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Research Paper

The Evaluation of the Capability of the Regression and Neural Network Models in Predicting Future Cash Flows

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ABSTRACT

Cash flow and profit are two important indicators for measuring the performance of a business unit. The future prediction was always a necessity in everyday life, and one of the subjects in which "The Prediction" has a great importance is economical and financial problems. The purpose of the present study is to predict future cash flows using regression and neural network models. Sub – separated variables of the accruals and operational cash flows were used to investigate this prediction. For this purpose, data of 137 accepted stock exchange companies in Tehran during 2009 to 2017 has been studied. In this study, Eviews9 software for regression model and Matlab13 software for Multi-Layer Artificial Neural Networks (MANN) with Error back propagation algorithm were used to test the hypotheses. The findings of the research show that both regression and neural network models within proposed variables in the present study have the capability of predicting future cash flows. Also, results of neural network models' processes show that a structure with 16 hidden neurons is the best model to predict future cash flows and this proposal neural network model compared with regression model in predicting future cash flows has a better and accurate function. Furthermore, in this study, it was noticed that accruals of assets compared with debt accrual and variables of operating cash flows with accrual components were more predictive for future cash flows.

1 Introduction

Cash flow and profit are two important indexes to measure functionality of a business unit. The existing resources and studies have reported different models to predict the cash flow. Nevertheless, they were not able to manage stabilities or non- linear specification in cash flow modelling [17]. For casting is an important component of the decision making process because decision making reflects

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what will happen in the future. In economic decision making, financial forecasting is an important activity. There is a need to forecast cash flow in different economic decisions because cash flows are the basis for paying dividends, interest, debt repayments, and so on. Predicting cash flows and their fluctuations as an economic event have long been the focus of researchers, investors, managers, financial analysts, and creditors [11, 12]. This is due to the use of cash flows in stock valuation models, payables assessment (dividends, interest and other liabilities), risk assessment, performance assessment of management and management experience, evaluation of management's choice of accounting methods and the use of cash flows for making decisions relevant to decision making models. Therefore, if cash flows can be properly predicted, a substantial portion of information needs related to the cash flow will be met. In a world where there are tremendous changes in the economy every moment, predicting future events will be a key factor in capturing profit opportunities, and while traditional techniques such as regression have proved to be ineffective in some cases, many people are interested in predicting future events more accurately [21, 23]. Previous studies have tested and proposed various models to predict future cash of the business units and many of the studies have used regression models to predict future cash flows. Differences among studies are also related to proposed models and variables, their linear and non-linear methods and also methods of analysis.

Therefore, to attain an accurate and comprehensive prediction, it is necessary to study data mining methods within regression approach. Without estimating the future cash flows, it is not possible to judge and make intelligent decision to choose the most suitable solution. Therefore, on the one hand, according to previous studies, the problem of cash flow prediction is not still solved and requires more studies. On the other hand, because of the existing non-linear relations among accounting information, it is necessary to study complicated and linear factors effective on forecasting future cash flows to find new methods and approaches which can forecast with the least possible deviation and error. Thus, this study examines separated explanatory power of their variables in each approach to propose an efficient powerful model with more explanatory power and feasibility both in public and private sectors for both mentioned models which are able to forecast future cash flows.

2 Theoretical Bases and Background

2.1 Theoretical Bases

The key role of accounting information in financial markets is to provide the necessary background for optimal resource allocation. Cash flow and profit are two important indicators for measuring the performance of a business unit. And the future liquidity position of a business depends on the ability of the business to provide the cash needed to settle its liabilities and other cash needs, which affect the market prices of the business securities. Historical cash flow information can help users of the financial statements in judging the amount, timing and extent of future cash flows. This information shows how the relationship between the profitability of the entity and its ability to generate cash determines the quality of profit and the quality of accruals acquired by the entity [17].

Based on what the theoretical frameworks emphasize, it is not possible to use current cash flow forecasts alone and to apply accruals in predicting future cash flows relative to when only current cash flow is used, Increases predictability. One of the information obtained from information systems is “accruals of companies” which is accrual based and is presented in financial statements [15]. Since accrual-based accounting profit is used by many financial information users to measure corporate performance, it is therefore an important item [16]. Scholars in the last decade of the twentieth century generally believed

in the principle that the assumption of rational investment, which is an indispensable principle in modern financial investment and one of the key assumptions in an efficient market, was not a real principle considering the complex factors affecting stocks markets. They have concluded that a capital market does not have a clear order and using complex mathematics in nonlinear and dynamic systems can create models that abrogate past theories. As a result, one of the considerations that financial data prediction needs to consider is the non-linearity of financial data. Based on the results of some studies, when data are of financial, seasonal and nonlinear nature, non-leaner model prediction such as neural networks will be more efficient. Many studies have proved that neural networks are more efficient compared with other traditional and linear models because neural networks, as opposed to linear models, reflect nonlinear effects and complex interactions among variables [8]. The conducted studies have emphasized the non-linear nature of the financial information in recent years. Therefore, numerous forecasting methods and unknown factors effective on investment return lead to uncertainty of the investors and creditors. That's why they are trying to find methods whose estimates are closer to reality and the errors are in the least possible rate [17]. A lot of studies have shown that neural networks models are more efficient and functional compared with other traditional and linear models because the neural networks unlike the linear models reflect nonlinear effects and complicated interactions among variables [8]. The artificial neural networks are considered as one of the computational methods in artificial intelligence in computational systems and methods.

The main idea behind these networks (to some extent) is originated from the bio-neural system for information and data processing for learning and science production. The key point of this idea is making new structures for information processing system. A neural system usually is composed of three layers of input, hidden or latent and output. The input layer only receives data and acts like an independent variable. The output layer also acts like a dependent variable and its neurons rate depends on the rate of the dependent variable. In this method it is assumed that accounting general variables are available in temporal form. Then the designed neural networks receive data from the beginning period to T period, and through these data they will learn to predict accounting data from time frame T to the end of considered period [4]. Therefore, the previous studies have been done mostly in linear regression models based on annuals and profit while fewer non-linear models have been used. Thus, on the one hand, the present study has used both regression approach and neural network model to forecast the future cash flow, and on the other hand, it has used new variables originated from the commitment models of the scholars Pang [17], Farshadfar and Monem[6], Larson et al[13], and by combining these variables in the form of one new model, it compares the results of both approaches to propose an efficient stable model with more explanatory power. It can be considered as an innovation aspect of this model.

2.2 Empirical Background of the Study

Different researchers have used different prediction models of the cash flows. However, there have been few studies to predict future cash flows using regression approach and neural network approach as comprehensive new analytic methods. Thus, some of the studies related to the present study in and out of the country will be reviewed briefly. The results of Farshadfar and Monem's [6] study titled "Further evidence of the relationship between accruals and future cash flows" using Australian data show that both working capital and non-current operating accruals are important in explaining future CFO but financing accruals is not significant. Moreover, the asset component of accruals plays a more

important role in explaining future CFO compared with the liability component. Al-attar et al [2], studying "The Effect of Earnings Quality On the Predictability of Accruals and Cash Flow Models in Forecasting Future Cash Flows" show that earning quality of cash affects forecasting power of both cash flows and profit. In addition, when "earnings" have high quality act better than cash flows in predicting annual future cash flow. Yarifard et al [24], in a study titled "the prediction of cash flows in the companies accepted in Tehran Stock Exchange" has shown that the price of the sold goods and the public and official price have a meaningful effect in forecasting the cash flows but sale, changes in payment accounts, changes in receivable accounts, changes in inventories, tax, previous year cash flows do not have a meaningful effect in forecasting the cash flow.

Heydarpour et al [9] studied the rational power of the profit variables and operational cash flow in forecasting the future cash flow during 3 temporal periods (short-term, middle-term and long-term), and regression results show that the earnings and cash flows operations have a forecasting power of the future CFO, but their predictive powers are different. Sagafi et al [19], in a study titled "application of artificial neural network to forecast the future cash flow" have shown that two structures with 8 and 11 hidden neurons are the best model to forecast the cash flow. Pang [17], in a study titled "Designing a dynamic and nonlinear model in cash flow prediction" relied on modelling and designing new model that can fill the gap between the simple and complicated models such as cash flow prediction model. Lee et al [14] studied "Cash flow forecasting for South African firms", and their results show that depreciation and inventory do not have a meaningful effect in forecasting cash flows. Shobita [22], investigated "power of accrual forecast and profit in relation to future cash flows in Jordan. Their findings show that accruals and the profit are able to predict future cash flows, and profit is more predictive than accruals. Sagafi and Sarraf [20], in a study titled "a model to forecast the cash flow in Iranian companies" has shown that random walk model can forecast operational cast flow better than reverse accrual model. However, according to the results achieved from the companies in which the government influences their management showed that accrual model is more suitable to the future cash flow. Rozbaksh et al [18], in a study titled "forecasting cash flows operations using artificial neural networks in Tehran Stock Exchange" have shown that artificial neural networks have high capability in predicting the future cash flow because the two hidden layers with 15 and 30 neurons in each layer can predict the cash flows with 99/2 % accuracy. Arndo et al [3], in a study titled" The role of accounting accruals for the prediction of future cash flows" in a 7 years' temporal period in Spain concluded that accounting accruals have a predicting power of future cash flows so that by adding accounting accruals to the current cash flows model the error index is reduced.

3 Research Hypothesis, Methodology of the Research and Statistical Data

3.1 Research Hypothesis

The main purpose of this study was to propose an efficient model for optimal decision making of the investors for future cash flows based on regression models and neural network in the capital market of Iran, and tried to answer this question whether it is possible to propose an efficient model to forecast the cash flows based on regression and neural network model in the capital market of Iran? To answer the above-mentioned question, research hypothesis is presented as follows:

Hypothesis 1: The regression model is a suitable model to forecast future cash flow.

Hypothesis 2: The neural network model is a suitable model to forecast future cash flow.

Hypothesis 3: The neural network model is a more suitable model than the regression model in forecasting future cash.

3.2 Research Methodology

This study aimed to provide a model for predicting future cash flows for listed companies in Tehran Stock Exchange using regression and neural network models. Therefore, this study was statistically modeled one and methodologically a descriptive (quasi-experimental) correlation study in which the relationship between variables was analyzed according to the research purpose, in terms of purpose applied type, in terms of the Implemention process of a quantitative data type and in terms of data collection it is an empirical correlation analysis. In order to collect analyze the relationship between the data, mainly the Rahavard Novin software and databases were used. Regression approach using Eviews9 software and neural network model using MATLAB13 software have been used. Artificial Neural Networks (ANN) Structure presented in figure 1.

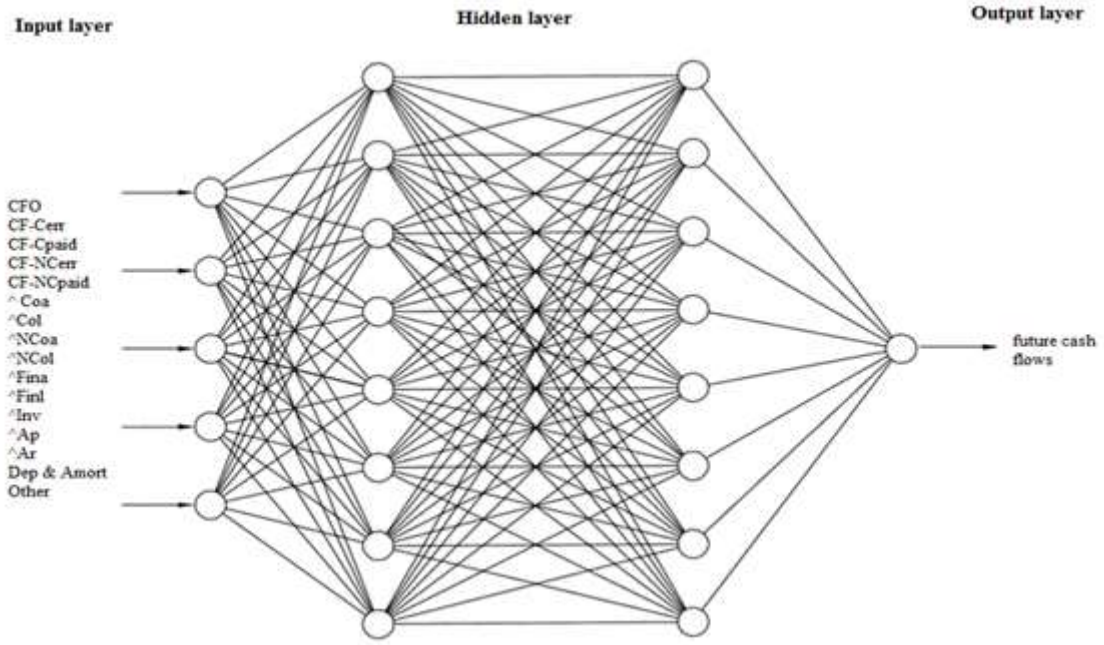

Fig 1: Artificial Neural Networks structure (ANN)

To analyze the data using the artificial neural network, we first split the data into three training, experimental, and validation groups randomly. Then the data are combined with a perceptron artificial neural network Layers were trained. These three layers include the input layer (including the independent variables), the middle or hidden layer, and the output layer (including the response variable). To do this, we change the number of middle layer neurons between 4 and 20 neurons to find the best model for the data. We also used Identity functions, tangent sigmoid and hyperbolic tangents as activity functions, and used the rock curve and the correct prediction percentage to select the best model. Each neuron in the artificial neural network has a specific weight, each neuron captures the output layer neurons in each layer and, after being affected by the output activity function, transmits them to each individual layer layer neurons. One of the most important goals of a neural network is to find neurons that fit in different layers. The algorithm uses two sweep paths after computing the error to compute grid weights and continues these steps to find the best estimate for the grid parameters. This process is referred to as the learning process.

Since it is not possible to predict which of the functions will produce the best response at the beginning of the study, a neural network with hypothetical functions should be considered and the best results can be obtained after analyzing and evaluating the results. Hypothetically, based on the researchers' experience, the Levenberg-Marquardt training function, the learning function of the fastest Gradient Descent with Momentum, and the Mean Square Error function are used as the default functions. In back propagation networks, the Hyperbolic Tangent Sigmoid, log sigmoid and linear function are used. In the beginning the tansig function is used for the hidden layers and the purelin function is used for the output layer. In the neural network, layer-by-layer calculations are performed and the output is calculated. First, the outputs of one layer of nerve cells are calculated and these outputs are used as inputs for the next layer. Then, from these inputs, the outputs of the second layer are calculated, and so the process is continued to obtain the output vector of the network. In the meantime, the learning functions of they are of particular importance.

Unlike traditional predictive methods such as regression, multilayer perceptron neural networks have a limited number of input variables.in methods such as regression modeling, the relationship has a direct non-direct relation with the number of explanatory input variables, in other words, by increasing the number of explanatory variables, the performance of the model will not decrease. But this is not the case in multilayer feedforward neural networks such as multilayer perceptrons. Therefore, the problem of determining the number of input variables into a network has become an important issue affecting the design of neural networks. Although the defined rules for the number of network inputs have not been determined in different issues, they are generally dependent on the number of network inputs to the network structure, the training algorithm, the complexity of the view, and the data traffic caused by the data. In the literature, the most common solution to this problem is to select the most influential input variables on the value of the objective function and to omit the other variables. The popularity of multilayer perceptron networks has diminished in the forecast. In the proposed hybrid method, instead of eliminating the low-impact variables, these variables are combined with other self-influencing variables. By combining the inputs together, we will no longer only have the problem of the number of inputs, but also the ability to analyze the type and extent of the impact of each of the variables.in order to overcome the limitation of the number of input variables of neural networks and also to improve the accuracy of predictions in financial environments, self-organizing mappings that are precisely present methods in identifying and analyzing nonlinear multidimensional spaces are proposed. The proposed hybrid approach generally comprises the following four basic stages:

1.Identify the influential variables
2. Clustering of influential variables
3. Combining the influential variables in each category
4. Designing the final neural network and predicting the dependent variable. [10]

3.3 Data

In this study, all accepted companies in “Tehran Stock Exchange” are Statistical population. To choose samples from companies in statistical population; the companies that have the following requirements had been selected.

1- The sample companies should be accepted in Tehran Stock Exchange from the beginning of 2009
2- The companies’ financial statements or other required data should be available from 2009 to 2017
3- For comparison purposes, those companies whose financial year did not end in March were excluded.

Table 1: Research Variables, Operational Definitions and Their Measuring Methods

Variable	Symbol	How to Measure
Dependent and Output variable		
future cash flows	CF_{it+j}	(the firm's net cash flow from operations of the next year)
Independent and input variables		
total accruals	TACit	Sum accruals (current operating + non-current operating + financing)
changes in working capital accruals	ΔWCit	Changes in working capital accruals during the year
changes in non-current operating accruals	ΔNCOit	Changes in non- current operational accruals during the year
changes in financing accruals	ΔFINit	changes in financing accruals during the year
cash flows from operations	CFO_{it}	the firm's net cash flow from operations, as disclosed in the statement of cash flows
changes in current operating assets accruals	ΔCOA_{it}	Changes in (total current assets – cash - current investments) during the year
changes in current operating liabilities accruals	ΔCOL_{it}	Changes in (total current liabilities - short-term facilities) during the year
changes in non-current operating assets accruals (investment)	$\Delta NCOA_{it}$	Changes in (total non-current assets - long-term investments) during the year
changes in non-current operating liabilities accruals (investment)	$\Delta NCOL_{it}$	changes(total non-current liabilities - long-term facilities) during the year
Changes in financing assets accruals	$\Delta FINA_{it}$	Changes in investments (short-term + long-term) during the year
Changes in financing liabilities accruals	$\Delta FINL_{it}$	Changes in receivable facilities (short-term + long-term) during the year
cash flows received from sales of goods and providing services	$CF\ Cerr_{it}$	cash flows received from customers (Net sales -increase/+ decrease of Net received accounts+ increase/-decrease Perreceived sales –cost of fuei claims)
cash flows Payments For the purchases of goods and services	$CF\ Cpaid_{it}$	cash flows Payments For purchases (Net purchases +increase/-decrease of inventories -increase/+ decrease Net payment accounts increase/-decrease of Prepayment of goods
other received cash flows (except for sales of goods and providing services)	$CF\ NCerr_{it}$	(related Revenue - increase/+decrease of related receivables Revenue +increase /-decrease related Per-received revenues)
Other Payments cash flows (except for purchase of goods and services)	$CF\ NCpaid_{it}$	cash flows Payments For costs (Total costs items with the exception of non- cash costs , interest and tax - increase /+decrease of payable costs)
Changes in inventories	ΔINV_{it}	Changes in inventory
Changes of payable accounts	ΔAP_{it}	Changes in account payable
Changes of receivable accounts	ΔAR_{it}	Changes in account receivable
tangible and intangible assets depreciation cost	$DEP_{it}\ and\ AMORT_{it}$	Depreciation and amortization
Other accruals	$OTHER_{it}$	Other accruals, calculated as earnings before interest, tax, depreciation and amortization. (EBITDA) – (CF + ΔAR + ΔINV – ΔAP – DA).
source: Pang, [17], Farshadfar and Monem [6], Larson et al [13], and standard No 2 of IRAN accounting.		

4- The investment companies and other financial intermediaries were excluded due to their different functional characteristics.

Finally, according to the above-mentioned requirements, among all accepted companies in "Tehran Stock Exchange"137 companies were selected as a sample for this study.

3.4 Variables and Research Model

In this research, based on theoretical and research background, Farshadfar and Monem[6], Larson et al [13] and Pang's [17] variables and accrual model have been used to propose an optimal model for cash flow in both approaches, the dependent and the output variables are future operating cash flows, respectively, and the other variables are the independent and input variables presented in Table 1 and the final model of the research and its components are as follows in equations 1 and 2 bellow.

$$CF_{it+j} = \gamma_0 + \gamma_1 CF - Cerr_t + \gamma_2 CF - Cpaid_t + \gamma_3 CF - NCerr_t + \gamma_4 CF - NCpaid_t + \gamma_5 \Delta COA_{it} + \gamma_6 \Delta COL_{it} + \gamma_7 \Delta NCOA_{it} + \gamma_8 \Delta NCOL_{it} + \gamma_9 \Delta FINA_{it} + \gamma_{10} \Delta FINL_{it} + \gamma_{11} \Delta INV_{it} + \gamma_{12} \Delta Ap_{it} + \gamma_{13} \Delta AR_{it} + \gamma_{14} DEP_{it} \; and \; AMORT_{it} + \gamma_{15} OTHER_{it} + \varepsilon_{it} \quad (1)$$

$$TACi,t = \Delta WCi,t + \Delta NCOi,t + \Delta FINi,t \quad (2)$$
$$CFO\ it = CF - Cerr_{it} + CF - Cpaid_{it} + CF - NCerr_{it} + CF - NCpaid_{it}$$

Table 2: The Summary of Neural Network Model Process

Parameter	Description
the type of neural network	Multi-Layer Artificial Neural Networks (MANN) (Feed forward) by newff function
Random data separation	Dividerand function
the number of neuron in each input layer	7neurons
the number of neurons in each hidden (middle) layer	4 to 20 neurons
the number of neuron in each output layer	1 neuron
transfer function (activity of hidden neurons layer)	tangent sigmoid function
transfer function(activity of output neurons layer)	Identity and purelin function
learning pattern	Error back propagation algorithm (delta rule)
learning course(repetition)	1000 epoch
learning rate	0.050 to 0.60
numbers of collection	Training 65% , accreditation 10% and test 25%
evaluation criteria and choosing the best structure to experimental results and test	Mean squared error (MSE) Root-mean-square error(RMSE) Normalized Mean Squared Standard Error (NMSE) Mean Absolute Error(MAE) Mean Absolute Percentage Error(MAPE) correlation coefficient(R2)
Choosing the most efficient variables to forecast-ing	Sensitivity Analyze (weight factor)

3.5 Implementation of Neural Network

To propose a neural network model for forecasting the future cash flows, at first the necessity of standard normalization for appropriate of the model will be discussed. Then, the number of network hidden layers, the number of neurons in each layer, learning algorithm, transfer function, application function, the number of repetition, the size of learning and educational collection should be specified

for which there is not a unique systematic method. Therefore, the best designed network will be achieved by trial and error. Table 2 and figure 2 summarizes the proposed neural network model process.

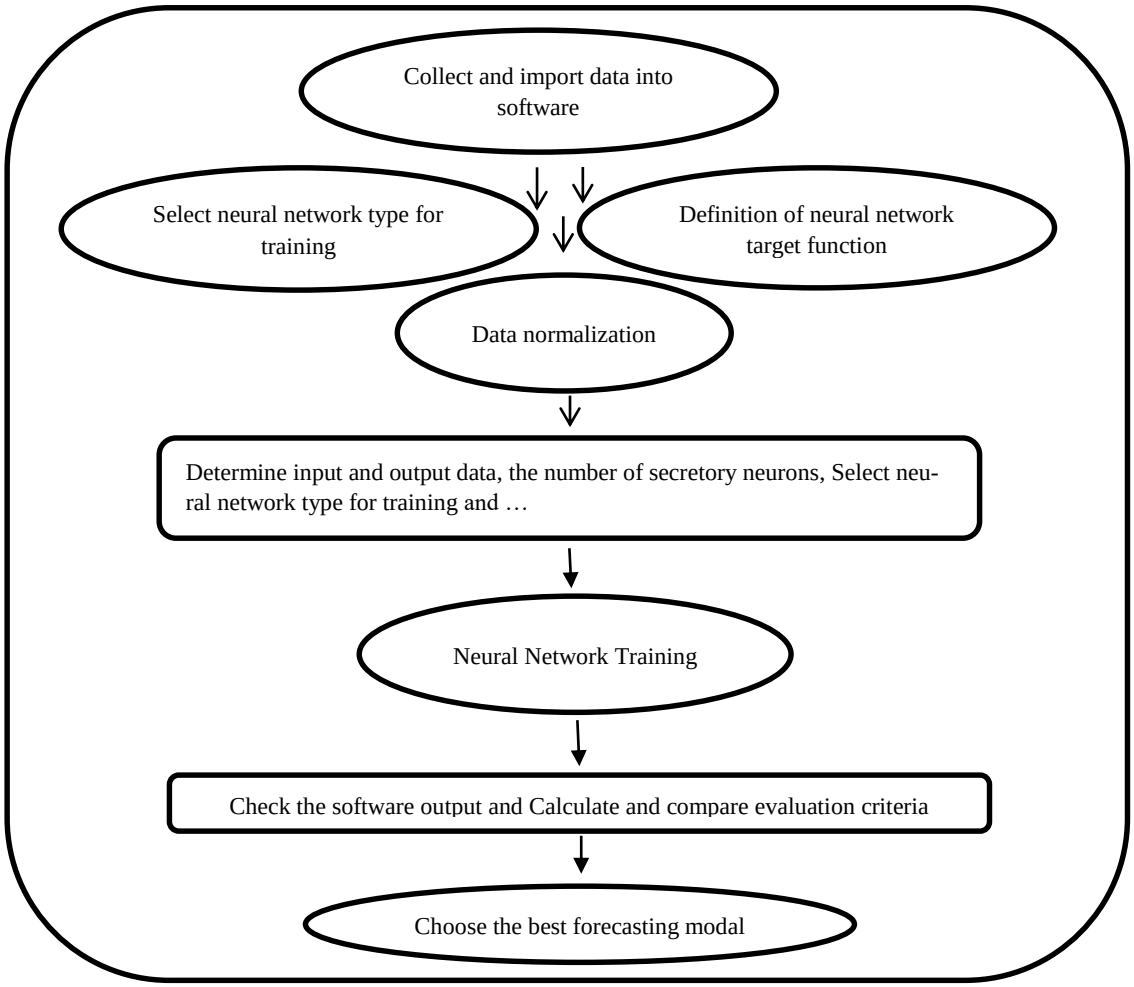

Fig 2: The Summary of the Implementation Process of Neural Network Model (NNA).

4 Research Findings

4.1 Descriptive Statistics

Descriptive statistics (regression and central tendency indexes) of the research variables is proposed in the Table 3. The main central tendency index is the "mean" which shows the balance point and distribution mean center. The mean index of all variables was positive and the highest index was related to cash flows received from sales of goods and providing services (CF-Cerr) with 1.070 around which most of the data had been concentrated. Generally, the regression parameters are criterion to determine the regression value from each other or their regression value with respect to the mean. One of the most important regression parameters is standard deviation. The amount of this parameter for paid cash flows

variable to purchase goods and services (CF-CAPID) is 0.86 and for the variable of tangible and intangible assets depreciation it is 0.017 that shows these two variables have the lowest and the highest regression value among the research variables.

Table 3: Descriptive Statistics of Research Variables

Variable/statistic index	mean	median	minimum	maximum	standard deviation
CF	0,169	0,138	-1,007	1,356	0,206
CFO	0,143	0,123	-0,723	1,147	0,165
COA	0,451	0,562	-0,011	2,213	0,151
COL	0,154	0,069	-0,854	1,054	0,214
$NCOA$	0,129	0,513	-0,754	3,333	0,201
$NCOL$	0,201	0,134	-0,087	2,041	0,176
$FINA$	0,098	0,017	-0,314	0,821	0,037
$FINL$	0,112	0,035	-0,425	1,678	0,142
CF_Cerr	1,070	0,867	-0,023	11,017	0,858
CF_Cpaid	0,992	0,776	0,002	10,336	0,860
CF_NCerr	0,117	0,057	0,000	1,812	0,170
CF_NCpaid	0,048	0,034	0,001	0,622	0,048
INV	0,065	0,062	-1,512	1,563	0,141
Ap	0,041	0,026	-0,289	0,851	0,094
AR	0,065	0,031	-0,721	2,021	0,174
$DEP\ and\ AMORT$	0,021	0,017	0,013	0,126	0,017
$OTHER$	-0,048	-0,037	-3,321	1,863	0,302
Number of Observations: 959					
source: Calculations of the research					

4.2 Results of the Regression Approach

Because statistical probability of Jarque-Bera test in the Table 4 for the dependent variable of the future operational cash flows is smaller than 5% error level, so the null hypothesis of the normality of the above-mentioned variable is rejected. It means that data does not follow the normal distribution for dependent variable.

Table 4: Normality and Stability of Dependent Variable Research and Flimer and Hasman Model Test.

variable	Jarque-Bera test		lewin,lin,chu test		result
	Statistic	Prob.	Statistic	Prob.	
CF	1369,6	0,000	-20	0,000	normal-stable
Model/test	Redundant Fixed Effects Tests		hasman test		model process method
	Statistic	Prob.	Statistic	Prob.	
The first	1,816	0,000	222,18	0,000	fixed effects, panel data
source: Calculations of research					

If the model is big enough in size (many of the resources consider thirty observations and so as a big size), even if the distribution of the estimated proposed model statements is normal, the calculated co-efficient will have minimum variance, and they are efficient and we can rely on these models to test

research hypothesis.[1] As a result, and considering the big size of this research sample, it is assumed that the dependent variable of the research is not normally disturbed. The results of the Table 4 show that the significance level of the Lowin, Lin and Cho test is less than 5% for the dependent variable of the research which shows the reliability of the research. Therefore, the results in the confidence level of 95% show that the dependent variable for the data was reliable and does not have a unique root. In addition, based on the results in Table 4 Flimor significance level in the research model is less than 5%. Therefore, Hasman test will determine regression type. According to the results of Hasman test when the Flimor significance level is less than 5%, the fixed effect panel data method is used, and if is more than 5%, the random data–panel method is used. The results of the tests indicate fixed effects panel data method.

Table 5: Results of the Regression Test

Variable	Coefficient	Std. Error	t-Statistic	P-value
C	502646.9	76558.43	6.565	0.000
CF_Cerr	0.133	0.051	2.6	0.009
CF_Cpaid	-0.118	0.047	-2.47	0.013
CF_NCerr	0.271	0.063	4.285	0.000
CF_NCpaid	-0.019	0.217	-0.087	0.030
ΔCOA	0.257	0.041	6.237	0.000
ΔCOL	-0.127	0.034	-3.651	0.000
$\Delta NCOA$	0.0348	0,025	1,378	0,008
$\Delta NCOL$	0.026	0.025	1.052	0.292
$\Delta FINA$	0.148	0.062	2.373	0.017
$\Delta FINL$	0.007	0.05	0.157	0.074
ΔINV	0,257	0.054	5,154	0.000
ΔAp	-0,21	0,061	-3,25	0.002
ΔAR	0.214	0.04	6.145	0.000
$DEP\ and\ AMORT$	1.542	0.398	4.452	0.000
$OTHER$	0.202	0.045	6.987	0.000
R-squared	0.789	F-statistic	16.8	
Durbin-Watson stat	2,15	Prob(F-statistic)	0.0000	
Adjusted R-squared	0.655			
source: Calculations of research				

As the results of the Table 5 show, the calculated significant level for each of the thirteen independent variable cash flows received from sales of goods and providing services(CF-cerr), other received cash flows (except for sales of goods and providing services) (CF-NCerr), cash flows Payments for the purchases of goods and services(CF-Cpaid), other payments cash flows (except for purchase of goods and services) (CF-NCpaid) , current operating asset accruals (COA), current operating liability accruals(COL), non-current operating asset accruals (NCOA), financing asset accruals (FINA),changes

in account receivable (AR), changes in account payable(AP),changes in inventories(INV),tangible and intangible assets depreciation cost (DEP and AMORT) and other accruals (other) is smaller than 5% error level , and calculated coefficient for ten variables is positive and for three variables it is negative. Therefore, it can be said that cash flows received from sales of goods and providing services(CF-cerr), other received cash flows (except for sales of goods and providing services) (CF-NCerr), cash flows payments for the purchase of goods and services(CF-Cpaid), other payment cash flows (except for purchase of goods and services) (CF-NCpaid) current operating asset accruals (COA), current operating liability accruals(COL), non-current operating asset accruals (NCOA), financing asset accruals (FINA),changes in accounts receivable (AR), changes in accounts payable(AP),changes in inventories(INV),tangible and intangible asset depreciation cost (DEP and AMORT) and other accruals (other) have a direct and meaningful effect on future cash flows of the accepted companies in Tehran Stock Exchange. Furthermore, cash flows payments for the purchase of goods and services(CF-Cpaid), current operating liability accruals(COL), changes in accounts payable(AP) have a revers meaningful effect on future cash flows of the accepted companies in Tehran Stock Exchange".

Nevertheless, the calculated significant level for the variables of non-current operating liability accruals (NCOL) and financing liability accruals (FINL) is larger than 5%, which indicates that the effect of these variables on forecasting cash flows is not meaningful. In addition, according to the results from balanced determination coefficient which is 65.5%%, it can be said that 65.5% of the dependent variable changes can be explained, and since Durbin –Watson statistic of the model is nearer to 2(2.15), it can be said that there is no first order autocorrelation in this model (confirming one of the regression hypotheses). In addition, the results of the Table 5 show that F test significant level is less than 5%. Since the F statistic shows the total reliability of the model, it can be stated that this model is 95% meaningful and have a high reliability. All in all, based on the results of the research model, the regression model is a suitable one for forecasting future cash flows. Thus, the first research hypothesis is accepted and this model with 13 effective and predictive variables is able to forecast future cash flows as follows:

$$CF_{it+j} = \gamma_0 + \gamma_1 CF - Cerr_t + \gamma_2 CF - Cpaid_t + \gamma_3 CF - NCerr_t + \gamma_4 CF - NCpaid_t + \gamma_5 \Delta COA_{it} + \gamma_6 \Delta COL_{it} + \gamma_7 \Delta NCOA_{it} + \gamma_8 \Delta FINA_{it} + \gamma_9 \Delta INV_{it} + \gamma_{10} \Delta Ap_{it} + \gamma_{11} \Delta AR_{it} + \gamma_{12} DEP_{it} \; and \; AMORT_{it} + \gamma_{13} OTHER_{it} + \varepsilon_{it} \quad (3)$$

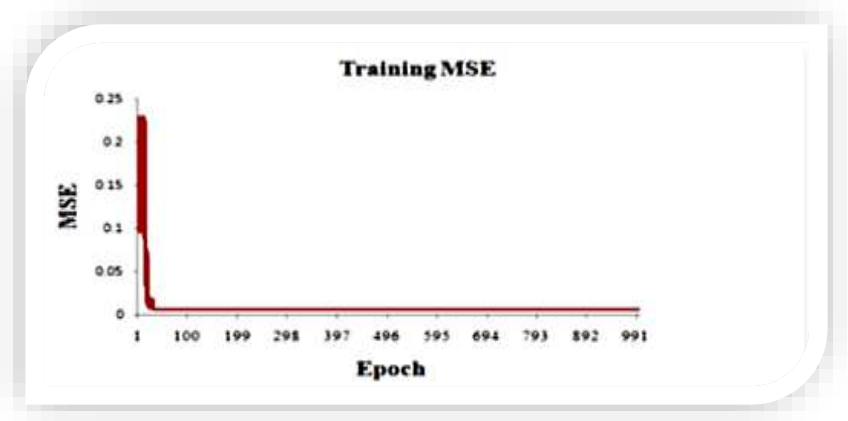

Fig. 1: The error convergence process of MSE for future cash output in neural network model

4.3 Results of Neural Network Model (NNA)

The error convergence process of MSE for future cash output in neural network model is shown in Fig.1. As can be seen, the neural network algorithm has rapidly converged and from the 52 rd epoch, the value of the target function has remained constant, indicating the power of the algorithm. Fig. 2 shows the trend of mse error in the neural network to its lowest value. As the Diagram shows, the number of replications of this model is 38, and in the marked green area, we see 6 replications without improvement that have stopped the training process.

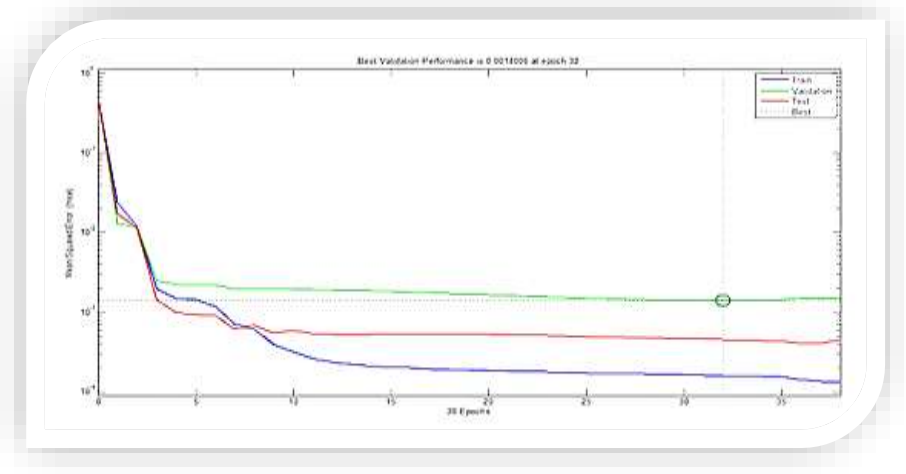

Fig. 2: Mse error process according to the number of repetitions

Table 6: Evaluation criteria for neural network model application in the best structure model

Evaluation criteria and parameters	amount of Training data	amount of test data
Mean Squared Error (MSE)	13,04	4,98
Root Mean Squared Error (RMSE)	7,45	4,56
Normalized Mean Squared Standard Error (NMSE)	1,18	0,068
Mean Absolute Error (MAE)	5,32	3,83
Mean Absolute Percentage Error (MAPE)	123	89,9
R Squared(R2)	0,88	0,97
source: Calculations of the research		

In the current study, different neural networks in the form of 17 structures have been processed. In this study due to the scope of the research, only the results of the best neural network structure model with 16 hidden neurons have been displayed in Table 6. According to the results, the predictive accuracy of the artificial neural network model with 16 hidden neurons has the Mean Squared Error 4.98 and the highest correlation coefficient 0.97, and this structure is the best predictor of future cash flows.
Table 7 shows the results of the Sensitivity Analyze in the variables of the research in the best (16 hidden neurons) neural network structure. The sensitivity analyze process is used to choose the most effective variable in cash flows prediction. It is natural that the more sensitivity Analysis (weight factor) of the variable is, the more effective the variable will be in the network output and prediction of the future cash flows. The sensitivity analysis process shows the amount of model sensitivity to its input

variables. The sensitivity coefficient value of the input variables can be obtained by dividing total network error in the absence of one variable to total network error in the presence of all input variables[4].

Table 7: The Results of Sensitivity Analyze (weight factor) Inputs of the Neural Network Models

variable	Weight factor	variable	Weight factor
CF_Cerr	0.132	$\Delta FINA$	0,147
CF_Cpaid	0.117	$\Delta FINL$	0,099
CF_NCerr	0.126	ΔINV	0,113
CF_NCpaid	0.103	ΔAp	0,128
ΔCOA	0.211	ΔAR	0,111
ΔCOL	0.178	$DEP\ and\ AMORT$	0,108
$\Delta NCOA$	0.115	$OTHER$	0,096
$\Delta NCOL$	0,093		
source: Calculations of the research			

Accordingly, if the value of the sensitivity coefficient of one variable is more than 1, the variable has more share in explaining changeability of the function evaluation criteria. As depicted by the Table 7, almost all of coefficient weight of the variables are larger than one or closer, indicating the abilities of all variables in forecasting the cash flows , and among the variables, the current operating asset accruals (COA) with the coefficient weight of 0.211 and non-current operating liability accruals(NCOL) with co-efficient weight of 0.093 are the most and the least effective in forecasting the future cash flows, respectively. Therefore, the second research hypothesis is accepted, and this model with all 15 variables as follows in equations 4 bellow forecasts the future cash flow.

$$\begin{aligned} \mathrm{CF_{it+j}} = \gamma_0 \ &+ \gamma_1 \mathrm{CF-Cerr_t} + \gamma_2 \mathrm{CF-Cpaid_t} + \gamma_3 \mathrm{CF-NCerr_t} + \gamma_4 \mathrm{CF-NCpaid_t} + \gamma_5\, \Delta \mathrm{COA_{it}} \\ &+ \gamma_6 \Delta \mathrm{COL_{it}} + \gamma_7 \Delta \mathrm{NCOA_{it}} + \gamma_8 \Delta \mathrm{NCOL_{it}} + \gamma_9 \Delta \mathrm{FINA_{it}} + \gamma_{10} \Delta \mathrm{FINL_{it}} \\ &+ \gamma_{11} \Delta \mathrm{INV_{it}} + \gamma_{12} \Delta \mathrm{Ap_{it}} + \gamma_{13} \Delta \mathrm{AR_{it}} + \gamma_{14} \mathrm{DEP_{it}} \text{ and } \mathrm{AMORT_{it}} + \gamma_{15} \mathrm{OTHER_{it}} \\ &+ \varepsilon_{it} \end{aligned} \tag{4}$$

5 Conclusions and Suggestions

Liquidity and profitability are two crucial issues that are of particular interest to financial scholars and managers. Indeed, some consider liquidity to be more important and believe that if a company is not profitable, it is sick, but if it does not have the liquidity it is dying. In other words, it is possible for a company not to be profitable but survive; however, it cannot survive without liquidity. Cash management is one of the main issues of corporate financial management. Liquidity demonstrates the ability of a corporate to engage in short-term commitments. In other words, liquidity is the relationship between the cash that will be available to the company in the short run and the cash that the company will need. The main purpose of liquidity management is to obtain a desirable liquidity so that the company is not exposed to excess liquidity or an abnormal liquidity shortage.

In economic theories, the value of a company is based on the existing future cash flows; the prediction of the future cash has a great importance. Therefore, one of the purposes of the "financial reporting "is helping the investors and creditors to predict the future cash flows. In addition, the Committee of Iran's editing accounting standards under the theoretical conceptions of the financial reporting noted that: "making an economical decision by the users of the financial statements requires evaluating the business units to make a cash and cash making certain". Evaluating the cash making power is facilitated by focusing on financial statements, financial functionality, and cash flows of business unit and using them

in forecasting expected cash flows and measuring the financial flexibility".[5] The future forecasting has been a necessity in everyday life and is a common area of interest in many scientific fields. One of the areas in which prediction has a great importance is economic and financial issues. The effect of stock exchange market in economic development of a country is undeniable. The main task of this market is effective operation of the capitals and optimal allocation of the resources[7] .In a world where there are tremendous changes in the economy every moment, predicting future events will be a key factor in capturing profit opportunities, and while traditional techniques such as regression have proved to be ineffective in some cases, many people are interested in predicting future events more accurately. Previous studies have examined various models to forecast future cash flows of the business units and most of these studies have used regression models to forecast the future cash flows. Therefore, it is necessary to try other new methods to attain a more exact prediction. Thus, on the one hand, the problem of forecasting the cash flow has not been solved according to the previous research and requires more studies, and on the other hand, due to the nonlinearity of the relationship among accounting data, it is necessary to study the complicated and non-linear factors effective in forecasting future cash flows and find new ways and models which is able to predict with the lowest possible error and deviation. Results from previous research have indicated that members of the capital market, such as investors, focus on current earnings, regardless of the different sustainability of accruals and cash components. Thus, the relative superiority of the relative power of profit in explaining stock returns is not crystal clear. Since realized cash flows may have scheduling and matching problems, this reduces the relative ability of cash flows to reflect firm performance. It should be noted that since profits are adjusted cash flows for accruals, there is a debate that cash flows cannot be more relevant than accruals.

However, management's opportunistic use of accruals or the measurement error in accruals can lead to a decrease in the information content of the profit. Therefore, this study examines explanatory power of individual variables in regression and neural network model and proposes an efficient model with more explanatory power in forecasting the future cash flows for each model. The results of the present research cannot be compared with other studies since there are not any similar studies. The results attained from the first research hypothesis showed that regression model with 13 predictive variables is a suitable model to forecast the future cash flow. This result is in line with those of (Farshadfar and Monem, [6]; Shobita, [20]; Arendo et al , [3]; Sagafi and Sarraf , [18], and results of the second hypothesis showed that neural network model with 15 predictive variables is a suitable model to forecast future cash flows and this result is in agreement with those of Pang, [15]; Sagafi et al, [17]; Roozbaksh et al, [16].In addition, based on the results of the first and second research hypotheses , it can be concluded that neural network model with 15 predictive variables compared with regression model with 13 predictive variables is a more suitable model to forecast future cash flows. Therefore, all three research hypotheses are accepted. Therefore, based on the results of this study, it the components of the operating cash flows compared with accruals components have greater relative ability to predict future cash flows. Accordingly, the investors financial analyzers and other financial statement users are advised should pay attention to the new data mining methods to make a logical decision. For further research it is suggested that the same topic can be investigated using other new artificial intelligence models (genetic algorithm, Support vector machine, Particle swarm algorithm and …) and the results can be compared with regression models. Since new variables are introduced in this study most of which have not been investigated in Iran with, it is suggested to conduct another study to investigate the future profit forecasting and profit quality using other new models whose results can be compared. Finally, except for the variables examined in this study, there may be other variables which can improve the

proposed models. Therefore, a study can be performed with new variables along with the current variables in the above mentioned models.

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