Evaluation of the Credit Risk with Statistical analysis

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Abstract   *The purpose of this study is to identify important variables that influence on credit risk. Statistical analysis was used. In order to achieve the purpose of this research, a frame of references has been constructed based on a wide literature review. The calculations have been done by using SPSS 18 software. Number of samples was 90 and 5 dependent variables. The achieved results indicate the relation between credit risk and independent variables were considered. The major contribution of this paper is specifying the most important determinants for rating of customers in Iran's banking sector.*

Key words   Credit risk, statistical analysis, loan, good customers, bad customers

1. Introduction

Today's credit risk is concerned by various stakeholders such as institutions, customers and regulators. Also, credit risk is interest topic among finance communities, researchers and banking. Collecting deposit is one of the major responsibilities of commercial banks. One of the tasks of banks is establish communication between lenders and borrowers by collect deposits and allocate them to investors. Financial system efficiency and level of financial improvement play an important role in economic development of countries.

Banks face problems such as the probability of non-repayment of received loans at the due date or non-repayment that are called "credit risk" (Nazari & Alidadi 2013). Previous studies have illustrated that credit risk is widely studied topic in bank lending decisions and profitability (Angelini, di Tollo & Roli, 2008). Generally, lenders do not have adequate data about the project to be finances; hence borrowers usually have proper information about those projects (Matoussi & Abdelmoula, 2009). A good legal customer with power of lending loans bring high profit for commercial banks, on the other hand bad legal customers who don't repay loans in due date, it will likely go bankrupt (Nazari & Alidadi 2013). There are various ways to predict credit risk such as probability and deterministic Simulation, Legit Analysis, Prohibit Analysis, Arbitrage Pricing Theory, Option Pricing Theory and linear probability model (Saunders and Allen, 2002). Factors affecting credit risk are divided into two categories: internal factors and external factors. External factors are those factors which bank management teams could take the matter under their control. These are called internal factors. External factors cannot be controlled by bank management teams and are considered for bank. Political changes, government, war and etc. are included in this category.

The main purpose of this paper is to identify and rank the internal factors that have effects on credit risk in one of the commercial banks in Iran.

2. Literature review

Credit rating is one of technical factor in credit risk evaluation (Khashman, 2010). Credit rating has two types of applicants which include good credit and bad credit (Ghodselahi & Amirmadhi, 2011). Multilayer feed forward networks are a class of universal approximation (Hornik, Stinchcombe & White, 1989). Beatty and Liao (2011) found that banks recording timelier loan loss provisions illustrate higher loan growth in recessions.

One of the characteristics of networks is highly-sophisticated pattern recognition and classification of factors according to their importance (Hall, Muljawan, Suprayogi & Moorena, 2009).

Pacelli and Azzollini (2011) illustrated that artificial neural network in combination with linear methods have further supported. Salehi and Mansoury (2011) find out the efficiency of neural network and logistic regression in forecasting customer credit risk. They state that both models have same efficiency. Credit rating is also investigated with other methods of artificial intelligence. Ghodselahi and Amirmadhi (2011) used a hybrid method for credit rating. They use Support Vector Machine, Neural Networks and Decision Tree as base classifiers. They found that accuracy of this hybrid model is more than other credit rating methods. Important factors of credit rating are also investigated with three methods including Logistic Regression, Neural Networks and Genetic Algorithms (Gouvêa & Gonçalves, 2007). According of this research's result, logistic regression and neural networks are good and similar. Although neural network is slightly better and genetic algorithms take third place. The important roles of artificial neural network in financial application are pattern recognition, classification and time series forecasting (Eletter & Yaseen, 2010). Al-Tamimi and Al-Mazrooei (2007) was focus on risk of UAE national and foreign banks. They found that the three most important types of risks encountered by UAE commercial banks are foreign exchange risk, followed by credit risk, then operating risk. Also they considered that here is no significant different on risk identification between UAE national and foreign banks, hence, the UAE banks clearly identified the potential risks linked to each of their goals and objectives. Moreover, risk identification is positively significant to influence credit risk.

3. Methodology of research

For this research, the quantitative data was used. Based on probability techniques, this research has chosen to use random sampling method over the period 2010-2013, based on documents and records of applicants for an Iranian commercial bank. Sample estimation has been done by a pretest sample size of 90 cases and according to the sample size formula, which are derived from legal customers' profiles. In this study dependent variables are divided in two groups. Good and bad legal customers; the aim of this study is to estimate the important independent variables. In this regard, good customer is a company which repays its loan plus the profit at the due date and in contrast, bad customer is a company which don't repay at the due date. To differentiate between good and bad customers in our statistical analysis calculations, 0 is illustrating good customers and 1 is illustrating bad customers. Five hypotheses are defined as follows:

H1: There is a significant and positive relationship between interest rate and credit risk.

H2: There is a significant and positive relationship between due date of repayment and credit risk.

H3: There is a significant and positive relationship between history of legal customer relationship with the bank of repayment and credit risk.

H4: There is a significant and positive relationship between delay Time of maturity and credit risk.

H5: There is a significant and positive relationship between customer in industrial sectors and credit risk.

4. Data Analysis and Results

Data analysis is used and can assist an investigator to summarize the conclusion of the research. The data were analyzed by utilizing 'Statistical Package for Social Science (SPSS Window) version 18.0. Pearson correlation, T-student test and Chi-square analysis was utilized to examining the relationship between credit risk and independent variables. According to pervious literatures and interview with bank experts, five variables are introduced as independent variables. Independent variables include: Interest rate which it expressed as percentage and it determine amount of bank's profit, history of customer relationship with the bank, period of re-payment of loan, delay in repayment of loan and the company which is in industrial sector or not.

Hypothesis 1 is about relationship between interest rate and credit risk. To assess their relationships T-student test is used. According to the result of T-student test, there is a significant relationship between interest rate and credit risk. It means when interest rate is increasing therefore credit risk will increase. Also, the mean value of repayment for legal customer at commerce bank is estimated around 17.51.

Table 1. Contingency table for H1

		N	Mean	Std. Deviation	Std. Error Mean
Interest rate	Good customer	47	17.511	2.9571	0.4313
	Bad customer	43	15.337	2.9655	0.4522

The result of Levene's test shows the variances are equal. According to t- test for equality of means, the means are not equal together.

Table 2. The result of Levene's test for H1

		Levene's Test		t-test for Equality of Means						
		F	Sig.	T	Df	Sig.	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Interest rate	Equal variances assumed	0.14	0.70	3.47	88	0.001	2.1734	0.6249	0.9316	3.4152
	Equal variances not assumed			3.47	87.2	0.001	2.1734	0.6250	0.9313	3.4155

Hypothesis 2 is about the relationship between due date of repayment and credit risk. We used Chi-Square test to assess their relationships. The results indicate that Pearson's chi-square test statistic is 26.18. Also, the significant of test is 0.000. It can be concluded that by more than 99% of certainty the variables have significant relationship.

Table 3. Contingency table for H2

		Kind of customer		Total
		Bad customer	Good customer	
Due date of repayment (year)	1	8	2	10
	2	14	3	17
	3	18	11	29
	4	4	6	10
	5	3	21	24
Total		47	43	90

*Table 4.*Chi-square test for H2

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	26.181[a]	4	.000
Likelihood Ratio	28.695	4	.000
Linear-by-Linear Association	24.039	1	.000
N of Valid Cases	90		

Hypothesis 3 is about the relationship between history of legal customer relationship with the bank of repayment and credit risk. We used T-student test to assess their relationships. The average years of cooperation of 47 good customers with bank are 8.56. According to result of table 4 the deference between the means of history of relationship for bad customers and good customers is significant.

Table 5. contingency table for H3

		N	Mean	Std. Deviation	Std. Error Mean
History of relationship	Bad customer	47	5.98	2.633	.384
	Good customer	43	8.56	4.328	.660

Table 4. T-test for H3

		Levene's Test for Equality of Variances		t-test for Equality of Means							
										95% Confidence Interval of the Difference	
		F	Sig.	T	df	Sig.	Mean Difference	Std. Error Difference		Lower	Upper
History of legal customer relationship with the bank	Equal variances assumed	17.703	.000	-3.44	88	.001	-2.579	.748		-4.066	-1.093
	Equal variances not assumed			-3.37	68.13	.001	-2.579	.764		-4.103	-1.056

In the forth hypothesis, it is used t-student test to estimated the relationship between Delay Time of maturity and credit risk. The mean value for good customers customer which have delay in repayment their loans is 1.860 and for bad customer is 3.436. According to result of table 6 the deference between the means of delay time for bad customers and good customers is significant. In other words, when the time of repayment is increase; afterwards credit risk will be increase.

Table 5. Contingency table for H4

		N	Mean	Std. Deviation	Std. Error Mean
Delay time	Bad customer	47	3.436	1.5058	0.2197
	Good customer	43	1.860	0.8189	0.1249

Table 6. T-test for H4

		Levene's Test for Equality of Variances		t-test for Equality of Means							
										95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference		Lower	Upper
Delay time	Equal variances assumed	18.93	.000	6.08	88	.000	1.5757	.258		1.0612	2.0902
	Equal variances not assumed			6.23	72.2	.000	1.5757	.252		1.0721	2.0794

We use chi-square test to evaluation of the Borrower's industry type and credit risk. The P-value of Chi-square test is 0.012. The result is less than 0.05 therefore there is significant relationship between credit risk and companies in industrial part. Companies in the industrial sector have more settled accounts than other companies.

Table 7. Contingency table for H5

	Bad customer	Good customer	total
Non industrial	24	33	57
industrial	23	10	33
Total	47	43	90

Table *8.* Chi-Square test for H5

	Value	Df	Asymp. Sig.	Exact Sig.	Exact Sig.
Pearson Chi-Square	6.377[a]	1	0.012		
Continuity Correction[b]	5.319	1	0.021		
Likelihood Ratio	6.512	1	0.011		
Fisher's Exact Test				0.016	0.010
Linear-by-Linear Association	6.306	1	0.012		
sN of Valid Cases	90				

5. Conclusion

This study set out to determine the importance and necessity of customers' credit risk measurement and explained the impact of different. Results of this study indicate that delay of repayment and interest rate and type of legal customer have most important effect in identifying classification criteria of good legal customers and bad legal customers and also due date of repayment and history of customer relationship with bank have least important effect. It means that bank managers and policy makers should focus on number of times that customers have delay to repayment loans and type of customer legal and interest rate of loan. These models help banks to decline credit risk and decline probability of bankruptcy.

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