeh Rad and Ismailpour (2016), in a study entitled "Investigating the Relationship between Electronic Banking and Financial Performance of Sina Bank," have examined the relationship between electronic banking and financial performance of Sina Bank. To evaluate e-banking, four indicators were used: ATM banking, based on sales terminal, SMS banking system, mobile banking system, and asset return rate as a criterion for performance evaluation. The statistical sample of this research includes all branches of Sina Bank during the years 1393-1384, and ordinary least squares regression has been used to test the hypotheses. The results show a positive and significant relationship between all indicators of electronic banking and the financial performance of Sina Bank. Therefore, with the increase and expansion of electronic banking, the bank's financial performance will improve.

Hosseini and Faramarzi Ebad (2016), in a study entitled "Investigating the Impact of Electronic Banking on Return on Equity in Selected Banks Operating on the Tehran Stock Exchange", investigate the effect of electronic banking on the return on equity in eight selected banks active in

the stock exchange in the period of 2006 to 2014. In this study, the ratio of the number of ATMs to the number of branches, the share of each bank in the total sales terminals used as electronic banking tools, and the Herfindahl-Hirschman index and real GDP as an external factor affecting profitability is examined on the return on equity. Results show that the expansion of ATMs in bank branches and banks' higher share of electronic devices to all sales terminals has had a positive and significant effect on the return on equity in the selected sample.

Dinh et al. (2015), in a study entitled "Measuring the Impacts of Internet Banking to Bank Performance: Evidence from Vietnam," examined the effect of electronic banking on the performance of banks in Vietnam during the period 2009-2014. In this research, the panel data method has been used to investigate the relationship between Internet banking and bank performance indicators. The results show that E-banking has affected the profitability of banks by increasing the income of service activities.

Akhisar et al. (2015), in a study entitled " The Effect of Innovations on Bank Performance: The Case of Electronic Banking Services," examined the impact of electronic banking on equity returns of banks in 23 countries, including developing and developed countries, from 2005-2013. In this study, the bank's profitability was examined by the dynamic data panel method, and the return on equity was considered a profitability index. The results show that the effect of E-banking on profitability for all sample countries is significant. Furthermore, the number of sales terminals and the number of E-banking users on profitability was negative. In contrast, the number of issued cards and the ratio of the number of ATMs to the number of branches had a positive and significant effect on profitability.

Petria et al. (2015), in a study entitled "Determinants of banks' profitability: evidence from EU 27 banking systems", divided the factors affecting profitability into two groups: internal factors (internal) and external factors (macroeconomic). This study applied a panel data model for the period 2004-2011. The indicators used in this study for profitability return on equity and return on total assets. Factors affecting the banks' profitability include bank size, financial structure, credit risk from liquidity, income-cost structure, capital adequacy ratio, and two External influential factors: economic growth and inflation. The results of this research are as follows: The degree of concentration of the bank, as shown by the Herfindahl-Hirschman index, has no significant effect on return on equity. Cost to income ratio and credit risk have negative and significant effects on both profitability indices. The capital adequacy ratio has a positive and significant effect on the return on total assets but has no significant effect on the return on equity. Finally, as expected, GDP (as an indicator of economic growth) has a positive and significant effect on profitability, but inflation does not significantly affect profitability.

In a study entitled "Impact of E-Banking on the profitability of commercial banks in India", Manminder and Tripti (2015) examined the effect of electronic banking on the profitability of Indian commercial banks in the period 2006-2014. This study includes 31 banks that are among the four main commercial banks in India. The results of the study show that e-banking services have a positive effect on the profitability of banks.

In a study entitled "Development of Internet Banking as the Innovative Distribution Channel and Turkey Example ", Sanli and Hobikoglu (2015) examined the effects of e-banking on customer reaction and the effectiveness of Turkish banks. The results of their research for the period 2012-2014 showed that despite the rapid expansion of electronic banking in this period, the number of products and services offered by Internet banking and the number of Internet banking customers in Turkish banks compared to other countries is still undesirable. Therefore, they recommend that compatibility between Internet infrastructure and Internet banking and create a sense of security for Internet banking customers be included in the program of Turkish banks to lead to the development of Internet

banking in this country.

Ehsanafar et al. (2014), in a study entitled "the impact of electronic banking development on the profitability of selected Iranian banks", investigate the effect of market concentration variables, total assets, number of ATMs, number of sales terminals, and the number of branch terminals on the return on assets in the period 1382 to 1390. They collected data from 14 selected Iranian banks. The results showed that the total assets of the bank and the number of ATMs had a positive and significant effect on banks' profitability. Still, the ratio of bank market concentration, branch terminals, and sales terminals had a negative and significant effect on banks' profitability.

Olson and Zoubi (2011), in a study entitled "Efficiency and bank profitability in MENA countries," examined the efficiency and profitability of banks in Mena. Their data included banks from ten Arab countries in 2000-2008, and the method used was Ordinary Least Squares. Their dependent variables included returns on equity, the total return on assets, total cost, and net operating profit. The independent variables were divided into two groups: bank size, bank liabilities, etc., and external variables such as the percentage of annual changes in GDP, inflation rate, capital intensity (ratio of equity to total assets), and credit risk. The results showed that there is a direct relationship between bank size and profitability. Although the size of MENA banks is smaller than the optimal size of world banks, it has a positive and significant effect on profitability. Moreover, bank debts and higher capital intensity of the bank are strongly related to profitability.

3. Research Methodology

In order to test the research hypotheses, following Dinh et al. (2015), models (1) and (2) have been used as follows:

$$ROA_{it} = \alpha_0 + \alpha_1 EB_{it} + \alpha_2 A_{it} + \alpha_3 Depos_{it}/A_{it} + \alpha_4 Loan_{it}/A_{it} + \varepsilon_{it} \qquad \text{Model (1)}$$
$$BF_{it} = \alpha_0 + \alpha_1 EB_{it} + \alpha_2 A_{it} + \alpha_3 Deposit/Ait + \alpha_4 Loan_{it}/A_{it} + \varepsilon_{it} \qquad \text{Model (2)}$$

To measure the bank's performance, two criteria of profitability and bank fees are used.

In model (1), ROA_{it} represents profitability, which is the ratio of operating profit to total bank assets.

In model (2), BF_{it} is bank fees derived from the ratio of bank fees to total assets.

EB_{it}: E-banking index, which is the number of ATMs, sales terminals, and telephone banks divided by the number of bank branches.

A_{it}: Bank i assets in year t

$Depos_{it}/A_{it}$: The ratio of deposits to the bank i assets in year t

$Loan_{it}/A_{it}$: The ratio of loans to assets of bank i in year t

3.1. Data

The statistical population in this study is all Iranian banks during 2005-2015, and the statistical sample includes banks that operate in the Tehran Stock Exchange, and their financial statements and information are presented to the public. These selected banks are Saderat, Tejarat, Mellat, Refah, Saman, Parsian, Pasargad, and Eghtesad Novin.

4. Results and Analysis

Given that the data used in this study are of the hybrid type, it is necessary to use the Chow and Hausman tests to determine the type of data before estimating the models. The results of the Chow (F-Limer) test and Hausman test are shown in Table 1:

Table 1. Chow Test and Hausman Test

Model	Hausman Test		Chow Test	
	P-Value	χ^2	P-Value	F statistic
1	0.00	55.58	0.00	16.94
2	0.01	80.23	0.00	90.03

Table 1 indicates that the p-values of the Chow test are significant in models (1) and (2). This shows that the most appropriate method to estimate model parameters is the fixed effects model. Further, the results of the Hausman test show that the probability value of the test statistics is smaller than the critical value (α=5%). Thus, the best method used in panel data regressions is the fixed effects model.

In the next step, using Wooldridge's autocorrelation test and modified Wald variance homogeneity test, the classical hypotheses of no-autocorrelation and variance homogeneity are performed for models (1) and (2). The results show that both models face the problem of autocorrelation and heteroscedasticity. Therefore, models estimate by the generalized least squares (GLS) regression method.

Table 2 indicates the estimation results for model (1), while the dependent variable is ROA.

Table 2. Estimation Results of Model (1)

Variable	P-value	t statistics	Coefficient
EB	0.00	4.98	0.003
A	0.00	6.31	0.42
DEP	0.00	5.14	0.09
LOAN	0.00	-14.5	-0.15
Adjusted R Squared	F statistic = 2422.5 P-Value = 0.00		0.93

Based on the results, all coefficients are significant at 99%, and the coefficient of determination equals 93 percent. It means that independent variables explain 93 percent of the dependent variable changes. Therefore, the F-statistic also indicates a good fit of the model. Regarding the p-value obtained for the F-statistic (p-value <0.05), the whole model is significant. This indicates that not all regression coefficients are zero simultaneously. The F-statistic indicates the significance of the generality of the regression, and therefore, overall, the regression fits well.

Moreover, based on the results obtained from Table (2), E-banking, the amount of assets, the amount of deposits to assets ratio positively affects ROA. In contrast, loans to assets ratio have a negative effect on the ROA of the banks. All variables are statistically significant at a 5 percent significance level.

As explained above, E-banking shows a positive and significant effect on ROA as an indicator of bank performance. Therefore, the first hypothesis stating that E-banking has a positive and significant effect on banks' profitability is confirmed.

Table 3 shows the estimation results for model (2), while the dependent variable is bank fees.

Table 3. Estimation Results of Model (2)

Variable	P-value	t statistics	Coefficient
EB	0.00	39.8	0.315
A	0.00	6.31	0.61
DEP	0.00	5.14	0.24
LOAN	0.00	-14.5	-0.66
Adjusted R Squared	F statistic = 1368.6 P-Value = 0.00		0.91

Based on the results, all coefficients are significant at 99%, and the adjusted R squared, as the coefficient of determination, equals 91 percent. It means that independent variables explain 91 percent of the dependent variable changes. The F-statistic also indicates a good fit of the model. Regarding the p-value obtained for the F-statistic (p-value <0.05), the whole model is significant. This indicates that not all regression coefficients are zero simultaneously. The F-statistic indicates the significance of the generality of the regression, and therefore, overall, the regression fits well.

Furthermore, regarding the results obtained from Table (3), E-banking, the amount of assets, the amount of deposits to assets ratio positively affects bank fees. In contrast, loans to assets ratio has a negative effect on bank fees. All variables are statistically significant at a 5 percent significance level.

Based on the above discussion, E-banking has a positive and significant effect on bank fees as an indicator of bank performance. Therefore, the study's second hypothesis stating that E-banking has a positive and significant effect on bank fees is confirmed.

5. Conclusion and Recommendations

E-banking on the performance of banks using two indices of bank fees and return on assets (ratio of profitability of the company to total assets), applying the multiple regression analysis with panel data is evaluated. The following hypotheses are tested.

Hypothesis 1: E-banking has a positive and significant effect on the profitability of banks.

For the bank profitability index, the rate of return on assets of banks (ROA: the ratio of company profitability to total assets) is considered. The results of the hypothesis testing indicate that E-banking, assets, and deposit to assets ratio have a positive effect, and loan to asset ratio has a negative impact on the rate of return on banks' assets. Therefore, based on the results, the first hypothesis is confirmed, and thus, E-banking has a positive effect on banks' profitability. It should be noted, however, that the effect of E-banking on this index is very small.

In fact, E-banking has improved banking operations, and due to the lower need for this type of banking in terms of hardware and bank fees, and the fact that less manpower is involved and less cost to the bank, and ultimately increase the profitability of banks.

Hypothesis 2: E-banking has a positive and significant effect on bank fees of banks.

Based on the results obtained from the regression of the amount of assets, E-banking and the variable of the amount of deposits to assets have a positive effect on bank fees and loan to asset ratio, has a negative effect on the bank fees. Therefore, based on this regression, the second hypothesis is confirmed, and thus, E-banking has a positive effect on bank fees. It should also be noted that the effect of E-banking on this index has a coefficient equal to 0.31, which is a relatively significant coefficient.

Meihami et al. (2013) showed that E-banking causes banks to use new banking methods to provide services to customers and provide electronic services, reducing the costs of both the bank and the customer. Since banking costs are reduced by using e-banking, E-banking increases the income of banks. Siam (2006) has concluded that the effect of E-banking on banks' profitability is positive and significant in the long run.

Saluja and Wadhe (2015) showed the positive effect of E-banking on the profitability of old and private banks. Furthermore, Ngango et al. (2015) also showed that the E-banking system has a great effect on the performance of banks due to the increase in profitability, productivity, and assets of the bank, as well as reducing operating costs has a significant effect on the performance of banks.

Moreover, Sumra et al. (2011) showed that E-banking increases banks' profitability and enables banks to match the costs and profits earned by the bank in a shorter period to each other. Therefore, the results obtained from the research are per the theoretical foundations and by the findings.

Also, the results of the research are consistent with the findings of Salehmanesh et al. (2014), Asadzadeh and Kiani (2012), Ehsanafar et al. (2014), and Shah Mohammadi et al. (2012), which confirm a positive and significant relationship between E-banking and profitability.

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Investigating the Effect of Business Strategy and Corporate Governance on Cash Balance Policies of Listed Companies in Tehran Stock Exchange

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Abstract

This study aims to investigate the effect of business strategy and corporate governance on maintaining cash balance policies in companies listed on the Tehran Stock Exchange. Accordingly, the annual data of 108 listed companies on the Tehran Stock Exchange during 2011 to 2019, unit root panel tests of Im, Pesaran, and Shim and *Levin*–Lin–the Chu was used. In addition, the f test was used to select one of the panel data and pooled data methods, and the Hausman test was used to select one of the fixed effects and random-effects models. This study showed that the company's strategy had a negative and significant effect on the cash balance of listed companies on the Tehran Stock Exchange. Thus, it can be stated that with increasing the company's prospector business strategies, the need for investment and innovation in the company will increase. Accordingly, companies' cash balance will decrease. Also, with an increase in the proportion of non-executive members on the board, the cash balance of companies decreased due to the lack of attention to voluntary opportunities, so the cash balance decreased significantly.

Keywords: business strategy, corporate governance, cash balance, listed companies in Tehran Stock Exchange

1. Introduction

Cash is one of the most important domestic capital sources, so that cash was more than 23% of companies' assets, equivalent to 12.5% of US GDP in 2015 (Ward et al., 2018). The main advantage of cash holdings is increasing the company's ability to take advantage of valuable investment opportunities and avoiding expensive foreign financing. By holding more cash, managers increase the resources under their control and prefer to work with the cash in the company so that they are not forced to provide detailed information to the capital market (Ferreira and Vilela, 2004). However, cash holdings are associated with costs, the most important of which is the cost of missing an opportunity to hold cash (Magerakis and Tzelepis, 2020). Considering the benefits and costs of cash holdings, identifying the factors affecting held cash has always been a debatable issue in the financial world. Various theories have been proposed in this area, including Pecking Order Theory and Trade-off Theory. However, various studies have been conducted in this area, including the studies conducted by Dittmar et al. (2003), Ferreira and Vilela (2004), Al-Najjar (2013), Fernandes and Gonenc (2016), Orlova and Sun (2018), and Magerakis and Tzelepis (2020). Different factors affecting holding cash in different countries have been studied in each study, and different results have been reported. Studies such as Orlova and Sun (2018) and Magerakis and Tzelepis (2020) have identified corporate governance and business strategy as two variables affecting cash holdings in companies. Corporate managers need to determine the optimal policies for cash balance to achieve their goals. Depending on the inflow into the company, managers must allocate their financial resources for investing and cash holding. Previous studies have indicated that most managers tend to hold their cash balance due to the reduced risk of futures trades and the ability to pay costs (Acharya et al., 2012; Fernandes and Gonenc, 2016; Magerakis and Tzelepis, 2020). Also, corporate governance mechanisms are one of the factors that cause a company's financial resources to be managed properly. Improving the quality of corporate governance leads to more efficient use of company resources to maximize company value and increase shareholder wealth and significantly reduce the risk of improper use of cash resources due to its effect on reducing agency conflicts (Boubaker et al., 2015; Orlova and Sun, 2018). Thus, it can be stated that both corporate governance and business strategy can affect cash holdings in different companies. In the present study, the effect of these two factors on the cash balances of listed companies on the Tehran Stock Exchange will be investigated. For this purpose, the present article is divided into five general sections. After stating the introduction in the first section, the theoretical foundations and background of the research will be reviewed in the second section. The third section of this study will present the model and describe the research variables. The fourth section will present the results of the model estimation. The fifth section will provide a summary and conclusion of the research.

2. Theoretical Foundations and Background of Research

As stated, companies' policies determine the level of cash holdings. In this regard, Almeida et al. (2014) state that increasing the company's liquidity prevents the firm from entering into investment activities that increase the company's value, so cash holdings reduce growth rate, and managers must minimize the cost of cash holdings based on the opportunities ahead. Accordingly, the type of management strategy can determine the level of cash holdings in a company (Almida et al., 2014; Wu et al., 2012; Higgins et al., 2015). If the business strategy is offensive and active, the main goal will always be to create innovation, produce new products and new investments. Hence, in this type of strategy, the company will need financial resources to expand its business, and it will experience less cash balance and higher risk. However, the conservative strategy will hold more cash due to the type of management (Magerakis and Tzelepis, 2020). Corporate governance can also determine cash

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holdings, as Chen (2008) stated that corporate governance could affect the use of cash holdings and investors' evaluation of cash. One of the functions of corporate governance is increasing investors' ability to assess using cash holding. Harford et al. (2008) stated that with increasing the likelihood of involvement of outside board members in management decisions, managers' personal interests would decrease. Kuan et al. (2011) showed that more non-executive members on board could effectively manage earnings, and board independence can significantly reduce opportunistic behavior (Greiner, 2013). Boubaker et al. (2013) investigated the effect of the board on the level of cash holding. Their research results revealed that the characteristics of the board had a positive and significant effect on cash holding. Wai and Zhu (2013) examined the relationship between corporate governance mechanism and cash holding in the Hong Kong Stock Exchange and concluded a negative and significant relationship between the duality of CEO duties and cash holding and a positive and significant relationship between managerial ownership and cash holding.

Raei et al. (2019) identified the factors affecting cash holdings in the companies listed on the Iranian Stock Exchange. In the mentioned study, using a stable variable based on the SCAD penalty function, it was shown that selecting a stable variable introduces variables as factors affecting cash holding that OLS regressions fail to identify. Joudi et al. (2019) investigated the role of corporate governance, quality of the relationship between cash holdings and company value at times of information asymmetry. In the mentioned study, which used data of 106 companies over ten years, the results showed that in the information asymmetry condition, the quality of strong (weak) corporate governance has a positive (negative) and significant effect on the relationship between cash holding and company value. Finally, Magerakis and Tzelepis (2020) investigated the effect of business strategy on cash holding in American companies. In the mentioned study, which used both defensively and prospector strategies, the results revealed that business strategy directly and significantly impacted cash holding in American companies.

3. Research Methodology

As mentioned, the present study aims at investigating the effect of business strategy and corporate governance on cash holdings in listed companies on the Tehran Stock Exchange. Accordingly, in this study, two econometric models will be estimated. In the first model, the effect of company strategy on cash holdings will be examined, and in the second model, the effect of corporate governance on demand will be analyzed. Therefore, the following models have been presented based on the Magerakis and Tzelepis (2020) and other related studies, access to information about listed companies in Tehran Stock Exchange, and by removing non-significant variables of the model.

$$cash_{it} = \beta_0 + \beta_1 Strategy_{it} + \beta_2 mtb_{it} + \beta_3 equity_{it} + \beta_4 loss_{it} + \beta_5 Size_{it} + \beta_6 nws_{it} + \beta_7 LEV_{it} + \varepsilon_{it} \qquad (1)$$

$$cash_{it} = \beta_0 + \beta_1 CG_{it} + \beta_2 mtb_{it} + \beta_3 equity_{it} + \beta_4 loss_{it} + \beta_5 Size_{it} + \beta_6 nwc_{it} + \beta_7 LEV_{it} + \varepsilon_{it} \qquad (2)$$

In the present study, the dependent variable is cash holdings (Cash). According to the study conducted by Magerakis and Tzelepis (2020), the level of cash or its equivalent in the company's assets has been used to measure this variable. The company's strategy has been measured according to the study conducted by Navissi et al. (2017). In this way, according to the 4 criteria, companies are classified into five classes, and the lowest is 1, and the highest is 5. Based on the sum of scores, the company's strategy is measured. A lower score indicates a defensive strategy, and higher scores indicate a prospector strategy. The ratio of non-executive board members to total board members has also been used to measure corporate governance. The control variables of this study are also measured

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based on the study conducted by Magerakis and Tzelepis (2020). To calculate Mtb, the ratio of market value to book value was used, to calculate equity, the total ratio of sold shares to total company value was used, to calculate loss, the amount of company loss was used, to calculate the size, the logarithm of the total assets of the company was used, to calculate NWC, the level of working capital was used and to calculate LEV, the ratio of debt to assets was used.

The statistical population of the present study included all listed companies in Tehran Stock Exchange. For this purpose, the annual data of the mentioned companies that were continuously active during the research period were used. The research period was 6 years, from 2011 to 2019. It was conducted on all listed companies on the Tehran Stock Exchange. In addition, to estimate the model, the data of 108 listed companies on the Tehran Stock Exchange in the mentioned period were used, and the systematic elimination method of selecting was used in this study. In this study, to estimate the proposed econometric model, a panel data method will be used. Before estimating the model, it is necessary to test the reliability of the variables. For this purpose, unit root panel tests of Im, Pesaran, and Shim and unit root panel tests of *Levin*–Lin–the Chu will be used. To estimate the model, the F test will be used to select one of the panel data, and pooled data, and the Hausman test will be used to select one of the fixed effects and random-effects models. In many cases, researchers can use the data panel in cases where issues cannot be examined only in time series or only cross-sectional manner. One of the data panel features is increasing the sample size, increasing the model efficiency, and reducing bias. The main reason for using this method was the existing statistical limitations, and the small number of samples and data panel method solved this problem. In this study, Eviews9 and other software, if needed, will be used.

4. Results

As stated above, in this study, to evaluate the reliability of the variables, two tests of Im, Pesaran, and Shim, and *Levin*–Lin–the Chu will be used. The results of these two tests for the research variables are presented in the table below. As shown in this table, the variables are at a reliable level based on both tests. Thus, the null hypothesis that states there is a unit root in the variables is rejected.

Table 1. Unit root test of variables

Variable	maximum	At least	Standard deviation	Average
Business Strategy	5	1	1	2.613
Company size	8.477	4.321	0.663	6.081
Corporate Governance	*0.843*	0.496	0.355	0.496
Financial leverage	0.782	0.012	0.249	0.628
Working capital	0.62	0.07	0.12	0.18
Company loss	0	-1327	118	-617
Market value to book value ratio	0.76	0.08	0.41	0.36

Results of the estimation of two research models are also presented in the table below. As shown in the table, the results of F-Limmer and Hausman F tests on both models confirm the use of the fixed effects method and panel data. Accordingly, two research models were estimated with the same method. The results of the F test, coefficient of determination, and Durbin-Watson show that the results obtained in the model can be trusted. Also, the coefficients obtained in both models are stable, so results will be reliable. As shown in the table, the coefficient related to the company's strategy variable is -0.458, and the probability level of this coefficient is 0.000. It indicates that the company's strategy has had a negative and significant effect on the cash balances of listed companies on the Tehran Stock Exchange. Thus, it can be stated that with the increasing prospector strategy of the company, the need for investment and innovation in the company will increase, and thus its cash

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balance will decrease. This causes the business strategy to have a negative and significant effect on the cash balances of listed companies on the Tehran Stock Exchange.

Table 2. Estimation results of research models

explanatory variables	First model		Second model	
	Coefficient	Probability level	Statistic t	Probability level
Business Strategy	-0.483	0.1	-	-
Corporate Governance (CG)	-	-	0.819	0.026
Market value to book value ratio (mtb)	2.713	0.66	2.228	0.066
Ratio of sold shares (equity)	-10e89.9	0.002	-10e92.9	0.003
Company size	0.066	0.001	0.05	0.001
Financial leverage (lev)	-0.009	0.008	-0.021	0.008
Working capital (nwc)	-0.462	0.003	-0.411	0.003
Company loss	0.161	0.000	0.158	0.000
Constant	22.384	0.001	9.038	0.001
first log of the dependent variable	0.038	0.000	0.714	0.0000
F-Limmer test	1.633	0.001	14.105	0.001
Hausman test	38.184	0.000	29.149	0.001
Statistic F	3.128	0.000	3.468	0.000
Durbin-Watson Statistics	2.468		2.018	
coefficient of determination	0.544		0.582	
The adjusted coefficient of determination	0.370		0.422	

Source: research findings

Also, the results of Model 2 estimation showed that the coefficient related to the corporate governance variable is positive, and the probability level also shows the significance of the results. Thus, it can be stated that with an increase in the proportion of non-executive members on board, the cash balance of companies decreased due to a lack of attention to voluntary opportunities. Hence, it can be stated that corporate governance has had a positive and significant effect on the cash balance of listed companies on the Tehran Stock Exchange.

5. Conclusion

Identifying the factors affecting cash holdings has always been a debatable issue in the financial world. Various theories have been proposed in this regard, including Pecking Order Theory and Trade-off Theory. Various studies have introduced corporate governance as well as a business strategy as two variables affecting cash holdings in companies. These studies show that most managers tend to hold their cash balance due to the reduced risk of futures trades and the ability to pay costs. Improving the quality of corporate governance leads to more efficient use of company resources to maximize the company's value and increase shareholder wealth and significantly reduce the risk of improper use of cash resources due to its effect on reducing agency conflicts. Thus, this study was an attempt to investigate this issue. To achieve this goal, the annual data of 108 companies listed on the Tehran Stock Exchange from 2011 to 2019 were used. To analyze the data, two tests of Im, Pesaran, and Shim, and *Levin*–Lin–Chu were used, and F test was used to select one of the panel data and pooled data methods, and Hausman test was used to select one of the fixed effects and random-effects models. The results showed that all variables are reliable, and research models should be estimated using the fixed effects method in panel data. The present study results showed that the company's strategy had a negative and significant effect on the cash balance of companies listed on

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the Tehran Stock Exchange. Therefore, it can be stated that with an increase in the prospector strategy of the company, the need for investment and innovation in the company will increase, so the companies' cash balance will decrease. Also, with an increase in the proportion of non-executive members on board, the cash balance of companies decreased due to a lack of attention to voluntary opportunities, so the cash balance decreased significantly. Based on the results of this study, it is recommended that different companies provide the conditions for the company's growth through investment by promoting their corporate governance and considering the interests of the company and its financial needs. In addition, due to the negative relationship between strategy and cash balance, managers looking for investment and growth need to think about financing if they need cash so that the company does not face a financial crisis in line with prospector strategies.

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Intellectual Capital Measurement Model for Iran by Fuzzy Delphi

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Abstract

The portion of non-physical capital like knowledge in the corporations' value has been consistently increasing in the last three decades. However, the measurement for these factors has always been under question. The Intellectual Capital (IC) measurement models were a solution for the measurement. This study proposed a measurement model for IC in Iran. After reviewing and summarizing the other methods' dimensions and measures, it used two qualitative methods. In the first step, some in-depth interviews were done. The interviewees were provided with the detail of the previous models' summary. Their ideas were used to limit the number of variables in the next step. Then a group of 97 experts was asked to fulfill a questionnaire. Finally, the questionnaires were analyzed by the Fuzzy Delphi method. The result shows a measurement model with three dimensions (human, relational and structural capital), eight components, and 21 indicators (measures). This model is the first model, which is designed based on the Iranian experts' ideas. Furthermore, the first model provides all the model's indicators, components, and dimensions.

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1. Introduction

Increasing the company's value depends on its performance, which will ultimately increase the wealth of shareholders. Today, intellectual capital is considered one of the most influential factors in improving performance. Thus, value creation and knowledge have been identified as the most crucial intangible capital for financial and physical capital. The knowledge-based business environment requires an approach that includes new intangible organizational assets, such as human resource competencies and innovations, customer relations, administrative systems, structures, etc. In this regard, the theory of intellectual capital has attracted increasing attention from academic researchers and administrators. The role of intellectual capital in creating value for organizations and business units is much more significant than financial and physical capital. Financial statements' limitations in explaining the firm's value also reflect that resources' economic value is not limited to the value of material goods and includes intellectual capital (Mention and Bontis, 2013).

1.1. Intellectual Capital Measurement

Marr, Schiuma and Neely (2004) first proposed a model for measuring intellectual capital. After that, various methods and criteria were presented, which Sveiby (2010) classified into four main groups as follows:

1. Direct Intellectual Capital (DIC): These methods deal with the value of intangible assets. They insist on identifying their components. The result of these methods is the amount or ratio that determines the components of human capital.
2. Market Capitalization Models (MCM): These methods are based on the difference between the company's stock market value and the equity's book value.
3. Return On Assets (ROA): In these methods, based on subtracting the organization's return on assets from industry ratios and multiplying it by its average assets, the amount of annual profit earned is determined by the location of intangible assets. Dividing this profit by the average cost of the company's capital indicates the company's intellectual capital.
4. Balanced Score Card (BSC) methods: These methods are similar to the first group methods, except that they do not announce an amount for intellectual capital but provide indicators (Ferenhof et al., 2015). In the balanced scorecard model, customers' perspective provides indicators related to communication capital. The internal processes' view expresses indicators related to structural capital and training indicators about human capital.

One of the most important models for measuring intellectual capital is the Skandia model. This model was designed in 1997 by Edvinson for the Swedish insurance company Skandia. According to this model, the organization's total value is divided into financial capital and intellectual capital. Intellectual capital also includes two parts: human capital and structural capital. Human capital can be summarized in employees' ability, competence, and ability to communicate within their organization. The structural capital considers everything in the organization except human resources, such as brands, processes, structure, and organization concepts. This model can be regarded as a traditional model of intellectual capital.
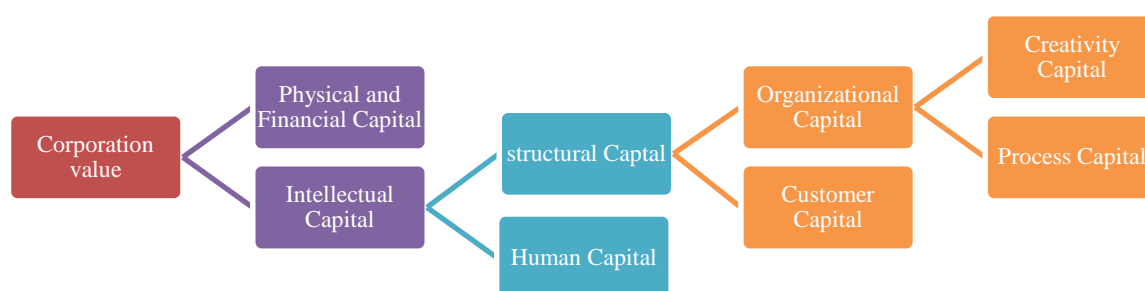
Fig 1. Traditional model of intellectual capital

The evolution of the Skandia model led to the creation of new models that briefly divide intellectual capital into the following three sections:

- Human capital: includes the knowledge, skills, and experience of employees (Subramaniam and Youndt, 2005).
- Structural capital: is related to the codified knowledge of the organization, its sources of information, and culture (Menor, Kristal and Rosenzweig, 2007).
- Communication capital means the knowledge accumulated in the organization's internal and external communication network (Buenechea, 2017).

Regarding the models of measuring intellectual capital, two groups of models can be distinguished. The first group includes models that measure the components of intellectual capital (Nazari, 2014). In this group, most constituent micro-items are considered and often have applications within the organization and management. Calculating some of these indicators requires the distribution of questionnaires among different parts of the organization. As the research limitations will be mentioned, such cases are outside the scope of this research. The second group is the indicators that calculate the intellectual capital at the level of the whole organization.

So far in Iran, various researches on intellectual capital have been conducted. However, no one has conducted any research that fully and comprehensively evaluates the various existing measurement models and provides a suitable Iran model. Therefore, this study's problem is to determine the model of measuring intellectual capital in Iran.

2. Literature Review

Marr, Schiuma and Neely (2004) stated that intellectual capital includes many invisible factors that help the organization pursue its strategies. He presented three main dimensions to the concept of intellectual capital. These dimensions are (1) human capital, (2) communication capital, and (3) structural capital. Stewart (1998) lists intellectual capital as the knowledge, information, intelligence, and experience used by an organization to create wealth. He considers the components of intellectual capital to include the following three components: (1) human capital, (2) structural capital, and (3) customer capital. Edvinsson (2002) considers intellectual capital as a combination of human capital and structural capital. Human capital includes the organization's current employees' knowledge and consists of customer relations' structural capital, the production process's efficiency, internal databases, and other institutionalized knowledge structures.

Guthrie, Ricceri and Dumay (2012) stated four components for intellectual capital. These components are (1) human capital, (2) organizational capital: related to the structure of formal and informal systems used by the organization, (3) marketing capital: related to marketing relationships

and its networks, and (4) production capital, which Includes a specialized production process developed over time.

Jacobsen, Hofman-Bang and Nordby (2005) emphasized that not measuring intellectual capital leads to irrelevant balance sheet information and challenges the full disclosure principle. Williams (2001) stated that current financial reporting provides an inappropriate accounting method for intellectual property. They argue that if we look at the usefulness of financial statements for valuation, the organization's knowledge assets' total value must be disclosed in the financial statements.

Andriessen (2004) concluded that accountants should include information about unreported intellectual property in financial statements or financial risk reports. Otherwise, these reports will no longer be suitable for shareholders to assess the value of the company. Montemari and Nielsen (2013) state that a balance sheet that does not include intellectual capital would be misleading in measuring firm value.

According to Statement of Accounting Concepts No. 8, the most crucial purpose of financial reporting is to provide helpful information for actual and potential suppliers of resources for the organization (Financial Accounting Standards Board, 2010). This information should determine the status of the resources available to the organization. One of the most important resources at the disposal of the organization is its intellectual capital. Based on the above, accounting does not currently provide complete information about intellectual capital.

Garanina and Dumay (2017) introduced the following three models for measuring intellectual capital:

1. Models based on market capital value: These models consider the difference between market value and the book value of owners' rights as intellectual capital.
2. Models based on the return on assets: According to these models, whenever a company's return on assets is higher than its industry, there is a difference in the value of this unregistered intellectual capital in that company.
3. Models based on a specific element: these models differentiate the different groups of existing knowledge, awareness assets and allocate an amount to that asset on a particular basis. Some of these fundamentals of value are the historical cost of creating the asset, the asset's replacement value, and the asset's discounted future cash flows.

3. Research Methodology

As mentioned, the questions of the present study have been answered in three steps. To design the model, in the first step, the research examined and analyzed the existing theoretical foundations, the theoretical model of measurement was presented. In the second step of the study, the initial model is reviewed, approved, and developed to present a modified conceptual model. Finally, in the third step, the model obtained from the second stage is reviewed and evaluated, and the final model is proposed and reviewed.

Step 1: Study the existing models

The paper discussed the previous models to analyze the similarities and differences, compare them, and propose the initial theoretical model.

Step 2: Get the opinion of experts in the form of interviews

This section designed semi-structured interviews and conducted them according to the commonalities and differences identified in the first step. Then, due to the novelty of the subject in Iran and the lack of access to knowledgeable people, we prepared the final questionnaire by the opinions of the research leadership team, the views of 3 people from universities in Australia, Canada,

and Spain (six people in total), and the literature of the topic.

Step 3: Descriptive survey research method by Fuzzy Delphi method

This section collected the experts' opinions by the Fuzzy Delphi method. Experts in this section include the following groups:

- Faculty members of universities and graduate students of accounting and finance,
- Independent auditors (members of the Iranian Society of Certified Public Accountants)
- Professional experts in relevant organizations

Also, due to the topic's multidisciplinary nature, another essential feature of the selected experts is to have a comprehensive view of various specialized dimensions and positions on the subject of intellectual capital. The results of this section are described in detail.

4. Research Results

4.1. Results of the First Step of model design

Table 1. Dimensions, Components, and Indicators of Intellectual Capital

Dimension	Component	Indicator
Human Capital	Employees' Characteristics	Number of Employees
		Labour Force Productivity
		Employees' Education Level
		Average Employees' Experience
	Training	Annual Training Hours
		Training Cost
	Work Environment	Employees' Job Satisfaction
Structural Capital	Processes	Accuracy of Information and Documentation
		Level of Information Sharing
		ISO Certificates
		Process Effectiveness
	Innovation	Innovation Capacity
		Time to Market for New Products
		Rate of New Technologies Use
		New Product and Service Resilience
		Research and Development Cost
		Level and Situation of the Inventories
		Good and Service Delivery Time
	Resources Usage	Inventory Turnover
		Productivity
		Machinery Utilization Rate
		Timeliness of Information
		Transparency of Information
		Reliability of Information
Relational Capital	Customer service	Variety of Services
		Customer Service Level
		Customer Inquiry Respond Time
		Responding and Solving Customer Problems
		Customer complaints
		Flexibility in Responding to Customers' Needs
	Customer Relationship	Level of relationships and partnerships
		Customers' Loyalty
		Trust and commitment to partners
		Customer and partner satisfaction
	Market Relationship	Market Portion
		Social Responsibility

this section reviewed the theoretical foundations to provide a basic theoretical model; after

examining different models and matching them, the dimensions, components, and intellectual capital indicators based on theoretical foundations are shown in Table 1.

4.2. Results of the second step of designing the model

As the second step stated, to provide a modified conceptual model, this step collected the interviewees' opinions on each item in the initial model to determine whether each item is approved or not. Based on the results obtained from the content of the interviews conducted in the second stage, the first stage's theoretical model was improved to present a modified conceptual model and used in the third stage of the research to become the final model. Table 2 illustrates the results of this step.

Table 2. Dimensions, Components, and Indicators of Modified Model

Dimension	Component	Indicator	Result
Human Capital	Employees' Characteristics	Number of Employees	Approve
		Labour Force Productivity	Approve
		Employees' Education Level	Reject
		Average Employees' Experience	Approve
	Training	Annual Training Hours	Approve
		Training Cost	Approve
	Work Environment	Employees' Job Satisfaction	Approve
Structural Capital	Processes	Accuracy of Information and Documentation	Reject
		Level of Information Sharing	Approve
		ISO Certificates	Approve
		Process Effectiveness	Approve
	Innovation	Innovation Capacity	Approve
		Time to Market for New Products	Approve
		Rate of New Technologies Use	Reject
		New Product and Service Resilience	Approve
		Research and Development Cost	Approve
	Resources Usage	Level and Situation of the Inventories	Approve
		Good and Service Delivery Time	Approve
		Inventory Turnover	Approve
		Productivity	Approve
		Machinery Utilization Rate	Approve
		Timeliness of Information	Approve
		Transparency of Information	Approve
		Reliability of Information	Approve
Relational Capital	Customer service	Variety of Services	Approve
		Customer Service Level	Approve
		Customer Inquiry Respond Time	Approve
		Responding and Solving Customer Problems	Approve
		Customer complaints	Approve
		Flexibility in Responding to Customers' Needs	Approve
	Customer Relationship	Level of relationships and partnerships	Approve
		Customers' Loyalty	Approve
		Trust and commitment to partners	Approve
		Customer and partner satisfaction	Approve
	Market Relationship	Market Portion	Approve
		Social Responsibility	Approve

4.3. Results of the Third Step of model design the final conceptual model

In the third step and present the final model, the respondents' answers about the distributed questionnaires' questions based on the second step's modified conceptual model have been studied. Ultimately, the final conceptual model for measuring intellectual capital in Iran is presented. Based on the review of theoretical and empirical foundations in the first step and specialist interviews

conducted in the second step, the indicators in the third stage of the research have been identified and screened. The second step identified 34 indicators to start the third step of the study, which Table 3 illustrates.

Table 3. Dimensions, Components, and Indicators of Modified Model codes

Dimension	Component	Indicator	Code
Human Capital	Employees' Characteristics	Number of Employees	C01
		Labour Force Productivity	C02
		Employees' Education Level	C03
		Average Employees' Experience	C04
	Training	Annual Training Hours	C05
		Training Cost	C06
	Work Environment	Employees' Job Satisfaction	C07
Structural Capital	Processes	Level of Information Sharing	C08
		ISO Certificates	C09
		Process Effectiveness	C10
	Innovation	Innovation Capacity	C11
		Time to Market for New Products	C12
		New Product and Service Resilience	C13
		Research and Development Cost	C14
	Resources Usage	Level and Situation of the Inventories	C15
		Good and Service Delivery Time	C16
		Inventory Turnover	C17
		Productivity	C18
		Machinery Utilization Rate	C19
		Timeliness of Information	C20
		Transparency of Information	C21
		Reliability of Information	C22
Relational Capital	Customer service	Variety of Services	C23
		Customer Service Level	C24
		Customer Inquiry Respond Time	C25
		Responding and Solving Customer Problems	C26
		Customer complaints	C27
		Flexibility in Responding to Customers' Needs	C28
	Customer Relationship	Level of relationships and partnerships	C29
		Customers' Loyalty	C30
		Trust and commitment to partners	C31
		Customer and partner satisfaction	C32
	Market Relationship	Market Portion	C33
		Social Responsibility	C34

In the third stage of the research, the Fuzzy Delphi approach was used to screen the indicators and identify the final indicators. As mentioned earlier, in the third step, the researcher first summarizes the concept of intellectual capital to the respondents to review the theoretical content of the topic for the audience. Then the respondents were asked to answer the questionnaire. This step used the Internet platform and Google questionnaire tools to complete the questionnaires. The questionnaire was sent by email to 270 people and sent to social networks related to accountants, auditors, and capital market activists, making it difficult to determine the exact number of questionnaires sent. However, the total number of responses received from all the mentioned sources was 105, of which 97 were identifiable.

Descriptions presented no items related to the questions' subject (measurement models, dimensions, components, and indicators) to maintain neutrality and not comment on conceptual information presentation. Based on the questionnaires' results, the final conceptual model of research measuring intellectual capital in Iran was proposed.

Experts were asked to comment on the mentioned factors in the form of relevant components and indicators. Then, the Fuzzy Delphi approach was used to screen and identify the final indicators. Thus, using the Delphi questionnaire, 97 experts' views on each index were collected. This step took the following steps to analyze the opinions received to identify the final indicators.

Step 1: Identify the appropriate spectrum for Fuzzy verbal expressions,
Step 2: Fuzzy aggregation of Fuzzy values,
Step 3: Fuzzy de-Fuzzy values and
Step 4: Select the tolerance threshold and sift through the effective indicators.

Step 1: Identify the appropriate spectrum for Fuzzy verbal expressions

Experts' perspectives have been used to assess the importance of the indicators. Although experts use their competencies and mental abilities to make comparisons, it should be noted that the traditional process of quantifying people's perspectives does not fully reflect the human thinking style. In other words, the use of Fuzzy sets is more compatible with linguistic and sometimes ambiguous human explanations. Therefore it is better to use Fuzzy sets (using Fuzzy numbers) to make long-term predictions and real-world decisions (Kahraman, 2008).

In this research, Fuzzy triangular numbers have been used to Fuzzy the view of experts. Experts' views on the importance of each indicator are collected with a 7-degree Fuzzy spectrum. In this study, the single-phase Fuzzy Delphi method is used to better and more accurately collect experts' opinions; a 7-point Likert scale with corresponding Fuzzy triangle numbers is used as described in Table 4

Table 4. 7-point Likert scale with corresponding Fuzzy triangle numbers for value evaluation

Definitive equivalent	Verbal Variable	Fuzzy Number
1	Completely Insignificant	(0, 0, 0.1)
2	Very Insignificant	(0, 0.1, 0.3)
3	Insignificant	(0.1, 0.3, 0.5)
4	Medium	(0.3, 0.5, 0.75)
5	Significant	(0.5, 0.75, 0.9)
6	Very Significant	(0.75, 0.9, 1)
7	Completely Significant	(0.9, 1, 1)

Step 2: Fuzzy aggregation of Fuzzy values

After selecting the appropriate Fuzzy spectrum, experts' opinions were collected and recorded fuzzily (here in the form of Fuzzy triangle numbers). First, the expert panel view was Fuzzy for each research indicator, using the Fuzzy average method. Table 5 summarizes opinions and describes results as a Fuzzy triangle.

Step 3: De-fuzzification of Fuzzy values

To sum up, it is usually the mean of triangular and trapezoidal Fuzzy numbers by a definite value that is the best corresponding mean. This operation is called de-fuzzing. There are several ways to de-Fuzzy. In this research, the surface center method has been used for de-fuzzing. In this step, after the Fuzzy aggregation of the experts' point of view, the values obtained for each index de-fuzzification using the surface center method. Table 6 shows the results of de-fuzzification and determination of the definite value of each indicator.

Table 5. The Fuzzy mean of the panel of experts for each of the research indicators

Code	Low	Medium	Up	mean
C01	0.90	0.79	0.60	(0.896,0.786,0.597)
C02	0.93	0.82	0.63	(0.93,0.819,0.63)
C03	0.93	0.81	0.63	(0.926,0.811,0.625)
C04	0.93	0.83	0.65	(0.934,0.827,0.65)
C05	0.93	0.84	0.67	(0.93,0.837,0.668)
C06	0.96	0.88	0.71	(0.964,0.875,0.708)
C07	0.81	0.65	0.47	(0.809,0.654,0.47)
C08	0.94	0.82	0.64	(0.936,0.822,0.644)
C09	0.95	0.86	0.70	(0.947,0.864,0.698)
C10	0.71	0.53	0.35	(0.71,0.531,0.353)
C11	0.71	0.53	0.36	(0.707,0.531,0.358)
C12	0.94	0.85	0.68	(0.943,0.847,0.677)
C13	0.94	0.84	0.67	(0.935,0.835,0.668)
C14	0.83	0.67	0.49	(0.831,0.673,0.488)
C15	0.76	0.58	0.39	(0.763,0.576,0.388)
C16	0.95	0.87	0.71	(0.951,0.87,0.709)
C17	0.97	0.89	0.72	(0.97,0.886,0.722)
C18	0.78	0.59	0.40	(0.778,0.59,0.402)
C19	0.95	0.84	0.66	(0.945,0.835,0.66)
C20	0.92	0.79	0.61	(0.916,0.792,0.61)
C21	0.93	0.81	0.64	(0.926,0.812,0.635)
C22	0.86	0.74	0.56	(0.86,0.735,0.557)
C23	0.71	0.53	0.36	(0.707,0.531,0.358)
C24	0.84	0.69	0.50	(0.843,0.686,0.495)
C25	0.76	0.58	0.39	(0.763,0.576,0.388)
C26	0.95	0.86	0.68	(0.954,0.857,0.684)
C27	0.79	0.63	0.45	(0.79,0.634,0.451)
C28	0.81	0.66	0.47	(0.811,0.656,0.466)
C29	0.75	0.59	0.42	(0.749,0.591,0.416)
C30	0.91	0.79	0.60	(0.912,0.787,0.601)
C31	0.79	0.64	0.46	(0.792,0.639,0.458)
C32	0.93	0.81	0.63	(0.928,0.811,0.628)
C33	0.88	0.76	0.59	(0.88,0.76,0.585)
C34	0.94	0.83	0.66	(0.941,0.833,0.658)

Step 4: Select the tolerance threshold and sift through the effective indicators

After de-fuzzification and determination of each indicator's definite values, a tolerance threshold should be considered to screen the final indicators. According to the type of research and following the study, the tolerance threshold is considered 0.7. If the definite value obtained from the fuzziness of the experts' aggregated view is greater than the tolerance threshold, the desired indicator is approved as an appropriate indicator. Otherwise, it is rejected. Thus, the de-Fuzzy value greater than 0.7 is acceptable, and an index with a score below 0.7 is rejected (Wu & Fang, 2011). Table 7 shows the final results of this section.

As the table shows, out of 34 indicators, in the form of 9 components, 25 indicators have been accepted by experts. It shows that experts leading indicators of measuring intellectual capital are perceived as useful due to their impact.

5. Conclusion

After performing the above steps and modifying the model, the final model for measuring intellectual capital in Iran is described in Table 10.

Table 6. Determining the definite value of each indicator

Code	mean	Crisp
C01	(0.896,0.786,0.597)	0.76
C02	(0.93,0.819,0.63)	0.79
C03	(0.926,0.811,0.625)	0.79
C04	(0.934,0.827,0.65)	0.80
C05	(0.93,0.837,0.668)	0.81
C06	(0.964,0.875,0.708)	0.85
C07	(0.809,0.654,0.47)	0.64
C08	(0.936,0.822,0.644)	0.80
C09	(0.947,0.864,0.698)	0.84
C10	(0.71,0.531,0.353)	0.53
C11	(0.707,0.531,0.358)	0.53
C12	(0.943,0.847,0.677)	0.82
C13	(0.935,0.835,0.668)	0.81
C14	(0.831,0.673,0.488)	0.66
C15	(0.763,0.576,0.388)	0.58
C16	(0.951,0.87,0.709)	0.84
C17	(0.97,0.886,0.722)	0.86
C18	(0.778,0.59,0.402)	0.59
C19	(0.945,0.835,0.66)	0.81
C20	(0.916,0.792,0.61)	0.77
C21	(0.926,0.812,0.635)	0.79
C22	(0.86,0.735,0.557)	0.72
C23	(0.707,0.531,0.358)	0.53
C24	(0.843,0.686,0.495)	0.67
C25	(0.763,0.576,0.388)	0.58
C26	(0.954,0.857,0.684)	0.83
C27	(0.79,0.634,0.451)	0.63
C28	(0.811,0.656,0.466)	0.64
C29	(0.749,0.591,0.416)	0.59
C30	(0.912,0.787,0.601)	0.77
C31	(0.792,0.639,0.458)	0.63
C32	(0.928,0.811,0.628)	0.79
C33	(0.88,0.76,0.585)	0.74
C34	(0.941,0.833,0.658)	0.81

For the first time, this study, using experts' opinions and the world's theoretical foundations, developed a model for measuring intellectual capital in Iran. This research, which results from gathering theoretical and experimental evidence in this field, can help increase the depth of the existing literature in the field and provide a tool for researchers to measure intellectual capital. In addition, the proposed model can also help valuation activists (including capital markets and financial and credit institutions) have a more accurate estimate of the actual value of intellectual capital hidden within organizations.

Table 7. Results of screening of research indicators

Code	Indicator	Crisp	Result
C01	Number of Employees	0.76	Approve
C02	Labour Force Productivity	0.79	Approve
C03	Employees' Education Level	0.79	Approve
C04	Average Employees' Experience	0.80	Approve
C05	Annual Training Hours	0.81	Approve
C06	Training Cost	0.85	Approve
C07	Employees' Job Satisfaction	0.64	Reject
C08	Level of Information Sharing	0.80	Approve
C09	ISO Certificates	0.84	Approve
C10	Process Effectiveness	0.53	Reject
C11	Innovation Capacity	0.53	Reject
C12	Time to Market for New Products	0.82	Approve
C13	New Product and Service Resilience	0.81	Approve
C14	Research and Development Cost	0.66	Reject
C15	Level and Situation of the Inventories	0.58	Reject
C16	Good and Service Delivery Time	0.84	Approve
C17	Inventory Turnover	0.86	Approve
C18	Productivity	0.59	Reject
C19	Machinery Utilization Rate	0.81	Approve
C20	Timeliness of Information	0.77	Approve
C21	Transparency of Information	0.79	Approve
C22	Reliability of Information	0.72	Approve
C23	Variety of Services	0.53	Reject
C24	Customer Service Level	0.67	Reject
C25	Customer Inquiry Respond Time	0.58	Reject
C26	Responding and Solving Customer Problems	0.83	Approve
C27	Customer complaints	0.63	Reject
C28	Flexibility in Responding to Customers' Needs	0.64	Reject
C29	Level of relationships and partnerships	0.59	Reject
C30	Customers' Loyalty	0.77	Approve
C31	Trust and commitment to partners	0.63	Reject
C32	Customer and partner satisfaction	0.79	Approve
C33	Market Portion	0.74	Approve
C34	Social Responsibility	0.81	Approve

Table 8. The final model for measuring intellectual capital in Iran

Dimension	Component	Indicator
Human Capital	Employees' Characteristics	Number of Employees Labour Force Productivity Employees' Education Level Average Employees' Experience
	Training	Annual Training Hours Training Cost
Structural Capital	Processes	Level of Information Sharing ISO Certificates
	Innovation	Time to Market for New Products New Product and Service Resilience
	Resources Usage	Good and Service Delivery Time Inventory Turnover Machinery Utilization Rate Timeliness of Information Transparency of Information Reliability of Information
Relational Capital	Customer service	Responding and Solving Customer Problems
	Customer Relationship	Customers' Loyalty Customer and partner satisfaction
	Market Relationship	Market Portion Social Responsibility

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The Relationship between Corporate Social Responsibility Disclosure and Intellectual Capital Considering the Role of Block Holder Ownership Moderation

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Abstract

The present study deals with the relationship between a corporate social responsibility disclosure and intellectual capital considering the role of block holder ownership moderation incorporates listed on Tehran Stock Exchange, and one of the points of the present study for which we are seeking an explanation is the social responsibility and intellectual capital status of corporates with block holder ownership. In terms of aim, this study is applied research and is correlational-descriptive in terms of methodology. The study population consists of all corporates accepted in Tehran Stock Exchange after sampling, 147; the period is 6 years (2011-2016). To measure corporate social responsibility, the method of Content Analysis has been used based on the information checklist and its coding, and measuring the intellectual capital has been done using Pulic Model (2000). Furthermore, to test the hypotheses of the present study, Multiple Regular Regression and OLS (Ordinary Least Squares) have been used with the help of the software Eviews. The study results show a significant relationship between corporate social responsibility disclosure and intellectual capital; also, block holder ownership significantly affects corporate social responsibility disclosure and intellectual capital.

1. Introduction

In the last two decades, corporate social responsibility has become the focal point of the economic units. Corporate social responsibility emphasizes important ethical, environmental, security, education, human rights, and the like. Although applying the corporate social responsibility costs the corporate some fundamental expenses, it will lead to the improvement of the corporate performance in the long run due to the improvement of the corporate fame, a decrease in the expenses, in the long run, an increase in the requests, an increase in the sales, and also an increase in the profit (Vergalli and Poddi, 2012). Corporate social responsibility consists of actions in which the corporate considers its cooperation with social activities and decreases the destructive effects of business on society and the environment (Setiawan, 2011). In other words, corporate social responsibility, in a general sense, is a method by which the firms harmonize the environmental, social, and economic approaches with their values, culture, strategies, decision-making structures, and operational methods in a clear and calculable way and, as a result, start better trends and processes in their corporates which leads to wealth production and improvement of the society (Amir Ghasemkhani et al., 2016). Programming the corporate social responsibility is done to bring sustainable value for the society, shareholders, and stakeholders and offers methods that corporates can apply in the business environment. Corporate social responsibility is an important dimension of management literature review and theoretical foundations; although applying the corporate social responsibility costs the corporate some fundamental expenses, it will, in the long run, lead to an improvement in the performance and financial/non-financial indexes because the corporate social responsibility will improve the consumers' perception, customers' long-run loyalty, corporate fame, more profit, more effective supervision of the corporate affairs, and more job satisfaction; all these factors will gain more intellectual capital (Memarzade Tehran and Vaziri Nezamdost, 2010). On the other hand, the corporates' effect on society is a universal concern, and the stakeholders' expectations from the economic units are increasing in the society (Hasas Yeganeh and Barzegar, 2014). Moreover, a revolution in information technology and the rapid progress of top technology have changed the universal economic growth pattern since 1990 (Chen et al., 2004).

Knowledge has (as the most important capital) taken the place of physical and financial capital in today's economy, a universal economy (Ghelichli and Moshabaki, 2006). A business environment, which is based on knowledge, requires an approach that contains the corporate's hidden new assets such as knowledge, human resources competence, innovation, communication with customers, organizational culture, systems, organizational structure, etc. In the same way, researchers and managers have grown interested in intellectual capital theory (Shaban, 2016). Also, in recent years, block holder ownership and its effect on corporate governance have become an essential issue in corporate governing literature due to their becoming common in most countries, especially among developing economies and the young Asian and European markets. With an increase in supervision, block holder ownership can cause positive changes in the corporate or, by creating information asymmetry, act vice versa. In this regard, a highlighted issue is that block holder shareholders and manager owners may use their controlling rights to gain personal profit and exploit the other shareholders.

These probabilities and uncertainty of the block holder ownership effect on the different corporate aspects cause various viewpoints concerning the behavior of block holder owners, and researchers have come to somehow contradictory conclusions. Therefore, one of the present study points for which we are seeking an explanation is the social responsibility and intellectual capital status of corporates with block holder ownership. Hence, according to the explanations offered by this study, we aim at answering the following questions: is there a significant relationship between corporate social responsibility disclosure and intellectual capital? And can block holder ownership affect the

relationship between corporate social responsibility disclosure and intellectual capital?

The structure of this paper is as follows: Section 2 presents the theory literature and hypotheses development. In Section 3, methodology including data gathering methods, variables, and the regression model are explained. In Section 4, empirical results are presented, and Section 5 is the conclusion and suggestions.

2. Literature Review and Hypotheses Development

Corporate social responsibility has been a remarkable concept in recent decades. This concept was first introduced more than 50 years ago, still with no clear standard definition. Nevertheless, its importance has progressively increased in universities and corporates in the past decades (Chaudhri 2014).

Various terms exist concerning corporate social responsibility: sustainability, business ethics, citizens' cooperation, and social responsiveness. However, the concept of corporate social responsibility has become the dominant paradigm of corporate management in recent years considering the growth of non-governmental organizations, movements protesting against the power of corporates, an increase in social awareness, capital market and corporations development, and financial and ethical scandals in large corporates; worldly-known large corporates have made social and environmental responsibility a part of their strategy (Babalola, 2012). Although corporate social responsibility has various definitions, all of them pinpoint the corporate's capability of protecting actions concerning the welfare of the workforce and the society (MellatParast and Adams, 2012). Corporate social responsibility is a comprehensive concept explaining the relation between business and society. It can serve as a tool for ethical guidance of the corporate, leading to its sustainable development (Safwat, 2015).

Nowadays, this concept is greatly pursued in developed countries and countries with an open economy by all effective institutes such as governments, corporates, urban society, international organizations, and scientific centers. Governments look at corporate social responsibility in terms of task allocation and stepping toward sustainable development as follows:

The corporates consider corporate social responsibility a kind of business strategy that adds to their credit in the highly competitive environment, leading to increased market share.

Urban society and non-governmental organizations ask for corporate social responsibility to become aware of the financial scandals and disasters.

International organizations believe that universal challenges cannot be overcome without the cooperation of the corporates because corporates are far more effective than governments in the modern world. Also, many statesmen are corporate managers somehow. Some contemporary researchers like Michelon et al. (2015) recommend others to perform a deeper study of CSR disclosures due to the incomplete and non-credible information provided by firms in the name of CSR reporting (Michelon et al., 2015). The disclosures mentioned come with a cost, and they need a considerable amount of time. However, if the disclosures accomplish the anticipated goals of being informational, management is usually not confident (Anwar and Malik, 2020). The concept of intellectual capital has been developed in the early 1980s in response to the need that was felt for business practitioners to comprehend the basis of organizational performance. The previous researches have also proposed many frameworks to explore intellectual capital and, also, to facilitate its operation at the enterprise level (Li et al., 2019).

Before detecting, managing, and measuring intellectual capital, we need to understand it. The

meaning of intellectual capital has always been vague; it has always had various definitions. Many people prefer using terms such as assets, performance stimulants, or resources instead of capital; they also prefer using hidden, knowledge-based, or non-financial instead of intellectual. Some professionals have quite different definitions, such as non-financial fixed assets with no physical existence (Marr and Moustaghfir, 2005). According to what was mentioned, different definitions have been proposed for intellectual capital, such as:

In Stewart's point of view, intellectual capital is a combination of knowledge, information, intellectual assets, competition, and organizational learning capable of being be used in wealth production. Based on the facts, intellectual capital comprises all employees, organizational knowledge, and capabilities to create added value that could lead to permanent competitive profit.

-Bontis defines intellectual capital as a set of hidden assets (resources, capabilities, competition) gained from organizational performance and creating value (Bontis, 1998).

-Edvinson and Malone define intellectual capital as "information and knowledge used in working to create value (Edvinson and Malone, 1997).

-Bontis and Holland, in their 2002 article, define intellectual capital as follows: intellectual capital shows storage of knowledge that exists in an organization at a specific point in time. In this definition, the relationship between intellectual capital and organizational learning is highlighted.

-Intellectual capital is a term showing the combination of the market hidden asset, intellectual asset, human asset, and sub-structural asset that enable the organization to do its activities (Brooking, 1996).

Intellectual capital, in the viewpoint of Roos et al. (1997), is composed of all processes and assets not normally shown in balance sheet also composed of all hidden assets (such as brand logo, registration, and productivity right, and brand name), which are considered substantial in modern accounting methods. In better words, intellectual capital is the combination of the knowledge of the organization's members plus its application.

Intellectual capital creates and adds value to organizational performance (Bhatti and Zaheer, 2008). Therefore, intellectual Capital (IC) has become the main mechanism in a company's capacity in order to stand out over competitors: that is because of its variable, widespread, and dynamic nature (Andreeva and Garanina, 2016; Verbano and Crema, 2016; Mendoza, 2017; Villegas González et al., 2017).

Blockholder ownership demonstrates a certain concentration in the company's ownership structure, where the ownership of the shares is concentrated in certain parties: the parties who have shares more than 5 percent. The company's management would be affected by this condition because the majority of the shareholders already have comprehensive access to company information. Another influential factor is thought to be the disclosure of corporate governance, which is the term of the board's office. The length of the term of office is closely related to the increasing experience and knowledge level. The higher level of experience and knowledge the board possesses is expected to increase further its ability to manage the company. Therefore, transparency is an indicator of good company management, which, in this case, is the disclosure of corporate governance (Dewayantoa et al., 2020).

In China, shares ownership is almost equally shared by the government, institutions, and local people. At the same time, in most developing countries, due to the limited private section and capital market, corporate supervision is done by families. As a result, considering the essence and concentration of shareholders ownership, the countries' corporate governing laws are relatively

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affected by these two factors (Davies, and Schlitzer, 2008).). Blockholders are considered to be large shareholders in a   company, according to Edmans (2014). Edmans (2014) believes that blockholders have a crucial role in governance because their shares in the company give the incentive to bear the costs incurred for monitoring activities.

Gallardo-Vázquez et al. (2019) concluded that CSR improves organizations' IC and that the resulting competitiveness is a source of legitimacy.

Zhao et al. (2019 (concluded a significant relationship between corporate social responsibility and competitive advantage.

Alfraih (2018 (concluded that corporate governing mechanisms have an intensive effect on intellectual capital disclosure quantity in annual reports of Karachi Stock Exchange corporates. Also, the corporates with more board director members, outdoor executive managers, and block holder ownership touch higher levels of intellectual capital disclosure.

Yu et al. (2017) showed that corporates with private and governmental ownership have a significant negative effect on the relationship between competitive advantage and corporate social responsibility.

Tantalo et al. (2012) showed that paying attention to 3 factors of social responsibility brings competitive advantage: environmental concerns, ethics, creating value for the customer.

Tsa et al. (2010 (concluded that activities related to social responsibility bring competitive advantage and can manage the customers' mentality regarding the organization.

Ismail (2010 (concluded that block holder ownership, governmental ownership, and audit committee could greatly affect the voluntary disclosure of intellectual capital in Egypt Stock Exchange corporates.

Oliviera et al. (2006 (concluded that block holder ownership significantly negatively relates with intellectual capital voluntary reports in Portugal Stock Exchange corporates.

Considering the theoretical foundations and researches mentioned above, the study hypotheses are:

Hypothesis 1: There exists a significant relationship between corporate social responsibility disclosure and intellectual capital.

Hypothesis 2: Block holder ownership significantly affects the relation between corporate social responsibility disclosure and intellectual capital.

3. Research Methodology

In terms of aim, this study is applied research and is correlational-descriptive in terms of methodology. To collect data and information, a library has been used. The theoretical foundations are taken from books, magazines, specialized Persian and Latin sites. The financial data needed is collected via the software Rahavard-e Novin and the website CODAL. The research population is composed of corporates accepted in Tehran Stock Exchange among all industries from 2011 to 2016. The statistical sampling was done based on systematic sampling in which the selected corporates belong to Tehran Stock Exchange considering the limitations mentioned below:

1. The end of the corporate financial year is every year's last day (December 31st) with no change.
2. The corporate should not be a financial corporate (such as investing corporates, holding, leasing, banks, and insurance institutes).
3. The corporate financial information must be accessible.
4. The corporate has to be listed on Tehran Stock Exchange throughout the research.
5. The corporate should not experience a business interval for more than 3 months.

Considering the above conditions, 147 corporates were selected as the population of the research. Therefore, using Multiple Regular Regression with the help of OLS, the research hypotheses were

investigated. Also, to test the research hypotheses, the software Eviews was used. Eviews software is used for analyzing common statistical and economic data such as (panel data analysis) and (time series estimation). It has been prepared from computational formulas and data communication technology with common simple exercises as a software package.

3.1. Research Variables and Measurement Method

According to the basic concepts presented in this study, variables are divided into 4 groups: independent, dependent, moderator, and controlling. They are as follows.

3.1.1. Independent Variable
3.1.1.1. Corporate Social Responsibility Disclosure

The independent variable of this study is the corporates' social and environmental information disclosure level. In order to measure it, the Content Analysis method was used. Content Analysis is a method of text coding to different groups considering pre-determined criteria; this method is extremely used in social and environmental information disclosure research. This method provides the researchers with a systematic approach to analyze huge non-structural data. In Content Analysis, the researcher has to use a coding checklist for evaluating the social and environmental information disclosure level (Aribi and Gao, 2010).

To measure the corporates' social and environmental information level disclosure, after extensive investigation of the literature review, the preliminary checklist of 43 kinds of information was written from the research done by Aribi and Gao (2010) and Gao et al. (2005). Having some cases omitted, the final checklist, containing 39 kinds of social and environmental information, was provided, which is expected to be disclosed, whether voluntarily or forcefully, in corporates' annual reports. Having the checklist written, the coding laws were determined: all of the disclosure subsections were clearly and practically defined in order to determine exactly each item properly belongs to which section and subsection. Thus, the totality of all of the disclosed items in the subsections of any disclosure section shows the corporate social and environmental information disclosure level. For instance, disclosure of 6 items in the environmental section, 4 items in the services and products section, 10 items in the human resources section, and 2 items in the energy section is considered: 22 social and environmental disclosure items on the whole for one year.

3.1.2. Dependent Variable
3.1.2.1. Intellectual Capital

According to Roos et al. (1997, (intellectual capital consists of all processes and assets not normally shown in the balance sheet. All hidden assets (such as brand logo, productivity and registration right, brand names) are paid attention to in modern accounting methods. In this study, Pulic Model (Pulic, 2000) was used to measure this variable as follows:

Pulic model contains 5 stages as the following:

Stage 1: Determining the Added Value

With the help of the information of the annual reports, added value is calculated as follows:

$$VA_{i,t} = OP_{i,t} + EC_{i,t} + D_{i,t} + A_{i,t} \qquad \text{(Equation 1)}$$

Where the variables are as follows:

$VA_{i,t}$: the added value of the corporate i in the year t.

$OP_{i,t}$: operational profit of the corporate i in the year t.

$EC_{i,t}$: the cost of employees (the information in the portable notes and financial sheets) of the corporate i in the year t.

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$D_{i,t}$: the corporate depreciation of the corporate i in the year t.

$A_{i,t}$: the depreciation of the hidden assets of the corporate i in the year t.

Stage 2: Determining the Physical Capital Efficiency.

Such efficiency can be calculated using the following equation:

$CEE_{i,t} = VA_{i,t}/CE_{i,t}$ (Equation 2)

$CE_{i,t}$: the (used) physical capital of the corporate i in the year t, which equals the book value of all corporate assets minus the hidden assets.

$CEE_{i,t}$: the physical capital efficiency of the corporate i in the year t.

Stage 3: Determining the Human Capital Efficiency

In this model, all employees' costs are considered human capital. The following equation calculates the human capital efficiency:

$HCE_{i,t} = VA_{i,t}/HC_{i,t}$ (Equation 3)

$HC_{i,t}$: the human capital of the corporate i in the year t, which equals all corporate wages and salary costs.

$HCE_{i,t}$: human capital efficiency of the corporate i in the year t.

Stage 4: Determining the Structural Capital Efficiency

Structural capital efficiency is calculated by the equation below:

$SC_{i,t} = VA_{i,t} - HC_{i,t}$ (Equation 4)

$SCE_{i,t} = SC_{i,t}/VA_{i,t}$ (Equation 5)

$SC_{i,t}$: the structural capital of the corporate i in the year t.

$SCE_{i,t}$: the structural capital efficiency of the corporate i in the year t.

Now, the intellectual capital efficiency could be calculated by the equation below:

$ICE_{i,t} = HCE_{i,t} + SCE_{i,t}$ (Equation 6)

$ICE_{i,t}$: the intellectual capital efficiency of the corporate in the year t.

Stage 5: Determining VAIC

The last stage is calculating VAIC as follows:

$VAIC_{i,t} = ICE_{i,t} + CEE_{i,t} = HCE_{i,t} + SCE_{i,t} + CEE_{i,t}$ (Equation 7)

$VAIC_{i,t}$: Value-added intellectual capital

3.1.3. Moderator Variable
3.1.3.1. Block Holder Ownership

In this study, to measure block holder ownership, the following instrument is used:

The percentage of the shares kept by block holder shareholders (the first 3 people own the highest percentage of ownership, more than 5 percent).

Then, according to the variable median index mentioned in the descriptive statistics table, the group above the median is considered code 1; the group below the median is considered code 0.

3.1.4. Controlling variables

SIZE = There are various criteria for measuring the corporate size variable, which are (The total assets, Sales amount, number of employees) The asset's natural logarithm is used as the corporate size (Chen et al., 2019).

LEV = LEV shows the amount of assets provided through debts and the cost of equity capital. In this study, the amount of debts compared with assets is used for measuring it (Chen et al., 2019).

ROA = Return of Assets gives us an idea about efficient management in relation to using the assets for producing benefit (productive assets); ROA is shown in percentage form. To measure ROA

$\frac{\text{Net Profit}}{\text{Total Asset}}$ is used (Kiyoung et al., 2019).

GROWTH = Sales growth index (income growth) tests the decrease or increase of the organization's income. This index is one of the most important instruments in every organization for observation, a key instrument in strategic decision making. In several periods, this index is observed for gaining a clear criterion of the corporate growth trend. This index helps you calculate the corporate income ups and downs on a monthly or seasonally basis. At the highest level, the income growth index is used by the sales manager and executive managers for evaluating the organization sales output, and $\frac{\text{Sales New Year - Sales Old Year}}{\text{Sales Old Year}}$ is used for measuring it (Chen et al., 2019).

ω = Is the rest of the model.

4. Results

In this section, the descriptive and deductive statistics are dealt with in connection with the study data analysis.

4.1. Descriptive Statistics

In this section, the data analysis has been done using central indexes such as mean and scatter indexes such as standard deviation and max and min.

Table 1. Variables Descriptive Statistics

Variables	Min	Max	Median	Mean	Standard Deviation
Continuous Variables					
IC	-4.004	305.043	8/573	22/583	49.831
CSR	0.154	0.667	0.410	0.420	0.112
SIZE	4.959	7.878	6.042	6.140	0.629
LEV	0.170	1.131	0.619	0.613	0.211
ROA	-0.213	0.455	0.101	0.114	0.138
GROWTH	-0.491	1.249	0.167	0.195	0.348
Synthetic Variable					
BHO	Num. of 0	405	Num. of 1		404

The most important central index is the mean that states the balance point and distribution center and is a good index for showing the data concentration. The standard deviation is one of the most important scatter parameters, and a criterion for the amount of observation scatter from the mean. For example, considering the results of the table mentioned above, the corporate intellectual capital variable mean equals 22.583 that shows that most of the data is concentrated at this point, and its standard deviation equals 49.831. In other words, the amount of standard deviation shows that the scattering of the intellectual capital amounts at the mean equals 49.831.

4.2. Deductive Statistics

Testing the first hypothesis

IC $_{it+1}$ = α_0 + α_1 CSR$_{it}$ + α_2 SIZE$_{it}$ + α_3 LEV$_{it}$ + α_4 ROA$_{it}$ + α_5 GROWTH$_{it}$ + ω_{it}

Regression model (1)

That in this model:

α: It shows constant in the model, IC $_{it+1}$: It shows corporates intellectual capital, CSR$_{it}$: It shows corporates corporate social responsibility disclosure, SIZE$_{it}$: It shows corporates size, LEV$_{it}$: It shows corporates leverage, ROA$_{it}$: It shows corporates return of assets, GROWTH$_{it}$: It shows corporates sales growth index, + ω_{it}: It shows rest of the model.

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In the following sections, the above hypothesis is tested.

4.3. Investigation of the classic regression hypotheses

To estimate the regression model parameters, the classic regression hypotheses test is of great importance. Some of those important hypotheses are the hypotheses related to the investigation of normal distribution of model errors with zero means, lack of self-correlation, lack of linearity, and homology variance of model errors. The normal distribution of model errors with zero means shows that the error distribution is somehow similar to normal distribution; considering the number of observations, one can accept the normality of error distribution. In order to detect the lack of self-correlation between residuals because estimating the model is not time series and considering the role of time using the controlling variables, this hypothesis is not true. On the other hand, about investigating linearity, considering the results of tables 2, 3, and 4, because VIF is less than 5 for all independent variables, this hypothesis is accepted. Finally, to investigate the existence of homology variance between residuals, considering that fortified White's variance is used in estimating research models, this hypothesis is accepted.

4.4. The Results of Estimating the Research First Model

Because all classic regression hypotheses are proved, results can be trustworthy. The results of estimating the research model are shown in Table 2. According to Table 2 results, F-statistic is 30.315, and its significance is less than 0.05. Therefore, the totality of the regression model is accepted; it means that there is a significant relationship between dependent and independent variables, and at least one independent variable has a significant relationship with the dependent variable. The summary of regression model (1) results is shown in Table 2:

Table 2. The Results of Estimating the Research First Model

Variables	Coefficient	Standard Deviation	T-statistic	Significance	VIF
β0	-63.345	5.585	-11.343	0.000	
CSR	-8.917	3.556	-2.508	0.012	1.135
SIZE	12.948	1.062	12.188	0.000	1.481
LEV	-4.465	3.104	-1.438	0.151	2.060
ROA	48.128	4.747	10.138	0.000	1.755
GROWTH	0.133	1.433	0.093	0.926	1.442

F-Statistic	F-Significance	R^2 model	Adjusted R^2	Num. of Observations
30.315	0.000	0.452	0.445	738

The social responsibility variable coefficient has a negative amount of -8.917, and its T-statistic is -2.508. Because the absolute value of the T-statistic is bigger than 2 and so its significance level is less than 0.05, one can accept that there is a negative and significant relationship between social responsibility and the intellectual capital of the corporate. In other words, there is a negative and significant relationship between social responsibility and corporate intellectual capital; as a result, the first hypothesis of the research is accepted. The corporate size variable coefficient equals 12.948. Because the significance level is less than 0.05, the zero hypotheses (that the coefficient is zero) are not confirmed. In other words, this coefficient is significant at the error level of 5 and has an effect different from zero on the intellectual capital variable; one can say that the corporate size affects the intellectual capital. Also, the leverage ratio variable coefficient equals -4.465. Because the significance level is more than 0.05, the zero hypothesis (that the coefficient is zero) is confirmed. In other words, this coefficient is not significant at the error level of 5 and does not have an effect different from zero on the intellectual capital variable; one can say that the financial leverage does

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not affect the intellectual capital. ROA variable coefficient equals 48.128. Because the significance level is less than 0.05, the zero hypotheses (that the coefficient is zero) are not confirmed. In other words, this coefficient is significant at the error level of 5 percent and has an effect on the intellectual capital variable different from zero; one can say that ROA affects intellectual capital. The sales growth variable coefficient equals 0.133. Because the significance level is more than 0.05, the zero hypotheses (that the coefficient is zero) are also confirmed; in other words, this coefficient is not significant at the error level of 5 percent and does not affect the intellectual capital variable differently from zero. One can say the sales growth does not affect the intellectual capital. Also, the model adjusted R^2 shows that about 44 percent of the dependent variable changes are stated by controlling and independent variables.

Testing the second hypothesis

$IC_{it+1} = \alpha_0 + \alpha_1 CSR_{it} + \alpha_2\ BHO_{it} + \alpha_3\ CSR_{it} * BHO_{it} + \alpha_4\ SIZE_{it} + \alpha_5\ LEV_{it} + \alpha_6\ ROA_{it} + \alpha_7\ GROWTH_{it} + \omega_{it}$

Regression model (2)

That in this model:

α: It shows constant in the model, IC_{it+1}: It shows corporates intellectual capital, CSR_{it}: It shows corporates corporate social responsibility disclosure, BHO_{it}: It shows block holder ownership, $SIZE_{it}$: It shows corporates size, LEV_{it}: It shows corporates leverage, ROA_{it}: It shows corporates return of assets, $GROWTH_{it}$: It shows corporates sales growth index, $+\omega_{it}$: It shows rest of the model.

4.5. The results of estimating the research second model with low block holder ownership

Because all the classic regression hypotheses are proved, the results can be trusted. The results of estimating the research model are stated in Table 3. According to Table 3 results, F-statistic is 13.755, and its significance is less than 0.05. As a result, the totality of the regression model is accepted. There is a significant relationship between dependent and independent variables, and at least one independent variable has a significant relationship with the dependent variable.

Table 3. Results of estimating the research second model in companies with low block holder ownership

Variables	Coefficient	Standard Deviation	T-statistic	Significance	VIF
β_0	-72.421	8.889	-8.147	0.000	
CSR	-16.422	6.810	-2.411	0.016	1.530
SIZE	14.899	1.627	9.160	0.000	1.542
LEV	-9.372	5.662	-1.655	0.099	1.351
ROA	81.249	12.563	6.467	0.000	1.453
GROWTH	4.118	3.366	1.223	0.222	1.424
F-Statistic	F-Significance	R^2 model	Adjusted R^2	Num. of Observations	
13.755	0.000	0.476	0.463	385	

The social responsibility variable coefficient is negative and equals -16.422, and the T-statistic related to it equals -2.411. Because the absolute value of the T-statistic is more than 2, and consequently its significance level is less than 0.05, one can accept that there is a negative and significant relationship between this variable and the corporate intellectual capital in companies with low block holder ownership. The corporate size variable coefficient equals 14.899. Because the significance level is less than 0.05, the zero hypotheses (that the coefficient is zero) are not confirmed. In other words, this coefficient is significant at the error level of 5 and has an effect on the intellectual capital variable different from zero; one can say the corporate size affects the intellectual capital. Moreover, the leverage ratio variable coefficient equals -9.372. Because the significance level is more than 0.05, the zero hypothesis (that the coefficient is zero) is confirmed. In other words, this

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coefficient is not significant at the error level of 5 and does not have an effect on the intellectual capital variable different from zero; one can say that the financial leverage does not affect the intellectual capital. ROA variable coefficient equals 81.249. Considering that the significance level is less than 0.05, the null hypothesis (that the coefficient is zero) is not confirmed; in other words, this coefficient is significant at the error level of 5 percent and affects intellectual capital differently from zero. Therefore, one can say that ROA affects intellectual capital. The sales growth variable coefficient equals 4.118. Bearing in mind that the significance level is more than 0.05, the zero hypotheses (that the coefficient is zero) are confirmed; in other words, this coefficient is not significant at the error level of 5 percent and does not have an effect on intellectual capital variable different from zero. Therefore, one can say the sales growth does not affect the intellectual capital. Also, the model adjusted R^2 shows that about 46 percent of dependent variable changes are stated by controlling and independent variables.

4.6. The results of estimating the research second model with high block holder ownership

Because all the classic regression hypotheses are proved, the results can be trusted. The results of estimating the research model are presented in Table 4. According to Table 4 results, it can be observed that F-statistic is 18.827, and its significance is less than 0.05. As a result, the totality of the regression model is accepted. Furthermore, there is a significant relationship between dependent and independent variables; at least one independent variable has a significant relationship with the dependent variable.

Table 4. Results of estimating the research second model in companies with high block holder ownership

Variables	Coefficient	Standard Deviation	T-statistic	Significance	VIF
β0	-33.135	5.508	-6.016	0.000	
CSR	-8.157	5.353	-1.524	0.128	1.615
SIZE	6.920	1.088	6.362	0.000	1.702
LEV	1.190	3.816	0.312	0.755	3.319
ROA	43.456	5.404	8.042	0.000	2.620
GROWTH	3.089	1.884	1.639	0.102	1.707

F-Statistic	F-Significance	R^2 model	Adjusted R^2	Num. of Observations
18.827	0.000	0.335	0.318	392

The social responsibility variable coefficient is negative and equals -8.157, and the T-statistic related to it is -1.524. Because the absolute value of the T-statistic is less than 2 and its significance level is more than 0.05, one cannot accept a negative and significant relationship between this variable and the corporate intellectual capital in the companies with high block holder ownership. The corporate size variable coefficient equals 6.920. Because the significance level is less than 0.05, the zero hypotheses (that the coefficient is zero) are not confirmed. In other words, this coefficient is significant at the error level of 5 percent has an effect on the intellectual capital variable different from zero; one can say that the corporate size affects the intellectual capital. Moreover, the leverage ratio variable coefficient is 1.190. because the significance level is more than 0.05, the zero hypotheses (that the coefficient is zero) is confirmed; in other words, this coefficient is not significant at the error level of 5 percent and does not have an effect on intellectual capital variable different from zero; one can say the financial leverage does not affect the intellectual capital. ROA variable coefficient is 43.456. Because the significance level is less than 0.05, the zero hypotheses (that the coefficient is zero) are not confirmed; in other words, this coefficient is significant at the error level of 5 percent and has an effect on the intellectual capital variable different from zero. Therefore, one can say that ROA affects intellectual capital. The sales growth variable coefficient is 3.089. Because

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the significance level is more than 0.05, the zero hypothesis (that the coefficient is zero) is confirmed; in other words, this coefficient is not significant at the error level of 5 percent and does not affect the intellectual capital variable differently from zero. Therefore, one can say that sales growth does not affect intellectual capital. Also, the model adjusted R^2 shows that about 31 percent of the dependent variable changes are stated by controlling and independent variables.

To investigate the moderation role, Clogg et al.'s Coefficients Compare Test (1995) is used. The results of this test are shown in Table 5:

Table 5. Results of moderation role in the research second model

High block holder ownership	Low block holder ownership	Description
-8.157	-16.422	Social Responsibility Coefficient Variable
5.353	6.810	Standard Deviation Coefficient
8.265		Coefficients of Difference
0.496		Standard Deviation
16.667		T-statistic
0.000		Significance

Based on Table 5 results, it can be observed that T-statistic is positive. Therefore, in companies with high block holder ownership, social responsibility is more effective on intellectual capital. And because the significance of the T-statistic is less than 0.05, one can accept the existence of the moderation role of block holder ownership variable. As a result, the second hypothesis is accepted at the level of block holder ownership. In the end, a summary of the results of the hypotheses investigation is shown in Table 6:

Table 6. Summary of the results of the hypotheses investigation

Results	Hypothesis
Accepted	There exists a significant relationship between corporate social responsibility disclosure and intellectual capital.
Accepted	Block holder ownership has a significant effect on the relation between corporate social responsibility disclosure and intellectual capital

5. Conclusion

The first hypothesis stated a significant relationship between intellectual capital and corporate social responsibility disclosure. As observed in regression analysis, the significance level of the corporate social responsibility coefficient is less than 5 percent in the first model. Hence, the corporate social responsibility coefficient is significant. It means that corporate social responsibility can affect intellectual capital. Therefore, there is a significant relationship between intellectual capital and corporate social responsibility, and the research first hypothesis is accepted. In elaborating the results of this hypothesis, one can point to the fact that the corporates' social responsibility programming is done to bring sustainable value for the society, all stakeholders, and shareholders, and this programming offers methods that the corporates can use in business. Corporate social responsibility is an important dimension of management fundamental theories and literature review. Although applying the social responsibility puts the burden of some fundamental expenses on the shoulders of the corporate, it will, in the long run, lead to an improvement in performance and financial/non-financial indexes of the corporate because the corporate social responsibility causes the improvement of consumers' perception, the customers' long run loyalty, the corporate fame, more profitability, a higher brand name, safer and healthier workforce, more effective supervision of the corporate affairs,

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and more job satisfaction; all theses will increase the intellectual capital gain. However, Iranian corporates do not understand the importance of social responsibility; therefore, there is a negative and significant relation between intellectual capital and corporate social responsibility disclosure. The results of this hypothesis are in agreement with the research results of Gallardo-Vázquez et al. (2019), Zhao et al. (2019), Yu et al. (2017), Tantalo et al. (2012), and Tsa et al. (2010).

The second hypothesis stated that block holder ownership significantly affects the relation between intellectual capital and corporate social responsibility disclosure. As observed in regression analysis, the significance level of the block holder ownership coefficient is less than 5 percent in the second model; therefore, the block holder ownership coefficient is significant; it means that block holder ownership can affect the relationship between intellectual capital and the corporate social responsibility disclosure. Hence, block holder ownership significantly affects the relation between intellectual capital and corporate social responsibility disclosure, and the research second hypothesis is accepted. According to this hypothesis elaboration, one can point to the fact that the relationship between intellectual capital and the corporate social responsibility disclosure is strengthened in which many block holder shareholders build the shares structure. This hypothesis results are in agreement with the results of researches done by Alfraih (2018), Ismail (2010), and Oliviera et al. (2006). Therefore, based on the results gained by testing the research hypotheses, the following topics are suggested to future researchers: Making the social responsibility operate in the corporates in order to gain intellectual capital needs development of a new culture because the corporate culture directs the business, therefore, the exchange corporates managers had better pay attention to this fact. And the managers of the exchange corporates in which many block holder shareholders build the shares structure should know that such shares structure does not bring intellectual capital for the corporate. Hence, a proper distribution has to be done in the shareholder's construction. Also, the shareholders who intend to buy the shares of corporates in which many block holder investors build the shares structure are advised not to do so because buying such corporates' shares does not properly gain intellectual capital.

Acknowledgments

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The Relationship between Auditor's Narcissism and Expectation Gap with Audit Fees: Evidence from an Emerging Market

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Abstract

The present study aims to assess the relationship between auditor's narcissism, expectation gap, and audit fee in listed firms on the Tehran Stock Exchange. In other words, this study attempts to answer the question of "whether a narcissistic auditor contributes to the expectation gap and the amount of fee or not." The multivariate regression model is used for hypothesis testing. The study's hypotheses were also tested using a sample of 768 listed year-firm on the Tehran Stock Exchange during 2012-2017 by applying the panel data approach and employing the fixed effects model. The obtained results also indicate that there is a positive and significant relationship between auditor's narcissism and expectation gap and a negative and significant relationship exists between auditor's narcissism and audit fee, which means that the increase of narcissistic features in an auditor would increase the expectation gap between auditor and users. In contrast, the presence of such features in the auditor affects its payment. Moreover, the results of hypothesis testing show that there is a negative and significant relationship between auditor change and audit expectation gap. This study utilized an empirical model for evaluating the audit expectation gap and the variable of signature magnitude for measuring narcissism. Further, this paper is the first study to assess such a relationship. Hence, the present study contributes to developing science and knowledge in this field and helps lawmakers present more effective standards and regulations based on society's needs and the obtained results.

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1. Introduction

Financial statements are a tool for shareholders, investors, creditors, the State, and society. The audit report provides the management based on the approved financial statements. These reports deliver plausible trust for the users, so the users expect the auditors to present honest reports to make sound economic and financial decisions. Users consider the auditors their agents. After the financial collapse of the 1970s and 1980s (like the insurance firm in Los Angles in 1973, the collapse of Securities of Penn Bank in 1982, 340 billion dollars scam in the American Stock Exchange) (Ojo et al., 2016), the audit profession has been criticized widely by the users. Moreover, the financial scandal of Enron, as the leading company in America based on the poll of the Fortune Magazine from most of the well-known companies (Mansur and Tangl, 2018), has led to the failure of the company within a year and its stock price went to 0 (Healy and Palepu, 2003). After Enron, WorldCom was the second largest communication company in the U.S. that faced failure (Handley-Schashler and Li, 2007). The consequences of all these breakdowns and events caused the auditors to face legal petitions (Ojo et al., 2016), which brought about an expectation gap between shareholders and external auditors (Mansur and Tangl, 2018). Audit scandals are the starting point for investigating auditors' ethical principles that influence their credits (Ardelean, 2013). Most of the beneficiaries believe that auditors should assess all the documents to recognize any possible error or fraud (Messier, Glover & Prawitt, 2005; Timothy Louwers et al.,2011). Some others also expect the auditor to present the audit report and interpret the financial statements for the users so that they can assess whether the firm under study is appropriate for investment. They also expect the auditors to carry out some of the audit policies while performing their duty (like the firm's main function in supervising the firm affairs, getting involved in management supervision, and tracking illegal actions or fraud in the management section). Such heightened societal expectations from auditing created a preposterous gap between auditor and society (Salehi, 2016). The audit expectation gap phenomenon is a leading issue that has been discussed from the mid-1970s to the present in the audit profession (Ojo et al., 2016). The objectives of the conducted empirical studies in this field are detecting the auditors' current and expected duties and the factors that generate such an expectation gap (Füredi-Fülöp, 2015).

This study aims to assess the psychological feature of auditor narcissism on the expectation gap and audit fee. In other words, we attempt to figure out whether this psychological feature contributes to the expectation gap and audit fee or not. And in the case of an effect, we have to specify whether the effect is direct or inverse. Moreover, by obtaining the result of the study, we should take some steps toward strengthening or decreasing such a psychological feature by lowering the expectation gap to secure the auditor's expectations from society and vice versa. Finally, we should minimize the gap, which means the users should make the best and the most reliable economic decisions. The auditors should also be able to do their best because each profession aims to improve performance. The increase in performance is itself a function of work quality increase. According to the studies of Hoitash, Markelevich, and Barragato (2007), Simunic and Stein (1987), Davis, Ricchiute and Trompeter (1993), O'Keefe, King and Gaver (1994), Choi et al. (2010), Callen and Siregar (2012), audit fee increases along with the increase in audit quality. In addition, since the audit expectation gap is measured qualitatively in the recent studies (Pourheydari and Abousaiedi, 2011; Salehi, 2016; Masoud, 2017), this project is the first study to change the measurement criteria and assess the gap quantitively.

2. Theoretical Principles, Literature, and Hypothesis Development
2.1. Narcissistic auditor

Narcissism is a moral character with positive or negative or even direct impacts on the decisions of individuals. Elis introduced the phenomenon in 1898 in psychology and psychiatry (Aabo and

Bang Eriksen, 2017). According to American Psychiatric Association (1994), narcissism is a severe characteristic syndrome that includes a sense of pride in oneself, striving for unlimited power and merit, weak continence, inability to bear criticism, lack of sympathy, and multiple cooperation. Hence, narcissism is a multifaceted personality trait that coexists with a sense of dominance and inclination to be engaged in others' behavior (Olsen and Stekelberg, 2015).

Campbell et al. (2011; 2005) declare that narcissism is a stable and multidimensional personal characteristic that includes magnification, self-conceit, and pretension. Raskin and Terry (1988) posit that narcissism is specified using the following seven components: power, flamboyance, dominance, pride, stability, merit decrease, and self-sufficiency, so such a psychological characteristic in an individual can contribute to his/her performance. The motive may be created by a sense of dominance and flamboyance, which causes the individual to attempt to achieve more success and show him/herself. Besides, since the individual believes that he/she is better than others, this feature may lead to more benefits for the narcissistic person, which means seeking to maximize the interests by the minimum of attempt. Hence, realizing the type of effect of psychological features in the current era is a matter of the utmost importance. This trait can erupt in the behavior or performance of an individual.

2.2. Audit expectation gap

Firms have changed extensively along with the development of communities, the escalation of industries, and economic growth. In line with the booming economy and the complication of business procedures, firms sought experienced accounting staff to align their financial activities with accounting regulations and standards. Audit firms established, in the meanwhile, to act as a supervisor on the financial performance of the firms to, in addition to giving credit to financial statements of a business firm, on the one hand, lower the chance of fraud and on the other hand, as the agent of people, to assure them by the audit reports that the included information of the financial statements has no distortion. Wallace (1987) also declares that auditing determines the quality of reported financial information and provides special quality and economic benefits for the organization and external members. Hence, the formation of audit firms ensured the users of financial statements that audit report, without any secrecy, indicates the firm's financial status. So they would be able to make the best financial decisions in that auditing is an independent and systematic process to determine whether the existing activities and their performance are officially compatible with planning requirements or not. Therefore, the presence of the auditing profession is beneficial both for the firms and users. It is considered an important section of today's world's commercial settings in each country's legal status (Gbadago, 2015). Auditing is a kind of social performance (Flint, 1998) because auditors' role changes in line with the needs and demands of individuals and groups (Porter, Simon, and Hatherly, 2005). During the 1840s to 1920s, auditors' role was mainly concentrated on detecting frauds (Masoud, 2017). However, from the 1920s to the 1960s, the primary aim of auditing has changed from detecting fraud and errors to give credit to financial statements (Lee and Ali, 2008). The empirical studies of the 1970s and 1980s by Lee (1970), Beck (1973), Steen (1990), Porter (1991), and Porter and Gowthorpe (2004) show that most people still believe that the main role of an auditor is to detect fraud (Masoud, 2017), while the main role of independent auditing is to give credit to financial statements (Behzadian and Izadi Nia, 2017). Following the serious failures of the recent decades, auditing has gained great importance because large audit firms did not expect to experience such great failures, which has caused the users of financial statements to change their opinion about the auditors. These failures show that there is a difference between what people expect from auditors and what the auditors do, and this has motivated the auditors to study the gap, more precisely, to the

point that Liggio (1974) has used the term "expectation gap" between user and auditor for the first time. On the other hand, a proportion of this distance can be due to the public expectation from the auditing role and the objectives the audit profession is expected to reach. Another proportion can stem from evaluating the quality of audit services (Behzadian and Izadi Nia, 2017). Hence, Porter (1993) also indicates that weak performance, insufficient standards, and illogical expectations are among the factors that lead to creating the audit expectation gap (Masoud, 2017). Moreover, Pierce and Kilcommins (1996) and McEnroe and Martens (2001) also declare that this gap is due to erroneous interpretation and misunderstanding about audit performance and the role of auditors by the users. However, the existing evidence shows that the user of financial statements and public people are not informed of auditors' responsibilities at the macro level, which would lead to an audit expectation gap (Gbadago, 2015). The term "expectation gap" has been used in conventional studies since the 1970s, and since then, the evidence has shown that there is a gap between the expectation of individuals (Gbadago, 2015). In this regard, Liggio (1974) defined the expectation gap as a difference between the expected performance level of independent auditors and users' predicted financial statements. Various definitions are provided, so far, on the audit expectation gap. For example, the Cohen Commission (1978) claims that this distance is the difference between people's beliefs and demands and what the auditor can logically perform. Besides, Guy and Sullivan (1988) define the audit expectation gap as the difference between public opinions and responsibilities and auditors' beliefs from their roles. In other words, such a distance in expectations is related to the complication and misunderstanding about nature, objective, and capabilities of the auditor, which is observable in the society (Porter, 1993). Dennis (2010) explains the audit expectation gap as the difference between users' and auditors' beliefs and needs. Dibia (2015) believes that there is an expected gap between auditors and users of audit services, which elucidates the opinions about auditors' duties and responsibilities and the sent messages of audit reports. Lazarus Elad (2017) also posits the expectation gap between beliefs and inclinations between auditors and public people about auditors' duties and responsibilities. In other words, the expectation gap is the difference between what people and users of financial statements perceive the auditor's role and what the audit profession expects from the auditors during the project. Regardless of the users of financial statements and public people, auditors may face some different or even worse interpretations than the audit profession (Ojo et al., 2016). In other words, we can claim that the reason for such a distance is both the auditors and users of financial statements. Therefore, it is important to consider the entire domain of the audit expectation gap to lower society's expectations and improve the perceived performance of the users (Porter, 1993).

2.3. The relationship between auditor's narcissism and audit expectation gap

According to the agency theory, an auditor presents as the agent of shareholders in business firms to minimize the conflict of interests between manager and owners, so the audit process should benefit from a high quality to enable the users to decide based on the obtained report (Jensen and Meckling, 1976). When the audit does not have the required quality, others' expectations from audit performance are more, so being familiar with the contributing factors to the audit quality is of great importance for the audit profession. Audit quality which determines the audit performance, depends on a variety of factors, including auditors' capabilities such as knowledge, experience, adaptability power, technical efficiency, and professional performance, independence, impartiality, professional care, conflict of interests, and professional judgment (Behzadian and Izadi Nia, 2017). One of the other determining factors to the performance is personal factors (Bonner and Sprinkle, 2002). The psychological characteristics of people are among the personal factors, and narcissism is one of them. People face some situations during their lifetime that they have to decide. People's decisions in their lives and under different situations are influenced by their needs, interests, tastes, and moral and psychological

characteristic. We can claim that such factors contribute directly to the decisions of people. Today, the considerable effect of people's psychological characteristics on their performance is obvious, so one of the requirements of this period is to realize the psychological traits and their effects. Accordingly, the firm or the auditor of an organization is obliged to decide during their term of service, which contributes to the firm's performance, investors, and others because auditing is a judgmental process. The auditor should make some decisions judgments. As mentioned previously, people's decisions are influenced by their psychological characteristics called narcissism in psychology. Thus, the narcissism of people, auditors, and managers may contribute to their major decisions. The audit quality measures an auditor's performance, and in case audit quality is acceptable, it can meet the users' major information needs. In other words, a high-quality auditor can cover the expectations of society. These expectations may be divergent because people in the society have different and contradictory information needs, each of whom expects differently from the auditor and their related occupation. Presently, the expectation gap exists between auditor and people, and the auditor and him/herself is called the audit expectation gap. Audit quality is one factor that directly impacts the audit expectation gap if the gap is decreased. Audit quality is derived from the quality of judgment and auditors' decisions. Consequently, auditors should be responsible for their performance and the result of audit reports because auditors' capability to overcome different situations and make high-quality judgments relies on their attempts to improve efficiency (Salehi and Dastanpoor, 2018). Iskandar et al. (2012) declare a series of motivational factors for improving such judgments that affect the audit quality. These motivational factors are divided into two internal and external motivations (Salehi and Dastanpoor, 2018). Hence, narcissism can be named an internal motivational factor in an auditor, affecting decision-making, judgment, and performance. When an auditor benefits from a high level of narcissism, this may affect the audit judgment of the client's performance and lead to incorrect and partial reports about the firm performance (Banimahd, Dianati Dilami, and Javanmard, 2013). Bonner and Sprinkle (2002) also state that an auditor's performance is influenced by three personal, environmental, and acquired skills factors. Narcissism is among the personal and intrinsic factors of people. Most of the studies on accounting, like Cohen et al. (2010), indicate that narcissism is positively associated with recent frauds and scandals. Hence, one of the required measures for decreasing the audit expectation gap is to assess the auditor's psychological characteristics, be familiar with them, and be informed of the impact of these features on the audit expectation gap. However, moral regulations cannot attract public trust individually, and users should regulate moral behavior and interpret the standards as much as possible (Ardelean, 2013). Moreover, according to Zhuang (2018), the partner's narcissism increases the audit quality considerably by increasing the auditor's independence instead of the auditor's qualification.

Accordingly, realizing an auditor's psychological characteristics and the effect of such characteristics can improve the auditor's performance and finally lower the expectation gap from the auditor's side. Among the psychological characteristics, we can refer to narcissism. Numerous studies are conducted in this field during the 1970s to present, including Humphrey, Moizer, and Turley (1992); Beattie, Brandt, and Fearnley (1998); Best, Buckby, and Tan (2001); Gbadago (2015); Salehi (2016); Behzadian and Izadi Nia (2017); Mansur and Tangl (2018) but no study is carried out, so far, on the impact of psychological effects of the auditor on audit expectation gap. Hence, this study aims to assess the effect of narcissism on the expectation gap as a psychological factor. In fact, by testing the effect of psychological characteristics on the auditor's expectations from his/her duties, we attempt to specify whether the auditor's expectations are influenced by narcissism or not and, if yes, is this effect positive or negative. By specifying the test result, we can put some steps to strengthen or weaken narcissism. Since this is the first study to evaluate the effect of an auditor's psychological

characteristics on his/her expectations, the results of this study can contribute greatly to the field and the users of audit reports. The following studies are conducted in this field: Anderson, Lowe, and Reekers (1993), De Martinis, Aw and Meng Kim (2000), and Olagunju and Leyira (2012) show that social understanding of the duties of auditors is different from what the rules and regulation proposed about the public duty of an auditor. Moreover, Taebi Noghondari and Yua Foong (2013); Kumari, Ajward, and Dissabandara (2017); Lazarus Elad (2017); Mansur and Tangl (2018) perceive that training and experience of auditors decrease the audit expectation gap considerably. Banimahd, Dianati Dilami, and Javanmard (2013) observe that the level of narcissism among auditors is different in the private section, while in the public section, such a difference is not considerable. Moreover, in the private section, the young generation of auditors' level of narcissism is more than the old generation. Operu (2016) determined a positive correlation between the audit expectation gap and the investor's understating. Gbadago (2015) discover that the audit expectation gap is even observable among the senior students of accounting. Pourheydari and Abousaiedi (2011) find that the audit expectation gap exists in the areas of auditor responsibility, fraud detection, the accuracy of internal controls, and providing financial statements. Moreover, there is a significant relationship between users and independent auditors concerning the reliability and application of audited financial statements. The quantitative results from audit performance can be attributed to the culture of trust among auditors and shareholders. Enes et al. (2016) declare that audit training does not lead to the decline of the expectation gap but will change students' views concerning auditors' responsibility for preventing and detecting errors, frauds, and illegal actions. Salehi (2016) finds that there is an expected gap between auditors and investors in Iran. Behzadian and Izadi Nia (2017) discover that auditors' expertise and experience, which are among the contributing factors to audit quality, have no impact on the audit expectation gap, while the size and quality of audit firms are under the influence of the amount audit expectation gap. Boterenbrood (2017) argues that monetary levels (significance level) proposed by the provider of financial statements of business firms are of less importance to the auditors. Masoud (2017) declares that basic evidence exists of audit expectation gap among the undergraduate students of state-owned and private universities concerning auditors' roles and responsibilities. Zhuang (2018) reveal that real audit quality increases along with partner narcissism. This study shows that changes in audit quality are positively associated with the changes in partner narcissism due to the auditor's compulsory rotation and that audit quality does not affect the signature size of the partner. Moreover, the auditor's narcissism on audit quality is more evident when the client is larger, and the auditor is linked with his/her executive managers. Partner narcissism significantly improves audit quality growth by increasing the auditor's independence instead of the auditor's qualification. Further, the results illustrate that the narcissistic partner's role in audit quality is trivial in four big audit firms that benefit from powerful quality control structures and standardized audit methods. This limits the scope of characteristics of the level of partnership to a specific topic. In addition, although the narcissistic partner has no tangible impact on the type 1 error report and lowers the chance of type 2 error, it is less probable that narcissistic partners sacrifice their independence.

Given the abovesaid facts, the first hypothesis of the study is as follows:

H_1: There is a significant relationship between the auditor's narcissism and the audit expectation gap.

2.4. The relationship between auditor's narcissism and audit fees

Based on the economic theory of transaction costs, which creates the basic assumption of opportunism, people attempt to maximize their benefit and desirability (Cyert and March 1963). This causes the people to make some decisions for increasing their benefit, though such decisions may not be logical or correct. Hence, the auditor's performance may be under the influence of the amount of

fee to gain personal benefit, so this will affect the quality of the audit report. Consequently, being familiar with the contributing factors to audit fees is an important measure affecting the auditor's performance. The audit fee reflects the effort and risk of the auditor (Kusano and Sakuma, 2019). Hence, the audit fee decreases by extending the competition level, and the level of proceedings will also be minimized, the result of which is presenting a low-quality audit report. The amount of audit fees is not fixed, and several factors are included throughout the years (Lyubimov, 2019). Narcissism is one of the psychological factors of people that can contribute to the selection of people. The auditor is not an expectation of the case. An auditor with narcissistic features probably claims that he/she is qualified for a higher fee or even to prioritize his/her interests over the interests of others. Hence, this causes the auditor to ask for higher fees for his/her performance. Furthermore, when the auditor is supposed to receive a lower fee, this feature would cause him/her to lower his/her level of proceedings, which would debilitate the audit quality. Thus, this study attempts to prove that a narcissistic auditor can contribute to the received fee. Cheng, Mitra, and Song (2017) conclude that audit fee are negatively associated with the firm level. By increasing the union rate, audit fees will be lower. Moreover, Hoitash, Markelevich and Barragato (2007); Simunic and Stein (1987); Davis, Ricchiute and Trompeter (1993), O'Keefe, King and Gaver (1994); Callen and Siregar (2012) also figure out that the higher the audit quality goes, the higher the audit fee would be. Salehi, Jafarzadeh, and Nourbakhshhosseiny (2017) discover that during the sanctions of 2010 in Iran, commercial firms tried to lower the audit fee. Bryan, Mason, and Reynolds (2018) figure out that there is a negative (positive) relationship between income correlation (fluctuations) and audit fees. Moreover, the relationship between income correlation and audit fee is weak for industry-specialized auditors. Gul et al. (2018) perceive that higher managerial capability increases the audit fee in firms with financial problems and decreases audit fees in firms with no financial problems. Mohammadi, Kardan, and Salehi (2018) find a significant relationship between cash inventory and audit fees. In addition, they observe no significant relationship between cash properties, investment opportunities, and audit costs. Al-Najjar (2018) noticed that corporate governance mechanisms are of the utmost importance in determining the audit fee. Moreover, board independence, audit meeting, and board size positively impact the audit fee. Kwon and Yi (2018) noted that the auditor's partner's social relations with the firm's CEO under study have no impact on the decline of audit effort, audit fee, and audit quality. Buslepp et al. (2019) figure out that those firms that do not disclose the costs related to audit fees incur more fees. Chen et al. (2019) find that the audit fee increases due to systematic macro risks due to tension. Moreover, there is a significant and positive relationship between audit fees and financial restatement. An indicator of risk factors is related to poor financial report quality and poor audit quality. Lyubimov (2019) noticed that the four big audit firms experienced a big change in audit fees. Rank 2 audit firms increase the audit fee for the firms which are not compatible with section 404. Kusanoa and Sakuma (2019) noted that financial costs are associated with audit fees. Shan, Troshani, and Tarca (2019) find that when managerial ownership levels are compatible with shareholders' interests (interest convergence), the relationship between managerial ownership and audit firms' size and audit fee is negative. In contrast, the association is positive when the levels of managerial ownership are different from shareholders' interests (for example, entrenchment). Hanlon, Khedmati, and Lim (2019) observe that the number of board sessions is associated with increased audit fees. Given the facts mentioned above, the second hypothesis is as follows:

H2: There is a significant relationship between auditor's narcissism and audit fees.

3. Research Methodology
The present study's statistical population is all listed firms on the Tehran Stock Exchange between

2012 and 2017. First, the systematic elimination method is used for sampling, and finally, after applying the following conditions, the statistical population of the study will be selected:
1- Firms should be enlisted until the end of 2011 on the Tehran Stock Exchange;
2- Firms should be active during the period of the study, and their shares should be transacted;
3- The required financial information should be presented during the period of the study; and,
4- Firms should be affiliated with investment firms, banks, insurance, and financial intermediaries.
Given the gathered information at the end of 2017, the final sample is depicted in Table 1.
Table 1. Number of firms in the statistical population by imposing the conditions for selecting the sample

Table 1. Number of firms in the statistical population

Description	Eliminated firms in total periods	Total number of firms
Total listed firms on the Tehran Stock Exchange		445
Eliminating financial intermediaries, financial supply, insurance, and investment firms	88	
Firms with more than 6 months of transaction halt	112	
Eliminating firms entered the Stock Exchange during the study period	4	
Eliminating due to lack of access to information	113	
Statistical population		128

3.1. Data collection method
The primary and raw information and data for hypothesis testing were collected using the information bank of Tehran Stock Exchange, including Tadbir Pardaz and Rah Avard-e Novin and also the published reports of Tehran Stock Exchange via direct access (by analyzing the released reports in Codal Website and manually collected data) to CDs and also by referring to rdis.ir website and other necessary resources.

3.2. Data analysis method
The data analysis method is cross-sectional and year-by-year (panel data). In this paper, the multivariate linear regression model is used for hypothesis testing. In addition, descriptive and inferential statistical methods are used for analyzing the obtained data. Hence, the frequency distribution table is used for describing data, and at the inferential level, the F-Limer, Hausman test, test of normality, and multivariate linear regression model are used for hypothesis testing.

3.3. Research model
This paper aims to assess the relationship between auditor's narcissism and expectation gap, and audit fee. Hence, the multivariate regression model (1) is used for testing the first hypothesis, and multivariate regression model (2) is used for testing the second hypothesis, which is shown as follows:

Model (1)
$$AEG_{it} = a_0 + a_1 A\_NAR_{it} + a_{23} ATenure_{it} + a_{34} Achange_{it} + a_4 Size_{it} + a_5 Loss_{it} + a_6 LEV_{it} + a_7 Q - Tobin_{it} + a_8 ROA_{it} + a_9 Growth.sales_{it} + a_{10} ROE_{it} + a_{11} Age_{it} + a_{12} YEAR_{it} + a_{13} INDUSTRY_{it} + \varepsilon_{it}$$

Model (2)
$$LnAfee_{it} = a_0 + a_1 A\_NAR_{it} + a_{23} ATenure_{it} + a_{34} Achange_{it} + a_4 Size_{it} + a_5 Loss_{it} + a_6 LEV_{it} + a_7 Q - Tobin_{it} + a_8 ROA_{it} + a_9 Growth.sales_{it} + a_{10} ROE_{it} + a_{11} Age_{it} + a_{12} YEAR_{it} + a_{13} INDUSTRY_{it} + \varepsilon_{it}$$

Where

- Lnafee is the audit fee, the natural logarithm of audit fee in the year under study.
- A_NAR: auditor's narcissism, for the measurement of which auditors' signature criterion is used.
- ATenure: auditor tenure, which is equal to the number of years the auditor held his/her position in the department,
- Achange: auditor change if the auditor is changed in the year under study 1; otherwise, 0.
- SIZE: firm size, which is the natural logarithm of total assets of the firm.
- Loss: firm loss, a dummy variable if the firm is losing in the year under study 1; otherwise, 0.
- LEV: financial leverage, total debts to total assets of the firm.
- Q-Tobin: a ratio that shows the firm's total market value plus book value of debts divided by the total book value of the firm's assets in the year under study.
- ROA: return on assets, which is equal to net profit divided by the firm's total assets in the year under study.
- Growth: firm growth, which is equal to sales minus sales of the previous year divided by sales of the firm's previous year.
- ROE: return on equity, which is equal to net profit to book value of equity.
- Age: firm age, which is equal to the time interval between the date of establishment and the year under study.
- Year: virtual variable of year.
- Industry: virtual variable of industry

Dependent variable

According to Salehi et al. (2019), the absolute value of stock price changes is computed using the determining factors for assessing the expectation gap. Therefore, the absolute value of model (2) errors is indicative of the audit expectation gap as follows:

Model (2)

$$
\begin{aligned}
|ASP|_{it} = \beta_0 &+ \beta_1 profit\ and\ loss_{it} + \beta_2 industry_{it} + \beta_3 change\ board_{it} \\
&+ \beta_4 inflation_{it} + \beta_5 earning\ persistence_{it} + \beta_6 price\ earnings\ ratio_{it} \\
&+ \beta_7 the\ liquidity_{it} + \beta_8 debt\ ratio_{it} + \beta_9 dividends\ per\ share_{it} \\
&+ \beta_{10} capital\ structure_{it} + \beta_{11} capital\ increase_{it} \\
&+ \beta_{12} forecast\ earnings\ per\ share_{it} + \beta_{13} turnover_{it} \\
&+ \beta_{14} return\ on\ assets_{it} + \beta_{15} stock\ returns_{it} + \beta_{16} exchange\ rate_{it} \\
&+ \beta_{17} oil\ price_{it} + \beta_{18} election_{it} + \beta_{19} current\ ratio_{it} + \beta_{21} quick\ ratio_{it} \\
&+ \varepsilon_{it}
\end{aligned}
$$

Where

|ASP|: The absolute value of stock price changes three days before publishing the audit report and three days after that.

Profit and loss: using a 0 and 1 method, if the firm is profitable 1, otherwise, 0.

Industry: by the industry, we mean the firm in what class the firm is placed on concerning activity and mass production. The classification of the Tehran Stock Exchange is used for this purpose.

Change board: using a 0 and 1, the board's changes are analyzed, and if at least a member of the board has changes 1 otherwise, 0 will be used.

Inflation: inflation rate, which is extracted from the Central Bank.

Earnings persistence: earnings persistence, which is obtained from the errors of model no. 11.

Equation (1)

$$EARN_{i,t} = \alpha_0 + \alpha_1 EARN_{i,t-1} + \varepsilon_{it}$$

Earnit: earnings of the current period

α1: the (independent variable coefficient) degree of earnings persistence during the study

EARN,t-1: earnings of the previous period

εit: regression model residual

price-earnings ratio: dividing the stock price into the earnings per share

liquidity: stock liquidity is calculated as follows:

$$BAS = \frac{AP - BP}{\frac{AP+BP}{2}} * 100$$

BAS: the rate of the difference of the proposed price for buying and selling firm stocks

AP: average proposed price for selling the firm stocks

BP: average proposed price for buying the firm stocks

Debt ratio: total debts to total assets

Dividend per share: dividing total dividend into the number of firm shares

Capital structure: the capital structure is calculated as follows:

$$ML_{it} = \frac{BD_{it}}{BD_{it} + ME_{it}}$$

Mlit: financial leverage based on the market value for the firm i in the year t

BDit: book value of debts for the firm i in the year t

MEit: the market value of equity for the firm i in the year t (market value of equity is achieved by multiplying the market value of shares into the number of shares)

Capital increase: is analyzed using a 0 and 1 method. If the firm experienced a capital increase 1, otherwise, 0 will be assigned.

Forecast earnings per share: if the real earnings of the firm i in the year t are more than the forecasted earnings 1, otherwise, 0 will be assigned.

Turnover: the number of transacted shares of the firm i in the year t is considered as the transaction volume to control the price effects of the stocks, to the extent possible, and model no. 4 errors are used for this purpose:

Equation 1:

$$VOL_{it} = \beta_0 + \beta_1 MVOL_t + \varepsilon_{it}$$

$$MVOL_t = \frac{\text{no. of transacted shares in the entire market}}{\text{no. of published shares in the entire market}}$$

$$VOL_{it} = \frac{\text{no. of transacted shares of the firm } i}{\text{no. of published shares of rhe firm } t}$$

Return on assets: net profit divided by mean total assets

Stock returns:

$$R = \frac{(\text{based price} - \text{day price}) + DPS + priority + \text{awarded price}}{\text{base price} + (1000 * \text{the percentage of increase from contribution})} * 100$$

Exchange rate: rate of currency change which is extracted from the Central Bank

Oil price: oil price

Election: using a 0 and 1 method, if there is a presidential election in the year under study 1, otherwise, 0 will be assigned.

Current ratio: current assets divided by current debts

Quick ratio: current assets minus inventory divided by current debts

3.3.1. Independent variable

A_NAR: auditor's narcissism, determined by the magnitude of auditor's signature, equals 1 if the auditor's signature is large or more specifically in a particular form or its name and surname; otherwise, 0.

3.3.2. Control variables

- Size: firm size: natural logarithm of the market value of shares
- Loss: firm loss, a dummy variable if the firm is losing in the year under study 1; otherwise, 0.
- LEV: financial leverage, total debts to total assets of the firm.
- Q-Tobin: Tobin's Q
- ROA: return on assets, which is equal to net profit to book value of assets.
- ROE: return on equity, which is equal to net profit to book value of equity.
- MTenure: CEO tenure, which is equal to the period the CEO held the position until the year understudy
- Mchange: CEO change, if the CEO has changed in the year under study 1; otherwise, 0.
- Age: firm age, the time interval between the date of establishment, and the year under study.

4. Data Analysis

4.1. Descriptive statistics

In this paper, two models were used for analyzing the relationship between narcissism and the expectation gap and audit fee. Furthermore, the present study has used the panel data method, including 128 Iranian firms, in its database. Therefore, variables of the expectation gap and audit fee are used for model estimation.

Moreover, industry and year virtual variables were added to the model as descriptive variables for the modeling. The main source of these data is the Central Bank, Tehran Stock Exchange Official Website, Codel Website, and Rahavard Novin Software. Table 2 demonstrates, in brief, the information related to the variables of the firms.

According to the table of descriptive statistics, the maximum financial leverage is 4.003. In addition, the maximum and minimum value of return on equity is 6.8884 and -16.8455. On the other hand, the maximum value of the audit quality variable is 3, showing the Rank A firms and its minimum is 1, which indicates rank C firms. Further, the maximum value of management entrenchment is obtained from exploratory factor analysis of 12 variables (CEO duality, financial expertise and CEO industry, board compensation, managerial ownership, tenure, and CEO stability, board independence, financial expertise

Table 2. Descriptive statistics of variables

variable	obs	Mean	Std. dev	Min	Max
lniaegi	768	6.479	0.931	2.170	8.289
lnafee	706	7.605	1.862	3.245	14.390
a_nar	768	0.943	0.232	0	1
atenure	768	3.762	3.981	1	16
achange	768	0.346	0.476	0	1
size	768	14.247	1.526	10.533	19.374
loss	768	0.133	0.339	0	1
lev	768	0.611	0.264	0.090	4.003
qtobin	768	1.940	0.944	0.789	7.719
ROA	767	.0091	0.583	-12.273	2.618
growthsales	768	0.207	0.520	-0.845	7.705
ROE	768	0.226	0.868	-16.845	6.888

and board industry, correlation and board effort) is 13.7023 and its minimum is -5.3463.

4.2. The results of the unit root test of variables

By analyzing the unit root of variables, we realized that all variables are at no unit root (stationary). The obtained LM statistic for each variable is reported in Table 3. All variables are stationary and have no unit root.

Table 3. The results of the Hadri unit root test

Variable	Level	Variable	Sig.
Ln|AEG |	0.3542	LnAfee	1.0000
A_NAR	0.2984	ATenure	0.1985
AChange	1.0000	Size	0.7409
Loss	0.2389	Growth Sales	1.0000
ROA	0.1589	LEV	0.3158
Q-Tobin	0.7902	Age	0.5468
ROE	0.9402		

Note: the null hypothesis is the absence of unit root in variables. LM statistic is reported.

4.3. Inferential test

Hypothesis 1 estimation

Model (1) is used for testing the first hypothesis, the results of which are depicted in Table 4:

$$AEG_{it} = a_0 + a_1 A\_NAR_{it} + a_{23} ATenure_{it} + a_{34} Achange_{it} + a_4 Size_{it} + a_5 \text{Loss}_{it} + a_6 LEV_{it} + a_7 Q - Tobin_{it} + a_8 ROA_{it} + a_9 Growth.sales_{it} + a_{10} ROE_{it} + a_{11} Age_{it} + a_{12} YEAR_{it} + a_{13} INDUSTRY_{it} + \varepsilon_{it}$$

In order for model estimation, we should determine whether the data are pooled and panel using the F test. This test's null hypothesis shows that data are pooled, and H1 indicates that data are pooled. If performing the F test H0 is rejected, the question raised here is that using which models of random effects or fixed effects do the model is analyzable, determined by the Hausman test. Regarding the pooled test results presented in Tables 4 and 5, the null hypothesis concerning pooled data is rejected for the model at a 99% confidence level. Hence, the panel data model should be used for model estimation. According to Table (4) and (5), the Hausman test statistic based on the estimation is 140.83 and 386.58 for the research models. Therefore, the probability level of 0.000 and 0.000 is smaller than χ^2 the table's value, and the null hypothesis is rejected. So, the fixed effects model is used as the most appropriate model for both study models.

Table (4) shows a positive and significant relationship between the auditor's narcissism and the audit expectation gap. Its p-value is 0.033, less than the 0.05 significance level with the coefficient of 0.880, which confirms the presence of such a relationship. Moreover, the results of model (1) testing according to Table (4) illustrates that there is a negative and significant relationship between auditor change and audit expectation gap because its p-value is 0.008 less than the 0.05 significance level with the coefficient of 0.244, which confirms the presence of such a relationship. On the other hand, the results of Table (4) reveal that there is no relationship between tenure and audit expectation gap at 95% confidence level.

Table 4. The results of the model (1) estimation

lniaegi	Coef	Std.Err	z	p-value
A_NAR	0.880	0.405	2.17	0.033
Atenure	-0.023	0.014	-1.71	0.087
Achange	-0.244	0.093	-2.64	0.0008
Size	0.023	0.008	2.74	0.006
Loss	-0.522	0.221	-2.36	0.018
LEV	0.002	0.001	3.64	0.000
Qtobin	-0.018	0.004	-5.01	0.000
ROA	-1.106	0.420	-2.63	0.009
Growthsales	0.021	0.003	6.90	0.000
ROE	0.161	0.082	1.97	0.049
Age	0.009	0.002	5.39	0.000
_con	6.240	0.721	8.65	0.000
F-limer	F(110,446)	2.20		
	p-value	0.000		
Hausman	Chi2(11)	386.58		
	p-value	0.000		
Number of obs	568			
R-sq	0.4072			

The level of significance of the test is 95%

Hypothesis 2 estimation

A multivariate regression model is used for testing the second hypothesis:

$$LnAfee_{it} = a_0 + a_1 A\_NAR_{it} + a_{23} ATenure_{it} + a_{34} Achange_{it} + a_4 Size_{it} + a_5 Loss_{it} \\ + a_6 LEV_{it} + a_7 Q - Tobin_{it} + a_8 ROA_{it} + a_9 Growth.sales_{it} + a_{10} ROE_{it} \\ + a_{11} Age_{it} + a_{12} YEAR_{it} + a_{13} INDUSTRY_{it} + \varepsilon_{it}$$

According to Table 5, since the p-value is 0.000, less than 0.05 significant level, and its coefficient is -0.011, there is a negative and significant relationship between auditor's narcissism and audit fee. Besides, the results of model (2) test, based on Table 5, show a positive and significant relationship between change and tenure of auditor and audit fee, because the p-value is 0.006 and 0.000, respectively less than 0.05 significance level and the coefficient are 0.022 and 0.009 which is indicative of a positive and significant relationship.

As can be seen in Table 4 and 5, the results of the robust model (1) estimation are presented. In both panel data models, four classic econometric hypotheses are investigated, and reliable results are reported. These four hypotheses include linearity among variables, exogeneity of descriptive variables, the variance of homogeneity, and lack of serial autocorrelation among disruptive components. Given the applied regression, the intercept of the first model is significant for firms. The intercept of the first model is 6.420 with the p-value of 0.000, which is significant at the 99% level, but the p-value of the second model 0.148 and not significant at the 95% level. By comparing the two models, we can say that the first model outperforms the second model. The R^2 of the first model is 0.4072 and 0.3493 for the second model. Hence, the first model has more descriptive power over the second one.

Table 5. The results of the model (2) estimation

lnafee	Coef	Std.Err	z	p-value
A_NAR	-0.011	0.002	-4.49	0.000
Atenure	0.009	0.002	4.15	0.000
Achange	0.022	0.008	2.74	0.006
Size	0.703	0.120	5.86	0.000
Loss	0.252	0.114	2.21	0.027
LEV	0.529	0.267	1.98	0.048
Qtobin	0.069	0.026	2.66	0.008
ROA	-0.088	0.053	-1.65	0.099
Growthsales	-0.018	0.004	-5.01	0.000
ROE	-0.071	0.028	-2.58	0.010
Age	0.085	0.031	2.77	0.006
_con	-2.540	1.758	-1.44	0.148
F-lmer	F(127,566)	15.13		
	p-value	0.000		
Hausman	Chi2(11)	140.83		
	p-value	0.000		
Number of obs	705			
R-sq	0.3493			

The level of significance of the test is 95%

5. Conclusion

Auditor's narcissism is one of the auditors' psychological characteristics, causing an individual's performance to be affected in the related career because such people consider themselves superior to others. Hence, such a phenomenon is entangled with constant effort and performance enhancement in some people while, at the same time, such a feature by creating a sense of pride and false superiority can debilitate the performance (Raskin and Terry, 1998; Olsen and Stekelberg, 2015; APA, 1994). The payment such people ask for their performance is under the influence of such a phenomenon. Thus, we expect a narcissistic auditor to be significantly associated with the expectation gap and audit fee. Accordingly, the present study aims to assess the relationship between auditor's narcissism and expectation gap and audit fee. In this regard, the results of hypothesis testing show that there is a positive and significant relationship between auditor's narcissism and expectation gap, and the relationship between auditor's narcissism and audit fee is negative and significant, which means the increase of narcissism in the auditor would lead to the growth of expectation gap between auditor and users. In contrast, this feature in the auditor contributes negatively to the audit fee. These results are in line with that of Cohen et al. (2010). They declare that auditor's narcissism brings about the decline of audit quality because the decline of audit quality increases the audit expectation gap. Therefore, we can claim that an auditor's narcissism can lead to the audit expectation gap growth. Moreover, the study results contrast with that of Zhuang (2018), who asserts that audit firm partners' narcissism significantly enhances audit quality by increasing the auditor's independence instead of the auditor's qualification. This can be due to various reasons, including the declined market share of audit firms in the emerging markets and the competitiveness of the audit market in the developing countries are among the factors which lead to the drop in audit quality and following that the audit fee and the increase of audit expectation gap because competition in the audit market would increase the bargaining power of the employers and audit firms, to preserve their clients, work in collusion with the employers and even lower their payments in some cases (Archambeault and DeZoort, 2001). Hence, in developing countries, including Iran, such conditions are quite natural.

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The Relationship between the Audit Outputs and Managerial Entrenchment

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Abstract

The present study investigates the relationship between audit outputs (including audit quality, type of opinion, audit fee, and timeliness) and managerial entrenchment in firms listed on the Tehran Stock Exchange. The multivariate regression model is used for hypothesis testing, research hypotheses were tested using a sample of 678 listed observations on the Tehran Stock Exchange during 2012-2017, and the exploratory factor analysis of 12 variables (including CEO duality, financial expertise, and CEO industry, board compensation, managerial ownership, tenure, and CEO consistency, board independence, financial expertise, and board industry, correlation and board effort) is used for examining managerial entrenchment. As expected, the results show a significant relationship between audit outputs and managerial entrenchment, such that audit fee and audit quality are negatively associated with managerial entrenchment, and the relationship between report delay and type of opinion and managerial entrenchment is positive and significant. By adding new variables to measuring managerial entrenchment, the present study provides a better evaluation of this index. Moreover, it contributes to the field because the previous studies have benefited from limited proxies for this purpose.

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1. Introduction

Managerial entrenchment is one of the challenging global topics in accounting and auditing. The phenomenon occurs when managers exploit their executive and information power to benefit their interests. As the shareholders always seek to maximize their investment in the long-term, managers, especially if they are not the firm owner in the firm, hunt for their personal interests. The conflict of interests between owners and managers is among the main reasons for resorting to the audit profession. One of the main tools to ensure financial information clarity of firms is audited financial statements (Casterlla et al., 2004). In other words, audited financial statements make certain the external users that an expert checks the accuracy of financial information. Hence, confirming financial statements and their reliability causes the decline of information asymmetry and the convergence of managers and owners (Francis et al., 2004). Thus, we expect the growth of audit quality to contribute positively to the decrease of agency costs by attracting external users and, as controlling leverage, to lessen managerial entrenchment. Considering the proposed facts, we argue that audit outputs contribute to entrenchment. In the present study, audit outputs also include audit fees, type of auditor's opinion, audit report timeliness, and audit quality. Managerial entrenchment is a relatively new topic that is not discussed extensively in local and foreign studies. On the other hand, this paper is the first study to assess the relationship between audit outputs and managerial entrenchment separately. Therefore, the current study's main objective is to analyze the relationship between the outputs of audit procedures and managerial entrenchment and to assess the presence of a significant relationship between these two variables. In other words, we attempt to figure out whether audit outputs can increase or decrease managerial entrenchment in organizations or not. Moreover, by adding new variables to managerial entrenchment measurement, the present study has led to a better evaluation of this index. The previous studies have benefited from limited proxies as an index for measuring entrenchment. By adding new variables, however, this paper contributes to a better assessment of this variable. In the following, we discuss the theoretical principles and the conducted studies in this field.

2. Theoretical Principles, Literature, and Hypothesis Development

2.1. Managerial entrenchment

According to corporate governance mechanisms, the CEO always benefits from a high executive power in organizations, enabling them to influence the board considerably. Hence, the presence of a conflict of interests between managers and shareholders concerning managers' executive power encounters them with problems in organizations (Jensen, 1993). In other words, the agency theory states that managers always attempt to maximize their interests in the firm, so they may make some decisions that are not in conformity with shareholders' interests. One of the consequences of diverging shareholders' interests from managers in business firms is the increase in agency costs and information asymmetry. Besides, CEO duality would cause the managers to be easily dominated and control the collected information. Broadly, compared with other managers, dual managers are more likely to show better the firm's performance (Davidson et al., 2004). One of the incentive factors for manipulating the accounting earnings, or in other words, to better show the organization's performance by the managers is CEO compensation because one of the main criteria for allocating compensation is measuring managers' performance. Since there is no appropriate criterion for allocating compensation to managers, managerial performance evaluation has always been an index for paying the reward. Hence, accounting figures and information were used as an available metric for analyzing managerial compensation contracts. Accruals are among the major contributing factors in signing contracts with managers (Kazan, 2016). The presence of accruals

provides an opportunity for managers to manage the accruals and manipulate actual financial events of the firms by applying accounting policies to preserve the agent's personal interests. Li and Kuo (2017) also reveal a positive relationship between CEO compensation and earnings management. Moreover, managers with financial expertise can better manage earnings due to familiarity with accounting techniques and policies. Further, Managers with financial expertise guide more analysts concerning the earnings and commit fewer earnings management. They have more understandings of the advantages of financial information disclosure relative to the increase of firm value and decline of information asymmetry (Matsunaga and Yeung, 2009).

2.2. The relationship between audit outputs and managerial entrenchment

One of the major and determining controlling tools for corporate governance mechanisms is the active and significant supervisory role of auditors, which lowers the basis for opportunism and misuse of managers (Chen et al., 2011) such that numerous studies (including Klai and Omri, 2011; Allsufy et al., 2013; Desender et al., 2013) are conducted concerning the corporate governance mechanisms and their relationship with audit outputs. Klai and Omri (2011) perceive that any enhancement in corporate governance mechanisms has an increasing impact on financial reporting quality. Moreover, Allsufy et al. (2013) indicate that applying corporate leadership causes financial information to benefit from high precision and quality. Further, Desender et al. (2013) argue that audit services and board independence during ownership dispersion are complementary. They also find that there is a significant relationship between board composition and the audit fee. Hence, the present study expects a significant relationship between audit outputs and managerial entrenchment.

2.3. Audit outputs

In the present study, the following indices are used for measuring audit outputs:

2.3.1. Audit fees

The audit fee will be determined based on the actual cost of provided services in the audit procedures and the estimation of damages due to the auditor's responsibility concerning the issued report (Stanley, 2011). Along with the growth of competition in the audit profession, the need for providing high-quality services with lower costs is more evident. Therefore, audit firms are willing to optimize the audit fee and offer the best propose price to the clients to maximize their income and preserve their work contract in the competitive status of the audit market. Thus, being aware of and acquainted enough with the contributing factors to audit fees can be useful in the current era (Choi et al., 2008). Moreover, realizing the contributing factors to the audit fee can help the clients understand the provided services' advantages. Therefore, this would lead to the client's more tangible presence in audit procedures, which is a basis for the increase of audit quality and acceleration of audit procedure (Gist, 1992).

2.3.2. Audit fee and managerial entrenchment

The conflict of interests between owners and managers in firms is one of the contributing factors to the demand for audit services. Besides, such a conflict may occur in different types among the major shareholders and minorities, leading to agency costs for the beneficiaries and organization. Given that the costs derived from the owners' attempt to control the managers play a significant role in the agency costs, managers are willing to substantiate their appropriate performance for shareholders and their attempt to increase the owners' wealth (Jensen, 1986). Therefore, we can argue that both managers and owners are willing to use the audit services. Auditors play a

significant role in limiting managers' power and working as a controlling tool for decreasing managers' authority. However, audit services incur some costs for the firms, which are determined given the auditor's evaluation of the amount of risk and volume and complication of labor. Agency cost can also increasingly affect the audit fee via a direct impact on the factors above. Whinsenant et al. (2003) declare that the more the prevalence of agency costs in business firms, the more the auditor's effort to ensure the absence of fraud and significant errors in the financial statements, which would lead to the increase of audit fee. Hence, we can conclude that the increase in agency costs in firms will increase the level of risk, complication, operation volume, and the need for specialized force in the firm. Since these items are among the audit contract, they affect the audit fees. Desender et al. (2013) show a significant relationship between board independence and CEO duality, and audit fees. Moreover, Farooq et al. (2018) figure out a positive and significant relationship between the audit fee and the board quality. Additionally, Jizi and Nehme (2018) posit that firms with an independent board and efficient audit committees are more inclined toward high-quality auditing. Thus, they pay higher fees to back up shareholders' interests against misuse and opportunism of managers with higher executive power. Further, Gul et al. (2003) suggest that the audit fee is positively and significantly associated with the accruals. The amount of such an association has an inverse relationship with managerial ownership. The relationship between the audit fee and accruals is weaker in firms with higher managerial ownership. Given the abovesaid facts, we expect from the audit fee in organizations dealing with the entrenchment phenomenon to be higher than other firms, such that auditors, when planning audit procedures, administer more tests in firms with managers with higher executive power, which in turn increases the audit fee, so the first hypothesis of the study is as follows:

H_1: There is a significant relationship between the audit fee and managerial entrenchment.

2.3.3. Audit quality

The oldest and most salient of which is proposed by DeAngelo (1981), who said that audit quality is "market evaluation of the chance of exploring and reporting significant deviations by the auditor in the financial statements". Like Titman and Trueman (1986), other opinion leaders consider the precision and soundness of published information by the auditor as a criterion for audit quality. According to DeAngelo (1981), using a criterion or index directly associated with the audit quality is extremely economical in terms of time and cost for measuring the audit quality, which has a non-observable nature. In addition, larger audit firms are also more inclined to preserve their reputation in society, which causes clients' financial statements to be audited with higher quality. In general, we can declare that larger audit firms always have more customers, which leads to the independence of the client, so the bargaining power of such firms is more than that of the smaller firms.

2.3.4. Audit quality and managerial entrenchment

Any change in the ownership and/or the agency theory is one of the contributing factors to audit quality, which shows the separation of an owner from managers and a change in this formation can influence the demand for high-quality audit services (Chan et al., 2007; Watts and Zimmerman, 1986).

While in firms with a higher percentage of ownership, the demand for high-quality audit services is less evident due to the decline of the conflict of interests between clients and agents (Al Qadasi and Abidin, 2018). Moreover, firms with independent boards are less inclined toward the use of high-quality auditors (Jiraporn et al., 2018), which makes the financial statements clearer than before. On the other hand, concerning the relationship between the quality of auditors and corporate

governance mechanisms in the organizations, the required basis is provided for adding value to financial reporting and lowering the information asymmetry among internal and external users. In other words, managers are always willing to disclose information and useful news concerning their performance, so they need some mechanisms to secure related information's precision and reliability. One of these accreditation mechanisms is the high quality of audit. According to the agency theory, independent auditing as a controlling factor reduces agency costs by limiting managers' manipulation of accounting information (Fama, 1980). Moreover, Jensen and Mackling (1976) argue that an independent auditor works as a controlling factor who increase the firm value by supervising and reducing the infractions of the CEO in the organization. In general, if auditors have the required qualification, they would be able to diagnose, explore, and disclose fraud in the financial statements without being affected by the managers' opportunism. Concerning the relationship that exists between audit quality and managerial entrenchment, we can argue that the increase of audit quality causes the decline of conflict of interests between managers and owners, the reduction of accounting earnings manipulation by managers, and the growth of reliability and financial reporting quality, while audit quality drop would lead to the elevation of agency costs. Hence, we expect audit quality to contribute to the managerial entrenchment, so the second hypothesis of the study is as follows:

H_2: There is a significant relationship between audit quality and managerial entrenchment.

2.3.5. Audit report timeliness

Understanding the contributing factors to the characteristic of information quality is of great importance because they directly impact the timeliness of financial statements. The previous studies show that firms' timely presentation of financial statements raises the richness of information content and adds value to the economic firms (Blankley, Hurtt, and MacGregor, 2014). Generally, the annual return of audit is considered one of the major determining factors in the financial report's timeliness (Givoly and Palmon, 1982). Further, regarding recent financial corruption in the international setting, managerial characteristics are among the leading factors in the timely disclosure of financial information (Samaha and Khalif, 2017).

2.3.6. Audit report timeliness and managerial entrenchment

According to the agency theory, the conflict of interests between owners and shareholders in firms with ownership dispersion is more than that of the other firms because minor shareholders with a smaller share cannot influence the management decisions (Samaha and Khalif, 2017). Thus, one of the methods for decreasing or dealing with the agency problem in organizations is to use an appropriate trend in the framework of corporate governance, among which we can refer to delay reduction in the audit report as one of the components of such a trend (McGee and Yuan, 2012). In this regard, Abdelsalam and Street (2007) declare that the increase of concentration and ownership contribute to the delay in the audit report and reduce the duration of audit report presentation.

In addition, an audit report is timely in the board of firms with the required independence, so board independence via more supervision on managers' performance and behavior would lead to the reduction of intrinsic risk and delay in audit report (Afify, 2009). On the other hand, the phenomenon of CEO duality occurs in those organizations where the CEO is the board manager at the same time, which leads to the increase of executive power of the CEO in decision-making. On the other hand, CEO duality lowers the board's interdependence. Hence, this phenomenon's unfavorable effect is the board's inability to utilize its supervisory role over the CEO's performance, increasing the duration of the audit report (Mohamad Nore et al., 2010). In addition, Samaha and

Khalif (2017) posit that audit committee features, independent auditor, and the firm's strategic factors contribute significantly to audit report presentation and accounting information timeliness. Further, Afify (2009) declares that several variables, including board independence, CEO duality, audit committee, firm profitability, firm size, and type of industry, influence audit reports' timeliness. Additionally, Salehi et al. (2018) perceive a negative and significant relationship between CEO financial specialization and audit report delay. Regarding the effect of corporate governance mechanisms on audit report timeliness, we expect delayed audit reports to be considered an unfavorable issue in society. Therefore, the required basis should be provided concerning the impacts such a phenomenon exerts on business firms for lowering managers' opportunism. Hence, the third hypothesis is formulated as follows:

H_3: There is a significant relationship between managerial entrenchment and the timeliness of audit reports.

2.3.7. Type of auditor's opinion

In today's world, large corporations with a considerable volume of capital obtained via shareholders can control the economic resources at the national and international levels, known as an economic index in industrial and advanced countries. Firm shareholders, among them, to ensure the effectiveness and efficiency of managers in using the available resources, can benefit from a major assurance instrument called audited financial statements. Concerning the chance of bias in firms' financial statements by board members and managers, the need for performing audit operations is growing increasingly (Joli, Jubb, and Houghton, 2007). In addition, performing audit operations causes increased reliability of financial information by giving credit financial statements under study (Rumsin and Evans, 2017).

Therefore, auditors' opinions concerning the compatibility of financial statements with audit standards are significant criteria in decision-making that the users and investors consider when making decisions. DeAngelo (1981) declares that the auditor's opinion is performing independent audit operations for the firm's financial statements supplied by the management.

2.3.8. Auditor's opinion and managerial entrenchment

According to Jensen and Mackling (1976), the divergence of interests in an organization between owners and agents and lack of required ability of owners for monitoring the managers have incurred high agency costs on the organizations, among which the relationship between corporate governance mechanisms and high-quality reporting has brought about the decline of agency costs (Cohen et al., 2004). Thus, we can consider the audit services as a controlling tool in the corporate governance structure. By analyzing the financial statements presented by the management, auditors give credit to these documents. Still, a question always arises here that "whether the auditor's opinion relative to the presented information is under the influence of other factors or not". In other words, did the auditor mind the independence correctly in his/her opinion? In general, the audit procedure and making an opinion about financial statements is a complicated story for which evaluation, a realization of the client's activity, internal control structure, decisions on accepting the client's project, collecting positive documents concerning the claims of firm management are required for a suitable opinion (Felix and Kinney, 1982; Rittenbery et al., 2012). Hence, the final product of auditing financial statements will be presented in the form of an audit report which contains the auditor's opinion concerning the reliability of financial statements. Moreover, Susanto and Pradipta (2017) also figure out that auditors' chance of conditional opinions is higher in organizations with earnings management, audit quality, and tenure indices. Besides, Uzun et al. (2004) indicate that the chance of presenting adjusted opinions for published financial statements is

higher when the percentage of ownership of unbounded members and audit committee is lower, which increases the chance of bias in financial statements. Moreover, Abad et al. (2015) declare that high-quality opinion increases information asymmetry in an organization. Therefore, we argue that receiving the adjusted report can be an alarm for managers. Broadly, the auditors' adjusted report indicates violating control mechanisms and accounting standards that pave the way for managerial opportunism, so we expect from the favorite report of auditors to have a decreasing effect on managerial entrenchment. Hence, the fourth hypothesis is as follows:

H_4: There is a significant relationship between auditor's opinion and managerial entrenchment.

3. Research Methodology

The current study's statistical population includes all listed firms on the Tehran Stock Exchange from 2012 to 2017.

The systematic elimination method is used for sampling, and finally, after applying the following conditions, the statistical population of the study will be selected:

1- Firms should be enlisted until the end of 2011 on the Tehran Stock Exchange;
2- Firms should be active during the period of the study, and their shares should be transacted (transaction halt of more than 6 months is not accepted);
3- The required financial information should be presented during the period of the study; and,
4- Firms should be affiliated with investment firms, banks, insurance, and financial intermediaries.

Given the gathered information at the end of 2017, the final sample is depicted in Table 1.

Table 1. Number of firms in the statistical population

Description	Eliminated firms in total periods	Total number of firms
Total listed firms on Tehran Stock Exchange		445
Eliminating financial intermediaries, financial supply, insurance, and investment firms	88	
Firms with more than 6 months of transaction halt	112	
Eliminating firms entered the Stock Exchange during the study period	4	
Eliminating due to lack of access to information	113	
Statistical population		128

3.1. Data collection and method

The primary and raw information and data for hypothesis testing were collected using the Tehran Stock Exchange information bank, including Tadbir Pardaz and Rah Avard-e Novin, and the published reports of the Tehran Stock Exchange via direct access.

3.2. Data analysis

The data analysis method is cross-sectional and panel data. In this paper, the multivariate linear regression model is used for hypothesis testing. Descriptive and inferential statistical methods are used for analyzing the obtained data. Hence, the frequency distribution table is used for describing data. The F-Limer, Hausman test, normality test, and a multivariate linear regression model are used for hypothesis testing at the inferential level.

3.3. Research model

The following multivariate regression model (1) is used for hypothesis testing

Model (1)

$$ME_{it} = a_0 + a_1 AQ_{it} + a_2 ART_{it} + a_3 dealy_{it} + a_4 LnAfee_{it} + a_5 Tenure_{it} + a_6 Rest_{it} + a_7 Size_{it}$$
$$+ a_8 LEV_{it} + a_9 ROA_{it} + a_{10} ROE_{it} + a_{11} MTB_{it} + a_{12} Age_{it} + a_{13} Growth.sales_{it}$$
$$+ a_{14} ICW_{it} + a_{15} Change_{it} + a_{16} year_{it} + a_{17} Industry_{it} + \varepsilon_{it}$$

3.3.1. Dependent variable

The dependent variable of the present study is managerial entrenchment, which is measured by using the following variables:

CEO-CHAIR: if the CEO is the chief or vice president of the board at the same time 1; otherwise, 0 will be used.

FSM: financial specialization of the manager: if the CEO has a university degree related to one financial discipline, including accounting, economics, and financial management 1, otherwise, 0.

CEO-COM: CEO compensation: The firm's total assets are divided by the general annual assembly's compensation.

ISM: CEO industry specialization: if the CEO has a university degree related to one of the industries 1, otherwise, 0.

CEO-SHARE: the amount of managers' ownership: total shares available to the management divided by total published shares.

CEO-TENURE: CEO tenure: is equal to the duration the CEO holds the position consistently during the study.

CEO-STAB: CEO stability: if the CEO has changed in the year under study 1, otherwise, 0.

CEO-IND: board independence: is equal to the proportion of unbounded members to the board's total members.

BSE: board financial specialization: if at least one of the board members of the firm has a university degree related to one of the financial disciplines, including accounting, economics, and financial management 1, otherwise, 0.

BSI: board industry specialization: if at least one of the firm's board members has a university degree related to one of related industries 1, otherwise, 0.

BLNTER: CEO correlation: if at least one of the firm's board members is the common member of the board of other firms 1, otherwise, 0.

BEF: board effort: number of sessions held by the board in the year under study.

3.3.2. Independent variable

Auditor opinion: in this paper, the type of auditor's opinion is classified into two unqualified reports and qualified financial reports. In case the type of opinion is unqualified 1, otherwise, 0.

Audit quality: the variable of audit firm classification, which is disclosed annually by the official accountants' association, analyzes the audit quality. Such that rank A firms will be determined by 3, rank B firms with 2, rank C firms with 1, and rank D firms with 0, but since rank D firms cannot audit the Stock Exchange firms, they were excluded from the study.

Audit fees: is equal to the logarithm of audit fees in the year under study.

Audit report delay: is equal to a time interval between the end of the year and reporting data in the year under study.

3.3.3. Control variable

Tenure: auditor tenure equal to the years the audit firm is responsible for pursuing the desired firm.

Change: if the auditor has changed in fiscal year 1; otherwise, 0.

Rest: if the firm has had a restatement in the year under study 1; otherwise, 0.

Size is equal to the natural logarithm of total assets calculated at the end of the fiscal year.

Lev: is equal to the amount of debt utilization in the firm's capital structure, which is obtained from dividing total debts by total assets.

ROA: Return on assets or operational earnings after depreciation divided by total assets.

ROE: stock return rate, which is calculated by dividing the net profit into equity.

MTB: market value to book value of equity of the firm i in the year under study.

Age: a record of the audit firm i in the year t

Growth sales: The current year's sales minus sales of the previous year divided by sales of the previous year.

Icw: if the weakness in internal control is reported in audit report 1, otherwise, 0.

4. Data Analysis
4.1. Descriptive data

In this paper, one model is used for analyzing the relationship between audit outputs and managerial entrenchment. In addition, the present study has used the panel data method. In order to analyze the models, the variables of audit outputs are employed. Moreover, the virtual variables of industry and year were added to the model for modeling. The main source of these data is the Central Bank, Tehran Stock Exchange, Codal website, and Rah Avard-e Novin Software. Table 2 illustrates, in brief, the information related to firm variables.

Table 2. Descriptive statistics of variables

variable	obs	Mean	Std. dev	Min	Max
ME	768	1.969	2.524	-5.346	13.702
AQ	762	2.812	0.416	1	3
ART	768	0.485	0.500	0	1
dealy	766	4.237	0.388	2.890	4.983
LnAfee	706	7.604	1.861	3.245	14.390
Tenure	768	3.761	3.981	1	16
Change	768	0.346	0.476	0	1
Rest	768	0.799	0.400	0	1
Size	768	14.246	1.526	10.532	19.374
LEV	768	0.611	0.263	0.090	4.002
ROA	767	0.091	0.583	-12.273	2.618
ROE	768	0.225	0.868	-16.845	6.888
Age	768	38.436	12.839	10	66
Growth.sales	768	0.207	0.519	-0.845	7.705
ICW	739	0.307	0.461	0	1

According to the Table, the maximum financial leverage is 4.003. Besides, the maximum and minimum value of the return of equity is 6.8884 and -16.8455, respectively. On the other hand, maximum audit quality is 3, which is indicative of firms with rank A and its minimum is 1, which is indicative of firms with rank C. Further, maximum managerial entrenchment, which is obtained from exploratory factor analysis of 12 variables, is 13.7023 and its minimum is -5.3436.

4.2. The results of the unit root test of variables

We realized that all variables are at no unit root level by analyzing the unit root of variables. The

obtained LM statistic for each variable is reported in Table 3. All variables of the study are stationary and have no unit root.

Table 3. The results of Hadari unit root test

Variable	Level	Variable	Level
ME	0.325	Changea	0.285
AQ	0.957	Rest	0.215
ART	0.987	LEV	0.124
Dealy	0.254	Size	1.000
LnAfee	0.879	ROA	0.853
Tenure	1.000	ROE	0.874
Age	0.203	Growth Sales	0.258
ICW	0.189		

Note: the null hypothesis is the absence of unit root in variables. The LM statistic is reported.
Resource: research findings

4.3. Combining ability and Hausman tests

The null hypothesis is rejected at a 99% confidence level regarding the synthetic test results demonstrated in the following table. Thus, a panel data model should be used for estimating the coefficients of the model. Moreover, as depicted in the Table, the Hausman test statistic based on the estimation for the model is 22.52, with a probability level of 0.068, which is smaller than the table's value. Therefore, the null hypothesis is not rejected, so the random-effects model is more appropriate for the research model.

Table 4. The results of synthetic and Hausman tests

	Synthetic test		Hausman test	
Model 1	Calculated statistic	Probability level	Calculated statistic	Probability level
	1.56	0.000	22.52	0.068

Resource: research findings

4.3.1. Inferential test

The following model is used for hypothesis testing, the results of which are depicted in Table 5.

$$ME_{it} = a_0 + a_1 AQ_{it} + a_2 ART_{it} + a_3 dealy_{it} + a_4 LnAfee_{it} + a_5 Tenure_{it} + a_6 Rest_{it} + a_7 Size_{it} \\ + a_8 LEV_{it} + a_9 ROA_{it} + a_{10} ROE_{it} + a_{11} MTB_{it} + a_{12} Age_{it} + a_{13} Growth.sales_{it} \\ + a_{14} ICW_{it} + a_{15} Change_{it} + a_{16} year_{it} + a_{17} Industry_{it} + \varepsilon_{it}$$

According to Table 5, since the respective p-value of quality and audit fee is 0.035 and 0.001 lower than the 0.05 significance level and their coefficients are 0.5118 and 0.0341, there is a significant and negative relationship between quality and audit fees, managerial entrenchment, so the null hypothesis is rejected. Moreover, the results of Table 6 show that there is a positive and significant relationship between the type of report and audit report delay and managerial entrenchment because the p-value of type of report and audit report delay is 0.046 and 0.041, respectively, lower than the 0.05 significance level and their coefficients are 0.3632 and 0.5058, so the null hypothesis is rejected, and its opposite hypothesis is approved. Moreover, the study's other findings revealed no significant relationship between auditor tenure, the return of equity, and restatement and managerial entrenchment at 95% confidence level, but a positive and significant

relationship is observed between auditor change and managerial entrenchment. In addition, a negative and significant relationship was discovered between internal control weakness and firm size, and managerial entrenchment at a 95% level with a degree of tolerance. On the other hand, the study's findings suggest a positive and significant relationship between firm age and managerial entrenchment. As depicted in Table 6, sales growth, financial leverage, and return on assets are negatively and significantly associated with managerial entrenchment.

Table 5. The results of model estimation

ME	Coef	Std.Err	z	p-value
AQ	-0.511	0.242	-2.11	0.035
ART	0.363	0.180	2.01	0.046
dealy	0.505	0.247	2.04	0.041
LnAfee	-0.034	0.010	-3.32	0.001
Tenure	0.048	0.029	1.66	0.098
Change	0.293	0.127	2.29	0.022
Rest	1.315	0.724	1.82	0.072
Size	0.189	0.099	1.90	0.057
LEV	-1.342	0.513	-2.61	0.009
ROA	-0.183	0.061	-2.98	0.003
ROE	.0837	0.045	1.85	0.064
Age	0.009	0.003	2.86	0.004
Growth.sales	-0.695	0.277	-2.50	0.012
ICW	0.002	0.001	1.90	0.057
-Cons	-0.966	1.698	-0.57	0.569
Number of obs	672			
R-sq	0.4092			

5. Discussion and conclusion

The results indicate a negative and significant relationship between quality and audit fee and managerial entrenchment. The relationship between report type and audit report delay and managerial entrenchment is positive and significant. This means that managerial entrenchment decreases along with the increase of audit quality and audit fee, which is a function of audit quality. Management entrenchment goes up in the Iranian firms by increasing delays in audit reports and type of opinion. The results of the study are in line with that of the Desender et al. (2013), Watts and Zimmerman (1986), Chan et al. (2007), Ahmad and Bouri (2017), who declare that there is a negative and significant relationship between audit quality and corporate governance (including board independence, CEO tenure, and audit committee characteristics) and are in contrast with that of the Jiraporn et al. (2018) who posit that there is a negative and significant relationship between audit quality and the board independence index of managerial entrenchment because entrenchment is itself one of the components of corporate governance. Moreover, the results of the study are in line with that of Samaha and Khalif (2017), McGee and Yuan (2012), Mohammad Nore et al. (2010), and Afify (2009), who claim that there is a significant relationship between auditor's report delay and managerial entrenchment and are in contrast with that of the Salehi et al. (2018) who state that there is a negative and significant relationship between auditor's report delay and managerial entrenchment. On the other hand, the present study results conform with Farooq et al. (2018) and Desender et al. (2013), who suggest a significant relationship between audit fees and managerial entrenchment. The hypothesis testing results relative to the type of opinion and managerial entrenchment align with that of Susanto and Pradipa (2017). They express that there is a significant relationship between the type of opinion and CEO tenure (one of the managerial entrenchment indices) and also with that of the Uzun et al. (2004) This is because larger audit firms are more inclined to save their reputation in society, which, in turn, causes the financial statements of clients

to be audited with higher quality. On the other hand, larger audit firms always have a large number of clients, which leads to the client's independence. Hence, the growth of audit quality and even the audit fee, which is one example of audit quality, leads to the decline of managerial entrenchment.

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