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Credit Risk Assessment of Urban Cooperatives Using Neural Network Method

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Abstract: One of the most important issues for institutions that provide financial facilities to others is the issue of credit risk. One of the ways to quantify and measure credit risk and, consequently, its proper management, is to use a credit rating. Credit rating is a model for measuring the performance of facility recipients, which is based on quantitative criteria such as corporate financial information, in order to allow prospective clients to obtain a similar profile with facilities and customers with a proper and inappropriate credit position. To be identified. According to the mission of the organization, the Central Union of Cooperative Cooperatives of Consumers' Workers of Iran has numerous member cooperatives from across the country, which provides their products there. In this research, the effect of each of the factors involved in determining the risk of credit in this cooperative has been tested first. Then, using the self-organizing mapping algorithm, we will cluster the data to exclude clusters that are very remote and far-reaching. The credit risk of each of the cooperatives has been calculated through the algorithm of the multi-layer perceptron neural networks in MATLAB software and a model for predicting credit risk in the future. The main purpose of this research was to use this algorithm to classify cooperatives by calculating credit risk numbers and use it to predict the future credit risk of the future cooperatives.

Keywords: Scoring, Neural Network Algorithm, Validation, Credit Risk
JEL Classification: C15, C38, C45, C52

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1- Introduction

Risk as the probability of improper deviation from program is from amongst most important factors effective on the success and failure of projects and organizations. Economic companies and organizations require for risk management approach, as an internal trend and systemized, for maximizing the probability of success and preventing from negative effects of predicted risks and factors. (Chi & Hsu, 2012). Today, companies encounter the increase of complications and uncertainty, which makes the management of specialized risks and business more difficult. The process of risk assessment is the first phase of activities set of risk management. This vital process has a special stand in data security management system. The assessment of risk is performed for answering the following questions: if one risk occurs, who much damage will it bring about? How much is the probability of each risk? Who much is the expense of controlling each risk? Is it economical or not?

The most important benefit of risk assessment is to assist right decision making for selecting security solutions. Risk assessment may prove the requirement of expensing for security to the decision makers of organizations. The results of risk assessment may help the right direction in the selection of solutions; it may also be used in generating and amending the security policies of organization (Jones, 2014).

Cooperative is the independent gathering of individuals who agreed with each other to establish an institute with communal ownership in optional manner and manage and supervise it in democratic form for the purpose of providing and covering joint economic, social and cultural requirements and objectives. In the economy of capitalist and sociologist countries, the establishment of official cooperatives has been stated from the early years of nineteenth century, while in our country this phenomenon has a short record and despite it has had a record in its traditional type from long ago, the emergence of its official type is no longer than a few decades.

We can consider 1935 as the cooperatives' commencement year of activity in Iran. The number of cooperatives founded (including rural cooperative funds and consumer cooperatives) up to 1951 reaches one hundred hardly, the great majority of which had no effective and considerable activity as well. Now, more than one hundred thousand cooperative companies are engaged in activity in the country with the membership of more than 44 million people, which made occupation for more than one million, and six hundred forty three thousand people. In addition to the cooperative companies, 658 cooperative unions are active in various economic fields. (The Statistic Letter issued by the Ministry of Cooperation, Labor and Social Welfare, 2015). The economic nature of cooperative is in such a way that it makes great help in accomplishing the requirements of strength economic through its own strengthening levers, i.e. economic activity and value creating in retail and whole volume, entrepreneurship and justly distribution of income and capital by relying on human and social capital and procurement of financial capital from retail savings. Although, based on the General Policies of Principle 44, cooperation sector should have achieved a share of 25% from national economy up to the end of Iranian year 1394 (Mar. 20, 2016),

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evidences show that the share of this sector has a considerable difference with the specified objective. The reason of this matter relates to the structural weaknesses of cooperatives. (Bijan Abdi, 2015).

Since the granting of facilities to cooperative parties is one of the major activities of Central Union of Iranian Laborers Consumption Cooperatives, this activity requires for considering the credit status of facilities receiving parties. Considering the mass volume of cooperative parties and constant change of the data contributing the determination of credit risk such as the extent of each cooperative's capital in the union, the extent of each cooperative's dishonor cheque, and the extent of each cooperative's purchase from union, it is required that the credit risk of each cooperative is calculated separately and according to the existing formula manually in the specified interval and this affair requires for spending much time and expense and the probability of error in calculation is high. The use of old and inefficient methods in the union for the calculation of credit risk of cooperative parties caused outstanding claims raise up in the union especially in recent years. Despite the importance of credit risk in economic activities, no coherent and organized motion has been performed for establishing an optimized model of credit risk calculation. This mater caused the extent of profitability decrease in recent years in the union, accordingly the union could not achieve its first predictions, and consequently this event affected the situation of union directly- amongst shareholders and the market.

In other word, at the present time the union takes action toward approximate prediction of the credit of member cooperatives based on some of factors effective on determining the credit risk of member cooperatives through a manual method and based on a credit formula and this process is not of high efficiency due to time-consuming for the sake of separate calculation of the risk each of the cooperatives in manual form, not accurate determination of the extent of risk due to the consideration of only one or two features from amongst the features effective in determining the credit risk relevant to member cooperatives and the existence of a percent of error in determining the extent of risk due to not mechanization. Considering the previously mentioned sayings, it is required for an accurate, rapid and low cost ranking system for calculating the credit risk of member cooperatives. In fact, in this research we are going to present an acceptable solution for optimized scoring to the credit of customers so that the directors of unions take action toward their credit decision making by the said method using less cost and in a shorter time.

In this regard, this research aims to determine the effect of each of the factors effective on the calculation of credit risk which have been used in this research and to consider that how the assessment of credit risk of customers by means of neural network method will result in the decrease of expense and time of calculation and the optimization of efficiency and accuracy.

Considering the objective mentioned the following hypothesis is assumed for performing the research:

1- The extent of purchase of urban cooperatives from the union is effective on the credit risk of customers.

2- The amount of investment of urban cooperatives in the union is effective on the credit risk of customers.

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3- The amount of dishonor cheque of urban cooperatives in the union is effective in the credit risk of customers.

4- The number of urban cooperatives in the union is effective on the credit risk of customers.

5- The membership record of urban cooperatives in the union is effective on the credit risk of customers.

6- Neural network method optimizes the calculation of credit risk of cooperatives.

2- Literature Review

a) Foreign Researches

Eletter et al., (2010) presented the artificial smart model based on neuron for loan decision. Here a model of pioneer multi-layer neural network was presented for bank loan decisions with post-publication algorithm to introduce neural network as a good instrument for assessment of credit request for supporting Jordan's bank in connection with loan. The results showed that neural networks are successful technique, which can be used for assessment of credit request.

Koutanaei et al., (2015) began to consider the subject of article in an article titled "Combined Data Mining Model for Features Selection Algorithms and Group Learning Classifications for Credit Scoring." In this article data, mining model of features selection hybrid and classification algorithms in the features selection proposed and classification algorithms were three stages. At the end, the article assessed the hybrid pattern and proposed it as a strong and practical pattern for credit scoring.

Teng et al, (2013) proposed a hybrid model in an article titled "Customer Credit Scoring Based on Hybrid Model" to score customer's credit.

b) Iranian Researches

Tavakoli et al, (2010) took action toward considering the variables of the desired research in a research titled "applying data mining process for estimating customer defection patters in insurance." The present research has taken action toward studying the databases of one of public joint stock insurance companies in the field of fire insurance with the aim of describing the capabilities of data mining in customer defection management and by the utilization from standard methodologies of data mining. The results showed that customer absorption channel is the major factor in estimating the customer's defection or lasting in the company and in the next step purchase record and the use of insured place have been deemed as the defection prediction factors.

Jalili (2010) examined the subject of research in an article titled "credit assessment system for bank and insurance customers: the experience of Iranian Credit Scoring Consultation Company". In this article, the activities and achievements of the company have been presented as successive samples of credit assessment system and the stand of new technologies for credit assessment of bank and insurance customers and its scientific and technical aspects including data exchange, storage, processing, reporting, network security procurement, and data transmission routes and the exchange format of the mentioned system have been considered and debated.

Mehrara et al., (2011) began to investigate this matter in an article titled "Credit Rank of Legal Customers of Bank Parsian." For this purpose, the financial and qualitative data of a random 400-party sample from customers, who have received facilities, were considered and

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investigated. The results of the article, while indicating the confirmation of economic and financial theories, showed that the operation of prediction of neural network pattern (the percent of its true predictions) is far higher than customary econometrics Logit and Probit models.

Afsar et al., (2013) began to rank and classify the customers groups of stock exchange organization and to determine their superior parts. In this research, customers are processed in the form of Recency Frequency Monetary (RFM) model and then clustered by using neural network SOM as one of the clustering algorithms. Finally, three clusters were identified as superior clusters as target customers. The coefficient facilities to these three top clusters are respectively 1.271, 0.173, and 0.556 respectively.

Elahi et al., (2014) began to present a combined system for credit risk assessment in which collective learning is used for decision making on the subject of granting credit to facilities applicant individual. The results showed that this system makes a higher accuracy, better operation and less expense in classifying credit applicants in proportion to other similar methods.

Ghasemi & Donyayi-Haris began to design a model for ranking customers in the domain of credit risk with the combined approaches of SOM and MADM. For this purpose, with a view to the literature of subject, at first 29 indexes effective on customers credit assessment including the amount of capital and extent of dishonor cheque were identified and classified based on the model 6c. At the next stage, considering the frequency of indexes and the opinion of the skilled 12 indexes were considered as the final indexes. Then it was taken action toward determining optimized clusters by means of pattern diagnosis algorithm of neural network and legal customers receiving facilities were classified by means of k-means and SOM neural network.

3- Theoritical Background

With the consecutive and dynamic progress of credit industry, this industry plays a more important role every day in the economy of countries and credit grantors use new methods and instruments and modern technologies for the purpose of development of credit management process. Customer's credit and repayment assessment using advanced and new statistical techniques and methods are from amongst endeavors, which have been performed in this field. Most of quantitative models of credit risk have similar meaning framework, but there are differences in the implementation of these models arising from the method of prediction of major parameters from data in access. In general, the techniques of credit risk assessment may be divided into two main groups. (Kiss, 2003):

1- Parametric Credit Scoring Models: Linear probability, Logit, Probit, models based on assessment analysis.

2- Nonparametric Scoring Models: Mathematical planning, tree classification, closest neighbors models, hierarchy analysis system, smart systems, artificial neural networks, genetic algorithm.

Credit risk has been defined as the change in value due to unexpected in credit quality. (Darrel Duffie, 2003). In other definition, credit risk has been defined as a risk based on which the loan receiver is unable to repay his/her principal and subsidiary loan or liability according to the conditions inserted in the contract. In other word, according to this

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risk, repayments are done with delay or not received at all. This matter causes some problems in cash funds revolving. (Parker, 2000). In the report presented by means of "Bank) for International Settlements (BIS)," credit risk has been defined as the risk of not settlement of an obligation on due time or any time after that. The credit risk arising from bankruptcy and inability of customers is in repaying the principal and subsidiary of facilities. According to Basel Committee on Banking Supervision (BCBS), credit risk is possible potential failure of the borrower from the bank or on his account in the performance of ones' obligations to the bank within a specified period. In fact, the credit risk is the likelihood that some assets, in particular, lending facilities will be reduced or worthless in value terms.

Considering the above facts, the important thing for the economic institute is that the institute assesses their repayment ability and selects only the group which is confident of repayment of liability on due time. In other word, the credit risk or failure risk relevant to either of facilities receivers is considered and the required decision is made appropriately (Jones, 2014). Economic institutes, regardless of geographical region, may allocate their resources efficiently to credit applicants provided that they benefit from concentrated system, proper structure and criterion in assessing their customers in such a way that bank facilities are allocated to proper customers by means of this system.

Given that credit risk entails the risk of lending facilities, and any failure to repay the facility reduces the value of the assets of the institution and may therefore have the problem of meeting its obligations, the necessity and need the implementation of the correct and optimal system of scoring and validation is of great importance. The implementation of the rating system will allow the benchmark to be set for adjusting the rate of interest and the amount of collateral so that customers with a good credit standing can take advantage of it. Credit risk management ensures that the cash flow of funds promised for financial claims from individuals (real / legal) can be collected. The various consequences of this risk may be the reduction of the probability of repayment of the principal and the subsidiaries of the facility by the customer or even the non-repayment of the principal and the subsidiary of the facility. With regard to these two consequences of credit risks, the concept of customer validation is important. Credit risk management is one of the key issues that should always be considered by credit policymakers. In order to manage and control credit risk, credit rating systems of customers are indispensable. Such a system, based on current records and information, determines the credit rating of its customers and ranks them according to the amount of risk they will get to the institution. Obviously, such a system helps the company to better target its customers and, while controlling and reducing credit risk, improves the efficiency of the facility process (Talebi, 2015).

Self-Organizing Neural Network Map

Kohonen neural network and/or Self-Organizing Map is a special type of neural networks which is completely different from various types of formerly considered neural networks regarding the type of function, structure, application. The main idea of Self-Organizing Map has been inspired from dividing functional cortical region of the brain and its major application is in solving the problems, which are

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known as "unsupervised learning" problems. In fact, the major function of a Self-Organizing Map is to find the similarities and similar groups amongst a mass of data served to it. (Du et al. 2013).

Multi-layer Perceptron Neural Network

One of the most basic existing neural models is the Multi-layer Perceptron, which simulates the transfer function of human brain. In this type of neural network the network behavior of human brain and signal propagation in it are more considered, hence it is occasionally called Feedforward Networks as well. Each of the neural cells of human brain, named neuron, performs a processing on it after receiving input (from neural cell or other neural cell) and transfers the result to another cell (neural or non-neural). This behavior will continue up to a specified result, which will probably result in a decision, processing, thinking and/or a motion. These networks are composed of some layers. Each neuron in each layer connects to the entire neurons of former layer. These networks are called fully related network as well. These networks are composed of an output layer and some middle layers. The inputs of the first layer compose the vector of input of the second layer and in this manner the vector of input of the second layer composes the rector of input of the third layer, and finally the outputs of the last layer compose the real answer of network. In other words, the process of signal current in network is performed in a Feedforward direction. (from left to right and from a layer to another layer). These networks are able to approximate a non-linear map to the desired accuracy by selecting a proper number of layer and neural cells, which are note more too (Du et al., 2013).

4- Research Method

The present research is of descriptive-survey and it is applied from aspect of nature. From amongst features of descriptive research it shall be said that the researcher has no interference with the situation, status and role of variables and do not meddle with and control them and studies only existing things and only describe and remark it. Applied research is used for removing human requirements and optimization of instruments, methods, things and patterns in the direction of development of welfare and promotion of living level of human by means of recognition field and ground and instructions provided through constitutional researches. (Hafeznia, 2008).

Considering research literature and based on the model 6C and considering the volume of regular records in the database of society under investigation and repeatability of indexes in the research, which have been performed up to the present. In this research, several key features relevant to the cooperatives member in the union including the number of members of each cooperative, the record of membership of cooperative in the union, the amount of dishonor cheque of each cooperative, the amount of capital of each cooperative in the union, and the amount of purchase of each cooperative from the union have been extracted from the database of the company and at the next stage the effect of each of the factors effective in determining the cooperative's credit risk has been calculated by means of "Logistic Regression" in SPSS software. Then, the "Self-Organizing Map" cluster is used in neural network for normalization and removal of outliers. Then, these data are analyzed using the neural network

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algorithm of "Multi-layer Perceptron" and the number made from credit risk is compared with the major number of credit risk for considering the work accuracy. For analyzing the results, the neural network software MATLAB is used. In addition, for not being chance-based of the risk numbers made through neural network method is considered via Run-test in SPSS software.

In logistic regression, (the function made by linear regression), the probability of occurrence of an event is maximized instead of minimizing squared errors. (Habibpour et al., 2009). Logistic regression function, which consists of several independent variables and one dependent variable, are defined as follows:

$$\pi = P_r = (Y = 1 | X_1 = x_1, ..., X_p = x_p) = \frac{e^{\beta_0 + \beta_1 x_1 + \beta_2 x_2 + ... + \beta_p x_p}}{1 + e^{\beta_0 + \beta_1 x_1 + \beta_2 x_2 + ... + \beta_p}} \quad (1)$$

For the purpose of establishment of a linear function from parameters β0, β1, …, βP it is required to take a logarithm from odds ratio (the probability of occurrence of an event to not occurrence of that event). Therefore, logistic regression function is defined as equation 2.

$$\ln\left(\frac{\pi}{1-\pi}\right) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + ... + \beta_p x_p \quad (2)$$

The method used for the prediction of coefficients in logistic regression function is the method of maximum accurate prediction.

The statistical population used in this research is all urban cooperatives member in the Central Union for Iranian Laborer Consumer Cooperatives in the first six-month of Iranian year 1395 (2006). The number of member cooperatives in this period has been 1500 cooperatives. After the considerations performed, from total member cooperatives in the mentioned period sum 592 cooperatives were identified as active and the present research has been performed on the 592 active cooperatives too. The data relevant to the 592 active cooperatives has been collected through the official documentations and reports of the union.

5- Results

In order to examine the factors effective on determining the credit risk of customers and the extent of effect of each of these factors on credit risk, at first it is required that the normality of independent and dependent variables distribution be considered. In this research dependent variable, means the extent of credit risk and independent variables mean the extent of purchase, amount of capital, extent of dishonor cheque, record of membership and number of members. In addition, the normality of variable distribution of credit risk calculated by neural network is considered as well (Table1).

H_0: Factor *i* has normal distribution

H_1: Factor *i* has not normal distribution

i= 1, 2, 3, ……., 7

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Table1. The results of "Kolmogorov-Smirnov Test" for independent and dependent variables

Factors	Test Statistics	Significance Level	Result
Purchase volume	0.296	0.000	Non-normal distribution
Amount of capital	0.355	0.000	Non-normal distribution
Amount of dishonor cheque	0.419	0.000	Non-normal distribution
Number of members	0.360	0.000	Non-normal distribution
Membership record	0.075	0.000	Non-normal distribution
Present credit risk	0.045	0.006	Non-normal distribution
Calculated credit risk	0.071	0.005	Non-normal distribution

Using Kolmogorov-Smirnov Test, the theory of normality of major factors were considered and examined and the results have been inserted in the table (1) above. As you observe in the above table, since the amount of significance level for data is less than error probability (0.05), therefore, the H_0 theory is rejected and so it can be claimed that all distribution factors have non-normal distribution. Considering the non-normality of distribution of the factors under consideration, Binery Logistic Regression method is used for considering each of the theories of research. The results gained from the survey of subsidiary theories of research have been shown in the Table (2). As it is obvious in the Table 2, all of the subsidiary theories of research have been confirmed, because their significance level (sig=0.000) is less than error probability level (α =0.05), therefore, it can be said with a confidence of 95% that all factors under consideration are effective directly on the extent of credit risk. In addition, the extent of coefficient of determination of Kaks and Esnel relevant to the effect of each of the factors under consideration on credit risk has been shown. For example, the extent of coefficient of determination of Kaks and Esnel relevant to the effect of extent of cooperatives purchase from the union on credit risk is 0.725. This extent indicates that the independent variable the extent of cooperatives purchase from union could estimate 72.5 percent of changes of independent variable of credit risk.

Table2. The Results Made from Subsidiary Theories of Research

Theory	Significance Level	Coefficient of Determination of Kaks and Esnel Test	Test Result
Purchase volume effects credit risk	0.000	0.725	Acceptable of research theory
Amount of capital effects credit risk	0.000	0.077	Acceptable of research theory
Amount of dishonor cheque effects credit risk	0.000	0.031	Acceptable of research theory
Number of members effects credit risk	0.000	0.071	Acceptable of research theory
Record of membership effects credit risk	0.000	0.001	Acceptable of research theory

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Deleting Fling data

As presented in the proposed plan, at first we take action toward clustering data by means of SOM algorithm to run away those very low and far away clusters. This action will help to decrease the volume of calculations in next stages. For this purpose, we use toolbox of neural network in MATLAB software. The general architecture of algorithm SOM used in this research, considering the target function, which is ranking based on four lines, has been shown in Fig (1). As it is shown, the model input, are the scales of consideration, which are classified into four groups.

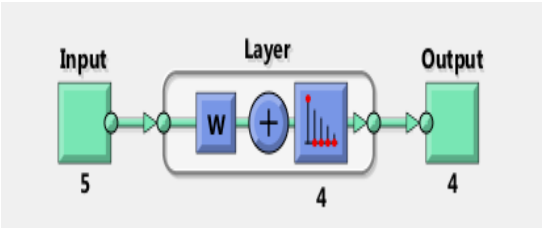


Fig1. General architecture of the SOM algorithm

The coefficients of clustering model of input data in Self-Organizing Map network method is as of the Table (3).

Table3. The results of Input Data Clustering via Self-Organizing Map Neural Network

Input Layer	Independent Variables	1	Number of cooperative members
		2	Amount of Cooperative's Capital
		3	Amount of Cooperative's Purchase
		4	Amount of Cooperative's Dishonor Cheque
		5	Record of Cooperative's Membership
	Number of Inputs		5
	Scaling Method		Standardization
Middle Layer	Number of Middle Layer		1
	Number of Neurons in Middle Layer		3
	Function Used		Lunberg–Marcard
Output Layer	Dependent Variable	1	Credit Risk
	Number of Output Layers		1
	Scaling Method		Standardization
	Function under Use		Linear
	Error Function		Minimum Squares

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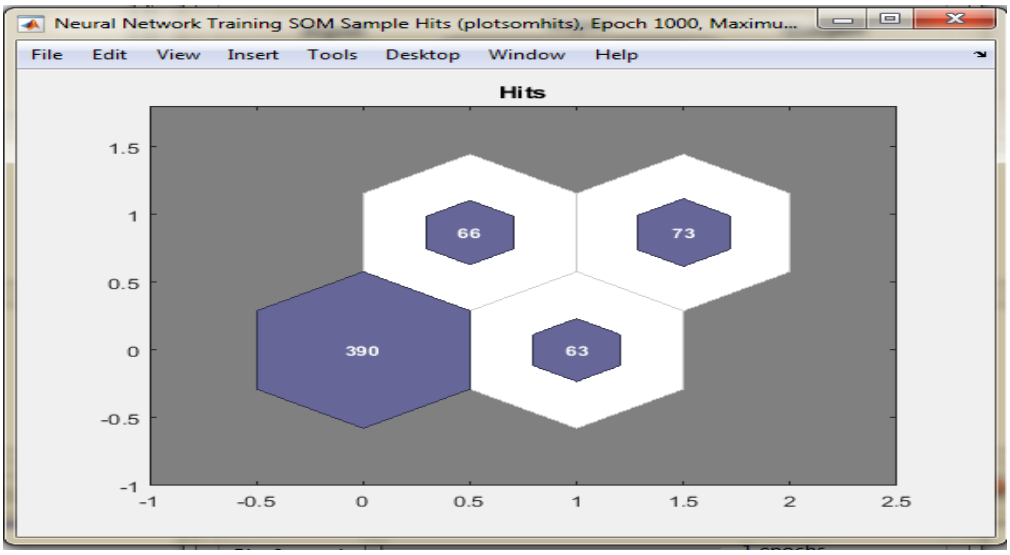


Fig2. Categorizing Cooperatives Based on SOM Algorithm

Figure (2) introduces the placement position of observations based on SOM algorithm. In this fig, the numbers of cooperatives, which belong to any category (neuron), have been shown. It should be mentioned that considering the results gained, no cluster has been omitted.

Neural Network Model Fitting for Estimating Credit Risk

Figure (3) shows the neural network model under use. Neural network architecture made consists of five input layers (which consist of the date relevant to five features under consideration on credit risk), one middle layer with three neurons and an output layer. The operation function under use in middle layer is Levenberg-Marquardt and the error function under use is squared minimum. The number of data allocated to each sample has been shown in Table (4).

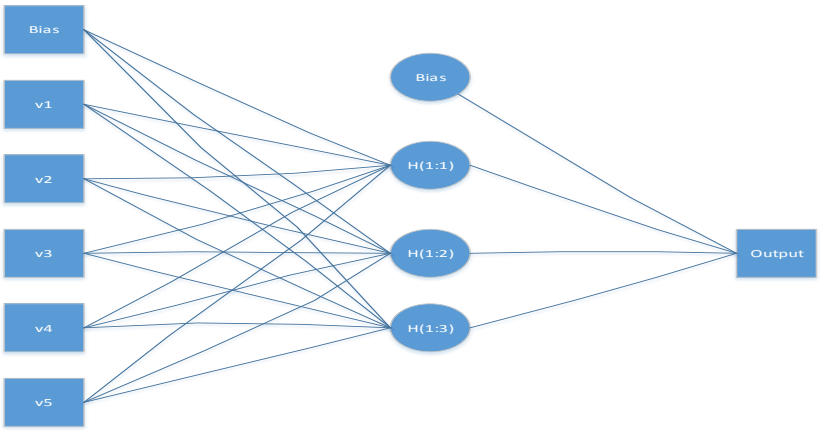


Fig3. Neural Network Model

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Table4. The Allocation of Number of Sample Members

		Number	Percent
Sample	Training	414	70
	Validating	89	15
	Testing	89	15
Total		592	100

In addition, the abstract of neural network model under use can be observed in Table (5). In table (6), the extent of error calculated for all of the three data samples has been shown. Furthermore, in Table (7) the extent of regression calculated for all of the three data samples has been specified. Considering the number relevant to the error squared and regression minimum, it is clear that the neural network under use could estimate the extent of credit risk with high accuracy.

Moreover, the coefficients of models fitted with neural network method are as of Table (8). In Table (8), since there is one-middle layer with three neurons, three models have been made. For the first model, which has been shown under symbol H(1:1), one unit of changes in the variables effective in credit risk makes 12.7 change unit in credit risk. In the second model, which has been shown under symbol H (1:2), one unit of changes in the variables effective in credit risk makes 4.4-change unit in credit risk. Additionally, in the third model, which has been shown under symbol H (1:3), one unit of changes in the variables effective in credit risk makes 8.2-change unit in credit risk. Therefore, the first model is the best model for estimating the credit risk. Considering Table (8) credit risk fitting model is as follows:

$Z= -65.12 - 5.02v_1 + 5.44v_2 - 63.5v_3 - 0.3v_4 – 0.02v_5$

It should be mentioned that the coefficient of model determination is 0.991.

Table5. The summary of Neural Network Model

Layers		**Middle Layer**		
		H(1:1)	**H(1:2)**	**H(1:3)**
Middle Layer	V1	457.83	679.55	664.31
	V2	197736590.95	292606785.87	284657529.20
	V3	788562238.06	2387881403.60	2237666369.57
	V4	85005614.97	142662264.63	156751946.93
	V5	13.39	13.34	13.30

Table 6.The Comparison of Model Fitting Error in Samples

Training	Error Squared Set	0.866586
Validation		1.11621
Test		1.68175

Table7. The Comparison of Model Fitting Regression in Samples

Training	Regression	0.942148
Validation		0.933687
Test		0.895969

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Table8. The Results of Model Fitting with Neural Network Method

Layers		Predicted			
		Middle Layer			Output Layer
		H(1:1)	H(1:2)	H(1:3)	(Credit Risk)
Input Layer	(Bias)	-65.1225	-2.8638	1.7721	
	v1	-5.0232	0.14905	0.20728	
	v2	5.4353	-0.17888	-0.15716	
	v3	-63.5014	-1.8388	-0.82223	
	v4	-0.30178	0.0079342	0.044675	
	v5	-0.016508	0.0019596	-0.0024502	
Middle Layer	(Bias)				8.2183
	H(1:1)				12.7096
	H(1:2)				4.3531
	H(1:3)				8.1652

Regression Diagram

The important and major diagram, which is considered here for considering the accuracy of results, is regression diagram. In fact, this diagram shows the conformity of trained data with real data. Figure (4) shows that how much estimated model conforms to real data. The more the data conforms, the larger the value of R. This comparison between neural network input and real answer has been performed on all of the three categories of data, i.e. learning, testing, credit assessment data. This amount has been calculated on all data at final as well.

As it is seen in the figure, in the considerations relevant to all of the three categories of data the teaching, testing, credit assessment and diagram relevant to all data there is more difference amongst the major figures of risk and figures calculated by neural network in the scope relevant to high risk customers and it is expected that in the neural network output this difference is upward in the figures relevant to high-risk and medium-risk customers. In general, the above results for the designed network show that this network got result with the required speed and accuracy.

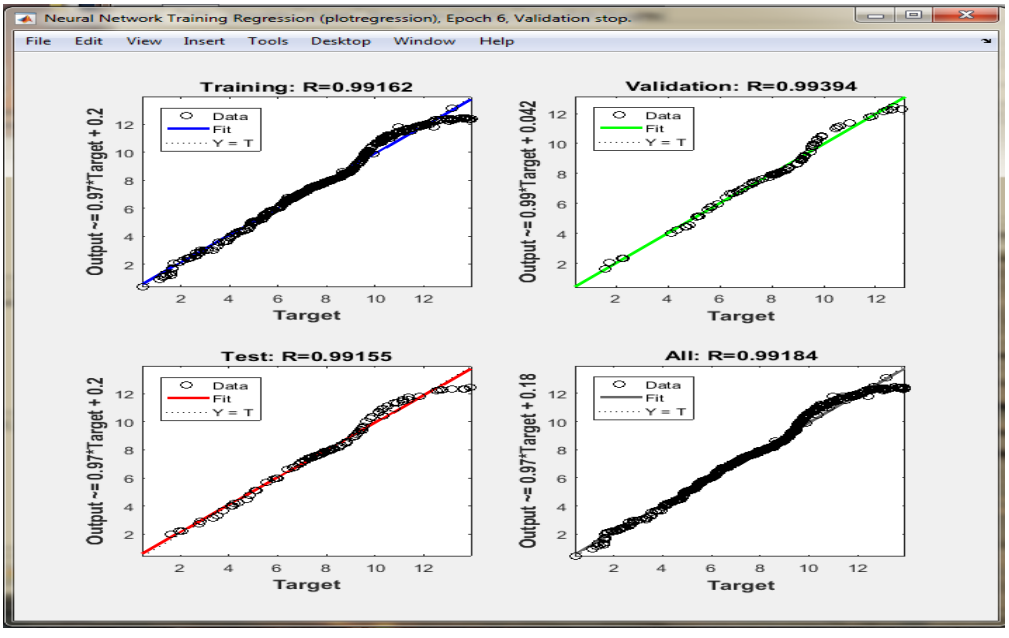


Fig4. Regression Diagram

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Test of Not Random-Based Status of Figures Calculated by Neural Network

Being not random-based figures made by neural network method through Run-Test in SPSS was considered. The theories used are as described below:

H_0: The data have been gained by chance.

H_1: The data have not been gained by chance.

In this test the significance level has been calculated at 0.000 and considering that this figure is less than error probability level (α =0.05), therefore, it can be said with the 95% confidence that the results gained are not random.

Comparison of Real Risk Figures to Neural Network Calculated Figures

The comparison between real risk figures and neural network calculated figures was performed through variance calculation. According to the input of SPSS software, the extent of variance of real risk figures was calculated at 7.5 and the extent of variance of risk figures calculated by neural network was calculated at 7.0 which shows the less error of neural network method as compared with the present method.

Table9. Calculation of Error of Two Methods of Credit Risk Calculation

Statistics			
ANNRisk	RealRisk		
592	592	Valid	N
0	0	Missig	
7.0	7.5	Variance	

As mentioned, Table (10) shows the comparison between the present two methods used in the union for risk calculation and neural network method. Considering the figure (4), the applied neural network could predict credit risk with an efficiency of 99.1% according to fact. In addition, considering Table (9) the extent of error of neural network method is less as compared with the present method and this matter indicates the ability of neural network model used in the optimization of credit risk calculation.

Table10. The Comparison of Present Credit Risk Calculation with Neural Network

	Present Method of Calculation		Neural Network Calculation	
Categories	**Number**	**Percent**	**Number**	**Percent**
Low Risk	35	5.9	36	6.1
Medium Risk Downward	352	59.5	344	58.1
Medium Risk Upward	157	26.5	192	32.4
High Risk	48	8.1	20	3.4

As it is specified in Table (10), the difference in the figures relevant to high risk and medium upward is more. Considering that the calculation of risk with the present method in the union is very time consuming, risk calculation with neural network method is done in a so shorter time.

6- Conclusion and Discussion

In neural network method we can calculate the credit risk of all cooperatives simultaneously and considering that the calculation of risk in the present status is performed separately and in manual form for each cooperative, using neural network will result in time saving in credit calculation and consequently in

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expense decrease. In addition, it will be possible to update the credit risk of cooperatives of union members in short time intervals. Due to the calculation of risk by system in neural network, the probability of error occurrence is so less in this method as compared with manual method and this method will cause accuracy optimization in risk calculation.

Considering the confirmation of effects of all five factors under consideration on determining the credit risk of member cooperatives, the following suggestions are resented for optimization or decrease of each of the mentioned factors:

Proposition for increasing the extent of purchase of cooperative members of union: The findings gained from the research confirmed the positive effects of extent of purchase from union in credit risk. Therefore, by granting more facilities to cooperatives it is practicable to encourage purchaser for more purchasing more and consequently obtaining more profit for the union. In this connection, we can point out to the opinion of Dany and Richard. According to their opinion, it is possible to enhance the sale by granting some facilities such as sales in installment. In addition, they proposed the followings for increasing the extent of sales.

Amount Discount: The union may grant an amount to cooperatives as credit to enhance the purchase power of cooperatives. For example, it is proposed to the cooperatives that if they purchase up to1,000,000,000 Rls they will not pay 50,000,000 Rls. of the mentioned amount. From psychology point of view the customer thinks that if in such condition it does not purchase, it losses the amount belongs to it.

Free Movement: One of propositions is free freight, which, of course depends on the unions' policy, will be at least one purchase.

Gift: Forwarding one gift to the goods purchasing cooperative in addition to its purchase may have several advantages. The union may make two different use of the gift: Firstly, with pleasing and satisfying the customer, it increases the purchase share of each cooperative. Secondly, it may render the customer the goods stored in warehouse and save some of warehousing expenses.

Time Propositions: Weekly, monthly, seasonal, and occasional

Gift Card: The union may enhance its purchase volume by rendering gift cards, which are usually usable during special period. The objective from rendering these cards is to achieve the determined sale objectives within the time specified.

Some Propositions for Loyal Customers: These propositions may be defined for the customers who have had high extent of purchase during specific time duration (for three months for example). By the way, the union enhances its market share.

Proposition for Increasing Amount of Capital of Cooperative Members of Union: For the procurement of capital for cooperative's operations and commerce, optimization three major resources can be used and these facts are confirmed by the Technical Department of Cooperatives of FAO[1] as well.

Financial resources procured directly from members consist of annual membership expenses, members' capital share etc. Financial resources created through reserving cooperative's surplus business, which is not granted directly to members,

1- Food and Agriculture Organization

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are one of other important financial resources of cooperatives. These financial resources reserved from surplus are called more often as "institutional capital" and shows the wealth belonging to cooperatives.

Cooperatives use, in addition to institutional capital and members' capital, often foreign financial resources for enforcing their activities and/or for investment. These financial resources may include cooperative or commercial banks, procurers, public organizations or assisting organizations. According to the announcement of this institute, institutional capital and members' capital bears the least risk and are amongst the most secure budgets and hence they are of the most priority. In all these cases borrowing from oversea, such as banks and procurers merely is a good strategy when its return for cooperative is larger than the expense of loan obtaining. The obtaining of commercial loans from banks bears high expense, because the banks shall benefit from it was well. Moreover, in case of failure in repayment of the said loan the joint assets, which are used as pledge, are at risk. For increasing investment in the union, it is required to follow approaches for increasing the number of member cooperative in the union.

Proposition for Decreasing the Amount of Dishonor Cheque of the Cooperatives Member to the Union: One of the facilities the Union renders to the member cooperatives is the facility of purchase through cheque. This matter although leads to an increase in the sales volume of the union and to the absorption of capital to the union, but it causes some problems as well. For decreasing the amount of dishonor cheque, some concessions can be considered for the cooperatives, which purchase in cash, in such as way that the cooperatives do not take action toward purchasing through cheque except special occasions. In fact, if the price difference is high in the two cash and cheque-based purchase sectors, the customer will be directed toward cash purchase.

Proposition for Number of Members of Cooperatives Member to the Union:

According to the findings, the number of members of cooperatives to the union affects their credit risk. The larger the size of cooperative is, the lower the credit risk will be. Therefore, the union shall pay the required attention to this matter upon absorbing the cooperatives.

Proposition for the Record of Membership of Cooperatives Member to the Union:

According to the results, it was founded that the record of cooperatives' membership in the union effects credit record. Considering this matter, the union shall take action toward preserving its loyal customers as well as increasing their numbers. From amongst the most important approaches for preserving loyal customer, to whom Kotler pointed out as well, the followings can be stated:

Customers Follow-up: From amongst actions, which can be taken for preserving faithful customers, is that trough establishing contact and following up of member cooperatives and their interests, their requests and requirements can be covered. If the customer relation methods are used, not only permanent customers are reserved, but also we can direct new customers toward goods purchase and utilization from services of union.

Creation of Changes Proportionate to New Changes in Market: Since new changes and requests occur with a rapid peed in market, therefore, it is required that the directors of union plan in such a way that

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the rendering of their goods and services is appropriate to new changes and requirements in market and change with simultaneously with them, otherwise, it is probable that they leave the field of competition. In this field requirement for skilled and trained staff is necessary.

Revision of Company's Plans and Strategies: Considering that the plans and programs of the union are old and repetitive, it is necessary to be revised.

Facilitating the Customers Communication with the Company: Using the methods by which the cooperatives can connect with the union and transfer their views, propositions and/or requirements as well as rapid reply to them may result in the increase of customers' faithfulness.

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