International Business Management 10 (Special Issue 4): 6322-6331, 2016
ISSN: 1993-5250

Study of Relation Between Credit Risk Management of Paid Loans to Natural Customers and Overdue Receivables of Bank Mellat (Case Study: Management of Branches of Bank Mellat, Semnan Province)

Yadollah Hemmati and Younos Vakilalroaia
Department of Management, Semnan Branch, Islamic Azad University,
Semnan, Iran

Abstract: The goal of this study is to investigate the relation between credit risk management of paid loans to natural customers and overdue receivables of Bank Mellat through a case study in the management of branches of Bank Mellat, Semnan Province. The statistical society of the current research is all the branches of Bank Mellat in Semnan Province. The statistical sample of the current study was selected according to collected data in the period between 2002 and 2012. The method of the current research is descriptive and is a correlative type of study. It was examined using regression analysis method and economic evaluation tests of research data. The data of the research was analyzed using SPSS Statistical Software. In general, the current study showed that there is a significant relation between credit risk management of loans (credits) received by customers individually (which is similar to individual analysis of negotiable documents risk) and overdue receivables of Bank Mellat, Semnan Province. This figure shows at error level of 5% that there is a significant relation between two variables of credit risk management of loans (credits) received by the customers individually (that corresponds with the individual analysis of negotiable documents risk) and overdue receivables of Bank Mellat, Semnan Province.

Key words: Credit risk management, loan, overdue receivables, Bank Mellat, Semnan Province

INTRODUCTION

Nowadays banking is considered as one of the most important parts of economy. In one hand banks facilitate commercial exchanges through organizing receipts and payments and expand markets and on the other hand, they equip small and big savings and lead them toward production firms and pave the ground for economic growth and flourishing. The correct relation between financial and production systems in every country is one of the most important factors of economic growth and development. Banks as the main part of the financial system (basic banking system) play the main role in financing the production, commercial, consumption and even governmental sectors. Considering the state economic structure in Iran and due to reasons such as lack of development of the capital markets and other non-banking and contractual networks, financing the main parts of economy is the responsibility of the state banking system. Unfortunately, this sector has not been very successful to fulfill this duty. Currently, the continued activities and survival of most state banks depend on governmental supports. High level of dishonored bank reserves and unreturned bank credits and loans is the reason for unsuitability of the models to measure credit risk and absence of risk management systems in the banking network (Tehrani and Fallah, 2005).

In a market where the margin of the banks profits is always reducing due to intensive competition and pressure for reduction of most costs is felt, credit risk models will be established to anticipate the losses of lack of reimbursement of loans and will create a relative superiority for banks and credit institutions. Credit risk models, measuring risks can create a wise relation between risk and return and facilitate the possibility of price setting for the assets. Also credit risk models provide the possibility to optimize the useful combination of credit and to determine the economic capital of banks to reduce the investment costs (Tehrani and Fallah, 2005).

On the other hand, problems such as inflation, economic recession and instability of interest rates at the end of 1970s and early 1980s made the assets and debts

Corresponding Author: Younos Vakilalroaia, Department of Management, Semnan Branch, Islamic Azad University, Semnan, Iran

management in banks become necessary to maintain the margin of the accepted profit (Greuning and Brajovice, 2003).

Generally speaking, design and establishment of measurement model of credit risk in the banking system will have an efficient role in increasing the productivity of state banks to allocate resources optimally. Thus, the goal of this study is to investigate the relation between credit risk management of paid loans to customers and overdue receivables of bank Mellat through a case study in the Management of branches of Bank Mellat, Semnan province. In this study, it was tried to investigate the efficiency of linear models in order to design and explain the most suitable model to measure credit risk of customers of the state banks.

Literature of topic and background of research: Credit risk is the possibility of non-reimbursement or payment with delay of the principal amount and applied credit interests and other sort of debts by the customers. Designing a model to measure and grade credit risk was initially tried in 1909 by John Mori, 1909 on government bonds (Glantz, 2003).

Now a days each of the valid institutions such as Moodys, Standard and Poors (S&P) use special methodologies to grade government bonds and other credit tools. The high similarity of banks' credit loans and government bonds made the grading of credit risk of bank credits, i.e., measurement of risk for non-payment of principal and interest rate of loans to be noted by researchers.

The first model used to determine the companies' bankruptcy was multi-factor Legit Regression model that was presented by Beaver (1966). Later this model was used to measure the risk credit of issued bonds by the companies. One of the other first studies in the area of credit risk was the companies' bonds using multi-variable scoring model presented by Altman (1968) that was known as Z score model. Altman's Z score model is an auditing analysis model that tries using the amounts of important financial ratios to distinguish the companies that have financial distress (i.e., are bankrupt) from companies that do not have financial distress. Considering this fact, non-payment of loans is mainly related to the companies who will suffer from financial distress in the future. Thus, the anticipation of credit risk using this model will become possible. That is why in 2001, Saunders and Allen used this model to anticipate the credit risk of companies who received loans from banks and the conducted studies showed that this model of anticipating credit risk is very powerful.

Using such a model in banks makes it possible that if the Z score of the loan receiving company goes below the critical level, the request for loan will be rejected and or there will be more control to increase the safety of the granted loan and in this way the losses from non-reimbursement of loan will reach the minimum. In this model, Z score depends on financial ratios of loan/credit recipient (customer) (X_j) (and the weights of each of these ratios. Also the weights of financial ratios depend on experience (cases), i.e., the loan/credit recipient (customer) failure to reimburse the loan.

Altman selected the five following variables out of the 22 variables (financial ratio) upon conducting auditing analysis to reach the mentioned model and the mixture and relation of these five variables in Altman's Z Model were estimated to anticipate the credit score of the loan/credit recipient (customer) as follows:

$$Z = 1.2X_1+1.4X_2+3.3X_3+0.6X_4+0.999X_5$$

Where:

X_1 = Ratio of working capital to the total assets
X_2 = Ratio of accumulated profit to the total assets
X_3 = Ratio of profit from interest and tax to the total assets
X_4 = Ratio of capital market value to the book value of total debts
X_5 = Ratio of sale to the total assets

The higher the Z amount is, the lower the risk class of non-reimbursement of the loan/credit recipient (customer) will be. Thus, the low or negative amount of Z index indicates that the loan/credit recipient (customer) is located at a high class as far as the non-reimbursement risk is concerned. Altman found out through the conducted studies that the low level of 1.81 (bankrupt class) and the high level of 2.99 (non-bankrupt class) are the optimal critical values. The lower score of 1.81 shows that the companies are anticipated to become bankrupt in foreseeable future and the higher score of 2.99 indicates that the companies will not have any problem in the future to reimburse their received loans. Altman tested his designed model in different countries and it was found out that the anticipations made by this model were correct in more than 75% of the cases.

One of the other important studies that was conducted to measure credit risk was the study conducted by Elmer and Borowski (1988). Elmer and Borowski used Perceptron multi-layered neural network model to anticipate the ability of loans reimbursement. Their input variables were the same variables used by Altman's Z Model. They compared the results of

Perceptron neural networks model and Altman's Z Model and found out that the power of anticipation of Perceptron model is more than the credit scoring models. The other studies that were conducted to design a credit risk measurement model was the one by Morgan (1998) to design the William (1998) to design the model of Value-at-Risk to estimate the density function of possibility for non-reimbursement. Now a days in most of the authentic banks of the world, one or several models are used to measure credit risk of loans and other debt tools. The most commonly used models are auditing analysis model, Logistic model, Probit model, internal ranking system and artificial neural networks (Gordy, 2003).

Nowadays together with the studies conducted by Bassel Committee (Supervisory Committee over Banking Regulations, Bank International Settlement), many studies are conducted by the researchers and credit institutions to design a precise model to measure the credit risk. Also many models using economic evaluation methods and neural and phase networks are used to measure credit risk in banks and credit institutions.

Although, measuring the credit risk of banks in developed countries such as the US and the EU has started for two decades, in Iran no study in the area of anticipation and measuring the credit risk of banks have been conducted.

Theoretical models of credit risk measurement: Many vast methods in the area of Mathematics, Statistics, economic evaluation and research in operations such as mathematical planning, probability and deterministic simulation, artificial neural networks, survival analysis, games theory, auditing analysis, Legit analysis and Probit analysis contributed to develop a model for precise measurement of credit risk. Also advancement of theories of financial markets including arbitrage Pricing Theory, Option Pricing theory and pricing model of investment assets all played a role in developing precise measurement models of credit risk.

Linear Probability Model: It is a type of regression model that the independent variables adopt small amounts and dependent variables adopt zero or one. When the dependent variable (Y_1) is equal to zero, the incidence in question has not occurred and when it is equal to one, the incident in question has occurred definitively. The regression model of linear probability is defined as follows:

$$\hat{Y} = E\left(\frac{Y_i}{X_i}\right) = \beta_0 + \sum_{i=1}^{n}\beta_i X_i = P_i \qquad (1)$$

The mathematical chance of Y_i according to certain X_i of $E(Y_i/X_i)$ can be considered as the conditional possibility of the occurrence of the incidence in question under certain X_i condition. Since, P_i has to be between zero and one, we will have the following restriction:

$$0 \le E\left(\frac{Y_i}{X_i}\right) \le 1 \qquad (2)$$

In other words, the conditional possibility of the occurrence of the incidence in question should necessarily (non-reimbursement of loan) be between zero and one because the possibility of occurrence of an incidence is never smaller than zero and bigger than one. When the conditional possibility of an incident occurrence is equal to zero, it means that the incident will not surely happen and when it is equal to one, it means that the incidents in question will happen definitely. Although, this issue is theoretically correct, there is no guarantee for putting (estimation of) between zero and one exists. One solution is that the amounts smaller than zero are assumed equal to zero and the amounts bigger than one are assumed equal to one. In this study linear probability model is used to anticipate the credit risk (possibility of non-reimbursement of loan) of customers (Abrishami, 2002).

Logistic regression: It is one of the regression models that the anticipation variables (independent) can be both in quantitative scale and categorized scale and dependent variable is a two-level category and these two categories refer to the membership and lack of membership in one group in a way (companies that are not able to reimburse their loans). In logistic regression, the concept of luck is used for the amount of dependent variable. In statistical terms, luck means the ratio of possibility of occurrence of an incidence (P_i) over the possibility of non-occurrence of ($1-P_i$) and the possibility varies between zero and one, while the chance might be more than one. The key word to analyze the structural logistic regression is which is the natural logarithm of luck. Logistic regression is defined as follows:

$$Z_i = Ln\left(\frac{P_i}{1-p_i}\right) = \beta_0 + \sum_{i=1}^{n}\beta_i X_i \qquad (3)$$

In the above equation, Ln indicates the natural logarithm. In logistic regression model, the possibility of occurrence of the incidence in question (non-reimbursement of loan credits by the customer) is calculated using the following formula:

$$P_i = \pi_i(X_1, X_2, ..., X_{k1}) = \frac{e^{\beta_0 + \sum_{i=1}^{n} \beta_i X_i}}{1 + e^{\beta_0 + \sum_{i=1}^{n} \beta_i X_i}} \quad (4)$$

Perceptron neural networks: Artificial neural networks are the systems based on artificial intelligence that try to imitate the function of human mind as a network of connected neurons in the decision making process. Neurons are the smallest calculating and decision-making units in the neural networks and each of the neurons were defined as a transformation equation. The defined equation in each of the neurons can be an economic evaluation model or another mathematic model such as sigmoid. In each of the neurons using this equation, the weight of each variable is determined so that the significant relation between data vector and results vector is established. In a common method, the coefficients are determined in each of the neurons in form of trial and error. In this way firstly the small weights are presented to each of the variables and then using algorithm of errors feedback, the coefficients are adjusted and this continues till when the errors reach the minimum possible determined by the researcher. In artificial neural networks, similar data that are used in economic evaluation techniques are also used to adopt suitable decisions, but the decision-making process in artificial neural networks is by trial and error method (Lopez and Saidenberg, 2000).

In fact an artificial neural system simulates the learning process of human being. The artificial neural network system, imitating human neural system and brain learns the relation among data (financial ratios, economic trend and quality of management) and results (credit situation of loan/credit recipients (customers) through repeating sampling of the total old data of data/result. Neural network has a fundamental superiority over an intelligent system and it is when the data are not complete or have parasites and it builds a logical assumption of data by old learning. A neural network is recognized by three characteristics of input data, weights and hidden layers.

Perceptron neural network, particularly multi-layered Perceptron is one of the most applied artificial neural networks. This network can do a non-linear writing with desirable precision by selecting the number of layers and neural cells (neurons) that are often not too many. Fundamental abilities of multi-layered Perceptron to anticipate credit risk (possible non-reimbursement of loan) comes from the fact which neurons and non-linear sigmoid functions are used publicly (Raei and Chavoshi, 2003):

$$F_{(x)} = \frac{1}{1 + \exp(-\beta X)} \quad (5)$$

In this study, the suggested neural networks of Perceptron model is two-layered and has one hidden layer (middle) and one output layer. In this model X_i is the input vector (input variable) and Y is the output vector (dependent variable), β_{ij} is the variable with j bias and in W^1_{jk}, the j variable weight to K neuron in I layer is shown.

Except input layer, each of the neurons of the hidden layer in the above model shows the function of changing the relevant neuron. According to the transformation function, the weight of each of the variables in each neuron is estimated. Having the weights of each of the hidden layers, the output of this layer for this example will be as follows:

$$Y^H = g\left(\sum_{k=1}^{k} \sum_{j=1}^{n} \left(W^j_{jk} X_j + W^1_{jb}\right)\right) \quad (6)$$

In the above relation, W^j_{jk} is the weight of J variable in K neuron in the first layer, W^1_{jb} is the bias amount of j variable in the first layer and g is the sigmoid transformation function that changes the weights altogether to zero and one amounts. Having the amount of hidden layer function, the amount of output layer will be defined as follows:

$$Y^0 = g\left(\sum_{j=1}^{n} W^2_{kj} \left(g \sum_{k=1}^{k} \sum_{j=1}^{n} W^1_{jk} . X_j\right) + W^1_{jb}\right) + W^2_{jb} \quad (7)$$

In the above relation, W^1_{jb} is the weight of j variable to K neuron in the second layer and W^1_{jb} shows the bias amount of j variable in the second layer. What is of importance in the neural network model is that the existing weights in the neural networks are estimated optimally. It goes without saying that upon determining the weights using optimal method and giving the vector of input variables, output vector is easily estimated (Yang *et al*., 1999).

In order to estimate the amounts of weights vector of (W^1_{jb}) optimally, back propagation error algorithm was used. In this method as its title shows, the amount of error is transferred once more to the neural network model and the amounts of weights are adjusted.

Research background: Many studies were conducted about the existing risks in Islamic banking, 2002 studied the complexities of financing using participation methods and risks resulting from it in Islamic banking in a paper under the title of 'position of investment tools and Islamic financial institutes in international financial system and main topics in risk management and existing challenges'.

Tariqollah and Ahmad (2008) in their book pointed to the necessity of using new financial tools for management of credit risk in Islamic banking while studying the role of different tools of financing in creation of credit risk.

Mahdavi and Mousavi in a research studied the possibility of using credit default swap as one of the credit derivations in Islamic banking using this derivation as insurance contract between one credit bank or institute and insurance company.

Mousavi in another study investigated the comparative credit default swap based on regulations of Islamic jurisprudence and found use of credit default swap within the framework of insurance contract possible. Meanwhile use of swap contract of total return is incorrect from the viewpoint of principles and conditions of Islamic contracts due to existence of Overnight negligence.

Mansouri (2003) in a study under the title of 'design and expression of efficient model of allocating bank credits neural network approach, logistic and linear regression' in order to assess the risk degree and credit capacity of three groups of customers of bank Mellat presented the two models of classic (regression) and artificial intelligence (neural network) and compared their efficiency together. In this study, 11 variables were identified as effective variables including rate of capital return, total debit turnover with the branch, total current assets, total fixed assets, total current debts, record of company management activity, record of customer's activity, type of company activity (production, agricultural, construction, commercial, service). He found out that using the customers' characteristics (financial statements, type of activity, etc.), their credit risk and credit capacity can be estimated. Also receiving the neural network model in comparison with the linear regression model to estimate the customer's credit capacity is of higher efficiency. But this model is not of very high efficiency in comparison with the logistic regression in estimation of credit risk of customers and they function almost similar to each other (Mansouri, 2003).

According to Chen and Pan (2012), financial credit risk is the fluctuation of value in debt tools and for the changes in basic quality of credit, it is derived from loan/credit recipients (customers) and the other party.

Coil defines financial credit risk as one of the losses by the credit customers to prevent and or not to be able to pay completely within the due time. Financial credit risk is what the banks face it when a loan/credit recipient (customer) fails to make his debt obligations in due time.

This loss is called transformational (risk of the other party) which is able if not sufficiently managed to put the banks in a position to seize assets. Credit risk management increases the possibility of banks' loss according to the amount of income maintaining the financial credit risk within the acceptable limits in order to present a framework for effective understanding of the financial credit risk management on the banks' profitability (Kargi, 2011).

Demirguc-Kunt and Huzinga (1999) expressed that financial credit risk management has two parts that consist of identification of post loss, losses that are not tolerable and advancements in this area from commercial and financial article and assets that change to negotiable documents and other non-banking competition of banks to find suitable loan-credit recipients (customers) to be pushed forward.

Epure and Lafuente (2012) studied the banking performance despite the risk for banking industry of Costa Rica between 1998 and 2007. The results show that performance advancements have regular changes and that risk explains differences in the banks and non-executive loans affected by reverse efficiency and return of assets, while the amount of sufficiency of capital has a direct and positive effect on the credit margin of the network profit.

Kithinji (2010) assessed the effect of financial credit risk management on profitability of commercial banks in Kenya. The data related to the amount of financial credit, level of non-executive loans and profits was collected for the period between 2004 and 2008. These findings showed that the volume of profits of commercial banks is not affected by the amount of financial credit and non-executive loans. Thus it is shown that other variables affect the profits except financial credits and non-executive loans.

Chen and Pan (2012) studied the credit risk efficiency of 34 banks of Taiwan during 2005 and 2008. Their study used the financial ratios for credit risk assessment and analyzed using the covering analysis of information. Financial credit risk parameters mean Credit Risk Technical Efficiency (CR-TE), Credit Risk Allocation Efficiency (CR-AE) and Credit Risk Costs Efficiency (CR-CE). The results show that only one bank has a good return and efficiency in all types of efficiency during assessment periods.

MATERIALS AND METHODS

The research is of descriptive type as it describes the existing conditions and since this study investigates the relation between credit risk management and overdue receivables of Bank Mellat and as a case study investigates the management of branches of Bank Mellat, Semnan province, the study is of correlative type.

Statistical society of research: The statistical society of this study as case study in the management of branches of Bank Mellat, Semnan province was selected in the period between 2012 and 2016.

Volume of research sample: To select the sample in the current study, the geographical domain as well as the statistical society of the current study as a case study in the management of branches of Bank Mellat is Semnan province during the period between 2012 and 2016. The above data were used to do statistical analysis and to assess the relations of the research variables.

Introduction of model for calculation of credit risk: Since, the most important factor for bank against customer is requesting for loan and receiving the principal and interest of loan given to the customer, the most important factor in credit risk of customer is the amount of debt non-reimbursement. The amount of penalty for each customer is calculated according to the amount and type of received loan through the following formula (Qodsipour *et al*., 2012):

$$D = \frac{\sum_{i=1}^{n} X_i \times T_i \times (R_1 + R_2)}{365}$$

Where:

X_i = Amount of the loan which was paid T_i days later than the sent date

T_i = The number of days past the payment date of X_i amount and the payment has not been made.

R_1 = The rate of banking profit related to the received loan

R_2 = The banking fine rate which is considered equal to 6%

Credit of i company in the area of non-reimbursement or payment of debt show the company's credit risk which is calculated through the following formula (Qodsipour *et al*., 2012):

$$R_i = \left(1 - \frac{D_i}{M_i}\right) \times 100$$

R_i = The credit risk of i company

D_i = The amount of find of i company in loan for M_i amount

M_i = The amount of received loan by i company

It is worth mentioning that if the loan fine is more than the principal received loan, the company's credit is considered as zero. This credit amount (R_i) for Bank Mellat, Islamic Republic of Iran whose customers have received loan from this bank is calculated and it is used for production of estimated function of the amount of credit of companies requesting for credit of the banks using HHONN Model (Qodsipour *et al*., 2012).

RESULTS AND DISCUSSION

Data analysis and expression of research findings

Statistical description of data: In this part, the statistical characteristics of the research variables are presented. These characteristics consist of average abundance and the number of observations for each used variables in the current study (Table 1 and 2).

Test to determine normality of variables: One of the most important regression hypotheses is normality of model remainders. To study the normality of variables and remainders, Kolmogorov-Smirnov test is used. Kolmogorov-Smirnov test which is called in honor of two Russian statisticians called A.N. Kolmogorov and N.V. Smirnov is a simple non-parametric method to determine the homogeneity of the experimental information by selected statistical distributions and they are shown by KS briefed title. H_0 and the other hypothesis are shown in this study as follows:

- H_0 is when the data follows the normal distribution for dependent variable
- H_1 is when the data does not follow the normal distribution for dependent variable

The statistic of this test is shown as follows:

$$D = \underset{1 \le i \le N}{Max}\left(F(Y_i) - \frac{1-1}{N}, \frac{i}{N} - F(Y_i) \right)$$

In this relation, $F(Y_i)$ is the theoretical collective distribution of the testable function which has to be continuous and completely distinct. If the amount of the possibility related to this test is bigger than 0.05, the distribution normality of variables and remainders is confirmed at 95% certainty level.

As it is noticed in Table 3, in every one of the research variables based on the test to determine normality or Kolmogorov-Smirnov test among the existing variables in the study, the normality hypothesis is in place. Because as it is noticed in Table 4 Kolmogorov-Smirnov test is used to study the normality of data distribution in the statistical society. The amount

Table 1: Statistical description of data

	Descriptive statistics				
	N	Minimum	Maximum	Mean	SD
Overdue bank receivables	11	28926	187189	75210.45	48347.817
Credit risk management	11	11	91	46.36	28.708
Valid N (list wise)	11				

SD = Standard Devistion; Research findings (calculated using SPSS Statistical Software)

Table 2: Statistical description of data

	Descriptive statistics								
				Variance		Skewness		Kurtosis	
	N (Statistic)	Range (Statistic)	Mean Statistic	Std. error	(Statistic)	Statistic	Std. Error	Statistic	Std. error
Overdue bank receivables	11	158263	75210.45	14577.415	2.338E9	1.408	0.661	1.786	1.279
Credit risk management	11	80	46.36	8.656	824.140	0.419	0.661	-1.304	1.279
Valid N	11								

Research findings (calculated using SPSS Statistical Software)

Table 3: Kolmogorov-Smirnov test to study the normality of distribution of research data

	One-sample Kolmogorov-Smirnov test	
	Overdue bank receivables	Credit risk management
N	11	11
Normal parameters[a, b]		
Mean	75210.45	46.36
Std. Deviation	48347.817	28.708
Most extreme differences		
Absolute	0.230	0.174
Positive	0.230	0.174
Negative	-0.169	-0.110
Kolmogorov-Smirnov Z	0.762	0.578
Asymp. Sig. (2-tailed)	0.606	0.892

[a]Test distribution is normal; [b]Calculated from data; research findings (calculated using SPSS Statistical Software)

of research error for all the research variables is bigger than the research error amount of 0.05. Thus, the distribution of data in the statistical society is normal and therefore, parametric statistics is used to analyze the data.

Results of first main hypothesis test of research:

The first main hypothesis of research: There is a significant relation between credit risk management of received loans (credits) by customers individually (similar to individual analysis of negotiable documents risk) and overdue receivables of Bank Mellat, Semnan Province:

- H_0: there is no significant relation between credit risk management of received loans (credits) by customers individually (similar to individual analysis of negotiable documents risk) and overdue receivables of Bank Mellat, Semnan Province
- H_1: there is a significant relation between credit risk management of received loans (credits) by customers individually (similar to individual analysis of negotiable documents risk) and overdue receivables of Bank Mellat, Semnan Province

According to Table 4, Pearson Correlative coefficient between the two variables of credit risk management of loans (credits) received by customers individually (similar to individual analysis of negotiable documents risk) and the overdue receivables of Bank Mellat, Semnan province is (0.601[a] (This figure shows a significant relation at 5% error level between the two variables of credit risk management of loans (credits) received by customers individually (similar to individual analysis of negotiable documents risk) and the overdue receivables of Bank Mellat, Semnan province. Thus considering the SPSS software outputs shown in the above tables, it could be expressed that since Sig. is <5% there, H_0 is rejected at 5% error level and the existence of correlation between the two variables is confirmed. Also the calculated adjusted determination coefficient also shows the figure of 0.291 which is a good figure and present a good fitting of overdue receivables of Bank Mellat, Semnan province by the variable of credit risk management of loans (credits) received by the customers individually (which is similar to individual analysis of negotiable document risk).

On the other hand, one of the hypotheses of regression is the independence of errors. If the hypothesis of independence of errors is rejected and the errors have correlation with each other, there is no possibility to use regression. One of the most important tests to diagnose the hypothesis of errors independence is Durbin-Watson test. Thus Durbin-Watson test is used to study the independence of errors from each other. If the amount of Durbin-Watson statistic is between 1.5 and 2.5, the correlative hypothesis between the errors is rejected and regression could be used. The amount of Durbin-Watson statistic according to Table 4 is 2.142 and this figure shows that errors are independent from each other and there is no correlation between the errors and correlation hypothesis between the errors is rejected andregression could be used.

Table 5 shows the variance analysis between the two variables of credit risk management of loans (credits) received by customers individually (which is similar to individual analysis of negotiable documents risk) as independent variable and changes of the overdue receivables variable of Bank Mellat, Semnan province as the dependent variable. According to this output, the general significance of regression model is tested by variance analysis (ANOVA) and through the statistical hypotheses as follows:

- H_0: There is no linear relation between the two variables

Table 4: Correlation coefficient test, determination coefficient, adjusted determination coefficient and Durbin-Watson test between two credit risk management of received loans by customers variable and overdue bank receivables variable

Variables entered/Removed[b]

Model	Variables entered	Variables removed	Method
1	Credit risk management	.	Enter

Model summary[b]

Model	R	R^2	Adjusted R^2	Std. error of the estimate	Durbin-Watson
1	0.601[a]	0.362	0.291	40715.083	2.142

Variables entered/Removed: [a]All requested variables entered; [b]Dependent variable: Overdue bank receivables. Model Summary: [a]Predictors: Constant, credit risk management; [b]Dependent variable: Overdue bank receivables; research findings (calculated using SPSS Statistical Software)

Table 5: Regression variance analysis test (ANOVA)-research main hypothesis

ANOVA[b]

Model	Sum of squares	df	Mean square	F	Sig.
1					
Regression	8.456E9	1	8.456E9	5.101	0.050[a]
Residual	1.492E10	9	1.658E9		
Total	2.338E10	10			

[a]Predictors: Constant, credit risk management; [b]Dependent variable: Overdue bank receivables; research findings (calculated using SPSS Statistical Software)

Table 6: Regression equation coefficient test (coefficients[a])-third research hypothesis

Coefficients[a]

Model	Unstandardized coefficients (B)	Std. error	Standardized coefficients (β)	t	Sig.	95.0% confidence interval for B	
						Lower bound	Upper bound
1 (Constant)	28253.553	24144.956		1.170	0.272	-26366.132	82873.237
Credit risk management	1012.915	448.492	0.601	2.258	0.050	-1.645	2027.475

[a]Dependent variable: Overdue bank receivables; research findings (calculated using SPSS Statistical Software)

Table 7: Remaining coefficients test of regression equation (coefficients)- research main hypothesis

Residuals statistics[a]

	Minimum	Maximum	Mean	Std. deviation	N
Predicted value	39304.46	119932.50	75210.45	29078.605	11
Residual	-52546.113	83361.852	0.000	38625.719	11
Std. predicted value	-1.235	1.538	0.000	1.000	11
Std. residual	-1.291	2.047	0.000	0.949	11

[a]Dependent variable: Overdue bank receivables; research findings (calculated using SPSS Statistical Software)

- H_1: There is a linear relation between the two variables

Considering the fact that sig is les than 5%. The hypothesis of linear relation between the two variables is confirmed. Now we look for finding this relation as follows.

In output of Table 6 and in B column the constant amount and the independent variable coefficient are respectively presented in regression equation and this equation is as follows:

$$Y = f(X_i) = \beta_1 + \beta_2.(X_i) + e_{it}$$

$$\text{Overdue bank receivables}_{it} = (28253.553) + (1012.915).(\text{Credit Risk Management}_{it}) + e_{it}$$

According to output of Table 7, the rest of the columns of the table consist of column coefficients criterion (B), t-student statistic (t) and test significance level (Sig.) which is used with zero figure to test the hypothesis of each of the coefficients of column B. Now if β and α are respectively the constant and the slope of regression line of the society, the test of hypotheses for both amounts is written as follows:

$$\begin{cases} H_0 : \beta = 0 \\ H_1 : \beta \neq 0 \end{cases}$$

$$\begin{cases} H_0 : \alpha = 0 \\ H_1 : \alpha \neq 0 \end{cases}$$

Since in this output, Sig. = 0, the equality test of regression coefficient and constant is equal to zero and is <5%. Thus, the hypothesis for equality of the two coefficients with zero is rejected and they should not be eliminated from the regression equation.

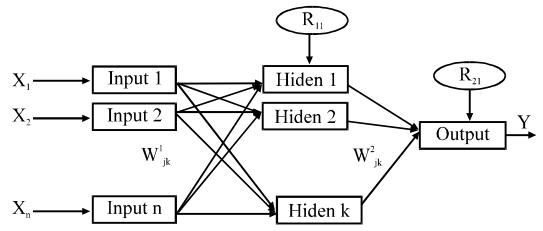

Fig. 1: Artificial neural networks

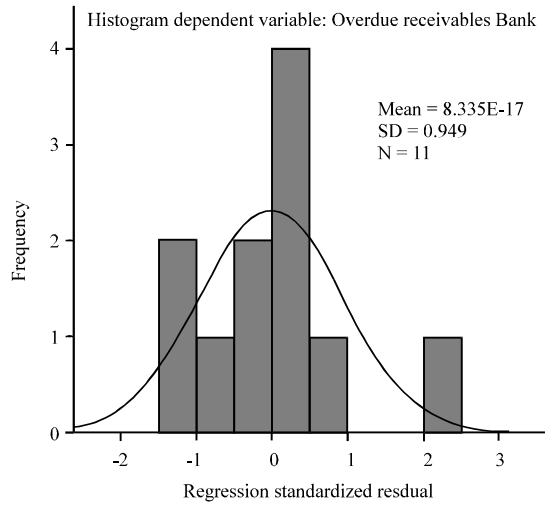

Fig. 2: Normality test of regression equation, main research hypothesis

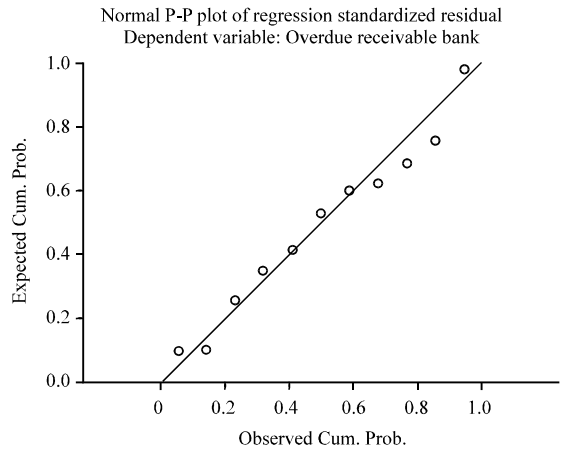

Fig. 3: Regression line and equation-third research hypothesis

Figure 1 studies the normality of errors as one of the other regression hypotheses. According to this hypothesis, the errors of regression equation has normal distribution with zero average which is Stad. Dev = (0.995) according to Fig. 2, Mean = (2.06e-15) as it is shown in the right side of the chart. Thus, by having this pre-assumption in mind, the estimated regression line equation is used regarding the two variables between the two variables of credit risk management of loans (credits) received by customers individually (which is similar to individual analysis of negotiable documents risk) as the independent variables and the changes of the overdue receivables of Bank Mellat, Semnan province as the dependent variable.

Figure 3 showed in addition to dispersion, simple linear regression equation and determination coefficient between the two variables of credit risk management of loans (credits) received by the customers individually (which is similar to the individual analysis of negotiable documents risk) as the independent variable and changes of the variable of overdue receivables of Bank Mellat, Semnan province as the dependent variable. These results correspond with the results of simple linear regression method.

CONCLUSION

Generally speaking, we in this study aim to test "the relation between credit risk management of paid loans to natural customers and overdue receivables of Bank Mellat as a case study in the management branches of Bank Mellat, Semnan Province. In the first part of the conducted study, the normality tests and statistical description of research data were presented. As the results of normality determination test or Kolomogrov-Smirnov test among existing variables in this study indicated, the hypothesis is normal because as it is shown in table 4, Kolomogrov-Smirnov test was used to study the normality of data distribution in the statistical society. The amount of research error for all research variables is >0.05. Thus it could be said that data distribution in the statistical society is normal and as a result parametric statistic will be used to analyze the data. Also in part 2 regarding the analysis of data and research hypotheses, all variables as independent variables of the credit risk management of paid loans/credits to natural customers and overdue receivables of Bank Mellat as the dependent variable were tested. Generally, the results of the current study showed that there is a significant relation between credit risk management of received loans (credits) by customers individually (which is similar to individual analysis of negotiable documents risk) and overdue receivables of Bank Mellat, Semnan province. This figure shows at error level of 5% that there is a significant relation between two variables of credit risk management of loans (credits) received by the customers individually

(that corresponds with the individual analysis of negotiable documents risk) and overdue receivables of Bank Mellat, Semnan Province.

REFERENCES

Abrishami, H., 2002. Economic Evaluation. Tehran University Publication, Tehran, Iran.

Altman, E.I., 1968. Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. J. Finance, 23: 589-609.

Beaver, W.H., 1966. Financial ratios and predictors of failure. J. Accounting Res., 4: 71-111.

Chen, K. and C. Pan, 2012. An empirical study of credit risk efficiency of banking industry in Taiwan. Web J. Chin. Manage. Rev., 15: 1-16.

Demirguc-Kunt, A. and H. Huizinga, 1999. Determinants of commercial bank interest margins and profitability: Some international evidence. World Bank Econ. Rev., 13: 379-380.

Elmer, P.J. and D.M. Borowski, 1988. An expert system and neural networks approach to financial analysis. Financial Manage., 12: 66-76.

Epure, M. and I. Lafuente, 2012. Monitoring bank performance in the presence of risk. Barcelona GSE Working Paper Series No. 61, Tehran University, Tehran.

Glantz, M., 2003. Managing Bank Risk. Academic Press, Cambridge, Massachusetts.

Gordy, M.B., 2003. A risk-factor model foundation for ratings-based bank capital rules. J. Financial Intermediation, 12: 199-232.

Greuning, H.V. and S. Brajovice, 2003. Analyzing and Managing Banking Risk: A Framework for Assessing Corporate Governance and Financial Risk. 2nd Edn., The world Bank Publications, Washington DC, USA., Pages: 367.

Kargi, H.S., 2011. Credit risk and the performance of Nigerian Banks. Ahmadu Bello University, Zaria.

Kithinji, A.M., 2010. Credit risk management and profitability of commercial banks in Kenya. School of Business, University of Nairobi, Nairobi.

Lopez, J.A. and M.R. Saidenberg, 2000. Evaluating credit risk models. J. Banking Finance, 24: 151-165.

Mansouri, A., 2003. Design of mathematical model for allocation of bank credits of classic models approach and neural networks. Master Thesis, Faculty of Human Sciences, Tarbiat Modaress University, Tehran, Iran.

Morgan, J.P., 1998. Creditmetrics Technical Document. J.P. Morgan & Co. Incorporated, New York, USA.,.

Qodsipour, S.H., S. Meisam and V. Delavari, 2012. Credit risk assessment of loan/credit recipient (customer) companies from banks using phase hierarchical analysis of high degree mixed neural network, Tehran. Ind. Eng. Intl. Publ. Univ. Sci. Technol., 23: 44-54.

Raei, R. and K. Chavoshi, 2003. Anticipation of shares return in Tehran stock exchange market: Artificial neural network model and multi-factor model. Financial Res. J., 15: 97-120.

Tariqollah, K. and H. Ahmad, 2008. Risk Management, Study of Factors Effective on its Occurrence in Islamic Financial Services Industry. Imam Sadeq University Publication, Tehran, Iran.

Tehrani, R. and S.M. Fallah, 2005. Design and Description of Credit Risk Model in State Banking System. 22nd Edn., Shiraz University, Shiraz, Iran, pp: 45-60.

William, F.T., 1998. Credit risk rating systems at large U.S. Bank. J. Banking Finance, 24: 167-201.

Yang, Z.R., M.B. Platt and H.D. Platt, 1999. Probabilistic neural networks in bankruptcy prediction. J. Bus. Res., 44: 67-74.