

## The Comparison of Applying a Designed Model to Measure Credit Risk Between Melli and Mellat Banks

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Received:

**25 February 2019**

Revised:

**12 November 2019**

Accepted:

**09 January 2020**

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**Abstract.** The main purpose of this paper is providing a model to calculate the credit risk of Melli bank clients and implement it at Mellat Bank. Therefore, the present study uses a multi-layered neural network method. The statistical population of this research is all real and legal clients of Melli and Mellat banks. Sampling method used in this research is a simple random sampling method. Friedman test was used to calculate the required number of samples in a random sampling method from Cochran formula (1977) and Friedman test was used to rank the factors affecting the credit risk. Friedman test was also performed using data from a completed questionnaire of active experts at the Melli Bank. Based on the results obtained from Friedman test, five important factors in the credit risk of real clients of the Melli Bank of Iran, type of

occupation, guarantee value, loan amount, having return checks, the balance average, and the value of the guarantee, the amount of the loan, the average of the balance, having returned checks and deferred loans are the most important factors affecting the credit risk of legal clients, which have been used as inputs in the neural network model. The results of credit risk prediction using the neural network showed that the designed model has a high ability to predict the credit risk of real and legal clients of the Melli bank, while it did not have this ability for the Mellat bank.

**Keywords:** Credit Risk; Real and Legal Clients; Multilayer Feed-Forward; Neural Network

## 1. Introduction

Nowadays, credit risk has turned to be one of the most significant issues in the banking industry. The potential impacts this risk-taking branch can have on the performance of banks and financial institutions are sometimes so widespread that results in the bankruptcy of the units. Credit risk is the probability that a client will not fulfil a bank's commitment. Facilities that are not fully repayable or delayed are the source of credit risk for the bank. This type of risk is intrinsically present in the facility, and in fact, the probability of uncollectable loans is causing a bankruptcy or a reduction in the credit quality of the borrower (Mirza'i, et al., 2012). One of the main reasons of the failure of banks is the credit risk. In this way, credit risk management is central to banking, as the main activity of a bank is to act as a financial intermediary and granting credit facilities requires credit risk. Despite the fact that in the real world, the danger of this risk cannot be completely eliminated, by knowing what causes it, it can be reduced to the extent possible. Therefore, the basic point is to provide a model for identifying and reducing the risk. The most important source of income in the banking system is granting facilities and credits; therefore, in the case of bank clients, identifying the important parameters for granting facility is one of the requirements and necessities for reducing credit risk, but the most important point about credit risk is quantification. The scope of banking activities is in such a way that it puts a variety of risks on banking operations. Also, the bank is the main active institution in

providing credit, which has led to banks' exposure to credit risk. For this reason, banks are paying special attention to the dynamic management of risk and designing internal models of credit risk management. They also set up a diverse organization and structure to optimize this risk management. The lack of proper management of this risk and its control, puts the bank in crisis and bankruptcy. Since the bank is an influential institution in any country's economic system, these crises disrupts the whole economic and social system. In order to control and mitigate credit risk, the bank needs to properly identify applicants for their credit facilities and can distinguish between those who have the ability to pay their loans on time and those who are at high risk. To this end, the Bank's credit rating system and client credit rating are needed as a key tool in credit risk management (Chen, et al., 2012).

## 2. Method

This research is of a documentary-analytical research in nature and a type of applied research. This number of clients were selected by using Simple Random Sampling method. The questionnaires were formulated based on theoretical foundations and previous research. The content validity index (CVR) was used to assess the validity of the questionnaires. The data were analysed using SPSS software. These results indicate that the questionnaire has a good reliability.

## 3. Findings

The results of ranking the factors affecting the credit risk of real clients from the viewpoint of experts were show in table 1.

**Table 1.** Friedman test results on rating factors affecting the credit risk of real clients

Variable	Average of the Rate
Deferred Amount	5.62
Loan Interest Rate	6.07
Due Date	7.43
Guarantee Value	8.84
Kind of Occupatin (Self-employed or employed)	9.22

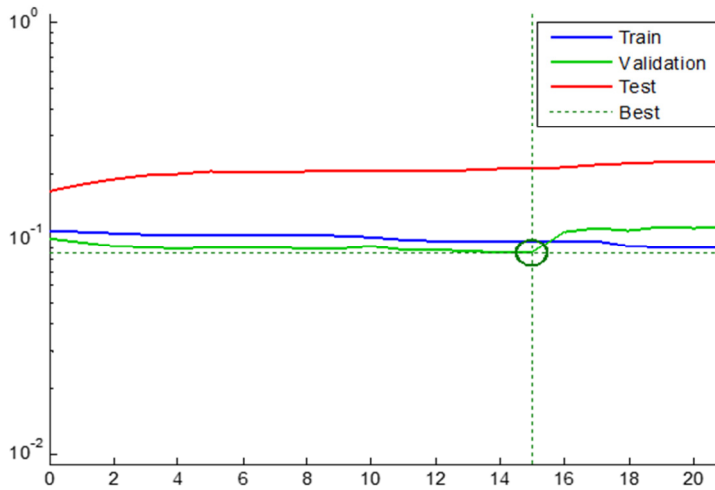
Variable	Average of the Rate
Loan Amount	8.40
Having Returned Cheques	7.61
Monthly Income Amount	6.12
Balance Average	7.54
Age	5.67

Other factors are in the next rank; therefore, it can be said that the five important factors in the credit risk of the clients of the Melli bank of Iran, the type of occupation, the guarantee value, the amount of the loan, having returned checks and the balance average are the most important factors affecting the credit risk of the clients of the Melli Bank. These factors will be used to predict the credit risk of the real clients of the Melli Bank. Table 2 also shows the results of Friedman's test on rating the factors affecting the credit risk of legal clients at the Melli bank.

**Table 2.** Friedman test results on rating factors affecting the credit risk of legal clients

Variables	Average of the Rate
Having refunded checks and deferred loans	4.90
Loan Interest Rate	4.59
Loan Amount	5.89
Refunded Amount	3.93
Net profit to sales ratio	4.30
Due Date	4.12
Participation History	5.43
Balance Average	5.68
Gaurantee Value	6.16
Asset turnover ratio	4.90

Figure 1 shows the corresponding error with the number of repetitions associated with the credit risk prediction of the real clients of the Melli bank. As can be seen in the figure, the mean squared error has faced increase in the repetitions in a way that the lowest mean squared error is close to 0.01.



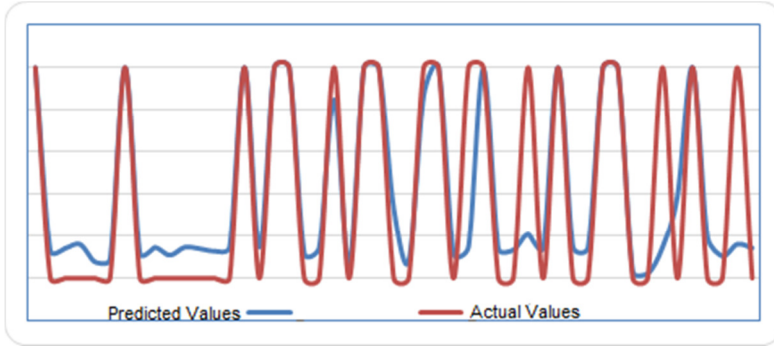
**Figure 1.** Mean squared error

Table 3 shows the results of training for the considered data in the prediction of credit risk of real clients of the Melli bank. The correlation coefficient between the predicted values and the actual values is 0.99. Also, the mean square error in the sample was about 34.73 and the correlation coefficient for it was 0.99.

**Table 3.** The results of model training

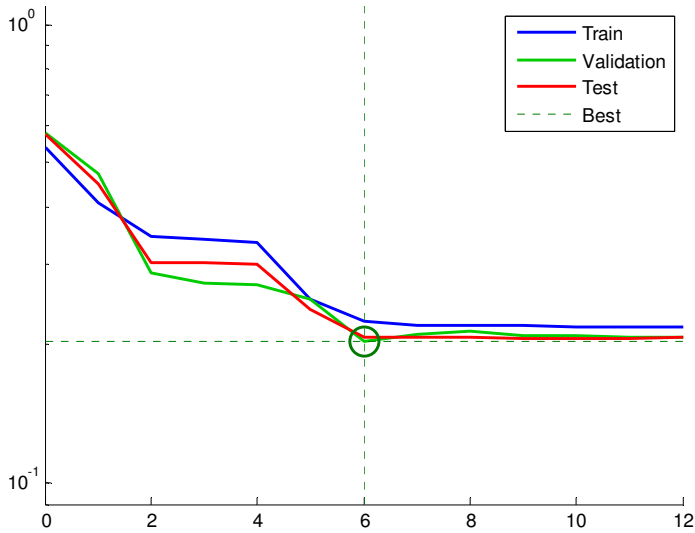
	Number of Samples	Mean Squared Error	The correlation coefficient
Training	204	0.3473	0.99
Validation	43	0	0.00
Test	43	0.4251	0

Figure 2 shows the results of the correlation between the predicted data and the actual data related to the prediction of credit risk of the real clients of the Melli bank. As shown in the figure, the model under study has been able to accurately predict the credit risk of sample clients. Therefore, it can be said that the neural network has been very careful in predicting the credit risk of the real clients of the Melli bank.



**Figure 2.** The estimated values and real values of the credit risk of the real clients

To predict the credit risk of the Melli Bank's legal clients, the guarantee value, the amount of the loan, the balance average, the history of participation, and the repaid checks and deferred loans were used as inputs. Figure 3 shows the corresponding error with the number of repetitions shows the results of the correlation between the predicted data and the actual data shows the results of network training to predict the credit risk of the Melli Bank's clients. As can be seen in the figure, the mean squared error is reduced by increasing the number of repetitions, so that the lowest average squared error is close to zero.



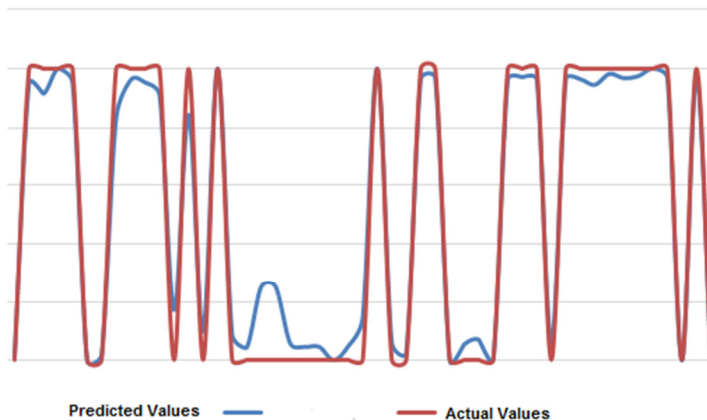
**Figure 3.** Mean squared error for credit risk estimation

Table 4 shows the results of training for the data under review. As shown, 154 samples for training and two 15% of the sample, i.e. 33 samples, were also used to validate and test the template. The correlation coefficient between the predicted values and the actual values is 0.99, which indicates a high correlation between these two.

**Table 4.** The results of model training to predict the credit risk

	Number of Samples	Mean Squared Error	The correlation coefficient
Training	154	0.66476	0.99
Validation	33	0.54328	0.99
Test	33	0.32768	0.99

As shown in figure 4 the model under study has been very careful in predicting the credit risk of the Melli Bank's clients, so that in some cases, the provided pattern has been able to predict precise amounts for the credit risk of the Melli Bank's clients. Therefore, it can be said that the neural network has a high potential for predicting the credit risk of the Iranian Melli Bank's legal clients.



**Figure 4.** Predicted values and actual values of credit risk

Based on the model obtained for the real clients of the Melli bank, the type of occupation, guarantee value, loan amount, returned checks and the balance average have been used as inputs of the model. Figure 5

shows the corresponding error with the number of repetition to predict the credit risk of the real clients of Mellat bank. As it is clear, with an increase in the number of repetitions, the mean squared error has decreased.

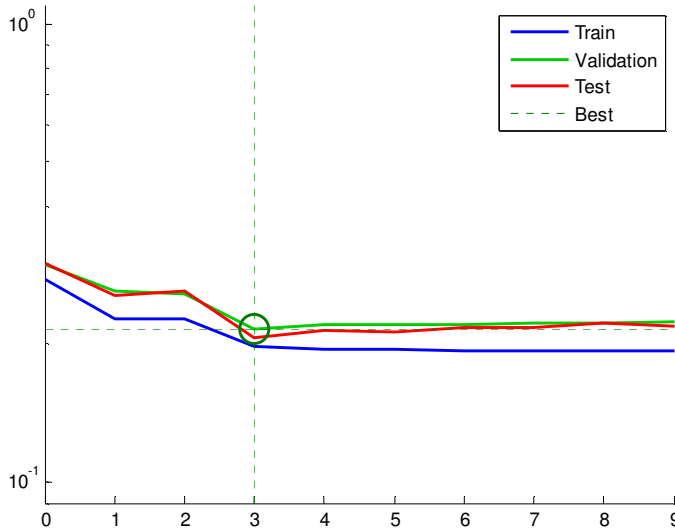


Figure 5. Average squared error

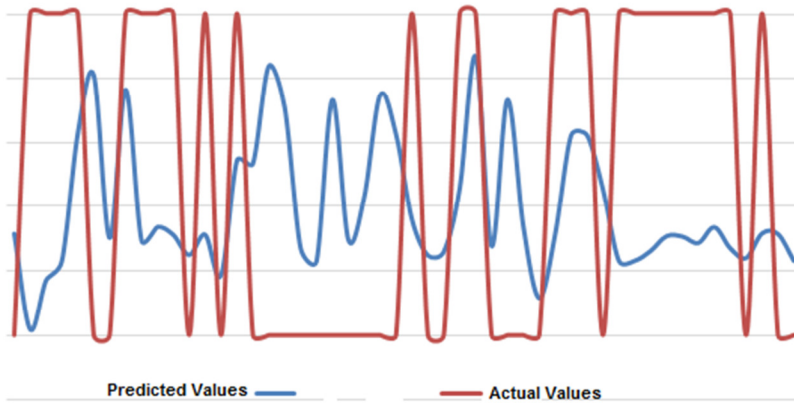
The results related to the calculation of the mean squared error and the correlation coefficient for real clients of Mellat bank are present in the Table 5.

Table 5. The results of training model

	Number of Samples	Mean Squared Error	The correlation coefficient
Training	230	0.73671	0.99
Validation	50	0.95864	0.99
Test	50	0.84094	0.99

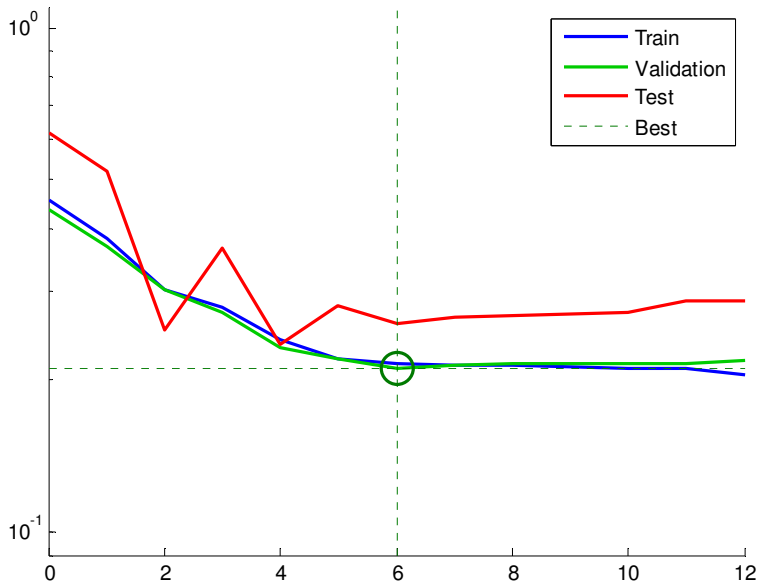
Figure 6 shows the comparison between the predicted values and the actual values of credit risk for real clients of the Mellat bank. As shown, the model under study has not been able to predict the credit risk with great care. This shows that the model obtained for real clients of the Melli bank has a low ability to predict the credit risk of real clients of the Mellat bank.





**Figure 6.** The predicted values and actual values of credit risk for real clients

Figure 7 shows the corresponding error in the number of repetitions. As shown, the results of the matching between the predicted data and the actual data the results of network training to predict the credit risk of the Mellat bank's legal clients. As can be seen in the figure, the mean squared error is reduced by increasing the number of repetitions.



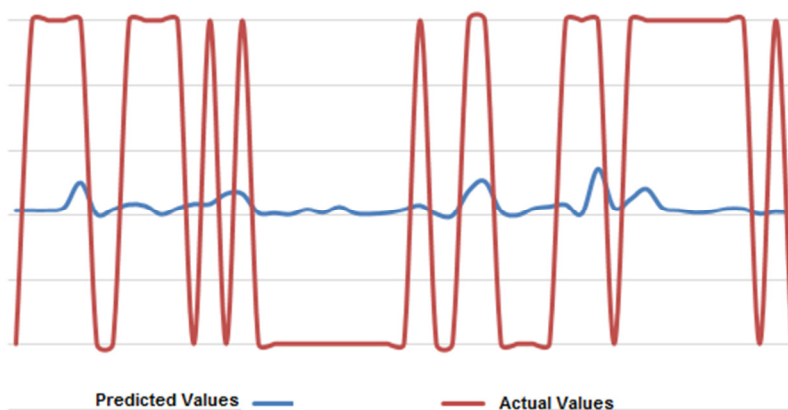
**Figure 7.** Average squared error

Table 6 shows the results of the training for the data under study. As shown, the correlation coefficient between the predicted values and the actual values is 0.99, which indicates a high correlation between the two.

**Table 6.** The results of training model

	Number of Samples	Mean Squared Error	The correlation coefficient
Training	126	0.8073	0.99
Validation	27	0.9172	0.99
Test	27	0.8325	0.99

Figure 8 shows the comparison between the predicted values and the actual values of credit risk of the Mellat bank's legal clients. As shown in the figure, the model has low accuracy in predicting the credit risk of Mellat bank's legal clients. These results have been somewhat expected, as the resulting model is designed based on the assessments of the Melli bank's clients, and this result can be somewhat problematic for the Mellat bank.



**Figure 8.** The predicted and actual values of risk credit risk of the legal clients

#### 4. Conclusion

The results of this study showed that the model under study has been able to accurately predict the credit risk of real and legal clients of the Melli bank in the model under study, but the accuracy of this model was low in predicting the credit risk of real and legal customers of the Melli bank.

### Resources

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